37. Osteoarthritis

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Summary

The purpose of osteoarthritis treatment is to teach the patient about the disease, alleviate pain, optimise and retain physical function, and to prevent or reverse the progress of harmful structural changes in cartilage, bone, ligaments and muscles. A physically active lifestyle, with demands comparable to those placed on good overall health, has been shown to reduce pain and increase function in older patients with osteoarthritis. Both fitness training and dynamic strength training lead to reduced pain and improved function. Initially, however, exercising is more painful, and pain relief is attained after 6–8 weeks. Physiotherapists are able to offer non-pharmacological pain relief and information on pain management.

Osteoarthritis is a chronic disease. In order to achieve lasting results, it is important that the individual chooses a form of exercise that is suitable and that he or she likes and can integrate into daily life. Suitable types of fitness training to start with are cycling and "Nordic walking" (i.e. with poles).

Type of training	Intensity	Frequency (times/week)	Duration (min./session)
Aerobic fitness training	Moderate (13 on the Borg RPE scale)	≥ 3	30 in total (e.g. 3 x 10 min.)
Strength training	1–3 sets of 8–10 exercises with 8–12 repetitions/set, successively increasing load	3	20–60

Definition

Osteoarthritis is not a single, well-defined disease condition but is best described as a final stage failure of the joints that presents similar symptoms and radiographic findings regardless of the original cause. How osteoarthritis is defined depends on the diagnostic criteria applied and varies between different areas of specialty such as orthopaedics, rheumatology, radiology, pathology and epidemiology.

Diagnosis

The main radiological criterion for osteoarthritis is narrowed joint space, which in turn is a result of deterioration of the articular cartilage. A consequence of this is that, when using routine radiographic examination, the diagnosis of osteoarthritis can only be made in a very advanced stage, once the articular cartilage is already eroded. In the early stages, radiographic images often appear essentially normal, even if cartilage changes can be seen with arthroscopy. This can be a contributing factor to the poor link between radiological signs of osteoarthritis and pain. It is not until the radiological signs of osteoarthritis are judged as serious that the link to pain becomes stronger. It is pain that brings the patient to health care, and to begin with the pain appears in connection with movements and loading, and later also at rest and during the night.

Underlying pathophysiological mechanisms

The pathogenesis of osteoarthritis is unclear. Osteoarthritis can be defined as a common final stage in failure of articular cartilage function. If we accept the definition "joint failure", it follows that osteoarthritis can arise in a normal joint subjected to excessive stress, or in a weakened joint subjected to normal loading. That the same factors that initiate the disease also lead to its advancement is given.

The surfaces of a joint are coated with a layer of articular cartilage several millimetres thick. The cartilage absorbs and distributes weight across the joint and reduces the friction of movements. The articular surfaces are lubricated with a thin layer of viscous synovial fluid with a high concentration of hyaluronic acid. The cartilage matrix can be likened to a fibre-reinforced, water-absorbent gel that seeks to absorb water. When the joint is loaded, the water is pressed out of the tissue and absorbed again when the load decreases. Articular cartilage is a highly specialised tissue in which a constant process of resorption and regeneration of the cartilage matrix occurs. Normally, the cartilage maintains a state of equilibrium, which is a prerequisite for its function. In the case of osteoarthritis, as in excessively high or excessively low joint load, the metabolic equilibrium changes and an imbalance between resorption and repair arises. The cell tries to repair itself but is not able to regenerate a functional matrix and the shock-absorbing function is successively lost.

What does the disease lead to?

Osteoarthritis develops slowly. In cases where the precipitating cause can be determined, it can take 10–30 years before the diagnosis of osteoarthritis can be made with the aid of radiology. Recent studies show that the course of the disease, as measured by radiology measures, is not always progressive but that in approximately 50% of cases slight changes can remain stationary for many years. UK studies show that only a fraction of patients with the diagnosis of osteoarthritis ever become candidates for surgical intervention.

The final stages of osteoarthritis are treated successfully today with arthroplasty (where articular surfaces are replaced with metal or plastic ones), which as a rule yields a stable, pain-free joint and a satisfied patient for many years. Problems that remain with this method are primarily loosening and wear on the new joint surfaces. These problems are most pronounced in younger patients. Arthroplasty surgery is best suited to older patients with lower expectations on their level of physical activity, or with a greater desire to adapt to the new activity level. Patients who receive a new joint are recommended to refrain from activities that involve significant loading, but are encouraged to do things such as cycling and Nordic walking.

Prevalence/Incidence

Osteoarthritis is common. It is a chronic disease and the strain on both the individual and society is considerable. Joint disease is the most common chronic disease in older people and is more common than high blood pressure, heart disease and diabetes. However, osteoarthritis can occur as early as in patients in their 30s. Osteoarthritis that appears early in life is often secondary to a joint injury. These patients make up a sub-group of the osteoarthritic population. They are younger and have a higher need for physical function and are thus less willing to adapt their activities to the problems.

In the US, osteoarthritis costs society an estimated 215 billion USD per year. In Sweden, health economists have estimated the cost of musculoskeletal diseases to be higher than the cost of diseases of the brain and nervous system put together (www.boneandjointdecade.org).

Risk factors

In addition to age, the risk factors for osteoarthritis include heredity, gender and joint overload. Examples of overloading include repetitive bending of the knees in one's work, certain elite sports, high body weight and joint injuries. Another risk factor is muscle weakness. Patients with poor muscle function develop knee osteoarthritis to a larger degree than patients with better muscle function (1–3).

Most common symptoms

The most common symptoms of osteoarthritis are pain and loss of physical ability. Other symptoms include stiffness and joints that click or make other detectable noises.

Current treatment principles

The purpose of osteoarthritis treatment is to:
- Teach the patient about the disease
- Relieve pain
- Optimise and retain physical function
- Prevent or reverse the progression of harmful structural changes to cartilage, bone, ligaments and muscles (4).

When asked about the benefits of different treatments for osteoarthritis, European experts put exercise at the top of the list, ahead of arthroplasty surgery, acetaminophen, NSAIDs (non-steroidal anti-inflammatory drugs) and educating the patient (4). All patients with osteoarthritis should be offered information and education. Since osteoarthritis is a chronic disease, it is of utmost importance that the patient be informed about the disease and understand the mechanisms behind the different treatment options offered. Many communities offer an osteoarthritis school, often led by a physiotherapist. It is essential that patients realise that the basis for osteoarthritis treatment is their own physical activity, which may be complemented, initially or as required, with some form of pain relief. A physically active lifestyle, with demands comparable to those placed on good overall health, has been shown not only to reduce pain and increase function in older patients with osteoarthritis, but also to yield improved overall well-being (5).

Effects of physical activity

The European guidelines, which are based on evidence gathered and the consensus of experts in the field, recommend exercise as treatment for osteoarthritis of the knee (6), hip (7) and hand (8).

Exercise as treatment for osteoarthritis – moderation is best!

Similarly to other biological tissues, cartilage thrives best when subjected to moderate loading. Too little loading, where total decompression is the end point, leads to erosion of the cartilage with reduced ability to absorb shock. Too much loading, as in the case of professional football, leads to an increased risk of osteoarthritis. This applies even when no serious injuries have been noted. Fitness activities (moderate loading) appear, however, rather to protect against the development of osteoarthritis (9, 10).

Positive effects of physical activity

A systematic review of 17 studies, in which a total of approximately 2,500 patients were randomly assigned exercise as treatment and compared to others with other or no treatment, concluded that there is sound evidence that exercise has a positive effect on both pain and physical function in knee osteoarthritis (11). At present, the number of studies

is insufficient to confirm the same conclusions for hip and hand osteoarthritis, but those that have been conducted point in the same direction. Compared to NSAID treatment, a greater reduction in pain is seen after 6–8 weeks of exercise training (4). It is also important to note in this context that the risk of side-effects with NSAID therapy is substantial, while the side-effects seen in exercising osteoarthritic patients are limited to minor muscle injuries (12).

It appears that there is a dose-response relation in exercise training as osteoarthritis treatment, whereby the more strength and fitness improves – the higher the gains. This is based on outcomes from exercise training in older people with osteoarthritis, and even better outcomes can perhaps be achieved in patients who may generally be assumed to want to train harder. It must be noted, however, that exercise training should not be confused with all physical activity. Training entails a well-planned, successive increase in the load on the joint under optimal loading conditions, which is not necessarily characteristic of physical activity as such. For example, a person with knee osteoarthritis benefits from cycling but is made worse by playing football. Data from younger patient groups is, however, lacking.

The scientific basis that exists today with respect to osteoarthritis and exercise training, deals primarily with older people with knee osteoarthritis. On the basis of this data, no one specific form of training can be recommended, as similar pain reduction is seen, for example, in strength training and fitness training. For older people with relatively low training levels, it appears that just doing something is more important than what it is they do. For younger or more physically active people, however, it can be expected that the type of activity plays a larger role since "you become what you train to be." The main goal is to achieve optimal loading of the knee, by emphasising how one can best load the leg, and through strength and endurance training.

Exercise is a perishable good. In order to be effective, exercise training and physical activity must be ongoing activities. It has been shown that, despite having less pain after training with a physiotherapist, it is difficult for patients to continue on their own. The perception is that, despite the positive effects, exercise wears out the joints (13, 14) and support is needed to get past this. A study done in the UK showed that only 28 per cent of patients on the waiting list for hip arthroplasty exercised or had been referred to a physiotherapist (15).

Indications

Primary prevention

Of the known risk factors, joint loading is the only one that can be modified. Optimal loading of the joints can be achieved through:

- Aerobic fitness activities
- Increased muscle strength
- Weight loss.

Secondary prevention

Osteoarthritis is the most common cause of physical inactivity in seniors. Patients with osteoarthritis have a higher body mass index (BMI) than people without osteoarthritis. Physical inactivity and overweight, both of which osteoarthritic patients suffer from, are known risk factors for increased ill-health and premature death. Thus, treating osteoarthritis early is critical, not only to reduce articular diseases, but also to counteract overall ill-health and the burden on society.

Prescription

Osteoarthritis is a chronic disease. Training must be integrated in daily life and, most importantly, finding a form of exercise that the individual likes is essential. To facilitate the exercise, an initial assessment and training period with a specially adapted programme are required, aimed at optimising the load on the affected joint. This can be achieved through strength training that stresses neuromuscular factors, usually in cooperation with a physiotherapist. 6–8 weeks of exercise training are needed to see definite improvement. In the beginning, it hurts for osteoarthritic patients to exercise. This is permitted, however, as long as the pain diminishes after training and does not increase from day to day. At the physiotherapist, the patient is able to get help with the dosage of training and temporary pain relief, for example, acupuncture, which provides effective pain relief for knee osteoarthritis. As the patient's strength increases, the pain decreases. The reduction of pain has been observed to remain up to 12–18 months after training. Constant maintenance is, however, necessary. Descriptions of various possible activities for patients with osteoarthritis are given below. An activity whose efficacy and tolerance is well-documented is cycling. Clinical experience tells us that patients with osteoarthritis often return to the physiotherapist once a year for "service", that is, for a short period to increase strength under optimal loading. Often this is done in the winter, a time when many find it more difficult to perform regular fitness activities.

A big risk factor for osteoarthritis is injury. Because joint injuries often occur in connection with physical activity, it is wise to consider which physical activities are suitable. Injuries occur more often in football and other contact sports, which should thus be avoided by patients with osteoarthritis.

Training of strength, flexibility, balance and coordination

Training should be individualised with respect to each patient's requirements and, initially, is best carried out with the aid of a physiotherapist. In general, dynamic strength training is recommended, to begin with using the body as the load, and successively increasing load thereafter. The exercises should be carried out in a loaded position. In knee osteoarthritis, training of the front thigh muscles should be emphasised. In hip osteoarthritis, maintaining good flexibility is of particular importance.

Intensity, frequency and duration of aerobic fitness training

The intensity of aerobic fitness training should be such that holding a conversation is possible, corresponding to a stress level of 13/20 on the Borg RPE scale. The activity should be carried out for 30 minutes per day *in total*, meaning that the person could walk for 10 minutes, 3 times a day. The activity should be carried out most days of the week.

Aerobic fitness-promoting activities

Walking

Benefits: Safe for the majority, something everyone can already do, easy to do, inexpensive. Improves aerobic fitness, reduces osteoarthritic pain and depression.
Limitations: Not suitable for severe osteoarthritis of the hips, knees and ankles.
Recommendations: Wear light shoes with good support and shock absorption. Walk on even, flat ground. If possible, avoid pavement. Choose a softer surface. Walk slowly rather than quickly.

Nordic walking

Benefits: The same as for walking without poles. Less loading of the hip, knee and ankle joints. More rapid improvement in fitness compared to walking without poles. Effective also for neck and back problems.
Limitations: Good clinical experience, but scientific data on patients with osteoarthritis is lacking.
Recommendations: Wear light shoes with good support and shock absorption. Walk on even, flat ground. If possible, avoid pavement. Choose a softer surface. Use the poles rhythmically. Walk as if skiing (right foot-left arm, left foot-right arm). Choose a pole length that gives a good grip and comfortable pendulum movement that does not hurt the shoulders. One recommendation states that the poles should reach one decimetre above the elbow when standing with arms at side of body. Another recommendation states that proper pole length can be calculated by multiplying body height by 0.7. Choose poles with adjustable length.

Running

Benefits: Data for patients with osteoarthritis is lacking.
Limitations: Overload injuries are common in the general public, changes in mechanical conditions as in osteoarthritis would suggest an increased risk of injury, and high loading of the hip, knee and ankle joints.
Recommendations: Do training exercises aimed at increasing strength and mobility of the legs before attempting to run. Run on even, flat surface. If possible, avoid pavement. Choose a softer surface. Use shoes with good support and shock absorption. Do not increase the distance or intensity by more than 5 per cent per week.

Treadmill

Benefits: Easy to use, soft even surface. Avoid downhill grades, the uphill grade can often be adjusted.
Limitations: Requires good balance as the surface is moving. On some models the slowest speed is too fast.
Recommendations: Choose a treadmill with a soft surface, sufficient length and breadth, and with hand rails along the sides.

Running in water

Benefits: The same movement pattern as when running on land but without the load on the hips, knees and feet.
Limitations: Requires access to a pool that is deep enough. Heart rate and oxygen intake are 15–20 per cent lower than on a treadmill. Data for patients with osteoarthritis is lacking.
Recommendations: Use the proper technique, that is, more upright than lying position. Use a life jacket designed for the purpose. When prescribing, specify the intensity (steps per minute).

Swimming/aquafit

Benefits: It is easy to perform the movements in the water. Very little stress on the joints.
Limitations: Requires access to a heated pool or suitable aquafit programme. Data on swimming is lacking.
Recommendations: Choose a fitness programme especially for patients with osteoarthritis. Work in water that is deep enough.

Dancing

Benefits: Studies have shown that dancing as treatment increases fitness and facilitates an increased level of activity as well as leading to reduced ill-health, pain and depression.
Limitations: Data is lacking with regard to loading of the joints. Relatively high risk of injury.
Recommendations: Use shoes with good support and shock absorption. Dance on wood floor or other surface with some give in it. Have a chair handy for resting or relieving the load.

Cycling outdoors or on a stationary bike

Benefits: Effective fitness training, activates the larger muscle groups of the legs.
Low joint load (1.2 times the body weight in the knees). Data shows that fitness, exercise tolerance and muscle strength increase at the same time as illness is reduced.
Limitations: Requires 90-degree mobility of the knee. Correct positioning of seat and handlebars is of utmost importance. Cycling outdoors requires good balance, which is not the case when using a stationary bike.
Recommendations: Correct positioning of seat and handlebars is of utmost importance. Seat height should be such that the knee's angle is 10–15° when most extended. Seek the assistance of a bike dealer accustomed to helping racing cyclists. Choose a bike with a comfortable seat and whose seat and handlebars can be easily adjusted.

Stair/step machine
Benefits: Functional activity, similar to walking up stairs. Data shows that younger patients with other knee injuries tolerate step machines well.
Limitations: Can entail considerable load on the joints. Temporary numbness of the forefoot is common. Data for patients with osteoarthritis is lacking.
Recommendations: Use a model with large pedals/stairs and hand rails. Change foot position often.

Functional mechanisms

Exercise training can be assumed to be an effective treatment for osteoarthritis via a number of mechanisms. The muscle activity relieves pain via the same mechanisms as with acupuncture. Aerobic fitness training increases endorphin levels in the brain, which reduces the sensation of pain. Increased muscle strength and improved neuromuscular function yield increased stability around the joints, factors that help to reduce the load on the joints (16, 17). One study shows that 4 months of training with a physiotherapist not only improves muscle strength, but also the quality of the cartilage of the knee joint (18), confirming earlier animal studies. In a group of older people with knee osteoarthritis, in comparison to mobility training, strength training was shown to lead to slower progression of osteoarthritis (19). Exercise training is often associated with weight loss, which helps to reduce the total load on the joint.

Evaluation

How do we know that exercising training is effective?

In treatment studies of osteoarthritis, efficacy is normally measured with the aid of well-documented *questionnaire surveys* that evaluate the patient's perceived pain, stiffness and other symptoms as well as impairment of function. In some cases, the effect of pain and disability on the patient's quality of life is also evaluated. For younger patients, or patients with early onset knee osteoarthritis, greater improvement is generally seen in the quality of life and physical function in addition to daily demands (such as squatting, kneeling, jumping and running), than in conventional measures such as pain and functions of daily life. Questionnaires designed for this purpose can be downloaded from the internet (www.koos.nu).

Testing of muscle strength and aerobic fitness can be used in part to motivate the patient to exercise, and in part to objectively document the outcomes of training. Simple functional tests of muscle strength in the quadriceps have proven to be able to be carried out by GPs. One example of a practical test that can be carried out is the so-called "step test", where the patient is asked to step up, one leg at a time, as high as he or she can. The step box has a removable shelf that can be set at seven different levels (20). Chairs and stools of

different heights can be used in place of the step box. Ensure, however, that the chair/stool is secured to avoid the risk of falling! Because the stepping height is dependent not only on the patient's height and weight, but also on the mobility of the hip, knee and foot joints, both comparison between patients and between a patient's two sides can be difficult. It is recommended that each patient serve as his or her own control. Good step ability can be measured by whether the patient is able to step up to the height where the initial angle of the knee joint is 90 degrees. This can be done up to 80–85 years of age.

For younger patients, more complex tests can be used. Hopping on one leg is easy to perform and is often used to assess the functional ability of patients with knee problems. The distance of the hop is dependent on several factors, including the patient's strength, joint stability, balance and confidence in the knee. Hopping on one leg has been found to have satisfactory test-retest reliability. Comparison with published normal measures and sample groups requires that the test be conducted in a standardised manner, as factors such as arm position and requirements for safe landing entail high variability in the distance hopped by a particular individual (20). A common requirement for adequate rehabilitation as measured by functional tests is a difference between the two sides of at most 10–15 per cent.

Interactions with drug therapy

As an initial increase in pain may occur during the training period, pain relief in the form of acetaminophen or an NSAID is often used to reduce pain. These drugs have no known interactions with physical activity.

Contraindications

Patients with generalised osteoarthritis or fibromyalgia usually have a very strong response to exercise and should be prescribed very low doses over a prolonged period. The positive effects of exercise are not as great as for osteoarthritis in individual joints either. The prescriptions for patients with osteoarthritis in this chapter are not suitable for these groups!

Risks

A big risk factor for osteoarthritis is injury. Because joint injuries often occur in connection with physical activity, it is wise to consider which physical activities are suitable for patients with osteoarthritis. Injuries occur more often in football/soccer and other contact sports, which should thus be avoided by these patients.

Sports that involve high loading in the form of both axial compression force and twisting can increase the risk for osteoarthritis. Basketball, handball, professional running, football, American football, rugby and waterskiing are examples of sports with high axial compression force and a risk for twisting. Patients with osteoarthritis should avoid these sports.

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