Rehabilitation for Osteoarthritis Overview of Osteoarthritis Rehabilitation

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OVERVIEW OF OSTEOARTHRITIS REHABILITATION

Overview of Osteoarthritis Rehabilitation

Osteoarthritis (OA) is a chronic disease process affecting synovial joints, particularly large weight-bearing joints. OA is particularly common in older patients but can occur in younger patients either through a genetic mechanism or, more commonly, because of previous joint trauma.

Rehabilitation for patients with OA can be provided in various forms, including the following [1]:

- Physical therapy
- Home exercise program
- Occupational therapy
- Medication
- Intra-articular injections
- Surgery

The patient can be taught joint-protection and energy-conservation techniques. Other physical therapy modalities include electrotherapy and thermotherapy.

For other discussions on OA, see Osteoarthritis, Wrist Arthritis, Surgical Treatment of Patellofemoral Arthritis, and Glenohumeral Arthritis, as well as Injection of the Acromioclavicular Joint, Total Knee Arthroplasty, Unicompartmental Knee Arthroplasty, Shoulder Arthrocentesis, Surgical Treatment of Interphalangeal Joint Arthritis, Medial Compartment Arthritis, Surgical Treatment of Lateral Compartment Arthritis, Imaging of Osteoarthritis, and Progression of Osteoarthritis.

Therapeutic Exercise for Osteoarthritis

General principles

Lifestyle modification, particularly exercise and weight reduction, is a core component of the management of osteoarthritis (OA). [2, 3, 4] Although a program of physical therapy should emphasize...
the importance of strengthening all muscles that cross the given joint affected by OA, other therapeutic exercise components have also been shown to be helpful, as discussed below.

**Mechanism of action of therapeutic exercise**

A literature review by Runhaar et al indicated that the mechanisms by which exercise reduces pain and improves function in cases of osteoarthritis may include the development of increased upper leg strength, the reduction of extension impairments, and the improvement of proprioception. The review involved 94 studies, most of which assessed patients with osteoarthritis only in the knee.\[^5\]

**Types of exercise**

A systematic review and meta-regression analysis by Juhl et al found that optimal therapeutic exercise programs focus on a single type of exercise, such as aerobic or muscle strengthening (of the quadriceps). The notion that it is preferable to perform either aerobic or resistance exercise, rather than both types, in a single session is related to the molecular response to exercise. The molecular response to resistance training involves an increase in myofibrillar proteins, whereas in aerobic training, mitochondrial activity is increased. When an individual performs aerobic and resistance exercises within the same session, the molecular response to both appears to decrease. The study also found that for best results in pain reduction, the exercise program should be supervised and consist of three sessions per week.\[^6\]

Most research focuses on quadriceps strengthening in knee OA. Also important are stretching exercises, which increase range of motion. The importance of aerobic conditioning, particularly low-impact exercises (if OA affects weight-bearing joints), should be stressed. Swimming, especially aerobic aquatic programs through the Arthritis Foundation, can be helpful. Certain studies also indicate that a home exercise program for patients with OA of the knee provides an important benefit.\[^5\]

A study by Farrokhi et al of patients with unilateral symptomatic knee OA found that walking exercise of 30 continuous minutes or more may result in undesirable knee joint loading and increased pain, while the same amount of exercise broken into separate intervals with rest periods in between may produce no pain increase. Patients in the study underwent two different exercise sessions, including one continuous 45-minute walk on a treadmill and three 15-minute treadmill walks separated by hour-long rest periods.\[^7\]

In a study of patients with knee OA, Jan et al found that, in most respects, non-weight-bearing exercise was as therapeutically effective as weight-bearing exercise.\[^8\] After an 8-week program, weight-bearing and non-weight-bearing exercise produced equally significant improvements in function, walking speed, and muscle torque. However, patients in the weight-bearing group demonstrated greater improvement in position sense, which may help with complex walking tasks, such as walking on a spongy surface.

A systematic review by Fransen et al found that land-based exercises reduced pain and improved physical function in patients with knee OA. Furthermore, the study determined that there was no difference in outcomes between weight-bearing and non-weight-bearing exercises that targeted the quadriceps. There was also no difference found between quadriceps exercises that were performed eccentrically/concentrically versus those that were performed isometrically.\[^9\]

Chaipinyo and Karoonsupcharoen found no significant difference in the reduction of OA-related knee pain between home-based strength training and home-based balance training.\[^10\] However, more improvement in knee-related quality of life was noted in the strength-training group than in the balance-training group.
Results from a study by Wang et al suggested that tai chi is a potentially effective treatment for pain associated with OA of the knee. In a prospective, single-blind, randomized, controlled trial, 40 patients with symptomatic tibiofemoral osteoarthritis who performed 60 minutes of tai chi twice weekly for 12 weeks experienced significantly greater pain reduction than did control subjects who underwent 12 weeks of wellness education and stretching. The tai chi cohort also had significantly better Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) physical function scores, patient and physician global visual analog scale scores, chair stand time, Center for Epidemiologic Studies Depression Scale scores, self-efficacy scores, and Short Form 36 physical component summaries.

Another study, a meta-analysis by Chang et al, found that an 8- to 24-week program of tai chi improves quadriceps muscle strength in knee OA, allowing elderly patients to prevent or reduce deterioration and loss of daily function. Furthermore, the study indicated that a program consisting of 10 movements of tai chi is ideal for these patients, since it appears that the geriatric population would be less compliant with the program if more than 10 movements were involved.

### Home exercise programs versus formal physical therapy

There is conflicting evidence with regard to the benefits of supervised versus nonsupervised exercise programs. A randomized, controlled study by Kuru Çolak et al found that in knee OA, supervised exercises were more effective at reducing pain and increasing quadriceps and hamstring strength than were nonsupervised exercises. The report determined that the best therapeutic results were derived from low-intensity exercises, due to the ease with which geriatric patients could perform them, and from performance of the exercises at least three times a week. The study also found that the total program should be composed of at least twelve sessions. The investigators noted that although a previous study acknowledged that both supervised and nonsupervised exercises would reduce pain from knee OA, the degree of pain relief was never assessed.

### Exercise compliance

A literature review by Marks and Allegrante indicated that in order to encourage people with OA to adhere to an exercise regimen, "interventions to enhance self-efficacy, social support, and skills in long-term monitoring of progress are necessary."

### Occupational Therapy for Osteoarthritis

Evaluation of how well the patient performs his/her activities of daily living, as well as retraining of the patient, can be assisted by the occupational therapist. Emphasize joint-protection techniques. Hand splinting, especially of the first carpometacarpal joint, may be indicated.

### Medication for Osteoarthritis

The American College of Rheumatology issued the following pharmacologic guidelines for the treatment of osteoarthritis of the hip and knee:

- Arthrocentesis with corticosteroid injection can be used only for knee OA if effusion is present
- Up to 4 g/d of acetaminophen can be administered; this is the preferred initial treatment for patients with OA
- Topical anti-inflammatory medications or capsaicin can be administered only for knee OA
• Low-dose nonsteroidal anti-inflammatory drugs (NSAIDs) (ie, analgesic doses) or nonacetylated salicylates may be indicated

• Administer full-dose NSAIDs with misoprostol if risk factors for upper gastrointestinal bleeding are present

• Narcotic analgesic use may be indicated in cases of severe pain

Other medications have been investigated in OA (eg, tramadol, cyclooxygenase (COX)-2 inhibitors, dietary supplements). Many medications have been tried and are in use, but research on their effectiveness is lacking.

Glucosamine and chondroitin sulfate, currently being studied by National Institutes of Health (NIH) in double-blind trials, have been used in Europe for many years. S-adenosylmethionine (SAM-e [pronounced "sammy"]) is a European supplement receiving considerable attention in the United States.

In a randomized, controlled study by Petersen et al of patients with knee OA, neither ibuprofen, a nonsteroidal anti-inflammatory drug (NSAID), nor glucosamine administration, improved muscle mass gain during a 12-week strength-training program. However, both did improve maximal muscle strength gain in comparison with the placebo treatment, but the benefits were not significant enough to advocate taking NSAIDs or glucosamine. [17]

Chondroprotective drugs (ie, matrix metalloproteinase [MMP] inhibitors, growth factors) are being tested as disease-modifying drugs in the management of OA. Although a number of agents are currently under study, no agent has been shown to have a disease-modifying effect in humans. [16]

In a randomized, double-blind, multicenter study, etodolac plus acetaminophen was significantly more effective than etodolac alone for osteoarthritic flare-ups. Measurements of reduced pain intensity, achievement of pain relief, and symptom resolution (eg, decreased morning stiffness, inflammation) showed significantly greater improvement with the combination compared with etodolac alone. [18]

**Intra-Articular Injections**

**Steroid injections**

Intra-articular steroid injections may provide pain relief and have an anti-inflammatory effect on the affected joint in OA. Such injections generally result in a clinically and statistically significant reduction in osteoarthritic knee pain beginning as soon as 1 week after injection. The effect may last, on average, anywhere from 4-6 weeks per injection, but this benefit is unlikely to continue beyond that time frame. [19] One randomized, placebo-controlled study confirmed the effectiveness of corticosteroid injection in the treatment of hip OA, with benefits often lasting up to 3 months. [20]

Some controversial evidence exists regarding frequent steroid injections and subsequent damage to cartilage (chondrodegeneration). Therefore, usually no more than 3 injections are recommended per year in any 1 osteoarthritic joint.

**Viscosupplementation**

Intra-articular injection of sodium hyaluronate (ie, hyaluronic acid [HA], hyaluronan), also referred to as viscosupplementation, has been shown to be safe and effective for the symptomatic relief of knee OA. This topic has been reviewed in depth elsewhere. [21] The largest meta-analysis of intra-articular HA
injection, using 76 controlled clinical studies (and subsequently updated by the Cochrane Collaboration), concluded that this therapy is safe and effective in patients with knee OA. [22]

To date, the US Food and Drug Administration (FDA) has approved 5 intra-articular HAs for the treatment of pain associated with knee OA. These include naturally extracted, non–cross-linked sodium hyaluronate products (Hyalgan, [23] Supartz, Orthovisc, Euflexxa) and 1 cross-linked sodium hyaluronate product known as hylan G-F 20 (Synvisc). Euflexxa is the only product derived from a fermentation process (Streptococcus), while the source material for the other 4 products is chicken combs. At present, no distinct advantage or disadvantage has been associated with either source of HA production.

Some differences between the viscosupplements do exist in the FDA-approved prescribing information. For example, Hyalgan and Synvisc have labeling that establishes their safety for repeat treatment, while other products have the precautionary statement that "the safety and efficacy of repeat treatment has not been established."

The HA class in general has demonstrated a very favorable safety profile for the chronic pain management of knee OA. The most common adverse event is injection-site pain.

While any intra-articular injection (all HA products and steroids) may elicit an inflammatory response and possible effusion, a clinically distinct acute inflammatory side effect (ie, severe acute inflammatory reaction [SAIR] or HA-associated intra-articular pseudosepsis) has been described. However, preclinical and clinical data provide compelling evidence that this reaction is limited to the cross-linked hylan G-F 20 product and may have an immunologic mechanism of action.

Molecular weight per se has not been found to correlate with efficacy (eg, higher or lower viscosity does not equate with better or worse clinical outcomes).

Interestingly, the duration of residence of an intra-articular injection (days) cannot explain the prolonged clinical benefit (months), and accordingly, subsequent biological mechanisms have also been proposed that may play an important role in the clinical benefit. The combination of quadriceps strengthening and HAs may have a synergistic effect on pain. [24]

In the United States, HAs are classified as medical devices rather than as drugs. Although the exact mechanisms of action through which they provide symptomatic relief are unknown, several possibilities exist, including direct binding to receptors (CD44 in particular) in the synovium and cartilage that can lead to several biologic activation pathways.

These mechanisms of action can include the increased endogenous production of hyaluronate and aggrecan by the joint, a mechanical barrier to the activation of nociceptors, the inhibition of pain mediators (eg, PGE, bradykinin), an anti-inflammatory effect (eg, inhibition of proinflammatory cytokine activity, inhibition of inflammatory cell function), a beneficial effect on immune cells, an antioxidant effect, and the restoration of the synovial fluid's physical characteristics (viscoelasticity). Viscosity can help to facilitate the cushioning and lubricating characteristics of the joint during slow movements, while elasticity blunts deforming forces (compression and resistance to shear forces) during rapid motions.

A study Waddell and colleagues hypothesized that hyaluronan inhibits interleukin-1beta–induced metalloproteinase production from osteoarthritic synovial tissue. [25]

As reviewed by Goldberg and Buckwalter, preclinical support is available for most of the HAs, as well as clinical evidence (particularly for Hyalgan) using arthroscopy, microscopy, and blinded morphologic assessments and weight-bearing radiographs for assessing joint space narrowing. [26] Intra-articular HAs may also possibly be chondroprotective early in the development of OA.
However, additional studies would seem to be warranted to further explore the ability of HAs to intervene in the disease processes associated with OA. Certainly, a single product with symptomatic and disease-modifying characteristics, even if only in some patient populations, would be a valuable option in the management of knee OA.

**Platelet-rich plasma (PRP) injections**

PRP injections are becoming more commonly performed as a treatment option for patients with osteoarthritis. PRP, which is derived from the patient’s own blood, delivers a concentration of growth factors to the site of pathology. In a randomized controlled trial on knee osteoarthritis patients conducted by Spaková et al., \(^{[27]}\) it was found that patients had decreased pain and stiffness and improved physical function at 3 and 6 months after the injection.

**Other Treatments**

**Pulsed electromagnetic field stimulation**

A pulsed electromagnetic field stimulation device (Bionicare) has been FDA-approved for use in patients with knee OA. Pulsed electromagnetic field stimulation is believed to act at the level of hyaline cartilage by maintaining proteoglycan composition of chondrocytes via down-regulation of its turnover. \(^{[28]}\) One published multicenter, double-blind, randomized, placebo controlled, 4-week trial in 78 patients with knee OA found improved pain and function in patients who were treated with the device. \(^{[29]}\)

**Transcutaneous electrical nerve stimulation**

Transcutaneous electrical nerve stimulation (TENS) may be another treatment option for pain relief. To date, however, there is limited evidence suggesting that this method would be beneficial for some patients. \(^{[30]}\)

**Acupuncture**

Acupuncture is becoming a more frequently utilized option in treating pain and physical dysfunction associated with osteoarthritis. There is some support in the literature for its use. For example, a review article of randomized, controlled trials found a significant decrease in pain after acupuncture in comparison with the amount of pain persisting after control treatments. \(^{[31]}\)

**Assistive devices**

The use of assistive devices for ambulation and activities of daily living may be indicated. A cane can be used in the opposite hand for OA of the hip, and a cane in the hand of comfort may be helpful for OA of the knee.

**Orthoses**

Braces and appropriate footwear may also be of some use. However, a 12-month study of 200 people aged 50 years or older with medial knee OA found no symptomatic or structural differences between patients who wore lateral wedge insoles and those who wore flat control insoles, inside their footwear. \(^{[32]}\)
Since 2015, a device known as the Unloader Hip brace has been available in the United States for use in patients with symptomatic hip OA. This brace was derived in part from the WISH-type modified S-form hip brace from Japan. The current Unloader Hip brace likely exerts its overall effect via several mechanisms, with the brace featuring a trochanteric pad that provides direct compression, thus helping with proprioceptive support of the hip joint, and a dynamic rotation strap that shifts compressive forces away from the main osteoarthritic region in the superior-lateral corner of the joint (via external rotation and abduction). The overall brace also improves joint stability.

Supportive evidence for the Unloader Hip brace's efficacy includes a gait analysis study of 14 subjects with unilateral hip OA. The report found that use of the brace led to a significant reduction in peak internal hip abduction force (the major factor indicative of hip joint loading during the single support phase of gait) and a significant decrease in ambulation pain. [33]

**Surgical Intervention**

Surgical intervention for osteoarthritis (OA) may be indicated. Types of procedures vary according to the site and the degree of involvement.

Surgical interventions for OA of the knee include the following:

- Arthroscopic lavage - Using a saline lavage to wash out the joint
- Joint realignment (realignment osteotomy) [34]
- Joint fusion (arthrodesis) - Surgically fusing the joint to eliminate motion
- Joint replacement (arthroplasty)

Surgical interventions for OA of the hip include the following:

- Joint realignment (realignment osteotomy)
- Joint fusion (arthrodesis) - Surgically fusing the joint to eliminate motion
- Joint replacement (arthroplasty)

Hip replacements generally are classified as either hemiarthroplasty (ie, replacement of the femoral side of the hip joint, while leaving the patient's acetabulum intact) or total hip arthroplasty (replacement of the femoral side of the hip joint and the acetabulum).

Further classification often involves specification of the specific hardware used (eg, unipolar prosthesis, bipolar prosthesis) and whether or not cement is used to hold the hardware in place.

The prognosis is good for patients with osteoarthritis who have undergone joint replacement. According to a meta-analysis by Vissers et al. [35] patients who undergo hip replacement can return up to 80% of normal daily activity around 6 months after surgery. The prosthesis may need revision 10-15 years after its installation, depending on the patient's activity level.

**Consultations**

Consultation with an orthopedic surgeon may sometimes be needed. Rheumatology consultation is indicated if an alternative diagnosis (eg, rheumatoid arthritis) is suggested.
Deterrence and Prevention

The prevention of osteoarthritis (OA) is a controversial topic; however, it is believed that maintaining ideal body weight lessens the probability of developing OA. This appears to be particularly true for weight-bearing joints (ie, hips, knees) in women. A cross-sectional retrospective analysis concluded that those with a higher risk for worse knee OA symptoms included women and persons with a higher body mass index. [36] According to Messier et al, [37] even a 10% weight loss in overweight and obese patients could improve knee OA by decreasing the weight loads during walking.

Physical activity improves function in adults with arthritis, according to Dunlop et al. [38] In this cohort study, positive improvement in knee OA occurred in adult patients with increased activity.

Some also believe that an adequate intake of vitamins C and D can help to lessen the probability of developing OA.

A small study from England suggested that a course of NSAIDs taken after a traumatic event seems to reduce the incidence of posttraumatic OA.

Patient Education

Patient education is one of the primary therapeutic approaches to OA. [39] Several Arthritis Foundation studies have demonstrated that education in OA benefits the patient. Through education, patients can institute ways to reduce pain and increase joint function. Emphasize the need for physician follow-up visits.

For patient education information, see the Arthritis Center, as well as Osteoarthritis.