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Dynamic Training versus Relaxation Training as Home Exercise for Patients with Inflammatory Rheumatic Diseases

A randomized controlled study

C. H. Stenström[1,2], B. Arge[1], and A. Sundbom[1,3]

[1]Department of Rheumatology, Mälarsjukhuset, Eskilstuna, [2] Department of Physical therapy, Karolinska institutet, Huddinge, [3] Department of Orthopaedic surgery, Mälarsjukhuset, Eskilstuna, Sweden

The aim of the study was to evaluate the effects of a dynamic training program versus a muscle relaxation training program as home exercise in patients with inflammatory rheumatic diseases. Fifty-four patients (mean age 54 years, mean symptom duration 14 years) were randomized to one of the two programs. After personal instructions every patient exercised at home for half an hour, 5 days a week during 3 months. Before and after the interventions, all patients were assessed for health-related quality of life, joint tenderness and physical capacities. The dynamic training group had improved in perceived exertion at the walking test ($p \leq 0.05$), while the relaxation training group had improved their total Nottingham Health Profile ($p \leq 0.01$), its subscale for lack of energy ($p \leq 0.05$), Ritchie's articular index ($p \leq 0.05$), muscle function of the lower extremities ($p \leq 0.01$), and arm endurance ($p \leq 0.01$). Regarding changes in muscle function of the lower extremities during the intervention period, there was a significant difference ($p \leq 0.05$) between the groups in favour of the relaxation training group. The results of the study thus indicated that progressive muscle relaxation training might improve health related quality of life, reduce joint tenderness and be superior to dynamic muscle training in improving the muscle function of the lower extremities in patients with inflammatory rheumatic diseases. The clinical effects were small and the results have to be interpreted with caution.

Key words: clinical trial, dynamic training, exercise, muscle relaxation, physiotherapy, rheumatic diseases

Therapeutic exercise has long been used as a complement to medical and surgical treatment for the preservation of the functional capacity in people with inflammatory joint diseases. Since the 70's, dynamic exercises, i.e. with muscle work during joint motion, and/or aerobic exercises have become gradually more recommended, and a number of evaluation studies have been carried out to determine their value (1). Dynamic therapeutic exercise has been found to influence the muscle function (2–9) as well as the aerobic capacity (2, 4–6, 10) and capacity in physical performance tests (2, 3, 5, 6, 11) positively, without negatively influencing the short-or long-term disease process (2, 3, 5, 6–10, 12, 13) in people with rheumatic diseases. Such exercise has also, although less frequently, been found to influence qualitative disease consequences such as pain (3, 9, 11), perceived exertion (2, 6), emotional and social factors (5), and cognition and behavior (5, 7, 11). Only recently, muscle exercise has also been found to influence the participating patients' reported capacity in activities of daily life (9).

A randomized placebo-controlled study of exercise seems hard to design, and has, thus, never been carried out in people with rheumatic diseases. Studies with a controlled design have rather compared aerobic, dynamic exercise programs either with no intervention at all (2, 7, 9, 10, 13) or with different types of static exercises, i.e. without joint motion at muscle work, range-of-motion exercises, and/or other non-aerobic exercises (2, 5, 6, 13). When exercise is compared to no intervention, placebo effects might be responsible for parts of the reported exercise effects. When comparing different types of exercise, the effects of the aerobic/dynamic exercise program studied might be reduced by the comparison with a program that, although to a lower extent, is still efficient. Musculature relaxation training, however, although maybe adequate for several purposes (14), might be suitable as a placebo treatment for dynamic muscle training in people with inflammatory rheumatic diseases, and could be expected to influence physical performance less than programs with range-of-motion exercises or static muscle training.

The aim of this study was to evaluate the effects on physical capacity, joint tenderness and health-related quality of life of a dynamic training program versus a muscle relaxation training program as three months' home exercise in patients with inflammatory rheumatic diseases.

Christina H. Stenström, Dept of Physical Therapy, Karolinska institutet, S-141 57 Huddinge, Sweden

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Material and methods

Patients

Patients with inflammatory rheumatic diseases diagnosed according to international standards (15–18),

belonging to ARA functional classes I and II (19), and aged 65 or below were screened for participation in the study. During March through November 1994, a total of 214 patients fulfilling the above criteria visited the outpatient clinic of the rheumatology department at Mälarsjukhuset. Of these, 75 individuals were in need of extensive treatment such as increased medication, in-patient rehabilitation, and/or surgery, 37 were already exercising within the health care system, and 7 had severe psychosocial problems making them unable to participate in a study of this kind. The remaining 95 patients were informed about the study and offered participation. Forty one of them declined and 54 (82% rheumatoid arthritis/11% psoriatic arthritis/7% other diagnoses with peripheral arthritis, 72% women, mean age 54 years, mean symptom duration 14 years, mean ESR 27 mm/h, mean Hb 129 g/l) accepted to participate. The patients who accepted participation were randomized into two groups after stratification for diagnosis. The characteristics of the two groups are shown in Table I.

Training programs

The patients in the dynamic training group were personally instructed in a 30-minute home program with exercises for strength and mobility in the upper and lower extremities, stretching, and walking. This program has previously been evaluated and considered efficient for patients with rheumatoid arthritis (11). The only patient with pelvospondylitis in the dynamic training group used a 30-minute exercise program with exercises for mobilization of the vertebral column, stretching and strengthening exercises, and aerobic exercises (20).

The patients of the relaxation training group were personally instructed in a 15-minute program for progressive muscle relaxation (21). The program consisted of exercises for the contraction and relaxation of several muscle groups in the extremities and the trunk, and of respiration exercises. To equalize the exercise time in both groups, the patients of the relaxation training group were instructed to remain resting for another 15 minutes after the completion of their exercises.

After personal instructions the patients in both groups managed their exercise at home 5 times a week for three months. To standardize the exercises, taped instructions to follow at each exercise were given to each patient. They also reported their exercises in a diary, and were phoned by a supervising physical therapist after the first week's exercise and then once a month.

Assessments and examinations

The patients were assessed with questionnaires mailed to them immediately before the baseline examinations

Table I. Characteristics of 54 patients with inflammatory rheumatic diseases who entered the study in either the dynamic training group or the relaxation training group.

	Dynamic training group n=27	Relaxation training group n=27
Female, n (%)	18 (67)	21 (78)
Age, years, md (iq range)	54 (45–64)	55 (48–64)
Diagnoses		
Rheumatoid arthritis, n (%)	22 (82)	22 (82)
Psoriatic arthritis, n (%)	3 (11)	3 (11)
SLE, n (%)	0 (0)	1 (4)
Pelvospondylitis, n (%)	0 (0)	1 (4)
Reiter's syndrome, n (%)	1 (4)	0 (0)
Oligoarthritis, n (%)	1 (4)	0 (0)
Symptom duration, years, md (iq range)	15 (7–24)	7 (2–22)
ESR, mm/h, md (iq range)	22 (10–38)	25 (14–44)
Hb, g/l, md (iq range)	130 (120–139)	124 (116–138)
Sicklisted/-pension		
no, n (%)	13 (48)	9 (33)
part, n (%)	6 (22)	8 (30)
full, n (%)	8 (30)	10 (37)
Rheumasurgery		
no, n (%)	13 (48)	18 (67)
arthroplasty, n (%)	5 (19)	5 (19)
Medication		
no, n (%)	0 (0)	4 (15)
NSAID only, n (%)	4 (15)	8 (30)
DMARD, n (%)	20 (74)	9 (33)
oral steroids, n (%)	1 (4)	4 (15)
DMARD + oral steroids, n (%)	2 (7)	2 (7)

and the three-month investigations respectively. The questionnaires were filled out at home and handed over to and checked by the physical therapist at the examination sessions.

Background information on symptom duration, marital status, work status, surgery, current medication, intra-articular steroid injections, and exercise habits was collected in questionnaires specially developed for this study.

An index of exercise motivation (30–300) containing three questions: "How do you like exercise?"; "What do you think about your own benefit from exercise?"; "How sure are you that you would be able to exercise 30 minutes, 5 days a week for 3 months, and then 2–3 times a week for another 9 months?" was developed specially for this study. Each question was followed by a scale of 10–100, where 100 indicated excellent motivation.

The Nottingham Health Profile is a generic instrument for the assessment of health-related quality of life. Part I, which was used in the present study, contains 38 "yes/no" questions grouped into six sub-scales: lack of energy; emotional reactions; physical mobility; sleep disturbances; pain; and social isolation. The answers are weighted and the value of each sub-scale varies between 0 (no problems) and 100 (severe problems). The original instrument as well as its Swedish version have shown satisfactory validity and reliability (22).

Before and directly after the three-month intervention, the patients were examined using the following measures by a physical therapist who was not aware of which group the patient belonged to:

Ritchie's articular index (23), which scores joint tenderness on a four-grade scale combined to a maximum possible score of 78 (maximum tenderness). Tenderness is elicited by palpation of the jaw joints, and all extremity joints except the hip, the talocalcaneal and the mid-tarsal joints, where it is elicited by passive movement as is the cervical spine. Ritchie's articular index has shown satisfactory validity and intra-assessor reliability (23).

Walking at self-selected speed 500 m indoors, the speed checked with a speedometer cart (24). Perceived exertion on the Borg RPE scale (25) graded from 6 (very, very light) to 20 (very, very hard) was rated by the patient directly after walking. At the post-intervention test, the patient (i) walked at his/her present self-selected walking speed, and (ii) had to keep up with the speed of the physical therapist who replicated the patient's speed from the baseline investigation. Thus, variations in self-selected walking speed as well as in perceived exertion at a fixed speed were measured. Walking at self-selected speed has been considered a reliable and valid method (24) as has the Borg RPE-scale (25).

The Muscle function index (26), where the patient's performance on various tests for strength, endurance, and balance/coordination of the lower extremities is observed and scored on three-point scales. The maximum score representing severe impairment is 34. The muscle function index has been found to possess sufficient validity and reliability (26).

Shoulder function assessment (27) has been modified (unpublished observations) to cover five common arm functions: hand-raising; hand-to-opposite-shoulder-behind-back; hand-to-neck; hand-to-opposite-shoulder-in-front-of-body; and hand-to-seat. Each function is assessed on a six-point scale except for hand-to-neck with seven points. The maximum score of 62 indicates normal function. The shoulder function assessment has shown satisfactory reliability (27).

Arm strength and arm endurance was tested by lifting a burden from 0.45 m to nose level. For the strength test, a maximum burden (0–10 kg) was chosen by the patient after trying different loads. For the endurance test, the maximum load was halved, and the maximum possible number of repetitions was noted. At the post-intervention endurance test, the burden from the baseline investigation was kept, also where the maximum capacity had increased.

Statistics

Data are presented mainly as median values with interquartile (25%tile–75%tile) ranges within brackets. Comparisons between groups at baseline and of differences in post- and pre-intervention results between groups were analysed with the Mann–Whitney test. Comparisons between pre-and post-intervention results within groups were analysed with the Wilcoxon test for matched pairs. The chi-squared test was used for the analysis of nominal data.

Ethical scrutiny

The design of the study was approved by the Ethical Research Committee, Örebro Regional Hospital, Sweden.

Results

The dynamic training group and the relaxation training group were comparable regarding all background characteristics except the number of patients on DMARD, which was significantly ($p \leq 0.001$) larger in the dynamic training group (Table I). Within baseline assessments and investigations the two groups were comparable (Table II). Also in exercise habits and exercise motivation the groups were comparable; median values for range-of-motion exercises

Table II. Results of the baseline examinations and of the three-month examinations for 54 and 48 patients with inflammatory rheumatic diseases respectively. Within-group differences analysed with Wilcoxon's test for matched pairs (#=p≤0.05, ##=p≤0.01), between-group differences with the Mann-Whitney test (*=p≤0.05). No corrected p-values for multiple comparisons have been used.

	Dynamic training group		Relaxation training group	
	Baseline n=27 md (IQ range)	Three-month n=23 md (IQ range)	Baseline n=27 md (IQ range)	Three-month n=25 md (IQ range)
Nottingham Health Profile, 0–100	16 (4.9–34.0)	14 (3.7–26.5)	18 (10.4–28.5)	12 (4.7–21.9)##
energy, 0–100	0 (0–60.5)	0 (0–63.2)	24 (0–39.4)	0 (0–23.8)#
emotions, 0–100	0 (0–8.6)	0 (0–0)	8 (0–12.2)	0 (0–7.7)
mobility, 0–100	21 (0–38.1)	10 (0–27.6)	17 (0–38.1)	20 (0–38.1)
sleep, 0–100	0 (0–33.1)	11 (0–22.0)	11 (0–35.8)	0 (0–19.6)
pain, 0–100	45 (10.9–63.5)	38 (10.9–72.4)	29 (15.6–63.5)	34 (0–53.7)
isolation, 0–100	0 (0–0)	0 (0–0)	0 (0–0)	0 (0–0)
Ritchie's articular index, 0–78	14 (6–21)	10 (5–17)	16 (9–21)	12 (6–17)#
Walking speed, min	6.7 (5.6–7.4)	6.0 (5.5–7.5)[d]	6.7 (5.8–7.7)	6.2 (5.7–7.7)[e]
Perceived exertion, 6–20	11 (11–13)	11 (9–11)[b,#]	11 (9–13)	11 (9–12)[f]
Muscle function index, 0–34	4 (1–13)	4 (1–8)	6 (5–11)	5 (2–8)##, *
Shoulder function, 10–62	60 (54–62)	60 (52–61)	59 (48–62)	58 (46–61)
Arm strength, 0–10 kg	10 (5–10)[a]	10 (6–10)	10 (7–10)	10 (7–10)
Arm endurance, repetitions, n	23 (15–40)[a]	35 (20–41)[b]	15 (9–30)	28 (12–50)[c,##]

[a] One patient unable to perform the test, [b] two values missing, [c] three values missing, [d] four values missing, [e] five values missing, [f] six values missing.

were 1–2 times a week (range 0–7), for strength and aerobic exercises 1–2 times a week (range 0–7), and for relaxation exercises 0 times a week (range 0–7) in both groups. The median values for the index of exercise motivation was 220 (range 70–280) in the dynamic training group and 200 (range 125–300) in the relaxation training group.

Four patients from the dynamic training group and two from the relaxation training group failed to comply with the exercise instructions and withdrew from the study. Thus, the results are based on the remaining 23 patients of the dynamic training group and the 25 patients from the relaxation training group.

The three-month investigations were performed at median 13 weeks (IQ range 13–14) after the baseline investigations. The exercise diaries showed that the participants in the dynamic training group had exercised at median 59 times (IQ range 48–63) while the participants of the relaxation training group had exercised at median 62 times (IQ range 53–65) during this time. Median values and ranges for self-reported exercise in addition to the study protocol were unchanged at three months compared with the baseline reports, and thus, there were no differences between the two groups in this (data not shown).

The results of the three-month investigations (Table II) indicated that the dynamic training group had improved, in perceived exertion at the walking test ($p \leq 0.05$), while the relaxation training group had improved their total Nottingham Health Profile ($p \leq 0.01$), its subscale for lack of energy ($p \leq 0.05$), Ritchie's articular index ($p \leq 0.05$), muscle function of the lower extremities ($p \leq 0.01$), and arm endurance ($p \leq 0.01$). Regarding changes in muscle function of the lower extremities during the intervention period, there was a significant difference ($p \leq 0.05$) in favour of the relaxation training group between the groups (Table II).

During the intervention period, 20 patients (87%) of the dynamic training group remained on unchanged medication, while 3 (13%) reduced it by ceasing their intake of DMARD. Eighteen patients (72%) of the relaxation training group remained on unchanged medication, while 3 (12%) reduced it by ceasing their intake of NSAID, DMARD, or oral steroids respectively, and 4 (16%) increased it by starting with NSAID, DMARD (2 patients), or oral steroids respectively. Seven patients (30%) of the dynamic training group received at median 2 intra-articular steroid injections (range 1–4) during the intervention period, while 10 (40%) patients in the relaxation training group received at median 2 steroid injections (range 1–3). Five and three patients from the relaxation training group and the dynamic training group, respectively, received their injections during the last month of intervention.

Discussion

The results of the study indicated that progressive muscle relaxation training might improve health related quality of life, reduce joint tenderness and improve the muscle function of the upper extremities, while perceived exertion at walking test was improved by the dynamic training. The relaxation training

program was also found to be superior to dynamic muscle training in improving muscle function in the lower extremities in patients with inflammatory rheumatic diseases. The excellent compliance with the home exercise instructions in our study supports earlier research (6, 11, 28), and indicates that many people with arthritis may very well manage their own exercise after personal instructions and with well-organized supervision.

The results were not in line with our hypothesis, in which the relaxation training program was not expected to give any effects regarding muscle function or other physical performance tests. Relaxation and biofeedback training has previously been found to influence the perception of pain and disability in people with arthritis (13), but no improvement of observed muscle function due to muscle relaxation training in people with inflammatory rheumatic diseases has been reported. However, EMG studies have indicated that improved performance among athletes, as well as the absence of joint complaints among employees in repetitive work, may be attributable to the ability to relax antagonist muscles rather than to the strength of the agonists (L. Jansson, unpublished observations). These results may also be applicable to people with arthritis and myalgia, who possess high levels of muscle tension (29), and contribute to the explanation of our results.

The insignificant outcome of the dynamic training program, which did not confirm a previous evaluation of the same program (11), might be due to weaker statistical power in the present study. It might also be due to a higher percentage of patients with a more serious disease (74% versus 43% on DMARDs), and subsequent difficulties to carry out the dynamic training program adequately. Intake of DMARD might also negatively influence the capacity of patients with arthritis in some way that we do not know, and the initial differences between the two groups of the present study in this matter might have influenced the results. However, initial differences between the groups were not indicated by ESR, Ritchie's articular index, functional capacity, or work status. Further, the changes in medication and the differences between the two groups in the number of patients who received intra-articular steroid injections during the intervention period, might be responsible for some of the improvements in the relaxation training group.

Despite the limitations of our study discussed above, and despite the statistically rather than clinically significant effects of the relaxation training program, further research on its efficacy in people with arthritis seems indicated. Other effects such as muscle strength and body awareness could then be included in the evaluation protocol. If adequately carried out and found to influence the main complaints from people with arthritis, muscle relaxation training should deserve increased attention and become a valuable supplement to established physiotherapeutic treatment techniques. Another important area for further research is the evaluation of dynamic training against placebo. However, the outcome of our study demonstrates the difficulties regarding the design of such studies.

In conclusion, the results of our study indicated that progressive muscle relaxation training might improve health related quality of life, reduce joint tenderness and muscle function of the upper extremities in patients with inflammatory rheumatic diseases. It was also found to be superior to dynamic muscle training in improving muscle function in the lower extremities. The clinical effects were small and the results have to be interpreted with caution.

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