Joint Protection : enabling change in musculoskeletal conditions

Hammond, A

http://dx.doi.org/10.1007/978-3-319-08141-0_42

Hammond A (2015) Ch. 42: Joint Protection: Enabling change in musculoskeletal conditions. In: Soderback I (ed). International Handbook of Occupational Therapy Interventions.2nd edition. Pp 607-618 Springer: New York. ISBN: 978-3-319-08140-3

Chapter 42
Joint Protection: Enabling Change in Musculoskeletal Conditions

Alison Hammond

The problem is changing habits of a lifetime. Joint protection principles are easy to learn; the difficulty is changing habits sufficiently to make a difference.

Abstract Joint protection includes applying ergonomic principles in daily life, altering working methods, using assistive devices, and modifying environments. It is taught to people with musculoskeletal conditions, such as rheumatoid arthritis (RA), osteoarthritis (OA), and soft tissue rheumatisms. Common principles are to: distribute load over several joints; reduce effort using assistive devices; pace activities; use orthoses; and exercise regularly. Cognitive-behavioral, self-efficacy, and motor-learning approaches are employed. Trials demonstrate that using these approaches is significantly more effective than advice and demonstration alone in changing joint-protection behavior, improving self-efficacy, function, and reducing pain in both early and established RA and hand OA. There is still conflicting evidence for its effectiveness in soft-tissue rheumatisms.

Keywords Arthritis diseases • Assistive devices • Energy conservation • Ergonomics • Joint protection • Musculoskeletal conditions.

Definition and Background

Joint protection is a core component of occupational therapy interventions for musculoskeletal conditions. Joint protection is an active coping (or self-management) strategy to improve clients' perceived control of their condition, psychological and health status, daily activities, role performance, and social participation (Hammond, 2004).

Joint protection intervention includes educating in (1) altering working methods, (2) use of proper joint and body mechanics through applying ergonomic principles, (3) use of assistive devices, and (4) modifying occupational performance and environments. It is often integrated with fatigue management, working splints, and flexibility and strength hand exercises.

Joint protection was first developed in the 1960s, based on increased understanding of pathophysiologic changes in rheumatoid arthritis (RA), and on biomechanics. Principles were extended to other inflammatory arthropathies, osteoarthritis (OA), and soft tissue rheumatisms (Brattstrom, 1987; Chamberlain et al., 1984; Cordery, 1965; Melvin, 1989; Sheon, 1985). At that time, clients were encouraged to regularly practice joint protection in the expectation that they would apply this to their personal situation (Chamberlain et al., 1984; Cordery, 1965). The focus

was on improving body structures and function, and maintaining the ability to perform daily activities.

Research in the past 15 years has used structured self-management education and skills training to promote attitudinal, cognitive, and behavioral changes for improving protection of the joints. These cognitive-behavioral approaches further affect personal factors (e.g., increased self-efficacy, perceived control of the condition, problem-solving abilities, and reduced frustration). Additionally, they aim to enable clients to change habits and routines in their daily activities, work, and leisure.

Purpose

Joint protection is an active self-management strategy aiming to *maintain or improve* (1) occupational performance in daily life, (2) role performance and participation in social life, (3) perceptions of control, and (4) psychological and health status (Hammond, 2013).

The aims of joint protection are as follows:

1. *For people with RA, reduce* (a) load and effort during daily activity performance, thus reducing strain on joint structures weakened by the disease process; (b) pain; (c) irritation of the synovial membrane; (d) local inflammation; and (e) fatigue.
2. *For people with osteoarthritis*, (a) *r*educe loading on articular cartilage and subchondral bone, (b) strengthen muscle support, and (c) improve shock-absorbing capabilities of joints (Cordery and Rocchi, 1998).
3. *For people with soft tissue disorders* (e.g., de Quervain's disease, carpal tunnel syndrome) to reduce (a) pain, (b) inflammation, and (c) strain on soft tissues.

Method

Candidates for the Intervention

Joint protection is provided to clients with the following:

- *Inflammatory polyarthropathies*, such as RA, seronegative and psoriatic arthritis. These diseases affect three times more women than men, most commonly in the 40- to 60-year age range, but they may start at any age. RA affects on average 1% of people globally (Kvien, 2004).
- *Osteoarthritis* (OA) affects the hand, hip, knee, or several joints of the body simultaneously (i.e., generalized OA). Nearly twice as many (1.8:1) women as men live with OA, and 10% of people over the age of 60 years are symptomatically affected (Dennison and Cooper, 2003).
- *Upper-limb soft tissue disorders:* (1) *de Quervain's disease* is more common in women than in men, with peak onset between 30 and 50 years of age. (2) *Carpal tunnel syndrome* occurs in 5.8% of women and 0.6% of men, with peak onset between 45 and 54 years of age (Fam, 2003).

Epidemiology

The numbers of people potentially benefiting from joint protection can be estimated from percentages of those with activity limitations. Among people living with RA, about 60% have activity limitations, particularly related to hand function (Young et al., 2000). There is a high prevalence of people with hand impairments, pain and muscle weakness in RA over 2 years duration (Horsten et al., 2010). A community survey by Jordan et al. (2000) found that 43% of people over 65 years of age with arthritis (mainly OA) experienced difficulty with household activities. The number of people living with *soft tissue disorders* who could benefit from joint protection interventions is unknown. These figures suggest many people with musculoskeletal conditions could benefit from joint protection advice.

Settings

Joint protection is most often provided in rheumatology and occupational therapy departments, to both in- and outpatients, as well as in community settings.

The Role of the Occupational Therapist

In providing joint protection, occupational therapists (OTs) have both *facilitatory and teaching roles*. The OT has knowledge of (1) pathophysiology of musculoskeletal conditions, (2) ergonomic and biomechanical principles for protecting joints, and (3) cognitive-behavioral methods. This knowledge constitutes the theoretical base for joint-protection interventions, which are clinically applied using educational and facilitatory strategies.

Result

Clinical Application

The commonest principles taught to clients are the following:

- *Joint protection*: Respect pain; distribute load over several joints; use the strongest, largest joint to perform an activity; avoid working in positions of potential deformity; reduce effort by using assistive devices and avoiding lifting and carrying; and avoid prolonged periods of working in the same position.
- *Energy conservation*: Pacing by balancing rest and work, and alternating heavy and light activities; use work simplification; use correct working positions and postures.
- *Orthoses*: Use working orthoses appropriately to reduce pain and improve grip function.
- *Exercise:* Exercise regularly to maintain range of motion and muscle strength. Beasley (2012) provides an extensive list of principles.

The educational and facilitatory strategies used include motivational, cognitive-behavioral, self-efficacy, and motor learning approaches. These enable clients to overcome barriers to changing behavior and to maximize performance of joint protection so that therapeutic aims are achieved.

These strategies include the following:

- *Discuss* health beliefs and attitudes to the disease. Additionally, clients may have developed misconceptions of joint protection, that it means using joints as little as possible, only during certain activities or only when pain is present (Niedermann et al, 2010).
- *Identify* clients' expectations, worries, or concerns, and their valued activities and life goals.
- *Teach cognitive-behavioral strategies*, such as self-monitoring, goal setting, and how to develop action plans for practicing techniques at home. Regular review of such home programs with clients is essential.
- *Teach* using effective educational techniques to enhance recall of joint protection principles and methods, such as simplification, use of advance organizers, and explicit categorization.
- *Teach* joint-protection techniques using effective skills training methods (e.g., practicing simple and then more complex activities using joint protection, feedback, and mental rehearsal).
- *Enable modeling*, that is, teaching in small groups, encouraging members to observe each other. Seeing others perform successfully increases self-efficacy and problem-solving ability (Hammond, 2010; Hammond and Niedermann, 2010).

Joint protection can be taught using individual or group education, supported by self-help booklets.

How the Intervention Eases Impairments, Activity Limitations, and Participation Restrictions

Joint protection reduces pain and the likelihood of deformities, and maintains activity and participation (Hammond and Freeman, 2001, 2004)

Evidence-Based Practice

A *survey* of United Kingdom practice found that joint protection education typically lasts for 1.5 hours over two treatment sessions and does not use behavioral approaches. The usual content is (1) education about RA, (2) how joints are affected, (3) joint-protection principles, (4) demonstrations with short (e.g., 15- to 30-minute) practice of hand joint protection methods commonly used in cooking and housework activities (e.g., making a cup of tea), and (5) discussion of solutions to specific problems, supported by a self-help booklet (Hammond, 1997). This is still the typical practice.

Trials Investigating Joint Protection Education

A randomized controlled trial (*n* = 55; 6-month follow-up) of 1 hour of individual education, similar to the typical content described above, but not compared to an intervention, improved clients' knowledge of joint protection methods (Barry et al., 1994). Similarly, a pretest, posttest trial of a group program (*n* = 21; 3-month follow-up) providing this typical intervention for 2.5 hours as part of an 8-hour arthritis education program also found improved knowledge of joint protection, but no significant changes in joint-protection behavior occurred. Barriers to changing behavior were identified through interview as (1) being unable to recall methods sufficiently during daily activity performance; (2) considering these as not applicable, as "my hands are not that bad yet" or using techniques on bad days only; (3) difficulty getting used to the different actions; and (4) difficulty changing the habits of a lifetime (Hammond and Lincoln, 1999).

Many early trials had small sample sizes but indicated that, in established RA, structured group programs emphasizing active learning, problem solving, behavioral approaches, frequent practice, and home programs gave significant improvements: balance of rest and activity (nonrandomized trial; *n* = 25; Furst et al., 1987); use of assistive devices (pretest, posttest trial, *n* = 53;, (Nordenskiold, 1994); and functional ability (pretest, posttest trial, *n* = 21; Nordenskiold et al., 1998).

More recent trials have been larger and methodologically sounder. A randomized trial with people with early RA (average 18-month disease duration, age 50 years, *n* = 127) compared a behavioral joint protection program with a standard arthritis education program (including 2.5 hours of typical joint-protection education). At 12 months, those in the behavioral group had significantly improved use of joint protection, less hand and general pain, improved functional ability (e.g., less early morning stiffness), and fewer flare-ups in comparison to the standard education group (Hammond and Freeman, 2001). At 4-year follow-up, the behavioral group continued to have significantly greater use of joint protection, less early morning stiffness, better activities of daily living (ADL) scores, and fewer hand deformities than the standard education group, who had continued to deteriorate (Hammond and Freeman, 2004).

The joint protection program was also tested in people with very early RA (average 4.5-month disease duration; age 51 years; *n* = 54) with little pain or functional difficulty. At 6-month follow-up, no significant differences between groups or over time occurred (Freeman and Hammond, 2002).

The same program has been tested in hand OA (n=257), compared to written advice only, in a factorial randomized trial. At 6-month follow-up, significantly more in the joint protection group reported globally higher scores on the AUSCAN (hand pain and function) scale (Dziedzic et al, 2013).

Trials Investigating the Effects of Joint Protection Combined with Exercise

A randomized controlled trial with clients with moderate-severe RA (average 15-year disease duration, age 53 years; *n* = 85) receiving a behavioral joint-protection, energy conservation and exercise program also identified significant improvements at 8-month follow-up in pain and functional and physical ability in comparison to those receiving usual care (Masiero et al., 2007). Both groups were receiving anti-tumor necrosis factor-alpha (TNF-α) drugs (e.g., Infliximab, Etanercept). A randomized with people with ankylosing spondylitis (AS) on anti-TNF-α receiving self-management education, including joint-protection, energy conservation and range of movement exercise, also demonstrated improvements in pain and function (Spadaro et al., 2008). This indicates that benefits from joint protection can be gained over and above such biologic drugs.

A randomized controlled trial in clients with hand OA (average age 60 years, *n* = 40) identified significant improvements at 3 months in grip strength and self-perceived hand function, although not in pain control or functional ability, in comparison to a control group receiving education about OA (Stamm et al., 2002). A further trial combining educational-behavioral joint protection education, splinting and hand exercises (n=40) demonstrated significant improvements in pain and stiffness compared to joint protection alone (Boustedt et al., 2009). This latter trial emphasizes the importance of providing joint protection as part of a package of hand management, alongside exercise, fatigue management and, if applicable, orthoses.

There is conflicting evidence for the effectiveness of ergonomic interventions in soft tissue rheumatisms (Verhagen et al., 2006).

Understanding the Value of Participating in Joint Protection Education

People with RA report joint protection education results in improved: (1) physical well-being, less pain and better function; (2) improved psychological well-being, a more positive outlook and feeling less stressed; (3) personal control, confidence and independence and (4) self-acceptance (Niedermann et al, 2010).

Discussion

These studies highlight three issues: (1) How the joint protection education is provided makes a significant difference to whether patients gain benefits. The use of educational, cognitive, and behavioral approaches is significantly more effective. (2) Providing ONLY information does not seemingly help clients with the tools to make changes when the need arises, as the standard intervention group provided with typical joint protection advice continued to deteriorate without making changes longer-term in response. (3) People need to perceive the relevance of using joint protection; it may be too early to use it if clients have few or no problems.

Conclusion

Joint protection intervention is effective if it is taught effectively. To date, research has focused on

developing effective group joint-protection programs for RA and hand OA clients. However, individual education is more often provided, and thus individual behavioral programs need to be developed and evaluated. Research with patients with hand OA demonstrates joint protection is effective and outcomes are enhanced by combining it with hand exercises. It is also beneficial in AS. Joint protection in lower-limb RA and OA has been little evaluated. In soft tissue rheumatism, randomized trials are needed using clearly defined conditions and interventions. The cost-effectiveness of joint protection has not been evaluated.

The Case study: Assisting Helen to Use Joint Protection, Energy Conservation and Exercise at Work, Home and In Leisure

Key words: (joint protection, energy conservation, ergonomics, arthritis)

Introduction

The ***theme*** of this case study is the application of educational and behavioral approaches to enable adoption of ergonomic solutions at home, work and in leisure.

The students' tasks include:

1. Finding out about the common symptoms, activity limitations and participation restrictions of people with rheumatoid arthritis.
2. Identifying the key joint protection and energy conservation principles which should be taught
3. Identifying key evidence for what are effective educational, cognitive-behavioral approaches to facilitate concordance with adopting ergonomic techniques sufficiently to be effective
4. Locating, selecting and analyzing the research literature related to the effectiveness of joint protection
5. Synthesizing the information into a report

As a starting point the students should use the following references to gather background information. Selected references are listed here and others are at the end of the chapter.

1. Katz PP (2011). Editor: Patient Outcomes in Rheumatology: a review of measures. *Arthritis Care Res* 63(11) (Supplement) S1-490
2. Hammond. A. (2010). Chapter 10: Joint protection and fatigue management. In:K. Dziedzic and A. Hammond (Eds.). *Rheumatology: Evidence-based Practice for Physiotherapists and Occupational Therapists.* Churchill Livingstone, Elsevier: Edinburgh, UK. (Pages: 137-150).
3. Goodacre L, McArthur M (2013) Eds. Rheumatology Practice in Occupational Therapy: promoting lifestyle management. John Wiley and Sons: Chichester.
4. O'Brien A, Backman C (2010) Ch. 16 Inflammatory Arthritis. In: K. Dziedzic and A. Hammond (Eds.). *Rheumatology: Evidence-based Practice for Physiotherapists and Occupational Therapists.* Churchill Livingstone, Elsevier: Edinburgh, UK. (pages 211-234).
5. Mason P, Butler C (2010). Health Behavior Change: a guide for practitioners. 2nd edition. Churchill Livingstone, Edinburgh
6. Hammond, A. and Niedermann, K. (2010). Chapter 6: Patient Education and Self-Management. In: K. Dziedzic and A. Hammond (Eds.). *Rheumatology: Evidence-based Practice for Physiotherapists and Occupational Therapists.* Churchill Livingstone, Elsevier: Edinburgh, UK. (Pages: 77-110).
7. Knittle K, Maes S, de Gucht V 2010). Psychological interventions for rheumatoid arthritis: examining the role of self-regulation with systematic review and meta-analysis of randomized controlled trials. Arthr Res Care 62(10:1460-1472.

Overview of the content

The major goal of the interventions is to reduce pain and fatigue, improve activity ability, participation and self-efficacy.

Learning objective

Understand how to design and deliver an intervention with a person with rheumatoid arthritis to enable concordance with use of ergonomic approaches in daily life.

The background history of the clinical case study

Personal data:

Helen is 44 years old. She is a health visitor (i.e. visits new babies, and also young children with difficulties, and their mothers at home) and is based in a large open-plan office in a Primary Health Care Centre. She is married and has a daughter (aged 11 years). Together they live in a two-bedroom terraced house six kilometers from work.

Medical Diagnoses and Prognoses:

Helen has had RA for four years and takes the medications of methotrexate, sulphasalazine and co-codamol. Although her disease activity is reasonably controlled, she still experiences pain (5.4/10 on a 10 point pain scale), hand pain (5.8/10) and fatigue (6.7/10). Her shoulders, wrists, hands and feet are bilaterally affected. Balancing work and home life is difficult.

Reason for seeking occupational therapy:

Helen enjoys her work but is concerned she may have to give it up. Therefore her physician referred her to an OT.

Current circumstances:

At the initial interview, the OT identifies that Helen works four days a week, taking a break on Wednesdays to "recover." Her manager knows she has arthritis and is keen to retain Helen who is an experienced employee.

Occupational performance issues:

Helen drives to work and uses her own car to visit clients. However, she has to park about 100 meters away from the Centre and often a similar distance from clients' homes, because of parking restrictions. She conducts home visits mornings and afternoons, needing to carry a heavy bag of case-notes and assessment equipment. When in the office, she has to fetch and return case-notes from stacks (manually opened), telephone clients and type up reports. Helen usually comes home from work tired, with neck, shoulder and hand pain. To allow time with family at weekends, she rushes round on Wednesdays doing the housework and shopping. She has given up some leisure activities (going out with friends, her Tai Chi class, and cross-stitch embroidery)

as she is too tired and lacks time to do these.

The student's report

The following guiding questions have been identified in developing possible solutions for Helen. These questions are generated from the available literature references and our clinical experiences:

Questions:

1. What reliable, valid assessments would you use to identify Helen's work, home and leisure difficulties?
2. What activity limitations and participation restrictions do you think Helen could have, based on your knowledge of RA and her impairments?
3. What are the short- and long-term goals for your treatment plan for Helen?
4. What theoretical models are most appropriate to apply when designing an intervention for Helen?
5. What education do you consider Helen needs to enable her to understand her condition and self-manage her arthritis effectively?
6. How can Helen practically be enabled to adopt ergonomic strategies in her daily life to reduce pain, fatigue and improve function?
7. What solutions can you suggest for Helen's key activity limitations and participation restrictions?

References

Barry, M.A., Purser, J., Hazleman, R., et al (1994). Effect of energy conservation and joint protection education in rheumatoid arthritis. *Br J Rheumatol*, 33, 1171–1174.

Beasley, J. (2012). Osteoarthritis and Rheumatoid Arthritis: conservative therapeutic management. *J Hand Ther* 25:163-172.

Boustedt, C., Nordenskiold. U., Nilsson, AL. (2009). Effects of a hand joint protection programme with an addition of splinting and exercise. *Clin Rheumatol* 28:793-799.

Brattstrom, M. (1987). Joint Protection and Rehabilitation in Chronic Rheumatic Diseases, 3rd ed. London: Wolfe Medical.

Chamberlain, M.A., Ellis, M., and Hughes, D. (1984). Joint protection. *Clin Rheum Dis*, 10(3), 727–743.

Cordery, J.C. (1965). Joint protection; a responsibility of the occupational therapist. *Am J Occup Ther*, 19, 285–294.

Cordery, J., and Rocchi, M. (1998). Joint protection and fatigue management. In: Melvin, J., and Jensen, G., eds. Rheumatologic Rehabilitation, Vol. 1: Assessment and Management. Bethesda, MD: American Occupational Therapy Association.

Dennison, E., and Cooper, C. (2003). Osteoarthritis: epidemiology and classification. In: Hochberg, M.C.et al, eds. Rheumatology, 3rd ed. (pp. 1781–1791). Edinburgh: Mosby.

Dziedzic, K., Nicholls, E., Hill, S., Hammond, A., Handy, J., Thomas, E., Hay, E. (2013). The clinical effectiveness of self-management approaches for osteoarthritis in the hand: a community based 2x2 factorial randomized trial. *Ann Rheum Dis* doi: 10.1136/annrheumdis-2013-203938

Fam, A.G. (2003). Regional and widespread pain: the wrist and hand. In: Hochberg, M.C.et al, eds. Rheumatology, 3rd ed. (pp. 641–650). Edinburgh: Mosby.

Freeman, K., and Hammond, A. (2002). Use of cognitive-behavioural arthritis education programmes in newly diagnosed rheumatoid arthritis. *Clin Rehabil*, 16, 828–836.

Furst, G.P., Gerber, L.H., Smith, C.C., et al (1987). A program for improving energy conservation behaviours in adults with rheumatoid arthritis. *Am J Occup Ther*, 41(2), 102–111.

Hammond, A. (1997). Joint protection education: what are we doing? *Br J Occup Ther*, 60(9), 401–406.

Hammond, A. (2004). What is the role of the occupational therapist? In: Sambrook, P., and March, L., eds. How to Manage Chronic Musculoskeletal Conditions. Best Pract Res Clin Rheumatol, 18(4), 491–505.

Hammond. A. (2010). Chapter 10: Joint protection and fatigue management. In: K. Dziedzic and A. Hammond (Eds.). *Rheumatology: Evidence-based Practice for Physiotherapists and Occupational Therapists.* Churchill Livingstone, Elsevier: Edinburgh, UK. (Pages: 137-150).

Hammond, A. and Niedermann, K. (2010). Chapter 6: Patient Education and Self-Management. In: K. Dziedzic and A. Hammond (Eds.). *Rheumatology: Evidence-based Practice for Physiotherapists and Occupational Therapists.* Churchill Livingstone, Elsevier: Edinburgh, UK. (Pages: 77-110).

Hammond, A. (2013). Chapter 8: Joint protection. In: L. Goodacre and M. McArthur (Eds). *Rheumatology Practice in Occupational Therapy: Promoting Lifestyle Management.* Wiley-Blackwell, Chichester, UK. (Pages: 111-132).

Hammond, A., and Freeman, K. (2001). One year outcomes of a randomised controlled trial of an educational-behavioural joint protection programme for people with rheumatoid arthritis. *Rheumatology*, 40, 1044–1051.

Hammond, A., and Freeman, K. (2004). The long term outcomes from a randomised controlled trial of an educational-behavioural joint protection programme for people with rheumatoid arthritis. *Clin Rehabil*, 18, 520–528.

Hammond, A., and Lincoln, N. (1999). Effect of a joint protection programme for people with rheumatoid arthritis. *Clin Rehabil*, 13, 392–400.

Horsten, N.C.A., Ursum, J., Roorda, L.J., van Schaardenburg, D., Dekker, J., Hoeksma, A.F.

(2010). Prevalence of hand symptoms, impairments and activity limitations in rheumatoid arthritis in relation to disease duration. *J Rehabil Med* 42:916-921.

Jordan, J.M., Bernard, S.L., Callahan, L.F., et al (2000). Self-reported arthritis related disruptions in sleep and daily life and the use of medical, complementary and self-care strategies for arthritis: The National Survey of Self-Care and Ageing. *Arch Fam Med*, 9, 143–149.

Kvien, T.K. (2004). Epidemiology and burden of illness in rheumatoid arthritis. *PharmacoEconomics*, 22(2) Suppl. 1, 1170–1176.

Masiero, S., Boniolo, A., Wassermann, L., et al (2007). Effects of an educational-behavioural joint protection program on people with moderate to severe rheumatoid arthritis: a randomized controlled trial. *Clin Rheumatol*, 26, 2043–2050.

Melvin, J.L. (1989) Rheumatic disease in the adult and child. In: Occupational Therapy and Rehabilitation, 3rd ed. Philadelphia: F.A. Davis.

Niedermann K, Hammond A, Forster A, de Bie R (2010). Perceived Benefits and Barriers of joint protection among people with rheumatoid arthritis and occupational therapists: a mixed methods study. *Musculoskel Care* 8(3):143-156

Nordenskiold, U. (1994). Evaluation of assistive devices after a course of joint protection. *Int J Technol Assess Health Care*, 10(2), 293–304.

Nordenskiold, U., Grimby, G., and Dahlin-Ivanoff, S. (1998). Questionnaire to evaluate effects of assistive devices and altered working methods in women with rheumatoid arthritis. *Clin Rheumatol*, 17, 6–16.

Sheon, R.P. (1985). A joint protection guide for non-articular rheumatic disorders. *Postgrad Med*, 77, 329–337.

Spadaro, A., De Luca, T., Massimiani, M.P., Ceccarelli, F., Riccieri, V., Valesini, G. (2008). Occupational therapy in ankylosing spondylitis: short-term prospective study in patients treated with anti_TNF-alpha drugs. *Joint Bone Spine* 75: 29-33.

Stamm, T., Machold, K.P., and Smolen, J.S. (2002). Joint protection and home hand exercises improve hand function in patients with hand osteoarthritis: a randomized controlled trial. *Arthritis Care Res*, 47, 44–49.

Verhagen, A.P., Karels, C., Bierma-Zeinstra, S.M.A., et al. (2006) Ergonomic and physiotherapeutic interventions for treating work-related complaints of the arm, neck or shoulder in adults. Cochrane Database of Syst Rev 3: CD003471. DOI: 10.1002/14651858.CD003471.pub3.

Young, A., Dixey, J., Cox, N., et al (2000) How does functional disability in early rheumatoid arthritis (RA) affect patients and their lives? Results of a 5 year follow-up in 732 patients from the Early RA Study (ERAS). *Rheumatology*, 39, 603–611.