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Consider these exercises for chronic musculoskeletal conditions

Exercise interventions reduce pain and improve function in knee/hip OA, chronic low back pain, shoulder pain, Achilles tendinopathy, and lateral epicondylitis.

PRACTICE RECOMMENDATIONS

- › Consider quadriceps strengthening for knee osteoarthritis with an initial period of supervision, which can provide greater pain relief than nonspecific, unsupervised lower limb exercises. (B)
- › Consider a generalized exercise program for subacromial impingement syndrome, to relieve shoulder pain and improve function, range of motion, and strength. (A)
- › Bear in mind that the Alfredson protocol for Achilles tendinopathy has yielded improvement in pain and function for up to 5 years, although other exercise regimens have also proven initially effective. (B)

Strength of recommendation (SOR)

- (A) Good-quality patient-oriented evidence
- (B) Inconsistent or limited-quality patient-oriented evidence
- (C) Consensus, usual practice, opinion, disease-oriented evidence, case series

Regular exercise confers several well-established benefits. In such conditions as coronary heart disease, stroke, heart failure, and diabetes, exercise has led to a reduction in mortality similar to that seen with pharmacotherapy.¹ For patients with chronic musculoskeletal conditions, the benefits of exercise-based interventions are measurably reduced pain and improved daily function.² However, prescribing of exercise is often neglected, with preference given to pharmacologic or surgical interventions.³ In part, the disregard of exercise as therapy results from unfamiliarity with appropriate exercise prescriptions,³ which include various forms of aerobic exercise, strength training, and stretching to increase flexibility (TABLE).

As is true of many therapeutic modalities, exercise must be tailored to the condition and to a patient's preferences to optimize its benefits. In this review, we describe exercise regimens well suited for common musculoskeletal conditions, examine the effectiveness of exercise in each condition, and provide examples for use in treating patients.

Osteoarthritis of the hip and knee

Osteoarthritis (OA), one of the most common chronic joint diseases, erodes the articular cartilage and subchondral bone of a synovial joint, eventually leading to joint failure. Pain and diminished muscle strength restrict physical activity and can lead to decreased fitness and impaired muscle function. Exercise helps reduce pain and improve muscle function and quality of life in patients with hip or knee OA regardless of age, disease severity, or level of pain and dysfunction.²

■ Knee exercises. Activities suitable for patients with OA include muscle strengthening, aerobic conditioning, and range-of-motion (ROM) exercises.⁴⁻⁶ A 2015 Cochrane review of OA of the knee showed that exercise reduced pain and improved physical function and quality of life in patients who

TABLE

Types of exercise and common examples

Type of exercise	Principle	Example
Aerobic	Exercise sustained at a low-to-moderate intensity that brings about breathlessness, fatigue, or sweating	Walking, running, biking, cross-country skiing
Strength	Use of resistance to induce muscular contraction and promote anaerobic endurance and muscle hypertrophy	Weight training, body-weight exercises
Flexibility	Stretching musculotendinous length through static and dynamic mechanisms	Pliability activities, yoga, Pilates

completed a treatment program, and that pain relief persisted up to 6 months after intervention.⁵

When designing an exercise prescription for patients with knee OA, consider quadriceps strengthening with an initial period of supervision, which may provide greater pain relief than nonspecific, unsupervised lower limb exercises.⁴ Enhanced strength of the lower limb may lessen force through the knee, thereby decreasing pain and improving overall physical function.⁷ Simple, teachable exercises include squats, step-ups, knee extension/flexion while sitting in a chair, and hip abduction/adduction while standing or lying down. Elastic bands, dumbbells, or cuff weights may be used to increase resistance.

■ **Hip exercises.** Exercise can significantly reduce pain and improve function for up to 6 months for patients with mild-to-moderate symptomatic hip OA.⁶ Types of exercise for hip OA include strength training of hip and core muscles, functional exercises that imitate movements in daily activities, and flexibility training. These exercises help reduce pain and increase ROM. Exercise should include resistance training and should not exceed the limit for acceptable pain.⁸

Aquatic therapy is also appropriate for exercise and strength training and can decrease pain and disability and improve quality of life.⁹ Supervised physical therapy, including strength training, manual therapy, and balance training, are important for reducing pain and improving function. Physical therapy can also enhance adherence to a prescribed exercise program.¹⁰

■ **Appropriate exercise prescriptions** for patients with knee or hip OA should fo-

cus on low-impact activities that can improve strength, flexibility, and function (FIGURE 1). A typical regimen would be 30 or more cumulative minutes daily of stationary cycling, water-based exercises, or strength training, 3 to 5 days per week. Individualize workout intensity for each patient, emphasizing that high-intensity, low-impact effort may yield greater strength gains and take less time to perform.¹¹ A high-intensity exercise prescription focusing on quadriceps, hip, and core strengthening may consist of 3 sets of 8 repetitions with resistance set at 40% of the maximum resistance against which the patient can perform 1 repetition.⁷

■ **Barriers to exercise in knee and hip OA** include negative patient and provider perspectives on exercise and patients' fear that increased activity may actually worsen OA.¹² Depending on a patient's personal preferences, ways to overcome these barriers and encourage adherence might be supervised exercises in an individual or group setting or audiotapes or videos of recommended exercises.¹⁰

Chronic low back pain

Chronic low back pain (LBP) is a large socioeconomic burden in the United States, with upward of \$100 billion per year accounted for in health care costs and decreased worker productivity.¹³ The etiology of chronic LBP can be multifactorial and due to any of several conditions such as degenerative disc disease, spinal stenosis, spondylolisthesis, and facet arthropathy. Treatment is difficult, given that many common interventions—medications, massage, manipulation—have limited efficacy.¹⁴

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For knee OA, supervised quadriceps strengthening may provide greater pain relief than nonspecific, unsupervised exercises.

FIGURE 1

Strength exercises for knee and hip osteoarthritis



Squatting can help with core, hip, and knee strengthening. The patient can use a stool or chair to ensure consistent lowering to a specified level (A). Leg extension using a resistance therapy band is another option (B).

However, for patients with nonspecific chronic LBP, exercise is an effective intervention for reducing pain and improving physical function.¹⁵

■ **An effective approach** is to design an exercise regimen for the individual by type, duration, and frequency of activity, admin-

FIGURE 2

A core and hip strengthening exercise for chronic low back pain



Having the patient elevate the hips while keeping the back straight will engage the core and the gluteus and hamstring muscles, thereby promoting stabilization and strengthening.

istered under supervision to encourage adherence.¹⁶ Appropriate exercises emphasize resistance, strength training, and core stabilization, often focusing on whole body and trunk motion (FIGURE 2).¹⁷

Although yoga or Pilates classes may have a small effect on function, no high-quality evidence exists for their superiority to other forms of exercise.^{18,19} Back School, a therapeutic program that includes education on anatomy and biomechanics, optimal posture, ergonomics, and back exercises, has limited, low-quality evidence for treatment comparisons.²⁰ Aerobic exercise, including treadmill, elliptical, or cycling exercises or walking outdoors can reduce pain and improve physical and psychologic functioning.²¹

The most common reported adverse effect of exercise is a temporary exacerbation of back pain. However, having patients continue daily activities within the permitted limits of pain leads to more rapid recovery than rest or back-mobilizing exercises.^{15,22,23}

■ Cautions. Exercise is contraindicated in patients with LBP arising from a serious medical condition, such as fracture, infection, cancer, or cauda equina syndrome.²⁴ Importantly, exercise interventions recommended for acute LBP have not shown benefit for chronic LBP.

Chronic shoulder pain

With a prevalence ranging from 7% to 26% in the general population,²⁵ chronic shoulder pain often interferes with essential activities of daily living. The etiology of chronic shoulder pain is broad and most commonly involves disorders of the rotator cuff, which functions in both motion and dynamic stabilization of the shoulder. The common term “rotator cuff pain syndrome” can cover such disorders as subacromial impingement syndrome, rotator cuff tendinopathy or tendinitis, partial or full thickness rotator cuff tears, calcific tendinitis, and subacromial bursitis. These pathologies may have overlapping presentations. Manual therapy and exercise, usually delivered as a component of structured physical therapy, focus on stretches and other exercises to increase ROM, stability, and strength of the rotator cuff musculature.²⁶

A 2016 Cochrane review that evaluated manual therapy and exercise for chronic shoulder pain yielded limited high-quality evidence for effectiveness compared with placebo.²⁷ Five trials found no important differences between manual therapy and exercise compared with glucocorticoid injection relative to overall pain, function, active shoulder abduction, and quality of life from 4 weeks up to 12 months.²⁷ But compared with placebo, exercise has been more effective in reducing reported pain, especially in

FIGURE 3

Rotator cuff strengthening and stabilization exercises for chronic shoulder pain



Internal/external rotation

The patient lies sideways on the unaffected shoulder and uses a small amount of resistance (5-10 lb) to rotate the affected shoulder through a full range of motion. Have the patient place a towel between the flexed elbow and chest to engage the rotator cuff in proper form.



External rotation strengthening using a fixed elastic band

Internal rotation strengthening using a fixed elastic band



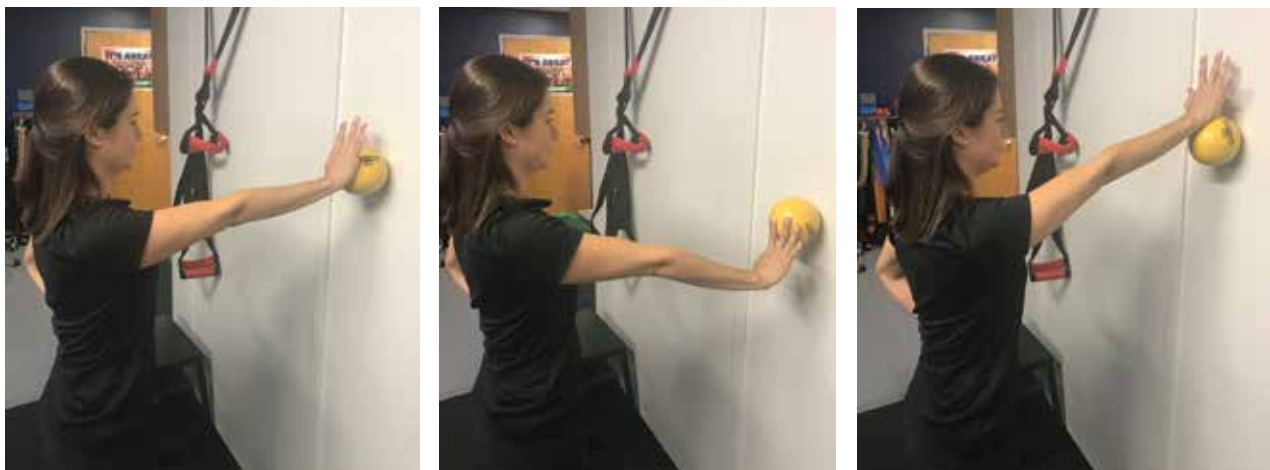
Shoulder abduction strengthening

Using a small amount of resistance (5-10 lb), have the patient stand with back against a wall to facilitate appropriate motion of the scapula and raise the weights to shoulder level. Have the patient continue this exercise until fatigue or discomfort occurs. This exercise can also be done with arms flexed forward 10-15 degrees.

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FIGURE 3

Rotator cuff strengthening and stabilization exercises for chronic shoulder pain (*cont'd*)



Shoulder stabilization exercise

With the arm flexed at the shoulder and extended at the elbow, the patient stabilizes a ball against the wall and moves the arm to mimic spelling the alphabet. Have the patient continue this exercise until fatigue or discomfort occurs.

the context of strengthening regimens focused on flexion, extension, and internal and external rotation.²⁸

■ **For subacromial impingement syndrome**, a 2017 meta-analysis found that a generalized exercise program relieves pain and improves function, ROM, and strength.²⁹ A generalized shoulder-strengthening program includes exercises that focus on internal and external rotation, horizontal abduction, and shoulder stabilization (FIGURE 3). These exercises can be completed with 3 sets of 15 to 20 repetitions, which create a fatigue response that improves strength and targets local muscular endurance.³⁰

Achilles tendinopathy

Achilles tendinopathy (also referred to as chronic Achilles tendinitis) is a degenerative condition of the Achilles tendon related to overuse that leads to pain, swelling, and impaired performance. It accounts for approximately 18% of injuries in runners and 4% of all patients presenting to sports medicine clinics.³¹ Eccentric muscle loading has become the dominant conservative intervention strategy for chronic Achilles tendinopathy.

For chronic tendinopathies, eccentric exercises subject greater force than concentric exercises through a controlled lengthening of a muscle-tendon unit, resulting in a greater remodeling stimulus of the tendon.³² Classically, the Alfredson protocol has been used to treat chronic Achilles tendinopathy. This program of eccentric heel-drop exercises recommends completion of 180 eccentric repetitions a day for up to 12 weeks (FIGURE 4).³³ Exercises are performed slowly, and load can be increased when exercises are performed without pain or perhaps with mild nondisabling pain.

A variation of this protocol has allowed a gradual escalation of repetitions over a week up to the recommended 180 repetitions, and has shown improvements in pain reduction and function similar to that achieved with the primary protocol.³⁴ Additionally, a 6-week “do as tolerated” program of eccentric exercises did not lead to lesser improvement for individuals with midportion Achilles tendinopathy.³⁵

Several systematic reviews have supported the use of eccentric exercises for chronic Achilles tendinopathy,^{31,36,37} but no specific protocol or exercise regimen has demonstrated superiority. However, with the Alfredson

FIGURE 4

Heel-drop eccentric exercise for chronic Achilles tendinitis



The patient rises on the edge of a step with both feet and then lowers the affected foot alone in a slow, controlled manner until the heel reaches a point below the level of the edge. The Alfredson protocol using this exercise recommends completion of 180 eccentric repetitions a day for up to 12 weeks.

protocol, improvement in pain and function in patients with chronic Achilles tendinopathy has persisted for up to 5 years.³⁸

Lateral epicondylitis

Lateral epicondylitis (also called lateral epicondylolysis or “tennis elbow”) is a disabling musculoskeletal condition that leads to pain and tenderness around the extensor mass of the lateral elbow. It is caused by microtrauma to the tendon, usually sustained through repetitive movement in a sporting activity, industrial work, or hobby. Affecting up to 3% of the US population, lateral epicondylitis is associated with pain and functional disability, as well as emotional and psychosocial consequences.³⁹

Proposed treatment and rehabilitation options for patients with lateral epicondylitis have included massage, manipulation, taping, acupuncture, orthotic devices, ultrasound, activity modification, and rest. Exercise programs incorporating eccentric muscle activity are becoming increasingly popular for such conditions as Achilles and

patellar tendinopathies, and they may translate well to other chronic tendinopathies, such as lateral epicondylitis.³²

An eccentric exercise program for lateral epicondylitis, either in isolation or as an adjunct to other therapies, has decreased pain and improved function and grip strength from baseline measures.⁴⁰ Compared with a standard exercise regimen without eccentric strength training, use of eccentric training improves such clinical measures as pain intensity and disability status, as it decreases tendon thickness and aids in recovering homogenous tendon structure.⁴¹

■ **A sample exercise.** The patient may sit in a chair and, with the forearm flexed and pronated over the edge of a table, grasp some form of resistance (bucket of water, training weight, resistance band) (FIGURE 5). The nonaffected hand can be used to help lift the affected wrist into full extension and then removed to allow lowering of the hand over several seconds into flexion. This activity can be performed in sets of 8 to 12 repetitions, 2 to 3 times a day, until the patient’s pain and function have improved.⁴²

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FIGURE 5

An eccentric exercise for lateral epicondylitis



Holding a light weight (1-5 lb) with the wrist extended, the patient performs an upward contraction of the wrist extensor musculature, and then lowers the weight slowly and steadily past the neutral position.

>
 Continuing daily activities within permitted limits of pain leads to more rapid recovery from low back pain than rest or back-mobilizing exercises.

Overcoming barriers to exercise

A major concern across all studies assessing the therapeutic value of exercise is patient compliance and adherence to prescribed programs. Compliance and adherence are affected in part by psychosocial factors such as low literacy and poor social support. From a physician's perspective, direct and indirect costs of treatment and rehabilitation of chronic musculoskeletal conditions may discourage the prescribing of supervised physical therapy.³

Steps to consider in overcoming these barriers would be advising an exercise regimen that requires only an initial period of supervision; educating patients about the benefits of an exercise program; exploring a patient's expectations, beliefs, and fears; and developing strategies for long-term adherence.¹⁶ Supervision through physical therapy is often suggested. However, significant barriers may exist that impede a patient's ability to attend or participate, in which case physician observation in the course of regularly scheduled clinical examinations could be considered.

When prescribing exercises, be sure to address patient expectations regarding pain,

duration, and limitations of exercise. It would be helpful for patients to know, for instance, that working through mild-to-moderate pain during exercise has been shown to shorten post-exercise recovery time and, in the short-term, improve relief from pain.⁴³

Tailoring specific exercise prescriptions for a patient will make the regimen more satisfying for the individual and optimize adherence, which in turn will increase the potential for pain reduction and improved function. Secondary benefits would likely be weight loss and prevention (or regression) of cardiovascular disease. Continued evaluation by the physician or physical therapist should be part of ongoing management, as well as "refresher courses" to ensure understanding of, and adherence to, the exercise program. The potential benefits and limited risks of exercise, if done properly, make it a primary intervention for specific musculoskeletal conditions.

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