Exercise therapy in rheumatoid arthritis

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Rheumatoid arthritis (RA) is a chronic, inflammatory, systemic disease with joint inflammation as its most prominent clinical feature. Inflammation of the joints and tendons results in pain, swelling, and restricted movement, and eventually leads to deformities and irreversible radiological changes. The disease is characterized by a highly variable course, with periods of remission alternating with periods of flares. Pain, swollen joints, and fatigue accompany exacerbation. RA affects physical, social, and psychological functioning. The treatment of RA is aimed at reducing pain and disease activity, slowing down joint destruction, and, ultimately, preventing functional decline.

'cise therapy is considered to be an important cornerstone of the treatment of RA in all stages of the disease. Exercise therapy particularly aims at reducing the consequences of the disease at the level of physical impairments and disability. Specific goals of exercise therapy in RA are to increase and maintain joint motion, muscle function, cardiorespiratory function, and functional ability.[1-3] Secondary goals of exercise therapy are to improve well-being, to improve social interactions, and to prevent comorbidity related to physical inactivity, such as osteoporosis and heart disease.
The main physical impairments in RA are limited joint mobility, reduction of muscle function, and physical deconditioning.
Limitation of active and passive joint movements is one of the most important clinical features of RA but information about the extent of loss of joint mobility in early and later stages of the disease is sparse. About 50% of patients show limited mobility of the hand joints already at the first presentation; in later years loss of joint motion is present in about 25-35% of the ankle, knee, hip, elbow, and shoulder joints.[4]
While pain and stiffness of the joints are the main impairments of RA, they are closely followed by muscle weakness. In mildly disabled patients the strength of knee and hip muscle groups is ıced to 50-75%[5-8] and muscle endurance to 45%[7] when compared to those of age-matched healthy people. In patients with severe RA the muscle strength of the knee extensors is reported to be 30-45% of that of healthy volunteers.[9] The reduction in muscle strength is more pronounced in patients using corticosteroids.[10,11] In addition to muscle weakness, poor cardiorespiratory function can contribute to diminished physical function. The reduction in aerobic capacity (VO_{2max}), assessed by submaximal or maximal ergometer testing, varies between 20% and 30%.[7,8,12,13] These figures are derived, however, from patients able to perform an ergometer test. The cardiorespiratory function of severely disabled patients is not known.
Although the mean decline in functional ability over time is low,[14-16] there is a wide individual variation in functional outcome. Of the patients alive and available after 10-15 years of follow-up, only 15-20% are still fit for all daily activities, whereas about 10-15% are confined to bed.[17-20]
Traditionally, the most important objectives of exercise therapy in RA are to preserve joint mobility and to maintain muscle strength. Exercise forms which put little stress on the joints, such as range of motion exercises and non-weight-bearing isometric exercises, were advocated.[21-23] Dynamic exercises with an intensity adequate to improve muscle strength and aerobic capacity were thought to increase pain and disease activity and to provoke joint damage. However, the fear that vigorous exercise might amplify joint inflammation and accelerate cartilage degeneration is not based on clinical evidence.
To investigate the benefits and disadvantages of intensive, dynamic exercises, two randomized clinical trials were carried out: one with patients with well-controlled disease and one with patients with active disease.

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Effect of an intensive exercise program in patients with well-controlled disease

Methods

A randomized study was undertaken to examine the effect of an intensive exercise program (high-intensity exercise) in patients with well-controlled disease.[24] One hundred consecutive patients were recruited from the outpatient rheumatology clinic of the University Hospital of Leiden and fulfilled the following inclusion criteria: rheumatoid arthritis according to the 1987 criteria of the American College of Rheumatology;[25] age between 20 and 70 years; on stable medication for the last 3 months; and able to cycle on a home trainer. Exclusion criteria were high disease activity, such that changing or starting a slow-acting antirheumatic drug was considered necessary by the rheumatologist; inability to tolerate physical fitness training due to the presence of serious cardiac or lung disease; and presence of one or more arthroplasties of weight-bearing joints.
Since conditioning (high-intensity) exercises require special facilities, this form of exercise is mostly provided as a group activity. Group exercises give the opportunity for socialization and are likely to have a positive impact on well-being and functional capacity. However, it is more usual for clinicians to prescribe exercise on an individual basis, supervised by the patient's own physical therapist. In order to exclude the influence of the 'group' factor, low-intensity exercises were incorporated in the study design in two forms, namely, as individual exercises and as group exercises. A group of patients with written instructions for home exercises served as a control group. The patients were randomly assigned to four different exercise programs, each lasting for 12 weeks.

High-intensity group exercise program

Twenty-five patients were randomized to take part in four exercise classes. All classes lasted 1 hour and were held three times a week. The training included warming-up exercises, an interval program of 12 exercises according to a standardized protocol, bicycle exercise for 20 minutes, and cooling-down exercises. The interval exercise program consisted of dynamic weight-bearing exercises such as knee bending, step ups, and walking at fast speed, alternating with muscle strengthening exercises for the trunk and the upper extremities. Exercises were performed at a high tempo. Every 4 weeks the exercise load of the interval exercise program was increased. During cycling, heart rate was maintained at 70-85% of the age-predicted maximal heart rate. Patients were taught how to deal with pain. If patients experienced extra pain that lasted more than 2 hours within 24 hours of an exercise session, the exercise load was temporarily decreased.

Low-intensity group exercise program

Twenty-five patients were randomized to take part in four classes. These classes lasted 1 hour and were held twice a week. The exercise program consisted of range of motion exercises and non-weight-bearing isometric, muscle-strengthening exercises for the trunk and upper and lower extremities at a low tempo. No resistance was applied. Exercises were performed in prone, sitting, and standing positions.

Low-intensity individual exercise program

Twenty-five patients had individual exercise therapy, twice a week. The program consisted of the same exercises as described for the low-intensity group exercise program. The patients were free to choose their own physical therapist, who was then instructed by the investigator.

Home exercise program

Twenty-five patients were given written instructions for range of motion and isometric exercises and were advised to exercise at least twice a week for 15 minutes. No further attempt was made during the intervention period to motivate these patients to exercise.

Assessments

Variables of physical condition, namely, muscle strength, joint mobility, daily functioning (Health Assessment Questionnaire, HAQ), and disease activity, were assessed before and after the 12-week exercise course and 12 weeks thereafter. A single observer who was not blinded assessed the patients in all treatment groups. All test procedures were standardized, and test indices included both subjective and objective measurement instruments.

Results

Ten patients did not complete the exercise course – three in the high-intensity exercise program, five in the low-intensity exercise program, and two in the low-intensity individual exercise program. Five patients – three patients in the high-intensity exercise program and two patients in the low-intensity exercise program – dropped out because of an increase in complaints.

After completion of the exercise course, aerobic capacity, muscle strength, and joint mobility in the high-intensity exercise group had increased by 17%, 17%, and 16%, respectively, and were significantly different from those of the other exercise groups. There were no significant changes in daily functioning, as measured with the HAQ, after the exercise period in any of the exercise groups. No deterioration of disease activity was observed. At the 12-week follow-up, the significant improvement in aerobic capacity and joint mobility achieved in the patients in the high-intensity exercise group had disappeared. The patients in the high-intensity exercise and the low-intensity exercise groups still showed a significant improvement in muscle strength compared to the baseline values. The significant improvement in 50-foot walking time in the high-intensity exercise group was sustained. At follow-up, there were no significant differences between the groups in any of the measures of functional ability or disease activity.

Effect of intensive exercise during active disease

Rest and immobilization are cornerstones of the treatment of active RA. Because of a fear of enhancing joint inflammation, it has been generally accepted that exercise therapy in active RA should be restricted to gentle, active-assisted range of motion exercises and isometric exercises. A conservative exercise regimen may not be adequate to counterbalance the risk of functional decline during periods of active disease. For this reason, the safety and benefit of an intensive exercise program was investigated in patients with active RA.[26]

Methods

Sixty-four patients hospitalized because of active disease with a mean (± SD) age of 60 ± 13 years and a mean disease duration of 8 ± 8 years participated in the study. All patients fulfilled the following inclusion criteria: RA according to the 1987 American Rheumatism Association criteria;[25] active disease; age between 20 and 80 years; and ability to walk 50 feet indoors. Exclusion criteria were the presence of arthroplasties of the knee joints and inability to tolerate training because of serious cardiac or lung disease. Within 3 days of admission the patients were randomly allocated to an intensive, dynamic exercise regimen or to a conservative exercise regimen during hospitalization. All patients participating in the study followed the usual conservative exercise program of range of motion exercises and isometric exercises.

Conservative exercise program

All joints of the upper and lower extremities were exercised throughout the entire possible range of motion and repeated two times. The movements were performed with active assistance at a low tempo. In addition, isometric exercises of the larger joints were performed without resistance. Exercises were carried out in prone and sitting positions. The exercises were individually supervised by exercise therapists four times a week. Once a week all patients participated in a group session of active range of motion exercises in a sitting position. In addition to the supervised exercise sessions, patients were encouraged to exercise on their own.

Intensive exercise program

Patients allocated to the intensive exercise regimen were individually given extra exercises plus those of the conservative exercise program. Exercise therapists not involved in the conservative exercise program supervised the intensive exercise program. The isometric and isokinetic strength of the knee extensors and flexors was reciprocally trained on an isokinetic dynamometer. The isometric training consisted of three series of five contractions at 70% maximal voluntary contraction during 6 seconds with the knee joint in 45° flexion. There was an interval of at least 30 seconds between each series. The isokinetic strength of both knees was trained in three series of eight reciprocal contractions at 70% maximal voluntary contraction at an angular velocity of 60°/s. To control the exercise load, maximal voluntary contraction was determined every week by the exercise therapist. Because of the stabilizing function of the shoulder girdle, the muscles of the shoulder were isometrically trained against resistance. Patients exercised in a prone position with 90° anteflexion of the shoulder. Resistance was manually applied in alternate directions of anteflexion and retroflexion, adduction and abduction, and endorotation and exorotation. Each movement direction was trained by performing six contractions for 6 seconds with a manual resistance such that the patients were just able to hold the starting position. After each contraction patients relaxed for 6 seconds. In addition to the muscle-strengthening exercises, patients bicycled three times a week for 15 minutes on a home trainer. During cycling, the heart rate was maintained at 60% of the age-predicted maximum.

A strict policy was followed with respect to pain during and after exercise. If patients experienced pain while exercising on the dynamometer, the angle velocity, exercised range of motion, or the number of repetitions was adjusted individually so that the patient was able to exercise without pain. If necessary, the amount of manually applied resistance and the number of repetitions of the stabilizing exercises of the shoulder joints were adjusted individually. If patients experienced pain while cycling, the exercise load or the exercise time was adjusted. If patients experienced extra pain in one or more joints that lasted for more than 2 hours within 24 hours of exercising, the exercise load of the joints concerned was temporarily decreased.

A single observer who was blinded to the allocation of the exercise programs assessed disease activity, pain, muscle strength, and functional ability. Patients were evaluated at the start of hospitalization, and at 3, 6, 12 weeks, and 24 weeks after admission.

Results

Four patients in the intensive exercise group left the program prematurely – two patients experienced too much psychological strain due to the extra exercise sessions and two patients dropped out in the course of their hospitalization because of an increase in pain.

During the observation period of 24 weeks there was an improvement in pain, disease activity, joint mobility, muscle strength, and functional ability in patients in both groups, but patients in the intensive exercise program group showed a greater improvement of disease activity and muscle strength than the patients in the conservative exercise program group. It was concluded that a short intensive exercise program is effective in improving the muscle strength of patients with active RA and does not have deleterious effects on disease activity.

Discussion

Both studies showed that, if closely supervised, intensive, dynamic exercise is well tolerated by patients on stable medication and by patients with active disease. In neither study were detrimental effects on disease activity observed. Moreover, a short intensive exercise program was effective in reducing the consequences of the disease on physical capacity (cardiorespiratory function, muscle strength, and joint mobility). However, in our opinion rest and exercise are complementary elements of the management of RA, especially during active disease, and an optimal balance should be found between the beneficial effects of rest and exercise for each patient. Therefore, only those forms of exercise that are known to be most effective in maintaining and improving function should be used. Furthermore, instruments need to be found to monitor pain during exercise therapy to make it possible to tailor exercise programs to the individual. A visual analog scale for pain might be an appropriate instrument to harmonize the exercise load with the patient's need for rest.

It has been suggested that active involvement in an exercise program contributes more to improvement in physical capacity than the type of exercise performed.[27] However, the results of the first study indicate that the 'group factor' does not have a significant effect on physical capacity and functional ability. The high-intensity group exercise program was more effective than the low-intensity group exercise program and no differences in effect were found between the low-intensity group program and the low-intensity individual exercise program. These results indicate that high-intensity exercises improve physical capacity. The patients who took part in the first study did not succeed in maintaining fitness after they completed the course of exercises. Regular exercise at an appropriate level requires discipline and determination. Many RA patients are restricted in their daily functioning by pain and tiredness. Supervision of efficient and attractive exercise therapy might help to embed exercise in the daily life of patients and enable them to keep up exercising in the long term.

The ultimate goal of the management of RA is to maintain and to improve functional ability. In both trials, dynamic, intensive exercise therapy failed to establish a significant improvement in functional ability, as assessed with the HAQ, when compared to the conservative exercise program. An explanation for this finding is that the benefit of exercise is only seen in the long term. Maintaining functional independence and forestalling a decline in function are important goals of exercise therapy, and the exercise programs in the two trials were tested for too short a time to meet these goals. Another explanation is that the HAQ is not an appropriate outcome measure to determine some important aspects of functional ability. The HAQ is mainly directed at activities of daily living involving personal care and does not incorporate aspects of functional ability, such as work capacity, endurance, and general health.[28] These aspects of functional ability are likely to be influenced by a regular exercise routine. Furthermore, exercise therapy is especially aimed at improving functional performance, whereas the HAQ measures functional ability as perceived by the patient.[29] Therefore, the HAQ might not be an appropriate instrument to detect changes in physical performance due to exercise therapy. Other outcome measures, for example, those based on activity patterns or on actual performance, may provide a more accurate estimate of the effects of exercise therapy on functional ability.

There is a lack of knowledge about the progression of physical impairments and disability in patients with RA. The International Classification of Impairments, Disabilities, and Handicaps model suggests that there is a linear and causal relation going from disease to impairments to disability, and consequently that there is a gradual loss of ability as a result of the progression of impairments. However, the pattern of progression of impairments and disability might be more complex than assumed in this model. An alternative characterization of the relation between physical impairments and functional ability is the 'threshold' concept.[30-32] According to this concept, only restrictions below a certain critical level of joint mobility and muscle strength result in a loss of functional ability. As a result, improvement in impairments will not necessarily lead to improvement in functional ability. Insight into the relation between impairments and disability is the basis for setting meaningful goals of exercise therapy for RA. Furthermore, a better understanding of the disablement process will optimize the timing and efficacy of exercise therapy in preventing functional disability.

Although limited joint mobility is one of the most prominent clinical features of RA, little is known about the efficacy of specific forms of exercise in improving joint mobility. For this purpose passive or active assisted range of motion exercises are recommended in all textbooks as the exercise treatment of choice. The first study showed that an intensive, dynamic exercise program which included functional exercises, such as cycling, walking and step ups, was more effective in improving joint mobility than a traditional program of range of motion exercises and isometric exercises. The effect of advanced exercise techniques on joint mobility (traction and translation) is not known in RA. Comparison of the efficacy of available types of exercises to improve joint mobility is an important area of future research.

These two randomized trials did not address the question about the long-term effects of intensive, dynamic exercises. Expected benefits of a continued intensive exercise regimen are preservation of functional ability, increased feelings of well-being, a reduced risk of cardiovascular disease, and the positive influence of weight-bearing exercises on bone mass. Progressive radiological damage is a feared long-term consequence of continued vigorous exercising.[33] Furthermore, apart from financial costs, a regular exercise routine requires substantial investments in time and energy on the part of the patient. The question about the net balance between the long-term benefits and the disadvantages of continued exercising needs to be answered in the future. Knowledge of the efficacy of exercise in reducing the consequences of RA in all stages of the disease will form the basis for the implementation of evidence-based exercise therapy in the total management of RA.

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