

Title 8, CALIFORNIA CODE OF REGULATIONS, SECTION 9792.20 ET AL.
INITIAL STATEMENT OF REASONS
APPENDIX E—POSTSURGICAL TREATMENT GUIDELINES (DWC 2008)
OFFICIAL DISABILITY GUIDELINES' REFERENCES

WORK LOSS DATA INSTITUTE
OFFICIAL DISABILITY GUIDELINES' REFERENCES
November 17, 2007 version of Physical Medicine Guidelines

Ankle & Foot (Acute & Chronic)
Burns
Carpal Tunnel Syndrome (Acute & Chronic)
Elbow (Acute & Chronic)
Forearm, Wrist, & Hand
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Low Back - Lumbar & Thoracic (Acute & Chronic)
Neck and Upper Back (Acute & Chronic)
Pain (Chronic)
Shoulder (Acute & Chronic)

Ankle & Foot (Acute & Chronic)

Aldridge T. Diagnosing heel pain in adults. *Am Fam Physician*. 2004 Jul 15;70(2):332-8.

Colorado Division of Workers' Compensation, Medical Treatment Guidelines, Rule XVII, Exhibit C, Lower Extremity Injury, 12/01/01.

Twaddle BC, Poon P. Early motion for Achilles tendon ruptures: is surgery important? A randomized, prospective study. *Am J Sports Med*. 2007 Dec;35(12):2033-8. Epub 2007 Sep 20.

Burns

Simons M, King S, Edgar D; ANZBA. Occupational therapy and physiotherapy for the patient with burns: principles and management guidelines. *J Burn Care Rehabil*. 2003 Sep-Oct;24(5):323-35; discussion 322.

Carpal Tunnel Syndrome (Acute & Chronic)

APTA (American Physical Therapy Association). Carpal Tunnel Syndrome. 2006.

Bilic R, Kolundzic R, Trkulja V, Crnkovic T, Vukovic A. The carpal tunnel syndrome: medical and economic advantages of well-timed surgical treatment. *Lijec Vjesn*. 2006 May-Jun;128(5-6):143-9.

Cameron ID. Coordinated multidisciplinary rehabilitation after hip fracture. *Disabil Rehabil*. 2005 Sep 30-Oct 15;27(18-19):1081-90.

Cook AC, Szabo RM, Birkholz SW, King EF, Early mobilization following carpal tunnel release. A prospective randomized study, *J Hand Surg [Br]* 1995 Apr;20(2):228-30

Feuerstein M, Burrell LM, Miller VI, Lincoln A, Huang GD, Berger R, Clinical management of carpal tunnel syndrome: a 12-year review of outcomes, *Am J Ind Med* 1999 Mar;35(3):232-45

O'Connor D, Marshall S, Massy-Westropp N. Non-surgical treatment (other than steroid injection) for carpal tunnel syndrome. *Cochrane Database Syst Rev.* 2003;(1):CD003219.

Verhagen AP, Bierma-Zeinstra SM, Feleus A, Karels C, Dahaghin S, Burdorf L, de Vet HC, Koes BW, Ergonomic and physiotherapeutic interventions for treating upper extremity work related disorders in adults, *Cochrane Database Syst Rev.* 2004;(1):CD003471

Elbow (Acute & Chronic)

Boisauvert B, Brousse C, Zaoui A, Montigny JP. Nonsurgical treatment of tennis elbow. *Ann Readapt Med Phys.* 2004 Aug;47(6):346-55

Boyer MI, Hastings H 2nd. Lateral tennis elbow: "Is there any science out there?" *J Shoulder Elbow Surg* 1999 Sep-Oct;8(5):481-91

Foley AE. Tennis elbow. *Am Fam Physician* 1993 Aug;48(2):281-8.

Handoll H, Gibson J, Madhok R, Interventions for treating proximal humeral fractures in adults, *Cochrane Database Syst Rev.* 2003;4:CD000434

Korthals-de Bos IB, Smidt N, van Tulder MW, Rutten-van Molken MP, Ader HJ, van der Windt DA, Assendelft WJ, Bouter LM. Cost effectiveness of interventions for lateral epicondylitis: results from a randomised controlled trial in primary care. *Pharmacoeconomics.* 2004;22(3):185-95.

Lund AT, Amadio PC. Treatment of cubital tunnel syndrome: perspectives for the therapist. *J Hand Ther.* 2006 Apr-Jun;19(2):170-8.

Piligian G, Herbert R, Hearn M, Dropkin J, Landsbergis P, Cherniack M. Evaluation and management of chronic work-related musculoskeletal disorders of the distal upper extremity. *Am J Ind Med* 2000 Jan;37(1):75-93.

Sevier TL, Wilson JK. Treating lateral epicondylitis. *Sports Med* 1999 Nov; 28(5):375-80

Smidt N, Assendelft WJ, Arola H, Malmivaara A, Greens S, Buchbinder R, van der Windt DA, Bouter LM, Effectiveness of physiotherapy for lateral epicondylitis: a systematic review, *Ann Med.* 2003;35(1):51-62.

Smidt N, Lewis M, Hay EM, Van der Windt DA, Bouter LM, Croft P. A comparison of two primary care trials on tennis elbow: issues of external validity. *Ann Rheum Dis*. 2005 Oct;64(10):1406-9. Epub 2005 Mar 30.

Struijs PA, Kerkhoffs GM, Assendelft WJ, Van Dijk CN. Conservative treatment of lateral epicondylitis: brace versus physical therapy or a combination of both—a randomized clinical trial. *Am J Sports Med*. 2004 Mar;32(2):462-9.

Waugh EJ, Jaglal SB, Davis AM, Tomlinson G, Verrier MC. Factors associated with prognosis of lateral epicondylitis after 8 weeks of physical therapy. *Arch Phys Med Rehabil*. 2004 Feb;85(2):308-18.

Forearm, Wrist, & Hand

Handoll H, Gibson J, Madhok R. Interventions for treating proximal humeral fractures in adults, *Cochrane Database Syst Rev*. 2003;4:CD000434

Handoll HH, Madhok R. Conservative interventions for treating distal radial fractures in adults, *Cochrane Database Syst Rev*. 2003;(2):CD000314.

Handoll HH, Madhok R, Howe TE. Rehabilitation for distal radial fractures in adults, *Cochrane Database Syst Rev*. 2002;(2):CD003324

Handoll HH, Madhok R, Howe TE. Rehabilitation for distal radial fractures in adults. *Cochrane Database Syst Rev*. 2006 Jul 19;3:CD003324.

Rapoliene J, Krisciunas A. The effectiveness of occupational therapy in restoring the functional state of hands in rheumatoid arthritis patients. *Medicina (Kaunas)*. 2006;42(10):823-8.

Head

Brown TH, Mount J, Rouland BL, Kautz KA, Barnes RM, Kim J. Body weight-supported treadmill training versus conventional gait training for people with chronic traumatic brain injury. *J Head Trauma Rehabil*. 2005 Sep-Oct;20(5):402-15.

Colorado Division of Workers' Compensation. Rule XVII, Exhibit G, Traumatic Brain Injury. Medical Treatment Guidelines. May 1, 2005

Driver S, O'connor J, Lox C, Rees K. Evaluation of an aquatics programme on fitness parameters of individuals with a brain injury. *Brain Inj*. 2004 Sep;18(9):847-59.

Franckeviciute E, Krisciunas A. Peculiarities of physical therapy for patients after traumatic brain injury. *Medicina (Kaunas)*. 2005;41(1):1-6.

Shiel A, Burn JP, Henry D, Clark J, Wilson BA, Burnett ME, McLellan DL. The effects of increased rehabilitation therapy after brain injury: results of a prospective controlled trial. *Clin Rehabil.* 2001 Oct;15(5):501-14.

Hip & Pelvis (Acute & Chronic)

Binder EF, Brown M, Sinacore DR, Steger-May K, Yarasheski KE, Schechtman KB. Effects of extended outpatient rehabilitation after hip fracture: a randomized controlled trial. *JAMA.* 2004 Aug 18;292(7):837-46.

Bolgia LA, Uhl TL. Electromyographic analysis of hip rehabilitation exercises in a group of healthy subjects. *J Orthop Sports Phys Ther.* 2005 Aug;35(8):487-94.

Brigham and Women's Hospital. Lower extremity musculoskeletal disorders. A guide to diagnosis and treatment. Boston (MA): Brigham and Women's Hospital; 2003.

Expert Clinical Benchmarks. Lower extremity (hip, knee and ankle). King of Prussia (PA): MedRisk, Inc.; 2004.

Handoll HH, Sherrington C, Parker MJ. Mobilisation strategies after hip fracture surgery in adults. *Cochrane Database Syst Rev.* 2004 Oct 18;(4):CD001704.

Jain R, Basinski A, Kreder HJ. Nonoperative treatment of hip fractures. *Int Orthop.* 2003;27(1):11-7. Epub 2002 Nov 12.

Jan MH, Hung JY, Lin JC, Wang SF, Liu TK, Tang PF. Effects of a home program on strength, walking speed, and function after total hip replacement. *Arch Phys Med Rehabil.* 2004 Dec;85(12):1943-51.

Kuisma R. A randomized, controlled comparison of home versus institutional rehabilitation of patients with hip fracture. *Clin Rehabil.* 2002 Aug;16(5):553-61.

Lauridsen UB, de la Cour BB, Gottschalck L, Svensson BH. Intensive physical therapy after hip fracture. A randomised clinical trial. *Dan Med Bull.* 2002 Feb;49(1):70-2.

Mangione KK, Craik RL, Tomlinson SS, Palombaro KM. Can elderly patients who have had a hip fracture perform moderate- to high-intensity exercise at home? *Phys Ther.* 2005 Aug;85(8):727-39.

National Osteoporosis Foundation. Health professional's guide to rehabilitation of the patient with osteoporosis. Washington (DC): National Osteoporosis Foundation; 2003.

Penrod JD, Boockvar KS, Litke A, Magaziner J, Hannan EL, Halm EA, Silberzweig SB, Sean Morrison R, Orosz GM, Koval KJ, Siu AL. Physical therapy and mobility 2 and 6 months after hip fracture. *J Am Geriatr Soc.* 2004 Jul;52(7):1114-20.

Sherrington C, Lord SR, Herbert RD. A randomized controlled trial of weight-bearing versus non-weight-bearing exercise for improving physical ability after usual care for hip fracture. *Arch Phys Med Rehabil.* 2004 May;85(5):710-6.

Tsauo JY, Leu WS, Chen YT, Yang RS. Effects on function and quality of life of postoperative home-based physical therapy for patients with hip fracture. *Arch Phys Med Rehabil.* 2005 Oct;86(10):1953-7.

White SC, Lifeso RM. Altering asymmetric limb loading after hip arthroplasty using real-time dynamic feedback when walking. *Arch Phys Med Rehabil.* 2005 Oct;86(10):1958-63.

Zhang W, Moskowitz RW, Nuki G, Abramson S, Altman RD, Arden N, Bierma-Zeinstra S, Brandt KD, Croft P, Doherty M, Dougados M, Hochberg M, Hunter DJ, Kwoh K, Lohmander LS, Tugwell P. OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. *Osteoarthritis Cartilage.* 2008 Feb;16(2):137-62.

Knee & Leg (Acute & Chronic)

Cochrane T, Davey RC, Matthes Edwards SM. Randomised controlled trial of the cost-effectiveness of water-based therapy for lower limb osteoarthritis. *Health Technol Assess.* 2005 Aug;9(31):iii-iv, ix-xi, 1-114.

Goodwin PC, Morrissey MC, Omar RZ, Brown M, Southall K, McAuliffe TB. Effectiveness of supervised physical therapy in the early period after arthroscopic partial meniscectomy, *Phys Ther.* 2003 Jun;83(6):520-35

Lowe CJ, Barker KL, Dewey M, Sackley CM. Effectiveness of physiotherapy exercise after knee arthroplasty for osteoarthritis: systematic review and meta-analysis of randomised controlled trials. *BMJ.* 2007 Oct 20;335(7624):812. Epub 2007 Sep 20.

Philadelphia Panel, Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for knee pain, *Phys Ther* 2001 Oct;81(10):1675-700

Rand SE, Goerlich C, Marchand K, Jablecki N. The physical therapy prescription. *Am Fam Physician.* 2007 Dec 1;76(11):1661-6.

Zhang W, Moskowitz RW, Nuki G, Abramson S, Altman RD, Arden N, Bierma-Zeinstra S, Brandt KD, Croft P, Doherty M, Dougados M, Hochberg M, Hunter DJ, Kwoh K, Lohmander LS, Tugwell P. OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. *Osteoarthritis Cartilage.* 2008 Feb;16(2):137-62.

Low Back - Lumbar & Thoracic (Acute & Chronic)

Airaksinen OV, Kyrklund N, Latvala K, Kouri JP, Gronblad M, Kolari P. Efficacy of cold gel for soft tissue injuries: a prospective randomized double-blinded trial. *Am J Sports Med.* 2003 Sep-Oct;31(5):680-4.

BlueCross BlueShield. Utilization Management Section - Physical Therapy. Policy No: 6. Effective Date: 03/01/2005

Cherkin DC, Deyo RA, Battie M, Street J, Barlow W. A Comparison of Physical Therapy, Chiropractic Manipulation, and Provision of an Educational Booklet for the Treatment of Patients with Low Back Pain. *NEJM* 1998;339:1021-9.

Erdogmus CB, Resch KL, Sabitzer R, Müller H, Nuhr M, Schöggel A, Posch M, Osterode W, Ungersböck K, Ebenbichler GR. Physiotherapy-based rehabilitation following disc herniation operation: results of a randomized clinical trial. *Spine*. 2007 Sep 1;32(19):2041-9.

Fritz JM, George SZ, Delitto A. The role of fear-avoidance beliefs in acute low back pain: relationships with current and future disability and work status. *Pain*. 2001 Oct;94(1):7-15.

Fritz JM, George SZ. Identifying psychosocial variables in patients with acute work-related low back pain: the importance of fear-avoidance beliefs. *Phys Ther*. 2002 Oct;82(10):973-83.

Fritz JM, Delitto A, Erhard RE. Comparison of classification-based physical therapy with therapy based on clinical practice guidelines for patients with acute low back pain: a randomized clinical trial. *Spine*. 2003 Jul 1;28(13):1363-71; discussion 1372.

Frost H, Lamb SE, Doll HA, Carver PT, Stewart-Brown S. Randomised controlled trial of physiotherapy compared with advice for low back pain. *BMJ*. 2004 Sep 25;329(7468):708. Epub 2004 Sep 17.

George SZ, Fritz JM, Bialosky JE, Donald DA. The effect of a fear-avoidance-based physical therapy intervention for patients with acute low back pain: results of a randomized clinical trial. *Spine*. 2003 Dec 1;28(23):2551-60.

Goldby LJ, Moore AP, Doust J, Trew ME. A randomized controlled trial investigating the efficiency of musculoskeletal physiotherapy on chronic low back disorder. *Spine*. 2006 May 1;31(10):1083-93.

Hayden JA, van Tulder MW, Tomlinson G. Systematic review: strategies for using exercise therapy to improve outcomes in chronic low back pain. *Ann Intern Med*. 2005 May 3;142(9):776-85.

Hicks GE, Fritz JM, Delitto A, McGill SM. Preliminary development of a clinical prediction rule for determining which patients with low back pain will respond to a stabilization exercise program. *Arch Phys Med Rehabil*. 2005 Sep;86(9):1753-62.

Jousset N, Fanello S, Bontoux L, Dubus V, Billabert C, Vielle B, Roquelaure Y, Penneau-Fontbonne D, Richard I. Effects of functional restoration versus 3 hours per week physical therapy: a randomized controlled study. *Spine*. 2004 Mar 1;29(5):487-93; discussion 494.

Klamber Moffett JA, Carr J, Howarth E. High fear-avoiders of physical activity benefit from an exercise program for patients with back pain. *Spine*. 2004 Jun 1;29(11):1167-72; discussion 1173.

Linz DH; Shepherd CD; Ford LF; Ringley LL; Klekamp J; Duncan JM. Effectiveness of occupational medicine center-based physical therapy. *Journal of Occupational and Environmental Medicine*. 01-Jan-2002; 44(1): 48-53.

Long A, Donelson R, Fung T. Does it matter which exercise? A randomized control trial of exercise for low back pain. *Spine*. 2004 Dec 1;29(23):2593-602.

Luijsterburg PA, Lamers LM, Verhagen AP, Ostelo RW, van den Hoogen HJ, Peul WC, Avezaat CJ, Koes BW. Cost-Effectiveness of Physical Therapy and General Practitioner Care for Sciatica. *Spine*. 2007;32:1942-1948.

Luijsterburg PA, Verhagen AP, Ostelo RW, van Os TA, Peul WC, Koes BW. Effectiveness of conservative treatments for the lumbosacral radicular syndrome: a systematic review. *Eur Spine J*. 2007;16:881-99. Epub 2007

Mannion AF, Muntener M, Taimela S, Dvorak J. Comparison of three active therapies for chronic low back pain: results of a randomized clinical trial with one-year follow-up. *Rheumatology (Oxford)*. 2001 Jul;40(7):772-8.

Price C, Arden N, Coglán L, Rogers P. Cost-effectiveness and safety of epidural steroids in the management of sciatica. *Health Technol Assess*. 2005 Aug;9(33):1-58, iii.

Rainville J, Hartigan C, Jouve C, Martinez E. The influence of intense exercise-based physical therapy program on back pain anticipated before and induced by physical activities. *Spine J*. 2004 Mar-Apr;4(2):176-83.

Rainville J, Jouve CA, Hartigan C, Martinez E, Hipona M. Comparison of short- and long-term outcomes for aggressive spine rehabilitation delivered two versus three times per week. *Spine J*. 2002 Nov-Dec;2(6):402-7.

Riipinen M, Niemisto L, Lindgren KA, Hurri H. Psychosocial differences as predictors for recovery from chronic low back pain following manipulation, stabilizing exercises and physician consultation or physician consultation alone. *J Rehabil Med*. 2005 May;37(3):152-8.

Skargren EI, Carlsson PG, Oberg BE. One-year follow-up comparison of the cost and effectiveness of chiropractic and physiotherapy as primary management for back pain. Subgroup analysis, recurrence, and additional health care utilization. *Spine*. 1998 Sep 1;23(17):1875-83; discussion 1884.

Smeal WL, Tyburski M, Alleva J, Prather H, Hunt D. Conservative management of low back pain, part I. Discogenic/radicular pain. *Dis Mon*. 2004;50:636-69.

Vad VB, Bhat AL, Lutz GE, Cammisa F. Transforaminal epidural steroid injections in lumbosacral radiculopathy: a prospective randomized study. *Spine*. 2002 Jan 1;27(1):11-6.

Zigenfus GC; Yin J; Giang GM; Fogarty WT. Effectiveness of early physical therapy in the treatment of acute low back musculoskeletal disorders. *Journal of Occupational and Environmental Medicine*. 01-Jan-2000; 42(1): 35-9.

Neck and Upper Back (Acute & Chronic)

Bigos SJ, Perils, pitfalls, and accomplishments of guidelines for treatment of back problems, *Neurol Clin* 1999 Feb;17(1):179-92

Colorado Division of Workers' Compensation, Medical Treatment Guidelines, Rule XVII, Cervical Spine Injury, 12/01/01.

Conlin A, Bhogal S, Sequeira K, Teasell R. Treatment of whiplash-associated disorders--part I: Non-invasive interventions. *Pain Res Manag*. 2005 Spring;10(1):21-32.

Kjellman GV, Skargren EI, Oberg BE. A critical analysis of randomised clinical trials on neck pain and treatment efficacy: a review of the literature. *Scandinavian Journal of Rehabilitation Medicine* 1999, 31(3), 139-152.

Kongsted A, Qerama E, Kasch H, Bendix T, Winther F, Korsholm L, Jensen TS. Neck collar, "act-as-usual" or active mobilization for whiplash injury? A randomized parallel-group trial. *Spine*. 2007 Mar 15;32(6):618-26.

Philadelphia Panel. Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for neck pain. *Phys Ther* 2001 Oct; 81(10): 1701-17.

Rosenfeld M, Gunnarsson R, Borenstein P. Early intervention in whiplash-associated disorders: a comparison of two treatment protocols. *Spine* 2000 Jul 15;25(14):1782-7.

Scholten-Peeters GG, Neeleman-van der Steen CW, van der Windt DA, Hendriks EJ, Verhagen AP, Oostendorp RA. Education by general practitioners or education and exercises by physiotherapists for patients with whiplash-associated disorders? A randomized clinical trial. *Spine*. 2006 Apr 1;31(7):723-31.

Seferiadis A, Rosenfeld M, Gunnarsson R. A review of treatment interventions in whiplash-associated disorders. *Eur Spine J*. 2004 Aug;13(5):387-97. Epub 2004 May 05.

Pain (Chronic)

Airaksinen O, Brox JI, Cedraschi C, Hildebrandt J, Klaber-Moffett J, Kovacs F, Mannion AF, Reis S, Staal JB, Ursin H, Zanoli G; On behalf of the COST B13 Working Group on Guidelines for Chronic Low Back Pain. Chapter 4 European guidelines for the management of chronic nonspecific low back pain. *Eur Spine J*. 2006 Mar;15(Supplement 2):s192-s300.

Li Z, Smith BP, Smith TL, Koman LA. Diagnosis and management of complex regional pain syndrome complicating upper extremity recovery. *J Hand Ther.* 2005 Apr-Jun;18(2):270-6.

State of Colorado Department of Labor and Employment, Division of Workers' Compensation. Colorado Rule XVII, Exhibit 7, Complex Regional Pain Syndrome Medical Treatment Guideline. 01/01/06

Shoulder (Acute & Chronic)

Anderson NH, Sojbjerg JO, Johannsen HV, Sneppen O, Self-training versus physiotherapist-supervised rehabilitation of the shoulder in patients treated with arthroscopic subacromial decompression: a clinical randomized study, *J Shoulder Elbow Surg* 1999 Mar-Apr;8(2):99-101

Bang MD, Deyle GD, Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome, *J Orthop Sports Phys Ther* 2000 Mar;30(3):126-37

Buchbinder R, Youd JM, Green S, Stein A, Forbes A, Harris A, Bennell K, Bell S, Wright WJ. Efficacy and cost-effectiveness of physiotherapy following glenohumeral joint distension for adhesive capsulitis: a randomized trial. *Arthritis Rheum.* 2007 Aug 15;57(6):1027-37.

Burbank KM, Stevenson JH, Czarnecki GR, Dorfman J. Chronic Shoulder Pain: Part I. Evaluation and Diagnosis. *Am Fam Physician.* 2008;77:453-460, 493-497.

Carette S, Moffet H, Tardif J, Bessette L, Morin F, Fremont P, Bykerk V, Thorne C, Bell M, Bensen W, Blanchette C. Intraarticular corticosteroids, supervised physiotherapy, or a combination of the two in the treatment of adhesive capsulitis of the shoulder: a placebo-controlled trial. *Arthritis Rheum.* 2003 Mar;48(3):829-38.

Ejnisman B, Andreoli CV, Soares BG, Fallopa F, Peccin MS, Abdalla RJ, Cohen M, Interventions for tears of the rotator cuff in adults, *Cochrane Database Syst Rev.* 2004;(1):CD002758

Michener LA, Walsworth MK, Burnet EN. Effectiveness of rehabilitation for patients with subacromial impingement syndrome: a systematic review. *J Hand Ther.* 2004 Apr-Jun;17(2):152-64.

Sauers EL. Effectiveness of rehabilitation for patients with subacromial impingement syndrome. *J Athl Train.* 2005 Jul;40(3):221-3.

Thomas M, Grunert J, Standtke S, Busse MW. Rope pulley isokinetic system in shoulder rehabilitation--initial results. *Z Orthop Ihre Grenzgeb.* 2001 Jan-Feb;139(1):80-6.

Verhagen AP, Bierma-Zeinstra SM, Feleus A, Karels C, Dahaghin S, Burdorf L, de Vet HC, Koes BW, Ergonomic and physiotherapeutic interventions for treating upper extremity work related disorders in adults, *Cochrane Database Syst Rev.* 2004;(1):CD003471

REFERENCE SUMMARIES

Ankle & Foot (Acute & Chronic)

Aldridge T. Diagnosing heel pain in adults. *Am Fam Physician*. 2004 Jul 15;70(2):332-8.

Department of Family and Community Medicine, Southern Illinois University School of Medicine, Springfield, Illinois 62794-9671, USA.

Heel pain is a common condition in adults that may cause significant discomfort and disability. A variety of soft tissue, osseous, and systemic disorders can cause heel pain. Narrowing the differential diagnosis begins with a history and physical examination of the lower extremity to pinpoint the anatomic origin of the heel pain. The most common cause of heel pain in adults is plantar fasciitis. Patients with plantar fasciitis report increased heel pain with their first steps in the morning or when they stand up after prolonged sitting. Tenderness at the calcaneal tuberosity usually is apparent on examination and is increased with passive dorsiflexion of the toes. Tendonitis also may cause heel pain. Achilles tendonitis is associated with posterior heel pain. Bursae adjacent to the Achilles tendon insertion may become inflamed and cause pain. Calcaneal stress fractures are more likely to occur in athletes who participate in sports that require running and jumping. Patients with plantar heel pain accompanied by tingling, burning, or numbness may have tarsal tunnel syndrome. Heel pad atrophy may present with diffuse plantar heel pain, especially in patients who are older and obese. Less common causes of heel pain, which should be considered when symptoms are prolonged or unexplained, include osteomyelitis, bony abnormalities (such as calcaneal stress fracture), or tumor. Heel pain rarely is a presenting symptom in patients with systemic illnesses, but the latter may be a factor in persons with bilateral heel pain, pain in other joints, or known inflammatory arthritis conditions.

Publication Types:

- Review
- Review, Tutorial

PMID: 15291091

Rating: 5a

Colorado Division of Workers' Compensation, Medical Treatment Guidelines, Rule XVII, Exhibit C, Lower Extremity Injury, 12/01/01.

Introduction

This document has been prepared by the Colorado Department of Labor and Employment, Division of Workers' Compensation (Division) and should be interpreted within the context of guidelines for physicians/providers treating individuals qualifying under Colorado Workers' Compensation Act as injured workers with lower extremity injuries.

Although the primary purpose of this document is advisory and educational, these guidelines are enforceable under the Workers' Compensation rules of Procedure, 7 CCR 1101-3. The Division recognizes that acceptable medical practice may include deviations from these guidelines, as individual cases dictate. Therefore, these guidelines are not relevant as evidence of a provider's legal standard of professional care. To properly utilize this document, the reader should not skip nor overlook any sections.

General Guideline Principles

The principles summarized in this section are key to the intended implementation of all Division of Workers' Compensation guidelines and critical to the reader's application of the guidelines in this document.

Rating: 7a

Twaddle BC, Poon P. Early motion for Achilles tendon ruptures: is surgery important? A randomized, prospective study. *Am J Sports Med.* 2007 Dec;35(12):2033-8. Epub 2007 Sep 20.

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BACKGROUND: Comparisons of surgically and nonsurgically treated Achilles tendon ruptures have demonstrated that those treated with surgery allow earlier motion and tend to show superior results. However, early motion enhances tendon healing with or without surgery and may be the important factor in optimizing outcomes in patients with Achilles tendon rupture.

HYPOTHESIS: There is no difference in the outcome of acute Achilles tendon rupture treated nonoperatively or operatively if controlled early motion is allowed as part of the rehabilitation program.

STUDY DESIGN: Randomized, controlled clinical trial; Level of evidence, 1.

METHODS: Patients with acute rupture of the Achilles tendon were randomized to surgery or no surgery, with both groups receiving early motion controlled in a removable orthosis, progressing to full weightbearing at 8 weeks from treatment. Both groups were followed prospectively for 12 months with measurements of range of motion, calf circumference, and the Musculoskeletal Functional Assessment Instrument (MFAI) outcome score; any reruptures and any complications were noted.

RESULTS: Both groups were comparable for age and sex. There were no significant differences between the 2 groups in plantar flexion, dorsiflexion, calf circumference, or the MFAI scores measured at 2, 8, 12, 26, or 52 weeks. One patient in each group was noncompliant and required surgical rerepair of the tendon. There were no differences in complications and a similar low number of reruptures in both groups.

CONCLUSION: This study supports early motion as an acceptable form of rehabilitation in both surgically and nonsurgically treated patients with comparable functional results and a low rerupture rate.

There appears to be no difference between the 2 groups, suggesting that controlled early motion is the important part of treatment of ruptured Achilles tendon.

PMID: 17885221

Rating: 2b

Burns

Simons M, King S, Edgar D; ANZBA. Occupational therapy and physiotherapy for the patient with burns: principles and management guidelines. J Burn Care Rehabil. 2003 Sep-Oct;24(5):323-35; discussion 322.

Occupational Therapy Department, Stuart Pegg Paediatric Burns Centre, Royal Children's Hospital, Brisbane, Queensland, Australia.

Clinical practice guidelines are a tool to assist with clinical decision making. They provide information about the care for a condition and make recommendations based on research evidence, which can be adapted locally. A focus group within the Allied Health Interest Group of the Australian and New Zealand Burn Association has compiled the "Occupational Therapy and Physiotherapy for the Patient with Burns--Principles and Management Guidelines." These guidelines are designed as a practical guide to the relevant clinical knowledge and therapy intervention techniques required for effective patient management. Content areas include respiratory management, edema management, splinting and positioning, physical function (mobility, function, exercise), scar management, and psychosocial and mutual elements. The document has undergone extensive review by members of the Australian and New Zealand Burn Association to ensure clarity, internal consistency, and acceptability. The guidelines have been endorsed by the Australian and New Zealand Burn Association. An abridged version of the guidelines is included in this article, with the full document available from www.anzba.org.au.

Publication Types:

- Guideline
- Practice Guideline

PMID: 14501405

Rating: 6b

Carpal Tunnel Syndrome (Acute & Chronic)

APTA (American Physical Therapy Association). Carpal Tunnel Syndrome. 2006.

This article explains what carpal tunnel syndrome is and the role physical therapists play in treating this debilitating disease and in educating people about possible risk factors.

Rating: 8c

Bilic R, Kolundzic R, Trkulja V, Crnkovic T, Vukovic A. The carpal tunnel syndrome: medical and economic advantages of well-timed surgical treatment. *Lijec Vjesn.* 2006 May-Jun;128(5-6):143-9.

Klinika za ortopediju Medicinskog fakulteta Sveucilista u Zagrebu i KBC-a Zagreb.

Carpal tunnel syndrome (CTS) is a somewhat neglected medical and economic problem, and surgery is one of the therapeutic options. We analyze the outcomes of surgical treatment in 114 consecutive patients (154 hands). Before the surgery, physical therapy was implemented (96% cases) and the patients were frequently on a sick leave (42% cases). Immediately before the surgery, the patients suffered intensive pain (median 7 on a 0-10 scale), and had a reduced hand function (median 2 on a 0-10 scale). After the surgery (6-12 months), the pain was reduced (difference -5.0, 95% CL -5.5, -4.5, $p < 0.001$), and the function improved (difference 4.5, 95% CLs 4.0, 5.0, $p < 0.001$). Longer time interval between referral to a primary care physician and referral to an orthopaedic surgeon (> 1 year in 48% of the cases) was an independent negative predictor for these outcomes. Total difference in costs for sick leaves and physical therapies between the pre- and postoperative periods was estimated at approximately 269.030,00 to over 375.315,00 euros. The time between the entrance into the healthcare system and recognition of the need for surgical treatment of CTS needs to be reduced in order to get better medical and economic results.

PMID: 16910414

Rating: 4c

Cook AC, Szabo RM, Birkholz SW, King EF, Early mobilization following carpal tunnel release. A prospective randomized study, *J Hand Surg [Br]* 1995 Apr;20(2):228-30

Kaiser Permanente, Davis, Sacramento, California, USA.

A prospective randomized study was undertaken of 50 consecutive patients undergoing surgery for idiopathic carpal tunnel syndrome to determine the value of splintage of the wrist following open carpal tunnel release. Patients were randomized to either be splinted for 2 weeks following surgery or to begin range-of-motion exercises on the first post-operative day. Subjects were evaluated at 2 weeks, 1 month, 3 months, and 6 months after surgery by motor and sensory testing, physical examination, and a questionnaire. Variables assessed included date of return to activities of daily living, dates of return to work at light duty and at full duty, pain level, grip strength, key pinch strength, and occurrence of

complications. Patients who were splinted had significant delays in return to activities of daily living, return to work at light and full duty, and in recovery of grip and key pinch strength. Patients with splinted wrists experienced increased pain and scar tenderness in the first month after surgery; otherwise there was no difference between the groups in the incidence of complications. We conclude that splinting the wrist following open release of the flexor retinaculum is largely detrimental, although it may have a role in preventing the rare but significant complications of bowstringing of the tendons or entrapment of the median nerve in scar tissue. We recommend a home physiotherapy programme in which the wrist and fingers are exercised separately to avoid simultaneous finger and wrist flexion, which is the position most prone to cause bowstringing.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

Rating: 2b

Feuerstein M, Burrell LM, Miller VI, Lincoln A, Huang GD, Berger R, Clinical management of carpal tunnel syndrome: a 12-year review of outcomes, *Am J Ind Med* 1999 Mar;35(3):232-45

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Carpal tunnel syndrome (CTS) is a disorder frequently encountered by occupational health care specialists. The health care management of this disorder has involved a diverse set of clinical procedures. The present article is a review of the literature related to CTS with an emphasis on occupational-related CTS. MEDLINE, Cumulative Index to Nursing and Allied Health Literature, PsycLIT, and NIOSHTIC databases from 1985-1997 were searched for treatment outcome studies related to CTS. Treatments of interest included surgery, physical therapy, drug therapy, chiropractic treatment, biobehavioral interventions, and occupational rehabilitation. A systematic review of the effects of these interventions on symptoms, medical status, function, return to work, psychological well-being, and patient satisfaction was completed. Compared to other treatments, the majority of studies assessed the effects of surgical interventions. Endoscopic release was associated with higher levels of physical functioning and fewer days to return to work when compared to open release. Limited evidence indicated: 1) steroid injections and oral use of B6 were associated with pain reduction; 2) in comparison to splinting, range of motion exercises appeared to be associated with less pain and fewer days to return to work; 3) cognitive behavior therapy yielded reductions in pain, anxiety, and depression; and, 4) multidisciplinary occupational rehabilitation was associated with a higher percentage of chronic cases returning to work than usual care. Workers' compensation status was associated with increased time to return to work following surgery. Conclusions are preliminary due to the small number of well-controlled studies, variability in duration of symptoms and disability, and the broad range of reported outcome measures. While there are several opinions regarding effective treatment, there is very little scientific support for the range of options currently used in practice. Despite the emerging evidence of the multivariate nature of CTS, the majority of outcome studies have focused on single interventions directed at individual etiological factors or symptoms and functional limitations secondary to CTS.

Publication Types:

- Review
- Review Literature

From Cochrane Library:

Author's objective

To identify scientifically validated treatment and rehabilitation approaches for carpal tunnel syndrome (CTS).

Type of intervention

Treatment.

Specific interventions included in the review

Surgery (open and endoscopic release), pharmacological/vitamins/steroids (taken orally, injected into the carpal canal or transported via iontophoresis), physical therapy (range or motion exercises)/splinting, chiropractic/manipulation, biobehavioural therapies (individual and group cognitive behaviour therapy, muscle activity biofeedback, neuromuscular re-education and movement retraining), and occupational/work rehabilitation

Participants included in the review

People with diagnosed carpal tunnel syndrome, or diagnoses such as 'hand pain', both work-related and non-work-related.

Outcomes assessed in the review

Medical status (two-point discrimination, nerve conduction velocity, Semmes-Weinstein, Phalen's test, Tinel's test, thenar atrophy, interstitial pressure), symptoms (self report) (pain, tenderness, numbness, paresthesia, weakness, night symptoms, fine dexterity loss), function (grip, key pinch, pulp pinch, range of motion, activities of daily living), work status (median days out of work, workers' compensation status, working with pain), psychological well-being (anxiety, depression, coping strategies, sickness), patient satisfaction (treatment satisfaction rating).

Study designs of evaluations included in the review

There were six study designs:

1. Prospective multiple group, in which patients were randomly assigned to treatment conditions and were followed longitudinally.
2. Non-randomised prospective multiple group, in which patients were assigned to different treatment conditions and followed longitudinally, but the assignment was not random.
3. Single group prospective, in which all patients were assigned to a single treatment group and followed longitudinally.
4. Multiple group retrospective, in which patients were assigned to different treatment conditions, and archival data were analysed to assess outcomes.
5. Single group retrospective, in which patients were assigned to one treatment condition and archival data were used.

6. Case study, which presented data on single patient outcomes.

All prospective multiple group studies available were included in the review. Other study designs were included depending on availability of studies with higher levels of study design within the treatment category.

What sources were searched to identify primary studies?

The authors searched the electronic databases of MEDLINE, CINAHL, PsycLIT, and NIOSHTIC for publications between January 1986 and December 1997 using the key words 'outcome', 'surgery', 'therapy', and 'treatment'. The search was limited to English language publications.

Number of studies included

Thirty-four studies met the inclusion criteria: 6 randomised prospective multiple group studies on surgical interventions for CTS with 485 participants (252 in the treatment group, and 233 in the comparison group); 8 non-randomised prospective multiple group studies on surgical interventions for CTS with 1,007 participants (400 in the treatment group, and 396 in the comparison group, with 1 study having three groups of 72, 90, and 49 participants); 6 studies in the pharmacological/vitamins/steroid injections intervention with 290 participants; 6 studies in the physical therapy/splinting for CTS intervention with 332 participants; 1 study in the chiropractic treatment for CTS intervention with 40 participants; 5 studies in the biobehavioural interventions for CTS group with more than 98 participants; and 2 studies in the work/occupational rehabilitation for CTS group with 400 participants.

How were the studies combined?

The studies were combined in a narrative review which gave a description of each individual intervention and then reported the results of each individual study to give a synthesis of the results for that intervention. For those studies that used statistical analysis, only significant findings are reported.

Results of the review

Endoscopic release was associated with higher levels of physical functioning and fewer days to return to work when compared with open release. Both types of surgery were associated with less pain at follow-up compared to pre-surgical levels.

Steroid injections combined with splinting and surgery and oral use of B6 were associated with pain reduction.

In comparison to splinting, range of motion exercises appeared to be associated with less pain and fewer days to return to work.

Cognitive behaviour therapy yielded reductions in pain, anxiety, and depression in one study.

Multidisciplinary occupational rehabilitation was associated with a higher percentage of chronic cases returning to work than usual care.

Was any cost information reported?

In 1989, the average claim amount (medical and indemnity) for new cases of CTS was \$8,070. Recently, (reported in 1998), compensation claims for the federal workforce that involved CTS had an average indemnity cost of \$4,941 per claim.

Author's conclusions

Conclusions are preliminary due to the small number of well- controlled studies, variability in duration of symptoms and disability, and the broad range of reported outcome measures. While there are several opinions regarding effective treatment, there is very little scientific support for the range of options currently used in practice. Despite the emerging evidence of the multivariate nature of CTS, the majority of outcome studies have focused on single interventions directed at individual etiological factors or symptoms and functional limitations secondary to CTS.

CRD commentary

The literature search did cover several databases for relevant material, but it is not clear whether additional studies may have been missed because unpublished and non-English publications were not included.

The authors have not reported on how the articles were selected, or how the quality of the chosen studies was assessed. There is also no report as to who, or how many of the authors, selected the articles and extracted the data. The categorisation of studies for the review was based on the abstracts found in the literature search which may not have provided sufficient data to categorise the studies appropriately. The data from each study is described in a subjective narrative review which gives detail about each study and summarises the outcome for each intervention. There is no discussion about the heterogeneity between the studies which include a wide range of participants and treatments. The results from these studies should be viewed with caution because of the review's limitations.

What are the implications of the review?

The authors state that this review shows the limitations of existing outcomes research in this area which may guide the design of further research.

The authors also state that in practice, given the evidence to date regarding surgery, particularly in workers' compensation cases, conservative care of the patient with CTS should be emphasised as a logical first step. This point is important in those cases where neurological findings are inconsistent or absent.

O'Connor D, Marshall S, Massy-Westropp N. Non-surgical treatment (other than steroid injection) for carpal tunnel syndrome. *Cochrane Database Syst Rev.* 2003;(1):CD003219.

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BACKGROUND: Non-surgical treatment for carpal tunnel syndrome is frequently offered to those with mild to moderate symptoms. The effectiveness and duration of benefit from non-surgical treatment for carpal tunnel syndrome remain unknown.

OBJECTIVES: To evaluate the effectiveness of non-surgical treatment (other than steroid injection) for carpal tunnel syndrome versus a placebo or other non-surgical, control interventions in improving clinical outcome.

SEARCH STRATEGY: We searched the Cochrane Neuromuscular Disease Group specialised register (searched March 2002), MEDLINE (searched January 1966 to February 7 2001), EMBASE (searched January 1980 to March 2002), CINAHL (searched January 1983 to December 2001), AMED (searched 1984 to January 2002), Current Contents (January 1993 to March 2002), PEDro and reference lists of articles.

SELECTION CRITERIA: Randomised or quasi-randomised studies in any language of participants with the diagnosis of carpal tunnel syndrome who had not previously undergone surgical release. We considered all non-surgical treatments apart from local steroid injection. The primary outcome measure was improvement in clinical symptoms after at least three months following the end of treatment.

DATA COLLECTION AND ANALYSIS: Three reviewers independently selected the trials to be included. Two reviewers independently extracted data. Studies were rated for their overall quality. Relative risks and weighted mean differences with 95% confidence intervals were calculated for the primary and secondary outcomes in each trial. Results of clinically and statistically homogeneous trials were pooled to provide estimates of the efficacy of non-surgical treatments.

MAIN RESULTS: Twenty-one trials involving 884 people were included. A hand brace significantly improved symptoms after four weeks (weighted mean difference (WMD) -1.07; 95% confidence interval (CI) -1.29 to -0.85) and function (WMD -0.55; 95% CI -0.82 to -0.28). In an analysis of pooled data from two trials (63 participants) ultrasound treatment for two weeks was not significantly beneficial. However one trial showed significant symptom improvement after seven weeks of ultrasound (WMD -0.99; 95% CI -1.77 to -0.21) which was maintained at six months (WMD -1.86; 95% CI -2.67 to -1.05). Four trials involving 193 people examined various oral medications (steroids, diuretics, nonsteroidal anti-inflammatory drugs) versus placebo. Compared to placebo, pooled data for two-week oral steroid treatment demonstrated a significant improvement in symptoms (WMD -7.23; 95% CI -10.31 to -4.14). One trial also showed improvement after four weeks (WMD -10.8; 95% CI -15.26 to -6.34). Compared to placebo, diuretics or nonsteroidal anti-inflammatory drugs did not demonstrate significant benefit. In two trials involving 50 people, vitamin B6 did not significantly improve overall symptoms. In one trial involving 51 people yoga significantly reduced pain after eight weeks (WMD -1.40; 95% CI -2.73 to -0.07) compared with wrist splinting. In one trial involving 21 people carpal bone mobilisation significantly improved symptoms after three weeks (WMD -1.43; 95% CI -2.19 to -0.67) compared to no treatment. In one trial involving 50 people with diabetes, steroid and insulin injections significantly improved symptoms over eight weeks compared with steroid and placebo injections. Two trials involving 105 people compared ergonomic keyboards versus control and demonstrated equivocal results for pain and function. Trials of magnet therapy, laser acupuncture, exercise or chiropractic care did not demonstrate symptom benefit when compared to placebo or control. **REVIEWER'S CONCLUSIONS:** Current evidence shows significant short-term benefit from oral steroids, splinting, ultrasound, yoga and carpal bone mobilisation. Other non-surgical treatments do not produce significant benefit. More trials are needed to compare treatments and ascertain the duration of benefit.

Publication Types:

- Review
- Review, Academic

PMID: 12535461

Rating: 1b

Some excerpts:

The incidence of CTS is increasing, and that with age expectancy of seventy years, 3.5 per cent of males and 11 per cent of females will be affected by CTS. Females in their fourth and fifth decades suffer CTS four times more commonly than men. Carpal tunnel syndrome does not follow a predictable course. Some patients experience a deterioration in hand function whilst others describe 'silent' periods and intermittent exacerbation of symptoms. Some patients have described spontaneous improvement of symptoms without medical treatment. The treatment of carpal tunnel syndrome can be categorized into surgical and non-surgical. Surgical treatment is usually offered to those with severe carpal tunnel syndrome, who have constant symptoms, severe sensory disturbance and/ or thenar motor weakness. Non-surgical treatments are offered to those who have the intermittent symptoms of mild to moderate carpal tunnel syndrome. Non-surgical interventions may also be used as a temporary measure while awaiting carpal tunnel release.

In summary, there is limited evidence that a nocturnal hand brace improves symptoms, hand function and overall patient-reported change in the short-term (up to four weeks of use).

In summary, there is limited evidence that night-only wrist splint use is equally effective as full-time wrist splint use in improving short-term symptoms and hand function.

In summary, there is limited evidence that neutral wrist splinting results in superior short-term overall and nocturnal symptom relief (at two weeks) when compared with wrist splinting in extension.

Furthermore, limited evidence suggests that short-term daytime symptom relief is similar for both splint groups.

In summary, there is moderate evidence that two weeks of ultrasound treatment does not improve short-term symptoms beyond that achieved with placebo. However, limited evidence does suggest that ultrasound results in superior symptom relief after seven weeks of treatment and beyond a seven week treatment period (assessed at six months) when compared with placebo. There is limited evidence that seven weeks of ultrasound therapy results in better sensory perception and self-reported improvement when compared to placebo. There is limited evidence that short-term pain and nocturnal waking are similar between ultrasound and placebo-treated groups. Furthermore, there is limited evidence that long-term nerve conduction, grip and pinch strength values are similar for ultrasound and placebo groups. No significant effect of varying intensity of ultrasound delivery was demonstrated for pain, symptoms or nocturnal waking. There is, therefore, limited evidence that continuous ultrasound at 1.5W/cm² is equally effective in improving short-term pain, symptoms and nocturnal waking as continuous ultrasound at 0.8W/cm². In summary, there is limited evidence that ultrasound delivery at 1 MHz is similar to ultrasound delivery at 3 MHz for pain, paraesthesia, sensation, grasp and provocative testing measures in the short-term.

In summary, limited evidence suggests that ergonomic and standard keyboards provide similar improvements in Phalen's and Tinel's sign, timed Phalen's test and peripheral nerve conduction. There is equivocal evidence regarding the effect of ergonomic keyboards on pain relief and hand function.

In summary, limited evidence suggests that diuretic treatment does not improve short-term symptoms in CTS.

No significant effect in favour of NSAID treatment was demonstrated for improving carpal tunnel symptoms. In summary, limited evidence suggests that NSAID treatment does not improve short-term symptoms in CTS.

In summary, there is moderate evidence that oral steroid treatment for two weeks improves short-term symptoms. Limited evidence suggests that symptom improvement is also achieved with four weeks of oral steroid treatment. There is equivocal evidence regarding the short-term symptom benefit beyond the end of an oral steroid treatment period.

In summary, limited evidence suggests that there is no difference in the effect of diuretics and NSAIDs on short-term CTS symptoms.

In summary, there is limited evidence that short-term oral steroid treatment improves CTS symptoms significantly more than diuretic treatment.

In summary, there is limited evidence to suggest that oral steroid use for 2 to 4 weeks significantly improves short-term symptoms when compared to NSAID treatment.

There is, therefore, limited evidence that vitamin B6 improves finger swelling and movement discomfort with 12 weeks of treatment. Limited evidence suggests that vitamin B6 does not improve symptoms, nocturnal discomfort, hand co-ordination, Phalen's sign and Tinel's sign in the short-term.

In summary, there is limited evidence that nerve and tendon gliding exercises and wrist splinting result in superior static two-point discrimination compared to wrist splinting alone in the medium-term. Limited evidence suggests that exercise plus wrist splinting and wrist splinting alone provide similar improvement in symptoms, hand function, grip strength, pinch strength, Phalen's sign, Tinel's sign and patient satisfaction.

In summary, there is limited evidence that yoga results in superior short-term pain relief and improved outcome for Phalen's sign compared to wrist splinting. There is limited evidence that yoga and wrist splinting provide similar short-term improvement in nocturnal waking, Tinel's sign and grip strength.

In summary, limited evidence suggests that neurodynamic mobilisation does not improve short-term symptoms, pain, hand function, wrist motion, upper limb tension testing nor reduce the likelihood of continuing to carpal tunnel release surgery.

In summary, limited evidence suggests that carpal bone mobilisation improves symptoms in the short-term (with three weeks of treatment). Limited evidence also suggests that carpal bone mobilisation does not improve short-term pain, hand function, wrist motion, upper limb tension test findings or the subsequent need for surgery.

In summary, limited evidence suggests that there is no significant benefit of neurodynamic over carpal bone mobilisation for improving short-term CTS outcomes.

In summary, limited evidence suggests that magnet therapy does not significantly improve short-term pain relief in CTS.

In summary, there is limited evidence that medical care over nine weeks improves physical distress in the short-term when compared with chiropractic treatment. Limited evidence also suggests that chiropractic and medical treatment provide similar short-term improvement in mental distress, vibrometry, hand function and health-related quality of life.

In summary, limited evidence suggests that laser acupuncture does not improve short-term paraesthesiae and night pain in CTS.

In summary, limited evidence suggests that a steroid injection followed by weekly insulin injections into the carpal tunnel for eight weeks results in superior symptom relief and nerve conduction compared with steroid injection and weekly placebo injections over the same period.

Verhagen AP, Bierma-Zeinstra SM, Feleus A, Karels C, Dahaghin S, Burdorf L, de Vet HC, Koes BW, Ergonomic and physiotherapeutic interventions for treating upper extremity work related disorders in adults, *Cochrane Database Syst Rev.* 2004;(1):CD003471

Department of General Practice, Erasmus MC, P.O. Box 1738, 3000 DR Rotterdam, Netherlands.

BACKGROUND: Conservative interventions such as physiotherapy and ergonomic adjustments play a major part in the treatment of most work-related musculoskeletal disorders (WRMD).

OBJECTIVES: The objective of this systematic review is to determine whether conservative interventions have a significant impact on short and long-term outcomes for upper extremity WRMD in adults.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised register (January 2002) and Cochrane Rehabilitation and Related Therapies Field specialised register (January 2002), the Cochrane Controlled Trials Register (The Cochrane Library Issue 3, 2001), PubMed (1966 to November 2001), EMBASE (1988 to November 2001), and CINAHL (1982 to November 2001). We also searched the Physiotherapy Index (1988 to November 2001) and reference lists of articles. No language restrictions were applied.

SELECTION CRITERIA: Only randomised controlled trials and concurrent controlled trials studying conservative interventions for adults suffering from upper extremity WRMD were included. Conservative interventions may include exercises, relaxation, physical applications, biofeedback, myofeedback and work place adjustments.

DATA COLLECTION AND ANALYSIS: Two reviewers independently selected the trials from the search yield and assessed the clinical relevance and methodological quality using the Delphi list. In the event of clinical heterogeneity or lack of data we used a rating system to assess levels of evidence.

MAIN RESULTS: We included 15 trials involving 925 people. Twelve trials included people with chronic non-specific neck or shoulder complaints, or non-specific upper extremity disorders. Over 20 interventions were evaluated; seven main subgroups of interventions could be determined: exercises, manual therapy, massage, ergonomics, multidisciplinary treatment, energised splint and individual treatment versus group therapy. Overall, the quality of the studies appeared to be poor. In 10 studies a form of exercise was evaluated, and there is limited evidence about the effectiveness of exercises only when compared to no treatment. Concerning manual therapy (1 study), massage (4 studies), multidisciplinary treatment (1 study) and energised splint (1 study) no conclusions can be drawn. Limited evidence is found concerning the effectiveness of specific keyboards for patients with carpal tunnel syndrome. **REVIEWER'S CONCLUSIONS:** This review shows limited evidence for the effectiveness of keyboards with an alternative force-displacement of the keys or an alternative geometry, and limited evidence for the effectiveness of individual exercises. The benefit of expensive ergonomic interventions (such as new chairs, new desks etc) in the workplace is not clearly demonstrated.

Publication Types:

- Meta-Analysis
- Review
- Review, Academic

PMID: 14974016

Rating: 1b

BACKGROUND

The term repetitive strain injury (RSI) is not a diagnosis, but an umbrella term for disorders that develop as a result of repetitive movements, awkward postures, and impact of force (Yassi 1997). Work-related musculoskeletal disorders (WRMD) have been described differently in various countries: RSI in Canada and Europe, both RSI and occupational overuse syndrome (OOS) in Australia and cumulative trauma disorder in the USA (Putz-Anderson 1988). Work-related musculoskeletal disorders can be divided into specific conditions such as carpal tunnel syndrome, which has relatively clear diagnostic criteria and pathology, or non-specific conditions such as tension neck syndrome, which is primarily defined by the location of complaints and whose pathophysiology is less clearly defined. With carpal tunnel syndrome, for instance, between 43 and 90 per cent of cases can be defined as work-related, depending on the setting (industrial or primary care setting) (Hagberg 1992; Miller 1994).

In the USA, cumulative trauma disorders account for between 56 and 65 percent of all occupational injuries (Melhorn 1998; Pilligan 2000). Overall, the estimated prevalence of upper-extremity WRMD is approximately 30 per cent (Yassi 1997; Melhorn 1998). Several studies report a rapidly increasing incidence of WRMD of the upper extremities (Yassi 1997). The costs associated with these disorders are high - over two billion dollars of direct and indirect costs estimated annually in the USA (Pilligan 2000).

Today, much attention is paid to the prevention and treatment of WRMD (Silverstein 1997; Yassi 1997). Conservative interventions such as physiotherapy and ergonomic adjustments play a major part in the prevention or treatment of most WRMD (Pilligan 2000). The direct and indirect costs of these WRMD

are a burden to patients, employers and insurance companies. Therefore, there is a need to determine whether conservative interventions have a significant impact on long-term outcomes.

TRIALS COMPARING DIFFERENT TYPES OF INCLUDED CONSERVATIVE TREATMENTS

Thirteen studies compared different conservative treatments.

1. Exercises

In three studies when different forms of exercises were compared the conclusion was defined as 'unclear', meaning not providing data (Ferguson 1976; Kamwendo 1991; Hagberg 2000). Three studies report conflicting results concerning the effectiveness of exercises compared to massage (Rundcrantz 1991; Levoska 1993; Vasseljen 1995). Only the study of Vasseljen 1995 was of high quality but here exercises were a part of both interventions. The study evaluated the difference between individual and group exercises, so no conclusions can be drawn about the effectiveness of the exercises themselves. Therefore we conclude that there is conflicting evidence concerning the effectiveness of exercises compared to massage, and no evidence concerning the effectiveness of exercises when different forms of exercises are compared.

2. Manual therapy/chiropractic treatment

In the study of Bang 2000 significant results were found in pain reduction and isodynamic strength in patients with a shoulder impingement syndrome. Therefore we conclude that there is limited evidence for the efficacy of manual therapy in patients with a shoulder impingement syndrome.

3. Massage

In one study (Ferguson 1976) the conclusion was defined as 'unclear', and one found positive results (significantly) in favour of massage (Leboeuf 1987). In the studies of Levoska 1993 and Vasseljen 1995 massage was a part of a combination of interventions (i.e. a black box), so no conclusions can be drawn concerning the efficacy of massage from these studies. All studies were of low quality, therefore we conclude that there is conflicting evidence of the efficacy of massage in the treatment of upper extremity WRMD.

4. Ergonomics

Two high quality studies (Rempel 1999; Tittiranonda 1999) evaluated the efficacy of six different keyboards on reduction of complaints. Rempel 1999 reported significant positive results of alternative force-displacement of the keys in pain reduction in 12 weeks and Tittiranonda 1999 found no significant differences between different keyboards. The results of the study of Kamwendo 1991 are classified as 'unclear'. Therefore we conclude that there is limited evidence of the efficacy of some keyboards in people with a carpal tunnel syndrome compared with other keyboards.

5. Multidisciplinary treatment

In one low quality non-randomised study a multidisciplinary work re-entry rehabilitation programme is compared with 'usual care' (Feuerstein 1993), reporting non significant positive results. We conclude that there is no evidence of efficacy of a multidisciplinary treatment.

6. Energised splint

There is one study comparing an 'energised splint' with placebo (Stralka 1998). See placebo comparison below.

7. Group therapy versus individual therapy

The study of Vasseljen 1995 is considered of high quality and shows significant short term positive results. Therefore we conclude that when individual exercises are compared with exercises in a group there is limited evidence on short-term efficacy for individual exercises.

TRIALS COMPARING CONSERVATIVE TREATMENTS WITH PLACEBO, OR NO TREATMENT/WAITING LIST CONTROLS

1. Placebo

Two studies compared a conservative treatment with a placebo (Stralka 1998; Tittiranonda 1999). One high quality study (Tittiranonda 1999) evaluated the efficacy of three different keyboards in people with a carpal tunnel syndrome on reduction of complaints and improvement of function with a placebo (= unchanged keyboard). They reported significant positive results of some keyboards compared with the placebo. Therefore we conclude that there is limited evidence for the efficacy of alternative keyboards over a placebo.

One low quality RCT compared an 'energised splint' with placebo (Stralka 1998). The results were classified as 'unclear'.

2. No treatment/waiting list controls

Four studies compared a conservative treatment with a control group receiving no treatment (Kamwendo 1991; Takala 1994; Lundblad 1999; Waling 2000). In all studies forms of exercises were compared with a control group receiving no treatment. In one study the conclusion was defined as 'unclear' (Kamwendo 1991), in two studies (Lundblad 1999; Takala 1994) positive but non-significant results were found and Waling 2000 found significant positive results of exercises on pain, strength and function. All studies were regarded of low quality, therefore we conclude that there is limited evidence concerning the efficacy of exercises compared to a control group receiving no treatment.

DISCUSSION

This review shows that there is limited evidence concerning the effectiveness of specific keyboards for patients with a carpal tunnel syndrome, and limited evidence for the effectiveness of exercises in patients with chronic non-specific neck and shoulder complaints when compared to no treatment. As well as these results, an individual approach appeared to be more effective compared with a group approach.

Elbow (Acute & Chronic)

Boyer MI, Hastings H 2nd. Lateral tennis elbow: "Is there any science out there?" J Shoulder Elbow Surg 1999 Sep-Oct;8(5):481-91

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As orthopaedic surgeons, we are besieged by myths that guide our treatment of lateral epicondylitis, or "tennis elbow." This extends from the term used to describe the condition to the nonoperative and operative treatments as well. The term epicondylitis suggests an inflammatory cause; however, in all but 1 publication examining pathologic specimens of patients operated on for this condition, no evidence of acute or chronic inflammation is found. Numerous nonoperative modalities have been described for the treatment of lateral tennis elbow. Most are lacking in sound scientific rationale. This has led to a therapeutic nihilism with respect to the nonoperative management of this condition. An examination of the literature can only lead us to believe that most, if not all, common nonoperative therapeutic modalities used for the treatment of tennis elbow are unproven at best or costly and time-consuming at worst. Most of the published literature on the nonoperative treatment of patients with lateral tennis elbow consists of poorly designed trials. The selection criteria are nebulous, the control group is questionably designed, and the number of patients is often too low to avoid a serious loss of study power. These studies therefore have a high beta error, implying an inability to detect a difference between groups, even if one truly existed. If clinical signs and symptoms persist beyond the limit of acceptability of both patient and surgeon, then an array of surgical options are available. These range from a 10-minute office procedure (the percutaneous release of the extensor origin with the patient under local anesthetic) to an extensive joint denervation, in which all radial nerve branches ramifying to the lateral epicondyle are directly or indirectly divided. How is the surgeon to choose, given the fact that most of the published surgical studies are case series of one type of operation or another, consisting of patients operated on and evaluated by the same surgeon, who has a vested interest in his or her own patients' successful outcome? The orthopaedic surgeon therefore has very little on which to "hang his hat" when it comes to objective data to guide treatment of patients with lateral tennis elbow syndrome. In the final analysis we are guided simply by our own subjective viewpoint and clinical experience. In 1999, to have such a common clinical condition have such a paucity of peer-reviewed published data of acceptable scientific quality is disappointing. In this review article we will examine the "myths" of tennis elbow: the name, the salient features on history and physical examination, the diagnostic modalities, the pathology of the "lesion," the anatomy of the lateral elbow and extensor origin and why it has led to such confusion in differential diagnosis, the nonoperative and operative treatment of tennis elbow, and finally the various studies that have been carried out on elbow biomechanics as it relates to the pathoetiology of true "tennis elbow." It is our hope that the reader will emerge with a clearer picture of the pathoetiology of the condition and the scientific rationale (or lack thereof) of the various operative and nonoperative treatment modalities.

Publication Types:

- Review
- Review, Tutorial

Rating: 5b

Boisaubert B, Brousse C, Zaoui A, Montigny JP. Nonsurgical treatment of tennis elbow. *Ann Readapt Med Phys.* 2004 Aug;47(6):346-55.

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OBJECTIVE: To review the literature on nonsurgical treatment of tennis elbow.

METHODS: We searched Medline for all randomized controlled trials (RCTs), controlled clinical trials (CCTs) and literature reviews published from 1966 to December 2003 on nonsurgical treatment of tennis elbow. We used the keys words controlled clinical trial, tennis elbow on lateral epicondylitis, and treatment. We found 46 reports of RCTs and CCTs on 14 nonsurgical treatments and 11 literature reviews.

RESULTS: Corticosteroid injection is the best treatment option for the short term. However, beneficial effects persisted only for a short time, and the long-term outcome could be poor. For the long term, physiotherapy (pulsed ultrasound, deep friction massage and exercise programme) was the best option but was not significantly different from the "wait-and-see" approach. Some support is offered for the use of topical nonsteroid anti-inflammatory drugs, at least for the short term. There is insufficient evidence to support or refute the use of acupuncture, extracorporeal shock wave therapy, manipulation, orthoses, low-energy laser, glycosaminoglycan polysulfate injection, botulinum toxin injection, or topical nitric oxide application.

CONCLUSION: Further trials, with use of appropriate methods and adequate sample sizes, are needed before conclusions can be drawn about the effects of many of the treatments for tennis elbow and their ability to change the condition's natural course.

PMID: 15297125

Rating: 1b

Foley AE. Tennis elbow. *Am Fam Physician* 1993 Aug;48(2):281-8.

Wright State University School of Medicine, Dayton, Ohio.

The term "tennis elbow" usually refers to lateral epicondylitis, but the same symptoms can be caused by pathologic processes in the elbow. In fact, most cases of this common condition are caused by occupational stress rather than racket sports. Patients complain of elbow pain when the wrist is extended against resistance or during repetitive actions with the wrist and elbow extended. The condition is thought to be caused by a lesion at the origin of the common wrist extensor mechanism, at or very near the lateral epicondyle of the humerus. Differential diagnosis includes inflammatory, arthritic and nerve entrapment syndromes. Prompt conservative treatment has a high success rate. Patient education, use of a tennis-elbow band and physical therapy play key roles in the management of acute symptoms and in the prevention of recurrence. Surgical intervention is required only when other treatment fails.

Publication Types:

- Review
- Review, Tutorial

PMID: 8342481 [PubMed - indexed for MEDLINE]

Handoll H, Gibson J, Madhok R, Interventions for treating proximal humeral fractures in adults, *Cochrane Database Syst Rev.* 2003;4:CD000434

c/o University Department of Orthopaedic Surgery, Royal Infirmary of Edinburgh, Little France, Old Dalkeith Road, Edinburgh, UK, EH16 4SU.

BACKGROUND: Proximal humeral fractures are common yet the management of these injuries varies widely. In particular, the role and timing of any surgical intervention have not been clearly defined.

OBJECTIVES: To collate and evaluate the scientific evidence supporting the various methods used for treating proximal humeral fractures.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised register, the Cochrane Central Register of Controlled Trials, PEDro, MEDLINE (1966 to May week 4 2003), EMBASE (1980 to 2003 week 22), CINAHL (1982 to May week 3 2003), AMED (1985 to May 2003), the National Research Register (UK), Current Controlled Trials, and bibliographies of trial reports. The search was completed in May 2003.

SELECTION CRITERIA: All randomised studies pertinent to the treatment of proximal humeral fractures were selected.

DATA COLLECTION AND ANALYSIS: Independent quality assessment and data extraction were performed by two reviewers. Although quantitative data from trials are presented, trial heterogeneity prevented pooling of results.

MAIN RESULTS: Twelve randomised trials were included. All were small; the largest study involved only 86 patients. Bias in these trials could not be ruled out. Eight trials evaluated conservative treatment, three compared surgery with conservative treatment and one compared two surgical techniques. In the 'conservative' group there was very limited evidence indicating that the type of bandage used made any difference in terms of time to fracture union and the functional end result. However, an arm sling was generally more comfortable than a body bandage. There was some evidence that 'immediate' physiotherapy, without routine immobilisation, compared with that delayed until after three weeks immobilisation resulted in less pain and both faster and potentially better recovery in patients with undisplaced two-part fractures. Similarly, there was evidence that mobilisation at one week instead of three weeks alleviated pain in the short term without compromising long term outcome. Two trials provided some evidence that patients, when given sufficient instruction to pursue an adequate physiotherapy programme, could generally achieve a satisfactory outcome if allowed to exercise without supervision. Operative reduction improved fracture alignment in two trials. However, in one trial,

surgery was associated with a greater risk of complication, and did not result in improved shoulder function. In one trial, hemi-arthroplasty resulted in better short-term function with less pain and less need for help with activities of daily living when compared with conservative treatment for severe injuries. Fracture fixation of severe injuries was associated with a high rate of re-operation in one trial, comparing tension-band wiring fixation with hemi-arthroplasty. There was very limited evidence that similar outcomes resulted from mobilisation at one week instead of three weeks after surgical fixation.

REVIEWER'S CONCLUSIONS: Only tentative conclusions can be drawn from the available randomised trials, which do not provide sufficient evidence for many of the decisions that need to be made in contemporary fracture management. Early physiotherapy, without immobilisation, may be sufficient for some types of undisplaced fractures. It is unclear whether operative intervention, even for specific fracture types, will produce consistently better long term outcomes. There is a need for good quality evidence for the management of these fractures.

PMID: 14583921

Rating: 1b

Korthals-de Bos IB, Smidt N, van Tulder MW, Rutten-van Molken MP, Ader HJ, van der Windt DA, Assendelft WJ, Bouter LM. Cost effectiveness of interventions for lateral epicondylitis: results from a randomised controlled trial in primary care. *Pharmacoeconomics*. 2004;22(3):185-95.

Institute for Research in Extramural Medicine, VU University Medical Center, Amsterdam, The Netherlands. ibc.Korthals-de_Bos.EMGO@med.vu.nl

OBJECTIVE: Lateral epicondylitis is a common complaint, with an annual incidence between 1% and 3% in the general population. The Dutch College of General Practitioners in The Netherlands has issued guidelines that recommend a wait-and-see policy. However, these guidelines are not evidence based.

DESIGN AND SETTING: This paper presents the results of an economic evaluation in conjunction with a randomised controlled trial to evaluate the effects of three interventions in primary care for patients with lateral epicondylitis.

PATIENTS AND INTERVENTIONS: Patients with pain at the lateral side of the elbow were randomised to one of three interventions: a wait-and-see policy, corticosteroid injections or physiotherapy.

MAIN OUTCOME MEASURES AND RESULTS: Clinical outcomes included general improvement, pain during the day, elbow disability and QOL. The economic evaluation was conducted from a societal perspective. Direct and indirect costs (in 1999 values) were measured by means of cost diaries over a period of 12 months. Differences in mean costs between groups were evaluated by applying non-parametric bootstrap techniques. The mean total costs per patient for corticosteroid injections were euro430, compared with euro631 for the wait-and-see policy and euro921 for physiotherapy. After 12 months, the success rate in the physiotherapy group (91%) was significantly higher than in the injection

group (69%), but only slightly higher than in the wait-and-see group (83%). The differences in costs and effects showed no dominance for any of the three groups. The incremental cost-utility ratios were (approximately): euro7000 per utility gain for the wait-and-see policy versus corticosteroid injections; euro12000 per utility gain for physiotherapy versus corticosteroid injections, and euro34500 for physiotherapy versus the wait-and-see policy.

CONCLUSIONS: The results of this economic evaluation provided no reason to update or amend the Dutch guidelines for GPs, which recommend a wait-and-see policy for patients with lateral epicondylitis.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 14871165

Rating: 2c

Lund AT, Amadio PC. Treatment of cubital tunnel syndrome: perspectives for the therapist. *J Hand Ther.* 2006 Apr-Jun;19(2):170-8.

Department of Physical Medicine and Rehabilitation, Mayo Clinic College of Medicine, Rochester, Minnesota 55905, USA.

The treatment of cubital tunnel syndrome provides therapists the opportunity to use a wide variety of their skills. Whether managed surgically or nonoperatively, differential diagnosis, manual therapy, application of therapeutic modalities, splinting, pain management, and facilitating return to work are often all included in a comprehensive treatment plan for return to functional strength and mobility of the affected arm. When surgery is indicated due to a failure of nonoperative methods or the degree of nerve compression, the decision-making process for the specific procedure to perform is multifactorial. Anatomic factors, patient needs, and surgeon preference all play a role in determining which procedure is performed. As with many other conditions, an alliance of patient, therapist, and surgeon will provide the most effective therapeutic team, and the best chance for a good clinical outcome.

PMID: 16713864

Rating: 5b

Piligian G, Herbert R, Hearn M, Dropkin J, Landsbergis P, Cherniack M. Evaluation and management of chronic work-related musculoskeletal disorders of the distal upper extremity. *Am J Ind Med* 2000 Jan;37(1):75-93.

Mount Sinai School of Medicine, The Mount Sinai Hospital, One Gustave L. Levy Place, New York, NY, USA.

This clinical review will describe the epidemiology, clinical presentation, and management of the following work-related musculoskeletal disorders (WMSDs) of the distal upper extremity: deQuervain's disease, extensor and flexor forearm tendinitis/tendinosis, lateral and medial epicondylitis, cubital tunnel syndrome, and hand-arm vibration syndrome (HAVS). These conditions were selected for review either because they were among the most common WMSDs among patients attending the New York State Occupational Health Clinics (NYSOHC) network, or because there is strong evidence for work-relatedness in the clinical literature. Work-related carpal tunnel syndrome is discussed in an accompanying paper. In an attempt to provide evidence-based treatment recommendations, literature searches on the treatment of each condition were conducted via Medline for the years 1985-1999. There was a dearth of studies evaluating the efficacy of specific clinical treatments and ergonomic interventions for WMSDs. Therefore, many of the treatment recommendations presented here are based on a consensus of experienced public health-oriented occupational medicine physicians from the NYSOHC network after review of the pertinent literature. A summary table of the clinical features of the disorders is presented as a reference resource. Copyright 2000 Wiley-Liss, Inc.

Publication Types:

- Review
- Review, Tutorial

Rating: 5b

Sevier TL, Wilson JK. Treating lateral epicondylitis. Sports Med 1999 Nov; 28(5):375-80

(3) Ball Memorial Sports Medicine Fellowship, Muncie, Indiana, USA.

Lateral epicondylitis is a common problem among physically active individuals. One of the most important roles of the clinician is to provide the most effective rehabilitation intervention for the injured athlete and the physically active individual. Over 40 different treatment methods for lateral epicondylitis have been reported in the literature. Initially, lateral epicondylitis can be treated with rest, ice, tennis brace and/or injections. Injections are one of the most popular methods utilised, with a high success rate. However, when the condition is chronic or not responding to initial treatment, physical therapy is initiated. Common rehabilitation modalities utilised are ultrasound, phonophoresis, electrical stimulation, manipulation, soft tissue mobilisation, neural tension, friction massage, augmented soft tissue mobilisation (ASTM) and stretching and strengthening exercise. ASTM is becoming a more popular modality due to the detection of changes in the soft tissue texture as the patient progresses through the rehabilitation process. Other new modalities include laser and acupuncture. As a last resort for chronic or resistant cases, lateral epicondylitis may undergo surgery. Scientific research has found that all these methods have been inconsistently effective in treating lateral epicondylitis. Therefore, further research efforts are needed to determine which method is more effective.

Publication Types:

- Review
- Review, Tutorial

Smidt N, Assendelft WJ, Arola H, Malmivaara A, Greens S, Buchbinder R, van der Windt DA, Bouter LM, Effectiveness of physiotherapy for lateral epicondylitis: a systematic review, *Ann Med.* 2003;35(1):51-62.

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AIM: To evaluate the available evidence of the effectiveness of physiotherapy for lateral epicondylitis of the elbow.

METHOD: Randomised controlled trials (RCTs) identified by a highly sensitive search strategy in six databases in combination with reference checking. Two independent reviewers selected RCTs that included a physiotherapy intervention, patients with lateral epicondylitis, and at least one clinically relevant outcome measure. No language restrictions were made. Methodological quality was independently assessed by two blinded reviewers. A best evidence synthesis, including a quantitative and qualitative analysis, was conducted, weighting the studies with respect to their internal validity, statistical significance, clinical relevance, and statistical power.

RESULTS: 23 RCTs were included in the review, evaluating the effects of lasertherapy, ultrasound treatment, electrotherapy, and exercises and mobilisation techniques. Fourteen studies satisfied at least 50% of the internal validity criteria. Except for ultrasound, pooling of data from RCTs was not possible because of insufficient data, or clinical or statistical heterogeneity. The pooled estimate of the treatment effects of two studies on ultrasound compared to placebo ultrasound, showed statistically significant and clinically relevant differences in favour of ultrasound. There is insufficient evidence either to demonstrate benefit or lack of effect of lasertherapy, electrotherapy, exercises and mobilisation techniques for lateral epicondylitis.

CONCLUSIONS: Despite the large number of studies, there is still insufficient evidence for most physiotherapy interventions for lateral epicondylitis due to contradicting results, insufficient power, and the low number of studies per intervention. Only for ultrasound, weak evidence for efficacy was found. More better designed, conducted and reported RCTs are needed.

Publication Types:

- Review
- Review, Academic

PMID: 12693613

Rating: 1c

Smidt N, Lewis M, Hay EM, Van der Windt DA, Bouter LM, Croft P. A comparison of two primary care trials on tennis elbow: issues of external validity. *Ann Rheum Dis.* 2005 Oct;64(10):1406-9. Epub 2005 Mar 30.

Primary Care Science Research Centre, Keele University, Keele, Staffordshire, UK. n.smidt@vumc.nl

Title 8, California Code of Regulations, section 9792.20 et seq.
Appendix E—Postsurgical Treatment Guidelines (DWC 2008)
ODG's References
(Proposed Regulations—June 2008)

OBJECTIVE: To assess clinical heterogeneity across two studies with respect to study population, interventions, and outcome measures, and to evaluate the influence of these sources of heterogeneity on the results of the studies.

METHODS: The individual patient data were used from two randomised controlled trials investigating the effectiveness of conservative treatments in patients with tennis elbow in primary care. Patients were allocated at random to treatment with steroid injection, wait and see policy, non-steroidal anti-inflammatory drugs, placebo tablets, or physiotherapy. Outcome measures included severity of the main complaint, inconvenience of the elbow complaints, pain during the day, elbow disability, pain-free grip strength, and global improvement. All outcomes were assessed at 1, 6, and 12 months after randomisation.

RESULTS: The two study populations were similar with respect to age, sex, comorbid neck/shoulder complaints, and baseline scores for the severity of pain. However, significant differences were observed for employment status, duration of elbow complaints, dominant side affected, previous history of elbow complaints, and use of analgesics. Local injections differed between the two studies with respect to volume, number, and steroid preparation. However, after 1, 6, and 12 months, the treatment effects of steroid injections were very similar between the study populations.

CONCLUSIONS: Despite large differences in study population at baseline, the responses to steroid injections were remarkably similar. Also the responses to other conservative interventions and the placebo treatment were very consistent, suggesting a uniform course of a tennis elbow and a lack of influence of clinical heterogeneity.

Publication Types:

- Meta-Analysis

PMID: 15800009

Rating: 1c

Struijs PA, Kerkhoffs GM, Assendelft WJ, Van Dijk CN. Conservative treatment of lateral epicondylitis: brace versus physical therapy or a combination of both—a randomized clinical trial. *Am J Sports Med.* 2004 Mar;32(2):462-9.

Department of Orthopaedic Surgery, Academic Medical Center, Amsterdam, the Netherlands.
paastruijs@hotmail.com

BACKGROUND: The authors evaluated the effectiveness of brace-only treatment, physical therapy, and the combination of these for patients with tennis elbow.

METHODS: Patients were randomized over 3 groups: brace-only treatment, physical therapy, and the combination of these. Main outcome measures were success rate, severity of complaints, pain, disability, and satisfaction. Data were analyzed using both intention-to-treat and per-protocol analyses. Follow-up was 1 year.

RESULTS: A total of 180 patients were randomized. Physical therapy was superior to brace only at 6 weeks for pain, disability, and satisfaction. Contrarily, brace-only treatment was superior on ability of daily activities. Combination treatment was superior to brace on severity of complaints, disability, and satisfaction. At 26 weeks and 52 weeks, no significant differences were identified.

CONCLUSION: Conflicting results were found. Brace treatment might be useful as initial therapy. Combination therapy has no additional advantage compared to physical therapy but is superior to brace only for the short term.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 14977675

Rating: 2b

Waugh EJ, Jaglal SB, Davis AM, Tomlinson G, Verrier MC. Factors associated with prognosis of lateral epicondylitis after 8 weeks of physical therapy. *Arch Phys Med Rehabil.* 2004 Feb;85(2):308-18.

Department of Physical Therapy, University of Toronto, Toronto, ON, Canada. e.waugh@utoronto.ca

This study concluded, “Women and patients who report nerve symptoms are more likely to experience a poorer short-term outcome after PT management of lateral epicondylitis. Work-related onsets, repetitive keyboarding jobs, and cervical joint signs have a prognostic influence on women.”

Publication Types:

- Multicenter Study

PMID: 14966719

Rating: 4b

Forearm, Wrist, & Hand

Handoll H, Gibson J, Madhok R, Interventions for treating proximal humeral fractures in adults, *Cochrane Database Syst Rev.* 2003;4:CD000434

c/o University Department of Orthopaedic Surgery, Royal Infirmary of Edinburgh, Little France, Old Dalkeith Road, Edinburgh, UK, EH16 4SU.

BACKGROUND: Proximal humeral fractures are common yet the management of these injuries varies widely. In particular, the role and timing of any surgical intervention have not been clearly defined.

Title 8, California Code of Regulations, section 9792.20 et seq.
Appendix E—Postsurgical Treatment Guidelines (DWC 2008)
ODG’s References
(Proposed Regulations—June 2008)

OBJECTIVES: To collate and evaluate the scientific evidence supporting the various methods used for treating proximal humeral fractures.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised register, the Cochrane Central Register of Controlled Trials, PEDro, MEDLINE (1966 to May week 4 2003), EMBASE (1980 to 2003 week 22), CINAHL (1982 to May week 3 2003), AMED (1985 to May 2003), the National Research Register (UK), Current Controlled Trials, and bibliographies of trial reports. The search was completed in May 2003. **SELECTION CRITERIA:** All randomised studies pertinent to the treatment of proximal humeral fractures were selected.

DATA COLLECTION AND ANALYSIS: Independent quality assessment and data extraction were performed by two reviewers. Although quantitative data from trials are presented, trial heterogeneity prevented pooling of results.

MAIN RESULTS: Twelve randomised trials were included. All were small; the largest study involved only 86 patients. Bias in these trials could not be ruled out. Eight trials evaluated conservative treatment, three compared surgery with conservative treatment and one compared two surgical techniques. In the 'conservative' group there was very limited evidence indicating that the type of bandage used made any difference in terms of time to fracture union and the functional end result. However, an arm sling was generally more comfortable than a body bandage. There was some evidence that 'immediate' physiotherapy, without routine immobilisation, compared with that delayed until after three weeks immobilisation resulted in less pain and both faster and potentially better recovery in patients with undisplaced two-part fractures. Similarly, there was evidence that mobilisation at one week instead of three weeks alleviated pain in the short term without compromising long term outcome. Two trials provided some evidence that patients, when given sufficient instruction to pursue an adequate physiotherapy programme, could generally achieve a satisfactory outcome if allowed to exercise without supervision. Operative reduction improved fracture alignment in two trials. However, in one trial, surgery was associated with a greater risk of complication, and did not result in improved shoulder function. In one trial, hemi-arthroplasty resulted in better short-term function with less pain and less need for help with activities of daily living when compared with conservative treatment for severe injuries. Fracture fixation of severe injuries was associated with a high rate of re-operation in one trial, comparing tension-band wiring fixation with hemi-arthroplasty. There was very limited evidence that similar outcomes resulted from mobilisation at one week instead of three weeks after surgical fixation.

REVIEWER'S CONCLUSIONS: Only tentative conclusions can be drawn from the available randomised trials, which do not provide sufficient evidence for many of the decisions that need to be made in contemporary fracture management. Early physiotherapy, without immobilisation, may be sufficient for some types of undisplaced fractures. It is unclear whether operative intervention, even for specific fracture types, will produce consistently better long term outcomes. There is a need for good quality evidence for the management of these fractures.

PMID: 14583921

Rating: 1b

Handoll HH, Madhok R, Conservative interventions for treating distal radial fractures in adults, *Cochrane Database Syst Rev.* 2003;(2):CD000314.

c/o University Department of Orthopaedic Surgery, Royal Infirmary of Edinburgh, Little France, Old Dalkeith Road, Edinburgh, UK, EH16 4SU. h.handoll@ed.ac.uk

BACKGROUND: Fracture of the distal radius is a common clinical problem particularly in elderly white women with osteoporosis.

OBJECTIVES: To determine the most appropriate conservative treatment for fractures of the distal radius in adults.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised register (November 2002), the Cochrane Central Register of Controlled Trials (The Cochrane Library, Issue 1, 2003), MEDLINE (1966 to January week 1 2003), EMBASE (1988 to 2003 Week 3), CINAHL (1982 to December week 4 2002), the National Research Register (up to Issue 4, 2002), PEDro, conference proceedings and reference lists of articles. No language restrictions were applied.

SELECTION CRITERIA: Randomised or quasi-randomised clinical trials involving skeletally mature patients with a fracture of the distal radius, which compared commonly applied conservative interventions for fracture fixation. These included the application of an external support (plaster cast or brace) and fracture manipulation.

DATA COLLECTION AND ANALYSIS: All trials, judged as fitting the selection criteria by both reviewers, were independently assessed by both reviewers for methodological quality. Data were extracted for anatomical, functional and clinical, including complications, outcomes. The trials were grouped into categories relating to manipulation of displaced fractures; use and extent, including forearm position, of immobilisation; use of braces; different casting materials and techniques; and duration of immobilisation. Although quantitative data from some trials are presented, the lack of good quality trials and trial heterogeneity inhibited pooling of results.

MAIN RESULTS: Three trials were newly included in this update. In all, there are 36 trials, involving a total of 4114 mainly female and older patients, meeting the inclusion criteria for this review. Comprehensive details of the individual trials are provided in tabular form, and their results, grouped as indicated above, have been presented in text and analyses tables. The poor quality and heterogeneity in terms of patient characteristics, interventions compared and outcome measurement, of the included trials meant that no meta-analyses were undertaken.

REVIEWER'S CONCLUSIONS: There remains insufficient evidence from randomised trials to determine which methods of conservative treatment are the most appropriate for the more common types of distal radial fractures in adults. Therefore, at present, practitioners applying conservative management should use an accepted technique with which they are familiar, and which is cost-effective from the perspective of their provider unit. Patient preferences and circumstances, and the risk of complications should also be considered. Prioritising research questions to clarify the most appropriate conservative treatment for this common fracture is warranted. Researchers should differentiate between extra-

articular and intra-articular, and non-displaced and displaced fractures, ascertain patient preferences, and agree a core outcome data set.

Publication Types:

- Review
- Review, Academic

PMID: 12804395

Rating: 1c

Handoll HH, Madhok R, Howe TE, Rehabilitation for distal radial fractures in adults, *Cochrane Database Syst Rev.* 2002;(2):CD003324

c/o University Department of Orthopaedic Surgery, Royal Infirmary of Edinburgh, Little France, Old Dalkeith Road, Edinburgh, UK, EH16 4SU. h.handoll@ed.ac.uk

BACKGROUND: Fracture of the distal radius is a common clinical problem, particularly in older white women with osteoporosis.

OBJECTIVES: To examine the evidence for effectiveness of rehabilitation intervention(s) for adults with conservatively or surgically treated distal radial fractures.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised register (January 2002), the Cochrane Controlled Trials Register (The Cochrane Library, Issue 4, 2001), the Cochrane Rehabilitation and Related Therapies Field database, MEDLINE (1966 to January 2002), EMBASE (1988 to 2001 Week 50), CINAHL (1982 to December Week 2 2001), Current Controlled Trials (December 2001), AMED, PEDro, conference proceedings and reference lists of articles.

SELECTION CRITERIA: Randomised or quasi-randomised clinical trials evaluating rehabilitation as part of the management of fractures of the distal radius sustained by skeletally mature patients. Rehabilitation interventions such as active and passive mobilisation exercises, and training for activities of daily living, could be used on their own or in combination, and be applied in various ways by various clinicians.

DATA COLLECTION AND ANALYSIS: All trials meeting the selection criteria were independently assessed by all three reviewers for methodological quality. Data were extracted independently by two reviewers. The trials were grouped into categories relating to the main comparisons, and to when the intervention(s) commenced (for example, during or after plaster cast immobilisation). Quantitative data are presented using relative risks or mean differences together with 95 per cent confidence limits.

MAIN RESULTS: Twelve trials, involving 601 mainly female and older patients, were included. Initial treatment was conservative, involving plaster cast immobilisation, in all but 20 patients whose fractures were fixed surgically. Though some trials were well conducted, others were methodologically compromised. No trial provided definitive evidence. Only very limited pooling of results from

comparable trials was possible. During immobilisation, there was weak evidence of improved hand function in the short term, but not in the longer term, for early occupational therapy (1 trial), and of a lack of differences in outcome between supervised and unsupervised exercises (1 trial). Post-immobilisation, there was weak evidence of a lack of clinically significant differences in outcome in patients receiving formal rehabilitation therapy (3 trials), passive mobilisation (2 trials) or whirlpool immersion (1 trial) compared with no intervention. There was weak evidence of a short-term benefit of continuous passive motion (post external fixation) (1 trial), intermittent pneumatic compression (1 trial) and ultrasound (1 trial). There was weak evidence of better short-term hand function in patients given physiotherapy than in those given instructions for home exercises by a surgeon (1 trial).

REVIEWER'S CONCLUSIONS: The available evidence from randomised trials is insufficient to establish the relative effectiveness of the various interventions used in the rehabilitation of adults with fractures of the distal radius.

Publication Types:

- Review
- Review, Academic

PMID: 12076475

Rating: 1c

Handoll HH, Madhok R, Howe TE. Rehabilitation for distal radial fractures in adults. *Cochrane Database Syst Rev.* 2006 Jul 19;3:CD003324.

Royal Infirmary of Edinburgh, c/o University Department of Orthopaedic Surgery, Old Dalkeith Road, Little France, Edinburgh, UK EH16 4SU. h.handoll@ed.ac.uk

BACKGROUND: Fracture of the distal radius is a common clinical problem, particularly in older white women with osteoporosis.

OBJECTIVES: To examine the effects of rehabilitation interventions in adults with conservatively or surgically treated distal radial fractures.

SEARCH STRATEGY: We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (December 2005), the Cochrane Central Register of Controlled Trials (The Cochrane Library Issue 4, 2005), MEDLINE, EMBASE, CINAHL, AMED, PEDro, OTseeker and other databases, conference proceedings and reference lists of articles. No language restrictions were applied.

SELECTION CRITERIA: Randomised or quasi-randomised controlled trials evaluating rehabilitation as part of the management of fractures of the distal radius sustained by adults. Rehabilitation interventions such as active and passive mobilisation exercises, and training for activities of daily living, could be used on their own or in combination, and be applied in various ways by various clinicians.

DATA COLLECTION AND ANALYSIS: The authors independently selected and reviewed trials. Study authors were contacted for additional information. No data pooling was done.

MAIN RESULTS: Fifteen trials, involving 746 mainly female and older patients, were included. Initial treatment was conservative, involving plaster cast immobilisation, in all but 27 participants whose fractures were fixed surgically. Though some trials were well conducted, others were methodologically compromised. For interventions started during immobilisation, there was weak evidence of improved hand function for hand therapy in the days after plaster cast removal, with some beneficial effects continuing one month later (one trial). There was weak evidence of improved hand function in the short term, but not in the longer term (three months), for early occupational therapy (one trial), and of a lack of differences in outcome between supervised and unsupervised exercises (one trial). For interventions started post-immobilisation, there was weak evidence of a lack of clinically significant differences in outcome in patients receiving formal rehabilitation therapy (four trials), passive mobilisation (two trials), ice or pulsed electromagnetic field (one trial), or whirlpool immersion (one trial) compared with no intervention. There was weak evidence of a short-term benefit of continuous passive motion (post external fixation) (one trial), intermittent pneumatic compression (one trial) and ultrasound (one trial). There was weak evidence of better short-term hand function in participants given physiotherapy than in those given instructions for home exercises by a surgeon (one trial).

AUTHORS' CONCLUSIONS: The available evidence from randomised controlled trials is insufficient to establish the relative effectiveness of the various interventions used in the rehabilitation of adults with fractures of the distal radius.

PMID: 16856004

Rating: 1b

Rapoliene J, Krisciunas A. The effectiveness of occupational therapy in restoring the functional state of hands in rheumatoid arthritis patients. *Medicina (Kaunas)*. 2006;42(10):823-8.

Department of Rehabilitation, Kaunas University of Medicine, Eiveniu 2, 50009 Kaunas, Lithuania.
jolita.rapoliene@takas.lt

The aim of the study was to evaluate the effectiveness of occupational therapy in rheumatoid arthritis patients with impaired hand function. Standardized Functional Independence Measure was employed in order to evaluate the functional status of the patients and impaired activities. A dynamometer was used for the measurements of muscular strength of hands and a goniometer, for the range of motion of the wrist. Totally, we have examined 120 rheumatoid arthritis patients. They were divided into two groups: 60 patients in each. Occupational therapy was applied only to the patients of the first group. The mean age of Group 1 patients was 53.4 \pm 1.8 years, the mean age of Group 2 patients was 52.0 \pm 1.9 years. The mean duration of the disease was 11.5 \pm 2.6 years and 12.1 \pm 2.4 years, respectively. The effectiveness of therapy was considered ineffective if, after the completion of the course of occupational therapy, no increase in Functional Independence Measure score for patients with rheumatoid arthritis was observed. When the score increased from 1 to 3, we considered this as moderate effectiveness; when the score increased to 4-6, we evaluated the effectiveness of occupational therapy as good, and

when the score of 7 was attained, effectiveness of occupational therapy was considered as very good. In Group 1, the moderate effectiveness of occupational therapy was determined in 31.7% of patients; good effectiveness, in 61.7%; and very good effectiveness, in 3.3% of rheumatoid arthritis patients. In Group 2, the moderate effectiveness of treatment was determined in 48.3% of patients and good effectiveness, in 5% of rheumatoid arthritis patients.

CONCLUSIONS. Hand function (the strength of fingers and hands, the range of motion of the wrist) significantly improved in patients with rheumatoid arthritis after completion of a course of occupational therapy ($p<0.05$). The improvement of hand functions in patients with rheumatoid arthritis led to increased ability to take food and drink, to wash themselves, to put the clothes on the upper and lower parts of the body and take them off, to use the toilet, a bathtub or a shower, to walk, to manage a wheelchair, and to do personal hygiene ($p<0.05$).

PMID: 17090982

Rating: 2b

Head

Brown TH, Mount J, Rouland BL, Kautz KA, Barnes RM, Kim J. Body weight-supported treadmill training versus conventional gait training for people with chronic traumatic brain injury. J Head Trauma Rehabil. 2005 Sep-Oct;20(5):402-15.

Department of Physical Therapy, Beechwood Rehabilitation Services, Langhorne, PA 19047, USA.

OBJECTIVES: To compare body weight support treadmill training (BWSTT) to conventional overground gait training (COGT). **DESIGN:** Randomized controlled trial.

SETTING: Residential rehabilitation center.

PARTICIPANTS: Twenty subjects with chronic traumatic brain injury (TBI).

INTERVENTION: The BWSTT or COGT for 15 minutes plus 30 minutes of exercise 2 days per week, for 3 months.

MAIN OUTCOME MEASURES: Functional Ambulation Category (FAC), Functional Reach (FR), Timed Up and Go; gait velocity, step width (BOS) and step length differential using instrumented gait mat.

RESULTS: Step width approached the norm without between-group differences. Step length differential improved significantly more for the COGT.

CONCLUSIONS: Physical therapy can improve gait for patients more than 6 years post-TBI. The COGT is more effective than the BWSTT for improving gait symmetry during overground walking.

PMID: 16170249

Rating: 2c

Colorado Division of Workers' Compensation. Rule XVII, Exhibit G, Traumatic Brain Injury. Medical Treatment Guidelines. May 1, 2005

For the complete guidelines, click on the link above.

Very complete state workers' comp guidelines. Among the findings are:

ACUTE THERAPEUTIC PROCEDURES – NONOPERATIVE

Resuscitation

The first priority in TBI is complete and rapid physiologic resuscitation. Sedation and neuromuscular blockade are appropriate if needed for transport. Short-acting agents are preferred to allow for serial exams. Hypotension and hypoxia must be avoided to optimize outcome. Avoid unnecessary or prophylactic hyperventilation (Paco₂ less than 26), in the first 24-hours after injury

Intracranial Pressure (ICP) and Cerebral Perfusion Pressure (CPP)

Individuals with brain injury should not be treated for intracranial hypertension (ICH), without clear evidence of brain injury such as a neurologically focal exam, or evidence of herniation syndrome, Glasgow Coma Score (GCS) of less than 9 without systemic explanation (hypotension, hypoxia, significant intoxication), or CT evidence of intracranial pathology with significant mass lesion or swelling.

- a. ICP Monitoring is indicated in individuals with low GCS (less than 9) and/or CT changes, or when the individual cannot have continual neurologic evaluation (e.g., use of anesthesia), and it should also be considered in situations of posturing or multi-trauma.
- b. Aggressive treatment should be initiated with clinical evidence of ICH, to include transient mild hyperventilation, euvolemia and mannitol (if not hypovolemic), until ICP monitoring may be initiated to measure ICP.
- c. Sedation, neuromuscular blockade, and CSF drainage (if ventriculostomy is in place) are appropriate if needed to control ICH.
- d. Interpretation and treatment of ICP should be corroborated by frequent clinical examination and CPP data. In general, it is desirable to:
 1. Maintain ICP less than 20-25mm Hg
 2. Maintain mean arterial pressure (MAP) above 90
 3. Maintain CPP (MAP at head level minus ICP) at, or above 70mm Hg
- e. Intracranial pressure monitoring devices have therapeutic potential but consideration should be given to possible risks related to accuracy and reliability.
- f. Cerebral oxygen saturation monitoring is an emerging technology that may be used, usually in conjunction with ICP monitoring, to assess the effects of treatment interventions on oxygen delivery to the injured brain, and to optimize the management of brain swelling and intracranial pressure in the setting of severe brain injury.
- g. Hyperventilation: Controlled hyperventilation may be necessary for brief periods in acute neurologic deterioration not attributable to systemic pathology (i.e., hypotension). Avoid prophylactic hyperventilation (if Paco₂ is less than 30 mm) in the absence of ICP monitoring or

with normal ICP and within the first 24 hours after severe brain injury to reduce the risk of secondary ischemia

- h. Options for use of mannitol in treating ICP elevations:
 - 1. Use prior to ICP monitoring only if neurologic deterioration is not attributable to systemic pathology (i.e., hypotension) and/or if there are signs of transtentorial herniation
 - 2. Euvolemia must be established and maintained
 - 3. Keep serum osmolarity (OSM) less than 320, especially in acute renal failure (ARF)
 - 4. Bolus (rather than drip) mannitol is more effective treatment for elevated ICP
- i. Glucocorticoids (steroids) are not useful or generally accepted to improve outcome or decrease ICP, and in some instances may be harmful. There is good evidence that they do not decrease mortality, and there is some evidence that they may even increase the mortality rate in trauma individuals with brain injuries.
- j. Barbiturates may be used to treat elevated ICP as a last resort.

Nutrition

Nutritional support should be aggressively initiated as soon as practicable. Preferable route is jejunal by gastrojejunostomy. Early aggressive establishment of positive nitrogen balance is probably beneficial. Appropriate caloric input should be established by the seventh day. Nutritionist or dietitian consultation may be indicated.

Anticonvulsants

Anticonvulsant treatment may be used to prevent early posttraumatic seizures in the high-risk individual, and are usually administered for one week in those with intracranial hemorrhage. Prevention of early seizures has no statistically significant impact on long-term outcome or the development of late seizures or chronic epilepsy. Prevention of early seizures is reasonable to reduce seizure-associated complications during acute management.

Hypothermia is an evolving technology for controlling ICP. It has possible utility in hypoxic or ischemic encephalopathy, however, its use in TBI is currently investigational. It may benefit individuals with a critically elevated ICP unresponsive to traditional therapies.

Of course, hyperthermia must be treated aggressively to avoid exacerbation of increased ICP.

Imaging Procedures

Skull X-Rays: are well-established diagnostic tools used to detect a fracture of the skull base or cranial vault. CT scanning is preferred if fractures are suspected because the CT scan may identify clinically significant fracture as well as potentially co-existent contusion or hemorrhage. Skull x-rays are generally accepted if CT scans are not available.

Computed Axial Tomography (CT): is a well-established brain imaging x-ray study comprising of a mathematical reconstruction of the tissue densities of the brain, skull, and surrounding tissues. CT scans require the use of computer-based scanning equipment. For acute brain trauma, iodine contrast enhancement is not necessary. CT scans are noninvasive and should reveal the presence of blood, skull fracture, and/or structural changes in the brain. CT scans provide limited information about intrinsic cerebral damage involving deep brain structures.

CT scans are widely accepted for acute diagnostic purposes, and for planning acute treatment. They are the screening image of choice in acute brain injury and are used to assess the need for neurosurgical intervention. CT scans are recommended for abnormal mental status, focal neurologic deficits, or acute seizure and should also be considered in the following situations:

- Signs of basilar skull fracture
- Physical evidence of trauma above the clavicles
- Acute traumatic seizure
- Age greater than 60
- An interval of disturbed consciousness
- Pre-or post-event amnesia
- Drug or alcohol intoxication
- Any recent history of TBI, including MTBI

Magnetic Resonance Imaging (MRI): is a well-established brain imaging study in which the individual is positioned in a magnetic field and a radio-frequency pulse is applied. Hydrogen proton energy emission is translated into visualized structures. Normal tissues give off one signal, while abnormal structures give off a different signal. Due to its high contrast resolution, MRI scans are superior to CT scans for the detection of some intracranial pathology, except for bone injuries such as fractures. MRI may reveal an increased amount of pathology as compared with CT. Specific MRI sequences and techniques are very sensitive for detecting traumatic cerebral injury; they may include, but are not limited to, diffusion-tensor, gradient echo, and Fluid Attenuated Inversion Recovery (FLAIR). Some of these techniques are not available on an emergency basis. MRI scans are useful to assess transient or permanent changes, to determine the etiology of subsequent clinical problems, and to plan treatment. MRI is more sensitive than CT for detecting traumatic cerebral injury. Initially, MRI scans are clinically useful in the following situations to:

- Determine neurological deficits not explained by CT
- Evaluate prolonged interval of disturbed consciousness
- Define evidence of acute changes super-imposed on previous trauma or disease

VASCULAR IMAGING TESTS reveal arterial or venous abnormalities in the chest, neck, head, or extremities (e.g., thrombosis, dissection, spasm, emboli, or tearing). These studies are generally used if more standard CT/MRI fails to demonstrate suspected vascular abnormalities. They may be useful in moderate/severe TBI as an adjunct to aforementioned studies, but only rarely in MTBI. Procedures that are generally accepted include:

- Arteriography:** is generally accepted, when the above-noted traumatic vascular abnormalities are suspected but unproven with the techniques discussed so far, or when further investigation of the vascular lesion is necessary. This is particularly true with arteriovenous fistulous change.
- Venography:** is generally accepted, if increased venous flow and pressure are suspected and still undemonstrated. This is done either by the jugular or orbital systems.
- Noninvasive Vascular Assessment (NIVA):** is the least invasive and may demonstrate direction of blood flow and general patency of the carotid and vertebral arterial systems in the neck, but not in the head.

- d. **Magnetic Resonance Angiography(Magnetic Resonance Arteriography(MRA) /Magnetic Resonance Venography(MVA)):** is indicated when vessel changes are suspected but not demonstrated by other simpler tests. Internal obstruction of an artery (e.g., thrombosis, spasm, dissection, emboli from a concomitant chest, or neck injury) may be demonstrated. Arterial compression due to an external pressure (e.g., bony fracture or mass effect from a large intra-axial hemorrhage or cerebral edema) may be demonstrated. Dissection or arteriovenous fistula formation may be seen, but as with other vascular abnormalities may need conventional contrast arteriography/venography to confirm or refute the MRA or MRV findings. The source for intra or extra-axial bleeding may be seen. Intracerebral dural venous sinus thrombosis, as well as poor venous return may be demonstrated by MRA or MRV.

LUMBAR PUNCTURE is a well-established diagnostic procedure for examination cerebrospinal fluid (CSF) in neurological disease and injury. The procedure should be performed by qualified and trained physicians under sterile conditions. Lumbar puncture is contraindicated in acute trauma to the spinal column, certain infections, increased intracranial pressure due to space occupying lesions, and in some coagulation disorders or defects. Additionally, it should be avoided if there are cutaneous infections in the region of the puncture site.

In individuals with suspected or known increased intra-cranial pressure, lumbar puncture should be preceded by fundoscopic examination and by a CT scan or MRI. If no radiographic evidence of extra-axial hemorrhage, mass effect, or impending brain herniation is found then lumbar puncture may proceed. If CT or MRI shows intracerebral, intra-ventricular, or subarachnoid blood, lumbar puncture should be withheld until neurological consultation is obtained.

For the complete guidelines including information on therapeutic and operative procedures, click [here](#).

Publication Type:

- Nationally Recognized Treatment Guideline

Rating: 7a

Driver S, O'connor J, Lox C, Rees K. Evaluation of an aquatics programme on fitness parameters of individuals with a brain injury. Brain Inj. 2004 Sep;18(9):847-59.

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The primary objective was to determine the effect of an aquatic exercise programme on the physical fitness of people with a brain injury. A pre-test-post-test randomized-groups design was conducted. Sixteen outpatients with a brain injury were included in the study. Eight participants were assigned to an aquatic exercise group and eight to a control group. The components of physical fitness measured included cardiovascular endurance, body composition, muscular strength and endurance and flexibility. Measurements were taken pre- and post-programme. Results indicated an increase in components of physical fitness for the experimental group but not the control group. Increases in fitness were reported

as having a positive impact on the functional capacity of individuals in the exercise group as well as enhancing the individual's ability to complete activities of daily living successfully. Results indicate that aquatic exercise may positively impact the primary and secondary physical injuries caused by a brain injury. Copyright 2004 Taylor and Francis Ltd

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 15223738

Rating: 2c

Franckeviciute E, Krisciunas A. Peculiarities of physical therapy for patients after traumatic brain injury. Medicina (Kaunas). 2005;41(1):1-6.

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Literature review data about methods and means of physical therapy for patients after traumatic brain injury is presented in this article. Traumatic brain injury is an urgent medical and social problem all over the world. It is the most common cause of disability in Lithuania. Patient rehabilitation after traumatic brain injury is divided into two periods: acute and subacute. In the beginning of rehabilitation physical therapist evaluates patient's functional status, later he uses methods and means of treatment, and evaluates effectiveness of rehabilitation. Early verticalisation is very important for patients with coma. Physical therapy consists of prevention of complications, improvement of muscle force, and range of motions, balance, movement coordination, endurance and cognitive functions. Early rehabilitation is necessary for traumatic brain injury patients and use of physical therapy methods can help to regain lost functions and to come back to the society.

Publication Type:

- Review

PMID: 15687744

Rating: 5c

Shiel A, Burn JP, Henry D, Clark J, Wilson BA, Burnett ME, McLellan DL. The effects of increased rehabilitation therapy after brain injury: results of a prospective controlled trial. Clin Rehabil. 2001 Oct;15(5):501-14.

University of Southampton Rehabilitation Research Unit, UK. agnes.shiel@mrc-cbu.cam.ac.uk

OBJECTIVE: The objective was to investigate the effect of increased intensity of rehabilitation therapy provided to brain-injured subjects on the rate at which independence was regained and the duration of hospital admission.

DESIGN: A two-centre, prospective, controlled study with random allocation to groups.

SETTING: Two district general hospitals on the south coast of England.

SUBJECTS: Fifty-six people with moderate and severe head injury consecutively admitted to Southampton and Poole hospitals between June 1995 and September 1997.

INTERVENTIONS: Increased intensity of rehabilitation therapy input without change in content.

RESULTS: Subjects receiving more intensive therapy made more rapid progress and were discharged home sooner. The different intensities of therapy employed in this study showed no evidence of a 'ceiling' effect and the 'intervention group' made significantly more rapid progress on tests of dependency during the period of admission. A clear response to increased therapy input was seen in one of the centres with more rapid functional improvement and a shorter length of hospital stay. This centre already had more therapy and better community facilities. No such benefits were seen at the other centre where the intervention group had a longer hospital stay than the routine group.

CONCLUSION: Increasing the hours per week of therapy given to adults recovering from brain injury in hospital can accelerate the rate of recovery of personal independence and result in their being discharged from hospital sooner. Increased rehabilitation therapy after brain injury is associated with enhanced functional recovery and shorter hospital stay if provided in the context of an integrated service that can provide ongoing community support. There is no evidence of any ceiling effect of therapeutic intensity beyond which no further response is observed.

Publication Types:

- Clinical Trial
- Multicenter Study
- Randomized Controlled Trial

PMID: 11594640

Rating: 2c

Hip & Pelvis (Acute & Chronic)

Binder EF, Brown M, Sinacore DR, Steger-May K, Yarasheski KE, Schechtman KB. Effects of extended outpatient rehabilitation after hip fracture: a randomized controlled trial. *JAMA*. 2004 Aug 18;292(7):837-46.

Department of Internal Medicine, Washington University School of Medicine, St Louis, Mo 63108, USA. ebinder@im.wustl.edu

This RCT included 90 patients, and concluded that in elderly patients with hip fracture, six months of outpatient rehabilitation including progressive resistance training improves physical function and quality of life and reduces disability compared with low-intensity home exercise.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 15315998

Rating: 2c

Bolgia LA, Uhl TL. Electromyographic analysis of hip rehabilitation exercises in a group of healthy subjects. J Orthop Sports Phys Ther. 2005 Aug;35(8):487-94.

Rehabilitation Sciences, University of Kentucky, Lexington, KY, USA. labolg2@uky.edu

STUDY DESIGN: Single-occasion, repeated-measures design.

OBJECTIVE: To determine the magnitude of hip abductor muscle activation during 6 rehabilitation exercises.

BACKGROUND: Many researchers have reported that hip strengthening, especially of the hip abductors, is an important component of a lower extremity rehabilitation program. Clinicians employ non-weight-bearing and weight-bearing exercise to strengthen the hip musculature; however, researchers have not examined relative differences in muscle activation during commonly used exercises. Information regarding these differences may provide clinicians with a scientific rationale needed for exercise prescription.

METHODS AND MEASURES: Sixteen healthy subjects (mean +/- SD age, 27 +/- 5 years; range, 18-42 years; mean +/- SD height, 1.7 +/- 0.2 m; mean +/- SD body mass, 76 +/- 15 kg) volunteered for this study. Bipolar surface electrodes were applied to the right gluteus medius muscle. We measured muscle activation as subjects performed 3 non-weight-bearing (sidelying right hip abduction and standing right hip abduction with the hip at 0 degrees and 20 degrees of flexion) and 3 weight-bearing (left-sided pelvic drop and weight-bearing left hip abduction with the hips at 0 degrees and 20 degrees of flexion) exercises. Data were expressed as a percent of maximum voluntary isometric contraction of the right gluteus medius. Differences in muscle activation across exercises were determined using a 1-way analysis of variance with repeated measures, followed by a sequentially rejective Bonferroni post hoc analysis to identify differences between exercises.

RESULTS: The weight-bearing exercises demonstrated significantly greater EMG amplitudes ($P < .001$) than all non-weight-bearing exercises except non-weight-bearing sidelying hip abduction.

CONCLUSION: The weight-bearing exercises and non-weight-bearing sidelying hip abduction exercise resulted in greater muscle activation because of the greater external torque applied to the hip abductor musculature. Although the non-weight-bearing standing hip abduction exercises required the least activation, they may benefit patients who cannot safely perform the weight-bearing or sidelying hip abduction exercises. Clinicians may use results from this study when designing hip rehabilitation programs.

Publication Types:

- Clinical Trial

PMID: 16187509

Rating: 2c

Brigham and Women's Hospital. Lower extremity musculoskeletal disorders. A guide to diagnosis and treatment. Boston (MA): Brigham and Women's Hospital; 2003.

Osteoarthritis

Pain in the groin area, usually worsens with weight bearing and improves with rest. Lateral, flank, or buttock pain usually not "true" hip pain and suggests a different problem.

- May present as referred pain in the knee
- Painful, limping gait
- Progressive loss of range of motion
- Crossing one's legs, tying shoes, and walking are painful.

Diagnostic Testing

Differential diagnosis includes back pathology and trochanteric bursitis. Radiographic testing usually shows joint space narrowing in the superior lateral area of the hip. Spine films indicated when diagnosis is uncertain.

Physical Exam

Decreased range of motion of the hip in flexion, adduction, and internal rotation.

Treatment

- Acetaminophen, up to 4,000 mg a day initial drug of choice
- NSAIDs are more effective, but they are a second-line therapy because of toxicity. Cyclooxygenase (COX)-2 inhibitors are associated with fewer gastrointestinal (GI) side effects than NSAIDs but they carry a risk of renal toxicity and are quite costly.

Rehabilitation (Physical or Occupational Therapy)

- Pain management techniques (positioning, posture cues, use of heat/cold for symptom management)
- Exercise program to maintain or improve joint range of motion and muscle strength

- Appropriate assistive device (e.g., cane) to improve ambulation

Referral

Refer to surgery when patient feels the benefits of surgery outweigh the risks. For some this will be early in the process, to maintain active function, while for others this will be when pain is too severe to carry out activities of daily living.

Surgical Intervention

Total hip replacement (THR) should be undertaken when the above measures have failed. Total hip replacement is underutilized in women, yet it is a very effective treatment for osteoarthritis of the hip with a less than 1% mortality. Results are best in centers that perform high numbers of the procedure.

Trochanteric Bursitis

- May or may not have history of trauma/fall onto affected hip
- Pain is generally felt in the area of the posterior, lateral greater trochanter.
- Pain may also extend down the lateral thigh or occasionally into the buttocks.
- Patients complain that activities such as rising to a standing position, sleeping on affected side, and/or going up or down stairs cause increase in pain.

Diagnostic Testing

Clinical diagnosis

Physical Exam

Tenderness over the posterior lateral greater trochanter, especially when palpated with patient lying on unaffected side and downward pressure exerted over affected soft tissue

Treatment

NSAIDs are helpful for management of pain. Stretching program very helpful.

Rehabilitation (Physical or Occupational Therapy)

- Modalities for pain management (iontophoresis, heat/cold)
- Patient education for activity modification, specific stretching techniques, and home exercises program
- Exercise program to restore joint range of motion, correct muscle imbalance, promote joint proprioception
- Gait training

Referral

Referral to subspecialist for corticosteroid injection may be helpful.

Surgical Intervention

Not indicated

Iliotibial Band Syndrome

Aching or burning pain over the lateral femoral condyle or proximal lateral tibia, and may radiate up the thigh toward the hip

Diagnostic Testing

Clinical diagnosis

Physical Exam

Pain on palpation of the iliotibial band (localized or along the entire band)

Treatment

- NSAIDs to reduce pain and inflammation
- Wearing proper shoes and advising patients to run on even terrain or softer surfaces
- Orthotics may help to improve alignment.

Rehabilitation (Physical or Occupational Therapy)

- Stretching exercises to restore flexibility
- Patient education on activity modifications and proper shoe wear
- Exercises to restore muscle strength and correct imbalances
- Orthotics may be needed.

Referral

Referral to subspecialist for local corticosteroid injections into areas of tenderness may be helpful.

Surgical Intervention

Not indicated

Rating: 6b

Cameron ID. Coordinated multidisciplinary rehabilitation after hip fracture. Disabil Rehabil. 2005 Sep 30-Oct 15;27(18-19):1081-90.

Rehabilitation Studies Unit, Faculty of Medicine, University of Sydney, Australia.

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PURPOSE: To review the topic of coordinated multidisciplinary rehabilitation after hip fracture from a research perspective and to provide information to guide the provision of rehabilitation services for patients with hip fracture.

METHODS: Literature review including searches of Medline, Embase, Cochrane Collaboration and evidence based clinical guidelines, checking of references of publications and consultation with researchers.

RESULTS: The research evidence is heterogeneous and remains inclusive. Programs that assist patients with hip fracture to regain function and return home as soon as feasible are likely to be effective as they appear to increase the percentage of patients who return home and remain there after hip fracture. Rehabilitation programs that achieve this are likely to be cost effective. These programs involve health professionals from multiple disciplines (nurses, allied health professionals and medical practitioners) who work collaboratively, may operate in several settings, and routinely provide specific treatments that are supported by strong evidence of effectiveness.

CONCLUSIONS: Patients with hip fracture should be offered a coordinated a multidisciplinary rehabilitation program with the specific aim of regaining sufficient function to return to their pre-fracture living arrangements.

PMID: 16315427

Rating: 5b

Expert Clinical Benchmarks. Lower extremity (hip, knee and ankle). King of Prussia (PA): MedRisk, Inc.; 2004.

MAJOR RECOMMENDATIONS

General

During the initial evaluation, the therapist should include questions about work task requirements in the patient history interview and incorporate these findings in the treatment objectives.

The therapist's treatment regimen should be directed toward improving the patient's functional ability rather than based on the patient's impairment.

The therapist's treatment regimen should emphasize active interventions over passive modalities and should become less frequent toward the end of the episode of care in order to encourage patient behavioral gains.

Non-Surgical

For non-surgical lower extremity (hip, knee, and ankle) conditions, a series of physical therapy treatments should be delivered ranging from 10 to 24 visits over a period of 6 to 12 weeks, depending upon severity (see table below). Refer to the original guideline document for recommendations on the time, choice, and sequence of interventions, as well as interventions that are generally recommended, interventions recommended on a case specific/clinical judgement basis, and interventions that are not recommended. Specific interventions are listed in the "Interventions and Practices Considered" field in the Complete Summary.

Surgical

For surgical lower extremity (hip, knee, and ankle) conditions, a series of physical therapy treatments should be delivered ranging from 16 to 28 visits over a period of 6 to 15 weeks, depending upon severity (see table below). Refer to the original guideline document for recommendations on the time, choice, and sequence of interventions as well as interventions that are generally recommended, interventions recommended on a case specific/clinical judgement basis, and interventions that are not recommended.

Specific interventions are listed in the "Interventions and Practices Considered" field in the Complete Summary.

Publication Type:

- Nationally Recognized Treatment Guideline

Rating: 6b

Handoll HH, Sherrington C, Parker MJ. Mobilisation strategies after hip fracture surgery in adults. Cochrane Database Syst Rev. 2004 Oct 18;(4):CD001704.

University Department of Orthopaedic Surgery, Royal Infirmary of Edinburgh, Little France, Old Dalkeith Road, Edinburgh, UK, EH16 4SU.

BACKGROUND: Hip fracture, which happens in predominantly elderly populations, often results in a reduction in mobility. Care programmes after hip fracture surgery include strategies for mobilisation, such as early weight bearing and gait retraining. Other mobilisation strategies, such as exercises and physical training, are used at various stages in rehabilitation including after discharge from hospital.

OBJECTIVES: To evaluate the effects of different mobilisation strategies and programmes after hip fracture surgery.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group Specialised Register (May 2004), the Cochrane Central Register of Controlled Trials (The Cochrane Library Issue 2, 2004), MEDLINE and other databases, conference proceedings and reference lists of articles.

SELECTION CRITERIA: All randomised or quasi-randomised trials comparing different mobilisation strategies/programmes after hip fracture surgery.

DATA COLLECTION AND ANALYSIS: The reviewers independently assessed trial quality and extracted data.

MAIN RESULTS: Our third update, which extended the review scope to cover the whole rehabilitation period, included four new trials. Most of the 10 included trials were small and all had methodological limitations, including inadequate follow up. Seven trials evaluated mobilisation strategies started soon after hip fracture surgery. One trial (273 participants) found no statistically significant differences in unfavourable outcomes for weight bearing started at two versus 12 weeks after internal fixation of a displaced intracapsular fracture. Of two trials (188 participants) comparing a more with a less intensive regimen of physiotherapy, one reported a lack of demonstrable difference in recovery of the two patient groups, and the other found a higher level of drop-out in the more intensive group with no difference in length of hospital stay. One trial (80 participants) comparing two-week programmes of weight-bearing versus non-weight-bearing exercise found some short-term improvement in mobility and balance in the weight-bearing exercise group. One trial (80 participants) found improved mobility, leg extension power and Barthel score in those given a quadriceps muscle strengthening exercise programme. One trial (40 participants) found no statistically significant difference in recovery of mobility and time to hospital

discharge after a treadmill versus conventional gait retraining programme. One trial (27 participants) comparing neuromuscular stimulation of the quadriceps muscle with placebo found a greater recovery of pre-fracture mobility in the stimulation group. The interventions tested by the three remaining trials started after hospital discharge. One trial (28 participants) found improved outcome after 12 weeks of intensive physical training. One trial (120 participants) found improved outcome after home-based exercises started around 22 weeks from injury. One trial (44 participants) found home-based weight-bearing exercises starting at seven months produced no statistically significant differences aside, perhaps, for greater quadriceps strength.

REVIEWERS' CONCLUSIONS: There is insufficient evidence from randomised trials to determine the effectiveness of the various mobilisation strategies examined in this review that start either in the early post-operative period or during the later rehabilitation period. Further research is required to establish the possible benefits of the additional provision of interventions primarily aimed at enhancing mobility.

Publication Types:

- Meta-Analysis
- Review
-

PMID: 15495015

Rating: 1c

Jain R, Basinski A, Kreder HJ. Nonoperative treatment of hip fractures. *Int Orthop*. 2003;27(1):11-7. Epub 2002 Nov 12.

San Diego Sports Medicine and Orthopaedic Center, 6719 Alvarado Road, Suite 200, 92120 San Diego, CA, USA. rina.jain@sympatico.ca

We retrospectively reviewed a population database and a case series to compare the mortality of operative and nonoperative treatment of hip fractures in patients with severe comorbidity. Nonoperative treatment of hip fractures (bed rest or early weight bearing) was administered based on medical assessment of perioperative risk. Comparison of 30-day mortality was performed between the nonoperatively and operatively treated groups. We found that of 50,235 of hip fractures that occurred between 1992 and 1998, 89.4% were treated operatively. Thirty-day mortality rate in the nonoperatively treated patients (18.8%) was higher than the rate in operatively treated patients (11.0%) (odds ratio 1.7 times, 95% confidence interval (CI) 1.6, 1.8). In the case series, of 62 elderly patients with severe comorbidity treated nonoperatively, 41 had bed rest/traction, while 21 were mobilized early. A group of operatively treated patients (n=108) was compared to nonoperatively treated patients. Mortality with nonoperative treatment was higher with bed rest (73%) compared to early mobilization (odds ratio 3.8, 95% CI 1.1-14.0). There was no significant difference in mortality between operatively treated patients (29%) and patients treated nonoperatively with immediate mobilization (19%). Bed rest was 2.5 times more likely to be associated with mortality compared to operative treatment (95% CI 1.1-5.5).

Publication Type:

- Meta-analysis

PMID: 12582802

Rating: 1a

Jan MH, Hung JY, Lin JC, Wang SF, Liu TK, Tang PF. Effects of a home program on strength, walking speed, and function after total hip replacement. Arch Phys Med Rehabil. 2004 Dec;85(12):1943-51.

School and Graduate Institute of Physical Therapy, College of Medicine, National Taiwan University, Taipei, Republic of China.

OBJECTIVE: To assess the efficacy of a home exercise program in increasing hip muscle strength, walking speed, and function in patients more than 1.5 years after total hip replacement (THR).

DESIGN: Randomized controlled trial.

SETTING: Kinesiology laboratory.

PARTICIPANTS: Fifty-three patients with unilateral THR were randomly assigned to the training (n=26) and control (n=27) groups. Patients in the training group were further divided into exercise-high (n=13) and exercise-low (n=13) compliance groups according to their practice ratio (high, > or =50%).

INTERVENTION: The training group underwent a 12-week home program that included hip flexion range of motion exercises for both hip joints; strengthening exercises for bilateral hip flexors, extensors, and abductors; and a 30-minute walk every day. The control group did not receive any training.

MAIN OUTCOME MEASURES: Strength of bilateral hip muscles, free and fast walking speeds while walking over 3 different terrains, and functional performance were assessed by using a dynamometer, videotape analysis, and the functional activity part of the Harris Hip Score, respectively, before and after the 12-week period.

RESULTS: Subjects in the exercise-high compliance group showed significantly ($P < .05$) greater improvement in muscle strength for the operated hip, fast walking speed, and functional score than those in the exercise-low compliance and control groups.

CONCLUSIONS: The designed home program was effective in improving hip muscle strength, walking speed, and function in patients after THR who practiced the program at least 3 times a week, but adherence to this home program may be a problem.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 15605331

Rating: 2c

Kuisma R. A randomized, controlled comparison of home versus institutional rehabilitation of patients with hip fracture. Clin Rehabil. 2002 Aug;16(5):553-61.

Department of Rehabilitation Sciences, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong. rskuisma@polyu.edu.hk

OBJECTIVE: To compare ambulation outcomes between home and institutional rehabilitation of patients with hip fracture.

DESIGN: Randomized controlled clinical equivalence trial.

SETTING: The Queen Elizabeth Hospital in Hong Kong.

SUBJECTS: Eighty-one patients with hip fracture.

INTERVENTION: Study group patients (40) were discharged directly home from the acute hospital and visited by a physiotherapist an average of 4.6 times. The control group subjects (41) were discharged to a rehabilitation centre for further treatment lasting on average 36.2 days (SD 14.6) and they received physiotherapy daily.

MAIN OUTCOME MEASURES: Ambulation ability measured on a categorical scale.

RESULTS: The mean age of the subjects was 75 years (SD 8.3 years). Females comprised 60% of all the subjects and majority were retired or home makers. Both groups of patients improved in their ambulation ability during their rehabilitation period but neither group achieved their pre-ambulatory status by the time of completion of the study. The study group achieved significantly higher ambulation scores ($p < 0.05$) for community and household ambulation compared with the control group by the end of the study, a year after operation.

CONCLUSION: Five visits by a physiotherapist in the patient's home after discharge from an acute hospital after surgical treatment for hip fracture yielded better results in ambulation ability than one month of conventional institution-based rehabilitation.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 12194626

Rating: 2c

Lauridsen UB, de la Cour BB, Gottschalck L, Svensson BH. Intensive physical therapy after hip fracture. A randomised clinical trial. Dan Med Bull. 2002 Feb;49(1):70-2.

H:S Copenhagen Municipal Hospital, Department of Rheumatology.

INTRODUCTION: This randomised study evaluates the effect of intensive physical therapy on the duration of rehabilitation following hip fracture.

METHODS: Eighty-eight patients transferred for rehabilitation after surgical treatment for hip fracture were included in the trial. Forty-four patients were randomised to physical therapy 3.6 hours (median) a week, while the 44 control patients received physical therapy 1.9 hours a week. Outcome was defined as duration of physical rehabilitation until the patient was able to (1) walk 50 metres in less than 2 minutes, (2) manage stair climbing to the first floor, (3) manage sit-to-stand transfer, (4) move in and out of bed, (5) manage bathing, dressing and lavatory visits.

RESULTS: In the group randomised to intensive physical therapy 24 patients withdrew after 15 days while 13 patients withdrew from the control group after 22 days (median values). Early withdrawal was due to orthopaedic complications, general weakness and poor co-operation. No difference between the two groups was demonstrated in the duration of physical rehabilitation by a per protocol analysis of the patients who completed the trial.

DISCUSSION: The considerable drop-out rate suggests that intensive physical therapy may be of limited value when attempting to reduce the duration of rehabilitation following hip fracture. An altered objective including enhanced out-patient rehabilitation may be necessary in order to reduce the length of hospital stay after hip fracture.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 11894727

Rating: 2c

Mangione KK, Craik RL, Tomlinson SS, Palombaro KM. Can elderly patients who have had a hip fracture perform moderate- to high-intensity exercise at home? Phys Ther. 2005 Aug;85(8):727-39.

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BACKGROUND AND PURPOSE: The majority of patients after a hip fracture do not return to prefracture functional status. Depression has been shown to affect recovery. Although exercise can reduce impairments, access issues limit elderly people from participating in facility-based programs. The primary purpose of this study was to determine the effects and feasibility of a home exercise program of

moderate- or high-intensity exercise. A secondary purpose was to explore the relationship of depression and physical recovery.

SUBJECTS: Thirty-three elderly people (24 women, 9 men; mean = 78.6 years of age, SD = 6.8, range = 64-89) who had completed a regimen of physical therapy following hip fracture participated in the study. Subjects were randomly assigned to a resistance training group, an aerobic training group, or a control group.

METHODS: Subjects were tested before and upon completion of the exercise trial. Isometric lower-extremity force, 6-minute-walk distance, free gait speed, mental status, and physical function were measured. Each exercise session was supervised by a physical therapist, and subjects received 20 visits over 12 weeks. The control group received biweekly mailings. The resistance training group performed 3 sets of 8 repetitions at the 8-repetition maximum intensity using a portable progressive resistance exercise machine. The aerobic training group performed activities that increased heart rate 65% to 75% of their age-predicted maximum for 20 continuous minutes.

RESULTS: Resistance and aerobic training were performed without apparent adverse effects, and adherence was 98%. All groups improved in distance walked, force produced, gait speed, and physical function. Isometric force improved to a greater extent in the intervention groups than in the control group. Depressive symptoms interacted with treatment group in explaining the outcomes of 6-minute-walk distance and gait speed.

DISCUSSION AND CONCLUSION: High-intensity exercise performed in the home is feasible for people with hip fracture. Larger sample sizes may be necessary to determine whether the exercise regimen is effective in reducing impairments and improving function. Depression may play a role in the level of improvement attained.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 16048421

Rating: 2c

National Osteoporosis Foundation. Health professional's guide to rehabilitation of the patient with osteoporosis. Washington (DC): National Osteoporosis Foundation; 2003.

MAJOR RECOMMENDATIONS

Following hip fracture, physical therapy and exercise can improve transfers, gait, leg strength, flexibility, and balance. A total body exercise program also should include guided progression as strength improves.

Rehabilitation Following Hip Fracture

Hip fracture is a traumatic event that typically requires surgery to repair the fracture or replace the hip joint. It is important to regain as much mobility and independence as possible following hip fracture and to take steps to prevent future fractures. As the patient improves in terms of reduced pain and greater mobility, physical therapy and exercise programs can improve gait, leg strength, flexibility, and balance. A trained caregiver can safely assist the patient from a walker to a cane to unaided walking as her/his underlying health and physical status permits. Exercise principles should focus on hip-strengthening exercises. Fall prevention strategies should be implemented and should include a home-safety risk assessment and balance training. Slow-movement exercises, such as Tai Chi, should be encouraged. See the following

Simple Hip-Strengthening Exercises

Hip-flexors — Standing beside a chair, without bending at the waist, bend one knee up as close to chest as possible. Lower leg to floor. Repeat with other leg.

Hip abductors — Standing erect and holding onto the back of a chair, without bending at the waist or knee, move one leg straight out to the side, making sure that the toes point forward. Lower the leg and repeat on other side.

Hip-extensors — Stand holding onto the back of a chair, and bend forward about 45 degrees at the hips. Lift one leg straight out behind you as high as possible without bending the knee or moving the upper body. Lower leg and repeat on other side.

Hip Protectors

Hip protective pads, worn in the side pockets of stretchy undergarments, were shown to protect against hip fractures in an elderly nursing home population, but compliance is difficult to obtain. However, these devices should be considered for elderly individuals at risk for hip fracture following a fall.

Publication Type:

- Nationally Recognized Treatment Guideline

Rating: 6a

Penrod JD, Boockvar KS, Litke A, Magaziner J, Hannan EL, Halm EA, Silberzweig SB, Sean Morrison R, Orosz GM, Koval KJ, Siu AL. Physical therapy and mobility 2 and 6 months after hip fracture. J Am Geriatr Soc. 2004 Jul;52(7):1114-20.

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OBJECTIVES: To examine the relationship between early physical therapy (PT), later therapy, and mobility 2 and 6 months after hip fracture. **DESIGN:** Prospective, multisite observational study.

SETTING: Four hospitals in the New York City area.

PARTICIPANTS: Four hundred forty-three hospitalized older patients discharged after surgery for hip fracture in 1997-98.

MEASUREMENTS: Patient demographics, fracture type, comorbidities, dementia, number of new impairments at discharge, amount of PT between day of surgery and postoperative day (POD) 3, amount of therapy between POD4 and 8 weeks later, and prefracture, 2-, and 6-month mobility measured using the Functional Independence Measure.

RESULTS: More PT immediately after hip fracture surgery was associated with significantly better locomotion 2 months later. Each additional session from the day of surgery through POD3 was associated with an increase of 0.4 points ($P=.032$) on the 14-point locomotion scale, but the positive relationship between early PT and mobility was attenuated by 6 months postfracture. There was no association between later therapy and 2- or 6-month mobility.

CONCLUSION: PT immediately after hip fracture surgery is beneficial. The effects of later therapy on mobility were difficult to assess because of limitations of the data. Well-designed randomized, controlled trials of the effect of varying schedules and amounts of therapy on functional status after hip fracture would be informative.

Publication Types:

- Multicenter Study

PMID: 15209649

Rating: 2b

Sherrington C, Lord SR, Herbert RD. A randomized controlled trial of weight-bearing versus non-weight-bearing exercise for improving physical ability after usual care for hip fracture. Arch Phys Med Rehabil. 2004 May;85(5):710-6.

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OBJECTIVE: To compare the effects of weight-bearing and non-weight-bearing home exercise programs and a control program on physical ability (strength, balance, gait, functional performance) in older people who have had a hip fracture.

DESIGN: Randomized controlled trial with 4-month follow-up.

SETTING: Australian community-dwellers (82%) and residents of aged care facilities who had completed usual care after a fall-related hip fracture.

PARTICIPANTS: One hundred twenty older people entered the trial, 40 per group (average age \pm standard deviation, 79 ± 9 y) and 90% completed the 4-month retest.

INTERVENTION: Home exercise prescribed by a physical therapist.

MAIN OUTCOME MEASURES: Strength, balance, gait, and functional performance.

RESULTS: At the 4-month retest, there were differences between the groups in the extent of improvement since the initial assessment for balance ($F(10,196)=2.82$, $P<.001$) and functional performance ($F(6,200)=3.57$, $P<.001$), but not for strength ($F(12,190)=1.09$, $P=.37$) or gait ($F(8,200)=.39$, $P=.92$). The weight-bearing exercise group showed the greatest improvements in measures of balance and functional performance (between-group differences of 30%-40% of initial values).

CONCLUSIONS: A weight-bearing home exercise program can improve balance and functional ability to a greater extent than a non-weight-bearing program or no intervention among older people who have completed usual care after a fall-related hip fracture.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 15129393

Rating: 2b

Tsao JY, Leu WS, Chen YT, Yang RS. Effects on function and quality of life of postoperative home-based physical therapy for patients with hip fracture. Arch Phys Med Rehabil. 2005 Oct;86(10):1953-7.

School and Graduate Institute of Physical Therapy, College of Medicine, National Taiwan University, Taipei.

OBJECTIVE: To evaluate the effects of a 3-month home-based physical therapy (PT) program for patients with hip fracture after surgery. DESIGN: Randomized controlled trial.

SETTING: Home.

PARTICIPANTS: Twenty-five patients recently discharged from an acute orthopedic department.

INTERVENTIONS: Patients were randomized to the home-based PT group ($n=13$), where they received home-based PT 8 times from discharge to month 3 postdischarge, or to the control group ($n=12$). The home-based PT program included exercises for muscle strengthening, range of motion (ROM), balance, and functional training. Patients in the control group were instructed to practice the exercise program given at bedside before discharge.

MAIN OUTCOME MEASURES: Patients were evaluated for hip ROM, strength, walking velocity, Harris hip score, and health-related quality of life (HRQOL) at the week of discharge and at 1, 3, and 6 months after discharge.

RESULTS: The baseline characteristics showed no difference between the 2 groups. Harris score of the home-based PT group progressed from 58.6+/-8.5 to 90.1+/-5.4 at month 3, whereas Harris score of the control group progressed from 54.6+/-14.5 to 77.4+/-10.0 (P<.01). Scores of the psychologic domain of HRQOL for the home-based PT group were significantly better at month 1 (P<.05) and month 3 (P<.01) after discharge. Moreover, the physical domain score of the home-based PT group was also significantly better (P<.05) at 3 months after discharge.

CONCLUSIONS: Home-based PT programs could help patients regain function and HRQOL earlier.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 16213237

Rating: 2c

White SC, Lifeso RM. Altering asymmetric limb loading after hip arthroplasty using real-time dynamic feedback when walking. Arch Phys Med Rehabil. 2005 Oct;86(10):1958-63.

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OBJECTIVE: To evaluate a walking program incorporating real-time biofeedback to reduce asymmetric limb loading after total hip arthroplasty (THA).

DESIGN: Within-subject clinical intervention.

SETTING: Biomechanics laboratory.

PARTICIPANTS: Volunteers were screened for confounding disorders that could affect their gait other than unilateral THA. Participants included 28 subjects who were evaluated a minimum of 2 months after surgery and ambulatory without assistive devices.

INTERVENTIONS: THA subjects were assigned to a feedback, no-feedback, or control group. The feedback group walked on a treadmill 15 minutes, 3 times a week for 8 weeks while matching step-to-step reaction forces. Subjects walking without feedback had equal time. The control group did not train.

MAIN OUTCOME MEASURES: Symmetry indices for peak limb-loading force, rate of rise of loading force, and impulse calculated from vertical foot-ground forces. Symmetry index changes were evaluated using 2-factor, repeated-measures analyses of variance with a Tukey post hoc test.

RESULTS: Loading rate and impulse equalization improved for the feedback group ($P < .01$). Loading rate equalization improved for the no-feedback group ($P = .01$). There were no changes for the control group.

CONCLUSIONS: This preliminary study suggests that a treadmill walking program may help persons with a THA achieve a more symmetric gait. Additional investigation of the potential benefits of a rehabilitation program incorporating treadmill walking with and without biofeedback is recommended.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 16213238

Rating: 2c

Zhang W, Moskowitz RW, Nuki G, Abramson S, Altman RD, Arden N, Bierma-Zeinstra S, Brandt KD, Croft P, Doherty M, Dougados M, Hochberg M, Hunter DJ, Kwok K, Lohmander LS, Tugwell P. OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. *Osteoarthritis Cartilage*. 2008 Feb;16(2):137-62.

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PURPOSE: To develop concise, patient-focussed, up to date, evidence-based, expert consensus recommendations for the management of hip and knee osteoarthritis (OA), which are adaptable and designed to assist physicians and allied health care professionals in general and specialist practise throughout the world.

METHODS: Sixteen experts from four medical disciplines (primary care, rheumatology, orthopaedics and evidence-based medicine), two continents and six countries (USA, UK, France, Netherlands, Sweden and Canada) formed the guidelines development team. A systematic review of existing guidelines for the management of hip and knee OA published between 1945 and January 2006 was undertaken using the validated appraisal of guidelines research and evaluation (AGREE) instrument. A core set of management modalities was generated based on the agreement between guidelines. Evidence before 2002 was based on a systematic review conducted by European League Against Rheumatism and evidence after 2002 was updated using MEDLINE, EMBASE, CINAHL, AMED, the Cochrane Library and HTA reports. The quality of evidence was evaluated, and where possible, effect size (ES), number needed to treat, relative risk or odds ratio and cost per quality-adjusted life years gained were estimated. Consensus recommendations were produced following a Delphi exercise and the strength of recommendation (SOR) for propositions relating to each modality was determined using a visual analogue scale.

RESULTS: Twenty-three treatment guidelines for the management of hip and knee OA were identified from the literature search, including six opinion-based, five evidence-based and 12 based on both expert opinion and research evidence. Twenty out of 51 treatment modalities addressed by these guidelines were universally recommended. ES for pain relief varied from treatment to treatment. Overall there was no statistically significant difference between non-pharmacological therapies [0.25, 95% confidence interval (CI) 0.16, 0.34] and pharmacological therapies (ES=0.39, 95% CI 0.31, 0.47). Following feedback from Osteoarthritis Research International members on the draft guidelines and six Delphi rounds consensus was reached on 25 carefully worded recommendations. Optimal management of patients with OA hip or knee requires a combination of non-pharmacological and pharmacological modalities of therapy. Recommendations cover the use of 12 non-pharmacological modalities: education and self-management, regular telephone contact, referral to a physical therapist, aerobic, muscle strengthening and water-based exercises, weight reduction, walking aids, knee braces, footwear and insoles, thermal modalities, transcutaneous electrical nerve stimulation and acupuncture. Eight recommendations cover pharmacological modalities of treatment including acetaminophen, cyclooxygenase-2 (COX-2) non-selective and selective oral non-steroidal anti-inflammatory drugs (NSAIDs), topical NSAIDs and capsaicin, intra-articular injections of corticosteroids and hyaluronates, glucosamine and/or chondroitin sulphate for symptom relief; glucosamine sulphate, chondroitin sulphate and diacerein for possible structure-modifying effects and the use of opioid analgesics for the treatment of refractory pain. There are recommendations covering five surgical modalities: total joint replacements, unicompartmental knee replacement, osteotomy and joint preserving surgical procedures; joint lavage and arthroscopic debridement in knee OA, and joint fusion as a salvage procedure when joint replacement had failed. Strengths of recommendation and 95% CIs are provided.

CONCLUSION: Twenty-five carefully worded recommendations have been generated based on a critical appraisal of existing guidelines, a systematic review of research evidence and the consensus opinions of an international, multidisciplinary group of experts. The recommendations may be adapted for use in different countries or regions according to the availability of treatment modalities and SOR for each modality of therapy. These recommendations will be revised regularly following systematic review of new research evidence as this becomes available.

PMID: 18279766

Rating: 1b

February 27, 2008 — The Osteoarthritis Research Society International (OARSI) has issued 25 evidence-based, expert consensus recommendations for the management of osteoarthritis (OA) of the hip and knee. These guidelines, which are published in the February issue of *Osteoarthritis and Cartilage*, were intended to be adapted for use in different countries or regions according to the availability of treatment modalities and strength of recommendation (SOR) for each modality of therapy. "Osteoarthritis (OA) is the most common type of arthritis and the major cause of chronic musculoskeletal pain and mobility disability in elderly populations worldwide," write W. Zhang, PhD, from the University of Edinburgh, Osteoarticular Research Group, Queen's Medical Research Institute, Edinburgh, United Kingdom. "Knee and hip pain are the major causes of difficulty in walking and climbing stairs in the elderly in Europe and the USA and as many as 40% of people over the age of 65 in the community in the United Kingdom suffer symptoms associated with knee or hip OA." The objective

of these guidelines was to develop concise, current, patient-centered, evidence-based, expert consensus recommendations for the management of hip and knee OA. The panel intended these guidelines to be adaptable and designed them as an aid to clinicians and allied healthcare professionals in general and specialist practice throughout the world. Goals of treatment of knee and hip OA include decreasing joint pain and stiffness, stabilizing and increasing joint mobility, reducing physical limitations and disability, improving health-related quality of life, limiting the progression of joint damage, and providing patient education regarding the nature and management of OA. The medical literature has described more than 50 modalities of nonpharmacologic, pharmacologic, and surgical therapy for knee and hip OA. Despite the development of several National and Regional Guidelines to guide clinicians, allied healthcare professionals, and patients in their choice of treatment to manage knee and hip OA, there have been no internationally agreed-on and universally applicable guidelines for management. In September 2005, OARSI convened a meeting of an international, multidisciplinary committee of experts to critically review all existing evidence-based and consensus guidelines as well as the recent research evidence and to develop up-to-date, evidence-based, globally relevant consensus recommendations for management of knee and hip OA in 2007. "Patients with hip or knee OA who are not obtaining adequate pain relief and functional improvement from a combination of non-pharmacological and pharmacological treatment should be considered for joint replacement surgery," the authors of the guidelines write. "Replacement arthroplasties are effective, and cost-effective interventions for patients with significant symptoms, and/or functional limitations associated with a reduced health-related quality of life, despite conservative therapy." OARSI provided financial support for development of these guidelines. The authors of the guidelines have disclosed various financial relationships with such industrial entities as Abbott, AstraZeneca, Merck, Bristol-Meyers Squibb, GlaxoSmithKline, and Novartis.

Clinical Context: OA is the most common form of arthritis, and as many as 40% of community-dwelling adults older than 65 years in the United Kingdom have symptoms associated with OA of the hip or knee. Despite the widespread prevalence of OA, there remains controversy regarding the best management of this condition. To address this issue, the OARSI convened 16 experts in 4 medical disciplines to review current guidelines for the management of OA of the hip and knee. Researchers focused on guidelines published between 1945 and January 2006, and they emphasized the quality of evidence in the guidelines as well as ES, number need to treat, and cost per quality-adjusted life years. Consensus among the expert panel was achieved following a specific algorithm, and all current recommendations were assigned an SOR based on a scale of 0 to 100, with a higher assigned value indicating a stronger recommendation.

Study Highlights: The optimal management of OA of the hip and knee combines both nonpharmacologic and pharmacologic treatment modalities (SOR, 96%). The initial treatment of OA should focus on patient empowerment and self-driven therapies. All patients should receive education on lifestyle changes, exercise, pacing of activities, and weight reduction (SOR, 97%). Monthly telephone contact, even by lay personnel, can improve the clinical status of patients with OA (SOR, 66%). A physical therapy consultation focusing on appropriate exercises may benefit patients with OA, although this recommendation is largely based on expert opinion. The physical therapy visit may also include advice regarding assistive devices for ambulation (SOR, 89%). Weight loss is encouraged and can relieve pain and stiffness and improve function (SOR, 96%). Assistive devices for ambulation can reduce pain associated with OA. Frames or wheeled walkers are preferable for patients with bilateral disease (SOR, 90%). Among patients with knee OA and mild or moderate valgus or varus instability, a

knee brace can reduce pain, improve stability, and reduce the risk of falling (SOR, 76%). Insoles can also reduce pain among patients with knee OA (SOR, 77%). Thermal modalities may improve knee OA, but there is less evidence that ice may be effective (SOR, 64%). Transcutaneous electrical nerve stimulation can help with short-term pain control among patients with hip or knee OA (SOR, 58%). Acupuncture can relieve symptoms of knee OA (SOR, 59%). Acetaminophen is the first choice for pharmacologic treatment of OA. Doses up to 4 g/day may be initiated before the use of other medications (SOR, 92%). NSAIDs may be used at their lowest effective dose, and long-term use should be avoided if possible. Among patients at an increased risk for gastrointestinal tract bleeding, clinicians should prescribe either a COX-2 selective agent or a nonselective NSAID with co-prescription of a proton pump inhibitor or misoprostol. NSAIDs should be used with caution among patients with cardiovascular risk factors (SOR, 93%). Topical NSAIDs and capsaicin can be effective as monotherapy or adjunctive treatment for OA of the knee (SOR, 85%). Patients with moderate to severe pain associated with knee OA that is not responding to oral therapy can be treated with intra-articular injections (SOR, 78%). Intra-articular injections of hyaluronate are associated with delayed onset of analgesia but a prolonged duration of action vs injections of corticosteroids (SOR, 64%). Treatment with glucosamine and chondroitin may relieve symptoms of OA, but treatment should be discontinued if there is no relief after 6 months of therapy (SOR, 63%).

Unicompartmental knee replacement is effective among patients with knee OA restricted to a single compartment (SOR, 76%). Osteotomy may be considered for young adults with symptomatic hip OA, whereas high tibial osteotomy may reduce the need for joint replacement among young adults with knee OA (SOR, 75%). Joint fusion of the knee can be performed to salvage a failed joint replacement (SOR, 69%).

Pearls for Practice: The current recommendations for nonpharmacologic treatment of OA of the hip and knee include regular telephone calls from the clinician's office; self-driven therapies; and education on lifestyle changes, exercise, and weight reduction. For patients with knee OA, a knee brace for varus or valgus instability, insoles for appropriate patients, acupuncture, and thermal therapy are recommended. However, the topical application of ice is less proved. The current guidelines for pharmacologic treatment of OA of the hip and knee recommend acetaminophen as the first choice. Other treatments include NSAIDs and glucosamine and chondroitin, but long-term use of these medications should be avoided.

Knee & Leg (Acute & Chronic)

Cochrane T, Davey RC, Matthes Edwards SM. Randomised controlled trial of the cost-effectiveness of water-based therapy for lower limb osteoarthritis. *Health Technol Assess.* 2005 Aug;9(31):iii-iv, ix-xi, 1-114.

Faculty of Health and Sciences, Staffordshire University, Stoke-on-Trent, UK.

OBJECTIVES: To determine the efficacy of community water-based therapy for the management of lower limb osteoarthritis (OA) in older patients.

DESIGN: A pre-experimental matched-control study was used to estimate efficacy of water-based exercise treatment, to check design assumptions and delivery processes. The main study was a randomised controlled trial of the effectiveness of water-based exercise (treatment) compared with usual care (control) in older patients with hip and/or knee OA. The latter was accompanied by an economic evaluation comparing societal costs and consequences of the two treatments.

SETTING: Water exercise was delivered in public swimming pools in the UK. Physical function assessments were carried out in established laboratory settings.

PARTICIPANTS: 106 patients (93 women, 13 men) over the age of 60 years with confirmed hip and/or knee OA took part in the preliminary study. A similar, but larger, group of 312 patients (196 women, 116 men) took part in the main study, randomised into control (159) and water exercise (153) groups.

INTERVENTIONS: Control group patients received usual care with quarterly semi-structured telephone interview follow-up only. The intervention in the main study lasted for 1 year, with a further follow-up period of 6 months.

MAIN OUTCOME MEASURES: Pain score on the Western Ontario and McMaster Universities OA index (WOMAC). Additional outcome measures were included to evaluate effects on quality of life, cost-effectiveness and physical function measurements.

RESULTS: Short-term efficacy of water exercise in the management of lower limb OA was confirmed, with effect sizes ranging from 0.44 [95% confidence interval (CI) 0.03 to 0.85] on WOMAC pain to 0.76 (95% CI 0.33 to 1.17) on WOMAC physical function. Of 153 patients randomised to treatment, 82 (53.5%) were estimated to have complied satisfactorily with their treatment at the 1-year point. This had declined to 28 (18%) by the end of the 6-month follow-up period, during which support for the intervention had been removed and those wishing to continue exercise had to pay their own costs for maintaining their exercise treatment. High levels of co-morbidity were recorded in both groups. Nearly two thirds of all patients had a significant other illness in addition to their OA. Fifty-four control and 53 exercise patients had hospital inpatient episodes during the study period. Water exercise remained effective in the main study but overall effect size was small, on WOMAC pain at 1 year, a reduction of about 10% in group mean pain score. This had declined, and was non-significant, at 18 months. Mean cost difference estimates showed a saving in the water exercise group of pound123--175 per patient per annum and incremental cost-effectiveness ratios ranged from pound3838 to pound5951 per quality-adjusted life-year (QALY). Net reduction in pain was achieved at a net saving of pound135--175 per patient per annum and the ceiling valuation of pound580--740 per unit of WOMAC pain reduction was favourably low.

CONCLUSIONS: Group-based exercise in water over 1 year can produce significant reduction in pain and improvement in physical function in older adults with lower limb OA, and may be a useful adjunct in the management of hip and/or knee OA. The water-exercise programme produced a favourable cost--benefit outcome, using reduction in WOMAC pain as the measure of benefit. Further research is suggested into other similar public health interventions. Investigation is also needed into how general practice can best be supported to facilitate access to participants for research trials in healthcare, as well as an examination of the infrastructure and workforce capacities for physical activity delivery and the

potential extent to which healthcare may be supported in this way. More detailed research is required to develop a better understanding of the types of exercise that will work for the different biomechanical subtypes of knee and hip OA and investigation is needed on access and environmental issues for physical activity programmes for older people, from both a provider and a participant perspective, the societal costs of the different approaches to the management of OA and longer term trends in outcome measures (costs and effects).

PMID: 16095546

Rating: 2a

Goodwin PC, Morrissey MC, Omar RZ, Brown M, Southall K, McAuliffe TB, Effectiveness of supervised physical therapy in the early period after arthroscopic partial meniscectomy, *Phys Ther.* 2003 Jun;83(6):520-35

Centre for Applied Biomedical Research, GKT School of Biomedical Sciences, King's College London, London, United Kingdom.

BACKGROUND AND PURPOSE: Controversy exists about the effectiveness of physical therapy after arthroscopic partial meniscectomy. This randomized controlled trial evaluated the effectiveness of supervised physical therapy with a home program versus a home program alone.

SUBJECTS: Eighty-four patients (86% males; overall mean age=39 years, SD=9, range=21-58; female mean age=39 years, SD=9, range=24-58; male mean age=40, SD=9, range=21-58) who underwent an uncomplicated arthroscopic partial meniscectomy participated.

METHODS: Subjects were randomly assigned to either a group who received 6 weeks of supervised physical therapy with a home program or a group who received only a home program. Blinded test sessions were conducted 5 and 50 days after surgery. Outcome measures were: (1) Hughston Clinic questionnaire, (2) Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) and EuroQol EQ-5D (EQ-5D) questionnaires, (3) number of days to return to work after surgery divided by the Factor Occupational Rating System score, (4) kinematic analysis of knee function during level walking and stair use, and (5) horizontal and vertical hops.

RESULTS: No differences between groups were found for any of the outcomes measured.

DISCUSSION AND CONCLUSION: The results indicate that the supervised physical therapy used in this study is not beneficial for patients in the early period after uncomplicated arthroscopic partial meniscectomy.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 12775198

Title 8, California Code of Regulations, section 9792.20 et seq.
Appendix E—Postsurgical Treatment Guidelines (DWC 2008)
ODG's References
(Proposed Regulations—June 2008)

Rating: 2b

Lowe CJ, Barker KL, Dewey M, Sackley CM. Effectiveness of physiotherapy exercise after knee arthroplasty for osteoarthritis: systematic review and meta-analysis of randomised controlled trials. *BMJ*. 2007 Oct 20;335(7624):812. Epub 2007 Sep 20.

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OBJECTIVE: To evaluate the effectiveness of physiotherapy exercise after elective primary total knee arthroplasty in patients with osteoarthritis.

DESIGN: Systematic review.

DATA SOURCES: Database searches: AMED, CINAHL, Embase, King's Fund, Medline, Cochrane library (Cochrane reviews, Cochrane central register of controlled trials, DARE), PEDro, Department of Health national research register. Hand searches: Physiotherapy, Physical Therapy, Journal of Bone and Joint Surgery (Britain) Conference Proceedings. Review methods Randomised controlled trials were reviewed if they included a physiotherapy exercise intervention compared with usual or standard physiotherapy care, or compared two types of exercise physiotherapy interventions meeting the review criteria, after discharge from hospital after elective primary total knee arthroplasty for osteoarthritis.

OUTCOME MEASURES: Functional activities of daily living, walking, quality of life, muscle strength, and range of motion in the knee joint. Trial quality was extensively evaluated. Narrative synthesis plus meta-analyses with fixed effect models, weighted mean differences, standardised effect sizes, and tests for heterogeneity. **RESULTS:** Six trials were identified, five of which were suitable for inclusion in meta-analyses. There was a small to moderate standardised effect size (0.33, 95% confidence interval 0.07 to 0.58) in favour of functional exercise for function three to four months postoperatively. There were also small to moderate weighted mean differences of 2.9 (0.61 to 5.2) for range of joint motion and 1.66 (-1 to 4.3) for quality of life in favour of functional exercise three to four months postoperatively. Benefits of treatment were no longer evident at one year. **CONCLUSIONS:** Interventions including physiotherapy functional exercises after discharge result in short term benefit after elective primary total knee arthroplasty. Effect sizes are small to moderate, with no long term benefit.

PMID: 17884861

Rating: 1b

September 24, 2007 — Functional exercises after discharge from the hospital result in a small to moderate short-term, but not long-term, benefit after elective primary total knee arthroplasty, according to an analysis of interventions from randomized trials, including physiotherapy, reported in the September 20 Online First issue of the *BMJ*. "As the length of hospital stay after joint arthroplasty surgery has markedly and rapidly decreased, and given that patients who undergo knee arthroplasty may still experience considerable functional impairment postoperatively, the effectiveness of physiotherapy after discharge is a valid question," write Catherine J. Minns Lowe, from the University of Birmingham, United Kingdom, and colleagues. "The present uncertainty regarding effectiveness makes it difficult for

commissioning organisations, healthcare practitioners, and patients to make decisions regarding such physiotherapy." Limitations of this review include possible failure to identify all pertinent studies, some studies that were relatively small and not included in the review, limited usefulness of range of motion in the knee as an outcome measure of physiotherapy interventions, no direct measurements of muscle strength in any of the trials, and limited number and size of available studies. "Presently, given the reduction in length of hospital stay, compressed inpatient rehabilitation, and the limitations of the available evidence, it seems reasonable to refer patients for a short course of physiotherapy after discharge to provide short term benefit," the review authors conclude. "While range of motion may be limited as an outcome measure of physiotherapy, the small to moderate standardised effect size obtained for function, which favours the intervention, is considered clinically important.... In the short term physiotherapy exercise interventions with exercises based on functional activities may be more effective after total knee arthroplasty than traditional exercise programmes, which concentrate on isometric muscle exercises and exercises to increase range of motion in the joint." Two of the review authors have disclosed financial relationships with the Department of Health and National Health Service research and development. In an accompanying editorial, Rob Herbert, PhD, and Marlene Fransen, PhD, MPH, from the University of Sydney and George Institute for International Health, also in Sydney, Australia, describe the findings of this meta-analysis as "provisional at best." In 4 of the 6 trials included in the review, all study participants were assigned either an exercise or physiotherapy program after hospital discharge; therefore, the effects of an exercise intervention could not be isolated. The other 2 trials focused on the effects of outpatient programs on the range of knee flexion and found little or no effect. "Most of the trials evaluated low intensity exercise programmes provided soon after surgery," Drs. Herbert and Fransen write. "More lengthy and intensive physiotherapy exercise programmes may be needed to overcome the considerable deficits in muscle strength and endurance that are evident in these patients.... It is difficult to make clinical recommendations on the basis of Minns Lowe and colleagues' review, although it does highlight the lack of research into the effectiveness of physiotherapy exercise programmes after total knee replacement."

Clinical Context: In elderly people, osteoarthritis is the most frequent cause of disability, with more than 80% of patients limited in activities of daily living including work, housework, and mobility outside the home. Given the trend toward reduced length of hospital stay after joint arthroplasty and the considerable functional postoperative impairment after knee arthroplasty, there is a need to determine the efficacy of physiotherapy after discharge. The existing uncertainty on the efficacy of physiotherapy in this setting hinders well-reasoned decisions regarding physiotherapy by third-party payers, clinicians, and patients. This systematic review of randomized controlled trials examined the effectiveness of physiotherapy exercise after hospital discharge for elective primary unilateral total knee arthroplasty in improving function, quality of life, walking, range of motion in the knee, and muscle strength.

Study Highlights: Of 27 potentially relevant studies, 6 trials were identified that met inclusion criteria for review, and 5 were suitable for meta-analyses with fixed-effect models, weighted mean differences, standardized effect sizes, and tests for heterogeneity. The number of participants was 554 in the 5 trials included in the meta-analyses, and 614 participants were included overall in the review. In 4 of the 6 trials included, all study participants were assigned either an exercise or physiotherapy program after hospital discharge; therefore, the effects of an exercise intervention could not be isolated. The other 2 trials focused primarily on the effects of outpatient programs on the range of flexion in the joint, which had little or no effect.

Pearls for Practice: Physiotherapy functional exercise was associated with small to moderate, short-term benefits in improved function, range of motion in the knee, and quality of life 3 to 4 months after elective primary total knee arthroplasty for osteoarthritis. At 1 year, any benefits of treatment seen 3 to 4 months after surgery were no longer apparent.

Philadelphia Panel, Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for knee pain, *Phys Ther* 2001 Oct;81(10):1675-700

INTRODUCTION: A structured and rigorous methodology was developed for the formulation of evidence-based clinical practice guidelines (EBCPGs), then was used to develop EBCPGs for selected rehabilitation interventions for the management of knee pain.

METHODS: Evidence from randomized controlled trials (RCTs) and observational studies were identified and synthesized using methods defined by the Cochrane Collaboration that minimize bias by using a systematic approach to literature search, study selection, data extraction, and data synthesis. Meta-analysis was conducted where possible. The strength of evidence was graded as level I for RCTs or level II for nonrandomized studies.

DEVELOPING RECOMMENDATIONS: An expert panel was formed by inviting stakeholder professional organizations to nominate a representative. This panel developed a set of criteria for grading the strength of both the evidence and the recommendation. The panel decided that evidence of clinically important benefit (defined as 15% greater relative to a control based on panel expertise and empiric results) in patient-important outcomes was required for a recommendation. Statistical significance was also required but was insufficient alone. Patient-important outcomes were decided by consensus as being pain, function, patient global assessment, quality of life, and return to work, providing that these outcomes were assessed with a scale for which measurement reliability and validity have been established.

VALIDATING THE RECOMMENDATIONS: A feedback survey questionnaire was sent to 324 practitioners from 6 professional organizations. The response rate was 51%. **RESULTS:** Two positive recommendations of clinical benefit were developed: (1) transcutaneous electrical nerve stimulation (TENS) and therapeutic exercises were beneficial for knee osteoarthritis, and (2) there was good agreement with these recommendations from practitioners (73% for TENS, 98% for exercises). For several interventions and indications (eg, thermotherapy, therapeutic ultrasound, massage, electrical stimulation), there was a lack of evidence regarding efficacy.

CONCLUSIONS: This methodology of developing EBCPGs provides a structured approach to assessing the literature and developing EBCPGs that incorporates clinicians' feedback and is widely acceptable to practicing clinicians. Further well-designed RCTs are warranted regarding the use of several interventions for patients with knee pain where evidence was insufficient to make recommendations.

Publication Types:

- Consensus Development Conference
- Guideline

- Meta-Analysis
- Practice Guideline
- Review

PMID: 11589643

Rand SE, Goerlich C, Marchand K, Jablecki N. The physical therapy prescription. *Am Fam Physician*. 2007 Dec 1;76(11):1661-6.

Conroe Medical Education Foundation, Conroe, TX, USA. scottrand@lonestarfamly.org

Numerous guidelines recommend physical therapy for the management of musculoskeletal conditions. However, specific recommendations are lacking concerning which exercises and adjunct modalities to use. Physical therapists use various techniques to reduce pain and improve mobility and flexibility. There is some evidence that specific exercises performed with the instruction of physical therapists improve outcomes in patients with low back pain. For most modalities, evidence of effectiveness is variable and controlled trials are lacking. Multiple modalities may be used to treat one clinical condition; decisions for the treatment of an individual patient depend on the expertise of the therapist, the equipment available, and the desire of the attending physician. A physical therapy prescription should include the diagnosis; type, frequency, and duration of the prescribed therapy; goals of therapy; and safety precautions.

PMID: 18092708

Rating: 5b

December 12, 2007 — Various treatments and modalities that a family clinician should know and include in physical therapy orders are reviewed in an article published in the December 1 issue of the *American Family Physician*. "Physical therapists are an integral part of inpatient and outpatient treatment of neurologic and musculoskeletal injuries and disabilities," write Scott E. Rand, MD, from the Conroe Medical Education Foundation in Conroe, Texas, and colleagues. "They also can assist with and augment the care of patients with cardiac, pulmonary, and developmental disorders. Family physicians should have some understanding of the various treatments and modalities used by physical therapists." Frequently used modalities of physical therapy include ultrasound, phonophoresis, iontophoresis, electrical stimulation, and low-level laser therapy. In ultrasound therapy, high-frequency sound waves are used to warm superficial soft tissues or with the intention of facilitating tissue healing at the cellular level. Ultrasound may be useful for tendon injuries or for short-term pain relief of muscle strain or spasm, but it should not be used near malignant tumors, nerve tissue in a patient who has recently had a laminectomy, joint replacements, permanent pacemakers, thrombophlebitis, eyes, reproductive organs, areas of acute inflammation, epiphyseal plates, or over breast implants. For Olympic athletes, exemption is needed for use of ultrasound. Phonophoresis refers to use of ultrasound to deliver therapeutic medications to subcutaneous tissues. This modality may be useful for inflammatory conditions including tendonitis, arthritis, and bursitis, and contraindications are the same as for ultrasound. During iontophoresis, an electric current helps deliver ionically charged substances through the skin to reach deeper tissues. Therefore, it may be indicated for calcific tendinopathy,

inflammatory conditions, or hyperhidrosis. Contraindications to use of iontophoresis include allergy or sensitivity to the substance being applied, open wounds, or impaired sensation. Iontophoresis also should not be used in the immediate vicinity of metallic implants, wires, or staples. Electrical stimulation causes a therapeutic effect by generating an action potential in nerve tissue, thereby causing a muscle contraction or change in sensory input. Electronic muscle stimulation may be useful for muscle spasm or contusion, whereas transcutaneous electrical nerve stimulation may help relieve neuropathic pain. Electrical stimulation is contraindicated in patients with cardiac pacemakers, known cardiac arrhythmias, or thrombophlebitis or thrombosis. It should not be used at all on the abdomen or pelvis of pregnant patients, and it should be used only with caution in patients with cardiac disease, malignant tumors, open wounds, or in those with impaired sensation, cognitive function, or communication ability. Low-level laser therapy acts via absorption of photon radiation, thereby affecting cellular oxidative metabolism and reducing concentrations of prostaglandin E2. This modality may be effective for minor musculoskeletal pain, carpal tunnel syndrome, osteoarthritis, or rheumatoid arthritis. However, it should be used with caution in patients with malignant tumors or in those being treated with anticoagulants, corticosteroids, or immunosuppressants, and it should not be used on the uterus of pregnant patients. Patients and therapists should use safety goggles to limit eye exposure to therapeutic wavelengths.

Specific clinical recommendations are as follows: Supervised therapeutic exercise improves outcomes in patients who have osteoarthritis or claudication of the knee (level of evidence, B). Compared with home exercise, supervised therapeutic exercise has been shown to improve walking speed and distance. Compared with usual care, iontophoresis is associated with improved outcomes in patients with myositis ossificans (level of evidence, B). In patients with osteoarthritis and rheumatoid arthritis, low-level laser therapy has been demonstrated to offer limited benefit (level of evidence, B). This modality has been associated with symptomatic benefit in the treatment of several inflammatory conditions, without known adverse effects. Better standardization should help define the role of this modality. "The frequency and duration of physical therapy treatments will vary based on the patient's condition," the study authors conclude. "Acute muscle strains often benefit from daily treatment over a short period, whereas chronic injuries are usually addressed less frequently over an extended period. . . . It is important for the physical therapist to document the patient's progress so that the physician can modify the care plan, if needed."

Clinical Context: For patients with neurologic and musculoskeletal injuries and disabilities, physical therapy is a cornerstone of management. In addition, physical therapy can be useful in the treatment of patients with cardiac, pulmonary, and developmental conditions. Therefore, it is useful for family practitioners and primary care providers to be familiar with available modalities of physical therapy and treatment regimens, and indications and contraindications for their use. Treatment decisions for an individual patient should be based on the expertise of the therapist, availability of needed equipment, and goals set by the attending clinician. The present review describes recommended use of various modalities of physical therapy and necessary components of a physical therapy prescription.

Study Highlights: The physical therapy prescription should include diagnosis (with proper coding for accurate insurance billing and reimbursement); type, frequency, and duration of the prescribed therapy; preferred protocols or treatments; therapeutic goals; and safety precautions (eg, joint range-of-motion and weight-bearing limitations, and concurrent illnesses). For a therapist to perform the requested services, clinician signature and date are required. Frequency and duration of physical therapy treatments vary based on the patient's condition. Acute muscle strains may benefit from a short period of

daily treatment, whereas less frequent treatment during a longer period is appropriate for chronic injuries. The physical therapist should document the patient's progress so that the clinician can modify the care plan as needed. In ultrasound therapy, high-frequency sound waves warm superficial soft tissues or promote tissue healing at the cellular level. Ultrasound may be useful for tendon injuries or for short-term pain relief of muscle strain or spasm. It should not be used near malignant tumors, nerve tissue in a patient who has recently had a laminectomy, joint replacements, permanent pacemakers, thrombophlebitis, eyes, reproductive organs, areas of acute inflammation, epiphyseal plates, or over breast implants. Exemption is needed for use of ultrasound in Olympic athletes. Phonophoresis, or ultrasound used to deliver therapeutic medications to subcutaneous tissues, may be useful for inflammatory conditions (eg, tendonitis, arthritis, and bursitis). Contraindications are the same as for ultrasound. During iontophoresis, electric current delivers ionically charged substances through the skin to deeper tissues. It may be indicated for calcific tendinopathy, inflammatory conditions, or hyperhidrosis, and is contraindicated for allergy or sensitivity to the applied substance, open wounds, or impaired sensation. It should not be used near metallic implants, wires, or staples. Electrical stimulation generates an action potential in nerve tissue, which causes a muscle contraction or change in sensory input. Contraindications are cardiac pacemakers, cardiac arrhythmias, thrombophlebitis, thrombosis, and abdominal or pelvic use in pregnancy. It should be used only with caution in patients with cardiac disease, malignancy, open wounds, or in those with impaired sensation, cognition, or communication. Electronic muscle stimulation may relieve muscle spasm or contusion; transcutaneous electrical nerve stimulation may help relieve neuropathic pain. Low-level laser therapy acts via absorption of photon radiation, affecting cellular oxidative metabolism and reducing concentrations of prostaglandin E2. It may be effective for minor musculoskeletal pain, carpal tunnel syndrome, osteoarthritis, or rheumatoid arthritis. Low-level laser therapy should be used with caution in patients with malignant tumors or in those being treated with anticoagulants, corticosteroids, or immunosuppressants. It should not be used over the uterus of pregnant patients. Safety goggles are needed to limit eye exposure to therapeutic wavelengths. Supervised therapeutic exercise improves outcomes for osteoarthritis or claudication of the knee. Supervised therapeutic vs home exercise has been shown to improve walking speed and distance. Iontophoresis vs usual care improves outcomes in patients with myositis ossificans. In osteoarthritis and rheumatoid arthritis, low-level laser therapy has been shown to provide limited benefit, without known adverse effects. Better standardization should be helpful.

Pearls for Practice: A physical therapy prescription should include diagnosis; type, frequency, and duration of the prescribed therapy; specific protocols or treatments that the clinician wants the therapist to use; therapeutic goals; and safety precautions. For a therapist to perform the requested services, clinician signature and date are required. Supervised therapeutic exercise improves outcomes in patients who have osteoarthritis or claudication of the knee. Compared with usual care, iontophoresis is associated with improved outcomes in patients with myositis ossificans. In patients with osteoarthritis and rheumatoid arthritis, low-level laser therapy has been demonstrated to offer limited benefit. Level of evidence for all of these recommendations is grade B.

Zhang W, Moskowitz RW, Nuki G, Abramson S, Altman RD, Arden N, Bierma-Zeinstra S, Brandt KD, Croft P, Doherty M, Dougados M, Hochberg M, Hunter DJ, Kwoh K, Lohmander LS, Tugwell P. OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. *Osteoarthritis Cartilage*. 2008 Feb;16(2):137-62.

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PURPOSE: To develop concise, patient-focussed, up to date, evidence-based, expert consensus recommendations for the management of hip and knee osteoarthritis (OA), which are adaptable and designed to assist physicians and allied health care professionals in general and specialist practise throughout the world.

METHODS: Sixteen experts from four medical disciplines (primary care, rheumatology, orthopaedics and evidence-based medicine), two continents and six countries (USA, UK, France, Netherlands, Sweden and Canada) formed the guidelines development team. A systematic review of existing guidelines for the management of hip and knee OA published between 1945 and January 2006 was undertaken using the validated appraisal of guidelines research and evaluation (AGREE) instrument. A core set of management modalities was generated based on the agreement between guidelines. Evidence before 2002 was based on a systematic review conducted by European League Against Rheumatism and evidence after 2002 was updated using MEDLINE, EMBASE, CINAHL, AMED, the Cochrane Library and HTA reports. The quality of evidence was evaluated, and where possible, effect size (ES), number needed to treat, relative risk or odds ratio and cost per quality-adjusted life years gained were estimated. Consensus recommendations were produced following a Delphi exercise and the strength of recommendation (SOR) for propositions relating to each modality was determined using a visual analogue scale.

RESULTS: Twenty-three treatment guidelines for the management of hip and knee OA were identified from the literature search, including six opinion-based, five evidence-based and 12 based on both expert opinion and research evidence. Twenty out of 51 treatment modalities addressed by these guidelines were universally recommended. ES for pain relief varied from treatment to treatment. Overall there was no statistically significant difference between non-pharmacological therapies [0.25, 95% confidence interval (CI) 0.16, 0.34] and pharmacological therapies (ES=0.39, 95% CI 0.31, 0.47). Following feedback from Osteoarthritis Research International members on the draft guidelines and six Delphi rounds consensus was reached on 25 carefully worded recommendations. Optimal management of patients with OA hip or knee requires a combination of non-pharmacological and pharmacological modalities of therapy. Recommendations cover the use of 12 non-pharmacological modalities: education and self-management, regular telephone contact, referral to a physical therapist, aerobic, muscle strengthening and water-based exercises, weight reduction, walking aids, knee braces, footwear and insoles, thermal modalities, transcutaneous electrical nerve stimulation and acupuncture. Eight recommendations cover pharmacological modalities of treatment including acetaminophen, cyclooxygenase-2 (COX-2) non-selective and selective oral non-steroidal anti-inflammatory drugs (NSAIDs), topical NSAIDs and capsaicin, intra-articular injections of corticosteroids and hyaluronates, glucosamine and/or chondroitin sulphate for symptom relief; glucosamine sulphate, chondroitin sulphate and diacerein for possible structure-modifying effects and the use of opioid analgesics for the treatment of refractory pain. There are recommendations covering five surgical modalities: total joint replacements, unicompartmental knee replacement, osteotomy and joint preserving surgical procedures; joint lavage and arthroscopic debridement in knee OA, and joint fusion as a salvage procedure when joint replacement had failed. Strengths of recommendation and 95% CIs are provided.

CONCLUSION: Twenty-five carefully worded recommendations have been generated based on a critical appraisal of existing guidelines, a systematic review of research evidence and the consensus opinions of an international, multidisciplinary group of experts. The recommendations may be adapted for use in different countries or regions according to the availability of treatment modalities and SOR for each modality of therapy. These recommendations will be revised regularly following systematic review of new research evidence as this becomes available.

PMID: 18279766

Rating: 1b

February 27, 2008 — The Osteoarthritis Research Society International (OARSI) has issued 25 evidence-based, expert consensus recommendations for the management of osteoarthritis (OA) of the hip and knee. These guidelines, which are published in the February issue of *Osteoarthritis and Cartilage*, were intended to be adapted for use in different countries or regions according to the availability of treatment modalities and strength of recommendation (SOR) for each modality of therapy. "Osteoarthritis (OA) is the most common type of arthritis and the major cause of chronic musculoskeletal pain and mobility disability in elderly populations worldwide," write W. Zhang, PhD, from the University of Edinburgh, Osteoarticular Research Group, Queen's Medical Research Institute, Edinburgh, United Kingdom. "Knee and hip pain are the major causes of difficulty in walking and climbing stairs in the elderly in Europe and the USA and as many as 40% of people over the age of 65 in the community in the United Kingdom suffer symptoms associated with knee or hip OA." The objective of these guidelines was to develop concise, current, patient-centered, evidence-based, expert consensus recommendations for the management of hip and knee OA. The panel intended these guidelines to be adaptable and designed them as an aid to clinicians and allied healthcare professionals in general and specialist practice throughout the world. Goals of treatment of knee and hip OA include decreasing joint pain and stiffness, stabilizing and increasing joint mobility, reducing physical limitations and disability, improving health-related quality of life, limiting the progression of joint damage, and providing patient education regarding the nature and management of OA. The medical literature has described more than 50 modalities of nonpharmacologic, pharmacologic, and surgical therapy for knee and hip OA. Despite the development of several National and Regional Guidelines to guide clinicians, allied healthcare professionals, and patients in their choice of treatment to manage knee and hip OA, there have been no internationally agreed-on and universally applicable guidelines for management. In September 2005, OARSI convened a meeting of an international, multidisciplinary committee of experts to critically review all existing evidence-based and consensus guidelines as well as the recent research evidence and to develop up-to-date, evidence-based, globally relevant consensus recommendations for management of knee and hip OA in 2007. "Patients with hip or knee OA who are not obtaining adequate pain relief and functional improvement from a combination of non-pharmacological and pharmacological treatment should be considered for joint replacement surgery," the authors of the guidelines write. "Replacement arthroplasties are effective, and cost-effective interventions for patients with significant symptoms, and/or functional limitations associated with a reduced health-related quality of life, despite conservative therapy." OARSI provided financial support for development of these guidelines. The authors of the guidelines have disclosed various financial relationships with such industrial entities as Abbott, AstraZeneca, Merck, Bristol-Meyers Squibb, GlaxoSmithKline, and Novartis.

Clinical Context: OA is the most common form of arthritis, and as many as 40% of community-dwelling adults older than 65 years in the United Kingdom have symptoms associated with OA of the hip or knee. Despite the widespread prevalence of OA, there remains controversy regarding the best management of this condition. To address this issue, the OARSI convened 16 experts in 4 medical disciplines to review current guidelines for the management of OA of the hip and knee. Researchers focused on guidelines published between 1945 and January 2006, and they emphasized the quality of evidence in the guidelines as well as ES, number need to treat, and cost per quality-adjusted life years. Consensus among the expert panel was achieved following a specific algorithm, and all current recommendations were assigned an SOR based on a scale of 0 to 100, with a higher assigned value indicating a stronger recommendation.

Study Highlights: The optimal management of OA of the hip and knee combines both nonpharmacologic and pharmacologic treatment modalities (SOR, 96%). The initial treatment of OA should focus on patient empowerment and self-driven therapies. All patients should receive education on lifestyle changes, exercise, pacing of activities, and weight reduction (SOR, 97%). Monthly telephone contact, even by lay personnel, can improve the clinical status of patients with OA (SOR, 66%). A physical therapy consultation focusing on appropriate exercises may benefit patients with OA, although this recommendation is largely based on expert opinion. The physical therapy visit may also include advice regarding assistive devices for ambulation (SOR, 89%). Weight loss is encouraged and can relieve pain and stiffness and improve function (SOR, 96%). Assistive devices for ambulation can reduce pain associated with OA. Frames or wheeled walkers are preferable for patients with bilateral disease (SOR, 90%). Among patients with knee OA and mild or moderate valgus or varus instability, a knee brace can reduce pain, improve stability, and reduce the risk of falling (SOR, 76%). Insoles can also reduce pain among patients with knee OA (SOR, 77%). Thermal modalities may improve knee OA, but there is less evidence that ice may be effective (SOR, 64%). Transcutaneous electrical nerve stimulation can help with short-term pain control among patients with hip or knee OA (SOR, 58%). Acupuncture can relieve symptoms of knee OA (SOR, 59%). Acetaminophen is the first choice for pharmacologic treatment of OA. Doses up to 4 g/day may be initiated before the use of other medications (SOR, 92%). NSAIDs may be used at their lowest effective dose, and long-term use should be avoided if possible. Among patients at an increased risk for gastrointestinal tract bleeding, clinicians should prescribe either a COX-2 selective agent or a nonselective NSAID with co-prescription of a proton pump inhibitor or misoprostol. NSAIDs should be used with caution among patients with cardiovascular risk factors (SOR, 93%). Topical NSAIDs and capsaicin can be effective as monotherapy or adjunctive treatment for OA of the knee (SOR, 85%). Patients with moderate to severe pain associated with knee OA that is not responding to oral therapy can be treated with intra-articular injections (SOR, 78%). Intra-articular injections of hyaluronate are associated with delayed onset of analgesia but a prolonged duration of action vs injections of corticosteroids (SOR, 64%). Treatment with glucosamine and chondroitin may relieve symptoms of OA, but treatment should be discontinued if there is no relief after 6 months of therapy (SOR, 63%).

Unicompartmental knee replacement is effective among patients with knee OA restricted to a single compartment (SOR, 76%). Osteotomy may be considered for young adults with symptomatic hip OA, whereas high tibial osteotomy may reduce the need for joint replacement among young adults with knee OA (SOR, 75%). Joint fusion of the knee can be performed to salvage a failed joint replacement (SOR, 69%).

Pearls for Practice: The current recommendations for nonpharmacologic treatment of OA of the hip and knee include regular telephone calls from the clinician's office; self-driven therapies; and education on lifestyle changes, exercise, and weight reduction. For patients with knee OA, a knee brace for varus or valgus instability, insoles for appropriate patients, acupuncture, and thermal therapy are recommended. However, the topical application of ice is less proved. The current guidelines for pharmacologic treatment of OA of the hip and knee recommend acetaminophen as the first choice. Other treatments include NSAIDs and glucosamine and chondroitin, but long-term use of these medications should be avoided.

Low Back - Lumbar & Thoracic (Acute & Chronic)

Airaksinen O, Brox JI, Cedraschi C, Hildebrandt J, Klaber-Moffett J, Kovacs F, Mannion AF, Reis S, Staal JB, Ursin H, Zanoli G; On behalf of the COST B13 Working Group on Guidelines for Chronic Low Back Pain. Chapter 4 European guidelines for the management of chronic nonspecific low back pain. *Eur Spine J.* 2006 Mar;15(Supplement 2):s192-s300.

Summary of the concepts of diagnosis in chronic low back pain (CLBP)

Patient assessment

Physical examination and case history: The use of diagnostic triage, to exclude specific spinal pathology and nerve root pain, and the assessment of prognostic factors (yellow flags) are recommended. We cannot recommend spinal palpatory tests, soft tissue tests and segmental range of motion or straight leg raising tests (Lasegue) in the diagnosis of nonspecific CLBP.

Imaging: We do not recommend radiographic imaging (plain radiography, CT or MRI), bone scanning, SPECT, discography or facet nerve blocks for the diagnosis of nonspecific CLBP unless a specific cause is strongly suspected. MRI is the best imaging procedure for use in diagnosing patients with radicular symptoms, or for those in whom discitis or neoplasm is suspected. Plain radiography is recommended for the assessment of structural deformities.

Electromyography: We cannot recommend electromyography for the diagnosis of nonspecific CLBP.

Summary of the concepts of treatment of chronic low back pain (CLBP)

Conservative treatments

Cognitive behavioural therapy, supervised exercise therapy, brief educational interventions, and multidisciplinary (bio-psycho-social) treatment can each be recommended for nonspecific CLBP. Back schools (for short-term improvement), and short courses of manipulation/mobilisation can also be considered. The use of physical therapies (heat/cold, traction, laser, ultrasound, short wave, interferential, massage, corsets) cannot be recommended. We do not recommend TENS.

Pharmacological treatments: The short term use of NSAIDs and weak opioids can be recommended for pain relief. Noradrenergic or noradrenergic-serotonergic antidepressants, muscle relaxants and capsaicin plasters can be considered for pain relief. We cannot recommend the use of Gabapentin.

Invasive treatments: Acupuncture, epidural corticosteroids, intra-articular (facet) steroid injections, local facet nerve blocks, trigger point injections, botulinum toxin, radiofrequency facet denervation, intradiscal radiofrequency lesioning, intradiscal electrothermal therapy, radiofrequency lesioning of the dorsal root ganglion, and spinal cord stimulation cannot be recommended for nonspecific CLBP. Intradiscal injections and prolotherapy are not recommended. Percutaneous electrical nerve stimulation (PENS) and neuroreflexotherapy can be considered where available. Surgery for nonspecific CLBP cannot be recommended unless 2 years of all other recommended conservative treatments – including multidisciplinary approaches with combined programs of cognitive intervention and exercises – have failed, or such combined programs are not available, and only then in carefully selected patients with maximum 2-level degenerative disc disease.

Overarching comments

- In contrast to acute low back pain, only very few guidelines exist for the management of CLBP.
- CLBP is not a clinical entity and diagnosis, but rather a symptom in patients with very different stages of impairment, disability and chronicity. Therefore assessment of prognostic factors before treatment is essential.
- Overall, there is limited positive evidence for numerous aspects of diagnostic assessment and therapy in patients with nonspecific CLBP.
- In cases of low impairment and disability, simple evidence-based therapies (i.e. exercises, brief interventions, and medication) may be sufficient.
- No single intervention is likely to be effective in treating the overall problem of CLBP of longer duration and more substantial disability, owing to its multidimensional nature.
- For most therapeutic procedures, the effect sizes are rather modest.
- The most promising approaches seem to be cognitivebehavioural interventions encouraging activity/exercise.
- It is important to get all the relevant players onside and to provide a consistent approach.
- There is strong evidence that TENS is not more effective than placebo or sham TENS in the treatment for chronic low back pain. There are arguments for more research on the effects of TENS, perhaps in combination with other interventions that aim to improve disability.

PMID: 16550448

Rating: 8a

BlueCross BlueShield. Utilization Management Section - Physical Therapy. Policy No: 6. Effective Date: 03/01/2005

Policy/Criteria

- I. Physical therapy may be medically necessary when all of the following criteria are met:
 - a) Services are for the treatment of a covered injury, illness or disease and are appropriate treatment for the condition;
 - b) Treatments are expected to result in significant, functional improvement in a reasonable, and generally predictable period of time, or are necessary for the establishment of a safe and effective maintenance program. Treatments should be directed towards restoration or compensation for

lost function. The improvement potential must be significant in relation to the extent and duration of therapy required;

- c) Therapy is prescribed by an eligible provider as defined by the contract;
- d) Therapy is rendered by an eligible provider as defined by the member contract;
- e) The services must be currently accepted standards of medical practice and be specific and effective treatments for the patient's existing condition;
- f) The complexity of the therapy and the patient's condition must require the judgment and knowledge of a physician or a licensed physical therapist;
- g) Services do not duplicate those provided concurrently by any other therapy, particularly occupational therapy; and
- h) Services are not for the treatment of psychological conditions.

II. If the above criteria are met, the following guidelines apply:

The treatments listed below require the skills and expertise of a licensed physical therapist. Different modalities, including but not limited to ultrasound, therapeutic exercise and manual therapy, may be employed in the delivery of these treatments and procedures. In conjunction with delivering these services, the physical therapist is expected to provide teaching and training to the patient and/or caregivers. Maintenance programs must be taught before the end of the active rehabilitation program.

III. The following services are not considered medically necessary:

Ongoing maintenance therapy after the patient has reached maximum rehabilitation potential, or functional level has shown no significant improvement for one to two weeks, and initial instruction in the maintenance program is completed. This is particularly applicable to patients with chronic, stable conditions where skilled supervision/ intervention is no longer required;

Rating: 8b

Cherkin DC, Deyo RA, Battie M, Street J, Barlow W. A Comparison of Physical Therapy, Chiropractic Manipulation, and Provision of an Educational Booklet for the Treatment of Patients with Low Back Pain. *NEJM* 1998;339:1021-9.

Department of Health Services, University of Washington, Seattle 98101, USA.

We randomly assigned 321 adults with low back pain that persisted for seven days after a primary care visit to the McKenzie method of physical therapy, chiropractic manipulation, or a minimal intervention (provision of an educational booklet).

CONCLUSIONS: For patients with low back pain, the McKenzie method of physical therapy and chiropractic manipulation had similar effects and costs, and patients receiving these treatments had only marginally better outcomes than those receiving the minimal intervention of an educational booklet. Whether the limited benefits of these treatments are worth the additional costs is open to question.

PMID: 9761803

From the Cochrane Library:

The authors' conclusion appears to be justified given the uncertainties in the data. Regarding the issue of generalisability to other settings or countries, it was noted that the generalisability of the study results was limited by the use of a single health care system, the use of specific forms of chiropractic and physical therapy, the use of one month of therapy, and the exclusion of patients with sciatica. Appropriate comparisons were made with other studies. The issue of whether the study sample was representative of the study population was discussed in the authors' comments.

Implications of the study.

Given the limited benefits and high costs, it seems unwise to refer all patients with low back pain for chiropractic or McKenzie therapy. Ideally, there would be some way of identifying the subgroups that would be most likely to benefit from one or both of these therapies, though the authors were unable to identify any predictive characteristics.

Rating: 2a, RCT, 321 cases

Erdogmus CB, Resch KL, Sabitzer R, Müller H, Nuhr M, Schögl A, Posch M, Osterode W, Ungersböck K, Ebenbichler GR. Physiotherapy-based rehabilitation following disc herniation operation: results of a randomized clinical trial. *Spine*. 2007 Sep 1;32(19):2041-9.

Department of Physical Medicine & Rehabilitation, Vienna Medical University, Vienna, Austria.

STUDY DESIGN: Three-group, randomized, single blinded, controlled trial.

OBJECTIVE: To test the effectiveness of physiotherapy-based rehabilitation starting 1 week after lumbar disc surgery. In addition, we tried to estimate the contribution of specific effects to the observed outcome (efficacy).

SUMMARY OF BACKGROUND DATA: Physiotherapy-based rehabilitation is usually recommended for patients following lumbar disc surgery. Few and conflicting data exist for the relative effectiveness of this intervention.

METHODS: A total of 120 patients following first-time, uncomplicated lumbar disc surgery were randomly assigned to "comprehensive" physiotherapy, "sham" neck massage, or no therapy. Before enrollment, all subjects completed a minimal physiotherapeutic intervention. Physiotherapy was administered by experienced physiotherapists and consisted of 20 sessions per patient over 12 weeks. Masseurs administered "sham massage" to the neck. The amount of treatment time was equal to that of physiotherapy. The main outcome measure was the Low Back Pain Rating Score (LBPRS) at 6 and 12 weeks, and 1.5 years after randomization. Secondary parameters were patients' overall satisfaction with treatment outcome and socioeconomic and psychologic measures.

RESULTS: At the end of therapy (12 weeks), the LBPRS revealed a significantly better improvement in the physiotherapy group than in the untreated group. LBPRS outcome, however, did not significantly differ between physiotherapy and "sham" therapy. There was a tendency toward significance between the sham therapy and no therapy. Within the 1.5-year follow-up, LBP rating scales remained

significantly improved compared with baseline, but there were no significant outcome differences. No statistically significant between-group differences were found for the secondary outcome parameters.

CONCLUSION: As compared with no therapy, physiotherapy following first-time disc herniation operation is effective in the short-term. Because of the limited benefits of physiotherapy relative to "sham" therapy, it is open to question whether this treatment acts primarily physiologically in patients following first-time lumbar disc surgery, but psychological factors may contribute substantially to the benefits observed.

PMID: 17762803

Rating: 2b

Fritz JM, George SZ. Identifying psychosocial variables in patients with acute work-related low back pain: the importance of fear-avoidance beliefs. Phys Ther. 2002 Oct;82(10):973-83.

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BACKGROUND AND PURPOSE: Psychosocial factors are known to affect recovery from acute low back pain. The factors with the greatest influence and the optimal methods of measurement and interpretation have not been established. The purpose of this study was to examine baseline psychosocial variables and their ability to predict prolonged work restrictions.

SUBJECTS: The subjects were 78 people with work-related low back pain who were participating in a clinical trial (mean age=37.4 years, SD=10.4, range=18-58; mean duration of pain=5.5 days, SD=4.6, range=0-19).

METHODS: A baseline examination including measures of impairment, disability, and psychosocial variables was performed. All subjects had physical therapy interventions. Work status was assessed after 4 weeks. Sensitivity, specificity, and likelihood ratios were calculated for the prediction of work status by the use of psychosocial variables. Receiver operator characteristic curves and logistic regression were used to identify the variables that were most predictive of work status.

RESULTS: Twenty-two subjects (29%) had persistent work restrictions. The work subscale of the Fear-Avoidance Beliefs Questionnaire was the strongest predictor of work status (negative likelihood ratio of 0.08 for scores less than 30, positive likelihood ratio of 3.33 for scores greater than 34).

DISCUSSION AND CONCLUSION: Fear-avoidance beliefs about work was the psychosocial factor that could best be used to predict return to work in patients with acute work-related low back pain. Examination of fear-avoidance beliefs may serve as a useful screening tool for identifying patients who are at risk for prolonged work restrictions.

PMID: 12350212

Rating: 4c

Fritz JM, George SZ, Delitto A. The role of fear-avoidance beliefs in acute low back pain: relationships with current and future disability and work status. *Pain*. 2001 Oct;94(1):7-15.

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Fear-avoidance beliefs have been identified as an important psychosocial variable in patients with chronic disability due to low back pain. The importance of fear-avoidance beliefs for individuals with acute low back pain has not been explored. Seventy-eight subjects with work-related low back pain of less than 3 weeks' duration were studied. Measurements of pain intensity, physical impairment, disability, nonorganic signs and symptoms, and depression were taken at the initial evaluation. Fear-avoidance beliefs were measured with the work and physical activity subscales of the Fear-avoidance Beliefs Questionnaire. Disability and work status were re-assessed after 4 weeks of physical therapy. Patterns of correlation between fear-avoidance beliefs and other concurrently-measured variables were similar to those reported in patients with chronic low back pain. Fear-avoidance beliefs did not explain a significant amount of the variability in initial disability levels after controlling for pain intensity and physical impairment. Fear-avoidance beliefs about work were significant predictors of 4-week disability and work status even after controlling for initial levels of pain intensity, physical impairment, and disability, and the type of therapy received. Fear-avoidance beliefs are present in patients with acute low back pain, and may be an important factor in explaining the transition from acute to chronic conditions. Screening for fear-avoidance beliefs may be useful for identifying patients at risk of prolonged disability and work absence.

PMID: 11576740

Rating: 3b

Fritz JM, Delitto A, Erhard RE. Comparison of classification-based physical therapy with therapy based on clinical practice guidelines for patients with acute low back pain: a randomized clinical trial. *Spine*. 2003 Jul 1;28(13):1363-71; discussion 1372.

Department of Physical Therapy, University of Pittsburgh, PA 15260, USA. jfritz@pitt.edu

STUDY DESIGN: A randomized clinical trial was conducted.

OBJECTIVE: To compare the effectiveness of classification-based physical therapy with that of therapy based on clinical practice guidelines for patients with acute, work-related low back pain.

SUMMARY OF BACKGROUND DATA: Clinical practice guidelines recommend minimal intervention during the first few weeks after acute low back injury. However, studies supporting this recommendation have not attempted to identify which patients are likely to respond to particular interventions.

METHODS: For this study, 78 subjects with work-related low back pain of less than 3 weeks duration were randomized to receive therapy based on a classification system that attempts to match patients to specific interventions or therapy based on the Agency for Health Care Policy and Research guidelines. The subjects were followed for 1 year. Outcomes included the impairment index, Oswestry scale, SF-36 component scores, satisfaction, medical costs, and return to work status.

RESULTS: After adjustment for baseline factors, subjects receiving classification-based therapy showed greater change on the Oswestry (P = 0.023) and the SF-36 physical component (P = 0.029) after 4 weeks. Patient satisfaction was greater (P = 0.006) and return to full-duty work status more likely (P = 0.017) after 4 weeks in the classification-based group. After 1 year, there was a trend toward reduced Oswestry scores in the classification-based group (P = 0.063). Median total medical costs for 1 year after injury were 1003.68 dollars for the guideline-based group and 774.00 dollars for the classification-based group (P = 0.13).

CONCLUSIONS: For patients with acute, work-related low back pain, the use of a classification-based approach resulted in improved disability and return to work status after 4 weeks, as compared with therapy based on clinical practice guidelines. Further research is needed on the optimal timing and methods of intervention for patients with acute low back pain.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 12838091

Rating: 2b

Classification	Examination Findings	Treatment
Mobilization		
Sacroiliac pattern	Unilateral symptoms without signs of nerve root compression, positive findings for sacroiliac region dysfunction (pelvic asymmetry, standing and seated flexion tests)	Joint mobilization or manipulation techniques and spinal active range of motion exercises
Lumbar pattern	Unilateral symptoms without signs of nerve root compression, asymmetrical restrictions of lumbar side-bending motion, lumbar segmental hypomobility.	Joint mobilization or manipulation techniques and spinal active range of motion exercises
Specific exercise		

Flexion pattern	Patient preference for sitting versus standing, centralization with lumbar flexion motions.	Lumbar flexion exercises, avoidance of extension activities
Extension pattern	Patient preference for standing versus sitting, centralization with lumbar extension motions.	Lumbar extension exercises, avoidance of flexion activities
Other		
Immobilization	Frequent previous episodes, positive response to prior manipulation or bracing as treatment, presence of “instability catch” or lumbar segmental hypermobility	Trunk strengthening and stabilization exercises
Traction	Radicular signs present, unable to centralize with movements, may have lateral shift deformity	Mechanical or auto-traction

With the classification system used in this study, the patient is placed into one of four classifications, each with its own treatment approach. Patients with signs and symptoms that suggest movement restrictions of the lumbar or sacroiliac region are treated with joint mobilization–manipulation techniques and range of motion exercises. Patients exhibiting the centralization phenomenon during lumbar range of motion testing are treated with the specific exercises (flexion or extension) that promote centralization of symptoms. [The centralization phenomenon was first described 20 years ago. It refers to the abolition of distal pain emanating from the spine in response to therapeutic exercises. The patient’s symptoms are abolished, located more proximal, or located more medial to the midline following single or repeated lumbar flexion and extension movements during the initial evaluation.] The centralization phenomenon has been identified as an important clinical finding, and exercises that promote centralization may improve outcomes in these patients. Numerous findings from the patient’s history or physical examination (e.g., frequent previous episodes with minimal perturbations, “instability catch”) reportedly are associated with clinical instability, and patients with these findings are treated with a trunk strengthening and stabilization exercise program. Finally, patients with signs of nerve root compression who do not demonstrate centralization during the examination are treated with spinal traction. These four treatment approaches are consistent with those widely used by physical therapists, yet indications for their application have not been adequately studied. There is some evidence supporting the use of manipulation, stabilization exercises, and specific exercises. However, when these treatments have been applied in clinical trials without an attempt to decide which patients may respond to particular a treatment, the results are generally equivocal, leading to the contention that these treatments offer no benefits beyond what could be achieved by reassurance, encouragement, and general activity.

Frost H, Lamb SE, Doll HA, Carver PT, Stewart-Brown S. Randomised controlled trial of physiotherapy compared with advice for low back pain. BMJ. 2004 Sep 25;329(7468):708. Epub 2004 Sep 17.

Division of Health in the Community, Warwick Medical School, University of Warwick, Warwick CV4 7AL. h.frost.1@warwick.ac.uk

OBJECTIVE: To measure the effectiveness of routine physiotherapy compared with an assessment session and advice from a physiotherapist for patients with low back pain.

DESIGN: Pragmatic, multicentre, randomised controlled trial.

SETTING: Seven British NHS physiotherapy departments.

PARTICIPANTS: 286 patients with low back pain of more than six weeks' duration.

INTERVENTION: Routine physiotherapy or advice on remaining active from a physiotherapist. Both groups received an advice book.

RESULTS: 200 of 286 patients (70%) provided follow up information at 12 months. Patients in the therapy group reported enhanced perceptions of benefit, but there was no evidence of a long term effect of physiotherapy in either disease specific or generic outcome measures (mean difference in change in Oswestry disability index scores at 12 months -1.0%, 95% confidence interval -3.7% to 1.6%). The most common treatments were low velocity spinal joint mobilisation techniques (72%, 104 of 144 patients) and lumbar spine mobility and abdominal strengthening exercises (94%, 136 patients).

CONCLUSIONS: Routine physiotherapy seemed to be no more effective than one session of assessment and advice from a physiotherapist.

PMID: 15377573

Rating: 2b

Synopsis:

Patients reported significantly more benefit at two and six months if they received physical therapy, but it is very possible—given that patients were aware of their treatment—that this finding reflects a placebo effect. Other research also has not shown a benefit of physical therapy for low-back pain. Bottom Line: Physical therapy sessions do not offer additional long-term benefit over simple advice to remain active in patients referred for physical therapy. Patients initially perceive a benefit while being treated, but this benefit disappears by one year.

George SZ, Fritz JM, Bialosky JE, Donald DA. The effect of a fear-avoidance-based physical therapy intervention for patients with acute low back pain: results of a randomized clinical trial. *Spine*. 2003 Dec 1;28(23):2551-60.

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STUDY DESIGN: A randomized clinical trial with 4-week and 6-month follow-up periods.

OBJECTIVE: To compare the effect of a fear-avoidance-based physical therapy intervention with standard care physical therapy for patients with acute low back pain.

SUMMARY OF BACKGROUND DATA: The disability reduction strategy of secondary prevention involves providing specific treatment for patients that are likely to have chronic disability from low back pain. Previous studies have indicated that elevated fear-avoidance beliefs are a precursor to chronic disability from low back pain. However, the effectiveness of physical therapy intervention based on a fear-avoidance model is unknown.

METHODS: Sixty-six consecutive patients referred to physical therapy with low back pain of less than 8 weeks' duration were randomly assigned to receive fear-avoidance-based physical therapy (n = 34) or standard care physical therapy (n = 32). The intervention period lasted 4 weeks for this study. Disability, pain intensity, and fear-avoidance beliefs measures were recorded before and after treatment. A 6-month follow-up of the same measures was obtained by mail.

RESULTS: An intention-to-treat principle (last value forward) was used for data analyses that tested the primary and secondary hypotheses. The prediction of disability at 4 weeks and 6 months after treatment was significantly improved by considering the interaction between the type of treatment and the initial level of fear-avoidance beliefs. Both groups had significant within group improvements for disability and pain intensity. The fear-avoidance treatment group had a significant improvement in fear-avoidance beliefs, and fear-avoidance beliefs about physical activity were significantly lower than the standard care group at 4 weeks and 6 months after treatment.

CONCLUSION: Patients with elevated fear-avoidance beliefs appeared to have less disability from fear-avoidance-based physical therapy when compared to those receiving standard care physical therapy. Patients with lower fear-avoidance beliefs appeared to have more disability from fear-avoidance-based physical therapy, when compared to those receiving standard care physical therapy. In addition, physical therapy supplemented with fear-avoidance-based principles contributed to a positive shift in fear-avoidance beliefs.

PMID: 14652471

Rating: 2b

Goldby LJ, Moore AP, Doust J, Trew ME. A randomized controlled trial investigating the efficiency of musculoskeletal physiotherapy on chronic low back disorder. *Spine*. 2006 May 1;31(10):1083-93.

Balance Performance Physiotherapy, London, United Kingdom. Lucy@balancephysio.com

METHODS: A total of 346 subjects were randomized to manual therapy, a 10-week spinal stabilization rehabilitation program, or a minimal intervention control group.

RESULTS: The results indicated statistically significant improvements in favor of the spinal stabilization group at the 6-month stage in pain (65.9% reduction in symptoms) and dysfunction (combined mean reduction of 134, standard error 23.84), and at the 1-year stage in medication (34.3% reduction in medication), dysfunction (combined mean reduction of 134, standard error 18.2), and disability (mean difference in change 15.71 Oswestry Disability Index, 95% confidence interval 19.3-10.01).

CONCLUSIONS: As a component of musculoskeletal physiotherapy, the spinal stabilization program is more effective than manually applied therapy or an education booklet in treating chronic low back disorder over time. Both manual therapy and the spinal stabilization program are significantly effective in pain reduction in comparison to an active control. To our knowledge and up until now, this result has not been shown in patients with chronic low back disorder.

PMID: 16648741

Rating: 2a

The spinal stabilization program evaluated consisted of "functionally progressive" exercises that emphasized strengthening of various muscles supporting the spine. A video illustrating the effect of the muscles on the stability of the spine was shown at the beginning and end of each of the 10 classes, between which the patients exercised at facilitation stations. By comparison, the manually applied therapy group received up to 10 standard physical therapy sessions in which no exercises were prescribed. For the control intervention, patients were given an educational booklet called "Back in Action," but no treatment or exercises were performed. All patients went on to receive a session called "the Back School," a single session that included a question and answer session and training on various topics related to back pain. The researchers also reported that manual therapy was significantly better the control group at reducing pain in patients with chronic low back disorder who have the highest amount of pain at 3 months after intervention. With regard to manual therapy, the authors note that this approach "remains physiotherapists' preferred modality for chronic low back disorder" and "is appropriate to be used on these patients as a pain reducing modality, but the results of this study suggest that it should not be used as an isolated modality because it does not concomitantly reduce disability, handicap, or improve quality of life."

Hayden JA, van Tulder MW, Tomlinson G. Systematic review: strategies for using exercise therapy to improve outcomes in chronic low back pain. *Ann Intern Med.* 2005 May 3;142(9):776-85.

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BACKGROUND: Exercise therapy encompasses a heterogeneous group of interventions. There continues to be uncertainty about the most effective exercise approach in chronic low back pain.

PURPOSE: To identify particular exercise intervention characteristics that decrease pain and improve function in adults with nonspecific chronic low back pain.

DATA SYNTHESIS: 43 trials of 72 exercise treatment and 31 comparison groups were included. Bayesian multivariable random-effects meta-regression found improved pain scores for individually designed programs (5.4 points [95% credible interval (CrI), 1.3 to 9.5 points]), supervised home exercise (6.1 points [CrI, -0.2 to 12.4 points]), group (4.8 points [CrI, 0.2 to 9.4 points]), and individually supervised programs (5.9 points [CrI, 2.1 to 9.8 points]) compared with home exercises only. High-dose exercise programs fared better than low-dose exercise programs (1.8 points [CrI, -2.1 to 5.5 points]). Interventions that included additional conservative care were better (5.1 points [CrI, 1.8 to 8.4 points]). A model including these most effective intervention characteristics would be expected to demonstrate important improvement in pain (18.1 points [CrI, 11.1 to 25.0 points] compared with no treatment and 13.0 points [CrI, 6.0 to 19.9 points] compared with other conservative treatment) and small improvement in function (5.5 points [CrI, 0.5 to 10.5 points] compared with no treatment and 2.7 points [CrI, -1.7 to 7.1 points] compared with other conservative treatment). Stretching and strengthening demonstrated the largest improvement over comparisons.

CONCLUSIONS: Exercise therapy that consists of individually designed programs, including stretching or strengthening, and is delivered with supervision may improve pain and function in chronic nonspecific low back pain. Strategies should be used to encourage adherence.

PMID: 15867410

Rating: 1b

This Bayesian meta-regression of 43 trials suggests that the most effective exercises for improving pain and function in adults with chronic low back pain are stretching and strengthening, respectively. Exercise performed over longer periods of time seemed more effective than exercise performed less than 20 hours total. Supervised programs that were individually tailored seemed to be more effective than other delivery modes.

The most effective strategy seems to be individually designed exercise programs delivered in a supervised format (for example, home exercises with regular therapist follow-up) and encouraging adherence to achieve high dosage. Adding other conservative treatment, such as advice to stay active, NSAIDs, or manual therapy, also resulted in improved pain and function outcomes. We found that

stretching and muscle-strengthening exercises were the best types of exercises for improving pain and function, respectively.

Hicks GE, Fritz JM, Delitto A, McGill SM. Preliminary development of a clinical prediction rule for determining which patients with low back pain will respond to a stabilization exercise program. *Arch Phys Med Rehabil.* 2005 Sep;86(9):1753-62.

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OBJECTIVE: To develop a clinical prediction rule to predict treatment response to a stabilization exercise program for patients with low back pain (LBP).

DESIGN: A prospective, cohort study of patients with nonradicular LBP referred to physical therapy (PT).

SETTING: Outpatient PT clinics.

PARTICIPANTS: Fifty-four patients with nonradicular LBP. I

INTERVENTION: A standardized stabilization exercise program.

MAIN OUTCOME MEASURE: Treatment response (success or failure) was categorized based on changes in the Oswestry Disability Questionnaire scores after 8 weeks.

RESULTS: Eighteen subjects were categorized as treatment successes, 15 as treatment failures, and 21 as somewhat improved. After using regression analyses to determine the association between standardized examination variables and treatment response status, preliminary clinical prediction rules were developed for predicting success (positive likelihood ratio [LR], 4.0) and failure (negative LR, .18). The most important variables were age, straight-leg raise, prone instability test, aberrant motions, lumbar hypermobility, and fear-avoidance beliefs.

CONCLUSIONS: It appears that the response to a stabilization exercise program in patients with LBP can be predicted from variables collected from the clinical examination. The prediction rules could be used to determine whether patients with LBP are likely to benefit from stabilization exercises.

PMID: 16181938

Rating: 3b

Jousset N, Fanello S, Bontoux L, Dubus V, Billabert C, Vielle B, Roquelaure Y, Penneau-Fontbonne D, Richard I. Effects of functional restoration versus 3 hours per week physical therapy: a randomized controlled study. *Spine*. 2004 Mar 1;29(5):487-93; discussion 494.

Departement de Sante Publique, UFR Medecine, 1 rue Haute de Reculee, 49045 Angers cedex 01, France.

STUDY DESIGN: Randomized parallel-group comparative trial with a 6-month follow-up period.

OBJECTIVE: To compare, in chronic low back pain patients, the effectiveness of a functional restoration program, including intensive physical training, occupational therapy, and psychological support to an active individual therapy consisting of 3 hours physical therapy per week during 5 weeks.

SUMMARY OF BACKGROUND DATA: Controlled studies conducted in the United States showed a benefit of functional restoration in patients with low back pain, especially on return to work. Randomized Canadian and European trials had less favorable results. In France, there has been up to now no randomized study. Controlled studies suggested a positive effect of functional restoration programs.

METHODS: Eighty-six patients with low back pain were randomized to either the functional restoration (44 patients) or the active individual therapy (42 patients) program. One person in each group never started the program. Two patients did not complete the functional restoration program, and one was lost to follow-up at 6 months. The mean number of sick-leave days in the 2 previous years was 6 months.

RESULTS: After adjustment on the variable "workplace enrolled in an ergonomic program", the mean number of sick-leave days was significantly lower in the functional restoration group. Physical criteria and treatment appreciation were also better. There was no significant difference in the intensity of pain, the quality of life and functional indexes, the psychological characteristics, the number of contacts with the medical system, and the drug intake.

CONCLUSIONS: This study demonstrates the effectiveness of a functional restoration program on important outcome measures, such as sick leave, in a country that has a social system that protects people facing difficulties at work.

PMID: 15129059

Rating: 2b

Klaber Moffett JA, Carr J, Howarth E. High fear-avoiders of physical activity benefit from an exercise program for patients with back pain. *Spine*. 2004 Jun 1;29(11):1167-72; discussion 1173.

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STUDY DESIGN: A subgroup analysis of patient outcomes from a randomized controlled trial comparing a Back to Fitness program with usual general practitioner care.

OBJECTIVES: To test whether patients with high scores on measures of fear-avoidance and distress/depression benefit the most.

SUMMARY OF BACKGROUND DATA: A fitness program, ongoing since the 1980s, was developed for use in the community and has been shown to be effective in reducing disability. Detailed analyses are needed to identify patient groups who benefit. Recent evidence points to the potentially important role of fear, distress, and depression.

METHOD: Data from 98 patients allocated to normal general practitioner care and 89 patients allocated to a group exercise program were analyzed after categorizing baseline scores on fear-avoidance beliefs (high/low) and distress/depression (at risk/normal). The main outcome measure was the Roland Disability Questionnaire. Outcomes were compared between the intervention and control groups at 6 weeks, 6 months, and 12 months.

RESULTS: High fear-avoiders fared significantly better in the exercise program than in usual general practitioner care at 6 weeks and at 1 year. Low fear-avoiders did not. Patients who were distressed or depressed were significantly better off at 6 weeks, but the benefits were not maintained long-term.

CONCLUSION: Patients with high levels of fear-avoidance beliefs could significantly benefit from the Back to Fitness program. The benefits of the exercise program for patients with high levels of distress/depression appear to be short-term only. Average attendance was only 4 to 5 classes, which may not be sufficient for more recalcitrant cases. Further research is indicated.

PMID: 15167652

Rating: 2b

Linz DH; Shepherd CD; Ford LF; Ringley LL; Klekamp J; Duncan JM. Effectiveness of occupational medicine center-based physical therapy. *Journal of Occupational and Environmental Medicine*. 01-Jan-2002; 44(1): 48-53.

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This study concluded, “the program saved employers approximately \$1.4 million, or \$2000 per client. The authors attribute the improved outcomes to early therapy using active rather than passive techniques and an emphasis on patient education and home exercise programs.”

PMID: 11802465

Rating: 4b, CT, 699 cases

Long A, Donelson R, Fung T. Does it matter which exercise? A randomized control trial of exercise for low back pain. *Spine*. 2004 Dec 1;29(23):2593-602.

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STUDY DESIGN: Multicentered randomized controlled trial.

OBJECTIVES: To determine if previously validated low back pain (LBP) subgroups respond differently to contrasting exercise prescriptions.

SUMMARY OF BACKGROUND DATA: The role of "patient-specific" exercises in managing LBP is controversial.

METHODS: A total of 312 acute, subacute, and chronic patients, including LBP-only and sciatica, underwent a standardized mechanical assessment classifying them by their pain response, specifically eliciting either a "directional preference" (DP) (i.e., an immediate, lasting improvement in pain from performing either repeated lumbar flexion, extension, or sideglide/rotation tests), or no DP. Only DP subjects were randomized to: 1) directional exercises "matching" their preferred direction (DP), 2) exercises directionally "opposite" their DP, or 3) "nondirectional" exercises. Outcome measures included pain intensity, location, disability, medication use, degree of recovery, depression, and work interference.

RESULTS: A DP was elicited in 74% (230) of subjects. One third of both the opposite and non-directionally treated subjects withdrew within 2 weeks because of no improvement or worsening (no matched subject withdrew). Significantly greater improvements occurred in matched subjects compared with both other treatment groups in every outcome (P values <0.001), including a threefold decrease in medication use.

CONCLUSIONS: Consistent with prior evidence, a standardized mechanical assessment identified a large subgroup of LBP patients with a DP. Regardless of subjects' direction of preference, the response to contrasting exercise prescriptions was significantly different: exercises matching subjects' DP significantly and rapidly decreased pain and medication use and improved in all other outcomes. If repeatable, such subgroup validation has important implications for LBP management.

PMID: 15564907

Rating: 2a

This study demonstrated better symptom relief with directional preference exercise.

Luijsterburg PA, Lamers LM, Verhagen AP, Ostelo RW, van den Hoogen HJ, Peul WC, Avezaat CJ, Koes BW. Cost-Effectiveness of Physical Therapy and General Practitioner Care for Sciatica. *Spine*. 2007;32:1942-1948.

From the Department of General Practice, Erasmus Medical Center, Rotterdam, The Netherlands; Institute for Medical Technology Assessment, and ‡Institute for Research in Extramural Medicine, VU University Medical Center, Amsterdam, The Netherlands and Amsterdam School of Allied Health Education, Amsterdam, The Netherlands; General Practice, Asten, The Netherlands; Neurosurgery, Leids University Medical Center, Leiden, The Netherlands; Neurosurgery, Medical Center Haaglanden, the Hague, The Netherlands; and the Department of Neurosurgery, Erasmus Medical Center Rotterdam, Rotterdam, The Netherlands.

STUDY DESIGN: An economic evaluation alongside a randomized clinical trial in primary care. A total of 135 patients were randomly allocated to physical therapy added to general practitioners' care (n = 67) or to general practitioners' care alone (n = 68).

OBJECTIVE: To evaluate the cost-effectiveness of physical therapy and general practitioner care for patients with an acute lumbosacral radicular syndrome (LRS, also called sciatica) compared with general practitioner care only.

SUMMARY OF BACKGROUND DAT.: There is a lack of knowledge concerning the cost-effectiveness of physical therapy in patients with sciatica.

METHODS: The clinical outcomes were global perceived effect and quality of life. The direct and indirect costs were measured by means of questionnaires. The follow-up period was 1 year. The Incremental Cost-effectiveness Ratio (ICER) between both study arms was constructed. Confidence intervals for the ICER were calculated using Fieller's method and using bootstrapping.

RESULTS: There was a significant difference on perceived recovery at 1-year follow-up in favor of the physical therapy group. The additional physical therapy did not have an incremental effect on quality of life. At 1-year follow-up, the ICER for the total costs was euro6224 (95% confidence interval, -10419, 27551) per improved patient gained. For direct costs only, the ICER was euro837 (95% confidence interval, -731, 3186).

CONCLUSION: The treatment of patients with LRS with physical therapy and general practitioners'care is not more cost-effective than general practitioners'care alone.

PMID: 17700438

Rating: 1b

Luijsterburg PA, Verhagen AP, Ostelo RW, van Os TA, Peul WC, Koes BW. Effectiveness of conservative treatments for the lumbosacral radicular syndrome: a systematic review. *Eur Spine J.* 2007;16:881-99. Epub 2007

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Patients with a lumbosacral radicular syndrome are mostly treated conservatively first. The effect of the conservative treatments remains controversial. To assess the effectiveness of conservative treatments of the lumbosacral radicular syndrome (sciatica). Relevant electronic databases and the reference lists of articles up to May 2004 were searched. Randomised clinical trials of all types of conservative treatments for patients with the lumbosacral radicular syndrome selected by two reviewers. Two reviewers independently assessed the methodological quality and the clinical relevance. Because the trials were considered heterogeneous we decided not to perform a meta-analysis but to summarise the results using the rating system of levels of evidence. Thirty trials were included that evaluated injections, traction, physical therapy, bed rest, manipulation, medication, and acupuncture as treatment for the lumbosacral radicular syndrome. Because several trials indicated no evidence of an effect it is not recommended to use corticosteroid injections and traction as treatment option. Whether clinicians should prescribe physical therapy, bed rest, manipulation or medication could not be concluded from this review. At present there is no evidence that one type of treatment is clearly superior to others, including no treatment, for patients with a lumbosacral radicular syndrome.

PMID: 17415595

Rating: 1b

Mannion AF, Muntener M, Taimela S, Dvorak J. Comparison of three active therapies for chronic low back pain: results of a randomized clinical trial with one-year follow-up. *Rheumatology (Oxford).* 2001 Jul;40(7):772-8.

Department of Neurology, Schulthess Clinic, Zurich, Switzerland.

OBJECTIVES: To examine the relative efficacy of three active therapies for patients with chronic low back pain.

METHODS: One hundred and forty-eight subjects with chronic low back pain were randomized to receive, twice weekly for 3 months, (i) active physiotherapy, (ii) muscle reconditioning on training devices, or (iii) low-impact aerobics. Questionnaires were administered to assess pain intensity, pain frequency and disability before and after therapy and at 6 and 12 months of follow-up.

RESULTS: One hundred and thirty-two of the 148 patients (89%) completed the therapy programmes and 127 of the 148 (86%) returned a questionnaire at all four time-points. The three treatments were equally efficacious in significantly reducing pain intensity and frequency for up to 1 yr after therapy. However, the groups differed with respect to the temporal changes in self-rated disability over the study period ($P=0.03$): all groups showed a similar reduction after therapy, but for the physiotherapy group

disability increased again during the first 6 months of follow-up whilst the other two groups showed a further decline. In all groups the values then remained stable up to the 12-month follow-up. The larger group size and minimal infrastructure required for low-impact aerobics rendered it considerably less expensive to administer than the other two programmes.

CONCLUSIONS: The introduction of low-impact aerobic exercise programmes for patients with chronic low back pain may reduce the enormous costs associated with its treatment.

PMID: 11477282

Rating: 2b

Price C, Arden N, Coglan L, Rogers P. Cost-effectiveness and safety of epidural steroids in the management of sciatica. *Health Technol Assess.* 2005 Aug;9(33):1-58, iii.

Pain Clinic, Royal South Hants Hospital, Southampton, UK.

OBJECTIVES: To investigate the clinical effectiveness of epidural steroid injections (ESIs) in the treatment of sciatica with an adequately powered study and to identify potential predictors of response to ESIs. Also, to investigate the safety and cost-effectiveness of lumbar ESIs in patients with sciatica.

DESIGN: A pragmatic, prospective, multicentre, double-blind, randomised, placebo-controlled trial with 12-month follow-up was performed. Patients were stratified according to acute (<4 months since onset) versus chronic (4-18 months) presentation. All analyses were performed on an intention-to-treat basis with last observation carried forward used to impute missing data.

SETTING: Rheumatology, orthopaedic and pain clinics in four participating centres: three district hospitals and one teaching hospital in the south of England.

PARTICIPANTS: Total of 228 patients listed for ESI with clinically diagnosed unilateral sciatica, aged between 18 and 70 years, who had a duration of symptoms between 4 weeks and 18 months.

INTERVENTIONS: Patients received up to three injections of epidural steroid and local anaesthetic (active), or an injection of normal saline into the interspinous ligament (placebo).

MAIN OUTCOME MEASURES: The primary outcome measure was the Oswestry Disability Questionnaire (ODQ); measures of pain relief and psychological and physical function were collected. Health economic data on return to work, analgesia use and other interventions were also measured. Quality-adjusted life-years (QALYs) were calculated using the SF-6D, calculated from the Short Form (SF-36). Costs per patient were derived from figures supplied by the centres' finance departments and a costings exercise performed as part of the study. A cost-utility analysis was performed using the SF-36 to calculate costs per QALY.

RESULTS: ESI led to a transient benefit in ODQ and pain relief, compared with placebo at 3 weeks ($p = 0.017$, number needed to treat = 11.4). There was no benefit over placebo between weeks 6 and 52.

Using incremental QALYs, this equates to an additional 2.2 days of full health. Acute sciatica seemed to respond no differently to chronic sciatica. There were no significant differences in any other indices, including objective tests of function, return to work or need for surgery at any time-points. There were no clinical predictors of response, although the trial lacked sufficient power to be confident of this. Adverse events were uncommon, with no difference between groups. Costs per QALY to providers under the trial protocol were 44,701 pounds sterling. Costs to the purchaser per QALY were 354,171 pounds sterling. If only one ESI was provided then costs per QALY fell to 25,745 pounds sterling to the provider and 167,145 pounds sterling to the purchaser. ESIs thus failed the QALY threshold recommended by the National Institute for Health and Clinical Excellence (NICE).

CONCLUSIONS: Although ESIs appear relatively safe, it was found that they confer only transient benefit in symptoms and self-reported function in a small group of patients with sciatica at substantial costs. ESIs do not provide good value for money if NICE recommendations are followed. Additional research is suggested into the epidemiology of radicular pain, producing a register of all ESIs, possible subgroups who may benefit from ESIs, the use of radiological imaging, optimal early interventions, analgesic agents and nerve root injections, the use of cognitive behavioural therapy in rehabilitation, improved methods of assessment, a comparative cost-utility analysis between various treatment strategies, and methods to reduce the effect of scarring and inflammation.

PMID: 16095548

Rating: 2a

Rainville J, Hartigan C, Jouve C, Martinez E. The influence of intense exercise-based physical therapy program on back pain anticipated before and induced by physical activities. *Spine J.* 2004 Mar-Apr;4(2):176-83.

The Spine Center, New England Baptist Hospital, Boston, MA 02120, USA.
jrainvil@caregroup.harvard.edu

BACKGROUND CONTEXT: Pain anticipated before and induced by physical activities has been shown to influence the physical performance of patients with chronic back pain. Limited data exist as to the influence of treatment on this component of pain.

PURPOSE: This study attempted to determine if pain anticipated before and induced by physical activities was altered during an exercise-oriented physical therapy program for chronic back pain.

STUDY DESIGN/SETTING: Subjects were recruited from three physical therapy sites with similar spine rehabilitation programs that used intense exercise delivered in a group format. During the recruitment period, 70 subjects with chronic low back pain and disability agreed to participate and complied with recommended treatments. The primary outcome measures were anticipated and induced pain as assessed by visual analog scales (VAS) during six tests of back flexibility and strength. Additional outcome measures included the performance levels of these six tests (trunk flexion, extension, straight leg raising, back strength, lifting from floor to waist and waist to shoulder height), global back and leg VAS and Oswestry Low Back Pain Disability Questionnaire scores.

METHODS: At evaluation for the spine rehabilitation programs, we recorded the anticipated and induced pain levels associated with the six tests of back function, the performance levels on each test and global pain and disability scores. Subjects then participated in the spine rehabilitation program that consisted of intense exercise delivered up to three times per week, for 2 hours over a period of 6 weeks. All outcome measures were reassessed at discharge. Pre- and posttreatment outcome scores were statistically compared using paired sample t tests and chi-squared test. Spearman correlation coefficients were used to compare anticipated and induced pain results with global back and leg pain VAS scores, Oswestry scores and physical performance levels for each physical test.

RESULTS: Most measures of anticipated and induced pain improved between evaluation and discharge. Improvements were noted for global back pain ($p < .001$), leg pain ($p = .001$), disability ($p < .001$) and performance on each physical testing ($p < .001$) after treatment. Performances on all physical testing correlated with anticipated and induced pain for all tests at evaluation but only for measures of flexibility at discharge. Improvements in global pain and disability correlated with improvements in anticipated and induced pain with physical testing.

CONCLUSION: Anticipated and induced pain with physical activities was lessened after physical therapy using exercise. Anticipated and induced pain with physical activities related to physical performance levels, global pain and disability ratings. These findings may help explain how exercise exerts a positive influence on chronic back pain and disability.

PMID: 15016395

Rating: 2b

Rainville J, Jouve CA, Hartigan C, Martinez E, Hipona M. Comparison of short- and long-term outcomes for aggressive spine rehabilitation delivered two versus three times per week. *Spine J.* 2002 Nov-Dec;2(6):402-7.

The Spine Center at New England Baptist Bone and Joint Institute, 125 Parker Hill Avenue, Boston, MA 02120, USA. jrainvil@caregroup.harvard.edu

BACKGROUND CONTEXT: Rehabilitation services using intensive exercise for the treatment of chronic spinal pain have traditionally been scheduled at a frequency of three times per week.

PURPOSE: In an attempt to reduce the cost of rehabilitation services, this study was designed to determine whether treatment offered two times per week could produce similar outcomes when compared with an established three times per week spine therapy program.

STUDY DESIGN: Prospective cohort study.

PATIENT SAMPLE: Seventy-seven consecutive patients with chronic spinal pain were treated with aggressive spine rehabilitation either two or three times per week.

OUTCOME MEASURES: Flexibility, trunk strength and lifting capacity were quantified before and after treatment. Pain visual analog scores and Oswestry disability scores were measured before and after treatment, as well as 12 months after treatment.

METHODS: A two times per week physical therapy program was developed to be identical in its treatment method to an established three times per week, group-oriented physical therapy program used for the treatment of chronic spinal pain. Patients with spinal pain who continued to work despite chronic pain complaints were allowed to choose between the two therapy programs based on availability of treatment slots and convenience. Treatment consisted of non-pain contingent quota-based exercises targeting identified physical impairments. Treatment sessions lasted for 2 hours and consisted of 30 minutes of stretching, 30 minutes of low-impact step aerobics class and 1 hour of exercise on strength and endurance equipment. Therapy occurred in groups consisting of a maximum of eight patients who were closely supervised by two therapists. Targeted treatment time was 6 weeks. At 12 months after treatment, subjects were surveyed by mailed questionnaires.

RESULTS: Seventy-seven patients with chronic spinal pain with a mean duration of symptoms of 32 months underwent treatment. Twenty-four subjects opted for the twice per week and 53 opted for the three times per week treatment. Seventy-one percent of subjects responded to the 12-month follow-up questionnaire. Physical and self-reported measures improved with both treatment frequencies. There were no differences in outcomes between treatment frequencies for measured flexibility, trunk strength, lifting capacity, pain intensity scores or Oswestry scores at the completion of treatment. At 12-month follow-up, no differences were noted between treatment frequencies for pain scores, Oswestry scores, patients' perceptions of adequacy of treatment, posttreatment exercise compliance or use of other treatments for their spinal problem. Total therapy visits were less in the two than three times per week groups (12 vs 15 visits).

CONCLUSION: Similar outcomes were obtained from aggressive spine rehabilitation occurring two versus three times per week in patients presenting with moderate levels of chronic spinal pain. Reduction in physical therapy services and therefore cost did not adversely affect clinical outcomes in the treatment of this patient population.

PMID: 14589260

Rating: 2b

Riipinen M, Niemisto L, Lindgren KA, Hurri H. Psychosocial differences as predictors for recovery from chronic low back pain following manipulation, stabilizing exercises and physician consultation or physician consultation alone. *J Rehabil Med.* 2005 May;37(3):152-8.

Orton Orthopaedic Hospital, Invalid Foundation, FIN-00280 Helsinki, Finland.
markku.riipinen@invalidisaatio.fi

OBJECTIVE: Three psychosocial profile groups are introduced in the Multidimensional Pain Inventory for chronic pain patients. Patients with the dysfunctional profile have shown a more favourable outcome after multidisciplinary treatments, due to the suggested effects of specific psychosocial treatment

elements. In this study we explored, among patients with chronic low back pain, whether the Multidimensional Pain Inventory patient profile groups might respond differently to treatment without planned psychosocial elements.

METHODS: Of 204 voluntarily recruited patients with chronic low back pain, 102 were randomized to a combined manipulation, exercise and physician consultation group (called the combination group) and 102 to a consultation-alone group.

RESULTS: Although all subjects showed improvement during follow-up both on the Oswestry index and the Visual Analogue Scale, the dysfunctional profile patients in the combination group improved the most. Their high pre-treatment ratings on Oswestry and Visual Analogue-scales fell at the 5- and 12-month follow-ups to the same level as those of the adaptive copers or interpersonally distressed patients, and they were on a significantly lower level than the dysfunctional profile patients in consultation group during follow-up. All dysfunctional profile patients also showed a decrease in affective distress, equally in combination and consultation groups.

CONCLUSION: We suggest that dysfunctional profile patients are more sensitive to respond even to treatment without any specific psychosocial elements. This should be considered when evaluating any treatment effects. Among dysfunctional profile patients, pain-related anxiety and decreased acceptance of pain may contribute to their sensitivity to treatment.

PMID: 16040472

Rating: 2b

Skargren EI, Carlsson PG, Oberg BE. One-year follow-up comparison of the cost and effectiveness of chiropractic and physiotherapy as primary management for back pain. Subgroup analysis, recurrence, and additional health care utilization. *Spine*. 1998 Sep 1;23(17):1875-83; discussion 1884.

Department of Neuroscience and Locomotion: Physiotherapy, Faculty of Health Sciences, Linköping University, Sweden.

STUDY DESIGN: A randomized trial was conducted in which patients with back and neck pain, visiting a general practitioner, were allocated to chiropractic or physiotherapy.

METHODS: A group of 323 patients aged 18-60 years who had no contraindications to manipulation and who had not been treated within the previous month were included. Outcome measures were changes in Oswestry scores, pain intensity, and general health; recurrence rate; and direct and indirect costs.

RESULTS: No differences were detected in health improvement, costs, or recurrence rate between the two groups. According to Oswestry score, chiropractic was more favorable for patients with a current pain episode of less than 1 week (5%) and physiotherapy for patients with a current pain episode of greater than 1 month (6.8%). Nearly 60% of the patients reported two or more recurrences. More

patients in the chiropractic group (59%) than in the physiotherapy group (41%) sought additional health care. Costs varied considerably among individuals and subgroups; the direct costs were lower for physiotherapy in a few subgroups.

CONCLUSIONS: Effectiveness and costs of chiropractic or physiotherapy as primary treatment were similar for the total population, but some differences were seen according to subgroups. Back problems often recurred, and additional health care was common. Implications of the result are that treatment policy and clinical decision models must consider subgroups and that the problem often is recurrent. Models must be implemented and tested.

PMID: 9762745

Rating: 2a

Smeal WL, Tyburski M, Alleva J, Prather H, Hunt D. Conservative management of low back pain, part I. Discogenic/radicular pain. *Dis Mon.* 2004;50:636-69.

Rehabilitation Institute of Chicago, Department of Physical Medicine and Rehabilitation, Northwestern University-Feinberg School of Medicine, USA.

PMID: 15767994

No review is provided. The authors state that the natural history of low back pain tends to be one of recovery. Medication, therapeutic injections and rehabilitation can expedite pain relief and recovery. Furthermore, the use of rehabilitation principles in a spinal stabilization program can help limit further occurrences of discogenic problems.

Rating: 5b

Vad VB, Bhat AL, Lutz GE, Cammisa F. Transforaminal epidural steroid injections in lumbosacral radiculopathy: a prospective randomized study. *Spine.* 2002 Jan 1;27(1):11-6.

The Hospital for Special Surgery, New York, New York 10021, USA. vadv@hss.edu

STUDY DESIGN: A prospective study randomized by patient choice from the private practice of a single physician affiliated with a major teaching hospital was conducted.

OBJECTIVES: To compare transforaminal epidural steroid injections with saline trigger-point injections used in the treatment of lumbosacral radiculopathy secondary to a herniated nucleus pulposus.

SUMMARY OF BACKGROUND DATA: Epidural steroid injections have been used for more than half a century in the management of lumbosacral radicular pain. At this writing, however, there have been no controlled prospective trials of transforaminal epidural steroid injections in the treatment of lumbar radiculopathy secondary to a herniated nucleus pulposus.

METHODS: Randomized by patient choice, patients received either a transforaminal epidural steroid injection or a saline trigger-point injection. Treatment outcome was measured using a patient satisfaction scale with choice options of 0 (poor), 1 (fair), 2 (good), 3 (very good), and 4 (excellent); a Roland-Morris low back pain questionnaire that showed improvement by an increase in score; a measurement of finger-to-floor distance with the patient in fully tolerated hip flexion; and a visual numeric pain scale ranging from 0 to 10. A successful outcome required a patient satisfaction score of 2 (good) or 3 (very good), improvement on the Roland-Morris score of 5 or more, and pain reduction greater than 50% at least 1 year after treatment. The final analysis included 48 patients with an average follow-up period of 16 months (range, 12-21 months).

RESULTS: After an average follow-up period of 1.4 years, the group receiving transforaminal epidural steroid injections had a success rate of 84%, as compared with 48% for the group receiving trigger-point injections ($P < 0.005$).

CONCLUSION: Fluoroscopically guided transforaminal injections serve as an important tool in the nonsurgical management of lumbosacral radiculopathy secondary to a herniated nucleus pulposus.

PMID: 11805628

Rating: 2b

Zigenfus GC; Yin J; Giang GM; Fogarty WT. Effectiveness of early physical therapy in the treatment of acute low back musculoskeletal disorders. *Journal of Occupational and Environmental Medicine*. 01-Jan-2000; 42(1): 35-9.

Concentra Health Services, Inc., Addison, Texas 75001, USA.

This study was designed to evaluate the effects of early physical therapy intervention on treatment outcomes for workers with acute low back injuries. A total of 3867 cases were randomly selected from the database of a large occupational health care provider. Cases were assigned to either the early therapy intervention group or one of the two comparison groups on the basis of their delay to physical therapy. The treatment outcomes for the three groups were compared. The results showed that patients in the early therapy intervention had more favorable outcomes than the two comparison groups. Specifically, patients in the early intervention group had fewer physician visits, fewer restricted workdays, fewer days away from work, and shorter case duration. These results provide a strong indication for the effectiveness of early therapy intervention. The financial implications of the findings is discussed.

PMID: 10652686

Rating: 4a, 3867 cases

Neck and Upper Back (Acute & Chronic)

Bigos SJ, Perils, pitfalls, and accomplishments of guidelines for treatment of back problems, *Neurol Clin* 1999 Feb;17(1):179-92

University of Washington School of Medicine, Seattle, Washington 98104, USA.

Science should be the basis for guidelines. As a result of the Flexner Report in 1911, we now live in an era where randomized trials are available. Statistical methods can truly be applied to evaluate the reliability of data published in the literature. The result is that we can now demand more from future publications and allow for a better evaluation of the mistakes or bias that can distort validity, applicability, and reliability. The importance of this methodology is to reduce misunderstandings by patients, clinicians, manufacturers, and government agencies about issues important to patient care.

Summary of differences in recommendations table since publication of ACOEM Guidelines:

- Column 4 heading changed to “Recommend Against” vs “Not Recommended”
- Patient education -- Now Recommend back school in occ. Settings; Optional in non-occ
- Medication: Muscle relaxants now Optional vs Not Recommended
- Physical methods -- Now Optional: Manipulation for patients who have symptoms >1 month, Self-application of heat or cold to low back, Shoe insoles, & Corset for prevention in occupational setting; Add to Recommended Against: Shoe lifts, & Corset for treatment.
- Activities & Exercise: remove Intensive physical training from Not Recommended
- Surgical – Recommended: Chymopapain, used after ruling out allergic sensitivity, acceptable but less efficacious than discectomy to treat herniated disc; Recommended Against: added Percutaneous discectomy less efficacious than chymopapain, removed chemonucleolysis

Publication Types:

- Review
- Review, Tutorial

PMID: 9855678

Rating: 6a

Table 1 -- Categories Of The Findings And Recommendation Statements
<i>Recommendations for:</i> If the available evidence (amount A, B, C, D) indicated potential benefit and outweighed potential harms
<i>Options:</i> If the available evidence (amount A, B, C, D) of potential benefit is weak or equivocal, (some studies for and some against) but potential harms and costs appear small
<i>Recommendations against:</i> If the available evidence (amount A, B, C, D) indicated that there was a lack of benefit, or that potential harms and costs outweighed potential benefits

Table 2 -- Summary of Findings and Recommendation Statements about Evidence with Amount of Evidence to Support the Statement (A, B, C, D)

	Recommend	Option	Recommend Against
History and Physical Examination (34 studies)	Basic history (B). History of cancer/infection (B). Signs/symptoms of cauda equina syndrome (C). History of significant trauma (C). Psychosocial history (C). Straight leg raising test (B). Focused neurologic exam (B).	Pain drawing and Visual Analog Scale (D)	
Patient Education (14 studies)	Patient education about low-back symptoms (B). Back school in occupational settings (C).	Back school in nonoccupational settings (C).	
Medication (23 studies)	Acetaminophen (C). NSAIDs (B).	Muscle relaxants (C). Opioids, short course (C).	Opioids used >2 wks (C). Phenylbutazone (C). Oral steroids (C). Colchicine (B). Antidepressants (C).
Physical Treatment Methods (42 studies)	Manipulation during first month of low-back pain (B).	Manipulation for patients who have radiculopathy (C). Manipulation for patients who have symptoms >1 month (C). Self-application of heat or cold to low back. Shoe insoles (C). Corset for prevention in occupational setting (C).	Manipulation for patients who have undiagnosed neurologic deficits (D). Prolonged course of manipulation (D). Traction (B). TNS (C). Biofeedback (C). Shoe lifts (D). Corset for treatment (D).
Injections (26 studies)		Epidural steroid injections for radicular pain to avoid surgery (C).	Epidural injections for back pain without radiculopathy (D). Trigger point injections (C). Ligamentous injections (C).

Table 2 -- Summary of Findings and Recommendation Statements about Evidence with Amount of Evidence to Support the Statement (A, B, C, D)

	Recommend	Option	Recommend Against
			Facet joint injections (C). Needle acupuncture (D).
Bed rest (<i>4 studies</i>)		Bed rest of 2-4 days for severe radiculopathy (D).	Bed rest >4 days (B).
Activities and Exercise (<i>20 studies</i>)	Temporary avoidance of activities that increase mechanical stress on spine (D). Gradual return to normal activities (B). Low-stress aerobic exercise (C). Conditioning exercises for trunk muscles after 2 weeks (C). Exercise quotas (C).		Back-specific exercise machines (D). Therapeutic stretching of back muscles (D).
Detection of Physiologic Abnormalities (<i>14 studies</i>)	If no improvement after 1 month: Bone scan (C). Needle EMG and H-reflex tests to clarify nerve root dysfunction (C). SEP to assess spinal stenosis (C).		EMG for clinically obvious radiculopathy (D). Surface EMG and F-wave tests (C). Thermography (C).
Radiographs of L-S spine (<i>18 studies</i>)	When Red flags for fracture present (C). When Red flags for cancer or infection present (C).		Routine use in first month of symptoms in absence of red flags (B). Routine oblique views (B).
Imaging (<i>18 studies</i>)	CT or MRI when cauda equina, tumor, infection, or fracture strongly suspected (C). MRI test of choice for patients who have prior back surgery (D). Assure quality criteria for imaging tests (B).	Myelography or CT-myelography for preoperative planning (D).	Use of imaging test before one month in absence of red flags (B). Discography or CT-discography (C).

Table 2 -- Summary of Findings and Recommendation Statements about Evidence with Amount of Evidence to Support the Statement (A, B, C, D)

	Recommend	Option	Recommend Against
Surgical Considerations (<i>14 studies</i>)	Discuss possible surgical options with patients who have persistent and severe sciatica and clinical evidence of nerve root compromise after 1 month of conservative therapy (B). Standard discectomy and microdiscectomy of similar efficacy in treatment of herniated disc (B). Chymopapain, used after ruling out allergic sensitivity, acceptable but less efficacious than discectomy to treat herniated disc (C).		Disc surgery in patients who have back pain alone, no red flags, and no nerve root compression (D). Percutaneous discectomy less efficacious than chymopapain (C). Surgery for spinal stenosis within the first 3 months of symptoms (D). Stenosis surgery justified by imaging test rather than patient's functional status (D). Spinal fusion during the first 3 months of symptoms in the absence of fracture, dislocation, complications of tumor or infection (C).
Psychosocial Factors	Social economic, and psychological factors can alter patient response to symptoms and treatment (D).		Referral for extensive evaluation/treatment prior to exploring patient expectations or psychosocial factors (D).

Abbreviations: NSAIDs = nonsteroidal anti-inflammatory drugs; TNS = transcutaneous nerve stimulator; CT = computerized tomography; MRI = magnetic resonance imaging; EMG = electromyography.

Table 3 -- Amount of Available Evidence as Interpreted by the Panel to Support Guideline Statements	
A	Strong research-based evidence (multiple specific and relevant high-quality scientific studies).
B	Moderate research-based evidence (multiple adequate or one specific and relevant high-quality scientific study).
C	Some research-based evidence (at least one adequate scientific study).
D	Indirect helpful information that did not meet the inclusion trial criteria on evidence tables.

Colorado Division of Workers' Compensation, Medical Treatment Guidelines, Rule XVII, Cervical Spine Injury, 12/01/01.

RULE XVII, EXHIBIT E

CERVICAL SPINE INJURY MEDICAL TREATMENT GUIDELINE

A. INTRODUCTION

This document has been prepared by the Colorado Department of Labor and Employment, Division of Workers' Compensation (Division) and should be interpreted within the context of guidelines for physicians/providers treating individuals qualifying under Colorado's Workers' Compensation Act as injured workers with cervical spine injuries.

Although the primary purpose of this document is advisory and educational, these guidelines are enforceable under the Workers' Compensation Rules of Procedure, 7 CCR 1101-3. The Division recognizes that acceptable medical practice may include deviations from these guidelines, as individual cases dictate. Therefore, these guidelines are not relevant as evidence of a provider's legal standard of professional care.

To properly utilize this document, the reader should not skip nor overlook any sections.

Rating: 7a

Conlin A, Bhogal S, Sequeira K, Teasell R. Treatment of whiplash-associated disorders--part I: Non-invasive interventions. *Pain Res Manag.* 2005 Spring;10(1):21-32.

St Joseph's Health Centre, Parkwood Hospital, London, Canada.

BACKGROUND: A whiplash-associated disorder (WAD) is an injury due to an acceleration-deceleration mechanism at the neck. WAD represents a very common and costly condition, both

economically and socially. In 1995, the Quebec Task Force published a report that contained evidence-based recommendations regarding the treatment of WAD based on studies completed before 1993 and consensus-based recommendations.

OBJECTIVE: The objective of the present article--the first installment of a two-part series on interventions for WAD--is to provide a systematic review of the literature published between January 1993 and July 2003 on noninvasive interventions for WAD using meta-analytical techniques.

METHODS OF THE REVIEW: Three medical literature databases were searched for identification of all studies on the treatment of WAD. Randomized controlled trials (RCTs) and epidemiological studies were categorized by treatment modality and analyzed by outcome measure. The methodological quality of the RCTs was assessed. When possible, pooled analyses of the RCTs were completed for meta-analyses of the data. The results of all the studies were compiled and systematically reviewed.

RESULTS: Studies were categorized as exercise alone, multimodal intervention with exercise, mobilization, strength training, pulsed magnetic field treatment and chiropractic manipulation. A total of eight RCTs and 10 non-RCTs were evaluated. The mean score of methodological quality of the RCTs was five out of 10. Pooled analyses were completed across all treatment modalities and outcome measures. The outcomes of each study were summarized in tables.

CONCLUSIONS: There exists consistent evidence (published in two RCTs) in support of mobilization as an effective noninvasive intervention for acute WAD. Two RCTs also reported consistent evidence that exercise alone does not improve range of motion in patients with acute WAD. One RCT reported improvements in pain and range of motion in patients with WAD of undefined duration who underwent pulsed electromagnetic field treatment. Conflicting evidence in two RCTs exists regarding the effectiveness of multimodal intervention with exercise. Limited evidence, in the form of three non-RCTs, exists in support of chiropractic manipulation. Future research should be directed toward clarifying the role of exercise and manipulation in the treatment of WAD, and supporting or refuting the benefit of pulsed electromagnetic field treatment. Mobilization is recommended for the treatment of pain and compromised cervical range of motion in the acute WAD patient.

PMID: 15782244

Rating: 1b

Kjellman GV, Skargren EI, Oberg BE. A critical analysis of randomised clinical trials on neck pain and treatment efficacy: a review of the literature. *Scandinavian Journal of Rehabilitation Medicine* 1999, 31(3), 139-152.

Department of Neuroscience and Locomotion, Faculty of Health Sciences, Linköping University, Sweden.

The efficacy of physiotherapy or chiropractic treatment for patients with neck pain was analysed by reviewing 27 randomised clinical trials published 1960-1995. Three different methods were employed: systematic analyses of; methodological quality; comparison of effect size; analysis of inclusion criteria,

intervention and outcome according to The Disablement Process model. The quality of most of the studies was low; only one-third scored 50 or more of a possible 100 points. Positive outcomes were noted for 18 of the investigations, and the methodological quality was high in studies using electromagnetic therapy, manipulation, or active physiotherapy. High methodological quality was also noted in studies with traction and acupuncture, however, the interventions had either no effect or a negative effect on outcome. Pooling data and calculation of effect size showed that treatments used in the studies were effective for pain, range of motion, and activities of daily living. Inclusion criteria, intervention, and outcome were based on impairment in most of the analysed investigations. Broader outcome assessments probably would have revealed relationships between treatment effect and impairment, functional limitation and disability.

(1) From Cochrane Library:

Record status

This record is a structured abstract written by CRD reviewers. The original has met a set of quality criteria. Since September 1996 abstracts have been sent to authors for comment. Additional factual information is incorporated into the record. Noted as (A:.....).

Author's objective

To critically review randomised studies of neck pain in regard to methodological quality and treatment effect size, as well as types of assessment, inclusion criteria and interventions.

Type of intervention

Treatment.

Specific interventions included in the review

Physiotherapy or chiropractic treatment. Specific interventions included acupuncture, manipulation, mobilisation, traction, active physiotherapy, electrostimulation/local heat. Control interventions included placebo, neck collars, manual treatment, advice, rest and analgesia, medication, rehabilitation exercises, cold packs, acupuncture, group exercise. Follow-up period ranged from two weeks to two years.

Participants included in the review

Ongoing neck pain. Participants in the studies had chronic headache, acute/chronic whiplash, acute/chronic neck pain, or mixed indications. Studies that involved people with both neck and lower back pain were excluded.

Outcomes assessed in the review

Outcomes were classified according to the Disablement Process (see Other Publications of Related Interest no.1). The components of this process include the pathology, the impairment, the functional limitations, disability, extra-individual factors, intra-individual factors, and risk factors. Outcomes assessed in the included studies included pain (SF-36 pain relief and neck pain disability index), range of motions, activities of daily living, analgesic and other medication consumption, headache frequency, associated symptoms such as dizziness, sleep disturbance, social dysfunction, subjective assessment of progress.

Kongsted A, Qerama E, Kasch H, Bendix T, Winther F, Korsholm L, Jensen TS. Neck collar, "act-as-usual" or active mobilization for whiplash injury? A randomized parallel-group trial. *Spine*. 2007 Mar 15;32(6):618-26.

Back Research Center, Clinical Locomotion Sciences, Backcenter Funen, University of Southern Denmark, Ringe, Denmark. alik@shf.fyns-amt.dk

STUDY DESIGN: Randomized, parallel-group trial.

OBJECTIVE: To compare the effect of 3 early intervention strategies following whiplash injury.

SUMMARY OF BACKGROUND DATA: Long-lasting pain and disability, known as chronic whiplash-associated disorder (WAD), may develop after a forced flexion-extension trauma to the cervical spine. It is unclear whether this, in some cases disabling, condition can be prevented by early intervention. Active interventions have been recommended but have not been compared with information only.

METHODS: Participants were recruited from emergency units and general practitioners within 10 days after a whiplash injury and randomized to: 1) immobilization of the cervical spine in a rigid collar followed by active mobilization, 2) advice to "act-as-usual," or 3) an active mobilization program (Mechanical Diagnosis and Therapy). Follow-up was carried out after 3, 6, and 12 months postinjury. Treatment effect was measured in terms of headache and neck pain intensity (0-10), disability, and work capability.

RESULTS: A total of 458 participants were included. At the 1-year follow-up, 48% of participants reported considerable neck pain, 53% disability, and 14% were still sick listed at 1 year follow-up. No significant differences were observed between the 3 interventions group.

CONCLUSION: Immobilization, "act-as-usual," and mobilization had similar effects regarding prevention of pain, disability, and work capability 1 year after a whiplash injury.

PMID: 17413465

Rating: 2a

In various studies, mobilization has been shown to have a somewhat better effect than a soft collar and passive treatment methods; advice to act-as-usual was superior to a soft collar; and immobilization in a semirigid neck collar for 4 weeks was reported to be superior to a mobilization regimen. To evaluate the spectrum of treatment regimens, the current prospective randomized trial focused on prevention of chronic sequelae after a whiplash injury using interventions directed toward soft tissue damage in the cervical spine.

Study Highlights

At 2 university research centers in Denmark, 458 participants were recruited from emergency units and general practitioners within 10 days after a whiplash injury. This trial took place between May 10, 2001, and June 17, 2004, and recruitment ended in June 2003.

Inclusion criteria were 18 to 70 years of age, exposure to a rear-end or frontal car collision, symptomatic within 72 hours, and could be examined within 10 days of the collision. Exclusion criteria were fractures or dislocations of the cervical spine, amnesia or unconsciousness, injuries other than whiplash, self-reported average neck pain during the preceding 6 months of more than 2 on a scale of 0 to 10, significant preexisting somatic or psychiatric disease, and known alcohol or drug abuse.

Those with marked symptoms and an expected increased risk of developing persistent symptoms were included in this trial; those who reported milder symptoms were included in a separate study.

Participants were randomized to receive (1) immobilization of the cervical spine in a semirigid Philadelphia neck collar worn during all waking hours for 2 weeks, followed by active mobilization, (2) advice in a 1-hour session to act as usual, or (3) an active mobilization program (Mechanical Diagnosis and Therapy; physical therapy twice weekly for 3 weeks). All participants received a pamphlet emphasizing a generally good prognosis and simple advice about use of ice and mild analgesics.

At baseline, age, sex distribution, pain intensity, and cervical range of motion were similar in all groups.

Follow-up visits were at 3, 6, and 12 months. Treatment outcome measures were headache and neck pain intensity (scale, 0 - 10), neck disability (15-item Copenhagen Neck Functional Disability Scale, 0 = no neck disability to 30 = extremely disabled), and self-reported work capability. Primary analyses were by intent-to-treat.

Participants lost to follow-up: act-as-usual group, 25; immobilization group, 8; and active mobilization group, 5. Those lost to follow-up did not differ significantly from the others in terms of baseline parameters.

There was good treatment compliance for 80 (53%) of 151 in the collar group and 106 (76%) of 140 in the active mobilization group, and poor compliance in 40 (26%) of 151 and 9 (6%) of 140 in these groups, respectively. Participants with poor compliance in the collar group were less likely to be listed as sick at baseline, but other baseline data did not differ between compliance groups. Poorly compliant participants in the collar group reported a better outcome at 1-year than did others. The outcome of those poorly compliant to active mobilization could not be reliably estimated because only 4 of 9 completed follow-up.

All groups reported reduced headache and neck pain intensity, with improvement occurring mainly during the first 3 months after injury. At 1-year follow-up, 48% of participants had considerable neck pain, 53% reported disability, and 14% were still listed as sick.

There were no significant differences between the 3 groups. Improvement from baseline to 1-year follow-up was reported by 38% in the collar group, 33% in the act-as-usual group, and by 40% in the mobilization group. Worsening was reported by 12%, 17%, and 10%, respectively (P = .60).

Per-protocol analyses showed results close to the primary analyses, but the neck collar group tended to have a poorer outcome, with estimated higher risk for altered working ability in this group vs act-as-usual (odds ratio, 2.3) or mobilization (odds ratio, 3.2; P < .05).

Pearls for Practice

After whiplash injury, patients at high risk for whiplash-associated disorder treated conservatively reported reduced headache and neck pain intensity, with improvement occurring mainly during the first 3 months after injury. At 1-year follow-up, 48% of participants reported considerable neck pain, 53% reported disability, and 14% were still listed as sick.

There were no significant differences noted between the 3 intervention groups. Improvement from baseline to 1-year follow-up was reported by 38% in the collar group, 33% in the act-as-usual group, and 40% in the mobilization group.

Philadelphia Panel. Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for neck pain. Phys Ther 2001 Oct; 81(10): 1701-17.

INTRODUCTION: A structured and rigorous methodology was developed for the formulation of evidence-based clinical practice guidelines (EBCPGs), then was used to develop EBCPGs for selected rehabilitation interventions for the management of neck pain.

METHODS: Evidence from randomized controlled trials (RCTs) and observational studies was identified and synthesized using methods defined by the Cochrane Collaboration that minimize bias by using a systematic approach to literature search, study selection, data extraction, and data synthesis. Meta-analysis was conducted where possible. The strength of evidence was graded as level I for RCTs or level II for nonrandomized studies.

DEVELOPING RECOMMENDATIONS: An expert panel was formed by inviting stakeholder professional organizations to nominate a representative. This panel developed a set of criteria for grading the strength of both the evidence and the recommendation. The panel decided that evidence of clinically important benefit (defined as 15% greater relative to a control based on panel expertise and empiric results) in patient-important outcomes was required for a recommendation. Statistical significance was also required but was insufficient alone. Patient-important outcomes were decided by consensus as being pain, function, patient global assessment, quality of life, and return to work, providing that these outcomes were assessed with a scale for which measurement reliability and validity have been established.

VALIDATING THE RECOMMENDATIONS: A feedback survey questionnaire was sent to 324 practitioners from 6 professional organizations. The response rate was 51%.

RESULTS: For neck pain, therapeutic exercises were the only intervention with clinically important benefit relative to a control (grade A for pain and function, grade B for patient global assessment). There was good agreement with this recommendation from practitioners (93%). For several interventions and indications (eg, thermotherapy, therapeutic ultrasound, massage, electrical stimulation), there was a lack of evidence regarding efficacy.

CONCLUSIONS: This methodology of developing EBCPGs provides a structured approach to assessing the literature and developing guidelines that incorporates clinicians' feedback and is widely acceptable to practicing clinicians. Further well-designed RCTs are warranted regarding the use of several interventions for patients with neck pain where evidence was insufficient to make recommendations.

Publication Types:

- Consensus Development Conference
- Guideline
- Meta-Analysis
- Practice Guideline
- Review

PMID: 11589644

Rating: A

Rosenfeld M, Gunnarsson R, Borenstein P. Early intervention in whiplash-associated disorders: a comparison of two treatment protocols. Spine 2000 Jul 15;25(14):1782-7.

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STUDY DESIGN: A prospective randomized trial in 97 patients with a whiplash injury caused by a motor vehicle collision.

OBJECTIVES: The study evaluates early active mobilization versus a standard treatment protocol and the importance of early versus delayed onset of treatment.

SUMMARY OF BACKGROUND DATA: There is no compelling evidence to date on the management of acute whiplash-associated disorders. The few studies describing treatment, however, provide evidence to support the recommendation that an active treatment in the acute stage is preferable to rest and a soft collar in most patients. **METHODS:** Patients were randomized to four groups. Active versus standard treatment and early (within 96 hours) versus delayed (after 2 weeks) treatment. Measures of range of motion and pain were registered initially and at 6 months. **RESULTS:** Eighty-eight patients (91%) could be followed up at 6 months. Active treatment reduced pain more than standard treatment ($P < 0.001$). When type and onset of treatment were analyzed, a combined effect was seen. When active treatment

was provided, it was better when administered early, and if standard treatment was provided, it was better when administered late for reduction of pain ($P = 0.04$) and increasing cervical flexion ($P = 0.01$).

CONCLUSIONS: In patients with whiplash-associated disorders caused by a motor vehicle collision treatment with frequently repeated active submaximal movements combined with mechanical diagnosis and therapy is more effective in reducing pain than a standard program of initial rest, recommended use of a soft collar, and gradual self-mobilization. This therapy could be performed as home exercises initiated and supported by a physiotherapist.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

Rating: 2b, 97 cases

Scholten-Peeters GG, Neeleman-van der Steen CW, van der Windt DA, Hendriks EJ, Verhagen AP, Oostendorp RA. Education by general practitioners or education and exercises by physiotherapists for patients with whiplash-associated disorders? A randomized clinical trial. *Spine*. 2006 Apr 1;31(7):723-31.

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STUDY DESIGN: Randomized clinical trial.

OBJECTIVE: To compare the effectiveness of education and advice given by general practitioners (GPs) with education, advice, and active exercise therapy given by physiotherapists (PTs) for patients with whiplash-associated disorders.

SUMMARY OF BACKGROUND DATA: Available evidence from systematic reviews has indicated beneficial effects for active interventions in patients with whiplash-associated disorders. However, it remained unclear which kind of active treatment was most effective.

METHODS: Whiplash patients with symptoms or disabilities at 2 weeks after accident were recruited in primary care. Eligible patients still having symptoms or disabilities at 4 weeks were randomly allocated to GP care or physiotherapy. GPs and PTs treated patients according to a dynamic multimodal treatment protocol primarily aimed to increase activities and influence unfavorable psychosocial factors for recovery. We trained all health care providers about the characteristics of the whiplash problem, available evidence regarding prognosis and treatment, and protocol of the interventions. The content of the information provided to patients during treatment depended on the treatment goals set by the GPs or PTs. Also, the type of exercises chosen by the PTs depended on the treatment goals, and it was not explicitly necessary that exercise therapy was provided in all patients. Primary outcome measures included neck pain intensity, headache intensity, and work activities. Furthermore, an independent blinded assessor measured functional recovery, cervical range of motion, disability, housekeeping and social activities, fear of movement, coping, and general health status. We assessed outcomes at 8, 12, 26, and 52 weeks after the accident.

RESULTS: A total of 80 patients were randomized to either GP care (n = 42) or physiotherapy (n = 38). At 12 and 52 weeks, no significant differences were found concerning the primary outcome measures. At 12 weeks, physiotherapy was significantly more effective than GP care for improving 1 of the measures of cervical range of motion (adjusted mean difference 12.3 degrees ; 95% confidence interval [CI] 2.7-21.9). Long-term differences between the groups favored GP care but were statistically significant only for some secondary outcome measures, including functional recovery (adjusted relative risk 2.3; 95% CI 1.0-5.0), coping (adjusted mean difference 1.7 points; 95% CI 0.2-3.3), and physical functioning (adjusted mean difference 8.9 points; 95% CI 0.6-17.2).

CONCLUSIONS: We found no significant differences for the primary outcome measures. Treatment by GPs and PTs were of similar effectiveness. The long-term effects of GP care seem to be better compared to physiotherapy for functional recovery, coping, and physical functioning. Physiotherapy seems to be more effective than GP care on cervical range of motion at short-term follow-up.

PMID: 16582844

Rating: 2b

Seferiadis A, Rosenfeld M, Gunnarsson R. A review of treatment interventions in whiplash-associated disorders. *Eur Spine J.* 2004 Aug;13(5):387-97. Epub 2004 May 05.

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In recent years, there has been much debate on the treatment of whiplash-associated disorders (WAD). It is not clear if the treatments commonly employed are effective, and concerns have been raised on the available scientific evidence of many of these treatments. The aim of this study was to review the literature systematically to analyze the evidence basis of many commonly used treatments for patients suffering from WAD, both in the acute and the chronic state. A computer-assisted search of the databases Medline (from 1962 to May 2003), CINAHL (1960-2003), Embase (1976-2003), and Psychinfo (1960-2003) was conducted as well as a check of the reference lists of relevant studies. All randomized controlled trials (RCTs) were retrieved and systematically analyzed with three common instruments of measurement of methodological quality. A qualitative analysis ("best-evidence synthesis") was performed. The methodological quality of 26 RCTs was analyzed. The median quality scores for all three instruments were poor. Based on the degrees of evidence and the practical obstacles, the following treatments can be recommended: Early physical activity in acute WAD, radiofrequency neurotomy, combination of cognitive behavioral therapy with physical therapy interventions, and coordination exercise therapy in chronic WAD. High-quality RCTs are not common in the field of WAD. More research is needed, particularly on the treatment of chronic WAD.

PMID: 15133721

Rating: 1b

Conclusions

Few randomised clinical trials on neck problems are of high methodological quality and comprise a sufficiently long follow-up time. In the studies that did show high quality, three different interventions led to a slight tendency towards positive results but the number of publications considered was inadequate to allow general conclusions to be drawn. The effect size calculations and the disablement process analysis indicated that the intervention in the trials had a positive influence on two impairment components, pain and range of motion. Effect size was also positive for one disability component, activities of daily living, but this finding was based on a very limited number of studies. Further analyses are needed to determine whether physiotherapy and chiropractic treatments have positive effects on functional limitation and various aspects of disability.

Rating: 1b

Pain (Chronic)

Airaksinen O, Brox JI, Cedraschi C, Hildebrandt J, Klaber-Moffett J, Kovacs F, Mannion AF, Reis S, Staal JB, Ursin H, Zanolli G; On behalf of the COST B13 Working Group on Guidelines for Chronic Low Back Pain. Chapter 4 European guidelines for the management of chronic nonspecific low back pain. *Eur Spine J.* 2006 Mar;15(Supplement 2):s192-s300.

Objectives

The primary objective of the European evidence-based guidelines is to provide a set of recommendations that can support existing and future national and international guidelines or future updates of existing back pain guidelines.

Summary of the concepts of diagnosis in chronic low back pain (CLBP)

Patient assessment

Physical examination and case history: The use of diagnostic triage, to exclude specific spinal pathology and nerve root pain, and the assessment of prognostic factors (yellow flags) are recommended. We cannot recommend spinal palpatory tests, soft tissue tests and segmental range of motion or straight leg raising tests (Lasegue) in the diagnosis of nonspecific CLBP.

Imaging: We do not recommend radiographic imaging (plain radiography, CT or MRI), bone scanning, SPECT, discography or facet nerve blocks for the diagnosis of nonspecific CLBP unless a specific cause is strongly suspected. MRI is the best imaging procedure for use in diagnosing patients with radicular symptoms, or for those in whom discitis or neoplasm is suspected. Plain radiography is recommended for the assessment of structural deformities.

Electromyography: We cannot recommend electromyography for the diagnosis of nonspecific CLBP.

Prognostic factors

We recommend the assessment of work related factors, psychosocial distress, depressive mood, severity of pain and functional impact, prior episodes of LBP, extreme symptom reporting and patient expectations in the assessment of patients with nonspecific CLBP.

Summary of the concepts of treatment of chronic low back pain (CLBP)

Conservative treatments: Cognitive behavioural therapy, supervised exercise therapy, brief educational interventions, and multidisciplinary (bio-psycho-social) treatment can each be recommended for nonspecific CLBP. Back schools (for short-term improvement), and short courses of manipulation/mobilisation can also be considered. The use of physical therapies (heat/cold, traction, laser, ultrasound, short wave, interferential, massage, corsets) cannot be recommended. We do not recommend TENS.

Pharmacological treatments: The short term use of NSAIDs and weak opioids can be recommended for pain relief. Noradrenergic or noradrenergic-serotonergic antidepressants, muscle relaxants and capsaicin plasters can be considered for pain relief. We cannot recommend the use of Gabapentin.

Invasive treatments: Acupuncture, epidural corticosteroids, intra-articular (facet) steroid injections, local facet nerve blocks, trigger point injections, botulinum toxin, radiofrequency facet denervation, intradiscal radiofrequency lesioning, intradiscal electrothermal therapy, radiofrequency lesioning of the dorsal root ganglion, and spinal cord stimulation cannot be recommended for nonspecific CLBP. Intradiscal injections and prolotherapy are not recommended. Percutaneous electrical nerve stimulation (PENS) and neuroreflexotherapy can be considered where available. Surgery for nonspecific CLBP cannot be recommended unless 2 years of all other recommended conservative treatments – including multidisciplinary approaches with combined programs of cognitive intervention and exercises – have failed, or such combined programs are not available, and only then in carefully selected patients with maximum 2-level degenerative disc disease.

Overarching comments

- In contrast to acute low back pain, only very few guidelines exist for the management of CLBP.
- CLBP is not a clinical entity and diagnosis, but rather a symptom in patients with very different stages of impairment, disability and chronicity. Therefore assessment of prognostic factors before treatment is essential.
- Overall, there is limited positive evidence for numerous aspects of diagnostic assessment and therapy in patients with nonspecific CLBP.
- In cases of low impairment and disability, simple evidence-based therapies (i.e. exercises, brief interventions, and medication) may be sufficient.
- No single intervention is likely to be effective in treating the overall problem of CLBP of longer duration and more substantial disability, owing to its multidimensional nature.
- For most therapeutic procedures, the effect sizes are rather modest.
- The most promising approaches seem to be cognitivebehavioural interventions encouraging activity/exercise.
- It is important to get all the relevant players onside and to provide a consistent approach.

PMID: 16550448

Rating: 8a

Li Z, Smith BP, Smith TL, Koman LA. Diagnosis and management of complex regional pain syndrome complicating upper extremity recovery. J Hand Ther. 2005 Apr-Jun;18(2):270-6.

Department of Orthopaedic Surgery, Wake Forest University School of Medicine, Winston-Salem, North Carolina 27157-1070, USA.

Complex regional pain syndrome (CRPS) is a clinical syndrome of pain, autonomic dysfunction, trophic changes, and functional impairment. CRPS is common after hand trauma or surgery. Early diagnosis and intervention is critical for adequate recovery. The diagnosis of CRPS requires a careful history, physical examination, and supporting diagnostic testing. Optimal treatment requires a multidisciplinary approach. A large spectrum of pharmacologic interventions is efficacious in treating CRPS. Surgery may be used to relieve nociceptive foci. Patient-specific hand therapy is very important in reducing swelling, decreasing pain, and improving range of motion.

Publication Types:

Review

Review, Tutorial

PMID: 15891984

Rating: 5

State of Colorado Department of Labor and Employment, Division of Workers' Compensation. Colorado Rule XVII, Exhibit 7, Complex Regional Pain Syndrome Medical Treatment Guideline. 01/01/06

Complex Regional Pain Syndrome (CRPS Types I and II) describes painful syndromes, which were formerly referred to as Reflex Sympathetic Dystrophy (RSD) and causalgia. CRPS conditions usually follow injury that appears regionally and have a distal predominance of abnormal findings, exceeding the expected clinical course of the inciting event in both magnitude and duration and often resulting in significant impairment of limb function.

CRPS-I (RSD) is a syndrome that usually develops after an initiating noxious event, is not limited to the distribution of a single peripheral nerve, and is apparently disproportionate to the inciting event. It is associated at some point with evidence of edema, changes in skin blood flow, abnormal sudomotor activity in the region of the pain, allodynia or hyperalgesia. The site is usually in the distal aspect of an affected extremity or with a distal to proximal gradient. The peripheral nervous system and possibly the central nervous system are involved.

CRPS-II (Causalgia) is the presence of burning pain, allodynia, and hyperpathia usually in the hand or foot after partial injury to a nerve or one of its major branches. Pain is within the distribution of the damaged nerve but not generally confined to a single nerve.

Stages seen in CRPS-I are not absolute and in fact, may not all be observed in any single patient. In some patients, stages may be missed or the patient may remain for long periods of time in one stage.

Stage 1 - Acute (Hyperemic)

Starts at the time of injury or even weeks later. Associated with spontaneous pain, aching, burning. Typically restricted to the distal extremity. Hyperpathia, allodynia, hypoesthesia or hyperesthesia may be present. Initially, hair and nail growth may be increased but later decrease. Skin may be warm or cold.

Stage 2 - Dystrophic (Ischemic)

Spontaneous burning and/or aching pain, more pronounced hyperpathia and or allodynia. Signs of chronic sympathetic overactivity include (a) reduced blood flow; (b) sudomotor changes; (c) increased edema; (d) cyanotic skin; (e) muscle wasting; (f) decreased hair and nail growth; and (g) osteoporosis.

Stage 3 – Atrophic

Signs and symptoms of this stage include (a) pain may be less prominent; (b) decreased hyperpathia and/or allodynia; (c) reduction in blood flow; (d) skin temperature and sweating may be increased or decreased; (e) irreversible trophic changes in skin and integument; and (f) pronounced muscle atrophy with contractures.

Education

Education of the patient and family, as well as the employer, insurer, policy makers and the community should be the primary emphasis in the treatment of chronic pain. Currently, practitioners often think of education last, after medications, manual therapy and surgery. Practitioners must develop and implement an effective strategy and skills to educate patients, employers, insurance systems, policy makers and the community as a whole. An education-based paradigm should always start with inexpensive communication providing reassuring information to the patient. More in-depth education currently exists within a treatment regime employing functional restorative and innovative programs of prevention and rehabilitation. No treatment plan is complete without addressing issues of individual and/or group patient education as a means of facilitating self-management of symptoms and prevention.

Return-to-Work

Return-to-work is therapeutic, assuming the work is not likely to aggravate the basic problem or increase long-term pain. Even if there is residual chronic pain, return-to-work is not necessarily contraindicated.

Diagnostic Criteria for CRPS

- a. CRPS-I (RSD)
 - 1) Patient complains of pain, usually diffuse burning or aching;
 - 2) Patient has physical findings on examination of at least vasomotor and/or sudomotor signs. Allodynia and/or trophic changes add strength to the diagnosis of CRPS-I; and
 - 3) At least two diagnostic testing procedures are positive. Even the most sensitive tests can have false negatives. The patient can still have CRPS-I, if clinical signs are strongly present. In patients with continued signs and symptoms of CRPS-I, further diagnostic testing may be appropriate.
- b. CRPS-II (causalgia)
 - 1) Patient complains of pain;
 - 2) Documentation of peripheral nerve injury with pain initially in the distribution of the injured nerve;
 - 3) Patient has physical findings on examination of at least vasomotor and/or sudomotor signs. Allodynia and/or trophic changes add strength to the diagnosis of CRPS-II; and
 - 4) At least two diagnostic testing procedures are positive. Even the most sensitive tests can have false negatives. The patient can still have CRPS-II, if clinical signs are strongly present. In patients with continued signs and symptoms of CRPS-II, further diagnostic testing may be appropriate.
- c. Sympathetically Mediated Pain (SMP)
 - 1) Patient complains of pain;
 - 2) Usually does not have clinically detectable vasomotor or sudomotor signs; and
 - 3) Has pain relief with sympathetic blocks.
- d. Not CRPS
 - 1) Patient complains of pain;
 - 2) May or may not have vasomotor or sudomotor signs;
 - 3) No relief with sympathetic blocks; and
 - 4) No more than one other diagnostic test procedure is positive.

Publication Type: State Treatment Guideline

Rating: 7a

Shoulder (Acute & Chronic)

Anderson NH, Sojbjerg JO, Johannsen HV, Sneppen O, Self-training versus physiotherapist-supervised rehabilitation of the shoulder in patients treated with arthroscopic subacromial decompression: a clinical randomized study, *J Shoulder Elbow Surg* 1999 Mar-Apr;8(2):99-101

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In a controlled clinical prospective study, 43 consecutive patients (43 shoulders) with subacromial impingement resistant to conservative therapy and without full-thickness rotator cuff tears underwent arthroscopic subacromial decompression. The patients were randomized to either self-training or

physiotherapist-guided rehabilitation for immediate postoperative rehabilitation. Postoperative follow-up was performed by an independent observer after 3, 6, and 12 months. With the use of the Constant score for evaluation of functional outcome, patients training themselves improved from a mean 53 points (range 26 to 81 points) to a mean 79 points (range 45 to 100) points after 12 months. Physiotherapist-supervised patients improved from a mean 54 points (range 20 to 90 points) to a mean 80 points (range 40 to 100 points). The self-training patients returned to work after a mean 8.5 weeks (range 1 to 14 weeks), whereas the physiotherapist-supervised patients returned to work after a mean 8 weeks (range 3 to 13 weeks). No statistical difference was found between the 2 rehabilitation methods. This study was unable to show any beneficial effect of physiotherapist-supervised rehabilitation after arthroscopic subacromial decompression of the shoulder.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 10226959

Rating: 2c, RCT, 43 cases

Bang MD, Deyle GD, Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome, *J Orthop Sports Phys Ther* 2000 Mar;30(3):126-37

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STUDY DESIGN: A prospective randomized clinical trial.

OBJECTIVE: To compare the effectiveness of 2 physical therapy treatment approaches for impingement syndrome of the shoulder.

BACKGROUND: Manual physical therapy combined with exercise is a commonly applied but currently unproven clinical treatment for impingement syndrome of the shoulder.

METHODS AND MEASURES: Thirty men and 22 women (age 43 years +/- 9.1) diagnosed with shoulder impingement syndrome were randomly assigned to 1 of 2 treatment groups. The exercise group performed supervised flexibility and strengthening exercises. The manual therapy group performed the same program and received manual physical therapy treatment. Both groups received the selected intervention 6 times over a 3-week period. The testers, who were blinded to group assignment, measured strength, pain, and function before treatment and after 6 physical therapy visits. Strength was a composite score of isometric strength tests for internal rotation, external rotation, and abduction. Pain was a composite score of visual analog scale measures during resisted break tests, active abduction, and functional activities. Function was measured with a functional assessment questionnaire. The visual analog scale used to measure pain with functional activities and the functional assessment questionnaire were also measured 2 months after the initiation of treatment.

RESULTS: Subjects in both groups experienced significant decreases in pain and increases in function, but there was significantly more improvement in the manual therapy group compared to the exercise group. For example, pain in the manual therapy group was reduced from a pretreatment mean (+/- SD) of 575.8 (+/- 220.0) to a posttreatment mean of 174.4 (+/- 183.1). In contrast, pain in the exercise group was reduced from a pretreatment mean of 557.1 (+/- 237.2) to a posttreatment mean of 360.6 (+/- 272.3). Strength in the manual therapy group improved significantly while strength in the exercise group did not.

CONCLUSION: Manual physical therapy applied by experienced physical therapists combined with supervised exercise in a brief clinical trial is better than exercise alone for increasing strength, decreasing pain, and improving function in patients with shoulder impingement syndrome.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 10721508

Rating: 2c, RCT, 52 cases

Buchbinder R, Youd JM, Green S, Stein A, Forbes A, Harris A, Bennell K, Bell S, Wright WJ. Efficacy and cost-effectiveness of physiotherapy following glenohumeral joint distension for adhesive capsulitis: a randomized trial. *Arthritis Rheum.* 2007 Aug 15;57(6):1027-37.

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OBJECTIVE: To determine whether an active physiotherapy program following arthrographic joint distension for adhesive capsulitis provides additional benefits.

METHODS: We performed a randomized, placebo-controlled, participant and single assessor blinded trial. A total of 156 participants with pain and stiffness in predominantly 1 shoulder for ≥ 3 months and restriction of passive motion >30 degrees in ≥ 2 planes of movement entered the study, and 144 completed the study. Following joint distension, participants were randomly assigned to either manual therapy and directed exercise or placebo (sham ultrasound), both administered twice weekly for 2 weeks then once weekly for 4 weeks. Pain, function, active shoulder movements, participant-perceived success, and quality of life were assessed at baseline, 6, 12, and 26 weeks. Costs were also collected.

RESULTS: Both groups improved over time with no significant differences in improvement between groups for pain, function, or quality of life at any time point. Significant differences favored the physiotherapy group for all active shoulder movements (e.g., pooled difference in mean change between groups across all time points for total shoulder abduction was 10.6 degrees, 95% confidence interval [95% CI] 3.1, 18.1) and participant-perceived success (pooled relative risk 1.4, 95% CI 1.1, 1.65; number needed to treat = 5). Net cost of physiotherapy was \$136.8 Australian (95% CI -177.5, 223.1) over the 6 months.

CONCLUSION: Physiotherapy following joint distension provided no additional benefits in terms of pain, function, or quality of life but resulted in sustained greater active range of shoulder movement and participant-perceived improvement up to 6 months.

PMID: 17665470

Rating: 2b

Burbank KM, Stevenson JH, Czarnecki GR, Dorfman J. Chronic Shoulder Pain: Part I. Evaluation and Diagnosis. *Am Fam Physician*. 2008;77:453-460, 493-497.

Shoulder pain is defined as chronic when it has been present for longer than six months. Common conditions that can result in chronic shoulder pain include rotator cuff disorders, adhesive capsulitis, shoulder instability, and shoulder arthritis. Rotator cuff disorders include tendinopathy, partial tears, and complete tears. A clinical decision rule that is helpful in the diagnosis of rotator cuff tears includes pain with overhead activity, weakness on empty can and external rotation tests, and a positive impingement sign. Adhesive capsulitis can be associated with diabetes and thyroid disorders. Clinical presentation includes diffuse shoulder pain with restricted passive range of motion on examination.

Acromioclavicular osteoarthritis presents with superior shoulder pain, acromioclavicular joint tenderness, and a painful cross-body adduction test. In patients who are older than 50 years, glenohumeral osteoarthritis usually presents as gradual pain and loss of motion. In patients younger than 40 years, glenohumeral instability generally presents with a history of dislocation or subluxation events. Positive apprehension and relocation are consistent with the diagnosis. Imaging studies, indicated when diagnosis remains unclear or management would be altered, include plain radiographs, magnetic resonance imaging, ultrasonography, and computed tomography scans. Plain radiographs may help diagnose massive rotator cuff tears, shoulder instability, and shoulder arthritis. Magnetic resonance imaging and ultrasonography are preferred for rotator cuff disorders. For shoulder instability, magnetic resonance imaging arthrogram is preferred over magnetic resonance imaging.

Rating: 5b

February 19, 2008 — A simple, effective approach for the primary care clinician regarding the diagnosis and treatment of chronic disorders of the shoulder is reviewed in 2 articles in the February 15 issue of *American Family Physician*. "Shoulder pain is responsible for approximately 16 percent of all musculoskeletal complaints, with a yearly incidence of 15 new episodes per 1,000 patients seen in the primary care setting," write Kelton M. Burbank, MD, from Leominster, Massachusetts, and colleagues. "Shoulder pain is defined as chronic when it has been present for longer than six months, regardless of whether the patient has previously sought treatment."

The first part of this 2-part article offers the primary care clinician a practical approach to the diagnosis of chronic shoulder disorders. Key recommendations for diagnosis of shoulder pain, all with a "C" level of evidence rating, are as follows:

- As part of the initial work-up for chronic shoulder pain, all patients should receive radiographs.
- When the diagnosis of chronic shoulder pain remains unclear or the outcome would affect management, additional testing with use of imaging modalities should be performed.

- The acromioclavicular joint should be evaluated for tenderness if acromioclavicular osteoarthritis is suspected, and a cross-body adduction test should be performed to help confirm the diagnosis.
- When a rotator cuff injury is suspected, the patient should be evaluated for nocturnal pain and pain with overhead activity.
- A painful shoulder with severely limited active and passive ranges of motion should warrant consideration of the diagnosis of adhesive capsulitis.

"Numerous other problems that can affect the shoulder are somewhat less common, such as biceps and labral pathology (e.g., SLAP tear—superior labrum anterior to posterior tear—an avulsion injury to the root of the long head of the biceps tendon) and multidirectional instability," the review authors conclude. "Other conditions are extremely uncommon, such as a suprascapular nerve injury, Parsonage Turner syndrome (brachial plexus neuritis), and a neuropathic shoulder from syringomyelia. The shoulder can also be the area of perceived pain for many non-shoulder problems, including fibromyalgia, cervical radiculopathy, and thoracic outlet syndrome."

The second article, by the same group, notes that effective treatment of chronic shoulder pain requires an accurate diagnosis. "A recent Cochrane review showed little evidence for or against the most common treatments of these chronic shoulder disorders; this is mainly because of a lack of well-designed clinical trials," the review authors write. "Nonetheless, most patients with a chronic shoulder disorder can initially be treated conservatively with some combination of activity modification, physical therapy, medications, and corticosteroid injections, if necessary. This approach produces satisfactory results in the majority of patients." In most cases, the initial treatment should include modification of physical activity and analgesic medications. If the initial presentation is of sufficient severity or if initial treatment does not result in improvement, a trial of physical therapy targeting the specific diagnosis is indicated. Combined steroid and local anesthetic injections may be helpful, either alone or in combination with physical therapy. The specific diagnosis should guide choice of the site of injection (subacromial, acromioclavicular joint, or intra-articular). Fluoroscopic guidance is recommended for injections into the glenohumeral joint. An orthopaedic specialist should be consulted for symptoms that persist or worsen after 6 to 12 weeks of directed treatment. Specific key recommendations for treatment of chronic shoulder pain, all with level of evidence B, are as follows:

- Most patients with chronic shoulder pain have improvement with nonoperative treatment, but severe pain, prolonged symptoms, or gradual onset predicts worse outcomes.
- Evidence for or against the use of medication for chronic shoulder pain is limited.
- For rotator cuff disorders, physical therapy can improve short-term recovery and long-term function.
- Subacromial corticosteroid injections are in widespread clinical use for rotator cuff disorders, but evidence is lacking to support or refute use of this treatment.
- In patients with adhesive capsulitis, injections into the glenohumeral joint have been shown to hasten the resolution of symptoms, but most patients have resolution of their symptoms without intervention, and interventions have not been demonstrated to improve long-term outcomes.

"The prognosis of chronic shoulder pain largely depends on the underlying pathology, but it appears to respond well to conservative treatment overall," the review authors conclude. "There is limited research

on the success of nonoperative management, but it appears that symptoms of gradual onset, prolonged symptoms, and more severe pain at presentation are associated with a worse outcome for protracted recovery. In general, the speed of recovery in chronic shoulder pain is slow."

Study Highlights: Anterior-superior shoulder pain is often localized to the acromioclavicular joint, whereas pain in the lateral deltoid region often indicates a pathologic process involving the rotator cuff. Range of motion of the shoulder should always be examined in cases of shoulder pain, but an assessment of passive range of motion is not necessary if active range of motion is normal. Loss of both active and passive range of motion suggests adhesive capsulitis or glenohumeral osteoarthritis. Plain radiographs should be routinely ordered for patients with chronic shoulder pain, including anteroposterior, scapular Y, and axillary views. Radiographs of the acromioclavicular joint can be difficult to interpret because osteoarthritis of this joint is common by the age of 40 to 50 years. The preferred imaging modality for patients with suspected rotator cuff disorders is MRI. However, ultrasonography may emerge as a cost-effective alternative to MRI. Conservative treatment is the first option for the majority of patients with chronic shoulder pain. This treatment strategy should include modification of physical activities, including a reduction in overhead activity for patients with pathologic process involving the rotator cuff, glenohumeral osteoarthritis, or adhesive capsulitis. Cross-body shoulder adduction, as in a golf swing, should be limited among patients with acromioclavicular osteoarthritis. Although nonsteroidal anti-inflammatory drugs are frequently used among patients with chronic shoulder pain, there is limited evidence that these medications are more effective than acetaminophen. In a similar fashion, there is limited research to support the routine use of subacromial injections for pathologic processes involving the rotator cuff, but this treatment can be offered to patients. Intra-articular injections are effective in reducing pain and increasing function among patients with adhesive capsulitis. Although injections into the subacromial space and acromioclavicular joint can be performed in the clinician's office, injections into the glenohumeral joint should only be performed under fluoroscopic guidance. Regarding the management of specific conditions, adhesive capsulitis tends to resolve spontaneously in 1 to 2 years. However, if symptoms continue for more than 6 weeks, an intra-articular steroid injection can potentiate the effects of physical therapy. Stretching exercises should be reinitiated 1 week after the injection. Referral to an orthopaedist is recommended for patients with adhesive capsulitis who do not respond to 6 months of therapy. The mainstays of treatment for instability of the glenohumeral joint are modification of physical activity and an aggressive strengthening program. Osteoarthritis of the glenohumeral joint usually responds to analgesics and injections into the glenohumeral joint. However, aggressive physical therapy can actually exacerbate this condition because of a high incidence of joint incongruity. For rotator cuff pain with an intact tendon, a trial of 3 to 6 months of conservative therapy is reasonable before orthopaedic referral. Patients with small tears of the rotator cuff may be referred to an orthopaedist after 6 to 12 weeks of conservative treatment.

Table 1. History Findings and Associated Shoulder Disorders	
<i>History</i>	<i>Associated condition</i>
Age	If younger than 40 years: instability, rotator cuff tendinopathy If older than 40 years: rotator cuff tears, adhesive capsulitis, glenohumeral osteoarthritis

<i>History</i>	<i>Associated condition</i>
Diabetes or thyroid disorders	Adhesive capsulitis
History of trauma	If younger than 40 years: shoulder dislocation/subluxation If older than 40 years: rotator cuff tears
Loss of range of motion	Adhesive capsulitis, glenohumeral osteoarthritis
Night pain	Rotator cuff disorders, adhesive capsulitis
Numbness, tingling, pain radiating past elbow	Cervical etiology
Pain location	Anterior-superior shoulder pain associated with acromioclavicular joint pathology Diffuse shoulder pain in deltoid region associated with rotator cuff disorders, adhesive capsulitis, or glenohumeral osteoarthritis
Pain with overhead activity	Rotator cuff disorders
Sports participation	Shoulder instability associated with overhead sports (e.g., baseball, softball, tennis), and collision sports (e.g., football, hockey) Acromioclavicular joint pathology associated with weight lifting
Weakness	Rotator cuff disorders, glenohumeral osteoarthritis

<i>Examination maneuver</i>	<i>Associated condition</i>	<i>Sensitivity (%)</i>	<i>Specificity (%)</i>	<i>LR+</i>	<i>LR-</i>
Inspection					
Supraspinatus or infraspinatus atrophy	Chronic rotator cuff tear	56	73	2.07	0.60
Palpation					
Acromioclavicular tenderness	Acromioclavicular joint OA or chronic sprain	96	10	1.07	0.4
Range of motion					
Restrictive active	Rotator cuff disorder	30	78	1.36	0.90

Table 2. Selected Tests of the Shoulder					
<i>Examination maneuver</i>	<i>Associated condition</i>	<i>Sensitivity (%)</i>	<i>Specificity (%)</i>	<i>LR+</i>	<i>LR-</i>
Provocative tests					
Hawkins' impingement	Impingement/rotator cuff disorder	72	66	2.1	0.42
Drop-arm	Large rotator cuff tear	27	88	2.25	0.83
Empty-can supraspinatus	Rotator cuff disorder involving supraspinatus	44	90	4.4	0.62
Lift-off subscapularis	Rotator cuff disorder involving subscapularis	62	100	> 25	0.38
External rotation/infraspinatus strength	Rotator cuff disorder involving infraspinatus	42	90	4.2	0.64
Cross-body adduction	Acromioclavicular joint OA or chronic sprain	77	79	3.50	0.29
Apprehension	Glenohumeral instability	72	96	20.22	0.29
Relocation	Glenohumeral instability	81	92	10.35	0.2

LR+ = positive likelihood ratio; *LR-* = negative likelihood ratio; *OA* = osteoarthritis.

Note: The recommended progression of shoulder examination maneuvers is inspection, palpation, range of motion and strength tests, and provocative tests.

Carette S, Moffet H, Tardif J, Bessette L, Morin F, Fremont P, Bykerk V, Thorne C, Bell M, Bensen W, Blanchette C. Intraarticular corticosteroids, supervised physiotherapy, or a combination of the two in the treatment of adhesive capsulitis of the shoulder: a placebo-controlled trial. *Arthritis Rheum.* 2003 Mar;48(3):829-38.

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OBJECTIVE: To compare the efficacy of a single intraarticular corticosteroid injection, a supervised physiotherapy program, a combination of the two, and placebo in the treatment of adhesive capsulitis of the shoulder.

METHODS: Ninety-three subjects with adhesive capsulitis of <1 year's duration were randomized to 1 of 4 treatment groups: group 1, corticosteroid injection (triamcinolone hexacetonide 40 mg) performed under fluoroscopic guidance followed by 12 sessions of supervised physiotherapy; group 2, corticosteroid injection alone; group 3, saline injection followed by supervised physiotherapy; or group 4, saline injection alone (placebo group). All subjects were taught a simple home exercise program. Subjects were reassessed after 6 weeks, 3 months, 6 months, and 1 year. The primary outcome measure was improvement in the Shoulder Pain and Disability Index (SPADI) score.

RESULTS: At 6 weeks, the total SPADI scores had improved significantly more in groups 1 and 2 compared with groups 3 and 4 ($P = 0.0004$). The total range of active and passive motion increased in all groups, with group 1 having significantly greater improvement than the other 3 groups. At 3 months, groups 1 and 2 still showed significantly greater improvement in SPADI scores than group 4. There was no difference between groups 3 and 4 at any of the followup assessments except for greater improvement in the range of shoulder flexion in group 3 at 3 months. At 12 months, all groups had improved to a similar degree with respect to all outcome measures.

CONCLUSION: A single intraarticular injection of corticosteroid administered under fluoroscopy combined with a simple home exercise program is effective in improving shoulder pain and disability in patients with adhesive capsulitis. Adding supervised physiotherapy provides faster improvement in shoulder range of motion. When used alone, supervised physiotherapy is of limited efficacy in the management of adhesive capsulitis.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 12632439

Rating: 2b

Ejnisman B, Andreoli CV, Soares BG, Fallopa F, Peccin MS, Abdalla RJ, Cohen M, Interventions for tears of the rotator cuff in adults, *Cochrane Database Syst Rev.* 2004;(1):CD002758

Orthopaedic Department, Universidade Federal de Sao Paulo, Av. Lineu de Paula Machado, 660, Sao Paulo, SP, Brazil.

BACKGROUND: Tears of the rotator cuff tendons, which surround the joints of the shoulder, are one of the most common causes of pain and disability in the upper extremity.

OBJECTIVES: To review the efficacy and safety of common interventions for tears of the rotator cuff in adults.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised trial register (July 2002), the Cochrane Controlled Trials Register (The Cochrane Library issue 2, 2002), MEDLINE (1966 to December 2001), EMBASE (1974 to December 2001), Biological Abstracts (1980 to December 2001), LILACS (1982 to December 2001), CINAHL (November 1982 to December 2001), Science Citation Index and reference lists of articles. We also contacted authors and handsearched conference proceedings focusing on shoulder conditions.

SELECTION CRITERIA: Randomised or quasi-randomised clinical trials involving tears of the rotator cuff were the focus of this review. All trials involving conservative interventions or surgery were included (non-steroidal anti-inflammatory drugs, intra-articular or subacromial glucocorticosteroid injection, oral glucocorticosteroid treatment, physiotherapy, and open or arthroscopic surgery).

DATA COLLECTION AND ANALYSIS: Two reviewers independently assessed suitability for inclusion, methodological quality and extracted data. Dichotomous data were presented as relative risks (RR) and 95% confidence intervals (CI), using the fixed effects model.

MAIN RESULTS: Eight trials involving 455 people were included and 393 patients analysed. Trials were grouped in eight categories of conservative or surgical treatment. The median quality score of all trials combined was 16 out of a possible 24 points, with a range of 12-18. In general, included trials differed on diagnostic criteria for rotator cuff tear, there was no uniformity in reported outcome measures, and data which could be summarised were rarely reported. Only results from two studies comparing open repair to arthroscopic debridement could be pooled. There is weak evidence for the superiority of open repair of rotator cuff tears compared with arthroscopic debridement.

REVIEWER'S CONCLUSIONS: There is little evidence to support or refute the efficacy of common interventions for tears of rotator cuff in adults. As well as the need for further well designed clinical trials, uniform methods of defining interventions for rotator cuff tears and validated outcome measures are also essential.

Publication Types:

- Review
- Review, Academic

PMID: 14973989

Rating: 1c

BACKGROUND

The rotator cuff plays a major role in shoulder pathology (Neer 1983). The shoulder consists of five joints - the sternoclavicular, acromioclavicular, glenohumeral joints and the scapulothoracic and subacromial gliding plane. These ideally function in a precise, synchronous manner to achieve a large

range of motion. The properties of the soft tissue envelope surrounding the glenohumeral joint, mainly rotator cuff tendons, significantly affect the function and kinematics of the shoulder mechanism. Defining these properties can contribute to successful surgical reconstruction and repair (Tibone 1986).

Tears of the rotator cuff tendons are one of the most common causes of pain and disability in the upper extremity (Hawkins 1980). Those who suffer from this condition range from athletes (Warner 1991; Blevins 1996) and workers with repetitive overhead activities (Ozaki 1988), to the elderly through years of use (Rowe 1998). This review aims to examine the effectiveness of the different methods of surgical and non-surgical treatment currently employed for complete rotator cuff tear, impingement syndrome III (Neer 1983).

RESULTS

Dexamethasone Injection Versus Placebo - Berry 1980 involved 60 patients in total and 24 patients in this comparison. No improvement (failure after treatment) was the only outcome that could be evaluated and no significant difference was found between interventions.

Physiotherapy Versus Placebo - Berry 1980, with 24 patients. No improvement (failure after treatment) was the only outcome that could be evaluated and no significant difference was found between interventions.

Acupuncture Versus Placebo - Berry 1980, with 24 patients. No improvement (failure after treatment) was the only outcome that could be evaluated and no significant difference was found between interventions.

Dexamethasone Injection Versus Sodium Hyaluronate Injection - Shibata 2001, involving 78 patients. No improvement of pain and no effectiveness were the two outcomes that could be evaluated and no significant difference was found between interventions.

Arthroscopic Subacromial Decompression And Debridement Versus Open Repair And Acromioplasty - Ogilvie-Harris 1993, Montgomery 1994, involving 133 patients. Montgomery 1994, in its nine years follow up (Melillo 1997) presented the only statistically significant difference favouring open repair for the outcome 'No global improvement according to UCLA criteria' (RR 4.14, 95% CI 2.03 to 8.46, NNT 1.4 95%CI 1.1 to 1.9).

Rotator Cuff Repair (Rcr) And Continuous Passive Motion Versus Rcr And Manual Passive Range Of Movement (Rom) Exercises - Raab 1996, Lastayo 1998, involving 58 patients. No improvement was the only outcome that could be evaluated and no significant difference was found between interventions.

Rcr And Splinting In Abduction Versus Rcr Resting The Arm At The Side - Watson 1985, involving 89 patients in total, and 63 patients analysed. No improvement was the only outcome that could be evaluated and no significant difference was found between interventions.

Nerve Block With Methylprednisolone Injection Versus Placebo - Vecchio 1992 included 13 subjects with rotator cuff tears. Data were presented only as skewed continuous data with mean change and Standard Error (SE).

DISCUSSION

We anticipated that it would be difficult to compare the outcome of different treatment methods because there are many different scoring systems which attempt to quantify the results of treatment (Tegner 1985; Hefti 1993). This review has confirmed the lack of uniformity in the way rotator cuff tears are labelled and defined. It has also highlighted the wide variation in assessment of outcome in clinical trials investigating the efficacy for rotator cuff tears. These factors limit the degree to which the results of different trials can be compared and pooled. In addition, the heterogeneity of the interventions studied, the timing of outcome assessment, the overall poor methodological quality, inadequate reporting of results, and small sample sizes makes it difficult to draw firm conclusions on the efficacy of any of the interventions studied in rotator cuff tears.

Pooling of reported data from the two studies comparing arthroscopic debridement of rotator cuff tears with open repair suggests that open repair is superior. This finding should be interpreted with considerable caution. Both trials were quasi-randomised. In Montgomery 1994, this was by alternation, but the allocation in some participants was subsequently changed, reportedly for reasons of patient preference. At five year follow-up, 88 participants were evaluated with inconclusive results, but at nine year follow-up data were only available for 53. Thus, this study as reported has risk of both selection and ascertainment bias. The evidence base for the superiority of open repair over arthroscopic debridement is weak.

No reported randomised trials compared conservative to surgical treatment.

Like the present research, another systematic review of interventions for shoulder pain found little evidence on the efficacy of common interventions (Green 2003). As well as the need for further well designed clinical trials, more research is needed to establish a uniform method of developing outcome measures which are valid, reliable, and responsive in affected people.

REVIEWERS' CONCLUSIONS

Implications for practice

There is little evidence to either support or refute the efficacy of common interventions for rotator cuff tears. There is poor data from non controlled open studies favouring conservative interventions, but this still needs to be proved. Considering these interventions are less invasive and less expensive than the surgical approach, they could be the first choice for the rotator cuff tears, until we have better and more reliable results from clinical trials.

Michener LA, Walsworth MK, Burnet EN. Effectiveness of rehabilitation for patients with subacromial impingement syndrome: a systematic review. *J Hand Ther.* 2004 Apr-Jun;17(2):152-64.

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Prior systematic reviews of rehabilitation for nondescript shoulder pain have not yielded clinically applicable results for those patients with subacromial impingement syndrome (SAIS). The purpose of this study was to examine the evidence for rehabilitation interventions for SAIS. The authors used data source as the method. The computerized bibliographic databases of Medline, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), and the Cochrane Database of Systematic Reviews were searched from 1966 up to and including October 2003. Key words used were "shoulder," "shoulder impingement syndrome," "bursitis," and "rotator cuff" combined with "rehabilitation," "physical therapy," "electrotherapy," "ultrasound," "acupuncture," and "exercise," limited to clinical trials. Randomized clinical trials that investigated physical interventions used in the rehabilitation of patients with SAIS with clinically relevant outcome measures of pain and quality of life were selected. The search resulted in 635 potential studies, 12 meeting inclusion criteria. Two independent reviewers graded all 12 trials with a quality checklist averaged for a final quality score. The mean quality score for 12 trials was 37.6 out of a possible 69 points. Various treatments were evaluated: exercise in six trials, joint mobilizations in two trials, laser in three trials, ultrasound in two trials, and acupuncture in two trials. The limited evidence currently available suggests that exercise and joint mobilizations are efficacious for patients with SAIS. Laser therapy appears to be of benefit only when used in isolation, not in combination with therapeutic exercise. Ultrasound is of no benefit, and acupuncture trials present equivocal evidence. The low to mediocre methodologic quality, small sample sizes, and general lack of long-term follow-up limit these findings for the development of useful clinical practice guidelines. Further trials are needed to investigate these rehabilitation interventions, the superiority of one intervention over another, and the long-term outcomes of rehabilitation. Moreover, it is imperative that clinical guidelines are developed to indicate those patients who are likely to respond to rehabilitation.

PMID: 15162102

Rating: 1b

Sauers EL. Effectiveness of rehabilitation for patients with subacromial impingement syndrome. J Athl Train. 2005 Jul;40(3):221-3.

Arizona School of Health Sciences, A. T. Still University, Mesa, AZ.

REFERENCE: Michener LA, Walsworth MK, Burnet EN. Effectiveness of rehabilitation for patients with subacromial impingement syndrome: a systematic review. *J Hand Ther.* 2004;17: 152-164.

CLINICAL QUESTION: Which physical rehabilitation techniques are effective in reducing pain and functional loss for patients with subacromial impingement syndrome (SAIS)?

DATA SOURCES: Investigations were identified by MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Cochrane Central Register of Controlled Trials Register searches from 1966 through October 2003 and by hand searching the references of all retrieved articles and relevant conference proceedings. The search terms were shoulder, shoulder impingement syndrome, bursitis, and rotator cuff combined with rehabilitation, physical therapy, electrotherapy, ultrasound, exercise, and acupuncture and limited to clinical trial, random assignment, or placebo.

STUDY SELECTION: Inclusion criteria involved randomized controlled trials or clinical trials comparing nonsurgical, nonpharmacologic physical interventions for patients with SAIS with another intervention, no treatment, or a placebo treatment. Included studies required clinically relevant and well-described outcome measures of pain, disability, or functional loss. The study was limited to adult patients who met specific inclusion criteria for the signs and symptoms of SAIS and exclusion criteria for systemic impairment, cervical involvement, degenerative joint changes, clinical findings of other shoulder injury, previous history of surgery or physical therapy treatment, and workers' compensation claim/litigation.

DATA EXTRACTION: A 23-item checklist, with each item assigned 0, 1, or 2 quality points for a total of 46 possible points, was used independently by 2 examiners to assess each study. In their original report, Michener et al stated that the 23-item checklist was worth a possible 69 points. However, in a conversation with L. A. Michener, she stated that this was an inadvertent publication error and confirmed that the possible point value for this checklist was indeed 46. This checklist encompasses 7 major areas, including the rationale for the research question, study design, subjects, intervention, outcome, analysis, and recommendations. If a discrepancy of more than 1 quality point was present for any item, the 2 investigators discussed it to reach a consensus. The total quality points were summed for each independent evaluator, and the average of the 2 final scores was used to determine the total quality score for an individual study.

MAIN RESULTS: The specific search criteria identified a total of 635 papers for review, of which only 12 met the inclusion and exclusion criteria for study. The average total quality score of these 12 studies was 37.6 (range, 33.5-41) of 46 possible points. Analysis of the inclusion criteria for SAIS revealed that shoulder pain was present in all 12 trials, painful or weak resisted abduction was present in 7 trials, positive Neer test was present in 6 trials, painful arc was present in 5 trials, positive Hawkins-Kennedy test was present in 4 trials, painful or weak resisted shoulder internal and external rotation in 4 trials, and positive impingement injection test was present in 2 trials. Physical interventions, performed in isolation or in combination, for patients with SAIS were divided into 5 types: exercise, joint mobilization, ultrasound, acupuncture, and laser. Authors employed a variety of outcomes measures, with all studies using a numeric rating or visual analog scale for pain, a direct measure of functional loss or disability (in 10 of 12 studies), or an indirect measure of a global rating of change or a measure of strength in a functional position (in 2 of 12 studies). Therapeutic exercise was the most widely studied form of physical intervention and demonstrated short-term and long-term effectiveness for decreasing pain and reducing functional loss. Upper quarter joint mobilizations in combination with therapeutic exercise were more effective than exercise alone. Laser therapy is an effective single intervention when compared with placebo treatments, but adding laser treatment to therapeutic exercise did not improve treatment efficacy. The limited data available do not support the use of ultrasound as an effective treatment for reducing pain or functional loss. Two studies evaluating the effectiveness of acupuncture produced equivocal results.

CONCLUSIONS: These data indicate that exercise, joint mobilization, and laser therapy are effective physical interventions for decreasing pain and functional loss or disability for patients with SAIS. The current evidence does not support the use of ultrasound, and studies evaluating the effectiveness of acupuncture were equivocal. The number of trials evaluating the effectiveness of physical rehabilitation

interventions for patients with SAIS is limited, and those available are of moderate quality. Clinicians should interpret the conclusions with these limitations in mind.

PMID: 16284646

Rating: 1b

Thomas M, Grunert J, Standtke S, Busse MW. Rope pulley isokinetic system in shoulder rehabilitation--initial results. *Z Orthop Ihre Grenzgeb.* 2001 Jan-Feb;139(1):80-6.

Orthopadische Klinik und Poliklinik der Universitat Leipzig.

AIM: Of this study was to evaluate the results of a shoulder rehabilitation program of different shoulder diseases, based on an isokinetic pulley system ("Moflex", Recotec/Bernina, Swiss).

METHOD: In this prospective study 70 patients participated in a standardized rehabilitation program (instability: n = 19; rotator cuff disorders: n = 23; impingement syndrome without lesion: n = 16; others: n = 12; operative therapy: n = 47). The major aspect of the program was an isokinetic pulley system.

RESULTS: Isokinetic training with the used device affords strict monitor-feedback to avoid critical torque values. Strength which was attained without relevant pain was almost linearly increased by a mean of 31% until the 20th day of rehabilitation, workload by 79%. At the end of the rehabilitation program the strength of the affected (mostly dominant) shoulder was 15% higher than in the unaffected shoulder; the respective workload values were almost equal.

CONCLUSION: These first results demonstrate the value of the isokinetic pulley system in the rehabilitation of the investigated shoulder diseases. The equipment may be used already in an early postoperative state. First results of strength increases using an isokinetic pulley system in shoulder rehabilitation are presented.

PMID: 11253528

Rating: 4b

Verhagen AP, Bierma-Zeinstra SM, Feleus A, Karels C, Dahaghin S, Burdorf L, de Vet HC, Koes BW, Ergonomic and physiotherapeutic interventions for treating upper extremity work related disorders in adults, *Cochrane Database Syst Rev.* 2004;(1):CD003471

Department of General Practice, Erasmus MC, P.O. Box 1738, 3000 DR Rotterdam, Netherlands.

BACKGROUND: Conservative interventions such as physiotherapy and ergonomic adjustments play a major part in the treatment of most work-related musculoskeletal disorders (WRMD).

OBJECTIVES: The objective of this systematic review is to determine whether conservative interventions have a significant impact on short and long-term outcomes for upper extremity WRMD in adults.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised register (January 2002) and Cochrane Rehabilitation and Related Therapies Field specialised register (January 2002), the Cochrane Controlled Trials Register (The Cochrane Library Issue 3, 2001), PubMed (1966 to November 2001), EMBASE (1988 to November 2001), and CINAHL (1982 to November 2001). We also searched the Physiotherapy Index (1988 to November 2001) and reference lists of articles. No language restrictions were applied.

SELECTION CRITERIA: Only randomised controlled trials and concurrent controlled trials studying conservative interventions for adults suffering from upper extremity WRMD were included. Conservative interventions may include exercises, relaxation, physical applications, biofeedback, myofeedback and work place adjustments.

DATA COLLECTION AND ANALYSIS: Two reviewers independently selected the trials from the search yield and assessed the clinical relevance and methodological quality using the Delphi list. In the event of clinical heterogeneity or lack of data we used a rating system to assess levels of evidence.

MAIN RESULTS: We included 15 trials involving 925 people. Twelve trials included people with chronic non-specific neck or shoulder complaints, or non-specific upper extremity disorders. Over 20 interventions were evaluated; seven main subgroups of interventions could be determined: exercises, manual therapy, massage, ergonomics, multidisciplinary treatment, energised splint and individual treatment versus group therapy. Overall, the quality of the studies appeared to be poor. In 10 studies a form of exercise was evaluated, and there is limited evidence about the effectiveness of exercises only when compared to no treatment. Concerning manual therapy (1 study), massage (4 studies), multidisciplinary treatment (1 study) and energised splint (1 study) no conclusions can be drawn. Limited evidence is found concerning the effectiveness of specific keyboards for patients with carpal tunnel syndrome.

REVIEWER'S CONCLUSIONS: This review shows limited evidence for the effectiveness of keyboards with an alternative force-displacement of the keys or an alternative geometry, and limited evidence for the effectiveness of individual exercises. The benefit of expensive ergonomic interventions (such as new chairs, new desks etc) in the workplace is not clearly demonstrated.

Publication Types:

- Meta-Analysis
- Review
- Review, Academic

PMID: 14974016

Rating: 1b

BACKGROUND

The term repetitive strain injury (RSI) is not a diagnosis, but an umbrella term for disorders that develop as a result of repetitive movements, awkward postures, and impact of force (Yassi 1997). Work-related musculoskeletal disorders (WRMD) have been described differently in various countries: RSI in Canada and Europe, both RSI and occupational overuse syndrome (OOS) in Australia and cumulative trauma disorder in the USA (Putz-Anderson 1988). Work-related musculoskeletal disorders can be divided into specific conditions such as carpal tunnel syndrome, which has relatively clear diagnostic criteria and pathology, or non-specific conditions such as tension neck syndrome, which is primarily defined by the location of complaints and whose pathophysiology is less clearly defined. With carpal tunnel syndrome, for instance, between 43 and 90 per cent of cases can be defined as work-related, depending on the setting (industrial or primary care setting) (Hagberg 1992; Miller 1994).

In the USA, cumulative trauma disorders account for between 56 and 65 percent of all occupational injuries (Melhorn 1998; Pilligan 2000). Overall, the estimated prevalence of upper-extremity WRMD is approximately 30 per cent (Yassi 1997; Melhorn 1998). Several studies report a rapidly increasing incidence of WRMD of the upper extremities (Yassi 1997). The costs associated with these disorders are high - over two billion dollars of direct and indirect costs estimated annually in the USA (Pilligan 2000).

Today, much attention is paid to the prevention and treatment of WRMD (Silverstein 1997; Yassi 1997). Conservative interventions such as physiotherapy and ergonomic adjustments play a major part in the prevention or treatment of most WRMD (Pilligan 2000). The direct and indirect costs of these WRMD are a burden to patients, employers and insurance companies. Therefore, there is a need to determine whether conservative interventions have a significant impact on long-term outcomes.

TRIALS COMPARING DIFFERENT TYPES OF INCLUDED CONSERVATIVE TREATMENTS

Thirteen studies compared different conservative treatments.

1. Exercises

In three studies when different forms of exercises were compared the conclusion was defined as 'unclear', meaning not providing data (Ferguson 1976; Kamwendo 1991; Hagberg 2000). Three studies report conflicting results concerning the effectiveness of exercises compared to massage (Rundcrantz 1991; Levoska 1993; Vasseljen 1995). Only the study of Vasseljen 1995 was of high quality but here exercises were a part of both interventions. The study evaluated the difference between individual and group exercises, so no conclusions can be drawn about the effectiveness of the exercises themselves. Therefore we conclude that there is conflicting evidence concerning the effectiveness of exercises compared to massage, and no evidence concerning the effectiveness of exercises when different forms of exercises are compared.

2. Manual therapy/chiropractic treatment

In the study of Bang 2000 significant results were found in pain reduction and isodynamic strength in patients with a shoulder impingement syndrome. Therefore we conclude that there is limited evidence for the efficacy of manual therapy in patients with a shoulder impingement syndrome.

3. Massage

In one study (Ferguson 1976) the conclusion was defined as 'unclear', and one found positive results (significantly) in favour of massage (Leboeuf 1987). In the studies of Levoska 1993 and Vasseljen 1995 massage was a part of a combination of interventions (i.e. a black box), so no conclusions can be drawn concerning the efficacy of massage from these studies. All studies were of low quality, therefore we conclude that there is conflicting evidence of the efficacy of massage in the treatment of upper extremity WRMD.

4. Ergonomics

Two high quality studies (Rempel 1999; Tittiranonda 1999) evaluated the efficacy of six different keyboards on reduction of complaints. Rempel 1999 reported significant positive results of alternative force-displacement of the keys in pain reduction in 12 weeks and Tittiranonda 1999 found no significant differences between different keyboards. The results of the study of Kamwendo 1991 are classified as 'unclear'. Therefore we conclude that there is limited evidence of the efficacy of some keyboards in people with a carpal tunnel syndrome compared with other keyboards.

5. Multidisciplinary treatment

In one low quality non-randomised study a multidisciplinary work re-entry rehabilitation programme is compared with 'usual care' (Feuerstein 1993), reporting non significant positive results. We conclude that there is no evidence of efficacy of a multidisciplinary treatment.

6. Energised splint

There is one study comparing an 'energised splint' with placebo (Stralka 1998). See placebo comparison below.

7. Group therapy versus individual therapy

The study of Vasseljen 1995 is considered of high quality and shows significant short term positive results. Therefore we conclude that when individual exercises are compared with exercises in a group there is limited evidence on short-term efficacy for individual exercises.

TRIALS COMPARING CONSERVATIVE TREATMENTS WITH PLACEBO, OR NO TREATMENT/WAITING LIST CONTROLS

1. Placebo

Two studies compared a conservative treatment with a placebo (Stralka 1998; Tittiranonda 1999). One high quality study (Tittiranonda 1999) evaluated the efficacy of three different keyboards in people with a carpal tunnel syndrome on reduction of complaints and improvement of function with a placebo (= unchanged keyboard). They reported significant positive results of some keyboards compared with the placebo. Therefore we conclude that there is limited evidence for the efficacy of alternative keyboards over a placebo.

One low quality RCT compared an 'energised splint' with placebo (Stralka 1998). The results were classified as 'unclear'.

2. No treatment/waiting list controls

Four studies compared a conservative treatment with a control group receiving no treatment (Kamwendo 1991; Takala 1994; Lundblad 1999; Waling 2000). In all studies forms of exercises were compared with a control group receiving no treatment. In one study the conclusion was defined as 'unclear' (Kamwendo 1991), in two studies (Lundblad 1999; Takala 1994) positive but non-significant results were found and Waling 2000 found significant positive results of exercises on pain, strength and function. All studies were regarded of low quality, therefore we conclude that there is limited evidence concerning the efficacy of exercises compared to a control group receiving no treatment.

DISCUSSION

This review shows that there is limited evidence concerning the effectiveness of specific keyboards for patients with a carpal tunnel syndrome, and limited evidence for the effectiveness of exercises in patients with chronic non-specific neck and shoulder complaints when compared to no treatment. As well as these results, an individual approach appeared to be more effective compared with a group approach.

ODG's References in the November 17, 2007 version of the ODG Physical Medicine

HIGHER PRIORITY REFERENCES

Ankle & Foot (Acute & Chronic)

Burns

Carpal Tunnel Syndrome (Acute & Chronic)

Elbow (Acute & Chronic)

Forearm, Wrist, & Hand

Head

Hip & Pelvis (Acute & Chronic)

Knee & Leg (Acute & Chronic)

Low Back - Lumbar & Thoracic (Acute & Chronic)

Neck and Upper Back (Acute & Chronic)

Pain (Chronic)

Shoulder (Acute & Chronic)

Ankle & Foot (Acute & Chronic)

Aldridge T. Diagnosing heel pain in adults. *Am Fam Physician*. 2004 Jul 15;70(2):332-8.

Colorado Division of Workers' Compensation, Medical Treatment Guidelines, Rule XVII, Exhibit C, Lower Extremity Injury, 12/01/01.

Twaddle BC, Poon P. Early motion for Achilles tendon ruptures: is surgery important? A randomized, prospective study. *Am J Sports Med.* 2007 Dec;35(12):2033-8. Epub 2007 Sep 20.

Burns

Simons M, King S, Edgar D; ANZBA. Occupational therapy and physiotherapy for the patient with burns: principles and management guidelines. *J Burn Care Rehabil.* 2003 Sep-Oct;24(5):323-35; discussion 322.

Carpal Tunnel Syndrome (Acute & Chronic)

APTA (American Physical Therapy Association). Carpal Tunnel Syndrome. 2006.

Bilic R, Kolundzic R, Trkulja V, Crnkovic T, Vukovic A. The carpal tunnel syndrome: medical and economic advantages of well-timed surgical treatment. *Lijec Vjesn.* 2006 May-Jun;128(5-6):143-9.

Cameron ID. Coordinated multidisciplinary rehabilitation after hip fracture. *Disabil Rehabil.* 2005 Sep 30-Oct 15;27(18-19):1081-90.

Cook AC, Szabo RM, Birkholz SW, King EF, Early mobilization following carpal tunnel release. A prospective randomized study, *J Hand Surg [Br]* 1995 Apr;20(2):228-30

Feuerstein M, Burrell LM, Miller VI, Lincoln A, Huang GD, Berger R, Clinical management of carpal tunnel syndrome: a 12-year review of outcomes, *Am J Ind Med* 1999 Mar;35(3):232-45

O'Connor D, Marshall S, Massy-Westropp N. Non-surgical treatment (other than steroid injection) for carpal tunnel syndrome. *Cochrane Database Syst Rev.* 2003;(1):CD003219.

Verhagen AP, Bierma-Zeinstra SM, Feleus A, Karels C, Dahaghin S, Burdorf L, de Vet HC, Koes BW, Ergonomic and physiotherapeutic interventions for treating upper extremity work related disorders in adults, *Cochrane Database Syst Rev.* 2004;(1):CD003471

Elbow (Acute & Chronic)

Boisauvert B, Brousse C, Zaoui A, Montigny JP. Nonsurgical treatment of tennis elbow. *Ann Readapt Med Phys.* 2004 Aug;47(6):346-55

Boyer MI, Hastings H 2nd. Lateral tennis elbow: "Is there any science out there?" *J Shoulder Elbow Surg* 1999 Sep-Oct;8(5):481-91

Foley AE. Tennis elbow. *Am Fam Physician* 1993 Aug;48(2):281-8.

Handoll H, Gibson J, Madhok R, Interventions for treating proximal humeral fractures in adults, *Cochrane Database Syst Rev.* 2003;4:CD000434

Korthals-de Bos IB, Smidt N, van Tulder MW, Rutten-van Molken MP, Ader HJ, van der Windt DA, Assendelft WJ, Bouter LM. Cost effectiveness of interventions for lateral epicondylitis: results from a randomised controlled trial in primary care. *Pharmacoeconomics*. 2004;22(3):185-95.

Lund AT, Amadio PC. Treatment of cubital tunnel syndrome: perspectives for the therapist. *J Hand Ther*. 2006 Apr-Jun;19(2):170-8.

Piligian G, Herbert R, Hearn M, Dropkin J, Landsbergis P, Cherniack M. Evaluation and management of chronic work-related musculoskeletal disorders of the distal upper extremity. *Am J Ind Med* 2000 Jan;37(1):75-93.

Sevier TL, Wilson JK. Treating lateral epicondylitis. *Sports Med* 1999 Nov; 28(5):375-80

Smidt N, Assendelft WJ, Arola H, Malmivaara A, Greens S, Buchbinder R, van der Windt DA, Bouter LM, Effectiveness of physiotherapy for lateral epicondylitis: a systematic review, *Ann Med*. 2003;35(1):51-62.

Smidt N, Lewis M, Hay EM, Van der Windt DA, Bouter LM, Croft P. A comparison of two primary care trials on tennis elbow: issues of external validity. *Ann Rheum Dis*. 2005 Oct;64(10):1406-9. Epub 2005 Mar 30.

Struijs PA, Kerkhoffs GM, Assendelft WJ, Van Dijk CN. Conservative treatment of lateral epicondylitis: brace versus physical therapy or a combination of both—a randomized clinical trial. *Am J Sports Med*. 2004 Mar;32(2):462-9.

Waugh EJ, Jaglal SB, Davis AM, Tomlinson G, Verrier MC. Factors associated with prognosis of lateral epicondylitis after 8 weeks of physical therapy. *Arch Phys Med Rehabil*. 2004 Feb;85(2):308-18.

Forearm, Wrist, & Hand

Handoll H, Gibson J, Madhok R, Interventions for treating proximal humeral fractures in adults, *Cochrane Database Syst Rev*. 2003;4:CD000434

Handoll HH, Madhok R, Conservative interventions for treating distal radial fractures in adults, *Cochrane Database Syst Rev*. 2003;(2):CD000314.

Handoll HH, Madhok R, Howe TE, Rehabilitation for distal radial fractures in adults, *Cochrane Database Syst Rev*. 2002;(2):CD003324

Handoll HH, Madhok R, Howe TE. Rehabilitation for distal radial fractures in adults. *Cochrane Database Syst Rev*. 2006 Jul 19;3:CD003324.

Rapoliene J, Krisciunas A. The effectiveness of occupational therapy in restoring the functional state of hands in rheumatoid arthritis patients. *Medicina (Kaunas)*. 2006;42(10):823-8.

Head

Brown TH, Mount J, Rouland BL, Kautz KA, Barnes RM, Kim J. Body weight-supported treadmill training versus conventional gait training for people with chronic traumatic brain injury. *J Head Trauma Rehabil.* 2005 Sep-Oct;20(5):402-15.

Colorado Division of Workers' Compensation. Rule XVII, Exhibit G, Traumatic Brain Injury. Medical Treatment Guidelines. May 1, 2005

Driver S, O'connor J, Lox C, Rees K. Evaluation of an aquatics programme on fitness parameters of individuals with a brain injury. *Brain Inj.* 2004 Sep;18(9):847-59.

Franckeviciute E, Krisciunas A. Peculiarities of physical therapy for patients after traumatic brain injury. *Medicina (Kaunas).* 2005;41(1):1-6.

Shiel A, Burn JP, Henry D, Clark J, Wilson BA, Burnett ME, McLellan DL. The effects of increased rehabilitation therapy after brain injury: results of a prospective controlled trial. *Clin Rehabil.* 2001 Oct;15(5):501-14.

Hip & Pelvis (Acute & Chronic)

Binder EF, Brown M, Sinacore DR, Steger-May K, Yarasheski KE, Schechtman KB. Effects of extended outpatient rehabilitation after hip fracture: a randomized controlled trial. *JAMA.* 2004 Aug 18;292(7):837-46.

Bolgia LA, Uhl TL. Electromyographic analysis of hip rehabilitation exercises in a group of healthy subjects. *J Orthop Sports Phys Ther.* 2005 Aug;35(8):487-94.

Brigham and Women's Hospital. Lower extremity musculoskeletal disorders. A guide to diagnosis and treatment. Boston (MA): Brigham and Women's Hospital; 2003.

Expert Clinical Benchmarks. Lower extremity (hip, knee and ankle). King of Prussia (PA): MedRisk, Inc.; 2004.

Handoll HH, Sherrington C, Parker MJ. Mobilisation strategies after hip fracture surgery in adults. *Cochrane Database Syst Rev.* 2004 Oct 18;(4):CD001704.

Jain R, Basinski A, Kreder HJ. Nonoperative treatment of hip fractures. *Int Orthop.* 2003;27(1):11-7. Epub 2002 Nov 12.

Jan MH, Hung JY, Lin JC, Wang SF, Liu TK, Tang PF. Effects of a home program on strength, walking speed, and function after total hip replacement. *Arch Phys Med Rehabil.* 2004 Dec;85(12):1943-51.

Kuisma R. A randomized, controlled comparison of home versus institutional rehabilitation of patients with hip fracture. *Clin Rehabil.* 2002 Aug;16(5):553-61.

Lauridsen UB, de la Cour BB, Gottschalck L, Svensson BH. Intensive physical therapy after hip fracture. A randomised clinical trial. *Dan Med Bull.* 2002 Feb;49(1):70-2.

Mangione KK, Craik RL, Tomlinson SS, Palombaro KM. Can elderly patients who have had a hip fracture perform moderate- to high-intensity exercise at home? *Phys Ther.* 2005 Aug;85(8):727-39.

National Osteoporosis Foundation. Health professional's guide to rehabilitation of the patient with osteoporosis. Washington (DC): National Osteoporosis Foundation; 2003.

Penrod JD, Boockvar KS, Litke A, Magaziner J, Hannan EL, Halm EA, Silberzweig SB, Sean Morrison R, Orosz GM, Koval KJ, Siu AL. Physical therapy and mobility 2 and 6 months after hip fracture. *J Am Geriatr Soc.* 2004 Jul;52(7):1114-20.

Sherrington C, Lord SR, Herbert RD. A randomized controlled trial of weight-bearing versus non-weight-bearing exercise for improving physical ability after usual care for hip fracture. *Arch Phys Med Rehabil.* 2004 May;85(5):710-6.

Tsauo JY, Leu WS, Chen YT, Yang RS. Effects on function and quality of life of postoperative home-based physical therapy for patients with hip fracture. *Arch Phys Med Rehabil.* 2005 Oct;86(10):1953-7.

White SC, Lifeso RM. Altering asymmetric limb loading after hip arthroplasty using real-time dynamic feedback when walking. *Arch Phys Med Rehabil.* 2005 Oct;86(10):1958-63.

Zhang W, Moskowitz RW, Nuki G, Abramson S, Altman RD, Arden N, Bierma-Zeinstra S, Brandt KD, Croft P, Doherty M, Dougados M, Hochberg M, Hunter DJ, Kwoh K, Lohmander LS, Tugwell P. OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. *Osteoarthritis Cartilage.* 2008 Feb;16(2):137-62.

Knee & Leg (Acute & Chronic)

Cochrane T, Davey RC, Matthes Edwards SM. Randomised controlled trial of the cost-effectiveness of water-based therapy for lower limb osteoarthritis. *Health Technol Assess.* 2005 Aug;9(31):iii-iv, ix-xi, 1-114.

Goodwin PC, Morrissey MC, Omar RZ, Brown M, Southall K, McAuliffe TB. Effectiveness of supervised physical therapy in the early period after arthroscopic partial meniscectomy, *Phys Ther.* 2003 Jun;83(6):520-35

Lowe CJ, Barker KL, Dewey M, Sackley CM. Effectiveness of physiotherapy exercise after knee arthroplasty for osteoarthritis: systematic review and meta-analysis of randomised controlled trials. *BMJ.* 2007 Oct 20;335(7624):812. Epub 2007 Sep 20.

Philadelphia Panel, Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for knee pain, *Phys Ther* 2001 Oct;81(10):1675-700

Rand SE, Goerlich C, Marchand K, Jablecki N. The physical therapy prescription. *Am Fam Physician*. 2007 Dec 1;76(11):1661-6.

Zhang W, Moskowitz RW, Nuki G, Abramson S, Altman RD, Arden N, Bierma-Zeinstra S, Brandt KD, Croft P, Doherty M, Dougados M, Hochberg M, Hunter DJ, Kwoh K, Lohmander LS, Tugwell P. OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. *Osteoarthritis Cartilage*. 2008 Feb;16(2):137-62.

Low Back - Lumbar & Thoracic (Acute & Chronic)

Airaksinen OV, Kyrklund N, Latvala K, Kouri JP, Gronblad M, Kolari P. Efficacy of cold gel for soft tissue injuries: a prospective randomized double-blinded trial. *Am J Sports Med*. 2003 Sep-Oct;31(5):680-4.

BlueCross BlueShield. Utilization Management Section - Physical Therapy. Policy No: 6. Effective Date: 03/01/2005

Cherkin DC, Deyo RA, Battie M, Street J, Barlow W. A Comparison of Physical Therapy, Chiropractic Manipulation, and Provision of an Educational Booklet for the Treatment of Patients with Low Back Pain. *NEJM* 1998;339:1021-9.

Erdogmus CB, Resch KL, Sabitzer R, Müller H, Nuhr M, Schögl A, Posch M, Osterode W, Ungersböck K, Ebenbichler GR. Physiotherapy-based rehabilitation following disc herniation operation: results of a randomized clinical trial. *Spine*. 2007 Sep 1;32(19):2041-9.

Fritz JM, George SZ, Delitto A. The role of fear-avoidance beliefs in acute low back pain: relationships with current and future disability and work status. *Pain*. 2001 Oct;94(1):7-15.

Fritz JM, George SZ. Identifying psychosocial variables in patients with acute work-related low back pain: the importance of fear-avoidance beliefs. *Phys Ther*. 2002 Oct;82(10):973-83.

Fritz JM, Delitto A, Erhard RE. Comparison of classification-based physical therapy with therapy based on clinical practice guidelines for patients with acute low back pain: a randomized clinical trial. *Spine*. 2003 Jul 1;28(13):1363-71; discussion 1372.

Frost H, Lamb SE, Doll HA, Carver PT, Stewart-Brown S. Randomised controlled trial of physiotherapy compared with advice for low back pain. *BMJ*. 2004 Sep 25;329(7468):708. Epub 2004 Sep 17.

George SZ, Fritz JM, Bialosky JE, Donald DA. The effect of a fear-avoidance-based physical therapy intervention for patients with acute low back pain: results of a randomized clinical trial. *Spine*. 2003 Dec 1;28(23):2551-60.

Goldby LJ, Moore AP, Doust J, Trew ME. A randomized controlled trial investigating the efficiency of musculoskeletal physiotherapy on chronic low back disorder. *Spine*. 2006 May 1;31(10):1083-93.

Hayden JA, van Tulder MW, Tomlinson G. Systematic review: strategies for using exercise therapy to improve outcomes in chronic low back pain. *Ann Intern Med*. 2005 May 3;142(9):776-85.

Hicks GE, Fritz JM, Delitto A, McGill SM. Preliminary development of a clinical prediction rule for determining which patients with low back pain will respond to a stabilization exercise program. *Arch Phys Med Rehabil*. 2005 Sep;86(9):1753-62.

Jousset N, Fanello S, Bontoux L, Dubus V, Billabert C, Vielle B, Roquelaure Y, Penneau-Fontbonne D, Richard I. Effects of functional restoration versus 3 hours per week physical therapy: a randomized controlled study. *Spine*. 2004 Mar 1;29(5):487-93; discussion 494.

Klaber Moffett JA, Carr J, Howarth E. High fear-avoiders of physical activity benefit from an exercise program for patients with back pain. *Spine*. 2004 Jun 1;29(11):1167-72; discussion 1173.

Linz DH; Shepherd CD; Ford LF; Ringley LL; Klekamp J; Duncan JM. Effectiveness of occupational medicine center-based physical therapy. *Journal of Occupational and Environmental Medicine*. 01-Jan-2002; 44(1): 48-53.

Long A, Donelson R, Fung T. Does it matter which exercise? A randomized control trial of exercise for low back pain. *Spine*. 2004 Dec 1;29(23):2593-602.

Luijsterburg PA, Lamers LM, Verhagen AP, Ostelo RW, van den Hoogen HJ, Peul WC, Avezaat CJ, Koes BW. Cost-Effectiveness of Physical Therapy and General Practitioner Care for Sciatica. *Spine*. 2007;32:1942-1948.

Luijsterburg PA, Verhagen AP, Ostelo RW, van Os TA, Peul WC, Koes BW. Effectiveness of conservative treatments for the lumbosacral radicular syndrome: a systematic review. *Eur Spine J*. 2007;16:881-99. Epub 2007

Mannion AF, Muntener M, Taimela S, Dvorak J. Comparison of three active therapies for chronic low back pain: results of a randomized clinical trial with one-year follow-up. *Rheumatology (Oxford)*. 2001 Jul;40(7):772-8.

Price C, Arden N, Coglan L, Rogers P. Cost-effectiveness and safety of epidural steroids in the management of sciatica. *Health Technol Assess*. 2005 Aug;9(33):1-58, iii.

Rainville J, Hartigan C, Jouve C, Martinez E. The influence of intense exercise-based physical therapy program on back pain anticipated before and induced by physical activities. *Spine J*. 2004 Mar-Apr;4(2):176-83.

Rainville J, Jouve CA, Hartigan C, Martinez E, Hipona M. Comparison of short- and long-term outcomes for aggressive spine rehabilitation delivered two versus three times per week. *Spine J.* 2002 Nov-Dec;2(6):402-7.

Riipinen M, Niemisto L, Lindgren KA, Hurri H. Psychosocial differences as predictors for recovery from chronic low back pain following manipulation, stabilizing exercises and physician consultation or physician consultation alone. *J Rehabil Med.* 2005 May;37(3):152-8.

Skargren EI, Carlsson PG, Oberg BE. One-year follow-up comparison of the cost and effectiveness of chiropractic and physiotherapy as primary management for back pain. Subgroup analysis, recurrence, and additional health care utilization. *Spine.* 1998 Sep 1;23(17):1875-83; discussion 1884.

Smeal WL, Tyburski M, Alleva J, Prather H, Hunt D. Conservative management of low back pain, part I. Discogenic/radicular pain. *Dis Mon.* 2004;50:636-69.

Vad VB, Bhat AL, Lutz GE, Cammisa F. Transforaminal epidural steroid injections in lumbosacral radiculopathy: a prospective randomized study. *Spine.* 2002 Jan 1;27(1):11-6.

Zigenfus GC; Yin J; Giang GM; Fogarty WT. Effectiveness of early physical therapy in the treatment of acute low back musculoskeletal disorders. *Journal of Occupational and Environmental Medicine.* 01-Jan-2000; 42(1): 35-9.

Neck and Upper Back (Acute & Chronic)

Bigos SJ, Perils, pitfalls, and accomplishments of guidelines for treatment of back problems, *Neurol Clin* 1999 Feb;17(1):179-92

Colorado Division of Workers' Compensation, Medical Treatment Guidelines, Rule XVII, Cervical Spine Injury, 12/01/01.

Conlin A, Bhogal S, Sequeira K, Teasell R. Treatment of whiplash-associated disorders--part I: Non-invasive interventions. *Pain Res Manag.* 2005 Spring;10(1):21-32.

Kjellman GV, Skargren EI, Oberg BE. A critical analysis of randomised clinical trials on neck pain and treatment efficacy: a review of the literature. *Scandinavian Journal of Rehabilitation Medicine* 1999, 31(3), 139-152.

Kongsted A, Qerama E, Kasch H, Bendix T, Winther F, Korsholm L, Jensen TS. Neck collar, "act-as-usual" or active mobilization for whiplash injury? A randomized parallel-group trial. *Spine.* 2007 Mar 15;32(6):618-26.

Philadelphia Panel. Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for neck pain. *Phys Ther* 2001 Oct; 81(10): 1701-17.

Rosenfeld M, Gunnarsson R, Borenstein P. Early intervention in whiplash-associated disorders: a comparison of two treatment protocols. *Spine* 2000 Jul 15;25(14):1782-7.

Scholten-Peeters GG, Neeleman-van der Steen CW, van der Windt DA, Hendriks EJ, Verhagen AP, Oostendorp RA. Education by general practitioners or education and exercises by physiotherapists for patients with whiplash-associated disorders? A randomized clinical trial. *Spine*. 2006 Apr 1;31(7):723-31.

Seferiadis A, Rosenfeld M, Gunnarsson R. A review of treatment interventions in whiplash-associated disorders. *Eur Spine J*. 2004 Aug;13(5):387-97. Epub 2004 May 05.

Pain (Chronic)

Airaksinen O, Brox JI, Cedraschi C, Hildebrandt J, Klüber-Moffett J, Kovacs F, Mannion AF, Reis S, Staal JB, Ursin H, Zanoli G; On behalf of the COST B13 Working Group on Guidelines for Chronic Low Back Pain. Chapter 4 European guidelines for the management of chronic nonspecific low back pain. *Eur Spine J*. 2006 Mar;15(Supplement 2):s192-s300.

Li Z, Smith BP, Smith TL, Koman LA. Diagnosis and management of complex regional pain syndrome complicating upper extremity recovery. *J Hand Ther*. 2005 Apr-Jun;18(2):270-6.

State of Colorado Department of Labor and Employment, Division of Workers' Compensation. Colorado Rule XVII, Exhibit 7, Complex Regional Pain Syndrome Medical Treatment Guideline. 01/01/06

Shoulder (Acute & Chronic)

Anderson NH, Sojbjerg JO, Johannsen HV, Sneppen O. Self-training versus physiotherapist-supervised rehabilitation of the shoulder in patients treated with arthroscopic subacromial decompression: a clinical randomized study. *J Shoulder Elbow Surg* 1999 Mar-Apr;8(2):99-101

Bang MD, Deyle GD. Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. *J Orthop Sports Phys Ther* 2000 Mar;30(3):126-37

Buchbinder R, Youd JM, Green S, Stein A, Forbes A, Harris A, Bennell K, Bell S, Wright WJ. Efficacy and cost-effectiveness of physiotherapy following glenohumeral joint distension for adhesive capsulitis: a randomized trial. *Arthritis Rheum*. 2007 Aug 15;57(6):1027-37.

Burbank KM, Stevenson JH, Czarnecki GR, Dorfman J. Chronic Shoulder Pain: Part I. Evaluation and Diagnosis. *Am Fam Physician*. 2008;77:453-460, 493-497.

Carette S, Moffet H, Tardif J, Bessette L, Morin F, Fremont P, Bykerk V, Thorne C, Bell M, Bensen W, Blanchette C. Intraarticular corticosteroids, supervised physiotherapy, or a combination of the two in the treatment of adhesive capsulitis of the shoulder: a placebo-controlled trial. *Arthritis Rheum*. 2003 Mar;48(3):829-38.

Ejnisman B, Andreoli CV, Soares BG, Fallopa F, Peccin MS, Abdalla RJ, Cohen M, Interventions for tears of the rotator cuff in adults, *Cochrane Database Syst Rev.* 2004;(1):CD002758

Michener LA, Walsworth MK, Burnet EN. Effectiveness of rehabilitation for patients with subacromial impingement syndrome: a systematic review. *J Hand Ther.* 2004 Apr-Jun;17(2):152-64.

Sauers EL. Effectiveness of rehabilitation for patients with subacromial impingement syndrome. *J Athl Train.* 2005 Jul;40(3):221-3.

Thomas M, Grunert J, Standtke S, Busse MW. Rope pulley isokinetic system in shoulder rehabilitation--initial results. *Z Orthop Ihre Grenzgeb.* 2001 Jan-Feb;139(1):80-6.

Verhagen AP, Bierma-Zeinstra SM, Feleus A, Karels C, Dahaghin S, Burdorf L, de Vet HC, Koes BW, Ergonomic and physiotherapeutic interventions for treating upper extremity work related disorders in adults, *Cochrane Database Syst Rev.* 2004;(1):CD003471

REFERENCE SUMMARIES

Ankle & Foot (Acute & Chronic)

Aldridge T. Diagnosing heel pain in adults. *Am Fam Physician.* 2004 Jul 15;70(2):332-8.

Department of Family and Community Medicine, Southern Illinois University School of Medicine, Springfield, Illinois 62794-9671, USA.

Heel pain is a common condition in adults that may cause significant discomfort and disability. A variety of soft tissue, osseous, and systemic disorders can cause heel pain. Narrowing the differential diagnosis begins with a history and physical examination of the lower extremity to pinpoint the anatomic origin of the heel pain. The most common cause of heel pain in adults is plantar fasciitis. Patients with plantar fasciitis report increased heel pain with their first steps in the morning or when they stand up after prolonged sitting. Tenderness at the calcaneal tuberosity usually is apparent on examination and is increased with passive dorsiflexion of the toes. Tendonitis also may cause heel pain. Achilles tendonitis is associated with posterior heel pain. Bursae adjacent to the Achilles tendon insertion may become inflamed and cause pain. Calcaneal stress fractures are more likely to occur in athletes who participate in sports that require running and jumping. Patients with plantar heel pain accompanied by tingling, burning, or numbness may have tarsal tunnel syndrome. Heel pad atrophy may present with diffuse plantar heel pain, especially in patients who are older and obese. Less common causes of heel pain, which should be considered when symptoms are prolonged or unexplained, include osteomyelitis, bony abnormalities (such as calcaneal stress fracture), or tumor. Heel pain rarely is a presenting symptom in patients with systemic illnesses, but the latter may be a factor in persons with bilateral heel pain, pain in other joints, or known inflammatory arthritis conditions.

Publication Types:

Title 8, California Code of Regulations, section 9792.20 et seq.
Appendix E—Postsurgical Treatment Guidelines (DWC 2008)
ODG's References
(Proposed Regulations—June 2008)

- Review
- Review, Tutorial

PMID: 15291091

Rating: 5a

Colorado Division of Workers' Compensation, Medical Treatment Guidelines, Rule XVII, Exhibit C, Lower Extremity Injury, 12/01/01.

Introduction

This document has been prepared by the Colorado Department of Labor and Employment, Division of Workers' Compensation (Division) and should be interpreted within the context of guidelines for physicians/providers treating individuals qualifying under Colorado Workers' Compensation Act as injured workers with lower extremity injuries.

Although the primary purpose of this document is advisory and educational, these guidelines are enforceable under the Workers' Compensation rules of Procedure, 7 CCR 1101-3. The Division recognizes that acceptable medical practice may include deviations from these guidelines, as individual cases dictate. Therefore, these guidelines are not relevant as evidence of a provider's legal standard of professional care. To properly utilize this document, the reader should not skip nor overlook any sections.

General Guideline Principles

The principles summarized in this section are key to the intended implementation of all Division of Workers' Compensation guidelines and critical to the reader's application of the guidelines in this document.

Rating: 7a

Twaddle BC, Poon P. Early motion for Achilles tendon ruptures: is surgery important? A randomized, prospective study. *Am J Sports Med.* 2007 Dec;35(12):2033-8. Epub 2007 Sep 20.

Department of Orthopaedics, Auckland City Hospital, Private Bag 92-024, Auckland 1, New Zealand.
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BACKGROUND: Comparisons of surgically and nonsurgically treated Achilles tendon ruptures have demonstrated that those treated with surgery allow earlier motion and tend to show superior results. However, early motion enhances tendon healing with or without surgery and may be the important factor in optimizing outcomes in patients with Achilles tendon rupture.

HYPOTHESIS: There is no difference in the outcome of acute Achilles tendon rupture treated nonoperatively or operatively if controlled early motion is allowed as part of the rehabilitation program.

STUDY DESIGN: Randomized, controlled clinical trial; Level of evidence, 1.

METHODS: Patients with acute rupture of the Achilles tendon were randomized to surgery or no surgery, with both groups receiving early motion controlled in a removable orthosis, progressing to full weightbearing at 8 weeks from treatment. Both groups were followed prospectively for 12 months with measurements of range of motion, calf circumference, and the Musculoskeletal Functional Assessment Instrument (MFAI) outcome score; any reruptures and any complications were noted.

RESULTS: Both groups were comparable for age and sex. There were no significant differences between the 2 groups in plantar flexion, dorsiflexion, calf circumference, or the MFAI scores measured at 2, 8, 12, 26, or 52 weeks. One patient in each group was noncompliant and required surgical rerepair of the tendon. There were no differences in complications and a similar low number of reruptures in both groups.

CONCLUSION: This study supports early motion as an acceptable form of rehabilitation in both surgically and nonsurgically treated patients with comparable functional results and a low rerupture rate. There appears to be no difference between the 2 groups, suggesting that controlled early motion is the important part of treatment of ruptured Achilles tendon.

PMID: 17885221

Rating: 2b

Burns

Simons M, King S, Edgar D; ANZBA. Occupational therapy and physiotherapy for the patient with burns: principles and management guidelines. J Burn Care Rehabil. 2003 Sep-Oct;24(5):323-35; discussion 322.

Occupational Therapy Department, Stuart Pegg Paediatric Burns Centre, Royal Children's Hospital, Brisbane, Queensland, Australia.

Clinical practice guidelines are a tool to assist with clinical decision making. They provide information about the care for a condition and make recommendations based on research evidence, which can be adapted locally. A focus group within the Allied Health Interest Group of the Australian and New Zealand Burn Association has compiled the "Occupational Therapy and Physiotherapy for the Patient with Burns--Principles and Management Guidelines." These guidelines are designed as a practical guide to the relevant clinical knowledge and therapy intervention techniques required for effective patient management. Content areas include respiratory management, edema management, splinting and positioning, physical function (mobility, function, exercise), scar management, and psychosocial and mutual elements. The document has undergone extensive review by members of the Australian and New Zealand Burn Association to ensure clarity, internal consistency, and acceptability. The guidelines have been endorsed by the Australian and New Zealand Burn Association. An abridged version of the guidelines is included in this article, with the full document available from www.anzba.org.au.

Publication Types:

- Guideline
- Practice Guideline

PMID: 14501405

Rating: 6b

Carpal Tunnel Syndrome (Acute & Chronic)

APTA (American Physical Therapy Association). Carpal Tunnel Syndrome. 2006.

This article explains what carpal tunnel syndrome is and the role physical therapists play in treating this debilitating disease and in educating people about possible risk factors.

Rating: 8c

Bilic R, Kolundzic R, Trkulja V, Crnkovic T, Vukovic A. The carpal tunnel syndrome: medical and economic advantages of well-timed surgical treatment. *Lijec Vjesn.* 2006 May-Jun;128(5-6):143-9.

Klinika za ortopediju Medicinskog fakulteta Sveucilista u Zagrebu i KBC-a Zagreb.

Carpal tunnel syndrome (CTS) is a somewhat neglected medical and economic problem, and surgery is one of the therapeutic options. We analyze the outcomes of surgical treatment in 114 consecutive patients (154 hands). Before the surgery, physical therapy was implemented (96% cases) and the patients were frequently on a sick leave (42% cases). Immediately before the surgery, the patients suffered intensive pain (median 7 on a 0-10 scale), and had a reduced hand function (median 2 on a 0-10 scale). After the surgery (6-12 months), the pain was reduced (difference -5.0, 95% CL -5.5, -4.5, $p < 0.001$), and the function improved (difference 4.5, 95% CLs 4.0, 5.0, $p < 0.001$). Longer time interval between referral to a primary care physician and referral to an orthopedic surgeon (> 1 year in 48% of the cases) was an independent negative predictor for these outcomes. Total difference in costs for sick leaves and physical therapies between the pre- and postoperative periods was estimated at approximately 269.030,00 to over 375.315,00 euros. The time between the entrance into the healthcare system and recognition of the need for surgical treatment of CTS needs to be reduced in order to get better medical and economic results.

PMID: 16910414

Rating: 4c

Cook AC, Szabo RM, Birkholz SW, King EF, Early mobilization following carpal tunnel release. A prospective randomized study, *J Hand Surg [Br]* 1995 Apr;20(2):228-30

Kaiser Permanente, Davis, Sacramento, California, USA.

A prospective randomized study was undertaken of 50 consecutive patients undergoing surgery for idiopathic carpal tunnel syndrome to determine the value of splintage of the wrist following open carpal tunnel release. Patients were randomized to either be splinted for 2 weeks following surgery or to begin range-of-motion exercises on the first post-operative day. Subjects were evaluated at 2 weeks, 1 month, 3 months, and 6 months after surgery by motor and sensory testing, physical examination, and a questionnaire. Variables assessed included date of return to activities of daily living, dates of return to work at light duty and at full duty, pain level, grip strength, key pinch strength, and occurrence of complications. Patients who were splinted had significant delays in return to activities of daily living, return to work at light and full duty, and in recovery of grip and key pinch strength. Patients with splinted wrists experienced increased pain and scar tenderness in the first month after surgery; otherwise there was no difference between the groups in the incidence of complications. We conclude that splinting the wrist following open release of the flexor retinaculum is largely detrimental, although it may have a role in preventing the rare but significant complications of bowstringing of the tendons or entrapment of the median nerve in scar tissue. We recommend a home physiotherapy programme in which the wrist and fingers are exercised separately to avoid simultaneous finger and wrist flexion, which is the position most prone to cause bowstringing.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

Rating: 2b

Feuerstein M, Burrell LM, Miller VI, Lincoln A, Huang GD, Berger R, Clinical management of carpal tunnel syndrome: a 12-year review of outcomes, *Am J Ind Med* 1999 Mar;35(3):232-45

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Carpal tunnel syndrome (CTS) is a disorder frequently encountered by occupational health care specialists. The health care management of this disorder has involved a diverse set of clinical procedures. The present article is a review of the literature related to CTS with an emphasis on occupational-related CTS. MEDLINE, Cumulative Index to Nursing and Allied Health Literature, PsycLIT, and NIOSHTIC databases from 1985-1997 were searched for treatment outcome studies related to CTS. Treatments of interest included surgery, physical therapy, drug therapy, chiropractic treatment, biobehavioral interventions, and occupational rehabilitation. A systematic review of the effects of these interventions on symptoms, medical status, function, return to work, psychological well-being, and patient satisfaction was completed. Compared to other treatments, the majority of studies assessed the effects of surgical interventions. Endoscopic release was associated with higher levels of

physical functioning and fewer days to return to work when compared to open release. Limited evidence indicated: 1) steroid injections and oral use of B6 were associated with pain reduction; 2) in comparison to splinting, range of motion exercises appeared to be associated with less pain and fewer days to return to work; 3) cognitive behavior therapy yielded reductions in pain, anxiety, and depression; and, 4) multidisciplinary occupational rehabilitation was associated with a higher percentage of chronic cases returning to work than usual care. Workers' compensation status was associated with increased time to return to work following surgery. Conclusions are preliminary due to the small number of well-controlled studies, variability in duration of symptoms and disability, and the broad range of reported outcome measures. While there are several opinions regarding effective treatment, there is very little scientific support for the range of options currently used in practice. Despite the emerging evidence of the multivariate nature of CTS, the majority of outcome studies have focused on single interventions directed at individual etiological factors or symptoms and functional limitations secondary to CTS.

Publication Types:

- Review
- Review Literature

From Cochrane Library:

Author's objective

To identify scientifically validated treatment and rehabilitation approaches for carpal tunnel syndrome (CTS).

Type of intervention

Treatment.

Specific interventions included in the review

Surgery (open and endoscopic release), pharmacological/vitamins/steroids (taken orally, injected into the carpal canal or transported via iontophoresis), physical therapy (range of motion exercises)/splinting, chiropractic/manipulation, biobehavioural therapies (individual and group cognitive behaviour therapy, muscle activity biofeedback, neuromuscular re-education and movement retraining), and occupational/work rehabilitation.

Participants included in the review

People with diagnosed carpal tunnel syndrome, or diagnoses such as 'hand pain', both work-related and non-work-related.

Outcomes assessed in the review

Medical status (two-point discrimination, nerve conduction velocity, Semmes-Weinstein, Phalen's test, Tinel's test, thenar atrophy, interstitial pressure), symptoms (self report) (pain, tenderness, numbness, paresthesia, weakness, night symptoms, fine dexterity loss), function (grip, key pinch, pulp pinch, range of motion, activities of daily living), work status (median days out of work, workers' compensation status, working with pain), psychological well-being (anxiety, depression, coping strategies, sickness), patient satisfaction (treatment satisfaction rating).

Study designs of evaluations included in the review

There were six study designs:

1. Prospective multiple group, in which patients were randomly assigned to treatment conditions and were followed longitudinally.
2. Non-randomised prospective multiple group, in which patients were assigned to different treatment conditions and followed longitudinally, but the assignment was not random.
3. Single group prospective, in which all patients were assigned to a single treatment group and followed longitudinally.
4. Multiple group retrospective, in which patients were assigned to different treatment conditions, and archival data were analysed to assess outcomes.
5. Single group retrospective, in which patients were assigned to one treatment condition and archival data were used.
6. Case study, which presented data on single patient outcomes.

All prospective multiple group studies available were included in the review. Other study designs were included depending on availability of studies with higher levels of study design within the treatment category.

What sources were searched to identify primary studies?

The authors searched the electronic databases of MEDLINE, CINAHL, PsycLIT, and NIOSHTIC for publications between January 1986 and December 1997 using the key words 'outcome', 'surgery', 'therapy', and 'treatment'. The search was limited to English language publications.

Number of studies included

Thirty-four studies met the inclusion criteria: 6 randomised prospective multiple group studies on surgical interventions for CTS with 485 participants (252 in the treatment group, and 233 in the comparison group); 8 non-randomised prospective multiple group studies on surgical interventions for CTS with 1,007 participants (400 in the treatment group, and 396 in the comparison group, with 1 study having three groups of 72, 90, and 49 participants); 6 studies in the pharmacological/vitamins/steroid injections intervention with 290 participants; 6 studies in the physical therapy/splinting for CTS intervention with 332 participants; 1 study in the chiropractic treatment for CTS intervention with 40 participants; 5 studies in the biobehavioural interventions for CTS group with more than 98 participants; and 2 studies in the work/occupational rehabilitation for CTS group with 400 participants.

How were the studies combined?

The studies were combined in a narrative review which gave a description of each individual intervention and then reported the results of each individual study to give a synthesis of the results for that intervention. For those studies that used statistical analysis, only significant findings are reported.

Results of the review

Endoscopic release was associated with higher levels of physical functioning and fewer days to return to work when compared with open release. Both types of surgery were associated with less pain at follow-up compared to pre-surgical levels.

Steroid injections combined with splinting and surgery and oral use of B6 were associated with pain reduction.

In comparison to splinting, range of motion exercises appeared to be associated with less pain and fewer days to return to work.

Cognitive behaviour therapy yielded reductions in pain, anxiety, and depression in one study. Multidisciplinary occupational rehabilitation was associated with a higher percentage of chronic cases returning to work than usual care.

Was any cost information reported?

In 1989, the average claim amount (medical and indemnity) for new cases of CTS was \$8,070. Recently, (reported in 1998), compensation claims for the federal workforce that involved CTS had an average indemnity cost of \$4,941 per claim.

Author's conclusions

Conclusions are preliminary due to the small number of well- controlled studies, variability in duration of symptoms and disability, and the broad range of reported outcome measures. While there are several opinions regarding effective treatment, there is very little scientific support for the range of options currently used in practice. Despite the emerging evidence of the multivariate nature of CTS, the majority of outcome studies have focused on single interventions directed at individual etiological factors or symptoms and functional limitations secondary to CTS.

CRD commentary

The literature search did cover several databases for relevant material, but it is not clear whether additional studies may have been missed because unpublished and non-English publications were not included.

The authors have not reported on how the articles were selected, or how the quality of the chosen studies was assessed. There is also no report as to who, or how many of the authors, selected the articles and extracted the data. The categorisation of studies for the review was based on the abstracts found in the literature search which may not have provided sufficient data to categorise the studies appropriately. The data from each study is described in a subjective narrative review which gives detail about each study and summarises the outcome for each intervention. There is no discussion about the heterogeneity between the studies which include a wide range of participants and treatments. The results from these studies should be viewed with caution because of the review's limitations.

What are the implications of the review?

The authors state that this review shows the limitations of existing outcomes research in this area which may guide the design of further research.

The authors also state that in practice, given the evidence to date regarding surgery, particularly in workers' compensation cases, conservative care of the patient with CTS should be emphasised as a logical first step. This point is important in those cases where neurological findings are inconsistent or absent.

O'Connor D, Marshall S, Massy-Westropp N. Non-surgical treatment (other than steroid injection) for carpal tunnel syndrome. *Cochrane Database Syst Rev.* 2003;(1):CD003219.

School of Occupational Therapy, University of South Australia, City East Campus, North Terrace, Adelaide, South Australia, Australia. Denise.OConnor@unisa.edu.au

BACKGROUND: Non-surgical treatment for carpal tunnel syndrome is frequently offered to those with mild to moderate symptoms. The effectiveness and duration of benefit from non-surgical treatment for carpal tunnel syndrome remain unknown.

OBJECTIVES: To evaluate the effectiveness of non-surgical treatment (other than steroid injection) for carpal tunnel syndrome versus a placebo or other non-surgical, control interventions in improving clinical outcome.

SEARCH STRATEGY: We searched the Cochrane Neuromuscular Disease Group specialised register (searched March 2002), MEDLINE (searched January 1966 to February 7 2001), EMBASE (searched January 1980 to March 2002), CINAHL (searched January 1983 to December 2001), AMED (searched 1984 to January 2002), Current Contents (January 1993 to March 2002), PEDro and reference lists of articles.

SELECTION CRITERIA: Randomised or quasi-randomised studies in any language of participants with the diagnosis of carpal tunnel syndrome who had not previously undergone surgical release. We considered all non-surgical treatments apart from local steroid injection. The primary outcome measure was improvement in clinical symptoms after at least three months following the end of treatment.

DATA COLLECTION AND ANALYSIS: Three reviewers independently selected the trials to be included. Two reviewers independently extracted data. Studies were rated for their overall quality. Relative risks and weighted mean differences with 95% confidence intervals were calculated for the primary and secondary outcomes in each trial. Results of clinically and statistically homogeneous trials were pooled to provide estimates of the efficacy of non-surgical treatments.

MAIN RESULTS: Twenty-one trials involving 884 people were included. A hand brace significantly improved symptoms after four weeks (weighted mean difference (WMD) -1.07; 95% confidence interval (CI) -1.29 to -0.85) and function (WMD -0.55; 95% CI -0.82 to -0.28). In an analysis of pooled data from two trials (63 participants) ultrasound treatment for two weeks was not significantly beneficial. However one trial showed significant symptom improvement after seven weeks of ultrasound (WMD -0.99; 95% CI -1.77 to -0.21) which was maintained at six months (WMD -1.86; 95% CI -2.67 to -1.05). Four trials involving 193 people examined various oral medications (steroids, diuretics, nonsteroidal anti-inflammatory drugs) versus placebo. Compared to placebo, pooled data for two-week oral steroid treatment demonstrated a significant improvement in symptoms (WMD -7.23; 95% CI -10.31 to -4.14). One trial also showed improvement after four weeks (WMD -10.8; 95% CI -15.26 to -6.34). Compared to placebo, diuretics or nonsteroidal anti-inflammatory drugs did not demonstrate significant benefit. In two trials involving 50 people, vitamin B6 did not significantly improve overall symptoms. In one trial involving 51 people yoga significantly reduced pain after eight weeks (WMD -1.40; 95% CI -2.73 to -0.07) compared with wrist splinting. In one trial involving 21 people carpal bone mobilisation

significantly improved symptoms after three weeks (WMD -1.43; 95% CI -2.19 to -0.67) compared to no treatment. In one trial involving 50 people with diabetes, steroid and insulin injections significantly improved symptoms over eight weeks compared with steroid and placebo injections. Two trials involving 105 people compared ergonomic keyboards versus control and demonstrated equivocal results for pain and function. Trials of magnet therapy, laser acupuncture, exercise or chiropractic care did not demonstrate symptom benefit when compared to placebo or control.

REVIEWER'S CONCLUSIONS: Current evidence shows significant short-term benefit from oral steroids, splinting, ultrasound, yoga and carpal bone mobilisation. Other non-surgical treatments do not produce significant benefit. More trials are needed to compare treatments and ascertain the duration of benefit.

Publication Types:

- Review
- Review, Academic

PMID: 12535461

Rating: 1b

Some excerpts:

The incidence of CTS is increasing, and that with age expectancy of seventy years, 3.5 per cent of males and 11 per cent of females will be affected by CTS. Females in their fourth and fifth decades suffer CTS four times more commonly than men. Carpal tunnel syndrome does not follow a predictable course. Some patients experience a deterioration in hand function whilst others describe 'silent' periods and intermittent exacerbation of symptoms. Some patients have described spontaneous improvement of symptoms without medical treatment. The treatment of carpal tunnel syndrome can be categorized into surgical and non-surgical. Surgical treatment is usually offered to those with severe carpal tunnel syndrome, who have constant symptoms, severe sensory disturbance and/ or thenar motor weakness. Non-surgical treatments are offered to those who have the intermittent symptoms of mild to moderate carpal tunnel syndrome. Non-surgical interventions may also be used as a temporary measure while awaiting carpal tunnel release.

In summary, there is limited evidence that a nocturnal hand brace improves symptoms, hand function and overall patient-reported change in the short-term (up to four weeks of use).

In summary, there is limited evidence that night-only wrist splint use is equally effective as full-time wrist splint use in improving short-term symptoms and hand function.

In summary, there is limited evidence that neutral wrist splinting results in superior short-term overall and nocturnal symptom relief (at two weeks) when compared with wrist splinting in extension.

Furthermore, limited evidence suggests that short-term daytime symptom relief is similar for both splint groups.

In summary, there is moderate evidence that two weeks of ultrasound treatment does not improve short-term symptoms beyond that achieved with placebo. However, limited evidence does suggest that ultrasound results in superior symptom relief after seven weeks of treatment and beyond a seven week treatment period (assessed at six months) when compared with placebo. There is limited evidence that seven weeks of ultrasound therapy results in better sensory perception and self-reported improvement when compared to placebo. There is limited evidence that short-term pain and nocturnal waking are similar between ultrasound and placebo-treated groups. Furthermore, there is limited evidence that long-term nerve conduction, grip and pinch strength values are similar for ultrasound and placebo groups. No significant effect of varying intensity of ultrasound delivery was demonstrated for pain, symptoms or nocturnal waking. There is, therefore, limited evidence that continuous ultrasound at 1.5W/cm² is equally effective in improving short-term pain, symptoms and nocturnal waking as continuous ultrasound at 0.8W/cm². In summary, there is limited evidence that ultrasound delivery at 1 MHz is similar to ultrasound delivery at 3 MHz for pain, paraesthesia, sensation, grasp and provocative testing measures in the short-term.

In summary, limited evidence suggests that ergonomic and standard keyboards provide similar improvements in Phalen's and Tinel's sign, timed Phalen's test and peripheral nerve conduction. There is equivocal evidence regarding the effect of ergonomic keyboards on pain relief and hand function.

In summary, limited evidence suggests that diuretic treatment does not improve short-term symptoms in CTS.

No significant effect in favour of NSAID treatment was demonstrated for improving carpal tunnel symptoms. In summary, limited evidence suggests that NSAID treatment does not improve short-term symptoms in CTS.

In summary, there is moderate evidence that oral steroid treatment for two weeks improves short-term symptoms. Limited evidence suggests that symptom improvement is also achieved with four weeks of oral steroid treatment. There is equivocal evidence regarding the short-term symptom benefit beyond the end of an oral steroid treatment period.

In summary, limited evidence suggests that there is no difference in the effect of diuretics and NSAIDs on short-term CTS symptoms.

In summary, there is limited evidence that short-term oral steroid treatment improves CTS symptoms significantly more than diuretic treatment.

In summary, there is limited evidence to suggest that oral steroid use for 2 to 4 weeks significantly improves short-term symptoms when compared to NSAID treatment.

There is, therefore, limited evidence that vitamin B6 improves finger swelling and movement discomfort with 12 weeks of treatment. Limited evidence suggests that vitamin B6 does not improve symptoms, nocturnal discomfort, hand co-ordination, Phalen's sign and Tinel's sign in the short-term.

In summary, there is limited evidence that nerve and tendon gliding exercises and wrist splinting result in superior static two-point discrimination compared to wrist splinting alone in the medium-term. Limited evidence suggests that exercise plus wrist splinting and wrist splinting alone provide similar improvement in symptoms, hand function, grip strength, pinch strength, Phalen's sign, Tinel's sign and patient satisfaction.

In summary, there is limited evidence that yoga results in superior short-term pain relief and improved outcome for Phalen's sign compared to wrist splinting. There is limited evidence that yoga and wrist splinting provide similar short-term improvement in nocturnal waking, Tinel's sign and grip strength.

In summary, limited evidence suggests that neurodynamic mobilisation does not improve short-term symptoms, pain, hand function, wrist motion, upper limb tension testing nor reduce the likelihood of continuing to carpal tunnel release surgery.

In summary, limited evidence suggests that carpal bone mobilisation improves symptoms in the short-term (with three weeks of treatment). Limited evidence also suggests that carpal bone mobilisation does not improve short-term pain, hand function, wrist motion, upper limb tension test findings or the subsequent need for surgery.

In summary, limited evidence suggests that there is no significant benefit of neurodynamic over carpal bone mobilisation for improving short-term CTS outcomes.

In summary, limited evidence suggests that magnet therapy does not significantly improve short-term pain relief in CTS.

In summary, there is limited evidence that medical care over nine weeks improves physical distress in the short-term when compared with chiropractic treatment. Limited evidence also suggests that chiropractic and medical treatment provide similar short-term improvement in mental distress, vibrometry, hand function and health-related quality of life.

In summary, limited evidence suggests that laser acupuncture does not improve short-term paraesthesiae and night pain in CTS.

In summary, limited evidence suggests that a steroid injection followed by weekly insulin injections into the carpal tunnel for eight weeks results in superior symptom relief and nerve conduction compared with steroid injection and weekly placebo injections over the same period.

Verhagen AP, Bierma-Zeinstra SM, Feleus A, Karels C, Dahaghin S, Burdorf L, de Vet HC, Koes BW, Ergonomic and physiotherapeutic interventions for treating upper extremity work related disorders in adults, *Cochrane Database Syst Rev.* 2004;(1):CD003471

Department of General Practice, Erasmus MC, P.O. Box 1738, 3000 DR Rotterdam, Netherlands.

BACKGROUND: Conservative interventions such as physiotherapy and ergonomic adjustments play a major part in the treatment of most work-related musculoskeletal disorders (WRMD).

OBJECTIVES: The objective of this systematic review is to determine whether conservative interventions have a significant impact on short and long-term outcomes for upper extremity WRMD in adults.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised register (January 2002) and Cochrane Rehabilitation and Related Therapies Field specialised register (January 2002), the Cochrane Controlled Trials Register (The Cochrane Library Issue 3, 2001), PubMed (1966 to November 2001), EMBASE (1988 to November 2001), and CINAHL (1982 to November 2001). We also searched the Physiotherapy Index (1988 to November 2001) and reference lists of articles. No language restrictions were applied.

SELECTION CRITERIA: Only randomised controlled trials and concurrent controlled trials studying conservative interventions for adults suffering from upper extremity WRMD were included. Conservative interventions may include exercises, relaxation, physical applications, biofeedback, myofeedback and work place adjustments.

DATA COLLECTION AND ANALYSIS: Two reviewers independently selected the trials from the search yield and assessed the clinical relevance and methodological quality using the Delphi list. In the event of clinical heterogeneity or lack of data we used a rating system to assess levels of evidence.

MAIN RESULTS: We included 15 trials involving 925 people. Twelve trials included people with chronic non-specific neck or shoulder complaints, or non-specific upper extremity disorders. Over 20 interventions were evaluated; seven main subgroups of interventions could be determined: exercises, manual therapy, massage, ergonomics, multidisciplinary treatment, energised splint and individual treatment versus group therapy. Overall, the quality of the studies appeared to be poor. In 10 studies a form of exercise was evaluated, and there is limited evidence about the effectiveness of exercises only when compared to no treatment. Concerning manual therapy (1 study), massage (4 studies), multidisciplinary treatment (1 study) and energised splint (1 study) no conclusions can be drawn. Limited evidence is found concerning the effectiveness of specific keyboards for patients with carpal tunnel syndrome.

REVIEWER'S CONCLUSIONS: This review shows limited evidence for the effectiveness of keyboards with an alternative force-displacement of the keys or an alternative geometry, and limited evidence for the effectiveness of individual exercises. The benefit of expensive ergonomic interventions (such as new chairs, new desks etc) in the workplace is not clearly demonstrated.

Publication Types:

- Meta-Analysis
- Review
- Review, Academic

PMID: 14974016

Rating: 1b

BACKGROUND

The term repetitive strain injury (RSI) is not a diagnosis, but an umbrella term for disorders that develop as a result of repetitive movements, awkward postures, and impact of force (Yassi 1997). Work-related musculoskeletal disorders (WRMD) have been described differently in various countries: RSI in Canada and Europe, both RSI and occupational overuse syndrome (OOS) in Australia and cumulative trauma disorder in the USA (Putz-Anderson 1988). Work-related musculoskeletal disorders can be divided into specific conditions such as carpal tunnel syndrome, which has relatively clear diagnostic criteria and pathology, or non-specific conditions such as tension neck syndrome, which is primarily defined by the location of complaints and whose pathophysiology is less clearly defined. With carpal tunnel syndrome, for instance, between 43 and 90 per cent of cases can be defined as work-related, depending on the setting (industrial or primary care setting) (Hagberg 1992; Miller 1994).

In the USA, cumulative trauma disorders account for between 56 and 65 percent of all occupational injuries (Melhorn 1998; Pilligan 2000). Overall, the estimated prevalence of upper-extremity WRMD is approximately 30 per cent (Yassi 1997; Melhorn 1998). Several studies report a rapidly increasing incidence of WRMD of the upper extremities (Yassi 1997). The costs associated with these disorders are high - over two billion dollars of direct and indirect costs estimated annually in the USA (Pilligan 2000).

Today, much attention is paid to the prevention and treatment of WRMD (Silverstein 1997; Yassi 1997). Conservative interventions such as physiotherapy and ergonomic adjustments play a major part in the prevention or treatment of most WRMD (Pilligan 2000). The direct and indirect costs of these WRMD are a burden to patients, employers and insurance companies. Therefore, there is a need to determine whether conservative interventions have a significant impact on long-term outcomes.

TRIALS COMPARING DIFFERENT TYPES OF INCLUDED CONSERVATIVE TREATMENTS

Thirteen studies compared different conservative treatments.

1. Exercises

In three studies when different forms of exercises were compared the conclusion was defined as 'unclear', meaning not providing data (Ferguson 1976; Kamwendo 1991; Hagberg 2000). Three studies report conflicting results concerning the effectiveness of exercises compared to massage (Rundcrantz 1991; Levoska 1993; Vasseljen 1995). Only the study of Vasseljen 1995 was of high quality but here exercises were a part of both interventions. The study evaluated the difference between individual and group exercises, so no conclusions can be drawn about the effectiveness of the exercises themselves. Therefore we conclude that there is conflicting evidence concerning the effectiveness of exercises compared to massage, and no evidence concerning the effectiveness of exercises when different forms of exercises are compared.

2. Manual therapy/chiropractic treatment

In the study of Bang 2000 significant results were found in pain reduction and isodynamic strength in patients with a shoulder impingement syndrome. Therefore we conclude that there is

limited evidence for the efficacy of manual therapy in patients with a shoulder impingement syndrome.

3. Massage

In one study (Ferguson 1976) the conclusion was defined as 'unclear', and one found positive results (significantly) in favour of massage (Leboeuf 1987). In the studies of Levoska 1993 and Vasseljen 1995 massage was a part of a combination of interventions (i.e. a black box), so no conclusions can be drawn concerning the efficacy of massage from these studies. All studies were of low quality, therefore we conclude that there is conflicting evidence of the efficacy of massage in the treatment of upper extremity WRMD.

4. Ergonomics

Two high quality studies (Rempel 1999; Tittiranonda 1999) evaluated the efficacy of six different keyboards on reduction of complaints. Rempel 1999 reported significant positive results of alternative force-displacement of the keys in pain reduction in 12 weeks and Tittiranonda 1999 found no significant differences between different keyboards. The results of the study of Kamwendo 1991 are classified as 'unclear'. Therefore we conclude that there is limited evidence of the efficacy of some keyboards in people with a carpal tunnel syndrome compared with other keyboards.

5. Multidisciplinary treatment

In one low quality non-randomised study a multidisciplinary work re-entry rehabilitation programme is compared with 'usual care' (Feuerstein 1993), reporting non significant positive results. We conclude that there is no evidence of efficacy of a multidisciplinary treatment.

6. Energised splint

There is one study comparing an 'energised splint' with placebo (Stralka 1998). See placebo comparison below.

7. Group therapy versus individual therapy

The study of Vasseljen 1995 is considered of high quality and shows significant short term positive results. Therefore we conclude that when individual exercises are compared with exercises in a group there is limited evidence on short-term efficacy for individual exercises.

TRIALS COMPARING CONSERVATIVE TREATMENTS WITH PLACEBO, OR NO TREATMENT/WAITING LIST CONTROLS

1. Placebo

Two studies compared a conservative treatment with a placebo (Stralka 1998; Tittiranonda 1999). One high quality study (Tittiranonda 1999) evaluated the efficacy of three different keyboards in people with a carpal tunnel syndrome on reduction of complaints and improvement of function with a placebo (= unchanged keyboard). They reported significant positive results of some keyboards compared with the placebo. Therefore we conclude that there is limited evidence for the efficacy of alternative keyboards over a placebo.

One low quality RCT compared an 'energised splint' with placebo (Stralka 1998). The results were classified as 'unclear'.

2. No treatment/waiting list controls

Four studies compared a conservative treatment with a control group receiving no treatment (Kamwendo 1991; Takala 1994; Lundblad 1999; Waling 2000). In all studies forms of exercises were compared with a control group receiving no treatment. In one study the conclusion was defined as 'unclear' (Kamwendo 1991), in two studies (Lundblad 1999; Takala 1994) positive but non-significant results were found and Waling 2000 found significant positive results of exercises on pain, strength and function. All studies were regarded of low quality, therefore we conclude that there is limited evidence concerning the efficacy of exercises compared to a control group receiving no treatment.

DISCUSSION

This review shows that there is limited evidence concerning the effectiveness of specific keyboards for patients with a carpal tunnel syndrome, and limited evidence for the effectiveness of exercises in patients with chronic non-specific neck and shoulder complaints when compared to no treatment. As well as these results, an individual approach appeared to be more effective compared with a group approach.

Elbow (Acute & Chronic)

Boyer MI, Hastings H 2nd. Lateral tennis elbow: "Is there any science out there?" J Shoulder Elbow Surg 1999 Sep-Oct;8(5):481-91

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As orthopaedic surgeons, we are besieged by myths that guide our treatment of lateral epicondylitis, or "tennis elbow." This extends from the term used to describe the condition to the nonoperative and operative treatments as well. The term epicondylitis suggests an inflammatory cause; however, in all but 1 publication examining pathologic specimens of patients operated on for this condition, no evidence of acute or chronic inflammation is found. Numerous nonoperative modalities have been described for the treatment of lateral tennis elbow. Most are lacking in sound scientific rationale. This has led to a therapeutic nihilism with respect to the nonoperative management of this condition. An examination of the literature can only lead us to believe that most, if not all, common nonoperative therapeutic modalities used for the treatment of tennis elbow are unproven at best or costly and time-consuming at worst. Most of the published literature on the nonoperative treatment of patients with lateral tennis elbow consists of poorly designed trials. The selection criteria are nebulous, the control group is questionably designed, and the number of patients is often too low to avoid a serious loss of study power. These studies therefore have a high beta error, implying an inability to detect a difference between groups, even if one truly existed. If clinical signs and symptoms persist beyond the limit of acceptability of both patient and surgeon, then an array of surgical options are available. These range from a 10-minute office procedure (the percutaneous release of the extensor origin with the patient under local anesthetic) to an extensive joint denervation, in which all radial nerve branches ramifying to the

lateral epicondyle are directly or indirectly divided. How is the surgeon to choose, given the fact that most of the published surgical studies are case series of one type of operation or another, consisting of patients operated on and evaluated by the same surgeon, who has a vested interest in his or her own patients' successful outcome? The orthopaedic surgeon therefore has very little on which to "hang his hat" when it comes to objective data to guide treatment of patients with lateral tennis elbow syndrome. In the final analysis we are guided simply by our own subjective viewpoint and clinical experience. In 1999, to have such a common clinical condition have such a paucity of peer-reviewed published data of acceptable scientific quality is disappointing. In this review article we will examine the "myths" of tennis elbow: the name, the salient features on history and physical examination, the diagnostic modalities, the pathology of the "lesion," the anatomy of the lateral elbow and extensor origin and why it has led to such confusion in differential diagnosis, the nonoperative and operative treatment of tennis elbow, and finally the various studies that have been carried out on elbow biomechanics as it relates to the pathoetiology of true "tennis elbow." It is our hope that the reader will emerge with a clearer picture of the pathoetiology of the condition and the scientific rationale (or lack thereof) of the various operative and nonoperative treatment modalities.

Publication Types:

- Review
- Review, Tutorial

Rating: 5b

Boisauvert B, Brousse C, Zaoui A, Montigny JP. Nonsurgical treatment of tennis elbow. *Ann Readapt Med Phys.* 2004 Aug;47(6):346-55.

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OBJECTIVE: To review the literature on nonsurgical treatment of tennis elbow.

METHODS: We searched Medline for all randomized controlled trials (RCTs), controlled clinical trials (CCTs) and literature reviews published from 1966 to December 2003 on nonsurgical treatment of tennis elbow. We used the keys words controlled clinical trial, tennis elbow on lateral epicondylitis, and treatment. We found 46 reports of RCTs and CCTs on 14 nonsurgical treatments and 11 literature reviews.

RESULTS: Corticosteroid injection is the best treatment option for the short term. However, beneficial effects persisted only for a short time, and the long-term outcome could be poor. For the long term, physiotherapy (pulsed ultrasound, deep friction massage and exercise programme) was the best option but was not significantly different from the "wait-and-see" approach. Some support is offered for the use of topical nonsteroid anti-inflammatory drugs, at least for the short term. There is insufficient evidence to support or refute the use of acupuncture, extracorporeal shock wave therapy, manipulation, orthoses, low-energy laser, glycosaminoglycan polysulfate injection, botulinum toxin injection, or topical nitric oxide application.

CONCLUSION: Further trials, with use of appropriate methods and adequate sample sizes, are needed before conclusions can be drawn about the effects of many of the treatments for tennis elbow and their ability to change the condition's natural course.

PMID: 15297125

Rating: 1b

Foley AE. Tennis elbow. Am Fam Physician 1993 Aug;48(2):281-8.

Wright State University School of Medicine, Dayton, Ohio.

The term "tennis elbow" usually refers to lateral epicondylitis, but the same symptoms can be caused by pathologic processes in the elbow. In fact, most cases of this common condition are caused by occupational stress rather than racket sports. Patients complain of elbow pain when the wrist is extended against resistance or during repetitive actions with the wrist and elbow extended. The condition is thought to be caused by a lesion at the origin of the common wrist extensor mechanism, at or very near the lateral epicondyle of the humerus. Differential diagnosis includes inflammatory, arthritic and nerve entrapment syndromes. Prompt conservative treatment has a high success rate. Patient education, use of a tennis-elbow band and physical therapy play key roles in the management of acute symptoms and in the prevention of recurrence. Surgical intervention is required only when other treatment fails.

Publication Types:

- Review
- Review, Tutorial

PMID: 8342481 [PubMed - indexed for MEDLINE]

Handoll H, Gibson J, Madhok R, Interventions for treating proximal humeral fractures in adults, Cochrane Database Syst Rev. 2003;4:CD000434

c/o University Department of Orthopaedic Surgery, Royal Infirmary of Edinburgh, Little France, Old Dalkeith Road, Edinburgh, UK, EH16 4SU.

BACKGROUND: Proximal humeral fractures are common yet the management of these injuries varies widely. In particular, the role and timing of any surgical intervention have not been clearly defined.

OBJECTIVES: To collate and evaluate the scientific evidence supporting the various methods used for treating proximal humeral fractures.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised register, the Cochrane Central Register of Controlled Trials, PEDro, MEDLINE (1966 to May week 4 2003), EMBASE (1980 to 2003 week 22), CINAHL (1982 to May week 3 2003), AMED (1985 to May 2003),

the National Research Register (UK), Current Controlled Trials, and bibliographies of trial reports. The search was completed in May 2003.

ELECTION CRITERIA: All randomised studies pertinent to the treatment of proximal humeral fractures were selected.

DATA COLLECTION AND ANALYSIS: Independent quality assessment and data extraction were performed by two reviewers. Although quantitative data from trials are presented, trial heterogeneity prevented pooling of results.

MAIN RESULTS: Twelve randomised trials were included. All were small; the largest study involved only 86 patients. Bias in these trials could not be ruled out. Eight trials evaluated conservative treatment, three compared surgery with conservative treatment and one compared two surgical techniques. In the 'conservative' group there was very limited evidence indicating that the type of bandage used made any difference in terms of time to fracture union and the functional end result. However, an arm sling was generally more comfortable than a body bandage. There was some evidence that 'immediate' physiotherapy, without routine immobilisation, compared with that delayed until after three weeks immobilisation resulted in less pain and both faster and potentially better recovery in patients with undisplaced two-part fractures. Similarly, there was evidence that mobilisation at one week instead of three weeks alleviated pain in the short term without compromising long term outcome. Two trials provided some evidence that patients, when given sufficient instruction to pursue an adequate physiotherapy programme, could generally achieve a satisfactory outcome if allowed to exercise without supervision. Operative reduction improved fracture alignment in two trials. However, in one trial, surgery was associated with a greater risk of complication, and did not result in improved shoulder function. In one trial, hemi-arthroplasty resulted in better short-term function with less pain and less need for help with activities of daily living when compared with conservative treatment for severe injuries. Fracture fixation of severe injuries was associated with a high rate of re-operation in one trial, comparing tension-band wiring fixation with hemi-arthroplasty. There was very limited evidence that similar outcomes resulted from mobilisation at one week instead of three weeks after surgical fixation.

REVIEWER'S CONCLUSIONS: Only tentative conclusions can be drawn from the available randomised trials, which do not provide sufficient evidence for many of the decisions that need to be made in contemporary fracture management. Early physiotherapy, without immobilisation, may be sufficient for some types of undisplaced fractures. It is unclear whether operative intervention, even for specific fracture types, will produce consistently better long term outcomes. There is a need for good quality evidence for the management of these fractures.

PMID: 14583921

Rating: 1b

Korthals-de Bos IB, Smidt N, van Tulder MW, Rutten-van Molken MP, Ader HJ, van der Windt DA, Assendelft WJ, Bouter LM. Cost effectiveness of interventions for lateral epicondylitis: results from a randomised controlled trial in primary care. *Pharmacoeconomics*. 2004;22(3):185-95.

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OBJECTIVE: Lateral epicondylitis is a common complaint, with an annual incidence between 1% and 3% in the general population. The Dutch College of General Practitioners in The Netherlands has issued guidelines that recommend a wait-and-see policy. However, these guidelines are not evidence based.

DESIGN AND SETTING: This paper presents the results of an economic evaluation in conjunction with a randomised controlled trial to evaluate the effects of three interventions in primary care for patients with lateral epicondylitis.

PATIENTS AND INTERVENTIONS: Patients with pain at the lateral side of the elbow were randomised to one of three interventions: a wait-and-see policy, corticosteroid injections or physiotherapy.

MAIN OUTCOME MEASURES AND RESULTS: Clinical outcomes included general improvement, pain during the day, elbow disability and QOL. The economic evaluation was conducted from a societal perspective. Direct and indirect costs (in 1999 values) were measured by means of cost diaries over a period of 12 months. Differences in mean costs between groups were evaluated by applying non-parametric bootstrap techniques. The mean total costs per patient for corticosteroid injections were euro430, compared with euro631 for the wait-and-see policy and euro921 for physiotherapy. After 12 months, the success rate in the physiotherapy group (91%) was significantly higher than in the injection group (69%), but only slightly higher than in the wait-and-see group (83%). The differences in costs and effects showed no dominance for any of the three groups. The incremental cost-utility ratios were (approximately): euro7000 per utility gain for the wait-and-see policy versus corticosteroid injections; euro12000 per utility gain for physiotherapy versus corticosteroid injections, and euro34500 for physiotherapy versus the wait-and-see policy.

CONCLUSIONS: The results of this economic evaluation provided no reason to update or amend the Dutch guidelines for GPs, which recommend a wait-and-see policy for patients with lateral epicondylitis.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 14871165

Rating: 2c

Lund AT, Amadio PC. Treatment of cubital tunnel syndrome: perspectives for the therapist. *J Hand Ther.* 2006 Apr-Jun;19(2):170-8.

Department of Physical Medicine and Rehabilitation, Mayo Clinic College of Medicine, Rochester, Minnesota 55905, USA.

The treatment of cubital tunnel syndrome provides therapists the opportunity to use a wide variety of their skills. Whether managed surgically or nonoperatively, differential diagnosis, manual therapy, application of therapeutic modalities, splinting, pain management, and facilitating return to work are often all included in a comprehensive treatment plan for return to functional strength and mobility of the affected arm. When surgery is indicated due to a failure of nonoperative methods or the degree of nerve compression, the decision-making process for the specific procedure to perform is multifactorial. Anatomic factors, patient needs, and surgeon preference all play a role in determining which procedure is performed. As with many other conditions, an alliance of patient, therapist, and surgeon will provide the most effective therapeutic team, and the best chance for a good clinical outcome.

PMID: 16713864

Rating: 5b

Piligian G, Herbert R, Hearn M, Dropkin J, Landsbergis P, Cherniack M. Evaluation and management of chronic work-related musculoskeletal disorders of the distal upper extremity. *Am J Ind Med* 2000 Jan;37(1):75-93.

Mount Sinai School of Medicine, The Mount Sinai Hospital, One Gustave L. Levy Place, New York, NY, USA.

This clinical review will describe the epidemiology, clinical presentation, and management of the following work-related musculoskeletal disorders (WMSDs) of the distal upper extremity: deQuervain's disease, extensor and flexor forearm tendinitis/tendinosis, lateral and medial epicondylitis, cubital tunnel syndrome, and hand-arm vibration syndrome (HAVS). These conditions were selected for review either because they were among the most common WMSDs among patients attending the New York State Occupational Health Clinics (NYSOHC) network, or because there is strong evidence for work-relatedness in the clinical literature. Work-related carpal tunnel syndrome is discussed in an accompanying paper. In an attempt to provide evidence-based treatment recommendations, literature searches on the treatment of each condition were conducted via Medline for the years 1985-1999. There was a dearth of studies evaluating the efficacy of specific clinical treatments and ergonomic interventions for WMSDs. Therefore, many of the treatment recommendations presented here are based on a consensus of experienced public health-oriented occupational medicine physicians from the NYSOHC network after review of the pertinent literature. A summary table of the clinical features of the disorders is presented as a reference resource. Copyright 2000 Wiley-Liss, Inc.

Publication Types:

- Review
- Review, Tutorial

Rating: 5b

Sevier TL, Wilson JK. Treating lateral epicondylitis. Sports Med 1999 Nov; 28(5):375-80

(3) Ball Memorial Sports Medicine Fellowship, Muncie, Indiana, USA.

Lateral epicondylitis is a common problem among physically active individuals. One of the most important roles of the clinician is to provide the most effective rehabilitation intervention for the injured athlete and the physically active individual. Over 40 different treatment methods for lateral epicondylitis have been reported in the literature. Initially, lateral epicondylitis can be treated with rest, ice, tennis brace and/or injections. Injections are one of the most popular methods utilised, with a high success rate. However, when the condition is chronic or not responding to initial treatment, physical therapy is initiated. Common rehabilitation modalities utilised are ultrasound, phonophoresis, electrical stimulation, manipulation, soft tissue mobilisation, neural tension, friction massage, augmented soft tissue mobilisation (ASTM) and stretching and strengthening exercise. ASTM is becoming a more popular modality due to the detection of changes in the soft tissue texture as the patient progresses through the rehabilitation process. Other new modalities include laser and acupuncture. As a last resort for chronic or resistant cases, lateral epicondylitis may undergo surgery. Scientific research has found that all these methods have been inconsistently effective in treating lateral epicondylitis. Therefore, further research efforts are needed to determine which method is more effective.

Publication Types:

- Review
- Review, Tutorial

Smidt N, Assendelft WJ, Arola H, Malmivaara A, Greens S, Buchbinder R, van der Windt DA, Bouter LM, Effectiveness of physiotherapy for lateral epicondylitis: a systematic review, *Ann Med.* 2003;35(1):51-62.

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AIM: To evaluate the available evidence of the effectiveness of physiotherapy for lateral epicondylitis of the elbow.

METHOD: Randomised controlled trials (RCTs) identified by a highly sensitive search strategy in six databases in combination with reference checking. Two independent reviewers selected RCTs that included a physiotherapy intervention, patients with lateral epicondylitis, and at least one clinically relevant outcome measure. No language restrictions were made. Methodological quality was independently assessed by two blinded reviewers. A best evidence synthesis, including a quantitative and qualitative analysis, was conducted, weighting the studies with respect to their internal validity, statistical significance, clinical relevance, and statistical power.

RESULTS: 23 RCTs were included in the review, evaluating the effects of lasertherapy, ultrasound treatment, electrotherapy, and exercises and mobilisation techniques. Fourteen studies satisfied at least 50% of the internal validity criteria. Except for ultrasound, pooling of data from RCTs was not possible because of insufficient data, or clinical or statistical heterogeneity. The pooled estimate of the treatment effects of two studies on ultrasound compared to placebo ultrasound, showed statistically significant and clinically relevant differences in favour of ultrasound. There is insufficient evidence either to demonstrate benefit or lack of effect of lasertherapy, electrotherapy, exercises and mobilisation techniques for lateral epicondylitis.

CONCLUSIONS: Despite the large number of studies, there is still insufficient evidence for most physiotherapy interventions for lateral epicondylitis due to contradicting results, insufficient power, and the low number of studies per intervention. Only for ultrasound, weak evidence for efficacy was found. More better designed, conducted and reported RCTs are needed.

Publication Types:

- Review
- Review, Academic

PMID: 12693613

Rating: 1c

Smidt N, Lewis M, Hay EM, Van der Windt DA, Bouter LM, Croft P. A comparison of two primary care trials on tennis elbow: issues of external validity. *Ann Rheum Dis.* 2005 Oct;64(10):1406-9. Epub 2005 Mar 30.

Primary Care Science Research Centre, Keele University, Keele, Staffordshire, UK. n.smidt@vumc.nl

OBJECTIVE: To assess clinical heterogeneity across two studies with respect to study population, interventions, and outcome measures, and to evaluate the influence of these sources of heterogeneity on the results of the studies.

METHODS: The individual patient data were used from two randomised controlled trials investigating the effectiveness of conservative treatments in patients with tennis elbow in primary care. Patients were allocated at random to treatment with steroid injection, wait and see policy, non-steroidal anti-inflammatory drugs, placebo tablets, or physiotherapy. Outcome measures included severity of the main complaint, inconvenience of the elbow complaints, pain during the day, elbow disability, pain-free grip strength, and global improvement. All outcomes were assessed at 1, 6, and 12 months after randomisation.

RESULTS: The two study populations were similar with respect to age, sex, comorbid neck/shoulder complaints, and baseline scores for the severity of pain. However, significant differences were observed for employment status, duration of elbow complaints, dominant side affected, previous history of elbow complaints, and use of analgesics. Local injections differed between the two studies with respect to

volume, number, and steroid preparation. However, after 1, 6, and 12 months, the treatment effects of steroid injections were very similar between the study populations.

CONCLUSIONS: Despite large differences in study population at baseline, the responses to steroid injections were remarkably similar. Also the responses to other conservative interventions and the placebo treatment were very consistent, suggesting a uniform course of a tennis elbow and a lack of influence of clinical heterogeneity.

Publication Types:

- Meta-Analysis

PMID: 15800009

Rating: 1c

Struijs PA, Kerkhoffs GM, Assendelft WJ, Van Dijk CN. Conservative treatment of lateral epicondylitis: brace versus physical therapy or a combination of both—a randomized clinical trial. *Am J Sports Med.* 2004 Mar;32(2):462-9.

Department of Orthopaedic Surgery, Academic Medical Center, Amsterdam, the Netherlands.
paastruijs@hotmail.com

BACKGROUND: The authors evaluated the effectiveness of brace-only treatment, physical therapy, and the combination of these for patients with tennis elbow.

METHODS: Patients were randomized over 3 groups: brace-only treatment, physical therapy, and the combination of these. Main outcome measures were success rate, severity of complaints, pain, disability, and satisfaction. Data were analyzed using both intention-to-treat and per-protocol analyses. Follow-up was 1 year.

RESULTS: A total of 180 patients were randomized. Physical therapy was superior to brace only at 6 weeks for pain, disability, and satisfaction. Contrarily, brace-only treatment was superior on ability of daily activities. Combination treatment was superior to brace on severity of complaints, disability, and satisfaction. At 26 weeks and 52 weeks, no significant differences were identified.

CONCLUSION: Conflicting results were found. Brace treatment might be useful as initial therapy. Combination therapy has no additional advantage compared to physical therapy but is superior to brace only for the short term.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 14977675

Rating: 2b

Waugh EJ, Jaglal SB, Davis AM, Tomlinson G, Verrier MC. Factors associated with prognosis of lateral epicondylitis after 8 weeks of physical therapy. *Arch Phys Med Rehabil.* 2004 Feb;85(2):308-18.

Department of Physical Therapy, University of Toronto, Toronto, ON, Canada. e.waugh@utoronto.ca

This study concluded, “Women and patients who report nerve symptoms are more likely to experience a poorer short-term outcome after PT management of lateral epicondylitis. Work-related onsets, repetitive keyboarding jobs, and cervical joint signs have a prognostic influence on women.”

Publication Types:

- Multicenter Study

PMID: 14966719

Rating: 4b

Forearm, Wrist, & Hand

Handoll H, Gibson J, Madhok R, Interventions for treating proximal humeral fractures in adults, *Cochrane Database Syst Rev.* 2003;4:CD000434

c/o University Department of Orthopaedic Surgery, Royal Infirmary of Edinburgh, Little France, Old Dalkeith Road, Edinburgh, UK, EH16 4SU.

BACKGROUND: Proximal humeral fractures are common yet the management of these injuries varies widely. In particular, the role and timing of any surgical intervention have not been clearly defined.

OBJECTIVES: To collate and evaluate the scientific evidence supporting the various methods used for treating proximal humeral fractures.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised register, the Cochrane Central Register of Controlled Trials, PEDro, MEDLINE (1966 to May week 4 2003), EMBASE (1980 to 2003 week 22), CINAHL (1982 to May week 3 2003), AMED (1985 to May 2003), the National Research Register (UK), Current Controlled Trials, and bibliographies of trial reports. The search was completed in May 2003.

SELECTION CRITERIA: All randomised studies pertinent to the treatment of proximal humeral fractures were selected.

DATA COLLECTION AND ANALYSIS: Independent quality assessment and data extraction were performed by two reviewers. Although quantitative data from trials are presented, trial heterogeneity prevented pooling of results.

MAIN RESULTS: Twelve randomised trials were included. All were small; the largest study involved only 86 patients. Bias in these trials could not be ruled out. Eight trials evaluated conservative treatment, three compared surgery with conservative treatment and one compared two surgical techniques. In the 'conservative' group there was very limited evidence indicating that the type of bandage used made any difference in terms of time to fracture union and the functional end result. However, an arm sling was generally more comfortable than a body bandage. There was some evidence that 'immediate' physiotherapy, without routine immobilisation, compared with that delayed until after three weeks immobilisation resulted in less pain and both faster and potentially better recovery in patients with undisplaced two-part fractures. Similarly, there was evidence that mobilisation at one week instead of three weeks alleviated pain in the short term without compromising long term outcome. Two trials provided some evidence that patients, when given sufficient instruction to pursue an adequate physiotherapy programme, could generally achieve a satisfactory outcome if allowed to exercise without supervision. Operative reduction improved fracture alignment in two trials. However, in one trial, surgery was associated with a greater risk of complication, and did not result in improved shoulder function. In one trial, hemi-arthroplasty resulted in better short-term function with less pain and less need for help with activities of daily living when compared with conservative treatment for severe injuries. Fracture fixation of severe injuries was associated with a high rate of re-operation in one trial, comparing tension-band wiring fixation with hemi-arthroplasty. There was very limited evidence that similar outcomes resulted from mobilisation at one week instead of three weeks after surgical fixation.

REVIEWER'S CONCLUSIONS: Only tentative conclusions can be drawn from the available randomised trials, which do not provide sufficient evidence for many of the decisions that need to be made in contemporary fracture management. Early physiotherapy, without immobilisation, may be sufficient for some types of undisplaced fractures. It is unclear whether operative intervention, even for specific fracture types, will produce consistently better long term outcomes. There is a need for good quality evidence for the management of these fractures.

PMID: 14583921

Rating: 1b

Handoll HH, Madhok R, Conservative interventions for treating distal radial fractures in adults, *Cochrane Database Syst Rev.* 2003;(2):CD000314.

c/o University Department of Orthopaedic Surgery, Royal Infirmary of Edinburgh, Little France, Old Dalkeith Road, Edinburgh, UK, EH16 4SU. h.handoll@ed.ac.uk

BACKGROUND: Fracture of the distal radius is a common clinical problem particularly in elderly white women with osteoporosis.

OBJECTIVES: To determine the most appropriate conservative treatment for fractures of the distal radius in adults.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised register (November 2002), the Cochrane Central Register of Controlled Trials (The Cochrane Library, Issue 1, 2003), MEDLINE (1966 to January week 1 2003), EMBASE (1988 to 2003 Week 3), CINAHL (1982 to December week 4 2002), the National Research Register (up to Issue 4, 2002), PEDro, conference proceedings and reference lists of articles. No language restrictions were applied.

SELECTION CRITERIA: Randomised or quasi-randomised clinical trials involving skeletally mature patients with a fracture of the distal radius, which compared commonly applied conservative interventions for fracture fixation. These included the application of an external support (plaster cast or brace) and fracture manipulation.

DATA COLLECTION AND ANALYSIS: All trials, judged as fitting the selection criteria by both reviewers, were independently assessed by both reviewers for methodological quality. Data were extracted for anatomical, functional and clinical, including complications, outcomes. The trials were grouped into categories relating to manipulation of displaced fractures; use and extent, including forearm position, of immobilisation; use of braces; different casting materials and techniques; and duration of immobilisation. Although quantitative data from some trials are presented, the lack of good quality trials and trial heterogeneity inhibited pooling of results.

MAIN RESULTS: Three trials were newly included in this update. In all, there are 36 trials, involving a total of 4114 mainly female and older patients, meeting the inclusion criteria for this review. Comprehensive details of the individual trials are provided in tabular form, and their results, grouped as indicated above, have been presented in text and analyses tables. The poor quality and heterogeneity in terms of patient characteristics, interventions compared and outcome measurement, of the included trials meant that no meta-analyses were undertaken.

REVIEWER'S CONCLUSIONS: There remains insufficient evidence from randomised trials to determine which methods of conservative treatment are the most appropriate for the more common types of distal radial fractures in adults. Therefore, at present, practitioners applying conservative management should use an accepted technique with which they are familiar, and which is cost-effective from the perspective of their provider unit. Patient preferences and circumstances, and the risk of complications should also be considered. Prioritising research questions to clarify the most appropriate conservative treatment for this common fracture is warranted. Researchers should differentiate between extra-articular and intra-articular, and non-displaced and displaced fractures, ascertain patient preferences, and agree a core outcome data set.

Publication Types:

- Review
- Review, Academic

PMID: 12804395

Rating: 1c

Handoll HH, Madhok R, Howe TE, Rehabilitation for distal radial fractures in adults, *Cochrane Database Syst Rev.* 2002;(2):CD003324

c/o University Department of Orthopaedic Surgery, Royal Infirmary of Edinburgh, Little France, Old Dalkeith Road, Edinburgh, UK, EH16 4SU. h.handoll@ed.ac.uk

BACKGROUND: Fracture of the distal radius is a common clinical problem, particularly in older white women with osteoporosis.

OBJECTIVES: To examine the evidence for effectiveness of rehabilitation intervention(s) for adults with conservatively or surgically treated distal radial fractures.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised register (January 2002), the Cochrane Controlled Trials Register (The Cochrane Library, Issue 4, 2001), the Cochrane Rehabilitation and Related Therapies Field database, MEDLINE (1966 to January 2002), EMBASE (1988 to 2001 Week 50), CINAHL (1982 to December Week 2 2001), Current Controlled Trials (December 2001), AMED, PEDro, conference proceedings and reference lists of articles.

SELECTION CRITERIA: Randomised or quasi-randomised clinical trials evaluating rehabilitation as part of the management of fractures of the distal radius sustained by skeletally mature patients. Rehabilitation interventions such as active and passive mobilisation exercises, and training for activities of daily living, could be used on their own or in combination, and be applied in various ways by various clinicians.

DATA COLLECTION AND ANALYSIS: All trials meeting the selection criteria were independently assessed by all three reviewers for methodological quality. Data were extracted independently by two reviewers. The trials were grouped into categories relating to the main comparisons, and to when the intervention(s) commenced (for example, during or after plaster cast immobilisation). Quantitative data are presented using relative risks or mean differences together with 95 per cent confidence limits.

MAIN RESULTS: Twelve trials, involving 601 mainly female and older patients, were included. Initial treatment was conservative, involving plaster cast immobilisation, in all but 20 patients whose fractures were fixed surgically. Though some trials were well conducted, others were methodologically compromised. No trial provided definitive evidence. Only very limited pooling of results from comparable trials was possible. During immobilisation, there was weak evidence of improved hand function in the short term, but not in the longer term, for early occupational therapy (1 trial), and of a lack of differences in outcome between supervised and unsupervised exercises (1 trial). Post-immobilisation, there was weak evidence of a lack of clinically significant differences in outcome in patients receiving formal rehabilitation therapy (3 trials), passive mobilisation (2 trials) or whirlpool immersion (1 trial) compared with no intervention. There was weak evidence of a short-term benefit of continuous passive motion (post external fixation) (1 trial), intermittent pneumatic compression (1 trial)

and ultrasound (1 trial). There was weak evidence of better short-term hand function in patients given physiotherapy than in those given instructions for home exercises by a surgeon (1 trial).

REVIEWER'S CONCLUSIONS: The available evidence from randomised trials is insufficient to establish the relative effectiveness of the various interventions used in the rehabilitation of adults with fractures of the distal radius.

Publication Types:

- Review
- Review, Academic

PMID: 12076475

Rating: 1c

Handoll HH, Madhok R, Howe TE. Rehabilitation for distal radial fractures in adults. *Cochrane Database Syst Rev.* 2006 Jul 19;3:CD003324.

Royal Infirmary of Edinburgh, c/o University Department of Orthopaedic Surgery, Old Dalkeith Road, Little France, Edinburgh, UK EH16 4SU. h.handoll@ed.ac.uk

BACKGROUND: Fracture of the distal radius is a common clinical problem, particularly in older white women with osteoporosis.

OBJECTIVES: To examine the effects of rehabilitation interventions in adults with conservatively or surgically treated distal radial fractures.

SEARCH STRATEGY: We searched the Cochrane Bone, Joint and Muscle Trauma Group Specialised Register (December 2005), the Cochrane Central Register of Controlled Trials (The Cochrane Library Issue 4, 2005), MEDLINE, EMBASE, CINAHL, AMED, PEDro, OTseeker and other databases, conference proceedings and reference lists of articles. No language restrictions were applied.

SELECTION CRITERIA: Randomised or quasi-randomised controlled trials evaluating rehabilitation as part of the management of fractures of the distal radius sustained by adults. Rehabilitation interventions such as active and passive mobilisation exercises, and training for activities of daily living, could be used on their own or in combination, and be applied in various ways by various clinicians.

DATA COLLECTION AND ANALYSIS: The authors independently selected and reviewed trials. Study authors were contacted for additional information. No data pooling was done.

MAIN RESULTS: Fifteen trials, involving 746 mainly female and older patients, were included. Initial treatment was conservative, involving plaster cast immobilisation, in all but 27 participants whose fractures were fixed surgically. Though some trials were well conducted, others were methodologically compromised. For interventions started during immobilisation, there was weak evidence of improved hand function for hand therapy in the days after plaster cast removal, with some beneficial effects

continuing one month later (one trial). There was weak evidence of improved hand function in the short term, but not in the longer term (three months), for early occupational therapy (one trial), and of a lack of differences in outcome between supervised and unsupervised exercises (one trial). For interventions started post-immobilisation, there was weak evidence of a lack of clinically significant differences in outcome in patients receiving formal rehabilitation therapy (four trials), passive mobilisation (two trials), ice or pulsed electromagnetic field (one trial), or whirlpool immersion (one trial) compared with no intervention. There was weak evidence of a short-term benefit of continuous passive motion (post external fixation) (one trial), intermittent pneumatic compression (one trial) and ultrasound (one trial). There was weak evidence of better short-term hand function in participants given physiotherapy than in those given instructions for home exercises by a surgeon (one trial).

AUTHORS' CONCLUSIONS: The available evidence from randomised controlled trials is insufficient to establish the relative effectiveness of the various interventions used in the rehabilitation of adults with fractures of the distal radius.

PMID: 16856004

Rating: 1b

Rapoliene J, Krisciunas A. The effectiveness of occupational therapy in restoring the functional state of hands in rheumatoid arthritis patients. *Medicina (Kaunas)*. 2006;42(10):823-8.

Department of Rehabilitation, Kaunas University of Medicine, Eiveniu 2, 50009 Kaunas, Lithuania.
jolita.rapoliene@takas.lt

The aim of the study was to evaluate the effectiveness of occupational therapy in rheumatoid arthritis patients with impaired hand function. Standardized Functional Independence Measure was employed in order to evaluate the functional status of the patients and impaired activities. A dynamometer was used for the measurements of muscular strength of hands and a goniometer, for the range of motion of the wrist. Totally, we have examined 120 rheumatoid arthritis patients. They were divided into two groups: 60 patients in each. Occupational therapy was applied only to the patients of the first group. The mean age of Group 1 patients was 53.4 \pm 1.8 years, the mean age of Group 2 patients was 52.0 \pm 1.9 years. The mean duration of the disease was 11.5 \pm 2.6 years and 12.1 \pm 2.4 years, respectively. The effectiveness of therapy was considered ineffective if, after the completion of the course of occupational therapy, no increase in Functional Independence Measure score for patients with rheumatoid arthritis was observed. When the score increased from 1 to 3, we considered this as moderate effectiveness; when the score increased to 4-6, we evaluated the effectiveness of occupational therapy as good, and when the score of 7 was attained, effectiveness of occupational therapy was considered as very good. In Group 1, the moderate effectiveness of occupational therapy was determined in 31.7% of patients; good effectiveness, in 61.7%; and very good effectiveness, in 3.3% of rheumatoid arthritis patients. In Group 2, the moderate effectiveness of treatment was determined in 48.3% of patients and good effectiveness, in 5% of rheumatoid arthritis patients.

CONCLUSIONS: Hand function (the strength of fingers and hands, the range of motion of the wrist) significantly improved in patients with rheumatoid arthritis after completion of a course of occupational therapy ($p < 0.05$). The improvement of hand functions in patients with rheumatoid arthritis led to increased ability to take food and drink, to wash themselves, to put the clothes on the upper and lower parts of the body and take them off, to use the toilet, a bathtub or a shower, to walk, to manage a wheelchair, and to do personal hygiene ($p < 0.05$).

PMID: 17090982

Rating: 2b

Head

Brown TH, Mount J, Rouland BL, Kautz KA, Barnes RM, Kim J. Body weight-supported treadmill training versus conventional gait training for people with chronic traumatic brain injury. J Head Trauma Rehabil. 2005 Sep-Oct;20(5):402-15.

Department of Physical Therapy, Beechwood Rehabilitation Services, Langhorne, PA 19047, USA.

OBJECTIVES: To compare body weight support treadmill training (BWSTT) to conventional overground gait training (COGT).

DESIGN: Randomized controlled trial.

SETTING: Residential rehabilitation center.

PARTICIPANTS: Twenty subjects with chronic traumatic brain injury (TBI).

INTERVENTION: The BWSTT or COGT for 15 minutes plus 30 minutes of exercise 2 days per week, for 3 months.

MAIN OUTCOME MEASURES: Functional Ambulation Category (FAC), Functional Reach (FR), Timed Up and Go; gait velocity, step width (BOS) and step length differential using instrumented gait mat.

RESULTS: Step width approached the norm without between-group differences. Step length differential improved significantly more for the COGT.

CONCLUSIONS: Physical therapy can improve gait for patients more than 6 years post-TBI. The COGT is more effective than the BWSTT for improving gait symmetry during overground walking.

PMID: 16170249

Rating: 2c

Colorado Division of Workers' Compensation. Rule XVII, Exhibit G, Traumatic Brain Injury. Medical Treatment Guidelines. May 1, 2005

For the complete guidelines, click on the link above.

Very complete state workers' comp guidelines. Among the findings are:

ACUTE THERAPEUTIC PROCEDURES – NONOPERATIVE

Resuscitation

The first priority in TBI is complete and rapid physiologic resuscitation. Sedation and neuromuscular blockade are appropriate if needed for transport. Short-acting agents are preferred to allow for serial exams. Hypotension and hypoxia must be avoided to optimize outcome. Avoid unnecessary or prophylactic hyperventilation (Paco₂ less than 26), in the first 24-hours after injury

Intracranial Pressure (ICP) and Cerebral Perfusion Pressure (CPP)

Individuals with brain injury should not be treated for intracranial hypertension (ICH), without clear evidence of brain injury such as a neurologically focal exam, or evidence of herniation syndrome, Glasgow Coma Score (GCS) of less than 9 without systemic explanation (hypotension, hypoxia, significant intoxication), or CT evidence of intracranial pathology with significant mass lesion or swelling.

- a. ICP Monitoring is indicated in individuals with low GCS (less than 9) and/or CT changes, or when the individual cannot have continual neurologic evaluation (e.g., use of anesthesia), and it should also be considered in situations of posturing or multi-trauma.
- b. Aggressive treatment should be initiated with clinical evidence of ICH, to include transient mild hyperventilation, euolemia and mannitol (if not hypovolemic), until ICP monitoring may be initiated to measure ICP.
- c. Sedation, neuromuscular blockade, and CSF drainage (if ventriculostomy is in place) are appropriate if needed to control ICH.
- d. Interpretation and treatment of ICP should be corroborated by frequent clinical examination and CPP data. In general, it is desirable to:
 1. Maintain ICP less than 20-25mm Hg
 2. Maintain mean arterial pressure (MAP) above 90
 3. Maintain CPP (MAP at head level minus ICP) at, or above 70mm Hg
- e. Intracranial pressure monitoring devices have therapeutic potential but consideration should be given to possible risks related to accuracy and reliability.
- f. Cerebral oxygen saturation monitoring is an emerging technology that may be used, usually in conjunction with ICP monitoring, to assess the effects of treatment interventions on oxygen delivery to the injured brain, and to optimize the management of brain swelling and intracranial pressure in the setting of severe brain injury.
- g. Hyperventilation: Controlled hyperventilation may be necessary for brief periods in acute neurologic deterioration not attributable to systemic pathology (i.e., hypotension). Avoid prophylactic hyperventilation (if Paco₂ is less than 30 mm) in the absence of ICP monitoring or with normal ICP and within the first 24 hours after severe brain injury to reduce the risk of secondary ischemia

- h. Options for use of mannitol in treating ICP elevations:
 - 1) Use prior to ICP monitoring only if neurologic deterioration is not attributable to systemic pathology (i.e., hypotension) and/or if there are signs of transtentorial herniation
 - 2) Euvolemia must be established and maintained
 - 3) Keep serum osmolarity (OSM) less than 320, especially in acute renal failure (ARF)
 - 4) Bolus (rather than drip) mannitol is more effective treatment for elevated ICP
- i. Glucocorticoids (steroids) are not useful or generally accepted to improve outcome or decrease ICP, and in some instances may be harmful. There is good evidence that they do not decrease mortality, and there is some evidence that they may even increase the mortality rate in trauma individuals with brain injuries.
- j. Barbiturates may be used to treat elevated ICP as a last resort.

Nutrition

Nutritional support should be aggressively initiated as soon as practicable. Preferable route is jejunal by gastrojejunostomy. Early aggressive establishment of positive nitrogen balance is probably beneficial. Appropriate caloric input should be established by the seventh day. Nutritionist or dietitian consultation may be indicated.

Anticonvulsants

Anticonvulsant treatment may be used to prevent early posttraumatic seizures in the high-risk individual, and are usually administered for one week in those with intracranial hemorrhage. Prevention of early seizures has no statistically significant impact on long-term outcome or the development of late seizures or chronic epilepsy. Prevention of early seizures is reasonable to reduce seizure-associated complications during acute management.

Hypothermia is an evolving technology for controlling ICP. It has possible utility in hypoxic or ischemic encephalopathy, however, its use in TBI is currently investigational. It may benefit individuals with a critically elevated ICP unresponsive to traditional therapies.

Of course, hyperthermia must be treated aggressively to avoid exacerbation of increased ICP.

Imaging Procedures

Skull X-Rays: are well-established diagnostic tools used to detect a fracture of the skull base or cranial vault. CT scanning is preferred if fractures are suspected because the CT scan may identify clinically significant fracture as well as potentially co-existent contusion or hemorrhage. Skull x-rays are generally accepted if CT scans are not available.

Computed Axial Tomography (CT): is a well-established brain imaging x-ray study comprising of a mathematical reconstruction of the tissue densities of the brain, skull, and surrounding tissues. CT scans require the use of computer-based scanning equipment. For acute brain trauma, iodine contrast enhancement is not necessary. CT scans are noninvasive and should reveal the presence of blood, skull fracture, and/or structural changes in the brain. CT scans provide limited information about intrinsic cerebral damage involving deep brain structures.

CT scans are widely accepted for acute diagnostic purposes, and for planning acute treatment. They are the screening image of choice in acute brain injury and are used to assess the need for neurosurgical intervention. CT scans are recommended for abnormal mental status, focal neurologic deficits, or acute seizure and should also be considered in the following situations:

- Signs of basilar skull fracture
- Physical evidence of trauma above the clavicles
- Acute traumatic seizure
- Age greater than 60
- An interval of disturbed consciousness
- Pre-or post-event amnesia
- Drug or alcohol intoxication
- Any recent history of TBI, including MTBI

Magnetic Resonance Imaging (MRI): is a well-established brain imaging study in which the individual is positioned in a magnetic field and a radio-frequency pulse is applied. Hydrogen proton energy emission is translated into visualized structures. Normal tissues give off one signal, while abnormal structures give off a different signal. Due to its high contrast resolution, MRI scans are superior to CT scans for the detection of some intracranial pathology, except for bone injuries such as fractures. MRI may reveal an increased amount of pathology as compared with CT. Specific MRI sequences and techniques are very sensitive for detecting traumatic cerebral injury; they may include, but are not limited to, diffusion-tensor, gradient echo, and Fluid Attenuated Inversion Recovery (FLAIR). Some of these techniques are not available on an emergency basis. MRI scans are useful to assess transient or permanent changes, to determine the etiology of subsequent clinical problems, and to plan treatment. MRI is more sensitive than CT for detecting traumatic cerebral injury. Initially, MRI scans are clinically useful in the following situations to:

- Determine neurological deficits not explained by CT
- Evaluate prolonged interval of disturbed consciousness
- Define evidence of acute changes super-imposed on previous trauma or disease

Vascular Imaging Tests reveal arterial or venous abnormalities in the chest, neck, head, or extremities (e.g., thrombosis, dissection, spasm, emboli, or tearing). These studies are generally used if more standard CT/MRI fails to demonstrate suspected vascular abnormalities. They may be useful in moderate/severe TBI as an adjunct to aforementioned studies, but only rarely in MTBI. Procedures that are generally accepted include:

- a. Arteriography:** is generally accepted, when the above-noted traumatic vascular abnormalities are suspected but unproven with the techniques discussed so far, or when further investigation of the vascular lesion is necessary. This is particularly true with arteriovenous fistulous change.
- b. Venography:** is generally accepted, if increased venous flow and pressure are suspected and still undemonstrated. This is done either by the jugular or orbital systems.
- c. Noninvasive Vascular Assessment (NIVA):** is the least invasive and may demonstrate direction of blood flow and general patency of the carotid and vertebral arterial systems in the neck, but not in the head.

- d. **Magnetic Resonance Angiography(Magnetic Resonance Arteriography(MRA) /Magnetic Resonance Venography(MVA)):** is indicated when vessel changes are suspected but not demonstrated by other simpler tests. Internal obstruction of an artery (e.g., thrombosis, spasm, dissection, emboli from a concomitant chest, or neck injury) may be demonstrated. Arterial compression due to an external pressure (e.g., bony fracture or mass affect from a large intra-axial hemorrhage or cerebral edema) may be demonstrated. Dissection or arteriovenous fistula formation may be seen, but as with other vascular abnormalities may need conventional contrast arteriography/venography to confirm or refute the MRA or MRV findings. The source for intra or extra-axial bleeding may be seen. Intracerebral dural venous sinus thrombosis, as well as poor venous return may be demonstrated by MRA or MRV.

Lumbar Puncture is a well-established diagnostic procedure for examination cerebrospinal fluid (CSF) in neurological disease and injury. The procedure should be performed by qualified and trained physicians under sterile conditions. Lumbar puncture is contraindicated in acute trauma to the spinal column, certain infections, increased intracranial pressure due to space occupying lesions, and in some coagulation disorders or defects. Additionally, it should be avoided if there are cutaneous infections in the region of the puncture site.

In individuals with suspected or known increased intra-cranial pressure, lumbar puncture should be preceded by fundoscopic examination and by a CT scan or MRI. If no radiographic evidence of extra-axial hemorrhage, mass effect, or impending brain herniation is found then lumbar puncture may proceed. If CT or MRI shows intracerebral, intra-ventricular, or subarachnoid blood, lumbar puncture should be withheld until neurological consultation is obtained.

For the complete guidelines including information on therapeutic and operative procedures, click [here](#).

Publication Type:

- Nationally Recognized Treatment Guideline

Rating: 7a

Driver S, O'connor J, Lox C, Rees K. Evaluation of an aquatics programme on fitness parameters of individuals with a brain injury. Brain Inj. 2004 Sep;18(9):847-59.

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The primary objective was to determine the effect of an aquatic exercise programme on the physical fitness of people with a brain injury. A pre-test-post-test randomized-groups design was conducted. Sixteen outpatients with a brain injury were included in the study. Eight participants were assigned to an aquatic exercise group and eight to a control group. The components of physical fitness measured included cardiovascular endurance, body composition, muscular strength and endurance and flexibility. Measurements were taken pre- and post-programme. Results indicated an increase in components of physical fitness for the experimental group but not the control group. Increases in fitness were reported as having a positive impact on the functional capacity of individuals in the exercise group as well as

enhancing the individual's ability to complete activities of daily living successfully. Results indicate that aquatic exercise may positively impact the primary and secondary physical injuries caused by a brain injury. Copyright 2004 Taylor and Francis Ltd

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 15223738

Rating: 2c

Franckeviciute E, Krisciunas A. Peculiarities of physical therapy for patients after traumatic brain injury. Medicina (Kaunas). 2005;41(1):1-6.

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Literature review data about methods and means of physical therapy for patients after traumatic brain injury is presented in this article. Traumatic brain injury is an urgent medical and social problem all over the world. It is the most common cause of disability in Lithuania. Patient rehabilitation after traumatic brain injury is divided into two periods: acute and subacute. In the beginning of rehabilitation physical therapist evaluates patient's functional status, later he uses methods and means of treatment, and evaluates effectiveness of rehabilitation. Early verticalisation is very important for patients with coma. Physical therapy consists of prevention of complications, improvement of muscle force, and range of motions, balance, movement coordination, endurance and cognitive functions. Early rehabilitation is necessary for traumatic brain injury patients and use of physical therapy methods can help to regain lost functions and to come back to the society.

Publication Type:

- Review

PMID: 15687744

Rating: 5c

Shiel A, Burn JP, Henry D, Clark J, Wilson BA, Burnett ME, McLellan DL. The effects of increased rehabilitation therapy after brain injury: results of a prospective controlled trial. Clin Rehabil. 2001 Oct;15(5):501-14.

University of Southampton Rehabilitation Research Unit, UK. agnes.shiel@mrc-cbu.cam.ac.uk

OBJECTIVE: The objective was to investigate the effect of increased intensity of rehabilitation therapy provided to brain-injured subjects on the rate at which independence was regained and the duration of hospital admission.

DESIGN: A two-centre, prospective, controlled study with random allocation to groups.

SETTING: Two district general hospitals on the south coast of England.

SUBJECTS: Fifty-six people with moderate and severe head injury consecutively admitted to Southampton and Poole hospitals between June 1995 and September 1997.

INTERVENTIONS: Increased intensity of rehabilitation therapy input without change in content.

RESULTS: Subjects receiving more intensive therapy made more rapid progress and were discharged home sooner. The different intensities of therapy employed in this study showed no evidence of a 'ceiling' effect and the 'intervention group' made significantly more rapid progress on tests of dependency during the period of admission. A clear response to increased therapy input was seen in one of the centres with more rapid functional improvement and a shorter length of hospital stay. This centre already had more therapy and better community facilities. No such benefits were seen at the other centre where the intervention group had a longer hospital stay than the routine group.

CONCLUSION: Increasing the hours per week of therapy given to adults recovering from brain injury in hospital can accelerate the rate of recovery of personal independence and result in their being discharged from hospital sooner. Increased rehabilitation therapy after brain injury is associated with enhanced functional recovery and shorter hospital stay if provided in the context of an integrated service that can provide ongoing community support. There is no evidence of any ceiling effect of therapeutic intensity beyond which no further response is observed.

Publication Types:

- Clinical Trial
- Multicenter Study
- Randomized Controlled Trial

PMID: 11594640

Rating: 2c

Hip & Pelvis (Acute & Chronic)

Binder EF, Brown M, Sinacore DR, Steger-May K, Yarasheski KE, Schechtman KB. Effects of extended outpatient rehabilitation after hip fracture: a randomized controlled trial. JAMA. 2004 Aug 18;292(7):837-46.

Department of Internal Medicine, Washington University School of Medicine, St Louis, Mo 63108, USA. ebinder@im.wustl.edu

This RCT included 90 patients, and concluded that in elderly patients with hip fracture, six months of outpatient rehabilitation including progressive resistance training improves physical function and quality of life and reduces disability compared with low-intensity home exercise.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 15315998

Rating: 2c

Bolgia LA, Uhl TL. Electromyographic analysis of hip rehabilitation exercises in a group of healthy subjects. J Orthop Sports Phys Ther. 2005 Aug;35(8):487-94.

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STUDY DESIGN: Single-occasion, repeated-measures design.

OBJECTIVE: To determine the magnitude of hip abductor muscle activation during 6 rehabilitation exercises.

BACKGROUND: Many researchers have reported that hip strengthening, especially of the hip abductors, is an important component of a lower extremity rehabilitation program. Clinicians employ non-weight-bearing and weight-bearing exercise to strengthen the hip musculature; however, researchers have not examined relative differences in muscle activation during commonly used exercises. Information regarding these differences may provide clinicians with a scientific rationale needed for exercise prescription.

METHODS AND MEASURES: Sixteen healthy subjects (mean +/- SD age, 27 +/- 5 years; range, 18-42 years; mean +/- SD height, 1.7 +/- 0.2 m; mean +/- SD body mass, 76 +/- 15 kg) volunteered for this study. Bipolar surface electrodes were applied to the right gluteus medius muscle. We measured muscle activation as subjects performed 3 non-weight-bearing (sidelying right hip abduction and standing right hip abduction with the hip at 0 degrees and 20 degrees of flexion) and 3 weight-bearing (left-sided pelvic drop and weight-bearing left hip abduction with the hips at 0 degrees and 20 degrees of flexion) exercises. Data were expressed as a percent of maximum voluntary isometric contraction of the right gluteus medius. Differences in muscle activation across exercises were determined using a 1-way analysis of variance with repeated measures, followed by a sequentially rejective Bonferroni post hoc analysis to identify differences between exercises.

RESULTS: The weight-bearing exercises demonstrated significantly greater EMG amplitudes ($P < .001$) than all non-weight-bearing exercises except non-weight-bearing sidelying hip abduction.

CONCLUSION: The weight-bearing exercises and non-weight-bearing sidelying hip abduction exercise resulted in greater muscle activation because of the greater external torque applied to the hip abductor musculature. Although the non-weight-bearing standing hip abduction exercises required the least activation, they may benefit patients who cannot safely perform the weight-bearing or sidelying hip abduction exercises. Clinicians may use results from this study when designing hip rehabilitation programs.

Publication Types:

- Clinical Trial

PMID: 16187509

Rating: 2c

Brigham and Women's Hospital. Lower extremity musculoskeletal disorders. A guide to diagnosis and treatment. Boston (MA): Brigham and Women's Hospital; 2003.

Osteoarthritis

Pain in the groin area, usually worsens with weight bearing and improves with rest. Lateral, flank, or buttock pain usually not "true" hip pain and suggests a different problem.

- May present as referred pain in the knee
- Painful, limping gait
- Progressive loss of range of motion
- Crossing one's legs, tying shoes, and walking are painful.

Diagnostic Testing

Differential diagnosis includes back pathology and trochanteric bursitis. Radiographic testing usually shows joint space narrowing in the superior lateral area of the hip. Spine films indicated when diagnosis is uncertain.

Physical Exam

Decreased range of motion of the hip in flexion, adduction, and internal rotation.

Treatment

- Acetaminophen, up to 4,000 mg a day initial drug of choice
- NSAIDs are more effective, but they are a second-line therapy because of toxicity. Cyclooxygenase (COX)-2 inhibitors are associated with fewer gastrointestinal (GI) side effects than NSAIDs but they carry a risk of renal toxicity and are quite costly.

Rehabilitation (Physical or Occupational Therapy)

- Pain management techniques (positioning, posture cues, use of heat/cold for symptom management)
- Exercise program to maintain or improve joint range of motion and muscle strength
- Appropriate assistive device (e.g., cane) to improve ambulation

Referral

Refer to surgery when patient feels the benefits of surgery outweigh the risks. For some this will be early in the process, to maintain active function, while for others this will be when pain is too severe to carry out activities of daily living.

Surgical Intervention

Total hip replacement (THR) should be undertaken when the above measures have failed. Total hip replacement is underutilized in women, yet it is a very effective treatment for osteoarthritis of the hip with a less than 1% mortality. Results are best in centers that perform high numbers of the procedure.

Trochanteric Bursitis

- May or may not have history of trauma/fall onto affected hip
- Pain is generally felt in the area of the posterior, lateral greater trochanter.
- Pain may also extend down the lateral thigh or occasionally into the buttocks.
- Patients complain that activities such as rising to a standing position, sleeping on affected side, and/or going up or down stairs cause increase in pain.

Diagnostic Testing

Clinical diagnosis

Physical Exam

Tenderness over the posterior lateral greater trochanter, especially when palpated with patient lying on unaffected side and downward pressure exerted over affected soft tissue

Treatment

NSAIDs are helpful for management of pain. Stretching program very helpful.

Rehabilitation (Physical or Occupational Therapy)

- Modalities for pain management (iontophoresis, heat/cold)
- Patient education for activity modification, specific stretching techniques, and home exercises program
- Exercise program to restore joint range of motion, correct muscle imbalance, promote joint proprioception
- Gait training

Referral

Referral to subspecialist for corticosteroid injection may be helpful.

Surgical Intervention

Not indicated

Iliotibial Band Syndrome

Aching or burning pain over the lateral femoral condyle or proximal lateral tibia, and may radiate up the thigh toward the hip

Diagnostic Testing

Clinical diagnosis

Physical Exam

Pain on palpation of the iliotibial band (localized or along the entire band)

Treatment

- NSAIDs to reduce pain and inflammation
- Wearing proper shoes and advising patients to run on even terrain or softer surfaces
- Orthotics may help to improve alignment.

Rehabilitation (Physical or Occupational Therapy)

- Stretching exercises to restore flexibility
- Patient education on activity modifications and proper shoe wear
- Exercises to restore muscle strength and correct imbalances
- Orthotics may be needed.

Referral

Referral to subspecialist for local corticosteroid injections into areas of tenderness may be helpful.

Surgical Intervention

Not indicated

Rating: 6b

Cameron ID. Coordinated multidisciplinary rehabilitation after hip fracture. Disabil Rehabil. 2005 Sep 30-Oct 15;27(18-19):1081-90.

Rehabilitation Studies Unit, Faculty of Medicine, University of Sydney, Australia.
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PURPOSE: To review the topic of coordinated multidisciplinary rehabilitation after hip fracture from a research perspective and to provide information to guide the provision of rehabilitation services for patients with hip fracture.

METHODS: Literature review including searches of Medline, Embase, Cochrane Collaboration and evidence based clinical guidelines, checking of references of publications and consultation with researchers.

RESULTS: The research evidence is heterogeneous and remains inclusive. Programs that assist patients with hip fracture to regain function and return home as soon as feasible are likely to be effective as they appear to increase the percentage of patients who return home and remain there after hip fracture. Rehabilitation programs that achieve this are likely to be cost effective. These programs involve health

professionals from multiple disciplines (nurses, allied health professionals and medical practitioners) who work collaboratively, may operate in several settings, and routinely provide specific treatments that are supported by strong evidence of effectiveness.

CONCLUSIONS: Patients with hip fracture should be offered a coordinated a multidisciplinary rehabilitation program with the specific aim of regaining sufficient function to return to their pre-fracture living arrangements.

PMID: 16315427

Rating: 5b

Expert Clinical Benchmarks. Lower extremity (hip, knee and ankle). King of Prussia (PA): MedRisk, Inc.; 2004.

MAJOR RECOMMENDATIONS

General

During the initial evaluation, the therapist should include questions about work task requirements in the patient history interview and incorporate these findings in the treatment objectives.

The therapist's treatment regimen should be directed toward improving the patient's functional ability rather than based on the patient's impairment.

The therapist's treatment regimen should emphasize active interventions over passive modalities and should become less frequent toward the end of the episode of care in order to encourage patient behavioral gains.

Non-Surgical

For non-surgical lower extremity (hip, knee, and ankle) conditions, a series of physical therapy treatments should be delivered ranging from 10 to 24 visits over a period of 6 to 12 weeks, depending upon severity (see table below). Refer to the original guideline document for recommendations on the time, choice, and sequence of interventions, as well as interventions that are generally recommended, interventions recommended on a case specific/clinical judgement basis, and interventions that are not recommended. Specific interventions are listed in the "Interventions and Practices Considered" field in the Complete Summary.

Surgical

For surgical lower extremity (hip, knee, and ankle) conditions, a series of physical therapy treatments should be delivered ranging from 16 to 28 visits over a period of 6 to 15 weeks, depending upon severity (see table below). Refer to the original guideline document for recommendations on the time, choice, and sequence of interventions as well as interventions that are generally recommended, interventions recommended on a case specific/clinical judgement basis, and interventions that are not recommended. Specific interventions are listed in the "Interventions and Practices Considered" field in the Complete Summary.

Publication Type:

- Nationally Recognized Treatment Guideline

Rating: 6b

Handoll HH, Sherrington C, Parker MJ. Mobilisation strategies after hip fracture surgery in adults. Cochrane Database Syst Rev. 2004 Oct 18;(4):CD001704.

University Department of Orthopaedic Surgery, Royal Infirmary of Edinburgh, Little France, Old Dalkeith Road, Edinburgh, UK, EH16 4SU.

BACKGROUND: Hip fracture, which happens in predominantly elderly populations, often results in a reduction in mobility. Care programmes after hip fracture surgery include strategies for mobilisation, such as early weight bearing and gait retraining. Other mobilisation strategies, such as exercises and physical training, are used at various stages in rehabilitation including after discharge from hospital.

OBJECTIVES: To evaluate the effects of different mobilisation strategies and programmes after hip fracture surgery.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group Specialised Register (May 2004), the Cochrane Central Register of Controlled Trials (The Cochrane Library Issue 2, 2004), MEDLINE and other databases, conference proceedings and reference lists of articles.

SELECTION CRITERIA: All randomised or quasi-randomised trials comparing different mobilisation strategies/programmes after hip fracture surgery.

DATA COLLECTION AND ANALYSIS: The reviewers independently assessed trial quality and extracted data.

MAIN RESULTS: Our third update, which extended the review scope to cover the whole rehabilitation period, included four new trials. Most of the 10 included trials were small and all had methodological limitations, including inadequate follow up. Seven trials evaluated mobilisation strategies started soon after hip fracture surgery. One trial (273 participants) found no statistically significant differences in unfavourable outcomes for weight bearing started at two versus 12 weeks after internal fixation of a displaced intracapsular fracture. Of two trials (188 participants) comparing a more with a less intensive regimen of physiotherapy, one reported a lack of demonstrable difference in recovery of the two patient groups, and the other found a higher level of drop-out in the more intensive group with no difference in length of hospital stay. One trial (80 participants) comparing two-week programmes of weight-bearing versus non-weight-bearing exercise found some short-term improvement in mobility and balance in the weight-bearing exercise group. One trial (80 participants) found improved mobility, leg extension power and Barthel score in those given a quadriceps muscle strengthening exercise programme. One trial (40 participants) found no statistically significant difference in recovery of mobility and time to hospital discharge after a treadmill versus conventional gait retraining programme. One trial (27 participants) comparing neuromuscular stimulation of the quadriceps muscle with placebo found a greater recovery of pre-fracture mobility in the stimulation group. The interventions tested by the three remaining trials started after hospital discharge. One trial (28 participants) found improved outcome after 12 weeks of

intensive physical training. One trial (120 participants) found improved outcome after home-based exercises started around 22 weeks from injury. One trial (44 participants) found home-based weight-bearing exercises starting at seven months produced no statistically significant differences aside, perhaps, for greater quadriceps strength.

REVIEWERS' CONCLUSIONS: There is insufficient evidence from randomised trials to determine the effectiveness of the various mobilisation strategies examined in this review that start either in the early post-operative period or during the later rehabilitation period. Further research is required to establish the possible benefits of the additional provision of interventions primarily aimed at enhancing mobility.

Publication Types:

- Meta-Analysis
- Review

PMID: 15495015

Rating: 1c

Jain R, Basinski A, Kreder HJ. Nonoperative treatment of hip fractures. Int Orthop. 2003;27(1):11-7. Epub 2002 Nov 12.

San Diego Sports Medicine and Orthopaedic Center, 6719 Alvarado Road, Suite 200, 92120 San Diego, CA, USA. rina.jain@sympatico.ca

We retrospectively reviewed a population database and a case series to compare the mortality of operative and nonoperative treatment of hip fractures in patients with severe comorbidity. Nonoperative treatment of hip fractures (bed rest or early weight bearing) was administered based on medical assessment of perioperative risk. Comparison of 30-day mortality was performed between the nonoperatively and operatively treated groups. We found that of 50,235 of hip fractures that occurred between 1992 and 1998, 89.4% were treated operatively. Thirty-day mortality rate in the nonoperatively treated patients (18.8%) was higher than the rate in operatively treated patients (11.0%) (odds ratio 1.7 times, 95% confidence interval (CI) 1.6, 1.8). In the case series, of 62 elderly patients with severe comorbidity treated nonoperatively, 41 had bed rest/traction, while 21 were mobilized early. A group of operatively treated patients (n=108) was compared to nonoperatively treated patients. Mortality with nonoperative treatment was higher with bed rest (73%) compared to early mobilization (odds ratio 3.8, 95% CI 1.1-14.0). There was no significant difference in mortality between operatively treated patients (29%) and patients treated nonoperatively with immediate mobilization (19%). Bed rest was 2.5 times more likely to be associated with mortality compared to operative treatment (95% CI 1.1-5.5).

Publication Type:

- Meta-analysis

PMID: 12582802

Rating: 1a

Jan MH, Hung JY, Lin JC, Wang SF, Liu TK, Tang PF. Effects of a home program on strength, walking speed, and function after total hip replacement. Arch Phys Med Rehabil. 2004 Dec;85(12):1943-51.

School and Graduate Institute of Physical Therapy, College of Medicine, National Taiwan University, Taipei, Republic of China.

OBJECTIVE: To assess the efficacy of a home exercise program in increasing hip muscle strength, walking speed, and function in patients more than 1.5 years after total hip replacement (THR).

DESIGN: Randomized controlled trial.

SETTING: Kinesiology laboratory.

PARTICIPANTS: Fifty-three patients with unilateral THR were randomly assigned to the training (n=26) and control (n=27) groups. Patients in the training group were further divided into exercise-high (n=13) and exercise-low (n=13) compliance groups according to their practice ratio (high, > or =50%).

INTERVENTION: The training group underwent a 12-week home program that included hip flexion range of motion exercises for both hip joints; strengthening exercises for bilateral hip flexors, extensors, and abductors; and a 30-minute walk every day. The control group did not receive any training.

MAIN OUTCOME MEASURES: Strength of bilateral hip muscles, free and fast walking speeds while walking over 3 different terrains, and functional performance were assessed by using a dynamometer, videotape analysis, and the functional activity part of the Harris Hip Score, respectively, before and after the 12-week period. **RESULTS:** Subjects in the exercise-high compliance group showed significantly (P <.05) greater improvement in muscle strength for the operated hip, fast walking speed, and functional score than those in the exercise-low compliance and control groups.

CONCLUSIONS: The designed home program was effective in improving hip muscle strength, walking speed, and function in patients after THR who practiced the program at least 3 times a week, but adherence to this home program may be a problem.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 15605331

Rating: 2c

Kuisma R. A randomized, controlled comparison of home versus institutional rehabilitation of patients with hip fracture. Clin Rehabil. 2002 Aug;16(5):553-61.

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OBJECTIVE: To compare ambulation outcomes between home and institutional rehabilitation of patients with hip fracture.

DESIGN: Randomized controlled clinical equivalence trial.

SETTING: The Queen Elizabeth Hospital in Hong Kong.

SUBJECTS: Eighty-one patients with hip fracture.

INTERVENTION: Study group patients (40) were discharged directly home from the acute hospital and visited by a physiotherapist an average of 4.6 times. The control group subjects (41) were discharged to a rehabilitation centre for further treatment lasting on average 36.2 days (SD 14.6) and they received physiotherapy daily.

MAIN OUTCOME MEASURES: Ambulation ability measured on a categorical scale.

RESULTS: The mean age of the subjects was 75 years (SD 8.3 years). Females comprised 60% of all the subjects and majority were retired or home makers. Both groups of patients improved in their ambulation ability during their rehabilitation period but neither group achieved their pre-ambulatory status by the time of completion of the study. The study group achieved significantly higher ambulation scores ($p < 0.05$) for community and household ambulation compared with the control group by the end of the study, a year after operation.

CONCLUSION: Five visits by a physiotherapist in the patient's home after discharge from an acute hospital after surgical treatment for hip fracture yielded better results in ambulation ability than one month of conventional institution-based rehabilitation.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 12194626

Rating: 2c

Lauridsen UB, de la Cour BB, Gottschalck L, Svensson BH. Intensive physical therapy after hip fracture. A randomised clinical trial. Dan Med Bull. 2002 Feb;49(1):70-2.

H:S Copenhagen Municipal Hospital, Department of Rheumatology.

INTRODUCTION: This randomised study evaluates the effect of intensive physical therapy on the duration of rehabilitation following hip fracture.

METHODS: Eighty-eight patients transferred for rehabilitation after surgical treatment for hip fracture were included in the trial. Forty-four patients were randomised to physical therapy 3.6 hours (median) a week, while the 44 control patients received physical therapy 1.9 hours a week. Outcome was defined as duration of physical rehabilitation until the patient was able to (1) walk 50 metres in less than 2 minutes, (2) manage stair climbing to the first floor, (3) manage sit-to-stand transfer, (4) move in and out of bed, (5) manage bathing, dressing and lavatory visits.

RESULTS: In the group randomised to intensive physical therapy 24 patients withdrew after 15 days while 13 patients withdrew from the control group after 22 days (median values). Early withdrawal was due to orthopaedic complications, general weakness and poor co-operation. No difference between the two groups was demonstrated in the duration of physical rehabilitation by a per protocol analysis of the patients who completed the trial.

DISCUSSION: The considerable drop-out rate suggests that intensive physical therapy may be of limited value when attempting to reduce the duration of rehabilitation following hip fracture. An altered objective including enhanced out-patient rehabilitation may be necessary in order to reduce the length of hospital stay after hip fracture.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 11894727

Rating: 2c

Mangione KK, Craik RL, Tomlinson SS, Palombaro KM. Can elderly patients who have had a hip fracture perform moderate- to high-intensity exercise at home? Phys Ther. 2005 Aug;85(8):727-39.

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BACKGROUND AND PURPOSE: The majority of patients after a hip fracture do not return to prefracture functional status. Depression has been shown to affect recovery. Although exercise can reduce impairments, access issues limit elderly people from participating in facility-based programs. The primary purpose of this study was to determine the effects and feasibility of a home exercise program of

moderate- or high-intensity exercise. A secondary purpose was to explore the relationship of depression and physical recovery.

SUBJECTS: Thirty-three elderly people (24 women, 9 men; mean = 78.6 years of age, SD = 6.8, range = 64-89) who had completed a regimen of physical therapy following hip fracture participated in the study. Subjects were randomly assigned to a resistance training group, an aerobic training group, or a control group.

METHODS: Subjects were tested before and upon completion of the exercise trial. Isometric lower-extremity force, 6-minute-walk distance, free gait speed, mental status, and physical function were measured. Each exercise session was supervised by a physical therapist, and subjects received 20 visits over 12 weeks. The control group received biweekly mailings. The resistance training group performed 3 sets of 8 repetitions at the 8-repetition maximum intensity using a portable progressive resistance exercise machine. The aerobic training group performed activities that increased heart rate 65% to 75% of their age-predicted maximum for 20 continuous minutes.

RESULTS: Resistance and aerobic training were performed without apparent adverse effects, and adherence was 98%. All groups improved in distance walked, force produced, gait speed, and physical function. Isometric force improved to a greater extent in the intervention groups than in the control group. Depressive symptoms interacted with treatment group in explaining the outcomes of 6-minute-walk distance and gait speed.

DISCUSSION AND CONCLUSION: High-intensity exercise performed in the home is feasible for people with hip fracture. Larger sample sizes may be necessary to determine whether the exercise regimen is effective in reducing impairments and improving function. Depression may play a role in the level of improvement attained.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 16048421

Rating: 2c

National Osteoporosis Foundation. Health professional's guide to rehabilitation of the patient with osteoporosis. Washington (DC): National Osteoporosis Foundation; 2003.

MAJOR RECOMMENDATIONS

Following hip fracture, physical therapy and exercise can improve transfers, gait, leg strength, flexibility, and balance. A total body exercise program also should include guided progression as strength improves.

Rehabilitation Following Hip Fracture

Hip fracture is a traumatic event that typically requires surgery to repair the fracture or replace the hip joint. It is important to regain as much mobility and independence as possible following hip fracture and to take steps to prevent future fractures. As the patient improves in terms of reduced pain and greater mobility, physical therapy and exercise programs can improve gait, leg strength, flexibility, and balance. A trained caregiver can safely assist the patient from a walker to a cane to unaided walking as her/his underlying health and physical status permits. Exercise principles should focus on hip-strengthening exercises. Fall prevention strategies should be implemented and should include a home-safety risk assessment and balance training. Slow-movement exercises, such as Tai Chi, should be encouraged. See the following:

Simple Hip-Strengthening Exercises

Hip-flexors — Standing beside a chair, without bending at the waist, bend one knee up as close to chest as possible. Lower leg to floor. Repeat with other leg.

Hip abductors — Standing erect and holding onto the back of a chair, without bending at the waist or knee, move one leg straight out to the side, making sure that the toes point forward. Lower the leg and repeat on other side.

Hip-extensors — Stand holding onto the back of a chair, and bend forward about 45 degrees at the hips. Lift one leg straight out behind you as high as possible without bending the knee or moving the upper body. Lower leg and repeat on other side.

Hip Protectors

Hip protective pads, worn in the side pockets of stretchy undergarments, were shown to protect against hip fractures in an elderly nursing home population, but compliance is difficult to obtain. However, these devices should be considered for elderly individuals at risk for hip fracture following a fall.

Publication Type:

- Nationally Recognized Treatment Guideline

Rating: 6a

Penrod JD, Boockvar KS, Litke A, Magaziner J, Hannan EL, Halm EA, Silberzweig SB, Sean Morrison R, Orosz GM, Koval KJ, Siu AL. Physical therapy and mobility 2 and 6 months after hip fracture. J Am Geriatr Soc. 2004 Jul;52(7):1114-20.

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OBJECTIVES: To examine the relationship between early physical therapy (PT), later therapy, and mobility 2 and 6 months after hip fracture. **DESIGN:** Prospective, multisite observational study.

SETTING: Four hospitals in the New York City area.

PARTICIPANTS: Four hundred forty-three hospitalized older patients discharged after surgery for hip fracture in 1997-98.

MEASUREMENTS: Patient demographics, fracture type, comorbidities, dementia, number of new impairments at discharge, amount of PT between day of surgery and postoperative day (POD) 3, amount of therapy between POD4 and 8 weeks later, and prefracture, 2-, and 6-month mobility measured using the Functional Independence Measure.

RESULTS: More PT immediately after hip fracture surgery was associated with significantly better locomotion 2 months later. Each additional session from the day of surgery through POD3 was associated with an increase of 0.4 points ($P=.032$) on the 14-point locomotion scale, but the positive relationship between early PT and mobility was attenuated by 6 months postfracture. There was no association between later therapy and 2- or 6-month mobility.

CONCLUSION: PT immediately after hip fracture surgery is beneficial. The effects of later therapy on mobility were difficult to assess because of limitations of the data. Well-designed randomized, controlled trials of the effect of varying schedules and amounts of therapy on functional status after hip fracture would be informative.

Publication Types:

- Multicenter Study

PMID: 15209649

Rating: 2b

Sherrington C, Lord SR, Herbert RD. A randomized controlled trial of weight-bearing versus non-weight-bearing exercise for improving physical ability after usual care for hip fracture. Arch Phys Med Rehabil. 2004 May;85(5):710-6.

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OBJECTIVE: To compare the effects of weight-bearing and non-weight-bearing home exercise programs and a control program on physical ability (strength, balance, gait, functional performance) in older people who have had a hip fracture. DESIGN: Randomized controlled trial with 4-month follow-up.

SETTING: Australian community-dwellers (82%) and residents of aged care facilities who had completed usual care after a fall-related hip fracture.

PARTICIPANTS: One hundred twenty older people entered the trial, 40 per group (average age \pm standard deviation, 79 ± 9 y) and 90% completed the 4-month retest.

INTERVENTION: Home exercise prescribed by a physical therapist.

MAIN OUTCOME MEASURES: Strength, balance, gait, and functional performance.

RESULTS: At the 4-month retest, there were differences between the groups in the extent of improvement since the initial assessment for balance ($F(10,196)=2.82, P<.001$) and functional performance ($F(6,200)=3.57, P<.001$), but not for strength ($F(12,190)=1.09, P=.37$) or gait ($F(8,200)=.39, P=.92$). The weight-bearing exercise group showed the greatest improvements in measures of balance and functional performance (between-group differences of 30%-40% of initial values).

CONCLUSIONS: A weight-bearing home exercise program can improve balance and functional ability to a greater extent than a non-weight-bearing program or no intervention among older people who have completed usual care after a fall-related hip fracture.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 15129393

Rating: 2b

Tsao JY, Leu WS, Chen YT, Yang RS. Effects on function and quality of life of postoperative home-based physical therapy for patients with hip fracture. Arch Phys Med Rehabil. 2005 Oct;86(10):1953-7.

School and Graduate Institute of Physical Therapy, College of Medicine, National Taiwan University, Taipei.

OBJECTIVE: To evaluate the effects of a 3-month home-based physical therapy (PT) program for patients with hip fracture after surgery. DESIGN: Randomized controlled trial.

SETTING: Home.

PARTICIPANTS: Twenty-five patients recently discharged from an acute orthopedic department.

INTERVENTIONS: Patients were randomized to the home-based PT group ($n=13$), where they received home-based PT 8 times from discharge to month 3 postdischarge, or to the control group ($n=12$). The home-based PT program included exercises for muscle strengthening, range of motion (ROM), balance, and functional training. Patients in the control group were instructed to practice the exercise program given at bedside before discharge.

MAIN OUTCOME MEASURES: Patients were evaluated for hip ROM, strength, walking velocity, Harris hip score, and health-related quality of life (HRQOL) at the week of discharge and at 1, 3, and 6 months after discharge.

RESULTS: The baseline characteristics showed no difference between the 2 groups. Harris score of the home-based PT group progressed from 58.6+/-8.5 to 90.1+/-5.4 at month 3, whereas Harris score of the control group progressed from 54.6+/-14.5 to 77.4+/-10.0 (P<.01). Scores of the psychologic domain of HRQOL for the home-based PT group were significantly better at month 1 (P<.05) and month 3 (P<.01) after discharge. Moreover, the physical domain score of the home-based PT group was also significantly better (P<.05) at 3 months after discharge. CONCLUSIONS: Home-based PT programs could help patients regain function and HRQOL earlier.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 16213237

Rating: 2c

White SC, Lifeso RM. Altering asymmetric limb loading after hip arthroplasty using real-time dynamic feedback when walking. Arch Phys Med Rehabil. 2005 Oct;86(10):1958-63.

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OBJECTIVE: To evaluate a walking program incorporating real-time biofeedback to reduce asymmetric limb loading after total hip arthroplasty (THA).

DESIGN: Within-subject clinical intervention.

SETTING: Biomechanics laboratory.

PARTICIPANTS: Volunteers were screened for confounding disorders that could affect their gait other than unilateral THA. Participants included 28 subjects who were evaluated a minimum of 2 months after surgery and ambulatory without assistive devices.

INTERVENTIONS: THA subjects were assigned to a feedback, no-feedback, or control group. The feedback group walked on a treadmill 15 minutes, 3 times a week for 8 weeks while matching step-to-step reaction forces. Subjects walking without feedback had equal time. The control group did not train.

MAIN OUTCOME MEASURES: Symmetry indices for peak limb-loading force, rate of rise of loading force, and impulse calculated from vertical foot-ground forces. Symmetry index changes were evaluated using 2-factor, repeated-measures analyses of variance with a Tukey post hoc test.

RESULTS: Loading rate and impulse equalization improved for the feedback group ($P < .01$). Loading rate equalization improved for the no-feedback group ($P = .01$). There were no changes for the control group.

CONCLUSIONS: This preliminary study suggests that a treadmill walking program may help persons with a THA achieve a more symmetric gait. Additional investigation of the potential benefits of a rehabilitation program incorporating treadmill walking with and without biofeedback is recommended.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 16213238

Rating: 2c

Zhang W, Moskowitz RW, Nuki G, Abramson S, Altman RD, Arden N, Bierma-Zeinstra S, Brandt KD, Croft P, Doherty M, Dougados M, Hochberg M, Hunter DJ, Kwoh K, Lohmander LS, Tugwell P. OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. *Osteoarthritis Cartilage*. 2008 Feb;16(2):137-62.

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PURPOSE: To develop concise, patient-focussed, up to date, evidence-based, expert consensus recommendations for the management of hip and knee osteoarthritis (OA), which are adaptable and designed to assist physicians and allied health care professionals in general and specialist practise throughout the world.

METHODS: Sixteen experts from four medical disciplines (primary care, rheumatology, orthopaedics and evidence-based medicine), two continents and six countries (USA, UK, France, Netherlands, Sweden and Canada) formed the guidelines development team. A systematic review of existing guidelines for the management of hip and knee OA published between 1945 and January 2006 was undertaken using the validated appraisal of guidelines research and evaluation (AGREE) instrument. A core set of management modalities was generated based on the agreement between guidelines. Evidence before 2002 was based on a systematic review conducted by European League Against Rheumatism and evidence after 2002 was updated using MEDLINE, EMBASE, CINAHL, AMED, the Cochrane Library and HTA reports. The quality of evidence was evaluated, and where possible, effect size (ES), number needed to treat, relative risk or odds ratio and cost per quality-adjusted life years gained were estimated. Consensus recommendations were produced following a Delphi exercise and the strength of recommendation (SOR) for propositions relating to each modality was determined using a visual analogue scale.

RESULTS: Twenty-three treatment guidelines for the management of hip and knee OA were identified from the literature search, including six opinion-based, five evidence-based and 12 based on both expert opinion and research evidence. Twenty out of 51 treatment modalities addressed by these guidelines were universally recommended. ES for pain relief varied from treatment to treatment. Overall there was no statistically significant difference between non-pharmacological therapies [0.25, 95% confidence interval (CI) 0.16, 0.34] and pharmacological therapies (ES=0.39, 95% CI 0.31, 0.47). Following feedback from Osteoarthritis Research International members on the draft guidelines and six Delphi rounds consensus was reached on 25 carefully worded recommendations. Optimal management of patients with OA hip or knee requires a combination of non-pharmacological and pharmacological modalities of therapy. Recommendations cover the use of 12 non-pharmacological modalities: education and self-management, regular telephone contact, referral to a physical therapist, aerobic, muscle strengthening and water-based exercises, weight reduction, walking aids, knee braces, footwear and insoles, thermal modalities, transcutaneous electrical nerve stimulation and acupuncture. Eight recommendations cover pharmacological modalities of treatment including acetaminophen, cyclooxygenase-2 (COX-2) non-selective and selective oral non-steroidal anti-inflammatory drugs (NSAIDs), topical NSAIDs and capsaicin, intra-articular injections of corticosteroids and hyaluronates, glucosamine and/or chondroitin sulphate for symptom relief; glucosamine sulphate, chondroitin sulphate and diacerein for possible structure-modifying effects and the use of opioid analgesics for the treatment of refractory pain. There are recommendations covering five surgical modalities: total joint replacements, unicompartmental knee replacement, osteotomy and joint preserving surgical procedures; joint lavage and arthroscopic debridement in knee OA, and joint fusion as a salvage procedure when joint replacement had failed. Strengths of recommendation and 95% CIs are provided.

CONCLUSION: Twenty-five carefully worded recommendations have been generated based on a critical appraisal of existing guidelines, a systematic review of research evidence and the consensus opinions of an international, multidisciplinary group of experts. The recommendations may be adapted for use in different countries or regions according to the availability of treatment modalities and SOR for each modality of therapy. These recommendations will be revised regularly following systematic review of new research evidence as this becomes available.

PMID: 18279766

Rating: 1b

February 27, 2008 — The Osteoarthritis Research Society International (OARSI) has issued 25 evidence-based, expert consensus recommendations for the management of osteoarthritis (OA) of the hip and knee. These guidelines, which are published in the February issue of *Osteoarthritis and Cartilage*, were intended to be adapted for use in different countries or regions according to the availability of treatment modalities and strength of recommendation (SOR) for each modality of therapy.

"Osteoarthritis (OA) is the most common type of arthritis and the major cause of chronic musculoskeletal pain and mobility disability in elderly populations worldwide," write W. Zhang, PhD, from the University of Edinburgh, Osteoarticular Research Group, Queen's Medical Research Institute, Edinburgh, United Kingdom. "Knee and hip pain are the major causes of difficulty in walking and climbing stairs in the elderly in Europe and the USA and as many as 40% of people over the age of 65 in the community in the United Kingdom suffer symptoms associated with knee or hip OA." The objective

of these guidelines was to develop concise, current, patient-centered, evidence-based, expert consensus recommendations for the management of hip and knee OA. The panel intended these guidelines to be adaptable and designed them as an aid to clinicians and allied healthcare professionals in general and specialist practice throughout the world. Goals of treatment of knee and hip OA include decreasing joint pain and stiffness, stabilizing and increasing joint mobility, reducing physical limitations and disability, improving health-related quality of life, limiting the progression of joint damage, and providing patient education regarding the nature and management of OA. The medical literature has described more than 50 modalities of nonpharmacologic, pharmacologic, and surgical therapy for knee and hip OA. Despite the development of several National and Regional Guidelines to guide clinicians, allied healthcare professionals, and patients in their choice of treatment to manage knee and hip OA, there have been no internationally agreed-on and universally applicable guidelines for management. In September 2005, OARSI convened a meeting of an international, multidisciplinary committee of experts to critically review all existing evidence-based and consensus guidelines as well as the recent research evidence and to develop up-to-date, evidence-based, globally relevant consensus recommendations for management of knee and hip OA in 2007. "Patients with hip or knee OA who are not obtaining adequate pain relief and functional improvement from a combination of non-pharmacological and pharmacological treatment should be considered for joint replacement surgery," the authors of the guidelines write. "Replacement arthroplasties are effective, and cost-effective interventions for patients with significant symptoms, and/or functional limitations associated with a reduced health-related quality of life, despite conservative therapy." OARSI provided financial support for development of these guidelines. The authors of the guidelines have disclosed various financial relationships with such industrial entities as Abbott, AstraZeneca, Merck, Bristol-Meyers Squibb, GlaxoSmithKline, and Novartis.

Clinical Context: OA is the most common form of arthritis, and as many as 40% of community-dwelling adults older than 65 years in the United Kingdom have symptoms associated with OA of the hip or knee. Despite the widespread prevalence of OA, there remains controversy regarding the best management of this condition. To address this issue, the OARSI convened 16 experts in 4 medical disciplines to review current guidelines for the management of OA of the hip and knee. Researchers focused on guidelines published between 1945 and January 2006, and they emphasized the quality of evidence in the guidelines as well as ES, number need to treat, and cost per quality-adjusted life years. Consensus among the expert panel was achieved following a specific algorithm, and all current recommendations were assigned an SOR based on a scale of 0 to 100, with a higher assigned value indicating a stronger recommendation.

Study Highlights: The optimal management of OA of the hip and knee combines both nonpharmacologic and pharmacologic treatment modalities (SOR, 96%). The initial treatment of OA should focus on patient empowerment and self-driven therapies. All patients should receive education on lifestyle changes, exercise, pacing of activities, and weight reduction (SOR, 97%). Monthly telephone contact, even by lay personnel, can improve the clinical status of patients with OA (SOR, 66%). A physical therapy consultation focusing on appropriate exercises may benefit patients with OA, although this recommendation is largely based on expert opinion. The physical therapy visit may also include advice regarding assistive devices for ambulation (SOR, 89%). Weight loss is encouraged and can relieve pain and stiffness and improve function (SOR, 96%). Assistive devices for ambulation can reduce pain associated with OA. Frames or wheeled walkers are preferable for patients with bilateral disease (SOR, 90%). Among patients with knee OA and mild or moderate valgus or varus instability, a knee brace can

reduce pain, improve stability, and reduce the risk of falling (SOR, 76%). Insoles can also reduce pain among patients with knee OA (SOR, 77%). Thermal modalities may improve knee OA, but there is less evidence that ice may be effective (SOR, 64%). Transcutaneous electrical nerve stimulation can help with short-term pain control among patients with hip or knee OA (SOR, 58%). Acupuncture can relieve symptoms of knee OA (SOR, 59%). Acetaminophen is the first choice for pharmacologic treatment of OA. Doses up to 4 g/day may be initiated before the use of other medications (SOR, 92%). NSAIDs may be used at their lowest effective dose, and long-term use should be avoided if possible. Among patients at an increased risk for gastrointestinal tract bleeding, clinicians should prescribe either a COX-2 selective agent or a nonselective NSAID with co-prescription of a proton pump inhibitor or misoprostol. NSAIDs should be used with caution among patients with cardiovascular risk factors (SOR, 93%). Topical NSAIDs and capsaicin can be effective as monotherapy or adjunctive treatment for OA of the knee (SOR, 85%). Patients with moderate to severe pain associated with knee OA that is not responding to oral therapy can be treated with intra-articular injections (SOR, 78%). Intra-articular injections of hyaluronate are associated with delayed onset of analgesia but a prolonged duration of action vs injections of corticosteroids (SOR, 64%). Treatment with glucosamine and chondroitin may relieve symptoms of OA, but treatment should be discontinued if there is no relief after 6 months of therapy (SOR, 63%).

Unicompartmental knee replacement is effective among patients with knee OA restricted to a single compartment (SOR, 76%). Osteotomy may be considered for young adults with symptomatic hip OA, whereas high tibial osteotomy may reduce the need for joint replacement among young adults with knee OA (SOR, 75%). Joint fusion of the knee can be performed to salvage a failed joint replacement (SOR, 69%).

Pearls for Practice: The current recommendations for nonpharmacologic treatment of OA of the hip and knee include regular telephone calls from the clinician's office; self-driven therapies; and education on lifestyle changes, exercise, and weight reduction. For patients with knee OA, a knee brace for varus or valgus instability, insoles for appropriate patients, acupuncture, and thermal therapy are recommended. However, the topical application of ice is less proved. The current guidelines for pharmacologic treatment of OA of the hip and knee recommend acetaminophen as the first choice. Other treatments include NSAIDs and glucosamine and chondroitin, but long-term use of these medications should be avoided.

Knee & Leg (Acute & Chronic)

Cochrane T, Davey RC, Matthes Edwards SM. Randomised controlled trial of the cost-effectiveness of water-based therapy for lower limb osteoarthritis. *Health Technol Assess.* 2005 Aug;9(31):iii-iv, ix-xi, 1-114.

Faculty of Health and Sciences, Staffordshire University, Stoke-on-Trent, UK.

OBJECTIVES: To determine the efficacy of community water-based therapy for the management of lower limb osteoarthritis (OA) in older patients.

DESIGN: A pre-experimental matched-control study was used to estimate efficacy of water-based exercise treatment, to check design assumptions and delivery processes. The main study was a randomised controlled trial of the effectiveness of water-based exercise (treatment) compared with usual care (control) in older patients with hip and/or knee OA. The latter was accompanied by an economic evaluation comparing societal costs and consequences of the two treatments.

SETTING: Water exercise was delivered in public swimming pools in the UK. Physical function assessments were carried out in established laboratory settings.

PARTICIPANTS: 106 patients (93 women, 13 men) over the age of 60 years with confirmed hip and/or knee OA took part in the preliminary study. A similar, but larger, group of 312 patients (196 women, 116 men) took part in the main study, randomised into control (159) and water exercise (153) groups.

INTERVENTIONS: Control group patients received usual care with quarterly semi-structured telephone interview follow-up only. The intervention in the main study lasted for 1 year, with a further follow-up period of 6 months.

MAIN OUTCOME MEASURES: Pain score on the Western Ontario and McMaster Universities OA index (WOMAC). Additional outcome measures were included to evaluate effects on quality of life, cost-effectiveness and physical function measurements.

RESULTS: Short-term efficacy of water exercise in the management of lower limb OA was confirmed, with effect sizes ranging from 0.44 [95% confidence interval (CI) 0.03 to 0.85] on WOMAC pain to 0.76 (95% CI 0.33 to 1.17) on WOMAC physical function. Of 153 patients randomised to treatment, 82 (53.5%) were estimated to have complied satisfactorily with their treatment at the 1-year point. This had declined to 28 (18%) by the end of the 6-month follow-up period, during which support for the intervention had been removed and those wishing to continue exercise had to pay their own costs for maintaining their exercise treatment. High levels of co-morbidity were recorded in both groups. Nearly two thirds of all patients had a significant other illness in addition to their OA. Fifty-four control and 53 exercise patients had hospital inpatient episodes during the study period. Water exercise remained effective in the main study but overall effect size was small, on WOMAC pain at 1 year, a reduction of about 10% in group mean pain score. This had declined, and was non-significant, at 18 months. Mean cost difference estimates showed a saving in the water exercise group of pound123--175 per patient per annum and incremental cost-effectiveness ratios ranged from pound3838 to pound5951 per quality-adjusted life-year (QALY). Net reduction in pain was achieved at a net saving of pound135--175 per patient per annum and the ceiling valuation of pound580--740 per unit of WOMAC pain reduction was favourably low.

CONCLUSIONS: Group-based exercise in water over 1 year can produce significant reduction in pain and improvement in physical function in older adults with lower limb OA, and may be a useful adjunct in the management of hip and/or knee OA. The water-exercise programme produced a favourable cost--benefit outcome, using reduction in WOMAC pain as the measure of benefit. Further research is suggested into other similar public health interventions. Investigation is also needed into how general practice can best be supported to facilitate access to participants for research trials in healthcare, as well as an examination of the infrastructure and workforce capacities for physical activity delivery and the

potential extent to which healthcare may be supported in this way. More detailed research is required to develop a better understanding of the types of exercise that will work for the different biomechanical subtypes of knee and hip OA and investigation is needed on access and environmental issues for physical activity programmes for older people, from both a provider and a participant perspective, the societal costs of the different approaches to the management of OA and longer term trends in outcome measures (costs and effects).

PMID: 16095546

Rating: 2a

Goodwin PC, Morrissey MC, Omar RZ, Brown M, Southall K, McAuliffe TB, Effectiveness of supervised physical therapy in the early period after arthroscopic partial meniscectomy, *Phys Ther.* 2003 Jun;83(6):520-35

Centre for Applied Biomedical Research, GKT School of Biomedical Sciences, King's College London, London, United Kingdom.

BACKGROUND AND PURPOSE: Controversy exists about the effectiveness of physical therapy after arthroscopic partial meniscectomy. This randomized controlled trial evaluated the effectiveness of supervised physical therapy with a home program versus a home program alone. **SUBJECTS:** Eighty-four patients (86% males; overall mean age=39 years, SD=9, range=21-58; female mean age=39 years, SD=9, range=24-58; male mean age=40, SD=9, range=21-58) who underwent an uncomplicated arthroscopic partial meniscectomy participated.

METHODS: Subjects were randomly assigned to either a group who received 6 weeks of supervised physical therapy with a home program or a group who received only a home program. Blinded test sessions were conducted 5 and 50 days after surgery. Outcome measures were: (1) Hughston Clinic questionnaire, (2) Medical Outcomes Study 36-Item Short-Form Health Survey (SF-36) and EuroQol EQ-5D (EQ-5D) questionnaires, (3) number of days to return to work after surgery divided by the Factor Occupational Rating System score, (4) kinematic analysis of knee function during level walking and stair use, and (5) horizontal and vertical hops.

RESULTS: No differences between groups were found for any of the outcomes measured.

DISCUSSION AND CONCLUSION: The results indicate that the supervised physical therapy used in this study is not beneficial for patients in the early period after uncomplicated arthroscopic partial meniscectomy.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 12775198

Rating: 2b

Lowe CJ, Barker KL, Dewey M, Sackley CM. Effectiveness of physiotherapy exercise after knee arthroplasty for osteoarthritis: systematic review and meta-analysis of randomised controlled trials. *BMJ*. 2007 Oct 20;335(7624):812. Epub 2007 Sep 20.

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OBJECTIVE: To evaluate the effectiveness of physiotherapy exercise after elective primary total knee arthroplasty in patients with osteoarthritis.

DESIGN: Systematic review.

DATA SOURCES: Database searches: AMED, CINAHL, Embase, King's Fund, Medline, Cochrane library (Cochrane reviews, Cochrane central register of controlled trials, DARE), PEDro, Department of Health national research register. Hand searches: Physiotherapy, Physical Therapy, Journal of Bone and Joint Surgery (Britain) Conference Proceedings. Review methods Randomised controlled trials were reviewed if they included a physiotherapy exercise intervention compared with usual or standard physiotherapy care, or compared two types of exercise physiotherapy interventions meeting the review criteria, after discharge from hospital after elective primary total knee arthroplasty for osteoarthritis.

OUTCOME MEASURES: Functional activities of daily living, walking, quality of life, muscle strength, and range of motion in the knee joint. Trial quality was extensively evaluated. Narrative synthesis plus meta-analyses with fixed effect models, weighted mean differences, standardised effect sizes, and tests for heterogeneity.

RESULTS: Six trials were identified, five of which were suitable for inclusion in meta-analyses. There was a small to moderate standardised effect size (0.33, 95% confidence interval 0.07 to 0.58) in favour of functional exercise for function three to four months postoperatively. There were also small to moderate weighted mean differences of 2.9 (0.61 to 5.2) for range of joint motion and 1.66 (-1 to 4.3) for quality of life in favour of functional exercise three to four months postoperatively. Benefits of treatment were no longer evident at one year

CONCLUSIONS: Interventions including physiotherapy functional exercises after discharge result in short term benefit after elective primary total knee arthroplasty. Effect sizes are small to moderate, with no long term benefit.

PMID: 17884861

Rating: 1b

September 24, 2007 — Functional exercises after discharge from the hospital result in a small to moderate short-term, but not long-term, benefit after elective primary total knee arthroplasty, according

to an analysis of interventions from randomized trials, including physiotherapy, reported in the September 20 Online First issue of the BMJ. "As the length of hospital stay after joint arthroplasty surgery has markedly and rapidly decreased, and given that patients who undergo knee arthroplasty may still experience considerable functional impairment postoperatively, the effectiveness of physiotherapy after discharge is a valid question," write Catherine J. Minns Lowe, from the University of Birmingham, United Kingdom, and colleagues. "The present uncertainty regarding effectiveness makes it difficult for commissioning organisations, healthcare practitioners, and patients to make decisions regarding such physiotherapy." Limitations of this review include possible failure to identify all pertinent studies, some studies that were relatively small and not included in the review, limited usefulness of range of motion in the knee as an outcome measure of physiotherapy interventions, no direct measurements of muscle strength in any of the trials, and limited number and size of available studies. "Presently, given the reduction in length of hospital stay, compressed inpatient rehabilitation, and the limitations of the available evidence, it seems reasonable to refer patients for a short course of physiotherapy after discharge to provide short term benefit," the review authors conclude. "While range of motion may be limited as an outcome measure of physiotherapy, the small to moderate standardised effect size obtained for function, which favours the intervention, is considered clinically important.... In the short term physiotherapy exercise interventions with exercises based on functional activities may be more effective after total knee arthroplasty than traditional exercise programmes, which concentrate on isometric muscle exercises and exercises to increase range of motion in the joint." Two of the review authors have disclosed financial relationships with the Department of Health and National Health Service research and development. In an accompanying editorial, Rob Herbert, PhD, and Marlene Fransen, PhD, MPH, from the University of Sydney and George Institute for International Health, also in Sydney, Australia, describe the findings of this meta-analysis as "provisional at best." In 4 of the 6 trials included in the review, all study participants were assigned either an exercise or physiotherapy program after hospital discharge; therefore, the effects of an exercise intervention could not be isolated. The other 2 trials focused on the effects of outpatient programs on the range of knee flexion and found little or no effect. "Most of the trials evaluated low intensity exercise programmes provided soon after surgery," Drs. Herbert and Fransen write. "More lengthy and intensive physiotherapy exercise programmes may be needed to overcome the considerable deficits in muscle strength and endurance that are evident in these patients.... It is difficult to make clinical recommendations on the basis of Minns Lowe and colleagues' review, although it does highlight the lack of research into the effectiveness of physiotherapy exercise programmes after total knee replacement."

Clinical Context: In elderly people, osteoarthritis is the most frequent cause of disability, with more than 80% of patients limited in activities of daily living including work, housework, and mobility outside the home. Given the trend toward reduced length of hospital stay after joint arthroplasty and the considerable functional postoperative impairment after knee arthroplasty, there is a need to determine the efficacy of physiotherapy after discharge. The existing uncertainty on the efficacy of physiotherapy in this setting hinders well-reasoned decisions regarding physiotherapy by third-party payers, clinicians, and patients. This systematic review of randomized controlled trials examined the effectiveness of physiotherapy exercise after hospital discharge for elective primary unilateral total knee arthroplasty in improving function, quality of life, walking, range of motion in the knee, and muscle strength.

Study Highlights: Of 27 potentially relevant studies, 6 trials were identified that met inclusion criteria for review, and 5 were suitable for meta-analyses with fixed-effect models, weighted mean differences,

standardized effect sizes, and tests for heterogeneity. The number of participants was 554 in the 5 trials included in the meta-analyses, and 614 participants were included overall in the review. In 4 of the 6 trials included, all study participants were assigned either an exercise or physiotherapy program after hospital discharge; therefore, the effects of an exercise intervention could not be isolated. The other 2 trials focused primarily on the effects of outpatient programs on the range of flexion in the joint, which had little or no effect.

Pearls for Practice: Physiotherapy functional exercise was associated with small to moderate, short-term benefits in improved function, range of motion in the knee, and quality of life 3 to 4 months after elective primary total knee arthroplasty for osteoarthritis. At 1 year, any benefits of treatment seen 3 to 4 months after surgery were no longer apparent.

Philadelphia Panel, Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for knee pain, *Phys Ther* 2001 Oct;81(10):1675-700

INTRODUCTION: A structured and rigorous methodology was developed for the formulation of evidence-based clinical practice guidelines (EBCPGs), then was used to develop EBCPGs for selected rehabilitation interventions for the management of knee pain.

METHODS: Evidence from randomized controlled trials (RCTs) and observational studies were identified and synthesized using methods defined by the Cochrane Collaboration that minimize bias by using a systematic approach to literature search, study selection, data extraction, and data synthesis. Meta-analysis was conducted where possible. The strength of evidence was graded as level I for RCTs or level II for nonrandomized studies.

DEVELOPING RECOMMENDATIONS: An expert panel was formed by inviting stakeholder professional organizations to nominate a representative. This panel developed a set of criteria for grading the strength of both the evidence and the recommendation. The panel decided that evidence of clinically important benefit (defined as 15% greater relative to a control based on panel expertise and empiric results) in patient-important outcomes was required for a recommendation. Statistical significance was also required but was insufficient alone. Patient-important outcomes were decided by consensus as being pain, function, patient global assessment, quality of life, and return to work, providing that these outcomes were assessed with a scale for which measurement reliability and validity have been established.

VALIDATING THE RECOMMENDATIONS: A feedback survey questionnaire was sent to 324 practitioners from 6 professional organizations. The response rate was 51%.

RESULTS: Two positive recommendations of clinical benefit were developed: (1) transcutaneous electrical nerve stimulation (TENS) and therapeutic exercises were beneficial for knee osteoarthritis, and (2) there was good agreement with these recommendations from practitioners (73% for TENS, 98% for exercises). For several interventions and indications (eg, thermotherapy, therapeutic ultrasound, massage, electrical stimulation), there was a lack of evidence regarding efficacy.

CONCLUSIONS: This methodology of developing EBCPGs provides a structured approach to assessing the literature and developing EBCPGs that incorporates clinicians' feedback and is widely acceptable to practicing clinicians. Further well-designed RCTs are warranted regarding the use of several interventions for patients with knee pain where evidence was insufficient to make recommendations.

Publication Types:

- Consensus Development Conference
- Guideline
- Meta-Analysis
- Practice Guideline
- Review

PMID: 11589643

Rand SE, Goerlich C, Marchand K, Jablecki N. The physical therapy prescription. *Am Fam Physician*. 2007 Dec 1;76(11):1661-6.

Conroe Medical Education Foundation, Conroe, TX, USA. scottrand@lonestarfamly.org

Numerous guidelines recommend physical therapy for the management of musculoskeletal conditions. However, specific recommendations are lacking concerning which exercises and adjunct modalities to use. Physical therapists use various techniques to reduce pain and improve mobility and flexibility. There is some evidence that specific exercises performed with the instruction of physical therapists improve outcomes in patients with low back pain. For most modalities, evidence of effectiveness is variable and controlled trials are lacking. Multiple modalities may be used to treat one clinical condition; decisions for the treatment of an individual patient depend on the expertise of the therapist, the equipment available, and the desire of the attending physician. A physical therapy prescription should include the diagnosis; type, frequency, and duration of the prescribed therapy; goals of therapy; and safety precautions.

PMID: 18092708

Rating: 5b

December 12, 2007 — Various treatments and modalities that a family clinician should know and include in physical therapy orders are reviewed in an article published in the December 1 issue of the *American Family Physician*. "Physical therapists are an integral part of inpatient and outpatient treatment of neurologic and musculoskeletal injuries and disabilities," write Scott E. Rand, MD, from the Conroe Medical Education Foundation in Conroe, Texas, and colleagues. "They also can assist with and augment the care of patients with cardiac, pulmonary, and developmental disorders. Family physicians should have some understanding of the various treatments and modalities used by physical therapists." Frequently used modalities of physical therapy include ultrasound, phonophoresis, iontophoresis, electrical stimulation, and low-level laser therapy. In ultrasound therapy, high-frequency sound waves are used to warm superficial soft tissues or with the intention of facilitating tissue healing at the cellular

level. Ultrasound may be useful for tendon injuries or for short-term pain relief of muscle strain or spasm, but it should not be used near malignant tumors, nerve tissue in a patient who has recently had a laminectomy, joint replacements, permanent pacemakers, thrombophlebitis, eyes, reproductive organs, areas of acute inflammation, epiphyseal plates, or over breast implants. For Olympic athletes, exemption is needed for use of ultrasound. Phonophoresis refers to use of ultrasound to deliver therapeutic medications to subcutaneous tissues. This modality may be useful for inflammatory conditions including tendonitis, arthritis, and bursitis, and contraindications are the same as for ultrasound. During iontophoresis, an electric current helps deliver ionically charged substances through the skin to reach deeper tissues. Therefore, it may be indicated for calcific tendinopathy, inflammatory conditions, or hyperhidrosis. Contraindications to use of iontophoresis include allergy or sensitivity to the substance being applied, open wounds, or impaired sensation. Iontophoresis also should not be used in the immediate vicinity of metallic implants, wires, or staples. Electrical stimulation causes a therapeutic effect by generating an action potential in nerve tissue, thereby causing a muscle contraction or change in sensory input. Electronic muscle stimulation may be useful for muscle spasm or contusion, whereas transcutaneous electrical nerve stimulation may help relieve neuropathic pain. Electrical stimulation is contraindicated in patients with cardiac pacemakers, known cardiac arrhythmias, or thrombophlebitis or thrombosis. It should not be used at all on the abdomen or pelvis of pregnant patients, and it should be used only with caution in patients with cardiac disease, malignant tumors, open wounds, or in those with impaired sensation, cognitive function, or communication ability. Low-level laser therapy acts via absorption of photon radiation, thereby affecting cellular oxidative metabolism and reducing concentrations of prostaglandin E2. This modality may be effective for minor musculoskeletal pain, carpal tunnel syndrome, osteoarthritis, or rheumatoid arthritis. However, it should be used with caution in patients with malignant tumors or in those being treated with anticoagulants, corticosteroids, or immunosuppressants, and it should not be used on the uterus of pregnant patients. Patients and therapists should use safety goggles to limit eye exposure to therapeutic wavelengths.

Specific clinical recommendations are as follows: Supervised therapeutic exercise improves outcomes in patients who have osteoarthritis or claudication of the knee (level of evidence, B). Compared with home exercise, supervised therapeutic exercise has been shown to improve walking speed and distance. Compared with usual care, iontophoresis is associated with improved outcomes in patients with myositis ossificans (level of evidence, B). In patients with osteoarthritis and rheumatoid arthritis, low-level laser therapy has been demonstrated to offer limited benefit (level of evidence, B). This modality has been associated with symptomatic benefit in the treatment of several inflammatory conditions, without known adverse effects. Better standardization should help define the role of this modality. "The frequency and duration of physical therapy treatments will vary based on the patient's condition," the study authors conclude. "Acute muscle strains often benefit from daily treatment over a short period, whereas chronic injuries are usually addressed less frequently over an extended period. . . . It is important for the physical therapist to document the patient's progress so that the physician can modify the care plan, if needed."

Clinical Context: For patients with neurologic and musculoskeletal injuries and disabilities, physical therapy is a cornerstone of management. In addition, physical therapy can be useful in the treatment of patients with cardiac, pulmonary, and developmental conditions. Therefore, it is useful for family practitioners and primary care providers to be familiar with available modalities of physical therapy and treatment regimens, and indications and contraindications for their use. Treatment decisions for an individual patient should be based on the expertise of the therapist, availability of needed equipment, and

goals set by the attending clinician. The present review describes recommended use of various modalities of physical therapy and necessary components of a physical therapy prescription.

Study Highlights: The physical therapy prescription should include diagnosis (with proper coding for accurate insurance billing and reimbursement); type, frequency, and duration of the prescribed therapy; preferred protocols or treatments; therapeutic goals; and safety precautions (eg, joint range-of-motion and weight-bearing limitations, and concurrent illnesses). For a therapist to perform the requested services, clinician signature and date are required. Frequency and duration of physical therapy treatments vary based on the patient's condition. Acute muscle strains may benefit from a short period of daily treatment, whereas less frequent treatment during a longer period is appropriate for chronic injuries. The physical therapist should document the patient's progress so that the clinician can modify the care plan as needed. In ultrasound therapy, high-frequency sound waves warm superficial soft tissues or promote tissue healing at the cellular level. Ultrasound may be useful for tendon injuries or for short-term pain relief of muscle strain or spasm. It should not be used near malignant tumors, nerve tissue in a patient who has recently had a laminectomy, joint replacements, permanent pacemakers, thrombophlebitis, eyes, reproductive organs, areas of acute inflammation, epiphyseal plates, or over breast implants. Exemption is needed for use of ultrasound in Olympic athletes. Phonophoresis, or ultrasound used to deliver therapeutic medications to subcutaneous tissues, may be useful for inflammatory conditions (eg, tendonitis, arthritis, and bursitis). Contraindications are the same as for ultrasound. During iontophoresis, electric current delivers ionically charged substances through the skin to deeper tissues. It may be indicated for calcific tendinopathy, inflammatory conditions, or hyperhidrosis, and is contraindicated for allergy or sensitivity to the applied substance, open wounds, or impaired sensation. It should not be used near metallic implants, wires, or staples. Electrical stimulation generates an action potential in nerve tissue, which causes a muscle contraction or change in sensory input. Contraindications are cardiac pacemakers, cardiac arrhythmias, thrombophlebitis, thrombosis, and abdominal or pelvic use in pregnancy. It should be used only with caution in patients with cardiac disease, malignancy, open wounds, or in those with impaired sensation, cognition, or communication. Electronic muscle stimulation may relieve muscle spasm or contusion; transcutaneous electrical nerve stimulation may help relieve neuropathic pain. Low-level laser therapy acts via absorption of photon radiation, affecting cellular oxidative metabolism and reducing concentrations of prostaglandin E2. It may be effective for minor musculoskeletal pain, carpal tunnel syndrome, osteoarthritis, or rheumatoid arthritis. Low-level laser therapy should be used with caution in patients with malignant tumors or in those being treated with anticoagulants, corticosteroids, or immunosuppressants. It should not be used over the uterus of pregnant patients. Safety goggles are needed to limit eye exposure to therapeutic wavelengths. Supervised therapeutic exercise improves outcomes for osteoarthritis or claudication of the knee. Supervised therapeutic vs home exercise has been shown to improve walking speed and distance. Iontophoresis vs usual care improves outcomes in patients with myositis ossificans. In osteoarthritis and rheumatoid arthritis, low-level laser therapy has been shown to provide limited benefit, without known adverse effects. Better standardization should be helpful.

Pearls for Practice: A physical therapy prescription should include diagnosis; type, frequency, and duration of the prescribed therapy; specific protocols or treatments that the clinician wants the therapist to use; therapeutic goals; and safety precautions. For a therapist to perform the requested services, clinician signature and date are required. Supervised therapeutic exercise improves outcomes in patients who have osteoarthritis or claudication of the knee. Compared with usual care, iontophoresis is

associated with improved outcomes in patients with myositis ossificans. In patients with osteoarthritis and rheumatoid arthritis, low-level laser therapy has been demonstrated to offer limited benefit. Level of evidence for all of these recommendations is grade B.

Zhang W, Moskowitz RW, Nuki G, Abramson S, Altman RD, Arden N, Bierma-Zeinstra S, Brandt KD, Croft P, Doherty M, Dougados M, Hochberg M, Hunter DJ, Kwoh K, Lohmander LS, Tugwell P. OARSI recommendations for the management of hip and knee osteoarthritis, Part II: OARSI evidence-based, expert consensus guidelines. *Osteoarthritis Cartilage*. 2008 Feb;16(2):137-62.

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PURPOSE: To develop concise, patient-focussed, up to date, evidence-based, expert consensus recommendations for the management of hip and knee osteoarthritis (OA), which are adaptable and designed to assist physicians and allied health care professionals in general and specialist practise throughout the world.

METHODS: Sixteen experts from four medical disciplines (primary care, rheumatology, orthopaedics and evidence-based medicine), two continents and six countries (USA, UK, France, Netherlands, Sweden and Canada) formed the guidelines development team. A systematic review of existing guidelines for the management of hip and knee OA published between 1945 and January 2006 was undertaken using the validated appraisal of guidelines research and evaluation (AGREE) instrument. A core set of management modalities was generated based on the agreement between guidelines. Evidence before 2002 was based on a systematic review conducted by European League Against Rheumatism and evidence after 2002 was updated using MEDLINE, EMBASE, CINAHL, AMED, the Cochrane Library and HTA reports. The quality of evidence was evaluated, and where possible, effect size (ES), number needed to treat, relative risk or odds ratio and cost per quality-adjusted life years gained were estimated. Consensus recommendations were produced following a Delphi exercise and the strength of recommendation (SOR) for propositions relating to each modality was determined using a visual analogue scale.

RESULTS: Twenty-three treatment guidelines for the management of hip and knee OA were identified from the literature search, including six opinion-based, five evidence-based and 12 based on both expert opinion and research evidence. Twenty out of 51 treatment modalities addressed by these guidelines were universally recommended. ES for pain relief varied from treatment to treatment. Overall there was no statistically significant difference between non-pharmacological therapies [0.25, 95% confidence interval (CI) 0.16, 0.34] and pharmacological therapies (ES=0.39, 95% CI 0.31, 0.47). Following feedback from Osteoarthritis Research International members on the draft guidelines and six Delphi rounds consensus was reached on 25 carefully worded recommendations. Optimal management of patients with OA hip or knee requires a combination of non-pharmacological and pharmacological modalities of therapy. Recommendations cover the use of 12 non-pharmacological modalities: education and self-management, regular telephone contact, referral to a physical therapist, aerobic, muscle strengthening and water-based exercises, weight reduction, walking aids, knee braces, footwear and

insoles, thermal modalities, transcutaneous electrical nerve stimulation and acupuncture. Eight recommendations cover pharmacological modalities of treatment including acetaminophen, cyclooxygenase-2 (COX-2) non-selective and selective oral non-steroidal anti-inflammatory drugs (NSAIDs), topical NSAIDs and capsaicin, intra-articular injections of corticosteroids and hyaluronates, glucosamine and/or chondroitin sulphate for symptom relief; glucosamine sulphate, chondroitin sulphate and diacerein for possible structure-modifying effects and the use of opioid analgesics for the treatment of refractory pain. There are recommendations covering five surgical modalities: total joint replacements, unicompartmental knee replacement, osteotomy and joint preserving surgical procedures; joint lavage and arthroscopic debridement in knee OA, and joint fusion as a salvage procedure when joint replacement had failed. Strengths of recommendation and 95% CIs are provided.

CONCLUSION: Twenty-five carefully worded recommendations have been generated based on a critical appraisal of existing guidelines, a systematic review of research evidence and the consensus opinions of an international, multidisciplinary group of experts. The recommendations may be adapted for use in different countries or regions according to the availability of treatment modalities and SOR for each modality of therapy. These recommendations will be revised regularly following systematic review of new research evidence as this becomes available.

PMID: 18279766

Rating: 1b

February 27, 2008 — The Osteoarthritis Research Society International (OARSI) has issued 25 evidence-based, expert consensus recommendations for the management of osteoarthritis (OA) of the hip and knee. These guidelines, which are published in the February issue of *Osteoarthritis and Cartilage*, were intended to be adapted for use in different countries or regions according to the availability of treatment modalities and strength of recommendation (SOR) for each modality of therapy. "Osteoarthritis (OA) is the most common type of arthritis and the major cause of chronic musculoskeletal pain and mobility disability in elderly populations worldwide," write W. Zhang, PhD, from the University of Edinburgh, Osteoarticular Research Group, Queen's Medical Research Institute, Edinburgh, United Kingdom. "Knee and hip pain are the major causes of difficulty in walking and climbing stairs in the elderly in Europe and the USA and as many as 40% of people over the age of 65 in the community in the United Kingdom suffer symptoms associated with knee or hip OA." The objective of these guidelines was to develop concise, current, patient-centered, evidence-based, expert consensus recommendations for the management of hip and knee OA. The panel intended these guidelines to be adaptable and designed them as an aid to clinicians and allied healthcare professionals in general and specialist practice throughout the world. Goals of treatment of knee and hip OA include decreasing joint pain and stiffness, stabilizing and increasing joint mobility, reducing physical limitations and disability, improving health-related quality of life, limiting the progression of joint damage, and providing patient education regarding the nature and management of OA. The medical literature has described more than 50 modalities of nonpharmacologic, pharmacologic, and surgical therapy for knee and hip OA. Despite the development of several National and Regional Guidelines to guide clinicians, allied healthcare professionals, and patients in their choice of treatment to manage knee and hip OA, there have been no internationally agreed-on and universally applicable guidelines for management. In September 2005, OARSI convened a meeting of an international, multidisciplinary committee of experts to critically

review all existing evidence-based and consensus guidelines as well as the recent research evidence and to develop up-to-date, evidence-based, globally relevant consensus recommendations for management of knee and hip OA in 2007. "Patients with hip or knee OA who are not obtaining adequate pain relief and functional improvement from a combination of non-pharmacological and pharmacological treatment should be considered for joint replacement surgery," the authors of the guidelines write. "Replacement arthroplasties are effective, and cost-effective interventions for patients with significant symptoms, and/or functional limitations associated with a reduced health-related quality of life, despite conservative therapy." OARSI provided financial support for development of these guidelines. The authors of the guidelines have disclosed various financial relationships with such industrial entities as Abbott, AstraZeneca, Merck, Bristol-Meyers Squibb, GlaxoSmithKline, and Novartis.

Clinical Context: OA is the most common form of arthritis, and as many as 40% of community-dwelling adults older than 65 years in the United Kingdom have symptoms associated with OA of the hip or knee. Despite the widespread prevalence of OA, there remains controversy regarding the best management of this condition. To address this issue, the OARSI convened 16 experts in 4 medical disciplines to review current guidelines for the management of OA of the hip and knee. Researchers focused on guidelines published between 1945 and January 2006, and they emphasized the quality of evidence in the guidelines as well as ES, number need to treat, and cost per quality-adjusted life years. Consensus among the expert panel was achieved following a specific algorithm, and all current recommendations were assigned an SOR based on a scale of 0 to 100, with a higher assigned value indicating a stronger recommendation.

Study Highlights: The optimal management of OA of the hip and knee combines both nonpharmacologic and pharmacologic treatment modalities (SOR, 96%). The initial treatment of OA should focus on patient empowerment and self-driven therapies. All patients should receive education on lifestyle changes, exercise, pacing of activities, and weight reduction (SOR, 97%). Monthly telephone contact, even by lay personnel, can improve the clinical status of patients with OA (SOR, 66%). A physical therapy consultation focusing on appropriate exercises may benefit patients with OA, although this recommendation is largely based on expert opinion. The physical therapy visit may also include advice regarding assistive devices for ambulation (SOR, 89%). Weight loss is encouraged and can relieve pain and stiffness and improve function (SOR, 96%). Assistive devices for ambulation can reduce pain associated with OA. Frames or wheeled walkers are preferable for patients with bilateral disease (SOR, 90%). Among patients with knee OA and mild or moderate valgus or varus instability, a knee brace can reduce pain, improve stability, and reduce the risk of falling (SOR, 76%). Insoles can also reduce pain among patients with knee OA (SOR, 77%). Thermal modalities may improve knee OA, but there is less evidence that ice may be effective (SOR, 64%). Transcutaneous electrical nerve stimulation can help with short-term pain control among patients with hip or knee OA (SOR, 58%). Acupuncture can relieve symptoms of knee OA (SOR, 59%). Acetaminophen is the first choice for pharmacologic treatment of OA. Doses up to 4 g/day may be initiated before the use of other medications (SOR, 92%). NSAIDs may be used at their lowest effective dose, and long-term use should be avoided if possible. Among patients at an increased risk for gastrointestinal tract bleeding, clinicians should prescribe either a COX-2 selective agent or a nonselective NSAID with co-prescription of a proton pump inhibitor or misoprostol. NSAIDs should be used with caution among patients with cardiovascular risk factors (SOR, 93%). Topical NSAIDs and capsaicin can be effective as monotherapy or adjunctive treatment for OA of the knee (SOR, 85%). Patients with moderate to severe pain associated with knee OA that is not responding

to oral therapy can be treated with intra-articular injections (SOR, 78%). Intra-articular injections of hyaluronate are associated with delayed onset of analgesia but a prolonged duration of action vs injections of corticosteroids (SOR, 64%). Treatment with glucosamine and chondroitin may relieve symptoms of OA, but treatment should be discontinued if there is no relief after 6 months of therapy (SOR, 63%).

Unicompartmental knee replacement is effective among patients with knee OA restricted to a single compartment (SOR, 76%). Osteotomy may be considered for young adults with symptomatic hip OA, whereas high tibial osteotomy may reduce the need for joint replacement among young adults with knee OA (SOR, 75%). Joint fusion of the knee can be performed to salvage a failed joint replacement (SOR, 69%).

Pearls for Practice: The current recommendations for nonpharmacologic treatment of OA of the hip and knee include regular telephone calls from the clinician's office; self-driven therapies; and education on lifestyle changes, exercise, and weight reduction. For patients with knee OA, a knee brace for varus or valgus instability, insoles for appropriate patients, acupuncture, and thermal therapy are recommended. However, the topical application of ice is less proved. The current guidelines for pharmacologic treatment of OA of the hip and knee recommend acetaminophen as the first choice. Other treatments include NSAIDs and glucosamine and chondroitin, but long-term use of these medications should be avoided.

Low Back - Lumbar & Thoracic (Acute & Chronic)

Airaksinen O, Brox JI, Cedraschi C, Hildebrandt J, Klaber-Moffett J, Kovacs F, Mannion AF, Reis S, Staal JB, Ursin H, Zanoli G; On behalf of the COST B13 Working Group on Guidelines for Chronic Low Back Pain. Chapter 4 European guidelines for the management of chronic nonspecific low back pain. *Eur Spine J.* 2006 Mar;15(Supplement 2):s192-s300.

Summary of the concepts of diagnosis in chronic low back pain (CLBP)

Patient assessment

Physical examination and case history: The use of diagnostic triage, to exclude specific spinal pathology and nerve root pain, and the assessment of prognostic factors (yellow flags) are recommended. We cannot recommend spinal palpatory tests, soft tissue tests and segmental range of motion or straight leg raising tests (Lasegue) in the diagnosis of nonspecific CLBP.

Imaging: We do not recommend radiographic imaging (plain radiography, CT or MRI), bone scanning, SPECT, discography or facet nerve blocks for the diagnosis of nonspecific CLBP unless a specific cause is strongly suspected. MRI is the best imaging procedure for use in diagnosing patients with radicular symptoms, or for those in whom discitis or neoplasm is suspected. Plain radiography is recommended for the assessment of structural deformities.

Electromyography: We cannot recommend electromyography for the diagnosis of nonspecific CLBP.
Summary of the concepts of treatment of chronic low back pain (CLBP)

Conservative treatments: Cognitive behavioural therapy, supervised exercise therapy, brief educational interventions, and multidisciplinary (bio-psycho-social) treatment can each be recommended for nonspecific CLBP. Back schools (for short-term improvement), and short courses of manipulation/mobilisation can also be considered. The use of physical therapies (heat/cold, traction, laser, ultrasound, short wave, interferential, massage, corsets) cannot be recommended. We do not recommend TENS.

Pharmacological treatments: The short term use of NSAIDs and weak opioids can be recommended for pain relief. Noradrenergic or noradrenergic-serotonergic antidepressants, muscle relaxants and capsaicin plasters can be considered for pain relief. We cannot recommend the use of Gabapentin.

Invasive treatments: Acupuncture, epidural corticosteroids, intra-articular (facet) steroid injections, local facet nerve blocks, trigger point injections, botulinum toxin, radiofrequency facet denervation, intradiscal radiofrequency lesioning, intradiscal electrothermal therapy, radiofrequency lesioning of the dorsal root ganglion, and spinal cord stimulation cannot be recommended for nonspecific CLBP. Intradiscal injections and prolotherapy are not recommended. Percutaneous electrical nerve stimulation (PENS) and neuroreflexotherapy can be considered where available. Surgery for nonspecific CLBP cannot be recommended unless 2 years of all other recommended conservative treatments – including multidisciplinary approaches with combined programs of cognitive intervention and exercises – have failed, or such combined programs are not available, and only then in carefully selected patients with maximum 2-level degenerative disc disease.

Overarching comments

- In contrast to acute low back pain, only very few guidelines exist for the management of CLBP.
- CLBP is not a clinical entity and diagnosis, but rather a symptom in patients with very different stages of impairment, disability and chronicity. Therefore assessment of prognostic factors before treatment is essential.
- Overall, there is limited positive evidence for numerous aspects of diagnostic assessment and therapy in patients with nonspecific CLBP.
- In cases of low impairment and disability, simple evidence-based therapies (i.e. exercises, brief interventions, and medication) may be sufficient.
- No single intervention is likely to be effective in treating the overall problem of CLBP of longer duration and more substantial disability, owing to its multidimensional nature.
- For most therapeutic procedures, the effect sizes are rather modest.
- The most promising approaches seem to be cognitive behavioural interventions encouraging activity/exercise.
- It is important to get all the relevant players onside and to provide a consistent approach.
- There is strong evidence that TENS is not more effective than placebo or sham TENS in the treatment for chronic low back pain. There are arguments for more research on the effects of TENS, perhaps in combination with other interventions that aim to improve disability.

PMID: 16550448

Rating: 8a

BlueCross BlueShield. Utilization Management Section - Physical Therapy. Policy No: 6. Effective Date: 03/01/2005

Policy/Criteria

- I.** Physical therapy may be medically necessary when all of the following criteria are met:
- a. Services are for the treatment of a covered injury, illness or disease and are appropriate treatment for the condition;
 - b. Treatments are expected to result in significant, functional improvement in a reasonable, and generally predictable period of time, or are necessary for the establishment of a safe and effective maintenance program. Treatments should be directed towards restoration or compensation for lost function. The improvement potential must be significant in relation to the extent and duration of therapy required;
 - c. Therapy is prescribed by an eligible provider as defined by the contract;
 - d. Therapy is rendered by an eligible provider as defined by the member contract;
 - e. The services must be currently accepted standards of medical practice and be specific and effective treatments for the patient's existing condition;
 - f. The complexity of the therapy and the patient's condition must require the judgment and knowledge of a physician or a licensed physical therapist;
 - g. Services do not duplicate those provided concurrently by any other therapy, particularly occupational therapy; and
 - h. Services are not for the treatment of psychological conditions.

II. If the above criteria are met, the following guidelines apply:

The treatments listed below require the skills and expertise of a licensed physical therapist. Different modalities, including but not limited to ultrasound, therapeutic exercise and manual therapy, may be employed in the delivery of these treatments and procedures. In conjunction with delivering these services, the physical therapist is expected to provide teaching and training to the patient and/or caregivers. Maintenance programs must be taught before the end of the active rehabilitation program.

III. The following services are not considered medically necessary:

Ongoing maintenance therapy after the patient has reached maximum rehabilitation potential, or functional level has shown no significant improvement for one to two weeks, and initial instruction in the maintenance program is completed. This is particularly applicable to patients with chronic, stable conditions where skilled supervision/ intervention is no longer required;

Rating: 8b

Cherkin DC, Deyo RA, Battie M, Street J, Barlow W. A Comparison of Physical Therapy, Chiropractic Manipulation, and Provision of an Educational Booklet for the Treatment of Patients with Low Back Pain. *NEJM* 1998;339:1021-9.

Department of Health Services, University of Washington, Seattle 98101, USA.

We randomly assigned 321 adults with low back pain that persisted for seven days after a primary care

visit to the McKenzie method of physical therapy, chiropractic manipulation, or a minimal intervention (provision of an educational booklet).

CONCLUSIONS: For patients with low back pain, the McKenzie method of physical therapy and chiropractic manipulation had similar effects and costs, and patients receiving these treatments had only marginally better outcomes than those receiving the minimal intervention of an educational booklet. Whether the limited benefits of these treatments are worth the additional costs is open to question.

PMID: 9761803

From the Cochrane Library:

The authors' conclusion appears to be justified given the uncertainties in the data. Regarding the issue of generalisability to other settings or countries, it was noted that the generalisability of the study results was limited by the use of a single health care system, the use of specific forms of chiropractic and physical therapy, the use of one month of therapy, and the exclusion of patients with sciatica. Appropriate comparisons were made with other studies. The issue of whether the study sample was representative of the study population was discussed in the authors' comments.

Implications of the study.

Given the limited benefits and high costs, it seems unwise to refer all patients with low back pain for chiropractic or McKenzie therapy. Ideally, there would be some way of identifying the subgroups that would be most likely to benefit from one or both of these therapies, though the authors were unable to identify any predictive characteristics.

Rating: 2a, RCT, 321 cases

Erdogmus CB, Resch KL, Sabitzer R, Müller H, Nuhr M, Schögl A, Posch M, Osterode W, Ungersböck K, Ebenbichler GR. Physiotherapy-based rehabilitation following disc herniation operation: results of a randomized clinical trial. *Spine*. 2007 Sep 1;32(19):2041-9.

Department of Physical Medicine & Rehabilitation, Vienna Medical University, Vienna, Austria.

STUDY DESIGN: Three-group, randomized, single blinded, controlled trial.

OBJECTIVE: To test the effectiveness of physiotherapy-based rehabilitation starting 1 week after lumbar disc surgery. In addition, we tried to estimate the contribution of specific effects to the observed outcome (efficacy).

SUMMARY OF BACKGROUND DATA: Physiotherapy-based rehabilitation is usually recommended for patients following lumbar disc surgery. Few and conflicting data exist for the relative effectiveness of this intervention.

METHODS: A total of 120 patients following first-time, uncomplicated lumbar disc surgery were randomly assigned to "comprehensive" physiotherapy, "sham" neck massage, or no therapy. Before enrollment, all subjects completed a minimal physiotherapeutic intervention. Physiotherapy was administered by experienced physiotherapists and consisted of 20 sessions per patient over 12 weeks. Masseurs administered "sham massage" to the neck. The amount of treatment time was equal to that of physiotherapy. The main outcome measure was the Low Back Pain Rating Score (LBPRS) at 6 and 12 weeks, and 1.5 years after randomization. Secondary parameters were patients' overall satisfaction with treatment outcome and socioeconomic and psychologic measures.

RESULTS: At the end of therapy (12 weeks), the LBPRS revealed a significantly better improvement in the physiotherapy group than in the untreated group. LBPRS outcome, however, did not significantly differ between physiotherapy and "sham" therapy. There was a tendency toward significance between the sham therapy and no therapy. Within the 1.5-year follow-up, LBP rating scales remained significantly improved compared with baseline, but there were no significant outcome differences. No statistically significant between-group differences were found for the secondary outcome parameters.

CONCLUSION: As compared with no therapy, physiotherapy following first-time disc herniation operation is effective in the short-term. Because of the limited benefits of physiotherapy relative to "sham" therapy, it is open to question whether this treatment acts primarily physiologically in patients following first-time lumbar disc surgery, but psychological factors may contribute substantially to the benefits observed.

PMID: 17762803

Rating: 2b

Fritz JM, George SZ. Identifying psychosocial variables in patients with acute work-related low back pain: the importance of fear-avoidance beliefs. Phys Ther. 2002 Oct;82(10):973-83.

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BACKGROUND AND PURPOSE: Psychosocial factors are known to affect recovery from acute low back pain. The factors with the greatest influence and the optimal methods of measurement and interpretation have not been established. The purpose of this study was to examine baseline psychosocial variables and their ability to predict prolonged work restrictions.

SUBJECTS: The subjects were 78 people with work-related low back pain who were participating in a clinical trial (mean age=37.4 years, SD=10.4, range=18-58; mean duration of pain=5.5 days, SD=4.6, range=0-19).

METHODS: A baseline examination including measures of impairment, disability, and psychosocial variables was performed. All subjects had physical therapy interventions. Work status was assessed after

4 weeks. Sensitivity, specificity, and likelihood ratios were calculated for the prediction of work status by the use of psychosocial variables. Receiver operator characteristic curves and logistic regression were used to identify the variables that were most predictive of work status.

RESULTS: Twenty-two subjects (29%) had persistent work restrictions. The work subscale of the Fear-Avoidance Beliefs Questionnaire was the strongest predictor of work status (negative likelihood ratio of 0.08 for scores less than 30, positive likelihood ratio of 3.33 for scores greater than 34).

DISCUSSION AND CONCLUSION: Fear-avoidance beliefs about work was the psychosocial factor that could best be used to predict return to work in patients with acute work-related low back pain. Examination of fear-avoidance beliefs may serve as a useful screening tool for identifying patients who are at risk for prolonged work restrictions.

PMID: 12350212

Rating: 4c

Fritz JM, George SZ, Delitto A. The role of fear-avoidance beliefs in acute low back pain: relationships with current and future disability and work status. *Pain*. 2001 Oct;94(1):7-15.

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Fear-avoidance beliefs have been identified as an important psychosocial variable in patients with chronic disability due to low back pain. The importance of fear-avoidance beliefs for individuals with acute low back pain has not been explored. Seventy-eight subjects with work-related low back pain of less than 3 weeks' duration were studied. Measurements of pain intensity, physical impairment, disability, nonorganic signs and symptoms, and depression were taken at the initial evaluation. Fear-avoidance beliefs were measured with the work and physical activity subscales of the Fear-avoidance Beliefs Questionnaire. Disability and work status were re-assessed after 4 weeks of physical therapy. Patterns of correlation between fear-avoidance beliefs and other concurrently-measured variables were similar to those reported in patients with chronic low back pain. Fear-avoidance beliefs did not explain a significant amount of the variability in initial disability levels after controlling for pain intensity and physical impairment. Fear-avoidance beliefs about work were significant predictors of 4-week disability and work status even after controlling for initial levels of pain intensity, physical impairment, and disability, and the type of therapy received. Fear-avoidance beliefs are present in patients with acute low back pain, and may be an important factor in explaining the transition from acute to chronic conditions. Screening for fear-avoidance beliefs may be useful for identifying patients at risk of prolonged disability and work absence.

PMID: 11576740

Rating: 3b

Fritz JM, Delitto A, Erhard RE. Comparison of classification-based physical therapy with therapy based on clinical practice guidelines for patients with acute low back pain: a randomized clinical trial. *Spine*. 2003 Jul 1;28(13):1363-71; discussion 1372.

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STUDY DESIGN: A randomized clinical trial was conducted.

OBJECTIVE: To compare the effectiveness of classification-based physical therapy with that of therapy based on clinical practice guidelines for patients with acute, work-related low back pain.

SUMMARY OF BACKGROUND DATA: Clinical practice guidelines recommend minimal intervention during the first few weeks after acute low back injury. However, studies supporting this recommendation have not attempted to identify which patients are likely to respond to particular interventions.

METHODS: For this study, 78 subjects with work-related low back pain of less than 3 weeks duration were randomized to receive therapy based on a classification system that attempts to match patients to specific interventions or therapy based on the Agency for Health Care Policy and Research guidelines. The subjects were followed for 1 year. Outcomes included the impairment index, Oswestry scale, SF-36 component scores, satisfaction, medical costs, and return to work status.

RESULTS: After adjustment for baseline factors, subjects receiving classification-based therapy showed greater change on the Oswestry ($P = 0.023$) and the SF-36 physical component ($P = 0.029$) after 4 weeks. Patient satisfaction was greater ($P = 0.006$) and return to full-duty work status more likely ($P = 0.017$) after 4 weeks in the classification-based group. After 1 year, there was a trend toward reduced Oswestry scores in the classification-based group ($P = 0.063$). Median total medical costs for 1 year after injury were 1003.68 dollars for the guideline-based group and 774.00 dollars for the classification-based group ($P = 0.13$).

CONCLUSIONS: For patients with acute, work-related low back pain, the use of a classification-based approach resulted in improved disability and return to work status after 4 weeks, as compared with therapy based on clinical practice guidelines. Further research is needed on the optimal timing and methods of intervention for patients with acute low back pain.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 12838091

Rating: 2b

Classification	Examination Findings	Treatment
Mobilization		
Sacroiliac pattern	Unilateral symptoms without signs of nerve root compression, positive findings for sacroiliac region dysfunction (pelvic asymmetry, standing and seated flexion tests)	Joint mobilization or manipulation techniques and spinal active range of motion exercises
Lumbar pattern	Unilateral symptoms without signs of nerve root compression, asymmetrical restrictions of lumbar side-bending motion, lumbar segmental hypomobility.	Joint mobilization or manipulation techniques and spinal active range of motion exercises
Specific exercise		
Flexion pattern	Patient preference for sitting versus standing, centralization with lumbar flexion motions.	Lumbar flexion exercises, avoidance of extension activities
Extension pattern	Patient preference for standing versus sitting, centralization with lumbar extension motions.	Lumbar extension exercises, avoidance of flexion activities
Other		
Immobilization	Frequent previous episodes, positive response to prior manipulation or bracing as treatment, presence of “instability catch” or lumbar segmental hypermobility	Trunk strengthening and stabilization exercises
Traction	Radicular signs present, unable to centralize with movements, may have lateral shift deformity	Mechanical or auto-traction

With the classification system used in this study, the patient is placed into one of four classifications, each with its own treatment approach. Patients with signs and symptoms that suggest movement restrictions of the lumbar or sacroiliac region are treated with joint mobilization–manipulation techniques and range of motion exercises. Patients exhibiting the centralization phenomenon during lumbar range of motion testing are treated with the specific exercises (flexion or extension) that promote centralization of symptoms. [The centralization phenomenon was first described 20 years ago. It refers to the abolition of distal pain emanating from the spine in response to therapeutic exercises. The patient’s symptoms are abolished, located more proximal, or located more medial to the midline following single or repeated lumbar flexion and extension movements during the initial evaluation.] The centralization phenomenon has been identified as an important clinical finding, and exercises that promote centralization may improve outcomes in these patients. Numerous findings from the patient’s history or physical examination (e.g., frequent previous episodes with minimal perturbations, “instability catch”) reportedly are associated with clinical instability, and patients with these findings are treated

with a trunk strengthening and stabilization exercise program. Finally, patients with signs of nerve root compression who do not demonstrate centralization during the examination are treated with spinal traction. These four treatment approaches are consistent with those widely used by physical therapists, yet indications for their application have not been adequately studied. There is some evidence supporting the use of manipulation, stabilization exercises, and specific exercises. However, when these treatments have been applied in clinical trials without an attempt to decide which patients may respond to particular a treatment, the results are generally equivocal, leading to the contention that these treatments offer no benefits beyond what could be achieved by reassurance, encouragement, and general activity.

Frost H, Lamb SE, Doll HA, Carver PT, Stewart-Brown S. Randomised controlled trial of physiotherapy compared with advice for low back pain. *BMJ*. 2004 Sep 25;329(7468):708. Epub 2004 Sep 17.

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OBJECTIVE: To measure the effectiveness of routine physiotherapy compared with an assessment session and advice from a physiotherapist for patients with low back pain.

DESIGN: Pragmatic, multicentre, randomised controlled trial.

SETTING: Seven British NHS physiotherapy departments.

PARTICIPANTS: 286 patients with low back pain of more than six weeks' duration.

INTERVENTION: Routine physiotherapy or advice on remaining active from a physiotherapist. Both groups received an advice book.

RESULTS: 200 of 286 patients (70%) provided follow up information at 12 months. Patients in the therapy group reported enhanced perceptions of benefit, but there was no evidence of a long term effect of physiotherapy in either disease specific or generic outcome measures (mean difference in change in Oswestry disability index scores at 12 months -1.0%, 95% confidence interval -3.7% to 1.6%). The most common treatments were low velocity spinal joint mobilisation techniques (72%, 104 of 144 patients) and lumbar spine mobility and abdominal strengthening exercises (94%, 136 patients).

CONCLUSIONS: Routine physiotherapy seemed to be no more effective than one session of assessment and advice from a physiotherapist.

PMID: 15377573

Rating: 2b

Synopsis:

Patients reported significantly more benefit at two and six months if they received physical therapy, but it is very possible—given that patients were aware of their treatment—that this finding reflects a placebo effect. Other research also has not shown a benefit of physical therapy for low-back pain. Bottom Line: Physical therapy sessions do not offer additional long-term benefit over simple advice to remain active in patients referred for physical therapy. Patients initially perceive a benefit while being treated, but this benefit disappears by one year.

George SZ, Fritz JM, Bialosky JE, Donald DA. The effect of a fear-avoidance-based physical therapy intervention for patients with acute low back pain: results of a randomized clinical trial. *Spine*. 2003 Dec 1;28(23):2551-60.

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STUDY DESIGN: A randomized clinical trial with 4-week and 6-month follow-up periods.

OBJECTIVE: To compare the effect of a fear-avoidance-based physical therapy intervention with standard care physical therapy for patients with acute low back pain.

SUMMARY OF BACKGROUND DATA: The disability reduction strategy of secondary prevention involves providing specific treatment for patients that are likely to have chronic disability from low back pain. Previous studies have indicated that elevated fear-avoidance beliefs are a precursor to chronic disability from low back pain. However, the effectiveness of physical therapy intervention based on a fear-avoidance model is unknown.

METHODS: Sixty-six consecutive patients referred to physical therapy with low back pain of less than 8 weeks' duration were randomly assigned to receive fear-avoidance-based physical therapy (n = 34) or standard care physical therapy (n = 32). The intervention period lasted 4 weeks for this study. Disability, pain intensity, and fear-avoidance beliefs measures were recorded before and after treatment. A 6-month follow-up of the same measures was obtained by mail.

RESULTS: An intention-to-treat principle (last value forward) was used for data analyses that tested the primary and secondary hypotheses. The prediction of disability at 4 weeks and 6 months after treatment was significantly improved by considering the interaction between the type of treatment and the initial level of fear-avoidance beliefs. Both groups had significant within group improvements for disability and pain intensity. The fear-avoidance treatment group had a significant improvement in fear-avoidance beliefs, and fear-avoidance beliefs about physical activity were significantly lower than the standard care group at 4 weeks and 6 months after treatment.

CONCLUSION: Patients with elevated fear-avoidance beliefs appeared to have less disability from fear-avoidance-based physical therapy when compared to those receiving standard care physical therapy. Patients with lower fear-avoidance beliefs appeared to have more disability from fear-avoidance-based physical therapy, when compared to those receiving standard care physical therapy. In addition, physical

therapy supplemented with fear-avoidance-based principles contributed to a positive shift in fear-avoidance beliefs.

PMID: 14652471

Rating: 2b

Goldby LJ, Moore AP, Doust J, Trew ME. A randomized controlled trial investigating the efficiency of musculoskeletal physiotherapy on chronic low back disorder. *Spine*. 2006 May 1;31(10):1083-93.

Balance Performance Physiotherapy, London, United Kingdom. Lucy@balancephysio.com

METHODS: A total of 346 subjects were randomized to manual therapy, a 10-week spinal stabilization rehabilitation program, or a minimal intervention control group.

RESULTS: The results indicated statistically significant improvements in favor of the spinal stabilization group at the 6-month stage in pain (65.9% reduction in symptoms) and dysfunction (combined mean reduction of 134, standard error 23.84), and at the 1-year stage in medication (34.3% reduction in medication), dysfunction (combined mean reduction of 134, standard error 18.2), and disability (mean difference in change 15.71 Oswestry Disability Index, 95% confidence interval 19.3-10.01).

CONCLUSIONS: As a component of musculoskeletal physiotherapy, the spinal stabilization program is more effective than manually applied therapy or an education booklet in treating chronic low back disorder over time. Both manual therapy and the spinal stabilization program are significantly effective in pain reduction in comparison to an active control. To our knowledge and up until now, this result has not been shown in patients with chronic low back disorder.

PMID: 16648741

Rating: 2a

The spinal stabilization program evaluated consisted of "functionally progressive" exercises that emphasized strengthening of various muscles supporting the spine. A video illustrating the effect of the muscles on the stability of the spine was shown at the beginning and end of each of the 10 classes, between which the patients exercised at facilitation stations. By comparison, the manually applied therapy group received up to 10 standard physical therapy sessions in which no exercises were prescribed. For the control intervention, patients were given an educational booklet called "Back in Action," but no treatment or exercises were performed. All patients went on to receive a session called "the Back School," a single session that included a question and answer session and training on various topics related to back pain. The researchers also reported that manual therapy was significantly better than the control group at reducing pain in patients with chronic low back disorder who have the highest

amount of pain at 3 months after intervention. With regard to manual therapy, the authors note that this approach "remains physiotherapists' preferred modality for chronic low back disorder" and "is appropriate to be used on these patients as a pain reducing modality, but the results of this study suggest that it should not be used as an isolated modality because it does not concomitantly reduce disability, handicap, or improve quality of life."

Hayden JA, van Tulder MW, Tomlinson G. Systematic review: strategies for using exercise therapy to improve outcomes in chronic low back pain. *Ann Intern Med.* 2005 May 3;142(9):776-85.

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BACKGROUND: Exercise therapy encompasses a heterogeneous group of interventions. There continues to be uncertainty about the most effective exercise approach in chronic low back pain.

PURPOSE: To identify particular exercise intervention characteristics that decrease pain and improve function in adults with nonspecific chronic low back pain.

DATA SYNTHESIS: 43 trials of 72 exercise treatment and 31 comparison groups were included. Bayesian multivariable random-effects meta-regression found improved pain scores for individually designed programs (5.4 points [95% credible interval (CrI), 1.3 to 9.5 points]), supervised home exercise (6.1 points [CrI, -0.2 to 12.4 points]), group (4.8 points [CrI, 0.2 to 9.4 points]), and individually supervised programs (5.9 points [CrI, 2.1 to 9.8 points]) compared with home exercises only. High-dose exercise programs fared better than low-dose exercise programs (1.8 points [CrI, -2.1 to 5.5 points]). Interventions that included additional conservative care were better (5.1 points [CrI, 1.8 to 8.4 points]). A model including these most effective intervention characteristics would be expected to demonstrate important improvement in pain (18.1 points [CrI, 11.1 to 25.0 points] compared with no treatment and 13.0 points [CrI, 6.0 to 19.9 points] compared with other conservative treatment) and small improvement in function (5.5 points [CrI, 0.5 to 10.5 points] compared with no treatment and 2.7 points [CrI, -1.7 to 7.1 points] compared with other conservative treatment). Stretching and strengthening demonstrated the largest improvement over comparisons.

CONCLUSIONS: Exercise therapy that consists of individually designed programs, including stretching or strengthening, and is delivered with supervision may improve pain and function in chronic nonspecific low back pain. Strategies should be used to encourage adherence.

PMID: 15867410

Rating: 1b

This Bayesian meta-regression of 43 trials suggests that the most effective exercises for improving pain and function in adults with chronic low back pain are stretching and strengthening, respectively. Exercise performed over longer periods of time seemed more effective than exercise performed less than

20 hours total. Supervised programs that were individually tailored seemed to be more effective than other delivery modes.

The most effective strategy seems to be individually designed exercise programs delivered in a supervised format (for example, home exercises with regular therapist follow-up) and encouraging adherence to achieve high dosage. Adding other conservative treatment, such as advice to stay active, NSAIDs, or manual therapy, also resulted in improved pain and function outcomes. We found that stretching and muscle-strengthening exercises were the best types of exercises for improving pain and function, respectively.

Hicks GE, Fritz JM, Delitto A, McGill SM. Preliminary development of a clinical prediction rule for determining which patients with low back pain will respond to a stabilization exercise program. *Arch Phys Med Rehabil.* 2005 Sep;86(9):1753-62.

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OBJECTIVE: To develop a clinical prediction rule to predict treatment response to a stabilization exercise program for patients with low back pain (LBP).

DESIGN: A prospective, cohort study of patients with nonradicular LBP referred to physical therapy (PT).

SETTING: Outpatient PT clinics.

PARTICIPANTS: Fifty-four patients with nonradicular LBP.

INTERVENTION: A standardized stabilization exercise program.

MAIN OUTCOME MEASURE: Treatment response (success or failure) was categorized based on changes in the Oswestry Disability Questionnaire scores after 8 weeks.

RESULTS: Eighteen subjects were categorized as treatment successes, 15 as treatment failures, and 21 as somewhat improved. After using regression analyses to determine the association between standardized examination variables and treatment response status, preliminary clinical prediction rules were developed for predicting success (positive likelihood ratio [LR], 4.0) and failure (negative LR, .18). The most important variables were age, straight-leg raise, prone instability test, aberrant motions, lumbar hypermobility, and fear-avoidance beliefs.

CONCLUSIONS: It appears that the response to a stabilization exercise program in patients with LBP can be predicted from variables collected from the clinical examination. The prediction rules could be used to determine whether patients with LBP are likely to benefit from stabilization exercises.

PMID: 16181938

Rating: 3b

Jousset N, Fanello S, Bontoux L, Dubus V, Billabert C, Vielle B, Roquelaure Y, Penneau-Fontbonne D, Richard I. Effects of functional restoration versus 3 hours per week physical therapy: a randomized controlled study. *Spine*. 2004 Mar 1;29(5):487-93; discussion 494.

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STUDY DESIGN: Randomized parallel-group comparative trial with a 6-month follow-up period.

OBJECTIVE: To compare, in chronic low back pain patients, the effectiveness of a functional restoration program, including intensive physical training, occupational therapy, and psychological support to an active individual therapy consisting of 3 hours physical therapy per week during 5 weeks.

SUMMARY OF BACKGROUND DATA: Controlled studies conducted in the United States showed a benefit of functional restoration in patients with low back pain, especially on return to work. Randomized Canadian and European trials had less favorable results. In France, there has been up to now no randomized study. Controlled studies suggested a positive effect of functional restoration programs.

METHODS: Eighty-six patients with low back pain were randomized to either the functional restoration (44 patients) or the active individual therapy (42 patients) program. One person in each group never started the program. Two patients did not complete the functional restoration program, and one was lost to follow-up at 6 months. The mean number of sick-leave days in the 2 previous years was 6 months.

RESULTS: After adjustment on the variable "workplace enrolled in an ergonomic program", the mean number of sick-leave days was significantly lower in the functional restoration group. Physical criteria and treatment appreciation were also better. There was no significant difference in the intensity of pain, the quality of life and functional indexes, the psychological characteristics, the number of contacts with the medical system, and the drug intake.

CONCLUSIONS: This study demonstrates the effectiveness of a functional restoration program on important outcome measures, such as sick leave, in a country that has a social system that protects people facing difficulties at work.

PMID: 15129059

Rating: 2b

Klaber Moffett JA, Carr J, Howarth E. High fear-avoiders of physical activity benefit from an exercise program for patients with back pain. Spine. 2004 Jun 1;29(11):1167-72; discussion 1173.

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STUDY DESIGN: A subgroup analysis of patient outcomes from a randomized controlled trial comparing a Back to Fitness program with usual general practitioner care.

OBJECTIVES: To test whether patients with high scores on measures of fear-avoidance and distress/depression benefit the most.

SUMMARY OF BACKGROUND DATA: A fitness program, ongoing since the 1980s, was developed for use in the community and has been shown to be effective in reducing disability. Detailed analyses are needed to identify patient groups who benefit. Recent evidence points to the potentially important role of fear, distress, and depression.

METHOD: Data from 98 patients allocated to normal general practitioner care and 89 patients allocated to a group exercise program were analyzed after categorizing baseline scores on fear-avoidance beliefs (high/low) and distress/depression (at risk/normal). The main outcome measure was the Roland Disability Questionnaire. Outcomes were compared between the intervention and control groups at 6 weeks, 6 months, and 12 months.

RESULTS: High fear-avoiders fared significantly better in the exercise program than in usual general practitioner care at 6 weeks and at 1 year. Low fear-avoiders did not. Patients who were distressed or depressed were significantly better off at 6 weeks, but the benefits were not maintained long-term.

CONCLUSION: Patients with high levels of fear-avoidance beliefs could significantly benefit from the Back to Fitness program. The benefits of the exercise program for patients with high levels of distress/depression appear to be short-term only. Average attendance was only 4 to 5 classes, which may not be sufficient for more recalcitrant cases. Further research is indicated.

PMID: 15167652

Rating: 2b

Linz DH; Shepherd CD; Ford LF; Ringley LL; Klekamp J; Duncan JM. Effectiveness of occupational medicine center-based physical therapy. *Journal of Occupational and Environmental Medicine*. 01-Jan-2002; 44(1): 48-53.

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This study concluded, “the program saved employers approximately \$1.4 million, or \$2000 per client. The authors attribute the improved outcomes to early therapy using active rather than passive techniques and an emphasis on patient education and home exercise programs.”

PMID: 11802465

Rating: 4b, CT, 699 cases

Long A, Donelson R, Fung T. Does it matter which exercise? A randomized control trial of exercise for low back pain. *Spine*. 2004 Dec 1;29(23):2593-602.

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STUDY DESIGN: Multicentered randomized controlled trial.

OBJECTIVES: To determine if previously validated low back pain (LBP) subgroups respond differently to contrasting exercise prescriptions.

SUMMARY OF BACKGROUND DATA: The role of "patient-specific" exercises in managing LBP is controversial.

METHODS: A total of 312 acute, subacute, and chronic patients, including LBP-only and sciatica, underwent a standardized mechanical assessment classifying them by their pain response, specifically eliciting either a "directional preference" (DP) (i.e., an immediate, lasting improvement in pain from performing either repeated lumbar flexion, extension, or sideglide/rotation tests), or no DP. Only DP subjects were randomized to: 1) directional exercises "matching" their preferred direction (DP), 2) exercises directionally "opposite" their DP, or 3) "nondirectional" exercises. Outcome measures included pain intensity, location, disability, medication use, degree of recovery, depression, and work interference.

RESULTS: A DP was elicited in 74% (230) of subjects. One third of both the opposite and non-directionally treated subjects withdrew within 2 weeks because of no improvement or worsening (no matched subject withdrew). Significantly greater improvements occurred in matched subjects compared with both other treatment groups in every outcome (P values <0.001), including a threefold decrease in medication use.

CONCLUSIONS: Consistent with prior evidence, a standardized mechanical assessment identified a large subgroup of LBP patients with a DP. Regardless of subjects' direction of preference, the response to contrasting exercise prescriptions was significantly different: exercises matching subjects' DP significantly and rapidly decreased pain and medication use and improved in all other outcomes. If repeatable, such subgroup validation has important implications for LBP management.

PMID: 15564907

Rating: 2a

This study demonstrated better symptom relief with directional preference exercise.

Luijsterburg PA, Lamers LM, Verhagen AP, Ostelo RW, van den Hoogen HJ, Peul WC, Avezaat CJ, Koes BW. Cost-Effectiveness of Physical Therapy and General Practitioner Care for Sciatica. *Spine*. 2007;32:1942-1948.

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STUDY DESIGN.: An economic evaluation alongside a randomized clinical trial in primary care. A total of 135 patients were randomly allocated to physical therapy added to general practitioners' care (n = 67) or to general practitioners' care alone (n = 68).

OBJECTIVE: To evaluate the cost-effectiveness of physical therapy and general practitioner care for patients with an acute lumbosacral radicular syndrome (LRS, also called sciatica) compared with general practitioner care only.

SUMMARY OF BACKGROUND DATA: There is a lack of knowledge concerning the cost-effectiveness of physical therapy in patients with sciatica.

METHODS: The clinical outcomes were global perceived effect and quality of life. The direct and indirect costs were measured by means of questionnaires. The follow-up period was 1 year. The Incremental Cost-effectiveness Ratio (ICER) between both study arms was constructed. Confidence intervals for the ICER were calculated using Fieller's method and using bootstrapping.

RESULTS: There was a significant difference on perceived recovery at 1-year follow-up in favor of the physical therapy group. The additional physical therapy did not have an incremental effect on quality of life. At 1-year follow-up, the ICER for the total costs was euro6224 (95% confidence interval, -10419, 27551) per improved patient gained. For direct costs only, the ICER was euro837 (95% confidence interval, -731, 3186). **CONCLUSION.:** The treatment of patients with LRS with physical therapy and general practitioners'care is not more cost-effective than general practitioners'care alone.

PMID: 17700438

Rating: 1b

Luijsterburg PA, Verhagen AP, Ostelo RW, van Os TA, Peul WC, Koes BW. Effectiveness of conservative treatments for the lumbosacral radicular syndrome: a systematic review. *Eur Spine J.* 2007;16:881-99. Epub 2007

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Patients with a lumbosacral radicular syndrome are mostly treated conservatively first. The effect of the conservative treatments remains controversial. To assess the effectiveness of conservative treatments of the lumbosacral radicular syndrome (sciatica). Relevant electronic databases and the reference lists of articles up to May 2004 were searched. Randomised clinical trials of all types of conservative treatments for patients with the lumbosacral radicular syndrome selected by two reviewers. Two reviewers independently assessed the methodological quality and the clinical relevance. Because the trials were considered heterogeneous we decided not to perform a meta-analysis but to summarise the results using the rating system of levels of evidence. Thirty trials were included that evaluated injections, traction, physical therapy, bed rest, manipulation, medication, and acupuncture as treatment for the lumbosacral radicular syndrome. Because several trials indicated no evidence of an effect it is not recommended to use corticosteroid injections and traction as treatment option. Whether clinicians should prescribe physical therapy, bed rest, manipulation or medication could not be concluded from this review. At present there is no evidence that one type of treatment is clearly superior to others, including no treatment, for patients with a lumbosacral radicular syndrome.

PMID: 17415595

Rating: 1b

Mannion AF, Muntener M, Taimela S, Dvorak J. Comparison of three active therapies for chronic low back pain: results of a randomized clinical trial with one-year follow-up. *Rheumatology (Oxford).* 2001 Jul;40(7):772-8.

Department of Neurology, Schulthess Clinic, Zurich, Switzerland.

OBJECTIVES: To examine the relative efficacy of three active therapies for patients with chronic low back pain.

METHODS: One hundred and forty-eight subjects with chronic low back pain were randomized to receive, twice weekly for 3 months, (i) active physiotherapy, (ii) muscle reconditioning on training devices, or (ii) low-impact aerobics. Questionnaires were administered to assess pain intensity, pain frequency and disability before and after therapy and at 6 and 12 months of follow-up.

RESULTS: One hundred and thirty-two of the 148 patients (89%) completed the therapy programmes and 127 of the 148 (86%) returned a questionnaire at all four time-points. The three treatments were equally efficacious in significantly reducing pain intensity and frequency for up to 1 yr after therapy. However, the groups differed with respect to the temporal changes in self-rated disability over the study

period ($P=0.03$): all groups showed a similar reduction after therapy, but for the physiotherapy group disability increased again during the first 6 months of follow-up whilst the other two groups showed a further decline. In all groups the values then remained stable up to the 12-month follow-up. The larger group size and minimal infrastructure required for low-impact aerobics rendered it considerably less expensive to administer than the other two programmes.

CONCLUSIONS: The introduction of low-impact aerobic exercise programmes for patients with chronic low back pain may reduce the enormous costs associated with its treatment.

PMID: 11477282

Rating: 2b

Price C, Arden N, Coglan L, Rogers P. Cost-effectiveness and safety of epidural steroids in the management of sciatica. *Health Technol Assess.* 2005 Aug;9(33):1-58, iii.

Pain Clinic, Royal South Hants Hospital, Southampton, UK.

OBJECTIVES: To investigate the clinical effectiveness of epidural steroid injections (ESIs) in the treatment of sciatica with an adequately powered study and to identify potential predictors of response to ESIs. Also, to investigate the safety and cost-effectiveness of lumbar ESIs in patients with sciatica.

DESIGN: A pragmatic, prospective, multicentre, double-blind, randomised, placebo-controlled trial with 12-month follow-up was performed. Patients were stratified according to acute (<4 months since onset) versus chronic (4-18 months) presentation. All analyses were performed on an intention-to-treat basis with last observation carried forward used to impute missing data.

SETTING: Rheumatology, orthopaedic and pain clinics in four participating centres: three district hospitals and one teaching hospital in the south of England. **PARTICIPANTS:** Total of 228 patients listed for ESI with clinically diagnosed unilateral sciatica, aged between 18 and 70 years, who had a duration of symptoms between 4 weeks and 18 months. **INTERVENTIONS:** Patients received up to three injections of epidural steroid and local anaesthetic (active), or an injection of normal saline into the interspinous ligament (placebo).

MAIN OUTCOME MEASURES: The primary outcome measure was the Oswestry Disability Questionnaire (ODQ); measures of pain relief and psychological and physical function were collected. Health economic data on return to work, analgesia use and other interventions were also measured. Quality-adjusted life-years (QALYs) were calculated using the SF-6D, calculated from the Short Form (SF-36). Costs per patient were derived from figures supplied by the centres' finance departments and a costings exercise performed as part of the study. A cost-utility analysis was performed using the SF-36 to calculate costs per QALY.

RESULTS: ESI led to a transient benefit in ODQ and pain relief, compared with placebo at 3 weeks ($p = 0.017$, number needed to treat = 11.4). There was no benefit over placebo between weeks 6 and 52.

Using incremental QALYs, this equates to an additional 2.2 days of full health. Acute sciatica seemed to respond no differently to chronic sciatica. There were no significant differences in any other indices, including objective tests of function, return to work or need for surgery at any time-points. There were no clinical predictors of response, although the trial lacked sufficient power to be confident of this. Adverse events were uncommon, with no difference between groups. Costs per QALY to providers under the trial protocol were 44,701 pounds sterling. Costs to the purchaser per QALY were 354,171 pounds sterling. If only one ESI was provided then costs per QALY fell to 25,745 pounds sterling to the provider and 167,145 pounds sterling to the purchaser. ESIs thus failed the QALY threshold recommended by the National Institute for Health and Clinical Excellence (NICE).

CONCLUSIONS: Although ESIs appear relatively safe, it was found that they confer only transient benefit in symptoms and self-reported function in a small group of patients with sciatica at substantial costs. ESIs do not provide good value for money if NICE recommendations are followed. Additional research is suggested into the epidemiology of radicular pain, producing a register of all ESIs, possible subgroups who may benefit from ESIs, the use of radiological imaging, optimal early interventions, analgesic agents and nerve root injections, the use of cognitive behavioural therapy in rehabilitation, improved methods of assessment, a comparative cost-utility analysis between various treatment strategies, and methods to reduce the effect of scarring and inflammation.

PMID: 16095548

Rating: 2a

Rainville J, Hartigan C, Jouve C, Martinez E. The influence of intense exercise-based physical therapy program on back pain anticipated before and induced by physical activities. *Spine J.* 2004 Mar-Apr;4(2):176-83.

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BACKGROUND CONTEXT: Pain anticipated before and induced by physical activities has been shown to influence the physical performance of patients with chronic back pain. Limited data exist as to the influence of treatment on this component of pain.

PURPOSE: This study attempted to determine if pain anticipated before and induced by physical activities was altered during an exercise-oriented physical therapy program for chronic back pain.

STUDY DESIGN/SETTING: Subjects were recruited from three physical therapy sites with similar spine rehabilitation programs that used intense exercise delivered in a group format. During the recruitment period, 70 subjects with chronic low back pain and disability agreed to participate and complied with recommended treatments. The primary outcome measures were anticipated and induced pain as assessed by visual analog scales (VAS) during six tests of back flexibility and strength. Additional outcome measures included the performance levels of these six tests (trunk flexion,

extension, straight leg raising, back strength, lifting from floor to waist and waist to shoulder height), global back and leg VAS and Oswestry Low Back Pain Disability Questionnaire scores.

METHODS: At evaluation for the spine rehabilitation programs, we recorded the anticipated and induced pain levels associated with the six tests of back function, the performance levels on each test and global pain and disability scores. Subjects then participated in the spine rehabilitation program that consisted of intense exercise delivered up to three times per week, for 2 hours over a period of 6 weeks. All outcome measures were reassessed at discharge. Pre- and posttreatment outcome scores were statistically compared using paired sample t tests and chi-squared test. Spearman correlation coefficients were used to compare anticipated and induced pain results with global back and leg pain VAS scores, Oswestry scores and physical performance levels for each physical test.

RESULTS: Most measures of anticipated and induced pain improved between evaluation and discharge. Improvements were noted for global back pain ($p < .001$), leg pain ($p = .001$), disability ($p < .001$) and performance on each physical testing ($p < .001$) after treatment. Performances on all physical testing correlated with anticipated and induced pain for all tests at evaluation but only for measures of flexibility at discharge. Improvements in global pain and disability correlated with improvements in anticipated and induced pain with physical testing.

CONCLUSION: Anticipated and induced pain with physical activities was lessened after physical therapy using exercise. Anticipated and induced pain with physical activities related to physical performance levels, global pain and disability ratings. These findings may help explain how exercise exerts a positive influence on chronic back pain and disability.

PMID: 15016395

Rating: 2b

Rainville J, Jouve CA, Hartigan C, Martinez E, Hipona M. Comparison of short- and long-term outcomes for aggressive spine rehabilitation delivered two versus three times per week. *Spine J.* 2002 Nov-Dec;2(6):402-7.

The Spine Center at New England Baptist Bone and Joint Institute, 125 Parker Hill Avenue, Boston, MA 02120, USA. jrainvil@caregroup.harvard.edu

BACKGROUND CONTEXT: Rehabilitation services using intensive exercise for the treatment of chronic spinal pain have traditionally been scheduled at a frequency of three times per week.

PURPOSE: In an attempt to reduce the cost of rehabilitation services, this study was designed to determine whether treatment offered two times per week could produce similar outcomes when compared with an established three times per week spine therapy program.

STUDY DESIGN: Prospective cohort study.

PATIENT SAMPLE: Seventy-seven consecutive patients with chronic spinal pain were treated with aggressive spine rehabilitation either two or three times per week.

OUTCOME MEASURES: Flexibility, trunk strength and lifting capacity were quantified before and after treatment. Pain visual analog scores and Oswestry disability scores were measured before and after treatment, as well as 12 months after treatment.

METHODS: A two times per week physical therapy program was developed to be identical in its treatment method to an established three times per week, group-oriented physical therapy program used for the treatment of chronic spinal pain. Patients with spinal pain who continued to work despite chronic pain complaints were allowed to choose between the two therapy programs based on availability of treatment slots and convenience. Treatment consisted of non-pain contingent quota-based exercises targeting identified physical impairments. Treatment sessions lasted for 2 hours and consisted of 30 minutes of stretching, 30 minutes of low-impact step aerobics class and 1 hour of exercise on strength and endurance equipment. Therapy occurred in groups consisting of a maximum of eight patients who were closely supervised by two therapists. Targeted treatment time was 6 weeks. At 12 months after treatment, subjects were surveyed by mailed questionnaires.

RESULTS: Seventy-seven patients with chronic spinal pain with a mean duration of symptoms of 32 months underwent treatment. Twenty-four subjects opted for the twice per week and 53 opted for the three times per week treatment. Seventy-one percent of subjects responded to the 12-month follow-up questionnaire. Physical and self-reported measures improved with both treatment frequencies. There were no differences in outcomes between treatment frequencies for measured flexibility, trunk strength, lifting capacity, pain intensity scores or Oswestry scores at the completion of treatment. At 12-month follow-up, no differences were noted between treatment frequencies for pain scores, Oswestry scores, patients' perceptions of adequacy of treatment, posttreatment exercise compliance or use of other treatments for their spinal problem. Total therapy visits were less in the two than three times per week groups (12 vs 15 visits).

CONCLUSION: Similar outcomes were obtained from aggressive spine rehabilitation occurring two versus three times per week in patients presenting with moderate levels of chronic spinal pain. Reduction in physical therapy services and therefore cost did not adversely affect clinical outcomes in the treatment of this patient population.

PMID: 14589260

Rating: 2b

Riipinen M, Niemisto L, Lindgren KA, Hurri H. Psychosocial differences as predictors for recovery from chronic low back pain following manipulation, stabilizing exercises and physician consultation or physician consultation alone. *J Rehabil Med.* 2005 May;37(3):152-8.

Orton Orthopaedic Hospital, Invalid Foundation, FIN-00280 Helsinki, Finland.
markku.riipinen@invalidisaatio.fi

OBJECTIVE: Three psychosocial profile groups are introduced in the Multidimensional Pain Inventory for chronic pain patients. Patients with the dysfunctional profile have shown a more favourable outcome after multidisciplinary treatments, due to the suggested effects of specific psychosocial treatment elements. In this study we explored, among patients with chronic low back pain, whether the Multidimensional Pain Inventory patient profile groups might respond differently to treatment without planned psychosocial elements.

METHODS: Of 204 voluntarily recruited patients with chronic low back pain, 102 were randomized to a combined manipulation, exercise and physician consultation group (called the combination group) and 102 to a consultation-alone group.

RESULTS: Although all subjects showed improvement during follow-up both on the Oswestry index and the Visual Analogue Scale, the dysfunctional profile patients in the combination group improved the most. Their high pre-treatment ratings on Oswestry and Visual Analogue-scales fell at the 5- and 12-month follow-ups to the same level as those of the adaptive copers or interpersonally distressed patients, and they were on a significantly lower level than the dysfunctional profile patients in consultation group during follow-up. All dysfunctional profile patients also showed a decrease in affective distress, equally in combination and consultation groups.

CONCLUSION: We suggest that dysfunctional profile patients are more sensitive to respond even to treatment without any specific psychosocial elements. This should be considered when evaluating any treatment effects. Among dysfunctional profile patients, pain-related anxiety and decreased acceptance of pain may contribute to their sensitivity to treatment.

PMID: 16040472

Rating: 2b

Skargren EI, Carlsson PG, Oberg BE. One-year follow-up comparison of the cost and effectiveness of chiropractic and physiotherapy as primary management for back pain. Subgroup analysis, recurrence, and additional health care utilization. *Spine*. 1998 Sep 1;23(17):1875-83; discussion 1884.

Department of Neuroscience and Locomotion: Physiotherapy, Faculty of Health Sciences, Linköping University, Sweden.

STUDY DESIGN: A randomized trial was conducted in which patients with back and neck pain, visiting a general practitioner, were allocated to chiropractic or physiotherapy.

METHODS: A group of 323 patients aged 18-60 years who had no contraindications to manipulation and who had not been treated within the previous month were included. Outcome measures were changes in Oswestry scores, pain intensity, and general health; recurrence rate; and direct and indirect costs.

RESULTS: No differences were detected in health improvement, costs, or recurrence rate between the two groups. According to Oswestry score, chiropractic was more favorable for patients with a current pain episode of less than 1 week (5%) and physiotherapy for patients with a current pain episode of greater than 1 month (6.8%). Nearly 60% of the patients reported two or more recurrences. More patients in the chiropractic group (59%) than in the physiotherapy group (41%) sought additional health care. Costs varied considerably among individuals and subgroups; the direct costs were lower for physiotherapy in a few subgroups.

CONCLUSIONS: Effectiveness and costs of chiropractic or physiotherapy as primary treatment were similar for the total population, but some differences were seen according to subgroups. Back problems often recurred, and additional health care was common. Implications of the result are that treatment policy and clinical decision models must consider subgroups and that the problem often is recurrent. Models must be implemented and tested.

PMID: 9762745

Rating: 2a

Smeal WL, Tyburski M, Alleva J, Prather H, Hunt D. Conservative management of low back pain, part I. Discogenic/radicular pain. *Dis Mon.* 2004;50:636-69.

Rehabilitation Institute of Chicago, Department of Physical Medicine and Rehabilitation, Northwestern University-Feinberg School of Medicine, USA.

PMID: 15767994

No review is provided. The authors state that the natural history of low back pain tends to be one of recovery. Medication, therapeutic injections and rehabilitation can expedite pain relief and recovery. Furthermore, the use of rehabilitation principles in a spinal stabilization program can help limit further occurrences of discogenic problems.

Rating: 5b

Vad VB, Bhat AL, Lutz GE, Cammisa F. Transforaminal epidural steroid injections in lumbosacral radiculopathy: a prospective randomized study. *Spine.* 2002 Jan 1;27(1):11-6.

The Hospital for Special Surgery, New York, New York 10021, USA. vadv@hss.edu

STUDY DESIGN: A prospective study randomized by patient choice from the private practice of a single physician affiliated with a major teaching hospital was conducted.

OBJECTIVES: To compare transforaminal epidural steroid injections with saline trigger-point injections used in the treatment of lumbosacral radiculopathy secondary to a herniated nucleus pulposus.

SUMMARY OF BACKGROUND DATA: Epidural steroid injections have been used for more than half a century in the management of lumbosacral radicular pain. At this writing, however, there have been no controlled prospective trials of transforaminal epidural steroid injections in the treatment of lumbar radiculopathy secondary to a herniated nucleus pulposus.

METHODS: Randomized by patient choice, patients received either a transforaminal epidural steroid injection or a saline trigger-point injection. Treatment outcome was measured using a patient satisfaction scale with choice options of 0 (poor), 1 (fair), 2 (good), 3 (very good), and 4 (excellent); a Roland-Morris low back pain questionnaire that showed improvement by an increase in score; a measurement of finger-to-floor distance with the patient in fully tolerated hip flexion; and a visual numeric pain scale ranging from 0 to 10. A successful outcome required a patient satisfaction score of 2 (good) or 3 (very good), improvement on the Roland-Morris score of 5 or more, and pain reduction greater than 50% at least 1 year after treatment. The final analysis included 48 patients with an average follow-up period of 16 months (range, 12-21 months).

RESULTS: After an average follow-up period of 1.4 years, the group receiving transforaminal epidural steroid injections had a success rate of 84%, as compared with 48% for the group receiving trigger-point injections ($P < 0.005$).

CONCLUSION: Fluoroscopically guided transforaminal injections serve as an important tool in the nonsurgical management of lumbosacral radiculopathy secondary to a herniated nucleus pulposus.

PMID: 11805628

Rating: 2b

Zigenfus GC; Yin J; Giang GM; Fogarty WT. Effectiveness of early physical therapy in the treatment of acute low back musculoskeletal disorders. *Journal of Occupational and Environmental Medicine*. 01-Jan-2000; 42(1): 35-9.

Concentra Health Services, Inc., Addison, Texas 75001, USA.

This study was designed to evaluate the effects of early physical therapy intervention on treatment outcomes for workers with acute low back injuries. A total of 3867 cases were randomly selected from the database of a large occupational health care provider. Cases were assigned to either the early therapy intervention group or one of the two comparison groups on the basis of their delay to physical therapy. The treatment outcomes for the three groups were compared. The results showed that patients in the early therapy intervention had more favorable outcomes than the two comparison groups. Specifically, patients in the early intervention group had fewer physician visits, fewer restricted workdays, fewer days away from work, and shorter case duration. These results provide a strong indication for the effectiveness of early therapy intervention. The financial implications of the findings is discussed.

PMID: 10652686

Rating: 4a, 3867 cases

Neck and Upper Back (Acute & Chronic)

Bigos SJ, Perils, pitfalls, and accomplishments of guidelines for treatment of back problems, *Neurol Clin* 1999 Feb;17(1):179-92

University of Washington School of Medicine, Seattle, Washington 98104, USA.

Science should be the basis for guidelines. As a result of the Flexner Report in 1911, we now live in an era where randomized trials are available. Statistical methods can truly be applied to evaluate the reliability of data published in the literature. The result is that we can now demand more from future publications and allow for a better evaluation of the mistakes or bias that can distort validity, applicability, and reliability. The importance of this methodology is to reduce misunderstandings by patients, clinicians, manufacturers, and government agencies about issues important to patient care.

Summary of differences in recommendations table since publication of ACOEM Guidelines:

- Column 4 heading changed to “Recommend Against” vs “Not Recommended”
- Patient education -- Now Recommend back school in occ. Settings; Optional in non-occ
- Medication: Muscle relaxants now Optional vs Not Recommended
- Physical methods -- Now Optional: Manipulation for patients who have symptoms >1 month, Self-application of heat or cold to low back, Shoe insoles, & Corset for prevention in occupational setting; Add to Recommended Against: Shoe lifts, & Corset for treatment.
- Activities & Exercise: remove Intensive physical training from Not Recommended
- Surgical – Recommended: Chymopapain, used after ruling out allergic sensitivity, acceptable but less efficacious than discectomy to treat herniated disc; Recommended Against: added Percutaneous discectomy less efficacious than chymopapain, removed chemonucleolysis

Publication Types:

- Review
- Review, Tutorial

PMID: 9855678

Rating: 6a

Table 1 -- Categories Of The Findings And Recommendation Statements

<i>Recommendations for:</i> If the available evidence (amount A, B, C, D) indicated potential benefit and outweighed potential harms
<i>Options:</i> If the available evidence (amount A, B, C, D) of potential benefit is weak or equivocal, (some studies for and some against) but potential harms and costs appear small
<i>Recommendations against:</i> If the available evidence (amount A, B, C, D) indicated that there was a lack of benefit, or that potential harms and costs outweighed potential benefits

Table 2 -- Summary of Findings and Recommendation Statements about Evidence with Amount of Evidence to Support the Statement (A, B, C, D)

	Recommend	Option	Recommend Against
History and Physical Examination (34 studies)	Basic history (B). History of cancer/infection (B). Signs/symptoms of cauda equina syndrome (C). History of significant trauma (C). Psychosocial history (C). Straight leg raising test (B). Focused neurologic exam (B).	Pain drawing and Visual Analog Scale (D)	
Patient Education (14 studies)	Patient education about low-back symptoms (B). Back school in occupational settings (C).	Back school in nonoccupational settings (C).	
Medication (23 studies)	Acetaminophen (C). NSAIDs (B).	Muscle relaxants (C). Opioids, short course (C).	Opioids used >2 wks (C). Phenylbutazone (C). Oral steroids (C). Colchicine (B). Antidepressants (C).
Physical Treatment Methods (42 studies)	Manipulation during first month of low-back pain (B).	Manipulation for patients who have radiculopathy (C). Manipulation for patients who have symptoms >1 month (C). Self-application of heat	Manipulation for patients who have undiagnosed neurologic deficits (D). Prolonged course of manipulation (D). Traction (B). TNS (C).

Table 2 -- Summary of Findings and Recommendation Statements about Evidence with Amount of Evidence to Support the Statement (A, B, C, D)

	Recommend	Option	Recommend Against
		or cold to low back. Shoe insoles (C). Corset for prevention in occupational setting (C).	Biofeedback (C). Shoe lifts (D). Corset for treatment (D).
Injections (26 studies)		Epidural steroid injections for radicular pain to avoid surgery (C).	Epidural injections for back pain without radiculopathy (D). Trigger point injections (C). Ligamentous injections (C). Facet joint injections (C). Needle acupuncture (D).
Bed rest (4 studies)		Bed rest of 2-4 days for severe radiculopathy (D).	Bed rest >4 days (B).
Activities and Exercise (20 studies)	Temporary avoidance of activities that increase mechanical stress on spine (D). Gradual return to normal activities (B). Low-stress aerobic exercise (C). Conditioning exercises for trunk muscles after 2 weeks (C). Exercise quotas (C).		Back-specific exercise machines (D). Therapeutic stretching of back muscles (D).
Detection of Physiologic Abnormalities (14 studies)	If no improvement after 1 month: Bone scan (C). Needle EMG and H-reflex tests to clarify nerve root dysfunction (C). SEP to assess spinal stenosis (C).		EMG for clinically obvious radiculopathy (D). Surface EMG and F-wave tests (C). Thermography (C).
Radiographs of L-S spine (18 studies)	When Red flags for fracture present (C).		Routine use in first month of symptoms in absence

Table 2 -- Summary of Findings and Recommendation Statements about Evidence with Amount of Evidence to Support the Statement (A, B, C, D)

	Recommend	Option	Recommend Against
	When Red flags for cancer or infection present (C).		of red flags (B). Routine oblique views (B).
Imaging (<i>18 studies</i>)	CT or MRI when cauda equina, tumor, infection, or fracture strongly suspected (C). MRI test of choice for patients who have prior back surgery (D). Assure quality criteria for imaging tests (B).	Myelography or CT-myelography for preoperative planning (D).	Use of imaging test before one month in absence of red flags (B). Discography or CT-discography (C).
Surgical Considerations (<i>14 studies</i>)	Discuss possible surgical options with patients who have persistent and severe sciatica and clinical evidence of nerve root compromise after 1 month of conservative therapy (B). Standard discectomy and microdiscectomy of similar efficacy in treatment of herniated disc (B). Chymopapain, used after ruling out allergic sensitivity, acceptable but less efficacious than discectomy to treat herniated disc (C).		Disc surgery in patients who have back pain alone, no red flags, and no nerve root compression (D). Percutaneous discectomy less efficacious than chymopapain (C). Surgery for spinal stenosis within the first 3 months of symptoms (D). Stenosis surgery justified by imaging test rather than patient's functional status (D). Spinal fusion during the first 3 months of symptoms in the absence of fracture, dislocation, complications of tumor or infection (C).
Psychosocial Factors	Social economic, and psychological factors can alter patient response to symptoms and treatment (D).		Referral for extensive evaluation/treatment prior to exploring patient expectations or psychosocial factors (D).

Table 2 -- Summary of Findings and Recommendation Statements about Evidence with Amount of Evidence to Support the Statement (A, B, C, D)			
	Recommend	Option	Recommend Against
Abbreviations: NSAIDs = nonsteroidal anti-inflammatory drugs; TNS = transcutaneous nerve stimulator; CT = computerized tomography; MRI = magnetic resonance imaging; EMG = electromyography.			

Table 3 -- Amount of Available Evidence as Interpreted by the Panel to Support Guideline Statements	
A	Strong research-based evidence (multiple specific and relevant high-quality scientific studies).
B	Moderate research-based evidence (multiple adequate or one specific and relevant high-quality scientific study).
C	Some research-based evidence (at least one adequate scientific study).
D	Indirect helpful information that did not meet the inclusion trial criteria on evidence tables.

Colorado Division of Workers' Compensation, Medical Treatment Guidelines, Rule XVII, Cervical Spine Injury, 12/01/01.

RULE XVII, EXHIBIT E

CERVICAL SPINE INJURY MEDICAL TREATMENT GUIDELINE

A. INTRODUCTION

This document has been prepared by the Colorado Department of Labor and Employment, Division of Workers' Compensation (Division) and should be interpreted within the context of guidelines for physicians/providers treating individuals qualifying under Colorado's Workers' Compensation Act as injured workers with cervical spine injuries.

Although the primary purpose of this document is advisory and educational, these guidelines are enforceable under the Workers' Compensation Rules of Procedure, 7 CCR 1101-3. The Division recognizes that acceptable medical practice may include deviations from these guidelines, as individual cases dictate. Therefore, these guidelines are not relevant as evidence of a provider's legal standard of professional care.

To properly utilize this document, the reader should not skip nor overlook any sections.

Rating: 7a

Conlin A, Bhogal S, Sequeira K, Teasell R. Treatment of whiplash-associated disorders--part I: Non-invasive interventions. *Pain Res Manag.* 2005 Spring;10(1):21-32.

St Joseph's Health Centre, Parkwood Hospital, London, Canada.

BACKGROUND: A whiplash-associated disorder (WAD) is an injury due to an acceleration-deceleration mechanism at the neck. WAD represents a very common and costly condition, both economically and socially. In 1995, the Quebec Task Force published a report that contained evidence-based recommendations regarding the treatment of WAD based on studies completed before 1993 and consensus-based recommendations.

OBJECTIVE: The objective of the present article--the first installment of a two-part series on interventions for WAD--is to provide a systematic review of the literature published between January 1993 and July 2003 on noninvasive interventions for WAD using meta-analytical techniques.

METHODS OF THE REVIEW: Three medical literature databases were searched for identification of all studies on the treatment of WAD. Randomized controlled trials (RCTs) and epidemiological studies were categorized by treatment modality and analyzed by outcome measure. The methodological quality of the RCTs was assessed. When possible, pooled analyses of the RCTs were completed for meta-analyses of the data. The results of all the studies were compiled and systematically reviewed.

RESULTS: Studies were categorized as exercise alone, multimodal intervention with exercise, mobilization, strength training, pulsed magnetic field treatment and chiropractic manipulation. A total of eight RCTs and 10 non-RCTs were evaluated. The mean score of methodological quality of the RCTs was five out of 10. Pooled analyses were completed across all treatment modalities and outcome measures. The outcomes of each study were summarized in tables.

CONCLUSIONS: There exists consistent evidence (published in two RCTs) in support of mobilization as an effective noninvasive intervention for acute WAD. Two RCTs also reported consistent evidence that exercise alone does not improve range of motion in patients with acute WAD. One RCT reported improvements in pain and range of motion in patients with WAD of undefined duration who underwent pulsed electromagnetic field treatment. Conflicting evidence in two RCTs exists regarding the effectiveness of multimodal intervention with exercise. Limited evidence, in the form of three non-RCTs, exists in support of chiropractic manipulation. Future research should be directed toward clarifying the role of exercise and manipulation in the treatment of WAD, and supporting or refuting the benefit of pulsed electromagnetic field treatment. Mobilization is recommended for the treatment of pain and compromised cervical range of motion in the acute WAD patient.

PMID: 15782244

Rating: 1b

Kjellman GV, Skargren EI, Oberg BE. A critical analysis of randomised clinical trials on neck pain and treatment efficacy: a review of the literature. *Scandinavian Journal of Rehabilitation Medicine* 1999, 31(3), 139-152.

Department of Neuroscience and Locomotion, Faculty of Health Sciences, Linköping University, Sweden.

The efficacy of physiotherapy or chiropractic treatment for patients with neck pain was analysed by reviewing 27 randomised clinical trials published 1960-1995. Three different methods were employed: systematic analyses of; methodological quality; comparison of effect size; analysis of inclusion criteria, intervention and outcome according to The Disablement Process model. The quality of most of the studies was low; only one-third scored 50 or more of a possible 100 points. Positive outcomes were noted for 18 of the investigations, and the methodological quality was high in studies using electromagnetic therapy, manipulation, or active physiotherapy. High methodological quality was also noted in studies with traction and acupuncture, however, the interventions had either no effect or a negative effect on outcome. Pooling data and calculation of effect size showed that treatments used in the studies were effective for pain, range of motion, and activities of daily living. Inclusion criteria, intervention, and outcome were based on impairment in most of the analysed investigations. Broader outcome assessments probably would have revealed relationships between treatment effect and impairment, functional limitation and disability.

(1) From Cochrane Library:

Record status

This record is a structured abstract written by CRD reviewers. The original has met a set of quality criteria. Since September 1996 abstracts have been sent to authors for comment. Additional factual information is incorporated into the record. Noted as (A:.....).

Author's objective

To critically review randomised studies of neck pain in regard to methodological quality and treatment effect size, as well as types of assessment, inclusion criteria and interventions.

Type of intervention

Treatment.

Specific interventions included in the review

Physiotherapy or chiropractic treatment. Specific interventions included acupuncture, manipulation, mobilisation, traction, active physiotherapy, electrostimulation/local heat. Control interventions included placebo, neck collars, manual treatment, advice, rest and analgesia, medication, rehabilitation exercises, cold packs, acupuncture, group exercise. Follow-up period ranged from two weeks to two years.

Participants included in the review

Ongoing neck pain. Participants in the studies had chronic headache, acute/chronic whiplash, acute/chronic neck pain, or mixed indications. Studies that involved people with both neck and lower back pain were excluded.

Outcomes assessed in the review

Outcomes were classified according to the Disablement Process (see Other Publications of Related Interest no.1). The components of this process include the pathology, the impairment, the functional limitations, disability, extra-individual factors, intra-individual factors, and risk factors. Outcomes assessed in the included studies included pain (SF-36 pain relief and neck pain disability index), range of motions, activities of daily living, analgesic and other medication consumption, headache frequency, associated symptoms such as dizziness, sleep disturbance, social dysfunction, subjective assessment of progress.

Kongsted A, Qerama E, Kasch H, Bendix T, Winther F, Korsholm L, Jensen TS. Neck collar, "act-as-usual" or active mobilization for whiplash injury? A randomized parallel-group trial. *Spine*. 2007 Mar 15;32(6):618-26.

Back Research Center, Clinical Locomotion Sciences, Backcenter Funen, University of Southern Denmark, Ringe, Denmark. alik@shf.fyns-amt.dk

STUDY DESIGN: Randomized, parallel-group trial.

OBJECTIVE: To compare the effect of 3 early intervention strategies following whiplash injury.

SUMMARY OF BACKGROUND DATA: Long-lasting pain and disability, known as chronic whiplash-associated disorder (WAD), may develop after a forced flexion-extension trauma to the cervical spine. It is unclear whether this, in some cases disabling, condition can be prevented by early intervention. Active interventions have been recommended but have not been compared with information only.

METHODS: Participants were recruited from emergency units and general practitioners within 10 days after a whiplash injury and randomized to: 1) immobilization of the cervical spine in a rigid collar followed by active mobilization, 2) advice to "act-as-usual," or 3) an active mobilization program (Mechanical Diagnosis and Therapy). Follow-up was carried out after 3, 6, and 12 months postinjury. Treatment effect was measured in terms of headache and neck pain intensity (0-10), disability, and work capability.

RESULTS: A total of 458 participants were included. At the 1-year follow-up, 48% of participants reported considerable neck pain, 53% disability, and 14% were still sick listed at 1 year follow-up. No significant differences were observed between the 3 interventions group.

CONCLUSION: Immobilization, "act-as-usual," and mobilization had similar effects regarding prevention of pain, disability, and work capability 1 year after a whiplash injury.

PMID: 17413465

Rating: 2a

In various studies, mobilization has been shown to have a somewhat better effect than a soft collar and passive treatment methods; advice to act-as-usual was superior to a soft collar; and immobilization in a

semirigid neck collar for 4 weeks was reported to be superior to a mobilization regimen. To evaluate the spectrum of treatment regimens, the current prospective randomized trial focused on prevention of chronic sequelae after a whiplash injury using interventions directed toward soft tissue damage in the cervical spine.

Study Highlights

At 2 university research centers in Denmark, 458 participants were recruited from emergency units and general practitioners within 10 days after a whiplash injury. This trial took place between May 10, 2001, and June 17, 2004, and recruitment ended in June 2003.

Inclusion criteria were 18 to 70 years of age, exposure to a rear-end or frontal car collision, symptomatic within 72 hours, and could be examined within 10 days of the collision. Exclusion criteria were fractures or dislocations of the cervical spine, amnesia or unconsciousness, injuries other than whiplash, self-reported average neck pain during the preceding 6 months of more than 2 on a scale of 0 to 10, significant preexisting somatic or psychiatric disease, and known alcohol or drug abuse.

Those with marked symptoms and an expected increased risk of developing persistent symptoms were included in this trial; those who reported milder symptoms were included in a separate study. Participants were randomized to receive (1) immobilization of the cervical spine in a semirigid Philadelphia neck collar worn during all waking hours for 2 weeks, followed by active mobilization, (2) advice in a 1-hour session to act as usual, or (3) an active mobilization program (Mechanical Diagnosis and Therapy; physical therapy twice weekly for 3 weeks). All participants received a pamphlet emphasizing a generally good prognosis and simple advice about use of ice and mild analgesics. At baseline, age, sex distribution, pain intensity, and cervical range of motion were similar in all groups. Follow-up visits were at 3, 6, and 12 months. Treatment outcome measures were headache and neck pain intensity (scale, 0 - 10), neck disability (15-item Copenhagen Neck Functional Disability Scale, 0 = no neck disability to 30 = extremely disabled), and self-reported work capability. Primary analyses were by intent-to-treat.

Participants lost to follow-up: act-as-usual group, 25; immobilization group, 8; and active mobilization group, 5. Those lost to follow-up did not differ significantly from the others in terms of baseline parameters.

There was good treatment compliance for 80 (53%) of 151 in the collar group and 106 (76%) of 140 in the active mobilization group, and poor compliance in 40 (26%) of 151 and 9 (6%) of 140 in these groups, respectively. Participants with poor compliance in the collar group were less likely to be listed as sick at baseline, but other baseline data did not differ between compliance groups. Poorly compliant participants in the collar group reported a better outcome at 1-year than did others. The outcome of those poorly compliant to active mobilization could not be reliably estimated because only 4 of 9 completed follow-up.

All groups reported reduced headache and neck pain intensity, with improvement occurring mainly during the first 3 months after injury. At 1-year follow-up, 48% of participants had considerable neck pain, 53% reported disability, and 14% were still listed as sick.

There were no significant differences between the 3 groups. Improvement from baseline to 1-year follow-up was reported by 38% in the collar group, 33% in the act-as-usual group, and by 40% in the mobilization group. Worsening was reported by 12%, 17%, and 10%, respectively (P = .60).

Per-protocol analyses showed results close to the primary analyses, but the neck collar group tended to have a poorer outcome, with estimated higher risk for altered working ability in this group vs act-as-usual (odds ratio, 2.3) or mobilization (odds ratio, 3.2; P < .05).

Pearls for Practice

After whiplash injury, patients at high risk for whiplash-associated disorder treated conservatively reported reduced headache and neck pain intensity, with improvement occurring mainly during the first 3 months after injury. At 1-year follow-up, 48% of participants reported considerable neck pain, 53% reported disability, and 14% were still listed as sick.

There were no significant differences noted between the 3 intervention groups. Improvement from baseline to 1-year follow-up was reported by 38% in the collar group, 33% in the act-as-usual group, and 40% in the mobilization group.

Philadelphia Panel. Philadelphia Panel evidence-based clinical practice guidelines on selected rehabilitation interventions for neck pain. Phys Ther 2001 Oct; 81(10): 1701-17.

INTRODUCTION: A structured and rigorous methodology was developed for the formulation of evidence-based clinical practice guidelines (EBCPGs), then was used to develop EBCPGs for selected rehabilitation interventions for the management of neck pain. **METHODS:** Evidence from randomized controlled trials (RCTs) and observational studies was identified and synthesized using methods defined by the Cochrane Collaboration that minimize bias by using a systematic approach to literature search, study selection, data extraction, and data synthesis. Meta-analysis was conducted where possible. The strength of evidence was graded as level I for RCTs or level II for nonrandomized studies.

DEVELOPING RECOMMENDATIONS: An expert panel was formed by inviting stakeholder professional organizations to nominate a representative. This panel developed a set of criteria for grading the strength of both the evidence and the recommendation. The panel decided that evidence of clinically important benefit (defined as 15% greater relative to a control based on panel expertise and empiric results) in patient-important outcomes was required for a recommendation. Statistical significance was also required but was insufficient alone. Patient-important outcomes were decided by consensus as being pain, function, patient global assessment, quality of life, and return to work, providing that these outcomes were assessed with a scale for which measurement reliability and validity have been established.

VALIDATING THE RECOMMENDATIONS: A feedback survey questionnaire was sent to 324 practitioners from 6 professional organizations. The response rate was 51%. **RESULTS:** For neck pain, therapeutic exercises were the only intervention with clinically important benefit relative to a control (grade A for pain and function, grade B for patient global assessment). There was good agreement with this recommendation from practitioners (93%). For several interventions and indications (eg, thermotherapy, therapeutic ultrasound, massage, electrical stimulation), there was a lack of evidence regarding efficacy.

CONCLUSIONS: This methodology of developing EBCPGs provides a structured approach to assessing the literature and developing guidelines that incorporates clinicians' feedback and is widely acceptable to practicing clinicians. Further well-designed RCTs are warranted regarding the use of several interventions for patients with neck pain where evidence was insufficient to make recommendations.

Publication Types:

- Consensus Development Conference
- Guideline
- Meta-Analysis
- Practice Guideline
- Review
-

PMID: 11589644

Rating: A

Rosenfeld M, Gunnarsson R, Borenstein P. Early intervention in whiplash-associated disorders: a comparison of two treatment protocols. Spine 2000 Jul 15;25(14):1782-7.

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STUDY DESIGN: A prospective randomized trial in 97 patients with a whiplash injury caused by a motor vehicle collision.

OBJECTIVES: The study evaluates early active mobilization versus a standard treatment protocol and the importance of early versus delayed onset of treatment.

SUMMARY OF BACKGROUND DATA: There is no compelling evidence to date on the management of acute whiplash-associated disorders. The few studies describing treatment, however, provide evidence to support the recommendation that an active treatment in the acute stage is preferable to rest and a soft collar in most patients.

METHODS: Patients were randomized to four groups. Active versus standard treatment and early (within 96 hours) versus delayed (after 2 weeks) treatment. Measures of range of motion and pain were registered initially and at 6 months.

RESULTS: Eighty-eight patients (91%) could be followed up at 6 months. Active treatment reduced pain more than standard treatment ($P < 0.001$). When type and onset of treatment were analyzed, a combined effect was seen. When active treatment was provided, it was better when administered early, and if standard treatment was provided, it was better when administered late for reduction of pain ($P = 0.04$) and increasing cervical flexion ($P = 0.01$).

CONCLUSIONS: In patients with whiplash-associated disorders caused by a motor vehicle collision treatment with frequently repeated active submaximal movements combined with mechanical diagnosis and therapy is more effective in reducing pain than a standard program of initial rest, recommended use of a soft collar, and gradual self-mobilization. This therapy could be performed as home exercises initiated and supported by a physiotherapist.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

Rating: 2b, 97 cases

Scholten-Peeters GG, Neeleman-van der Steen CW, van der Windt DA, Hendriks EJ, Verhagen AP, Oostendorp RA. Education by general practitioners or education and exercises by physiotherapists for patients with whiplash-associated disorders? A randomized clinical trial. *Spine*. 2006 Apr 1;31(7):723-31.

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STUDY DESIGN: Randomized clinical trial.

OBJECTIVE: To compare the effectiveness of education and advice given by general practitioners (GPs) with education, advice, and active exercise therapy given by physiotherapists (PTs) for patients with whiplash-associated disorders.

SUMMARY OF BACKGROUND DATA: Available evidence from systematic reviews has indicated beneficial effects for active interventions in patients with whiplash-associated disorders. However, it remained unclear which kind of active treatment was most effective.

METHODS: Whiplash patients with symptoms or disabilities at 2 weeks after accident were recruited in primary care. Eligible patients still having symptoms or disabilities at 4 weeks were randomly allocated to GP care or physiotherapy. GPs and PTs treated patients according to a dynamic multimodal treatment protocol primarily aimed to increase activities and influence unfavorable psychosocial factors for recovery. We trained all health care providers about the characteristics of the whiplash problem, available evidence regarding prognosis and treatment, and protocol of the interventions. The content of the information provided to patients during treatment depended on the treatment goals set by the GPs or PTs. Also, the type of exercises chosen by the PTs depended on the treatment goals, and it was not explicitly necessary that exercise therapy was provided in all patients. Primary outcome measures included neck pain intensity, headache intensity, and work activities. Furthermore, an independent blinded assessor measured functional recovery, cervical range of motion, disability, housekeeping and social activities, fear of movement, coping, and general health status. We assessed outcomes at 8, 12, 26, and 52 weeks after the accident.

RESULTS: A total of 80 patients were randomized to either GP care (n = 42) or physiotherapy (n = 38). At 12 and 52 weeks, no significant differences were found concerning the primary outcome measures. At 12 weeks, physiotherapy was significantly more effective than GP care for improving 1 of the measures of cervical range of motion (adjusted mean difference 12.3 degrees ; 95% confidence interval [CI] 2.7-21.9). Long-term differences between the groups favored GP care but were statistically significant only for some secondary outcome measures, including functional recovery (adjusted relative risk 2.3; 95% CI 1.0-5.0), coping (adjusted mean difference 1.7 points; 95% CI 0.2-3.3), and physical functioning (adjusted mean difference 8.9 points; 95% CI 0.6-17.2).

CONCLUSIONS: We found no significant differences for the primary outcome measures. Treatment by GPs and PTs were of similar effectiveness. The long-term effects of GP care seem to be better compared to physiotherapy for functional recovery, coping, and physical functioning. Physiotherapy seems to be more effective than GP care on cervical range of motion at short-term follow-up.

PMID: 16582844

Rating: 2b

Seferiadis A, Rosenfeld M, Gunnarsson R. A review of treatment interventions in whiplash-associated disorders. *Eur Spine J.* 2004 Aug;13(5):387-97. Epub 2004 May 05.

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In recent years, there has been much debate on the treatment of whiplash-associated disorders (WAD). It is not clear if the treatments commonly employed are effective, and concerns have been raised on the available scientific evidence of many of these treatments. The aim of this study was to review the literature systematically to analyze the evidence basis of many commonly used treatments for patients suffering from WAD, both in the acute and the chronic state. A computer-assisted search of the databases Medline (from 1962 to May 2003), CINAHL (1960-2003), Embase (1976-2003), and Psychinfo (1960-2003) was conducted as well as a check of the reference lists of relevant studies. All randomized controlled trials (RCTs) were retrieved and systematically analyzed with three common instruments of measurement of methodological quality. A qualitative analysis ("best-evidence synthesis") was performed. The methodological quality of 26 RCTs was analyzed. The median quality scores for all three instruments were poor. Based on the degrees of evidence and the practical obstacles, the following treatments can be recommended: Early physical activity in acute WAD, radiofrequency neurotomy, combination of cognitive behavioral therapy with physical therapy interventions, and coordination exercise therapy in chronic WAD. High-quality RCTs are not common in the field of WAD. More research is needed, particularly on the treatment of chronic WAD.

PMID: 15133721

Rating: 1b

Conclusions

Few randomised clinical trials on neck problems are of high methodological quality and comprise a sufficiently long follow-up time. In the studies that did show high quality, three different interventions led to a slight tendency towards positive results but the number of publications considered was inadequate to allow general conclusions to be drawn. The effect size calculations and the disablement process analysis indicated that the intervention in the trials had a positive influence on two impairment components, pain and range of motion. Effect size was also positive for one disability component, activities of daily living, but this finding was based on a very limited number of studies. Further analyses are needed to determine whether physiotherapy and chiropractic treatments have positive effects on functional limitation and various aspects of disability.

Rating: 1b

Pain (Chronic)

Airaksinen O, Brox JI, Cedraschi C, Hildebrandt J, Klaber-Moffett J, Kovacs F, Mannion AF, Reis S, Staal JB, Ursin H, Zanoli G; On behalf of the COST B13 Working Group on Guidelines for Chronic Low Back Pain. Chapter 4 European guidelines for the management of chronic nonspecific low back pain. *Eur Spine J.* 2006 Mar;15(Supplement 2):s192-s300.

Objectives

The primary objective of the European evidence-based guidelines is to provide a set of recommendations that can support existing and future national and international guidelines or future updates of existing back pain guidelines.

Summary of the concepts of diagnosis in chronic low back pain (CLBP)

Patient assessment

Physical examination and case history: The use of diagnostic triage, to exclude specific spinal pathology and nerve root pain, and the assessment of prognostic factors (yellow flags) are recommended. We cannot recommend spinal palpatory tests, soft tissue tests and segmental range of motion or straight leg raising tests (Lasegue) in the diagnosis of nonspecific CLBP.

Imaging

We do not recommend radiographic imaging (plain radiography, CT or MRI), bone scanning, SPECT, discography or facet nerve blocks for the diagnosis of nonspecific CLBP unless a specific cause is strongly suspected. MRI is the best imaging procedure for use in diagnosing patients with radicular symptoms, or for those in whom discitis or neoplasm is suspected. Plain radiography is recommended for the assessment of structural deformities.

Electromyography

We cannot recommend electromyography for the diagnosis of nonspecific CLBP.

Prognostic factors

We recommend the assessment of work related factors, psychosocial distress, depressive mood, severity of pain and functional impact, prior episodes of LBP, extreme symptom reporting and patient expectations in the assessment of patients with nonspecific CLBP.

Summary of the concepts of treatment of chronic low back pain (CLBP)

Conservative treatments

Cognitive behavioural therapy, supervised exercise therapy, brief educational interventions, and multidisciplinary (bio-psycho-social) treatment can each be recommended for nonspecific CLBP. Back schools (for short-term improvement), and short courses of manipulation/mobilisation can also be considered. The use of physical therapies (heat/cold, traction, laser, ultrasound, short wave, interferential, massage, corsets) cannot be recommended. We do not recommend TENS.

Pharmacological treatments:

The short term use of NSAIDs and weak opioids can be recommended for pain relief. Noradrenergic or noradrenergic-serotonergic antidepressants, muscle relaxants and capsiicum plasters can be considered for pain relief. We cannot recommend the use of Gabapentin.

Invasive treatments

Acupuncture, epidural corticosteroids, intra-articular (facet) steroid injections, local facet nerve blocks, trigger point injections, botulinum toxin, radiofrequency facet denervation, intradiscal radiofrequency lesioning, intradiscal electrothermal therapy, radiofrequency lesioning of the dorsal root ganglion, and spinal cord stimulation cannot be recommended for nonspecific CLBP. Intradiscal injections and prolotherapy are not recommended. Percutaneous electrical nerve stimulation (PENS) and neuroreflexotherapy can be considered where available. Surgery for nonspecific CLBP cannot be recommended unless 2 years of all other recommended conservative treatments – including multidisciplinary approaches with combined programs of cognitive intervention and exercises – have failed, or such combined programs are not available, and only then in carefully selected patients with maximum 2-level degenerative disc disease.

Overarching comments

- In contrast to acute low back pain, only very few guidelines exist for the management of CLBP.
- CLBP is not a clinical entity and diagnosis, but rather a symptom in patients with very different stages of impairment, disability and chronicity. Therefore assessment of prognostic factors before treatment is essential.
- Overall, there is limited positive evidence for numerous aspects of diagnostic assessment and therapy in patients with nonspecific CLBP.
- In cases of low impairment and disability, simple evidence-based therapies (i.e. exercises, brief interventions, and medication) may be sufficient.
- No single intervention is likely to be effective in treating the overall problem of CLBP of longer duration and more substantial disability, owing to its multidimensional nature.
- For most therapeutic procedures, the effect sizes are rather modest.

- The most promising approaches seem to be cognitive behavioural interventions encouraging activity/exercise.
- It is important to get all the relevant players onside and to provide a consistent approach.

PMID: 16550448

Rating: 8a

Li Z, Smith BP, Smith TL, Koman LA. Diagnosis and management of complex regional pain syndrome complicating upper extremity recovery. J Hand Ther. 2005 Apr-Jun;18(2):270-6.

Department of Orthopaedic Surgery, Wake Forest University School of Medicine, Winston-Salem, North Carolina 27157-1070, USA.

Complex regional pain syndrome (CRPS) is a clinical syndrome of pain, autonomic dysfunction, trophic changes, and functional impairment. CRPS is common after hand trauma or surgery. Early diagnosis and intervention is critical for adequate recovery. The diagnosis of CRPS requires a careful history, physical examination, and supporting diagnostic testing. Optimal treatment requires a multidisciplinary approach. A large spectrum of pharmacologic interventions is efficacious in treating CRPS. Surgery may be used to relieve nociceptive foci. Patient-specific hand therapy is very important in reducing swelling, decreasing pain, and improving range of motion.

Publication Types:

- Review
- Review, Tutorial

PMID: 15891984

Rating: 5b

State of Colorado Department of Labor and Employment, Division of Workers' Compensation. Colorado Rule XVII, Exhibit 7, Complex Regional Pain Syndrome Medical Treatment Guideline. 01/01/06

Complex Regional Pain Syndrome (CRPS Types I and II) describes painful syndromes, which were formerly referred to as Reflex Sympathetic Dystrophy (RSD) and causalgia. CRPS conditions usually follow injury that appears regionally and have a distal predominance of abnormal findings, exceeding the expected clinical course of the inciting event in both magnitude and duration and often resulting in significant impairment of limb function

CRPS-I (RSD) is a syndrome that usually develops after an initiating noxious event, is not limited to the distribution of a single peripheral nerve, and is apparently disproportionate to the inciting event. It is associated at some point with evidence of edema, changes in skin blood flow, abnormal sudomotor

activity in the region of the pain, allodynia or hyperalgesia. The site is usually in the distal aspect of an affected extremity or with a distal to proximal gradient. The peripheral nervous system and possibly the central nervous system are involved.

CRPS-II (Causalgia) is the presence of burning pain, allodynia, and hyperpathia usually in the hand or foot after partial injury to a nerve or one of its major branches. Pain is within the distribution of the damaged nerve but not generally confined to a single nerve.

Stages seen in CRPS-I are not absolute and in fact, may not all be observed in any single patient. In some patients, stages may be missed or the patient may remain for long periods of time in one stage.

Stage 1 - Acute (Hyperemic)

Starts at the time of injury or even weeks later. Associated with spontaneous pain, aching, burning. Typically restricted to the distal extremity. Hyperpathia, allodynia, hypoesthesia or hyperesthesia may be present. Initially, hair and nail growth may be increased but later decrease. Skin may be warm or cold.

Stage 2 - Dystrophic (Ischemic)

Spontaneous burning and/or aching pain, more pronounced hyperpathia and or allodynia. Signs of chronic sympathetic overactivity include (a) reduced blood flow; (b) sudomotor changes; (c) increased edema; (d) cyanotic skin; (e) muscle wasting; (f) decreased hair and nail growth; and (g) osteoporosis.

Stage 3 - Atrophic

Signs and symptoms of this stage include (a) pain may be less prominent; (b) decreased hyperpathia and/or allodynia; (c) reduction in blood flow; (d) skin temperature and sweating may be increased or decreased; (e) irreversible trophic changes in skin and integument; and (f) pronounced muscle atrophy with contractures.

Education

Education of the patient and family, as well as the employer, insurer, policy makers and the community should be the primary emphasis in the treatment of chronic pain. Currently, practitioners often think of education last, after medications, manual therapy and surgery. Practitioners must develop and implement an effective strategy and skills to educate patients, employers, insurance systems, policy makers and the community as a whole. An education-based paradigm should always start with inexpensive communication providing reassuring information to the patient. More in-depth education currently exists within a treatment regime employing functional restorative and innovative programs of prevention and rehabilitation. No treatment plan is complete without addressing issues of individual and/or group patient education as a means of facilitating self-management of symptoms and prevention.

Return-to-Work

Return-to-work is therapeutic, assuming the work is not likely to aggravate the basic problem or increase long-term pain. Even if there is residual chronic pain, return-to-work is not necessarily contraindicated.

Diagnostic Criteria for CRPS

a. CRPS-I (RSD)

1. Patient complains of pain, usually diffuse burning or aching;
2. Patient has physical findings on examination of at least vasomotor and/or sudomotor signs. Allodynia and/or trophic changes add strength to the diagnosis of CRPS-I; and
3. At least two diagnostic testing procedures are positive. Even the most sensitive tests can have false negatives. The patient can still have CRPS-I, if clinical signs are strongly present. In patients with continued signs and symptoms of CRPS-I, further diagnostic testing may be appropriate.

b. CRPS-II (causalgia)

1. Patient complains of pain;
2. Documentation of peripheral nerve injury with pain initially in the distribution of the injured nerve;
3. Patient has physical findings on examination of at least vasomotor and/or sudomotor signs. Allodynia and/or trophic changes add strength to the diagnosis of CRPS-II; and
4. At least two diagnostic testing procedures are positive. Even the most sensitive tests can have false negatives. The patient can still have CRPS-II, if clinical signs are strongly present. In patients with continued signs and symptoms of CRPS-II, further diagnostic testing may be appropriate.

c. Sympathetically Mediated Pain (SMP)

1. Patient complains of pain;
2. Usually does not have clinically detectable vasomotor or sudomotor signs; and
3. Has pain relief with sympathetic blocks.

d. Not CRPS

1. Patient complains of pain;
2. May or may not have vasomotor or sudomotor signs;
3. No relief with sympathetic blocks; and
4. No more than one other diagnostic test procedure is positive.

Publication Type:

- State Treatment Guideline

Rating: 7a

Shoulder (Acute & Chronic)

Anderson NH, Sojbjerg JO, Johannsen HV, Sneppen O, Self-training versus physiotherapist-supervised rehabilitation of the shoulder in patients treated with arthroscopic subacromial decompression: a clinical randomized study, *J Shoulder Elbow Surg* 1999 Mar-Apr;8(2):99-101

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In a controlled clinical prospective study, 43 consecutive patients (43 shoulders) with subacromial

impingement resistant to conservative therapy and without full-thickness rotator cuff tears underwent arthroscopic subacromial decompression. The patients were randomized to either self-training or physiotherapist-guided rehabilitation for immediate postoperative rehabilitation. Postoperative follow-up was performed by an independent observer after 3, 6, and 12 months. With the use of the Constant score for evaluation of functional outcome, patients training themselves improved from a mean 53 points (range 26 to 81 points) to a mean 79 points (range 45 to 100) points after 12 months. Physiotherapist-supervised patients improved from a mean 54 points (range 20 to 90 points) to a mean 80 points (range 40 to 100 points). The self-training patients returned to work after a mean 8.5 weeks (range 1 to 14 weeks), whereas the physiotherapist-supervised patients returned to work after a mean 8 weeks (range 3 to 13 weeks). No statistical difference was found between the 2 rehabilitation methods. This study was unable to show any beneficial effect of physiotherapist-supervised rehabilitation after arthroscopic subacromial decompression of the shoulder.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 10226959

Rating: 2c, RCT, 43 cases

Bang MD, Deyle GD, Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome, *J Orthop Sports Phys Ther* 2000 Mar;30(3):126-37

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STUDY DESIGN: A prospective randomized clinical trial.

OBJECTIVE: To compare the effectiveness of 2 physical therapy treatment approaches for impingement syndrome of the shoulder.

BACKGROUND: Manual physical therapy combined with exercise is a commonly applied but currently unproven clinical treatment for impingement syndrome of the shoulder.

METHODS AND MEASURES: Thirty men and 22 women (age 43 years +/- 9.1) diagnosed with shoulder impingement syndrome were randomly assigned to 1 of 2 treatment groups. The exercise group performed supervised flexibility and strengthening exercises. The manual therapy group performed the same program and received manual physical therapy treatment. Both groups received the selected intervention 6 times over a 3-week period. The testers, who were blinded to group assignment, measured strength, pain, and function before treatment and after 6 physical therapy visits. Strength was a composite score of isometric strength tests for internal rotation, external rotation, and abduction. Pain was a composite score of visual analog scale measures during resisted break tests, active abduction, and

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functional activities. Function was measured with a functional assessment questionnaire. The visual analog scale used to measure pain with functional activities and the functional assessment questionnaire were also measured 2 months after the initiation of treatment.

RESULTS: Subjects in both groups experienced significant decreases in pain and increases in function, but there was significantly more improvement in the manual therapy group compared to the exercise group. For example, pain in the manual therapy group was reduced from a pretreatment mean (+/- SD) of 575.8 (+/- 220.0) to a posttreatment mean of 174.4 (+/- 183.1). In contrast, pain in the exercise group was reduced from a pretreatment mean of 557.1 (+/- 237.2) to a posttreatment mean of 360.6 (+/- 272.3). Strength in the manual therapy group improved significantly while strength in the exercise group did not.

CONCLUSION: Manual physical therapy applied by experienced physical therapists combined with supervised exercise in a brief clinical trial is better than exercise alone for increasing strength, decreasing pain, and improving function in patients with shoulder impingement syndrome.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 10721508

Rating: 2c, RCT, 52 cases

Buchbinder R, Youd JM, Green S, Stein A, Forbes A, Harris A, Bennell K, Bell S, Wright WJ. Efficacy and cost-effectiveness of physiotherapy following glenohumeral joint distension for adhesive capsulitis: a randomized trial. *Arthritis Rheum.* 2007 Aug 15;57(6):1027-37.

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OBJECTIVE: To determine whether an active physiotherapy program following arthrographic joint distension for adhesive capsulitis provides additional benefits.

METHODS: We performed a randomized, placebo-controlled, participant and single assessor blinded trial. A total of 156 participants with pain and stiffness in predominantly 1 shoulder for ≥ 3 months and restriction of passive motion >30 degrees in ≥ 2 planes of movement entered the study, and 144 completed the study. Following joint distension, participants were randomly assigned to either manual therapy and directed exercise or placebo (sham ultrasound), both administered twice weekly for 2 weeks then once weekly for 4 weeks. Pain, function, active shoulder movements, participant-perceived success, and quality of life were assessed at baseline, 6, 12, and 26 weeks. Costs were also collected.

RESULTS: Both groups improved over time with no significant differences in improvement between groups for pain, function, or quality of life at any time point. Significant differences favored the physiotherapy group for all active shoulder movements (e.g., pooled difference in mean change between

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groups across all time points for total shoulder abduction was 10.6 degrees , 95% confidence interval [95% CI] 3.1, 18.1) and participant-perceived success (pooled relative risk 1.4, 95% CI 1.1, 1.65; number needed to treat = 5). Net cost of physiotherapy was \$136.8 Australian (95% CI -177.5, 223.1) over the 6 months.

CONCLUSION: Physiotherapy following joint distension provided no additional benefits in terms of pain, function, or quality of life but resulted in sustained greater active range of shoulder movement and participant-perceived improvement up to 6 months.

PMID: 17665470

Rating: 2b

Burbank KM, Stevenson JH, Czarnecki GR, Dorfman J. Chronic Shoulder Pain: Part I. Evaluation and Diagnosis. *Am Fam Physician.* 2008;77:453-460, 493-497.

Shoulder pain is defined as chronic when it has been present for longer than six months. Common conditions that can result in chronic shoulder pain include rotator cuff disorders, adhesive capsulitis, shoulder instability, and shoulder arthritis. Rotator cuff disorders include tendinopathy, partial tears, and complete tears. A clinical decision rule that is helpful in the diagnosis of rotator cuff tears includes pain with overhead activity, weakness on empty can and external rotation tests, and a positive impingement sign. Adhesive capsulitis can be associated with diabetes and thyroid disorders. Clinical presentation includes diffuse shoulder pain with restricted passive range of motion on examination.

Acromioclavicular osteoarthritis presents with superior shoulder pain, acromioclavicular joint tenderness, and a painful cross-body adduction test. In patients who are older than 50 years, glenohumeral osteoarthritis usually presents as gradual pain and loss of motion. In patients younger than 40 years, glenohumeral instability generally presents with a history of dislocation or subluxation events. Positive apprehension and relocation are consistent with the diagnosis. Imaging studies, indicated when diagnosis remains unclear or management would be altered, include plain radiographs, magnetic resonance imaging, ultrasonography, and computed tomography scans. Plain radiographs may help diagnose massive rotator cuff tears, shoulder instability, and shoulder arthritis. Magnetic resonance imaging and ultrasonography are preferred for rotator cuff disorders. For shoulder instability, magnetic resonance imaging arthrogram is preferred over magnetic resonance imaging.

Rating: 5b

February 19, 2008 — A simple, effective approach for the primary care clinician regarding the diagnosis and treatment of chronic disorders of the shoulder is reviewed in 2 articles in the February 15 issue of *American Family Physician*. "Shoulder pain is responsible for approximately 16 percent of all musculoskeletal complaints, with a yearly incidence of 15 new episodes per 1,000 patients seen in the primary care setting," write Kelton M. Burbank, MD, from Leominster, Massachusetts, and colleagues. "Shoulder pain is defined as chronic when it has been present for longer than six months, regardless of whether the patient has previously sought treatment." The first part of this 2-part article offers the primary care clinician a practical approach to the diagnosis of chronic shoulder disorders. Key recommendations for diagnosis of shoulder pain, all with a "C" level of evidence rating, are as follows:

- As part of the initial work-up for chronic shoulder pain, all patients should receive radiographs.
- When the diagnosis of chronic shoulder pain remains unclear or the outcome would affect management, additional testing with use of imaging modalities should be performed.
- The acromioclavicular joint should be evaluated for tenderness if acromioclavicular osteoarthritis is suspected, and a cross-body adduction test should be performed to help confirm the diagnosis.
- When a rotator cuff injury is suspected, the patient should be evaluated for nocturnal pain and pain with overhead activity.
- A painful shoulder with severely limited active and passive ranges of motion should warrant consideration of the diagnosis of adhesive capsulitis.

"Numerous other problems that can affect the shoulder are somewhat less common, such as biceps and labral pathology (e.g., SLAP tear—superior labrum anterior to posterior tear—an avulsion injury to the root of the long head of the biceps tendon) and multidirectional instability," the review authors conclude. "Other conditions are extremely uncommon, such as a suprascapular nerve injury, Parsonage Turner syndrome (brachial plexus neuritis), and a neuropathic shoulder from syringomyelia. The shoulder can also be the area of perceived pain for many non-shoulder problems, including fibromyalgia, cervical radiculopathy, and thoracic outlet syndrome."

The second article, by the same group, notes that effective treatment of chronic shoulder pain requires an accurate diagnosis. "A recent Cochrane review showed little evidence for or against the most common treatments of these chronic shoulder disorders; this is mainly because of a lack of well-designed clinical trials," the review authors write. "Nonetheless, most patients with a chronic shoulder disorder can initially be treated conservatively with some combination of activity modification, physical therapy, medications, and corticosteroid injections, if necessary. This approach produces satisfactory results in the majority of patients." In most cases, the initial treatment should include modification of physical activity and analgesic medications. If the initial presentation is of sufficient severity or if initial treatment does not result in improvement, a trial of physical therapy targeting the specific diagnosis is indicated. Combined steroid and local anesthetic injections may be helpful, either alone or in combination with physical therapy. The specific diagnosis should guide choice of the site of injection (subacromial, acromioclavicular joint, or intra-articular). Fluoroscopic guidance is recommended for injections into the glenohumeral joint. An orthopaedic specialist should be consulted for symptoms that persist or worsen after 6 to 12 weeks of directed treatment. Specific key recommendations for treatment of chronic shoulder pain, all with level of evidence B, are as follows:

- Most patients with chronic shoulder pain have improvement with nonoperative treatment, but severe pain, prolonged symptoms, or gradual onset predicts worse outcomes.
- Evidence for or against the use of medication for chronic shoulder pain is limited.
- For rotator cuff disorders, physical therapy can improve short-term recovery and long-term function.
- Subacromial corticosteroid injections are in widespread clinical use for rotator cuff disorders, but evidence is lacking to support or refute use of this treatment.
- In patients with adhesive capsulitis, injections into the glenohumeral joint have been shown to hasten the resolution of symptoms, but most patients have resolution of their symptoms without intervention, and interventions have not been demonstrated to improve long-term outcomes.

"The prognosis of chronic shoulder pain largely depends on the underlying pathology, but it appears to respond well to conservative treatment overall," the review authors conclude. "There is limited research on the success of nonoperative management, but it appears that symptoms of gradual onset, prolonged symptoms, and more severe pain at presentation are associated with a worse outcome for protracted recovery. In general, the speed of recovery in chronic shoulder pain is slow."

Study Highlights: Anterior-superior shoulder pain is often localized to the acromioclavicular joint, whereas pain in the lateral deltoid region often indicates a pathologic process involving the rotator cuff. Range of motion of the shoulder should always be examined in cases of shoulder pain, but an assessment of passive range of motion is not necessary if active range of motion is normal. Loss of both active and passive range of motion suggests adhesive capsulitis or glenohumeral osteoarthritis. Plain radiographs should be routinely ordered for patients with chronic shoulder pain, including anteroposterior, scapular Y, and axillary views. Radiographs of the acromioclavicular joint can be difficult to interpret because osteoarthritis of this joint is common by the age of 40 to 50 years. The preferred imaging modality for patients with suspected rotator cuff disorders is MRI. However, ultrasonography may emerge as a cost-effective alternative to MRI. Conservative treatment is the first option for the majority of patients with chronic shoulder pain. This treatment strategy should include modification of physical activities, including a reduction in overhead activity for patients with pathologic process involving the rotator cuff, glenohumeral osteoarthritis, or adhesive capsulitis. Cross-body shoulder adduction, as in a golf swing, should be limited among patients with acromioclavicular osteoarthritis. Although nonsteroidal anti-inflammatory drugs are frequently used among patients with chronic shoulder pain, there is limited evidence that these medications are more effective than acetaminophen. In a similar fashion, there is limited research to support the routine use of subacromial injections for pathologic processes involving the rotator cuff, but this treatment can be offered to patients. Intra-articular injections are effective in reducing pain and increasing function among patients with adhesive capsulitis. Although injections into the subacromial space and acromioclavicular joint can be performed in the clinician's office, injections into the glenohumeral joint should only be performed under fluoroscopic guidance. Regarding the management of specific conditions, adhesive capsulitis tends to resolve spontaneously in 1 to 2 years. However, if symptoms continue for more than 6 weeks, an intra-articular steroid injection can potentiate the effects of physical therapy. Stretching exercises should be reinitiated 1 week after the injection. Referral to an orthopaedist is recommended for patients with adhesive capsulitis who do not respond to 6 months of therapy. The mainstays of treatment for instability of the glenohumeral joint are modification of physical activity and an aggressive strengthening program. Osteoarthritis of the glenohumeral joint usually responds to analgesics and injections into the glenohumeral joint. However, aggressive physical therapy can actually exacerbate this condition because of a high incidence of joint incongruity. For rotator cuff pain with an intact tendon, a trial of 3 to 6 months of conservative therapy is reasonable before orthopaedic referral. Patients with small tears of the rotator cuff may be referred to an orthopaedist after 6 to 12 weeks of conservative treatment.

Table 1. History Findings and Associated Shoulder Disorders	
<i>History</i>	<i>Associated condition</i>
Age	If younger than 40 years: instability, rotator cuff tendinopathy If older than 40 years: rotator cuff tears, adhesive capsulitis, glenohumeral osteoarthritis
Diabetes or thyroid disorders	Adhesive capsulitis
History of trauma	If younger than 40 years: shoulder dislocation/subluxation If older than 40 years: rotator cuff tears
Loss of range of motion	Adhesive capsulitis, glenohumeral osteoarthritis
Night pain	Rotator cuff disorders, adhesive capsulitis
Numbness, tingling, pain radiating past elbow	Cervical etiology
Pain location	Anterior-superior shoulder pain associated with acromioclavicular joint pathology Diffuse shoulder pain in deltoid region associated with rotator cuff disorders, adhesive capsulitis, or glenohumeral osteoarthritis
Pain with overhead activity	Rotator cuff disorders
Sports participation	Shoulder instability associated with overhead sports (e.g., baseball, softball, tennis), and collision sports (e.g., football, hockey) Acromioclavicular joint pathology associated with weight lifting
Weakness	Rotator cuff disorders, glenohumeral osteoarthritis

Table 2. Selected Tests of the Shoulder					
<i>Examination maneuver</i>	<i>Associated condition</i>	<i>Sensitivity (%)</i>	<i>Specificity (%)</i>	<i>LR+</i>	<i>LR-</i>
Inspection					
Supraspinatus or infraspinatus atrophy	Chronic rotator cuff tear	56	73	2.07	0.60
Palpation					
Acromioclavicular tenderness	Acromioclavicular joint OA or chronic	96	10	1.07	0.4

Table 2. Selected Tests of the Shoulder					
<i>Examination maneuver</i>	<i>Associated condition</i>	<i>Sensitivity (%)</i>	<i>Specificity (%)</i>	<i>LR+</i>	<i>LR-</i>
	sprain				
Range of motion					
Restrictive active	Rotator cuff disorder	30	78	1.36	0.90
Provocative tests					
Hawkins' impingement	Impingement/rotator cuff disorder	72	66	2.1	0.42
Drop-arm	Large rotator cuff tear	27	88	2.25	0.83
Empty-can supraspinatus	Rotator cuff disorder involving supraspinatus	44	90	4.4	0.62
Lift-off subscapularis	Rotator cuff disorder involving subscapularis	62	100	> 25	0.38
External rotation/infraspinatus strength	Rotator cuff disorder involving infraspinatus	42	90	4.2	0.64
Cross-body adduction	Acromioclavicular joint OA or chronic sprain	77	79	3.50	0.29
Apprehension	Glenohumeral instability	72	96	20.22	0.29
Relocation	Glenohumeral instability	81	92	10.35	0.2
<p><i>LR+ = positive likelihood ratio; LR- = negative likelihood ratio; OA = osteoarthritis.</i></p> <p>Note: <i>The recommended progression of shoulder examination maneuvers is inspection, palpation, range of motion and strength tests, and provocative tests.</i></p>					

Carette S, Moffet H, Tardif J, Besette L, Morin F, Fremont P, Bykerk V, Thorne C, Bell M, Bensen W, Blanchette C. Intraarticular corticosteroids, supervised physiotherapy, or a combination of the two in the treatment of adhesive capsulitis of the shoulder: a placebo-controlled trial. *Arthritis Rheum.* 2003 Mar;48(3):829-38.

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OBJECTIVE: To compare the efficacy of a single intraarticular corticosteroid injection, a supervised physiotherapy program, a combination of the two, and placebo in the treatment of adhesive capsulitis of the shoulder.

METHODS: Ninety-three subjects with adhesive capsulitis of <1 year's duration were randomized to 1 of 4 treatment groups: group 1, corticosteroid injection (triamcinolone hexacetonide 40 mg) performed under fluoroscopic guidance followed by 12 sessions of supervised physiotherapy; group 2, corticosteroid injection alone; group 3, saline injection followed by supervised physiotherapy; or group 4, saline injection alone (placebo group). All subjects were taught a simple home exercise program. Subjects were reassessed after 6 weeks, 3 months, 6 months, and 1 year. The primary outcome measure was improvement in the Shoulder Pain and Disability Index (SPADI) score.

RESULTS: At 6 weeks, the total SPADI scores had improved significantly more in groups 1 and 2 compared with groups 3 and 4 ($P = 0.0004$). The total range of active and passive motion increased in all groups, with group 1 having significantly greater improvement than the other 3 groups. At 3 months, groups 1 and 2 still showed significantly greater improvement in SPADI scores than group 4. There was no difference between groups 3 and 4 at any of the followup assessments except for greater improvement in the range of shoulder flexion in group 3 at 3 months. At 12 months, all groups had improved to a similar degree with respect to all outcome measures.

CONCLUSION: A single intraarticular injection of corticosteroid administered under fluoroscopy combined with a simple home exercise program is effective in improving shoulder pain and disability in patients with adhesive capsulitis. Adding supervised physiotherapy provides faster improvement in shoulder range of motion. When used alone, supervised physiotherapy is of limited efficacy in the management of adhesive capsulitis.

Publication Types:

- Clinical Trial
- Randomized Controlled Trial

PMID: 12632439

Rating: 2b

Ejnisman B, Andreoli CV, Soares BG, Fallopa F, Peccin MS, Abdalla RJ, Cohen M, Interventions for tears of the rotator cuff in adults, *Cochrane Database Syst Rev.* 2004;(1):CD002758

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BACKGROUND: Tears of the rotator cuff tendons, which surround the joints of the shoulder, are one of the most common causes of pain and disability in the upper extremity.

OBJECTIVES: To review the efficacy and safety of common interventions for tears of the rotator cuff in adults.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised trial register (July 2002), the Cochrane Controlled Trials Register (The Cochrane Library issue 2, 2002), MEDLINE (1966 to December 2001), EMBASE (1974 to December 2001), Biological Abstracts (1980 to December 2001), LILACS (1982 to December 2001), CINAHL (November 1982 to December 2001), Science Citation Index and reference lists of articles. We also contacted authors and handsearched conference proceedings focusing on shoulder conditions.

SELECTION CRITERIA: Randomised or quasi-randomised clinical trials involving tears of the rotator cuff were the focus of this review. All trials involving conservative interventions or surgery were included (non-steroidal anti-inflammatory drugs, intra-articular or subacromial glucocorticosteroid injection, oral glucocorticosteroid treatment, physiotherapy, and open or arthroscopic surgery).

DATA COLLECTION AND ANALYSIS: Two reviewers independently assessed suitability for inclusion, methodological quality and extracted data. Dichotomous data were presented as relative risks (RR) and 95% confidence intervals (CI), using the fixed effects model.

MAIN RESULTS: Eight trials involving 455 people were included and 393 patients analysed. Trials were grouped in eight categories of conservative or surgical treatment. The median quality score of all trials combined was 16 out of a possible 24 points, with a range of 12-18. In general, included trials differed on diagnostic criteria for rotator cuff tear, there was no uniformity in reported outcome measures, and data which could be summarised were rarely reported. Only results from two studies comparing open repair to arthroscopic debridement could be pooled. There is weak evidence for the superiority of open repair of rotator cuff tears compared with arthroscopic debridement.

REVIEWER'S CONCLUSIONS: There is little evidence to support or refute the efficacy of common interventions for tears of rotator cuff in adults. As well as the need for further well designed clinical trials, uniform methods of defining interventions for rotator cuff tears and validated outcome measures are also essential.

Publication Types:

- Review
- Review, Academic

PMID: 14973989

Rating: 1c

BACKGROUND

The rotator cuff plays a major role in shoulder pathology (Neer 1983). The shoulder consists of five joints - the sternoclavicular, acromioclavicular, glenohumeral joints and the scapulothoracic and subacromial gliding plane. These ideally function in a precise, synchronous manner to achieve a large range of motion. The properties of the soft tissue envelope surrounding the glenohumeral joint, mainly rotator cuff tendons, significantly affect the function and kinematics of the shoulder mechanism. Defining these properties can contribute to successful surgical reconstruction and repair (Tibone 1986). Tears of the rotator cuff tendons are one of the most common causes of pain and disability in the upper extremity (Hawkins 1980). Those who suffer from this condition range from athletes (Warner 1991; Blevins 1996) and workers with repetitive overhead activities (Ozaki 1988), to the elderly through years of use (Rowe 1998). This review aims to examine the effectiveness of the different methods of surgical and non-surgical treatment currently employed for complete rotator cuff tear, impingement syndrome III (Neer 1983).

RESULTS

Dexamethasone Injection Versus Placebo - Berry 1980 involved 60 patients in total and 24 patients in this comparison. No improvement (failure after treatment) was the only outcome that could be evaluated and no significant difference was found between interventions.

Physiotherapy Versus Placebo - Berry 1980, with 24 patients. No improvement (failure after treatment) was the only outcome that could be evaluated and no significant difference was found between interventions.

Acupuncture Versus Placebo - Berry 1980, with 24 patients. No improvement (failure after treatment) was the only outcome that could be evaluated and no significant difference was found between interventions.

Dexamethasone Injection Versus Sodium Hyaluronate Injection - Shibata 2001, involving 78 patients. No improvement of pain and no effectiveness were the two outcomes that could be evaluated and no significant difference was found between interventions.

Arthroscopic Subacromial Decompression And Debridement Versus Open Repair And Acromioplasty - Ogilvie-Harris 1993, Montgomery 1994, involving 133 patients. Montgomery 1994, in its nine years follow up (Melillo 1997) presented the only statistically significant difference favouring open repair for the outcome 'No global improvement according to UCLA criteria' (RR 4.14, 95% CI 2.03 to 8.46, NNT 1.4 95%CI 1.1 to 1.9).

Rotator Cuff Repair (Rcr) And Continuous Passive Motion Versus Rcr And Manual Passive Range Of Movement (Rom) Exercises - Raab 1996, Lastayo 1998, involving 58 patients. No improvement was the only outcome that could be evaluated and no significant difference was found between interventions.

Rcr And Splinting In Abduction Versus Rcr Resting The Arm At The Side - Watson 1985, involving 89 patients in total, and 63 patients analysed. No improvement was the only outcome that could be evaluated and no significant difference was found between interventions.

Nerve Block With Methylprednisolone Injection Versus Placebo - Vecchio 1992 included 13 subjects with rotator cuff tears. Data were presented only as skewed continuous data with mean change and Standard Error (SE).

DISCUSSION

We anticipated that it would be difficult to compare the outcome of different treatment methods because there are many different scoring systems which attempt to quantify the results of treatment (Tegner 1985; Hefti 1993). This review has confirmed the lack of uniformity in the way rotator cuff tears are labelled and defined. It has also highlighted the wide variation in assessment of outcome in clinical trials investigating the efficacy for rotator cuff tears. These factors limit the degree to which the results of different trials can be compared and pooled. In addition, the heterogeneity of the interventions studied, the timing of outcome assessment, the overall poor methodological quality, inadequate reporting of results, and small sample sizes makes it difficult to draw firm conclusions on the efficacy of any of the interventions studied in rotator cuff tears.

Pooling of reported data from the two studies comparing arthroscopic debridement of rotator cuff tears with open repair suggests that open repair is superior. This finding should be interpreted with considerable caution. Both trials were quasi-randomised. In Montgomery 1994, this was by alternation, but the allocation in some participants was subsequently changed, reportedly for reasons of patient preference. At five year follow-up, 88 participants were evaluated with inconclusive results, but at nine year follow-up data were only available for 53. Thus, this study as reported has risk of both selection and ascertainment bias. The evidence base for the superiority of open repair over arthroscopic debridement is weak.

No reported randomised trials compared conservative to surgical treatment.

Like the present research, another systematic review of interventions for shoulder pain found little evidence on the efficacy of common interventions (Green 2003). As well as the need for further well designed clinical trials, more research is needed to establish a uniform method of developing outcome measures which are valid, reliable, and responsive in affected people.

REVIEWERS' CONCLUSIONS

Implications for practice

There is little evidence to either support or refute the efficacy of common interventions for rotator cuff tears. There is poor data from non controlled open studies favouring conservative interventions, but this still needs to be proved. Considering these interventions are less invasive and less expensive than the surgical approach, they could be the first choice for the rotator cuff tears, until we have better and more reliable results from clinical trials.

Michener LA, Walsworth MK, Burnet EN. Effectiveness of rehabilitation for patients with subacromial impingement syndrome: a systematic review. *J Hand Ther.* 2004 Apr-Jun;17(2):152-64.

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Prior systematic reviews of rehabilitation for nondescript shoulder pain have not yielded clinically applicable results for those patients with subacromial impingement syndrome (SAIS). The purpose of this study was to examine the evidence for rehabilitation interventions for SAIS. The authors used data source as the method. The computerized bibliographic databases of Medline, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), and the Cochrane Database of Systematic Reviews were searched from 1966 up to and including October 2003. Key words used were "shoulder," "shoulder impingement syndrome," "bursitis," and "rotator cuff" combined with "rehabilitation," "physical therapy," "electrotherapy," "ultrasound," "acupuncture," and "exercise," limited to clinical trials. Randomized clinical trials that investigated physical interventions used in the rehabilitation of patients with SAIS with clinically relevant outcome measures of pain and quality of life were selected. The search resulted in 635 potential studies, 12 meeting inclusion criteria. Two independent reviewers graded all 12 trials with a quality checklist averaged for a final quality score. The mean quality score for 12 trials was 37.6 out of a possible 69 points. Various treatments were evaluated: exercise in six trials, joint mobilizations in two trials, laser in three trials, ultrasound in two trials, and acupuncture in two trials. The limited evidence currently available suggests that exercise and joint mobilizations are efficacious for patients with SAIS. Laser therapy appears to be of benefit only when used in isolation, not in combination with therapeutic exercise. Ultrasound is of no benefit, and acupuncture trials present equivocal evidence. The low to mediocre methodologic quality, small sample sizes, and general lack of long-term follow-up limit these findings for the development of useful clinical practice guidelines. Further trials are needed to investigate these rehabilitation interventions, the superiority of one intervention over another, and the long-term outcomes of rehabilitation. Moreover, it is imperative that clinical guidelines are developed to indicate those patients who are likely to respond to rehabilitation.

PMID: 15162102

Rating: 1b

Sauers EL. Effectiveness of rehabilitation for patients with subacromial impingement syndrome. *J Athl Train.* 2005 Jul;40(3):221-3.

Arizona School of Health Sciences, A. T. Still University, Mesa, AZ.

Reference: Michener LA, Walsworth MK, Burnet EN. Effectiveness of rehabilitation for patients with subacromial impingement syndrome: a systematic review. *J Hand Ther.* 2004;17: 152-164. Clinical Question: Which physical rehabilitation techniques are effective in reducing pain and functional loss for patients with subacromial impingement syndrome (SAIS)? Data Sources: Investigations were identified by MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), and Cochrane

Central Register of Controlled Trials Register searches from 1966 through October 2003 and by hand searching the references of all retrieved articles and relevant conference proceedings. The search terms were shoulder, shoulder impingement syndrome, bursitis, and rotator cuff combined with rehabilitation, physical therapy, electrotherapy, ultrasound, exercise, and acupuncture and limited to clinical trial, random assignment, or placebo. Study Selection: Inclusion criteria involved randomized controlled trials or clinical trials comparing nonsurgical, nonpharmacologic physical interventions for patients with SAIS with another intervention, no treatment, or a placebo treatment. Included studies required clinically relevant and well-described outcome measures of pain, disability, or functional loss. The study was limited to adult patients who met specific inclusion criteria for the signs and symptoms of SAIS and exclusion criteria for systemic impairment, cervical involvement, degenerative joint changes, clinical findings of other shoulder injury, previous history of surgery or physical therapy treatment, and workers' compensation claim/litigation. Data Extraction: A 23-item checklist, with each item assigned 0, 1, or 2 quality points for a total of 46 possible points, was used independently by 2 examiners to assess each study. In their original report, Michener et al stated that the 23-item checklist was worth a possible 69 points. However, in a conversation with L. A. Michener, she stated that this was an inadvertent publication error and confirmed that the possible point value for this checklist was indeed 46. This checklist encompasses 7 major areas, including the rationale for the research question, study design, subjects, intervention, outcome, analysis, and recommendations. If a discrepancy of more than 1 quality point was present for any item, the 2 investigators discussed it to reach a consensus. The total quality points were summed for each independent evaluator, and the average of the 2 final scores was used to determine the total quality score for an individual study. Main Results: The specific search criteria identified a total of 635 papers for review, of which only 12 met the inclusion and exclusion criteria for study. The average total quality score of these 12 studies was 37.6 (range, 33.5-41) of 46 possible points. Analysis of the inclusion criteria for SAIS revealed that shoulder pain was present in all 12 trials, painful or weak resisted abduction was present in 7 trials, positive Neer test was present in 6 trials, painful arc was present in 5 trials, positive Hawkins-Kennedy test was present in 4 trials, painful or weak resisted shoulder internal and external rotation in 4 trials, and positive impingement injection test was present in 2 trials. Physical interventions, performed in isolation or in combination, for patients with SAIS were divided into 5 types: exercise, joint mobilization, ultrasound, acupuncture, and laser. Authors employed a variety of outcomes measures, with all studies using a numeric rating or visual analog scale for pain, a direct measure of functional loss or disability (in 10 of 12 studies), or an indirect measure of a global rating of change or a measure of strength in a functional position (in 2 of 12 studies). Therapeutic exercise was the most widely studied form of physical intervention and demonstrated short-term and long-term effectiveness for decreasing pain and reducing functional loss. Upper quarter joint mobilizations in combination with therapeutic exercise were more effective than exercise alone. Laser therapy is an effective single intervention when compared with placebo treatments, but adding laser treatment to therapeutic exercise did not improve treatment efficacy. The limited data available do not support the use of ultrasound as an effective treatment for reducing pain or functional loss. Two studies evaluating the effectiveness of acupuncture produced equivocal results. Conclusions: These data indicate that exercise, joint mobilization, and laser therapy are effective physical interventions for decreasing pain and functional loss or disability for patients with SAIS. The current evidence does not support the use of ultrasound, and studies evaluating the effectiveness of acupuncture were equivocal. The number of trials evaluating the effectiveness of physical rehabilitation interventions for patients with SAIS is limited, and those available are of moderate quality. Clinicians should interpret the conclusions with these limitations in mind.

PMID: 16284646

Rating: 1b

Thomas M, Grunert J, Standtke S, Busse MW. Rope pulley isokinetic system in shoulder rehabilitation--initial results. *Z Orthop Ihre Grenzgeb.* 2001 Jan-Feb;139(1):80-6.

Orthopadische Klinik und Poliklinik der Universitat Leipzig.

AIM: Of this study was to evaluate the results of a shoulder rehabilitation program of different shoulder diseases, based on an isokinetic pulley system ("Moflex", Recotec/Bernina, Swiss).

METHOD: In this prospective study 70 patients participated in a standardized rehabilitation program (instability: n = 19; rotator cuff disorders: n = 23; impingement syndrome without lesion: n = 16; others: n = 12; operative therapy: n = 47). The major aspect of the program was an isokinetic pulley system.

RESULTS: Isokinetic training with the used device affords strict monitor-feedback to avoid critical torque values. Strength which was attained without relevant pain was almost linearly increased by a mean of 31% until the 20th day of rehabilitation, workload by 79%. At the end of the rehabilitation program the strength of the affected (mostly dominant) shoulder was 15% higher than in the unaffected shoulder; the respective workload values were almost equal.

CONCLUSION: These first results demonstrate the value of the isokinetic pulley system in the rehabilitation of the investigated shoulder diseases. The equipment may be used already in an early postoperative state. First results of strength increases using an isokinetic pulley system in shoulder rehabilitation are presented.

PMID: 11253528

Rating: 4b

Verhagen AP, Bierma-Zeinstra SM, Feleus A, Karels C, Dahaghin S, Burdorf L, de Vet HC, Koes BW, Ergonomic and physiotherapeutic interventions for treating upper extremity work related disorders in adults, *Cochrane Database Syst Rev.* 2004;(1):CD003471

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BACKGROUND: Conservative interventions such as physiotherapy and ergonomic adjustments play a major part in the treatment of most work-related musculoskeletal disorders (WRMD).

OBJECTIVES: The objective of this systematic review is to determine whether conservative interventions have a significant impact on short and long-term outcomes for upper extremity WRMD in adults.

SEARCH STRATEGY: We searched the Cochrane Musculoskeletal Injuries Group specialised register (January 2002) and Cochrane Rehabilitation and Related Therapies Field specialised register (January 2002), the Cochrane Controlled Trials Register (The Cochrane Library Issue 3, 2001), PubMed (1966 to November 2001), EMBASE (1988 to November 2001), and CINAHL (1982 to November 2001). We also searched the Physiotherapy Index (1988 to November 2001) and reference lists of articles. No language restrictions were applied.

SELECTION CRITERIA: Only randomised controlled trials and concurrent controlled trials studying conservative interventions for adults suffering from upper extremity WRMD were included. Conservative interventions may include exercises, relaxation, physical applications, biofeedback, myofeedback and work place adjustments.

DATA COLLECTION AND ANALYSIS: Two reviewers independently selected the trials from the search yield and assessed the clinical relevance and methodological quality using the Delphi list. In the event of clinical heterogeneity or lack of data we used a rating system to assess levels of evidence.

MAIN RESULTS: We included 15 trials involving 925 people. Twelve trials included people with chronic non-specific neck or shoulder complaints, or non-specific upper extremity disorders. Over 20 interventions were evaluated; seven main subgroups of interventions could be determined: exercises, manual therapy, massage, ergonomics, multidisciplinary treatment, energised splint and individual treatment versus group therapy. Overall, the quality of the studies appeared to be poor. In 10 studies a form of exercise was evaluated, and there is limited evidence about the effectiveness of exercises only when compared to no treatment. Concerning manual therapy (1 study), massage (4 studies), multidisciplinary treatment (1 study) and energised splint (1 study) no conclusions can be drawn. Limited evidence is found concerning the effectiveness of specific keyboards for patients with carpal tunnel syndrome.

REVIEWER'S CONCLUSIONS: This review shows limited evidence for the effectiveness of keyboards with an alternative force-displacement of the keys or an alternative geometry, and limited evidence for the effectiveness of individual exercises. The benefit of expensive ergonomic interventions (such as new chairs, new desks etc) in the workplace is not clearly demonstrated.

Publication Types:

- Meta-Analysis
- Review
- Review, Academic

PMID: 14974016

Rating: 1b

BACKGROUND

The term repetitive strain injury (RSI) is not a diagnosis, but an umbrella term for disorders that develop as a result of repetitive movements, awkward postures, and impact of force (Yassi 1997). Work-related musculoskeletal disorders (WRMD) have been described differently in various countries: RSI in Canada and Europe, both RSI and occupational overuse syndrome (OOS) in Australia and cumulative trauma disorder in the USA (Putz-Anderson 1988). Work-related musculoskeletal disorders can be divided into specific conditions such as carpal tunnel syndrome, which has relatively clear diagnostic criteria and pathology, or non-specific conditions such as tension neck syndrome, which is primarily defined by the location of complaints and whose pathophysiology is less clearly defined. With carpal tunnel syndrome, for instance, between 43 and 90 per cent of cases can be defined as work-related, depending on the setting (industrial or primary care setting) (Hagberg 1992; Miller 1994).

In the USA, cumulative trauma disorders account for between 56 and 65 percent of all occupational injuries (Melhorn 1998; Pilligan 2000). Overall, the estimated prevalence of upper-extremity WRMD is approximately 30 per cent (Yassi 1997; Melhorn 1998). Several studies report a rapidly increasing incidence of WRMD of the upper extremities (Yassi 1997). The costs associated with these disorders are high - over two billion dollars of direct and indirect costs estimated annually in the USA (Pilligan 2000).

Today, much attention is paid to the prevention and treatment of WRMD (Silverstein 1997; Yassi 1997). Conservative interventions such as physiotherapy and ergonomic adjustments play a major part in the prevention or treatment of most WRMD (Pilligan 2000). The direct and indirect costs of these WRMD are a burden to patients, employers and insurance companies. Therefore, there is a need to determine whether conservative interventions have a significant impact on long-term outcomes.

TRIALS COMPARING DIFFERENT TYPES OF INCLUDED CONSERVATIVE TREATMENTS

Thirteen studies compared different conservative treatments.

1. Exercises

In three studies when different forms of exercises were compared the conclusion was defined as 'unclear', meaning not providing data (Ferguson 1976; Kamwendo 1991; Hagberg 2000). Three studies report conflicting results concerning the effectiveness of exercises compared to massage (Rundcrantz 1991; Levoska 1993; Vasseljen 1995). Only the study of Vasseljen 1995 was of high quality but here exercises were a part of both interventions. The study evaluated the difference between individual and group exercises, so no conclusions can be drawn about the effectiveness of the exercises themselves. Therefore we conclude that there is conflicting evidence concerning the effectiveness of exercises compared to massage, and no evidence concerning the effectiveness of exercises when different forms of exercises are compared.

2. Manual therapy/chiropractic treatment

In the study of Bang 2000 significant results were found in pain reduction and isodynamic strength in patients with a shoulder impingement syndrome. Therefore we conclude that there is limited evidence for the efficacy of manual therapy in patients with a shoulder impingement syndrome.

3. Massage

In one study (Ferguson 1976) the conclusion was defined as 'unclear', and one found positive results (significantly) in favour of massage (Leboeuf 1987). In the studies of Levoska 1993 and Vasseljen 1995 massage was a part of a combination of interventions (i.e. a black box), so no conclusions can be drawn concerning the efficacy of massage from these studies. All studies were of low quality, therefore we conclude that there is conflicting evidence of the efficacy of massage in the treatment of upper extremity WRMD.

4. Ergonomics

Two high quality studies (Rempel 1999; Tittiranonda 1999) evaluated the efficacy of six different keyboards on reduction of complaints. Rempel 1999 reported significant positive results of alternative force-displacement of the keys in pain reduction in 12 weeks and Tittiranonda 1999 found no significant differences between different keyboards. The results of the study of Kamwendo 1991 are classified as 'unclear'. Therefore we conclude that there is limited evidence of the efficacy of some keyboards in people with a carpal tunnel syndrome compared with other keyboards.

5. Multidisciplinary treatment

In one low quality non-randomised study a multidisciplinary work re-entry rehabilitation programme is compared with 'usual care' (Feuerstein 1993), reporting non significant positive results. We conclude that there is no evidence of efficacy of a multidisciplinary treatment.

6. Energised splint

There is one study comparing an 'energised splint' with placebo (Stralka 1998). See placebo comparison below.

7. Group therapy versus individual therapy

The study of Vasseljen 1995 is considered of high quality and shows significant short term positive results. Therefore we conclude that when individual exercises are compared with exercises in a group there is limited evidence on short-term efficacy for individual exercises.

TRIALS COMPARING CONSERVATIVE TREATMENTS WITH PLACEBO, OR NO TREATMENT/WAITING LIST CONTROLS

1. Placebo

Two studies compared a conservative treatment with a placebo (Stralka 1998; Tittiranonda 1999). One high quality study (Tittiranonda 1999) evaluated the efficacy of three different keyboards in people with a carpal tunnel syndrome on reduction of complaints and improvement of function with a placebo (= unchanged keyboard). They reported significant positive results of some keyboards compared with the placebo. Therefore we conclude that there is limited evidence for the efficacy of alternative keyboards over a placebo.

One low quality RCT compared an 'energised splint' with placebo (Stralka 1998). The results were classified as 'unclear'.

2. No treatment/waiting list controls

Four studies compared a conservative treatment with a control group receiving no treatment (Kamwendo 1991; Takala 1994; Lundblad 1999; Waling 2000). In all studies forms of exercises were compared with a control group receiving no treatment. In one study the conclusion was defined as 'unclear' (Kamwendo 1991), in two studies (Lundblad 1999; Takala 1994) positive but non-significant results were found and Waling 2000 found significant positive results of exercises on pain, strength and function. All studies were regarded of low quality, therefore we conclude that there is limited evidence concerning the efficacy of exercises compared to a control group receiving no treatment.

DISCUSSION

This review shows that there is limited evidence concerning the effectiveness of specific keyboards for patients with a carpal tunnel syndrome, and limited evidence for the effectiveness of exercises in patients with chronic non-specific neck and shoulder complaints when compared to no treatment. As well as these results, an individual approach appeared to be more effective compared with a group approach.