Scand J Med Sci Sports 2004: 14: 138–142
Printed in Denmark · All rights reserved
DOI: 10.1111/j.1600-0838.2004.00396.x

SCANDINAVIAN JOURNAL OF
MEDICINE & SCIENCE
IN SPORTS

Review

Exercise therapy for people with rheumatoid arthritis and osteoarthritis

Jyrki A. Kettunen[1], Urho M. Kujala[2]

[1]*ORTON Orthopaedic Hospital, Invalid Foundation, Helsinki, Finland,* [2]*Department of Health Sciences, University of Jyväskylä, Jyväskylä, Finland*
Corresponding author: Jyrki A. Kettunen, The ORTON Orthopaedic Hospital, Invalid Foundation, Tenholantie 10, FIN-00280 Helsinki, Finland. Tel: +358 9 4748 6650, Fax: +358 9 2418 408, E-mail: jyrki.kettunen@invalidisaatio.fi

Accepted for publication 17 March 2004

Exercise therapy would appear to be effective at increasing aerobic capacity and muscle strength in patients with rheumatoid arthritis (RA), and no detrimental effects on disease activity or pain compared with controls has been observed. Exercise therapy – at least in the short-term, improves pain, muscular strength and function in elderly people with mild osteoarthritis (OA) of the hip or knee. For the treatment of both OA and RA the knowledge of the optimal type, frequency, duration and intensity of exercise is still limited, but the exercise should not include high-impact loads or high injury risk. Long-term compliance is important in achieving long-term benefits. Supervised classes appears to be as effective as treatments provided on a one-to-one basis, group-based exercise programme thus providing a cost-effective alternative. Adherence to home programmes seems to be lower. Future research should focus on finding optimal type and dose of exercise, ways of optimally maintaining the beneficial effects of exercise therapy over time as well as on the effects of exercise on the long-term progression of the disease and cost-effectiveness of the therapy.

Muscle weakness, restricted range of motion (ROM) of joints and reduced physical function are common signs in patients with rheumatoid arthritis (RA) or osteoarthritis (OA). The goal of exercise therapy in the treatment of RA and OA is to reduce pain and disability by improving aerobic fitness, muscle strength, and the stability and ROM of joints. Traditionally, some clinicians have recommended non-weight-bearing exercises for people with inactive stage of RA or mild OA. During last decade exercise therapy for RA and OA has been studied in many randomised controlled trials (RCTs) including also rather intensive training programmes, weight-bearing exercises as well as exercise for people with moderately active RA (Mangione, 1999; Van Baar et al., 1999; Van den Ende et al., 2000; Brosseau et al., 2004; Fransen et al., 2004; Van den Ende et al., 2004). The aim of this short review is to summarise the current evidence for the use of exercise therapy in the treatment of RA and OA without repeating exhaustive systematic analyses presented in recent reviews (Van Baar et al., 1999; Brosseau et al., 2004; Fransen et al., 2004; Van den Ende et al., 2004).

Method

This article is based on a search of the literature including the electronic databases of the Cochrane Controlled Trial Register (CCTR) and MEDLINE. We used the databases to identify reviews and articles on dynamic exercise therapy as a treatment for RA and OA of hip or knee. We based our conclusions mainly on the results of RCTs.

Exercise in the treatment of RA

A Cochrane review of RCTs using dynamic exercise therapy to treat RA suggested that dynamic exercise therapy is effective at increasing aerobic capacity and muscle strength (Van den Ende et al., 2004) and RCTs published after the latest update of this review agree on the conclusions (Table 1). No detrimental effects on disease activity and pain were observed. The effect of dynamic exercise therapy on functional ability and radiological progression was unclear. The conclusions were based on study populations consisting of patients with non-active to moderately active disease, which after some RCTs investigating the effects of exercise therapy have been published (Van den Ende et al., 2000; Häkkinen et al., 2001; Bearne et al., 2002; de Jong et al., 2003) (Table 1). Short-term strength training can be used successfully in the treatment of patients with active or chronic RA, providing an increase in knee extension strength without increase in pain or disease activity (Van den Ende et al., 2000; Bearne et al., 2002). The mean increase in knee extension strength after 5-weeks exercise period in patients with stable RA was 33% (Bearne et al., 2002). This exercise programme consisted of 10 exercise sessions and comprised relatively simple, progressive muscle strength, balance and co-ordination exercises.

The evidence on the long-term results of dynamic exercise therapy in patients with RA is based on a number of long-lasting interventions (Nordemar, 1981; Hansen et al., 1993; Häkkinen et al., 2001; de Jong et al., 2003). In his non-randomised controlled long-term follow-up study among patients with RA, Nordemar (1981) found that the subjects in the training group had a much better disease outcome with reference to changes as shown by X-rays, clinical evaluation and some physiological parameters compared with control patients. In contrast, Hansen et al. (1993) found no differences in disease activity, muscle strength, aerobic condition, functional capacity or radiographic scores among RA subjects on different training programmes and the control group after a

Table 1. The main results of randomised studies on the effect of dynamic exercise therapy in RA

Trial	Exercise type	Control treatment	Main results				
			Aerobic capacity	Knee extension strength	Function/functional ability	Self-reported pain	Disease activity
Harkcom et al. (1985)[a]	Dynamic exercise with bicycle training, three groups	ROM exercises	VO_2max: NS	Isometric: NS	50-foot walk time: NS functional status index (FSI): NS	Not measured	Pain and swelling: NS
Minor et al. (1989)[a]	Aerobic pool or aerobic walking	ROM exercises	VO_2max: Mean improvement greater in training groups combined than in control group	Not measured	50-foot walk time: Mean improvement greater in training groups combined than in control group	Arthritis impact measurements scales (AIMS): NS	Clinically active joints: NS
Baslund et al. (1993)[b]	Bicycle training	Training not allowed	VO_2max: Mean improvement greater in training group than in control group	Not measured	Not measured	Not measured	Erythrocyte sedimentation rate (ESR): NS
Hansen et al. (1993)[c]	Dynamic training (water, bicycle), four groups	No exercise	Aerobic fitness: NS	Isometric: Improvement in all groups, NS	HAQ: NS	VAS: NS	ESR: NS
Lyngberg et al. (1994)[a]	Bicycling and strengthening exercises	No exercise	VO_2max: NS	Isokinetic: NS	Fries index: NS	Not measured	ESR: NS
Van den Ende et al. (1996)[b]	Intensive bicycling and weight-bearing exercises	*Low intensity exercise* = ROM+isometric exercises or *Individually supervised low intensity exercise* = ROM+isometric exercises or *Home exercise* = written instruction for ROM+isometric exercises	VO_2max: Mean improvement greater in intensive training group than in control groups	Isokinetic ($120° s^{-1}$): Mean improvement greater in intensive training group than in individually supervised low intensity exercise group and in home exercise group	50-foot walk time: NS HAQ: NS	VAS: NS	ESR: NS
Van den Ende et al., 2000[a]	Intensive exercise training+ROM and isometric exercises	ROM and isometric exercises	Not measured	Isometric and isokinetic: Improvement greater in intensive exercise group than in control group	VAS: NS	HAQ: NS	ESR: NS Disease activity score (DAS): NS
Häkkinen et al., 2001[c]	Strength training combined with endurance-type physical activities	ROM exercises	Not measured	Concentric: Improvement greater in strength training group than in control group	VAS: Improvement greater in strength training group than in control group	HAQ: Improvement greater in strength training group than in control group	ESR: NS DAS28: NS
Bearne et al., 2002[e]	Strength, balance, co-ordination and functional exercises	Normal daily activities	Not measured	Isometric: Improvement greater in intervention group than in control group	VAS: NS	HAQ: NS	Clinical disease activity: NS, Concentrations of plasma proinflammatory cytokines: NS
de Jong et al., 2003[c]	High intensity exercise including bicycling, muscle strength and endurance training, ROM exercises, activities of daily living, and sporting activities	Usual care	Aerobic fitness: Improvement greater in high intensive exercise group than in usual care group	Isokinetic: Improvement greater in intensive exercise group than in usual care group	Not reported	The McMaster Toronto Arthritis (MACTAR) Patient Preference Disability Questionnaire: Improvement greater in intensive exercise group than in usual care group HAQ: NS	DAS4: NS

[a]Results after 12 weeks exercise intervention; [b]Results after 8 weeks exercise intervention; [c]Results after 24 months training period; [d]Results 24 weeks after admission to hospital; [e]Results after 5 weeks exercise intervention.

2-year training period. According to the report, the undetectable effect could be due to insufficient group differences in training during the follow-up. In their 2-year programme of dynamic strength training combined with endurance-type physical activities, Häkkinen et al. (2001) observed that training increases muscle strength among patients with early RA without detrimental effects on disease activity (Table 1). Functional capacity as measured by the Health Assessment Questionnaire (HAQ) improved in both the exercise group and the control group doing ROM exercises, but after 24-month training period the improvement was greater in strength-training group compared with ROM exercise group. A supervised long-term high-intensity exercise programme improved functional ability and physical capacity more than usual care among RA patients (de Jong et al., 2003) (Table 1). The median radiographic damage of the large joints did not increase in either group, but the mean difference in change between the groups showed a tendency to greater increase in damage in the exercise group compared with the usual care group.

Exercise in the treatment of OA

In their systematic review of RCTs, van Baar et al. (1999) analysed whether exercise therapy for OA of the hip or knee had an effect on pain, self-reported disability, observed disability or patient's global assessment of the effect. Six of the assessed trials satisfied at least 50% of their validity criteria. According to their analysis, exercise therapy had beneficial short-term effects on the studied parameters in patients with OA of the knee and, to a lesser extent (less evidence available), in those with OA of the hip. This conclusion applied to patients with mild to moderate OA who were recruited in outpatient settings and the community. Beneficial effects were found for various types of exercise therapy.

In a more recent systematic review, Fransen et al. (2004) analysed data of 17 RCTs comparing some form of land-based therapeutic exercise with a non-exercise in 2562 participants with knee OA. For pain, combining the results revealed a mean small beneficial effect (Fig. 1), while also for self-reported physical function a mean small beneficial effect was found (Fig. 2). No clear difference in the size of the mean effect was seen between participants allocated to individual treatments compared with participants allocated to group format programmes. Exercise dosage (frequency, intensity and programme duration) varied considerably between the reviewed studies and there was insufficient data to give specific recommendations either on optimal dosage or on optimal programme content. While most of the studies investigated patients with mild to moderate OA of the knee, it is possible that the physiological impairments were not yet large enough to translate into reportable difficulties on self-reported simple questionnaires. Brosseau et al. (2004) evaluated the data of RCTs comparing therapeutic exercise of different intensities on objective and subjective measures of disease activity in patients with OA. Only one study (Mangione, 1999) met their inclusion criteria. With the findings of this single study they concluded that both high and low intensity stationary cycling were equally effective in improving functional status, gait, pain and aerobic capacity with OA of the knee.

Until now, only one RCT reports results of exercise treatment for documented OA of the knee lasting over 1 year (Ettinger et al., 1997). The results of this study show that both aerobic and resistance exercise programme are beneficial, but the study also shows the problem of long-term compliance. Van Baar et al. (2001) followed patients who had participated in a randomised 3-month intervention study and concluded that the beneficial effects of exercise declined with time and finally disappeared during the 6 months follow-up period. So, long-term compliance may be more important in achieving long-term benefits than the type of exercise performed. The knowledge of the long-term effects of exercise on the progression of radiographic osteoarthritic changes is limited to the study of Ettinger et al. (1997) who did not find group differences as a consequence of their 18-month training programme.

Exercise with prosthesis

There is some evidence based on RCTs that perioperative (Gilbey et al., 2003) and postoperative (Maire et al., 2003) exercise therapy improves early functional recovery after total hip arthroplasty. In their RCT Kramer et al. (2003) compared clinic- and home-based rehabilitation programmes in patients with primary total knee arthroplasty, and concluded that the groups performed similarly 52 weeks after surgery. However, the recommendation for physical activity after total hip or knee arthroplasty is mostly based on clinical experience. According to clinical consensus statements participation in no-impact or low-impact sports (swimming, cycling, etc.) can be encouraged, but participation in high-impact sports (running, football, baseball, basketball, soccer, racquetball, etc.) should be prohibited after total joint replacement (McGrory et al., 1995; Healy et al., 2000).

There is evidence that a total joint replacement in an inactive patient will show less wear than that of an active patient (Dubs et al., 1983; Schmalzried et al., 2000) and the aseptic loosening rates may be lower in inactive patients (Kilgus et al., 1991).

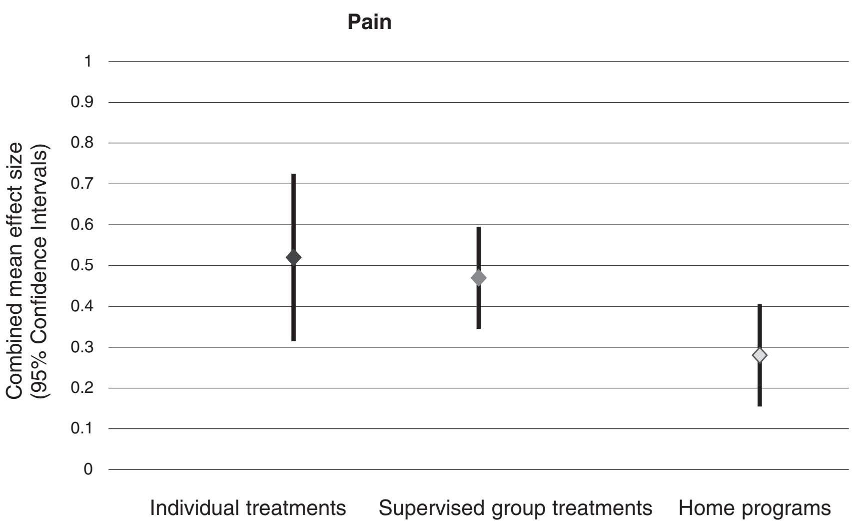

Fig. 1. Combined mean effect size (95% confidence intervals) of exercise therapy for osteoarthritis of the hip or knee for self-reported pain categorised by the treatment mode. Data adapted from Fransen et al. (2004).

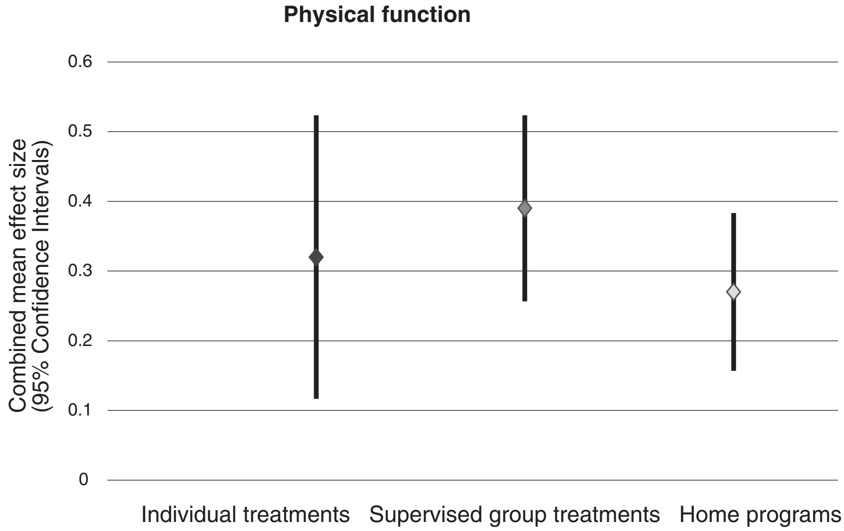

Fig. 2. Combined mean effect size (95% confidence intervals) of exercise therapy for osteoarthritis of the hip or knee physical function categorised by the treatment mode. Data adapted from Fransen et al. (2004).

Local bone destruction is known to depend on the number of wear particles. The total volume of wear particles produced strongly depend on the sliding distance or the amount of steps (linear relationship), on the applied load (exponential relationship) and the surface roughness (exponential relationship) (Kuster & Stachowiak, 2002). Based on biomechanical studies we know that the joint loads depend on the type of activity and also on the speed of activity (Kuster, 2002). At least theoretically, compared with normal walking, cycling with low resistance causes much smaller wear rates and running much higher wear rates, and in all activities the wear rates increase clearly when the resistance or speed is increased (Kuster, 2002). Overall, physical activity is important in maintaining function among aged. Patients should be motivated to remain physically active after total joint replacement for general health and also for improvement of general bone quality.

Table 2. General guidelines for tailoring exercise programmes for arthritis patients

Individual programmes and group-based programmes are equally effective; long-term compliance is a key factor. Utilise local resources to support the patients in planning and meeting the objectives of the programme.
Recommend • Progressive muscle strengthening • Stretching of tight muscles and maintaining the existing range of motion of the joints • Aerobic training is important as well Avoid • Exercises which include risk of injury or high impact loads

Discussion

The methodological quality varies considerably between the studies included in the systematic reviews on exercise therapy for people with arthritis (Van Baar et al., 1999; Brosseau et al., 2004; Fransen et al., 2004; Van den Ende et al., 2004), and low methodological quality may influence the results of many of the trials. The results of the two low methodological quality trials (fulfilling at most five out of 10 methodological criteria) in the treatment for RA were more positive than the results of the other trials (Van den Ende et al., 2004). In the treatment of OA, Fransen et al. (2004) found that the studies that used blinded outcomes assessment demonstrated lower effect size for self-reported pain and for physical function compared with studies using uncertain or unblinded outcomes assessment. The effect sizes were also smaller for self-reported pain and for physical function in the studies using "intention to treat" analysis compared with the studies assessing only the results of treatment completers or treatment efficacy. Overall, it has to be kept in mind that clinical trials using non-pharmacological treatments, such as exercise therapy, are less often properly blinded or placebo controlled than pharmacological trials (Boutron et al., 2003).

In conclusion, exercise therapy – at least in the short-term, improves pain, muscular strength and function in elderly people with mild OA of the hip or knee. Exercise therapy would appear to be effective at increasing aerobic capacity and muscle strength in patients with RA, and no detrimental effect on disease activity or pain compared with controls has been observed in RCTs. However, it should be remembered that earlier studies have shown that short-term bed rest decreases disease activity in some RA patients (Alexander et al., 1983) and patients with RA and hemiplegia have been reported to have less arthritis on their paralysed side (Bland & Eddy, 1968). Hence there remains a need for well-designed RCTs to investigate the long-term effects of dynamic exercise therapy in the management of RA, not least to exclude the possibility that intensive exercise therapy may cause progressive joint surface damage in some patients.

Perspectives

During the last decade published RCTs have given accumulating evidence on the beneficial effects of exercise therapy in the treatment of RA and OA.

These benefits include good muscle strength, function and decrease in pain symptoms. This knowledge justifies the implementation of exercise as a part of clinical therapy routines. However, only rather general exercise recommendations (Table 2) can be given based on scientific data. More research is needed on the optimal type and dose of exercise in patients with different stages of disease as well as on the effects of exercise on disease progression including analyses on quality of life outcomes as well as cost-effectiveness of the therapies.

Key words: disability, exercise, lower-limb, osteoarthritis, rheumatoid arthritis.

References

Alexander GJ, Hortas C, Bacon PA. Bed rest, activity and the inflammation of rheumatoid arthritis. Br J Rheumatol 1983: 22: 134–140.

Baslund B, Lyngberg K, Andersen V, Halkjaer Kristensen J, Hansen M, Klokker M, Pedersen BK. Effect of 8 wk of bicycle training on the immune system of patients with rheumatoid arthritis. J Appl Physiol 1993: 75: 1691–1695.

Bearne LM, Scott DL, Hurley MV. Exercise can reverse quadriceps sensorimotor dysfunction that is associated with rheumatoid arthritis without exacerbating disease activity. Rheumatol 2002: 41: 157–166.

Boutron I, Tubach F, Giraudeau B, Ravaud P. Methodological differences in clinical trials evaluating nonpharmacological and pharmacological treatments of hip and knee osteoarthritis. JAMA 2003: 290: 1062–1070.

Bland JH, Eddy WM. Hemiplegia and rheumatoid hemiarthritis. Arthritis Rheum 1968: 11: 72–80.

Brosseau L, MacLeay L, Wells G, Tugwell P. Intensity of exercise for the treatment of osteoarthritis (Cochrane Review). In: The Cochrane Library, Issue 1. Chichester, UK: John Wiley & Sons, Ltd, 2004.

de Jong Z, Munneke M, Zwinderman AH, Kroon HM, Jansen A, Ronday KH, van Schaardenburg D, Dijkmans BA, Van den Ende CH, Breedveld FC, Vliet Vlieland TP, Hazes JM. Is a long-term high-intensity exercise program effective and safe in patients with rheumatoid arthritis? Results of a randomized controlled trial. Arthritis Rheum 2003: 48: 2393–2395.

Dubs L, Gshwend N, Munzinger U. Sport after total hip arthroplasty. Arch Orthop Trauma Surg 1983: 101: 161–169.

Ettinger WH, Burns R, Messier SP, Applegate W, Rejeski WJ, Morgan T, Shumaker S, Berry M, O'Toole M, Monu J, Craven T. A randomized trial comparing aerobic exercise and resistance exercise with a health education program in older adults with knee osteoarthritis. JAMA 1997: 277: 25–31.

Fransen M, McConnell S, Bell M. Exercise for osteoarthritis of the hip or knee (Cochrane Review). In: The Cochrane Library, Issue 1. Chichester, UK: John Wiley & Sons, Ltd, 2004.

Gilbey HJ, Ackland TR, Wang AW, Morton AR, Trouchet T, Tapper J. Exercise improves early functional recovery after total hip arthroplasty. Clin Orthop 2003: 408: 193–200.

Häkkinen A, Sokka T, Kotaniemi A, Hannonen P. A randomized two-year study of the effects of dynamic strength training on muscle strength, disease activity, functional capacity, and bone mineral density in early rheumatoid arthritis. Arthritis Rheum 2001: 44: 515–522.

Hansen TM, Hansen G, Langgaard AM, Rasmussen JO. Long-term physical training in rheumatoid arthritis. A randomized trial with different training programs and blinded observers. Scand J Rheumatol 1993: 22: 107–112.

Harkcom TM, Lampman RM, Banwell BF, Castor CW. Therapeutic value of graded aerobic exercise training in rheumatoid arthritis. Arthritis Rheum 1985: 28: 32–39.

Healy WL, Iorio R, Lemos MJ. Athletic activity after total knee arthroplasty. Clin Orthop 2000: 380: 65–71.

Kilgus DJ, Dorey FJ, Finerman GAM, Amstutz HC. Patient activity, sports participation, and impact loading on the durability of cemented total hip replacements. Clin Orthop 1991: 269: 25–31.

Kramer JF, Speechley M, Bourne R, Rorabeck C, Vaz M. Comparison of clinic- and home-based rehabilitation programs after total knee arthroplasty. Clin Orthop Rel Res 2003: 410: 225–234.

Kuster MS. Exercise recommendations after total joint replacement. A review of the current literature and proposal of scientifically based guidelines. Sports Med 2002: 32: 433–445.

Kuster MS, Stachowiak GW. Factors affecting polyethylene wear in a total knee replacement. Orthopedics 2002: 25: S235–S242.

Lyngberg KK, Harreby M, Bentzen H, Frost B, Danneskiold-Samsoe B. Elderly rheumatoid arthritis patients on steroid treatment tolerate physical training without an increase in disease activity. Arch Phys Med Rehabil 1994: 75: 1189–1195.

Maire J, Dugue B, Faillenet-Maire AF, Tordi N, Parratte B, Smolander J, Rouillon JD. Recovery after total hip joint arthroplasty in elderly patients with osteoarthritis: positive effect of upper limb interval-training. J Rehabil Med 2003: 35: 174–179.

Mangione KK, McCully K, Gloviak A, Lefebvre I, Hofmann M, Craik R. The effects of high-intensity and low-intensity cycle ergometry in older adults with knee osteoarthritis. J Gerontol A Biol Sci Med Sci 1999: 54: M184–M190.

McGrory BJ, Stuart MJ, Sim FH. Participation in sports after hip and knee arthroplasty: review of literature and survey of surgeon preferences. Mayo Clin Proc 1995: 70: 342–348.

Minor MA, Hewett JE, Webel RR, Anderson SK, Kay DR. Efficacy of physical conditioning exercise in patients with rheumatoid arthritis and osteoarthritis. Arthritis Rheum 1989: 32: 1396–1405.

Nordemar R. Physical training in rheumatoid arthritis: a controlled long-term study. II. Functional capacity and general attitudes. Scand J Rheumatol 1981: 10: 25–30.

Schmalzried TP, Shepherd EF, Dorey FJ, Jackson WO, dela Rosa M, Fa'vae F, McKellop HA, McClung CD, Martell J, Moreland JR, Amstutz HC. The John Charnley Award: wear is a function of use, not time. Clin Orthop 2000: 381: 36–41.

Van Baar ME, Assendelft WJJ, Dekker J, Oostendorp RAB, Bijlsma JW. Effectiveness of exercise therapy in patients with osteoarthritis of the hip or knee. A systematic review of randomized clinical trials. Arthritis Rheum 1999: 42: 1361–1369.

Van Baar ME, Dekker J, Oostendorp RAB, Bijl D, Voorn ThB, Bijlsma JWJ. Effectiveness of exercise in patients with osteoarthritis of hip or knee: nine months' follow up. Ann Rheum Dis 2001: 60: 1123–1130.

Van den Ende CH, Hazes JM, le Cessie S, Mulder WJ, Belfor DG, Breedveld FC, Dijkmans BA. Comparison of high and low intensity training in well controlled rheumatoid arthritis. Results of a randomised clinical trail. Ann Rheum Dis 1996: 55: 798–805.

Van den Ende CH, Breedveld FC, le Cessie S, Dijkmans BA, de Mug AW, Hazes JM. Effect of intensive exercise on patients with active rheumatoid arthritis: a randomised clinical trial. Ann Rheum Dis 2000: 59: 615–621.

Van den Ende CHM, Vliet Vlieland TPM, Munneke M, Hazes JMW. Dynamic exercise therapy for treating rheumatoid arthritis (Cochrane Review). In: The Cochrane Library, Issue 1. Chichester, UK: John Wiley & Sons, Ltd, 2004.