9 Non-pharmacological therapies in osteoarthritis

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Non-pharmacological therapies are very important in osteoarthritis. Each form of this treatment should be individually devised, taking into account the anatomical distribution, the phase and the progression rate of the disease. Indications, contraindications, dosage and precautions are as important in non-pharmacological therapy as they are in drug treatment.

Therapeutic exercises decrease pain, increase muscle strength and range of joint motion as well as improve endurance and aerobic capacity. Exercise programmes should be designed, conducted and regularly supervised by professionally trained physiotherapists. Weight reduction is of proven benefit in obese patients with osteoarthritis of the knee. Walking aids, crutches, shoe insoles, braces and patellar taping are useful tools in some form of osteoarthritis. Patient education and the management of the psychosocial consequences are priority tasks. Therapeutic heat and cold, electrotherapy, ultrasound, acupuncture, hydrotherapy and spa treatment are widely used, although the effects and benefits have not been fully established.

Non-pharmacological therapies should undergo rigorous randomized controlled trials in a similar manner to pharmacological studies.

Key words: osteoarthritis; physiotherapy; occupational therapy; psychosocial support; exercise therapy.

The prescription of various methods of physiotherapy in osteoarthritis (OA), and their use either alone or in combination, should follow the general guidelines of medical therapy. Indications, contraindications, dosage regimens and measurable therapeutic effects as well as unwanted side effects (Bellamy, 1997).

There are few well designed, randomized controlled trials on the use of physiotherapy in musculoskeletal diseases (Beckermann et al, 1993; Puett and Griffin, 1994; Gam and Johannsen, 1995). It is clear therefore, that, as

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in drug trials, more multicentre trials are required. As a result, a detailed set of therapeutic guidelines should be established (Newham, 1997).

Therapeutic exercise in OA

Background and theoretical considerations

Both inactivity and overuse have disadvantageous effects on cartilage (Marks 1993b; Kiviranta et al, 1994). Normal loading of injured or inefficient cartilage, as well as abnormal loading of normal cartilage, may cause OA and the already damaged osteoarthritic cartilage is more prone to overuse (Buckwalter, 1995).

Motion, however, is essential even for osteoarthritic joints, because nutrition of the joint and removal of waste products is assisted and helped by motion (James et al, 1994). Loss of contraction of the periarticular muscles leads to atrophy of the cartilage (Palmoski et al, 1980).

Whenever an exercise programme for a patient with OA is prescribed, a balance should be kept between rest and activity, joint protection and joint load, weightbearing and non-weightbearing as well as between non-aerobic and aerobic exercises.

Rest is advised for osteoarthritic patients in the inflammatory or active stage of OA. However, in these situations the patients will usually rest instinctively. Hampson and colleagues found that 122 elderly patients with OA self-management, had more rest on a 'worse day' (Hampson et al, 1993).

OA causes periarticular muscle weakness. This is not only due to inactivity, but also a consequence of the inability to fully activate muscles during maximal voluntary contraction. This phenomenon has been called arthrogenous muscle inhibition (AMI) (Stokes and Young, 1984). In their classical self-experiment, Jayson and Dixon clearly demonstrated that 50 ml saline given intra-articularly, by increasing intra-articular pressure, immediately decreased the muscle strength in healthy volunteers (Jayson and Dixon, 1970). It is interesting that AMI may be present in pain-free joints without clinical effusion with early destructive changes (Hurley and Newham, 1993). In her excellent review, Marks listed all the animal experiments and human observations implicating muscle functions (increased and decreased muscle tone and muscle imbalance), that possibly cause or help in deterioration in the osteoarthritic process by diminishing the shock-absorbing function of the muscles and causing an asymmetrical pattern of joint wear (Marks, 1993b). Although neither human observations nor animal experiments provide conclusive evidence that muscle changes influence the osteoarthritic process, this strong possibility should always be considered when physiotherapy is prescribed for an individual patient.

Therapeutic exercises maintain or increase the range of movement (ROM) of joints, enhance joint stability and promote strength and endurance of muscles, all of which have been found to be deficient in patients with OA of the hip and knee (Beals et al, 1985; Lankhorst et al, 1985; Minor et al, 1989). It also has been found that aerobic capacity in osteoarthritic patients is considerably diminished (Beals et al, 1985; Lankhorst et al, 1985; Minor et al, 1988; Fischer and Pendergast, 1994).

A schematic diagram of the possible interactions between OA and treatment is shown in **Figure 1**.

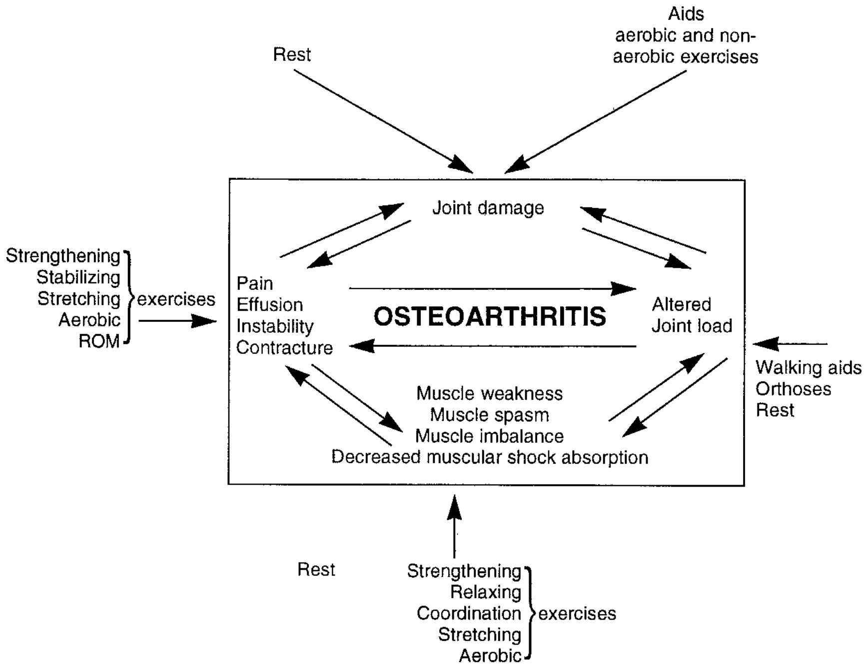

Figure 1. Possible interrelationships in osteoarthritis, showing also the action of different therapeutic interventions (rest, exercise) and aids.

Different forms of therapeutic exercise

Although the use of exercise for relief of musculoskeletal symptoms was described three thousand years ago, there is still an ongoing debate about the effectiveness of exercise therapy for patients with OA (Bunning and Materson, 1991).

Certainly, patients use physiotherapy for their self-management. In a community survey of 61 osteoarthritic patients aged 60 years or older, the investigators found that, on a typical day, out of 10 different types of physical activity, participants used about four to five methods (Hampson et al, 1993).

A clear documentation of the intended outcomes of interventions and clinical goals of using particular treatment procedures is required (Guccione, 1996). As previously mentioned, the prescription of therapeutic exercises, as in the case of pharmaceutical therapy, has goals, types, dosimetry and precautions. In practice, we are far from clear formulation and follow-up of therapeutic exercises (Bunning and Materson, 1991; Newham, 1997). In a recent review, 110 elderly osteoarthritis patients were interviewed. Fewer than half of them (46 patients (41.8%)) received medical advice about exercise, and only 8 patients (7.3%) had received thorough exercise-related teaching and monitoring. Arthritis specialists provide significantly more support for exercising than primary care physicians, but only 10% of patients received proper or detailed instructions (Dexter, 1992).

Before going through the main goals of exercise treatment of OA, an overview of the different methods of exercise therapy is provided.

Isometric exercise

Isometric contraction is that type of muscle contraction when muscle fibres do not change their length, and joint movement does not occur. Muscles are contracted against resistance set to avoid joint motion. The most important and relevant parameters of the effects of therapeutic isometric exercises include the length of contraction, the length of time between contractions, the number of repetitions, the percentage of maximum force used and the position of the joint during exercise. In OA of the knee, the average recommended therapeutic regimen is 6 seconds of maximal force contraction repeated 5–10 times and performed two to three times on average. This usually has a favourable therapeutic effect. Increase of strength due to isometric exercises can be achieved and measured both in normal volunteers and in arthritic patients (Bunning and Materson, 1991; Fischer et al, 1991). Isometric exercises in OA of the knee joint are easy to teach and can be performed without any equipment. They are usually very well tolerated and do not cause any flare up of the osteoarthritic process. An additional advantage of the isometric exercises is that they increase the intra-articular pressure by the slightest degree (Jayson and Dixon, 1970).

Dynamic exercise

In the case of dynamic exercises, a change in muscle length occurs. Theoretically, dynamic exercises can either be concentric, causing shortening of the muscle fibres, or eccentric, causing muscle lengthening, that is, the proximal and distal tendineal insertions move away from each other. Dynamic exercises can be divided into two main groups. In isotonic exercise, the limb moves against a constant resisting force throughout the full range of movement. While in isokinetic exercise, a device limits the speed of limb motion to a pre-set maximum through the range of motion (Bunning and Materson, 1991). Various types of devices have been designed and constructed for isometric exercises using different resistance at different angles of joint movement, to exercise at the different length of fibres and to allow isometric, isotonic and isokinetic exercises with variable parameters.

Stretching exercise

Stretching exercises apply force to the musculo-tendineous units around a joint either actively by the patient or passively by the therapist. These exercises are aimed at lengthening the non-contractible elements of the muscle after end length is achieved. Controlled strain on the involved tissues, preserves or increases range of movement by increasing non-contractible tissues and avoiding tears. Stretching exercises are especially important to maintain or improve range of movement (Leivseth et al, 1988).

Stretching should be carefully controlled, especially when inflammation is present, because overstretch, overstrain and tear may occur (Bunning and Materson, 1991). Stretching might improve even very old and rigid contractures and also strengthen the muscles.

In OA of the hip joint, stretching of adductor and flexor muscles (including the iliopsoas) is of most importance, because these muscles are usually weak and shortened, causing limitation in the range of extension and abduction (Leivseth et al, 1988).

Joint loading exercise

Joint loading exercises are necessary to preserve the anatomy and function of cartilage (Palmoski et al, 1980). In a recently published study, however, synovial fluid, keratan sulphate and hydroxyproline levels did not change, although the patients on exercise therapy showed a significant improvement in symptoms (Bautch et al, 1997).

Decrease of joint loading is very important when treating a diseased joint with cartilage injury, especially when the capsule is weakened or muscle weakness is severe enough to allow weightbearing joint distortion (Bunning and Materson, 1991). Again, a balance is necessary between full loading and part loading exercises. Diminished loading can be achieved either by underwater loading in hydrotherapeutic exercises (Ahern et al, 1995) or by using mechanical unweighting systems (Mangione et al, 1996).

Aerobic exercise

Aerobic exercises increase cardiovascular endurance or stamina. Endurance is the capacity to do work, in terms of oxygen consumption or metabolic work done, for example, when 3.5 ml of oxygen is consumed per kilogram of body weight per minute (Hicks and Gerber, 1992). An approximate measure of stamina is achieved through measurement of heart rate with aerobic exercises, usually performed at an intensity of 60–80% of maximal oxygen consumption (VO_2 max). Patients with OA have decreased endurance (Beals et al, 1985; Minor et al, 1988; Fischer and Pendergast, 1994), therefore low-rate aerobic exercises (60–70% of VO_2 max) should be prescribed in the form of walking, cycling, swimming, low impact aerobics, golfing and tennis (Minor et al, 1989; Hicks and Gerber, 1992).

Underwater exercise

Underwater exercises may provide diminished loading for an affected joint. The relative weightlessness achieved by partly eliminated gravity and the buoyancy of water is useful when minimal stress on a joint is desired during ROM exercises. Underwater exercises can be used for resisting or assisting ROM (Hicks and Gerber, 1992) and are especially favourable in patients with muscle weakness.

Underwater exercises are widely used, but few studies are available about their effects. In a recent study, no advantages of underwater treatment were found in treating OA of the hip joint compared with home exercises (Green et al, 1993). Underwater exercises can also be used for aerobic exercises (Minor et al, 1989).

Main goals of exercise therapy in OA

The main goals and outcome of exercise therapy in osteoarthritic patients (Guccione, 1996) are listed in **Table 1**.

Table 1. The goals of therapeutic exercise in osteoarthritis.*

- To increase or maintain the range of movements of all joints sufficient for all functional activities
- To increase or maintain muscle strength sufficient for the patient's level of function
- To increase joint stability and decrease biomechanical stress on all affected joints
- To increase endurance of all functional activities
- To improve efficiency and safety of gait pattern
- To decrease pain

* Adapted from Guccione (1996).

Increase or maintain the range of movements of the affected joints

Maintenance of the full ROM in OA is of outstanding importance. Contracture of soft tissues and tendons surrounding a joint, persistence of abnormal posture and imbalance between agonist and antagonist muscles may lead to a limited ROM (Bunning and Materson, 1991).

OA, even involving a single joint, might also cause a decreased ROM in neighbouring and contralateral joints. Therefore active ROM exercises should be performed at least a few times daily, not only for all affected joints, but for all neighbouring and non-affected contralateral joints (Messier et al, 1992; Jeusevar et al, 1993).

Patients with hip or knee OA prefer a flexed position because intra-articular pressure is minimal and pain is diminished in that position. However, a flexed position may lead to flexion contracture, with all of its harmful biomechanical and functional, as well as unfavourable, psychosocial consequences. Patients with knee OA therefore should be advised not to sleep with a pillow under their knees, and patients with hip OA should be encouraged to lie prone for 20–30 minutes as many times daily as they can, in order to prevent or improve flexion contracture of the hip.

Increase or maintain muscle strength

Sufficient muscle strength is important for a patient's normal joint function. Patients with OA of the knee have both decreased static and dynamic muscle strength (Beals et al, 1985; Fischer et al, 1991; Marks, 1993b; Hurley, 1997). Muscles are also shock-absorbers, and help to stabilize the joint; strengthening exercises of periarticular muscles are therefore recommended (Hicks and Gerber, 1992; Marks 1993b; Hurley 1997).

The functional threshold for lower extremity strength has yet to be determined (Minor, 1994). Isokinetic knee strength as a percentage of body weight is advised to be measured between 60° and 180° of ROM, and should be 20–30% of body weight for knee extension and 20–25% for knee flexion (Messier et al, 1992; Jeusevar et al, 1993).

For muscle strengthening, isometric (Chamberlain et al, 1982; Fischer et al, 1993), isotonic (Chamberlain et al, 1982; Callaghan et al, 1995) and isokinetic (Kreindler et al, 1989; Fischer et al, 1993) exercises are equally used.

Isokinetic exercises should not be used for patients with ligamentous laxity (Hicks and Gerber, 1992). Because people use both isometric and isotonic muscle contractions in their daily activities, it is best if osteoarthritic patients use both methods, beginning with isometric strengthening (Hicks and Gerber, 1992). Indications of excess exercise are post-exercise pain lasting longer than two hours, undue fatigue, increased weakness, decreased ROM and joint swelling (Hicks and Gerber, 1992).

Each patient's programme should be individually designed to achieve the desired results and avoid significant pain (Bunning and Materson, 1991).

The effect of muscle strengthening was studied in a relatively high number of controlled trials (Chamberlain et al, 1982; Kreindler et al, 1989; Fischer et al, 1993; Hurley and Newham, 1993; Fischer and Pendergast, 1994; Callaghan et al, 1995; Bautch et al, 1997), but some of them do not fulfil the requirements of well designed, randomized, controlled trials (Marks, 1993a). It is possible that muscle strengthening exercises really strengthen muscles and improve function in patients with OA. Only one study was identified where the authors could not detect differences between the exercise-treated group and the control group (Callaghan et al, 1995).

Increase joint stability and decrease biomechanical stress

OA often causes instability of the knee, the first carpometacarpal (CMC) and distal interphalangeal (DIP) joints. There are no conservative measures to stabilize DIP joints, but the knee and first CMC joint are stabilized by muscles. Therefore, strengthening of those muscles may help to stabilize the joint.

The main stabilizer of the knee is the quadriceps muscle, especially the vastus medialis. Isometric exercises of different muscle length and different angles of the knee are most effective for maintaining knee joint function (Fischer et al, 1991).

In order to decrease biomechanical stress as far as possible, the principles and practice of joint protection should be kept in mind (Table 2).

Table 2. Recommendations for joint protection and exercise.*

- Avoid carrying loads over 10% of body weight
- Carry load on the same side as the affected hip and divide load between hands
- Avoid stairs
- Alternate weightbearing and non-weightbearing activities throughout the day
- Select walking speeds that do not exacerbate joint symptoms
- Choose exercises to improve or maintain flexibility, strength, endurance and neuromuscular conditioning or necessary to reduce impairment and prepare for more vigorous activity
- Recommend non-weightbearing (bicycle, rowing machine) or partial weightbearing (aquatic) exercises for initial aerobic exercise made when pain and joint vulnerability limit weightbearing activity
- Proceed with weightbearing activity as safety and tolerance permit
- Progress gradually with the duration of aerobic activity and increase it in short periods throughout the day if necessary

* Adapted from Minor (1994).

Increase of endurance of all functional activities

Local muscular endurance is the ability to perform repetitive muscle contractions (Hicks and Gerber, 1992).

Both isometric and isokinetic muscle exercises can improve muscle endurance. OA decreases the endurance of the periarticular muscles, such as the quadriceps and hamstring muscles in OA of the knee, and this can be improved significantly by proper exercise (Chamberlain et al, 1982; Fischer et al, 1993; Fischer and Pendergast, 1994). Some types of home exercise programmes have failed to show improvement of muscle endurance (Fischer et al, 1994). The endurance, or aerobic capacity, is significantly diminished in patients with OA. Its significance for general clinical practice is that osteoarthritic patients are less active and less fit both in their musculoskeletal and cardiovascular status compared with age-matched controls (Beals et al, 1985; Lankhorst et al, 1985; Minor et al, 1988; Fischer et al, 1991).

Patients with OA of the hip and knee joint can safely take part in conditioning exercise programmes improving their physical fitness without exacerbation of disease symptoms.

Minor et al compared the use of aerobic walking and aquatic exercises with non-aerobic ROM exercises in a study involving 80 patients with OA of the weightbearing joints. The two aerobic groups showed a significant increase in aerobic capacity and heart rate recovery, without an exacerbation of the joint symptoms. To a lesser extent the ROM group also showed an increase in aerobic capacity and exercise endurance (Minor et al, 1989).

Kovar et al found in a controlled trial with 102 patients with primary OA of the knee, that the patient group undertaking an 8-week programme of supervised fitness walking improved significantly in the distance they could walk, AIMS, physical activity subsets and pain, compared with the control group which had standard routine medical care (Kovar et al, 1992).

Most recently, Ettinger and colleagues compared the effect of aerobic exercise and resistance exercise with a health endurance programme in elderly patients with OA of the knee. The patients, participating either in the aerobic or in the resistance exercise group, showed improvement in self-reported disability scores, muscle perfomance and in the level of pain compared with the health education group (Ettinger et al, 1997).

Fischer and Pendergast also demonstrated that osteoarthritic patients who performed a 3-month muscle exercise programme, showed an increased aerobic power, measured by treadmill test (Fischer and Pendergast, 1994).

Improving the efficiency and safety of gait pattern

Abnormal gait is a common consequence of OA of the lower limb, especially of the hip and knee.

Abnormal gait is due to pain (antalgic gait), joint instability, muscle weakness, joint defensity and contracture. In a recent study, gait strength and flexibility of patients with OA of the knee was compared with age, gender and weight-matched controls. The legs of the osteoarthritic patients were significantly weaker in both dominant and non-dominant legs and had significantly less knee angular velocity and knee ROM during walking. The osteoarthritic patients had an increased loading rate in the unaffected leg after heel strike, and exerted less peak vertical force during push off (Messier et al, 1992).

In another recent study, gait characteristics of patients with OA of the knee were investigated before and after an 8-week educational walking programme. The control group were surveyed weekly by telephone. The gait educated group showed a significant improvement in walking distance, and increase in stride length both at free and fast walking speeds, measured by a stride analyser (Peterson et al, 1993).

Muscle exercise programmes (Fischer et al, 1993; Marks, 1993b; Fischer et al, 1994; Fischer and Pendergast, 1994) and aerobic programmes (Minor et al, 1989) also decreased 50 feet walking time and increased walking speed.

Decrease of pain

Pain is the leading symptom of OA, therefore reduction of pain or a raising of the patient's pain threshold is one of the main purposes of therapy. However, a decrease of pain is not usually achieved by exercises prescribed for patients with OA. On the contrary, even isometric exercises might increase intra-articular pressure causing pain, and stretching may elicit pain of the tendons, joint capsules and entheses. Dynamic ROM exercises, especially resisted movements, can also be painful, not to mention weightbearing exercises or aerobic walking. Indeed, even non-weightbearing and isometric exercises might provoke pain, as pain is a feared effect of exercise. When post-exercise pain lasts longer than 1–2 hours, changing or redesigning of the exercise programmes might be necessary (Hicks and Gerber, 1992).

In contrast, in a recent study the mechanical 'unweighting' of elderly patients with knee OA did not decrease knee pain during walking (Mangione et al, 1996).

The mechanism for reducing pain through exercise may be diverse: reduction of the shock-absorbing function of muscles and reduction of swelling by facilitating venous and lymphatic return (although there are no data about it). A decrease of pain may be due to suppression of the β-endorphin system in response to a high intensity strengthening stimulus (Radosevich et al, 1989).

Concluding remarks about exercise therapy

The prescription of good and complex exercise programmes for patients with OA is a professional task. Assessment of ROM parameters, muscle strength, endurance, pain and aerobic capacity function are very important before designing and instituting proper exercise programmes. It is also important that the programme should not cause long-lasting pain or deterioration of functions.

Home exercise programmes seem to be more feasible than supervised ones (Chamberlain et al, 1982; Green et al, 1993), but some studies clearly showed that they are not as effective as the programmes performed under the supervision of physiotherapists (Chamberlain et al, 1982; Kreindler et al, 1989; Hurley and Newham, 1993; Fischer et al, 1994).

The best routine might be as follows: one session as an introduction, teaching and learning exercises, then continuation at home, following written and drawn instructions. Audio- and videotapes are also recommended for this purpose. From time to time the patients need supervising, and their exercise programme assessed and tailored for their requirements. Rational goals of treatment should certainly be set. Convincing the patient of the importance of exercise may improve outcome and increase compliance.

Exercise treatment activates the patient, mobilizes his or her energies for dealing with the progressive disease process, and diminishes anxiety and depression while increasing self-confidence at the same time (Minor et al, 1989).

Currently, treating OA by exercise is an art, based on the skills and inventions of the physiotherapist and patient. In other words, claims for its effectiveness are mostly based on clinical experience, rather than being scientifically proved. Although art will always have its place in the treatment of individual patients, we should ensure that the basic principles of exercise treatment are shifted more towards science and evidence-based practice (Newham, 1997).

Practice points

Exercise treatment should include:

- exercise programmes, designed and conducted by professionally trained physiotherapists
- general information and teaching of the exercises, provided at outpatient clinics with patient groups of 5–10 people
- home exercise programmes, regularly supervised by the same physiotherapist
- psychological support for each individual patient in order to enhance compliance and the effectivity of exercise therapy

Research agenda

- randomized controlled, multicentre trials with standardized exercise programmes
- studies of the efficacy of muscle strengthening in joint instability caused by OA of the knee and the thumb-base joint
- studies of the efficacy of gait education in patients with OA of the hip and knee
- cost/efficacy and cost/utility analyses of exercise treatment in OA

Other forms of physiotherapy

Therapeutic heat

Local heat and cold therapy have a measurable effect on both the surface and intra-articular temperature of joints (Oosterveld et al, 1992). Superficial heating can be achieved using conductive methods, for example, heating pads, paraffin baths, and mud packs, or with radiant energy, for example, infrared light therapy or by convected heat, for example, sauna or steam room (Hicks and Gerber, 1992). Deep heating can be achieved by short-wave diathermy and by high frequency (non-conventional) ultrasound therapy (Robertson and Ward, 1997).

In painful OA of the hands and knees, hot paraffin wax at a temperature between 47°C and 52°C is recommended (Hicks and Gerber, 1992). Cryotherapy (cold air or ice chips) is only used in the inflammatory phase of the condition, such as acute, severe synovitis of the knee (Brandt, 1995).

Hydrotherapy

Hydrotherapy is defined as a 'pool therapy programme specifically designed for an individual to improve neuromuscular skeletal-function conducted and supervised by appropriately qualified personnel, ideally in a purpose-built hydrotherapy pool' (Goldby and Scott, 1993). The cardiovascular, haematological, renal and hormonal effect of immersion into thermoneutral water was summarized in an excellent report (Hall et al, 1990).

Forty-nine patients with OA of the peripheral joint were treated with hydrotherapy in a recent trial. The results showed that the treatment improved not only on the pain level but also on their self-efficacy (Ahern et al, 1995). In a randomized, tap-water controlled, double-blind trial, thermal water was tested in 62 patients with OA of the knee, treated in a non-spa environment. By the end of the 3-week treatment period, pain decreased significantly more in the thermal water group compared with the control group (Szücs et al, 1989).

Spa treatment

Spa therapy is a combination of different pharmacological, physiotherapeutic and psychological modalities (Fam, 1991; Ernst, 1995; Schmidt, 1995). For centuries, spa resorts were the main centres for rheumatological practice, education and research in Europe (Bálint and Szebenyi, 1995). Evaluation of the different effects of spa therapy is not always possible, which needs to be taken into consideration when performing clinical trials at spa resorts (Bell, 1991; Fam, 1991; Bálint et al, 1993).

Two weeks of spa therapy in 12 patients with symptomatic OA of the knee resulted in a measurable effect in pain and tenderness in the joint, 6 months following completion of the treatment, which underlines the long lasting effects of this combined therapy (Elkayam et al, 1991). The same prolonged beneficial effects on joint pain and mobility were observed in a recent randomized, controlled trial of 188 patients with OA of the hip and knee (Nguyen et al, 1997).

Electrotherapy

There are few controlled trials in the literature about galvanic currents and neuromuscular stimulation, and the improvement observed with this treatment can not be differentiated from placebo effects (Švarcová et al, 1988; Oldham et al, 1995).

Trancutaneous electrical nerve stimulation (TENS) is a widely applied electrotherapeutic modality. In a recent, excellent meta-analytical study, the authors summarized the data of seven randomized, controlled trials of TENS therapy in OA. They concluded that the differences in the TENS pulse modes, frequency and other parameters, the inhomogeneity of the patient groups and the treatment periods make these trials relatively incompatable. However, the high placebo response rate seems to be a common feature in all of the studies (Aubin and Marks, 1995).

The effects of pulsed electromagnetic fields were observed long ago. In a recent experimental study, in vitro exposure of hyaline cartilage to pulsed electromagnetic fields maintained proteoglycan composition of the chondrocytes by down regulating its turnover without deleteriously affecting either molecular structure or function (Liu et al, 1996).

In a clinical study involving 86 patients with OA of the knee, a varying pulsed electromagnetic field, averaging 10–20 Gauss of magnetic energy, was applied over 4–6 weeks. The pain relief and mobility data were improved significantly compared to sham magnetotherapy treatment (Trock et al, 1994). Seventy-eight patients with OA of the knee were treated in a randomized placebo controlled trial. Pain and morning stiffness of the patients decreased significantly compared with baseline data versus the placebo group (Zizik et al, 1995).

Therapeutic ultrasound has achieved recognition as a suitable method to treat a wide range of acute and chronic musculoskeletal conditions. In a recent meta-analytical study, out of the 293 papers published since 1950 on the topic, only 22 randomized, sham-therapy controlled trials were found, and very few in the field of rheumatology (Gam and Johannsen, 1995). In OA, the therapeutic effect of ultrasound was indistinguishable from the sham therapy (Falconer et al, 1992).

The favourable effects of infrared light therapy were recently analysed in two randomized controlled trials. Fifty elderly patients with OA of the knee were treated with red, infrared and placebo light emitters. By the end of the 10-day treatment period, pain and disability scores were significantly improved in the red and infrared groups ($P < 0.05$) as compared with the sham therapy groups (Stelian et al, 1992). The same beneficial effect of infrared light therapy has been proved in a study, involving patients with erosive OA of the hand (Favaro et al, 1994).

Laser represents a special form of light therapy. Low energy helium–neon and gallium–arsenid lasers are usually recommended for rheumatological practice (Gerber, 1994). Among the few randomized controlled trials, a study found 0.9 mw continuous-wave helium-neon laser treatment superior to sham therapy in 81 patients with symptomatic thumb-base OA (Basford et al, 1987).

Acupuncture

Forty patients with OA in various joints were randomly treated either by conventional, standard therapeutic acupuncture, or sham acupuncture as control. Pain level in both groups improved significantly, but there was no significant difference between the treatment and placebo groups (Gaw et al, 1975).

The long-term effect of acupuncture treatment was studied in 29 patients with severe OA of the knee. The evaluation during and after the 50-week trial showed a significant reduction in pain and analgesic consumption in the treated group compared with the control group (Christensen et al, 1992).

A recent, randomized placebo-controlled study, involving 40 patients with OA of the knee, showed that both real and sham acupuncture significantly reduced pain, stiffness and physical disability, but no difference was found between the two groups (Takeda and Wessel, 1994).

Weight loss

The association between obesity and OA is the most pronounced in overweight post-menopausal women. These women have about four times the risk of developing bilateral knee OA compared with normal controls. The association is not so apparent in men or in hip disease, which underlines the role of both direct mechanical (excess force) and systemic (endocrine, probably other) factors (Felson, 1996).

Unfortunately, few controlled data are available about the effect of weight reduction in OA (Felson, 1996). In the Framingham Osteoarthritis Study, weight loss lowered the risk of the future development of knee OA in about 50% of cases (Felson et al, 1992). In an uncontrolled trial, following gastric stapling, knee pain decreased from 57 to 14% of the patients (McGoey et al, 1990).

Occupational therapy

Occupational therapy in rheumatology now encompasses a wide area. It includes all personal and microenvironmental support that patients would need on the level of their individual physical and psychological disability (Melvin, 1989; Kirby, 1994). In addition, the occupational therapist's approach to the patient means much more than prescribing orthotic devices and teaching their use, it also contains the complex measurement of their performance before and after treatment and the comprehensive follow up of the treatment process (Law et al, 1994; Backman and Mackie, 1997).

Patients suffering from OA of the peripheral joints need fewer splinting and hand-supporting devices for joint protection compared, for example, with splinting for rheumatoid arthritis patients. Occupational therapy has to support the economical functioning of the knee and hip joint, resulting in less pain and increased mobility (Hicks and Gerber, 1992; Kirby, 1994).

In severe cases of OA of the thumb-base (first CMC joint) a thumb post splint may be required (Hicks and Gerber, 1992).

In OA of the hip, hand and forearm crutches are used on the opposite site of the diseased hip. The crutches can be supplied with rubber tips which need to be replaced when worn. Several types of adaptations are available for walking on different surfaces or icy streets (Melvin, 1989; Kirby, 1994; Goldberg and Dilson, 1997).

In OA of the knee the purpose of bracing is to avoid instability and to diminish pain arising from the stretched ligaments. Hinged knee braces are very rarely needed. In the majority of cases, an elastic bandage may control the instability and provide sufficient support in walking on flat surfaces or on a slope (Goldberg and Dilson, 1997). For a patient with flexion contracture of the knee, serial casting or wedging is recommended (Hicks and Gerber, 1992).

In a long-term randomized, controlled trial of 62 patients with early medial compartment OA of the knee, lateral heel wedged insoles were shown to be beneficial for the early phase of the condition (Tohyama et al, 1991).

Patellofemoral OA needs a different approach to therapy than tibiofemoral compartment OA (McConnell, 1996). The method of taping the patella to the medial position was recently evaluated in a controlled study and shown to be highly effective for short-term pain relief (Cushnaghan et al, 1994).

Psychosocial issues and their management

Similar to other chronic diseases, OA causes pain, disability and handicap, and also alters the psychological and psychosocial state of the patients (Mattson and Broström, 1991).

Psychosocial support can be achieved by either providing external support and advice by trained personnel, or preparing patients to use and utilize their own ability to care for themselves (Hampson et al, 1993; Lorig et al, 1993).

External support for patient education in OA is based on patient information leaflets and verbal information provided during the personal consultation meeting and/or telephone contacts. A recent meta-analytical study compared the effectiveness of patient education trials with the effect of non-steroidal antirheumatic drugs in OA and concluded that patient education has a measurable effect on a patient's pain and disability (Superio-Cabuslay et al, 1996). Regular telephone contact has significantly reduced joint pain and psychosocial disability of patients suffering from OA in two randomized controlled studies (Weinberger et al, 1989; René et al, 1992). When a treatment counselling strategy was included in the programme, this also produced a measurable, significant improvement in health status for the recipients (Maisiak et al, 1996).

Coping with OA is a difficult task, considering its effect on personal mobility and the psychosocial status of patients. The important positive role of active, passive and behavioural coping was assessed in a recent study in 82 osteoarthritis patients (Hampson et al, 1996). Another recent study examined the effect of the family and the spouse's assistance and attitudes, and concluded that well designed and performed spouse-assisted coping skills training was able to lower the levels of pain and disability in patients with OA of the knee (Keefe et al, 1996). The effect of social support and educational interventions are useful aids for disabled and handicapped osteoarthritic patients. In addition, they have a measurable saving effect on healthcare costs (Lorig et al, 1993; Cronan et al, 1997).

Practice points

- therapeutic heat, hydrotherapy and spa treatment may have a beneficial therapeutic effect in patients with some localizations and in certain phases of OA
- certain forms of electrotherapy, such as treatment with pulsed electromagnetic fields and laser, proved to be more effective than placebo therapy in some trials
- other electrotherapeutic methods are widely used in clinical practice: they also have a measurable therapeutic effect which is indistinguishable from the effect of sham therapy
- diet therapy, mostly weight loss through reduction diets, seems to be a useful tool in the treatment of OA of the knee joint
- occupational therapy and a psychosocial approach are of the utmost importance both in short- and long-term treatment of the osteoarthritic condition

Research agenda

- controlled, multicentre trials to study the efficacy of therapeutic heat, ultrasound, magnetotherapy and other electrotherapeutic methods with standardized treatment regimens and different localizations of OA
- randomized controlled trials for assessing the effect of elastic bandaging and bracing in OA of the knee joint
- new, randomized controlled trials to prove the efficacy of patella-taping in OA of the patellofemoral and tibiofemoral joints
- further studies into the efficacy of patient education and counselling in OA

Summary

Non-pharmacological forms of treatment are widely used in the therapy of OA, probably because drug treatment fails to give completely satisfactory results. In addition, treatment, that is, for strengthening muscles, improving joint stability and function and improving endurance can be achieved

mostly by physiotherapy and occupational therapy, especially through exercise.

The rationale for exercise treatment seems to be plausible but, in spite of this, the number of well designed, controlled trials is surprisingly low, although there has been an increase in the past decade. It has been clearly shown now, that not only ROM and muscle strengthening exercises are indicated, but also weightbearing and aerobic exercises have their place. Treatment should be carefully designed for the individual patient after a full and thorough assessment of physical status, joint and muscle functions and aerobic capacity of the patient. Indications, dosimetry and precautions are as important in physiotherapy as in the field of drug treatment. More, well designed, randomised controlled trials are clearly indicated in this field.

Occupational therapy, education and the proper management of psychosocial consequences of OA are rational and they seem to be very important, although good trials are also lacking in this field.

Other forms of treatment, such as electro-, hydro- and spa therapy, acupuncture and laser therapy, all have a very high placebo effect, but there are only very few trials which actually show them superior to placebo.

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