Exercises for Older Adults With Knee and Hip Pain

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Half of all older adults report knee and/or hip pain. Obesity and sedentary lifestyle contribute to the incidence and prevalence of painful knee and hip conditions. Weight loss should be a priority in overweight or obese patients. Improving joint function over time requires a balance of rest and usage. Practitioners should assess joint disorders and recommend exercises for reducing knee and hip pain with patients when appropriate. Instruction should include a combination of 1) stretching and flexibility, 2) strength training, and 3) endurance conditioning exercises. Even small improvements in exercise can make meaningful improvements in pain, movement, endurance, and quality of life.

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This CE learning activity is designed to augment the knowledge, skills, and attitudes of nurse practitioners and assist in their development of strategies to improve physical activity in older adults with knee and hip pain as measured by a score of at least 70% on the CE evaluation quiz.

At the conclusion of this activity, the participant will be able to:

A. Identify common contributors to joint pain in older adults
B. Differentiate the 3 main types of exercises and their roles in improving joint fitness
C. Describe how to implement stretching and flexibility, strength training, and endurance conditioning exercises in the older adult with knee and hip pain

The authors, reviewers, editors, and nurse planners all report no financial relationships that would pose a conflict of interest.

The authors do not present any off-label or non-FDA-approved recommendations for treatment.

This activity has been awarded 1 Contact Hour, of which 0 credit is in the area of pharmacology. The activity is valid for CE credit until May 1, 2021.

Numerous factors ranging from the aging baby boomer generation, better health care, and increased life expectancy are all contributing to the unprecedented growth in the older adult population. In 2015, those aged 65 years and older accounted for approximately 14.9% of the United States population, or nearly 48 million people. This group has been adding almost 1 million people per year, and the rate at which this demographic increases will jump 231% over the next 15 years when 1 in 5 Americans will be an older adult.

With the pros of increased life expectancy come the burdens of a greater likelihood of joint problems. Half of all older adults self-report hip and/or knee pain and arthritis. Although rates of joint pain increase with age, this alone does not fully explain the rise in arthritis and painful joints. Factors that contribute to increasing incidence and prevalence of painful knee and hip conditions are obesity and an unbalanced activity profile. These morbidities result in over a 30% higher chance of developing arthritis compared with their physically active counterparts. Primary osteoarthritis caused by normal wear and tear may manifest itself in the 50s, so exercise for joint health may be appropriate and applied to people of any age who suffer from knee and hip pain.

Superior joint fitness is more likely to lead to better mobility and less pain. In general, the following simple equation explains how a joint holds up over time: 

\[
\text{wear and tear} = (\text{force} \times \text{time} \times \text{joint condition}) / \text{(joint fitness)}
\]

Although joint pain can begin at any time regardless of condition, when wear and tear reach a certain threshold, pain could be induced, often suggesting that 1 or more of the factors is imbalanced. Force on a joint considers both the intensity of the task (such as walking uphill) and the load (the weight of the extremity and the whole body). Time is a consideration of both recent use and total lifetime usage. Joint condition plays a considerable factor because degenerative changes inhibit mobility, and acute and chronic inflammation and remodeling alter smooth functioning. As is commonly understood but seldom practiced, good joint fitness reduces the impact of all negative factors including pain and decreased range of motion (ROM). Major organizations agree that a diverse array of activities alleviate pain and improve joint fitness (Table).


Table

| American College of Rheumatology\(^{10}\) | Recommends aquatic exercises as well as endurance conditioning and resistance land-based exercises. Appropriate insoles may also help with pain. Tai chi has been shown to reduce stress and joint pain caused by arthritis. Alternative medicine options to reduce moderate to severe pain include TENS and traditional Chinese acupuncture. Patients with knee pain should avoid chondroitin, glucosamine, and topical capsaicin. |
| Osteoarthritis Research Society International\(^{21}\) | Recommends land-based exercise, weight management, strength training, and water-based exercise as a nonpharmacologic treatment appropriate for any patient. |
| American Academy of Orthopaedic Surgeons\(^{22}\) | Recommends a moderate fitness schedule balanced among aerobic, anaerobic, and flexibility exercises. The recommendation is to begin exercises of short durations and slowly progress to a moderate intensity of exercise that can be sustained. Recommendations are 10-fold: 1) the use of strengthening and aerobic exercise reduces pain and improves function and health, 2) there are few contraindications to strengthening and aerobic exercises, 3) the use of both general and local exercises is essential, 4) exercise plans should be individualized, 5) exercise programs should include advice and education, 6) group and home exercise are equally effective, 7) adherence is the principle predictor of long-term outcomes, 8) strategies to improve and maintain adherence should be adopted, 9) exercise effectiveness is independent of the presence of severity of radiographic findings, and 10) improved strength and proprioception may reduce the progression of joint pain. |

TENS = transcutaneous electrical nerve stimulation.

Overweight, Obesity, and Sedentary Lifestyle

The role of obesity and sedentary lifestyle on knee and hip pain cannot be overemphasized. Rates of overweight and obesity continue to rise in the older adult population. Nearly 3 in 4 older adults are overweight (body mass index \(\geq 25\)), with 35\% fitting the obese category (body mass index \(\geq 30\)).\(^{6}\) Overweight and obesity increase the load on joints; thus, a higher amount of force contributes to wear and tear. Like increased body size, sedentary lifestyle is a proinflammatory state that degrades the joint.\(^6\) Sedentary behavior is defined as any waking behavior done in the sitting, reclining, or lying posture using only minimal energy expenditure of \(\leq 1.5\) metabolic equivalents.\(^7\)

Although healthy weight (body mass index 18.5-24.9 kg/m\(^2\)) older adults may still get knee and hip pain, overweight and obesity pose modifiable risk factors that are adversely affecting the knee and hip joints of older adults. The reduction of body weight should be the primary focus in improving knee and hip pain in older adults who are overweight or obese.\(^{5,9}\) It is estimated that for every 1-lb weight loss, there is a 4-lb reduction in pressure on the knees with each step during walking.\(^{10}\) This reduction is even greater for the hip joint or for more strenuous exercise like jogging. On average, the sedentary older adult accumulates up to 5,000 steps/d.\(^{11}\) If a patient succeeded in only a 1-lb weight loss, this decline equates to a reduction in 20,000 lb pressure on the knees per day. This amount increases to a profound reduction of 7.3 million lb pressure in 1 year, again considering just a single pound of reduced body weight. Although joints are made to be resilient, clearly excess weight and force have a serious impact on joint longevity.

Principles well-known in orthopedics and sports medicine are that improving joint function over time requires a balance of rest and usage. In a misguided effort to reduce the effects of time (aging) on joint function, patients often avoid workloads on the knee or hip, but in doing so receive no benefit that comes from exercise. Exercise has a 3-fold benefit: improved fitness level, reduced friction in the joint over time (thus improving joint condition), and reduced body mass (reducing the total force on the joint).\(^{10}\) Like muscles, joints should be exercised and will become more robust with appropriate use as supporting structures are reinforced.\(^3\) Similarly, overuse can be detrimental, although this is less common in older adults.

Patient Assessment

When seeing patients for knee and hip pain, the encounter should include a holistic assessment of pain factors and joint condition. This assessment should include medical and surgical history, history of trauma, pain type and location, associated signs/symptoms, alleviating and aggravating factors, diet, exercise, posture/gait, and ROM. If indicated, use diagnostic imaging to rule out other pathology.

Although details of the patient assessment and triage decisions are beyond the scope of this article, practitioners should use clinical judgment, consultation, and available resources for determining if exercise is indicated for the patient suffering from knee or hip pain. One of the best resources is the “Health Care Providers’ Action Guide” provided by Exercise is Medicine, which is a multi-organizational initiative that is coordinated by the American College of Sports Medicine.\(^{12}\) The American College of Sports Medicine also provides additional resources and guidelines on exercise testing and prescription.\(^{13}\) Practitioners should be diligent in following up with patients, usually within 1 to 4 weeks at first, to evaluate if the patient is performing the exercises correctly and to evaluate the initial response to this activity. Although the exercise examples given in this article are generally easy to perform and well tolerated by patients, practitioners may find that exercise adaption may be needed, thus warranting referral to physical therapy or additional evaluation by orthopedic or sports medicine providers.

Practitioners should discuss various exercises for reducing knee and hip pain. This discussion should include what each type of exercise does and why it is important for reducing pain and improving function. Three of the most basic types of exercises are stretching and flexibility, strength training, and endurance conditioning, all of which can be performed without a gym membership.

Stretching and Flexibility

Stretching maximizes the distance between the origin and the insertion of a muscle to enhance ROM, prevent injuries, and alleviate muscle soreness. Static stretching (holding a stretched position for an extended period of time) is preferred over ballistic or dynamic stretching because it effectively improves ROM with little risk for injury.\(^{14}\) It is important to stress to patients that flexibility training be performed after a warm-up period; there is an increased risk of muscular injury if stretching is performed cold.

Strength Training

Older adults are especially prone to injuries because their bones become brittle because of osteopenia and muscle weakening caused by sarcopenia. Postmenopausal women are particularly susceptible to osteopenia and osteoporosis because of the loss of bone density. According to Wolff’s law, bones adapt according to
the stresses placed on them. Increased load strengthens bones, but if neglected, they weaken over time. Without strength training, there is a progressive loss of muscle mass, beginning after the age of 40 and accelerating after age 50. Approximately 8% of muscle mass is lost each decade from age 40 to 70, and thereafter muscle loss is about 15% per decade. Therefore, strength training is a sensible strategy. Strength training is beneficial to older adults because it promotes bone strength and muscle growth or, at the very least, prevents or slows further weakening and loss. This increase in strength is primarily driven by neurologic and timing mechanisms in older adults as opposed to hypertrophy, as is observed in younger adults.

Positive muscle changes are also associated with a shorter recovery time from strenuous activity. The body needs to be stressed to a certain threshold to provoke a physiological response to induce compensatory muscle changes. After a sufficient recovery period from the physiological stress, the body needs to be loaded again, this time with a little more stress. Slowly, but surely, the body will get stronger and stronger by increasing its normal threshold. The exact time when to stress the body again after a workout is not exactly known; however, as a rule of thumb, larger muscles need longer to recover than smaller muscles. Guidelines vary, but generally several different exercises should be performed 2 or more days apart to allow sufficient recovery period from strenuous activity.

Endurance Conditioning

Endurance exercises strengthen muscles and improve cardiovascular and respiratory health. Even compression and decompression movements, such as activities like recumbent biking, swimming, and walking, increase synovial fluid and reduce inflammatory cytokines in the joint, which lead to a reduction of pain and increased mobility.

It is important to emphasize to patients that exercises of any variety do not need to be intense to be beneficial. Even small degrees of physical activity are better than staying sedentary. There are also benefits of localized exercises above and beyond what general physical activity does. General exercises will improve functional fitness (ie, the ability to perform activities of daily living) and overall health. Localized exercises (eg, weight-bearing targeting the quadriceps) will strengthen specific muscle groups and may more quickly reduce pain on joints close to those muscles.

Exercise Examples

Stretching/Flexibility

All stretching and flexibility exercises should be performed twice a week for 20 to 30 seconds each and repeated 2 to 3 times. Patients should set their own active ROM. As stretching and flexibility improves, active ROM can increase, and stretches may be held longer. Stretching should be performed after physical activity because it can be harmful when done before (do not stretch cold muscles). Instead, a warm-up is recommended before any exercise. A simple walk or gentle ROM repetitions of the targeted body area for several minutes are often sufficient.

Knees

Stretches for the knees include the hamstring stretch, gastrocnemius stretch, and rectus femoris stretch. Heel wall slides are a good ROM exercise. To properly perform a hamstring stretch, the patient should 1) sit on the floor upright with both legs extended, 2) bring hands toward the feet without the back of the knees coming off the floor, and 3) then slowly return to the upright position (Supplementary Figure 1). To modify this stretch, the patient can extend just 1 leg, bring the opposite hand to the foot of the extended leg, and hold, and then repeat with the opposite leg (Supplementary Figure 2). To properly perform a gastrocnemius stretch, the patient should 1) stand in a lunge position with both hands pushing against a wall, 2) ensure both feet are pointing forward and straighten the back leg as much as possible, and 3) repeat with the opposite leg (Supplementary Figure 3). To properly perform a rectus femoris stretch, the patient should 1) stand with 1 foot up on a chair while facing away from the chair, 2) do a posterior/backward tipping of the pelvis (posterior pelvic tilt), and 3) repeat with the opposite leg (Supplementary Figure 4). To properly perform a heel wall slide, the patient should 1) lie face up on an exercise mat with knees bent and toes touching the wall, 2) place a towel underneath the foot with the foot and towel flat against the wall, 3) slide the foot up with the towel as far as possible, and 4) repeat with the opposite leg (Supplementary Figure 5).

Hips

Stretches for the hips include quadriceps stretches and hip flexor stretches. To properly perform a quadriceps stretch, the patient should 1) lie on the side, 2) bend the knee of the top leg as much as possible and grab the front of the ankle with 1 hand, and 3) switch sides and repeat with the opposite leg. To modify this stretch, the patient can use a towel to go around the foot and grab the ends of the towel with the hand (Supplementary Figure 6). This stretch can also be done in the standing position; the patient should make sure to push the hips forward while grabbing the ankle and steadying oneself against something with the other hand. The decision to perform this stretch side lying or standing is dependent on whichever method provides the greatest degree of hip or knee comfort for the patient. To properly perform hip flexor stretches, we recommend using the “Thomas stretch” approach. To do this, the patient should 1) sit on the edge of a table or bed, 2) raise up 1 leg and grab behind the knee, 3) lay back on the surface with the leg pulled gently toward the body with the opposite leg hanging off the end of the table (or the side of the table), and 4) repeat with the opposite leg (Supplementary Figure 7). Note that the hanging leg is the one being stretched along the hip flexor.

Strength Building

All strength training exercises should include warm-ups and cooldowns. Exercises should begin with 15 to 20 repetitions each (1 set), 2 to 3 sets (per side where applicable), and be performed twice a week. Each exercise should be held for 2 to 3 seconds and progress to 5 to 10 seconds as the patient becomes stronger. The goal is to slowly increase the number of repetitions to 30 and then add external resistance such as a cuff weight. These are low-weight, high-repetition exercises. A patient’s own body weight is sufficient to start; no additional load is needed. Once this becomes easy, additional resistance or weight can be added. The purpose of these exercises is to strengthen the existing muscle, not necessarily to add to it, especially in the early stages of exercise. Patients need only perform as much, and as far, as their ROM and pain allows. Because most patients will be focusing on lower body exercises, it is important to include the upper body for a well-rounded workout, which will also help with weight loss or weight control.

Knees

Strength training exercises for the knees include standing knee flexion, long arc quads, and heel raises. To properly perform a standing knee flexion, the patient should 1) stand upright, 2) smoothly move 1 leg toward the buttocks by bending the knee, and
3) repeat with the opposite leg (Supplementary Figure 8). The knee should be held for 2 to 3 seconds; the time can be increased to 10 seconds as the patient’s strength increases. To properly perform long arc quads, the patient should 1) sit upright on a chair, 2) extend the knee as straight as possible, and 3) then repeat with the opposite leg (Supplementary Figure 9). To modify this exercise, the patient can lie on an exercise mat face up, place a big roll behind the back of the knees, and extend the knee while keeping it on a roll. To properly perform heel raises, the patient should 1) stand upright, 2) hold onto something sturdy to help with balance, and 3) then raise the heels (plantar flexion) (Supplementary Figure 10).

**Legs and Hips**

Exercises for the legs and hips include a sit to stand from a chair and mini-squats. To properly perform a sit to stand from a chair, the patient should 1) sit with feet flat on the floor about shoulder width apart and 2) slowly lean forward at the hip and rise to a standing position (Supplementary Figure 11). Patients may need to push down on the arms on the chair if only using leg strength is too difficult at first. Also, if needed, begin with a cushion or 2 on the chair to limit the amount of bending of the joints. Standing from a regular chair is unlikely to result in increased pain unless they have significant joint limits. Note that it is better for patients to lean forward sufficiently because it makes the gluteal muscles work harder. To properly perform mini-squats, the patient should 1) stand upright with legs approximately shoulder-width apart, 2) bend knees a few degrees (with an eventual goal to work toward a not quite sitting position), and 3) then return to the starting position (Supplementary Figure 12). Consider holding onto a table or other support if needed.

Strength training exercises targeting the hips include standing hip abduction, standing hip extension, and seated marches. One balance and motor control exercise is side stepping. To properly perform standing hip abduction, the patient should 1) stand upright with toes pointed forward; 2) hold onto something sturdy for balance; 3) bring 1 leg out to the side and slightly posterior, keeping the toes pointed forward; and 4) repeat with the opposite leg (Supplementary Figure 13). To properly perform standing hip extension, the patient should 1) stand upright, 2) hold onto something sturdy for balance, 3) smoothly move 1 leg backward with the knee extended, and 4) then return to the starting position and repeat with the opposite leg (Supplementary Figure 14). To properly perform seated marches, the patient should 1) sit upright in a chair, 2) raise the knee straight up as if marching, and 3) alternate legs (Supplementary Figure 15). To properly perform side stepping, the patient should 1) walk sideways for about 10 to 15 feet, 2) walk back sideways to the starting position, and 3) then repeat in the opposite direction (Supplementary Figure 16).

**Endurance Conditioning**

All endurance exercises should be performed twice a week, 5 to 10 minutes if done as a warm-up before other activities or 20 to 30 minutes total if completed independently. In younger populations, optimal endurance conditioning is estimated using the following simple age-predicted maximal heart rate equation: 220 – age. However, this equation underestimates the maximal heart rate in older adults. Instead, patients can apply the following more accurate equation: 208 – (0.7 × age) = maximal heart rate. The target heart rate for these exercises should be 60% to 65% of the maximal heart rate. For example, the maximal heart rate of a 70 year old is approximately 159; thus, the target heart rate would be near the range of 95 to 103. Individuals on heart rate—altering medicines like beta blockers, or for those without access to a simple heart rate monitor or who have difficulty counting a pulse, may use a rating of the perceived exertion (RPE) scale to estimate the target intensity level. If using the Borg 6 to 20 RPE scale, this would equate to a 9 to 13. If using a different RPE scale, the light to moderate level of exertion is the target range (usually 2-3 on a 10-point scale). Examples of endurance conditioning exercises include outdoor biking, recumbent bike, stationary bike, walking, recumbent stepping machine, and swimming. When doing bike activities, the knee should be slightly bent when the pedal reaches the furthest point away from the body. Note that swimming laps is considered endurance conditioning; however, most water aerobics is strength building in nature.

**Conclusion**

In the self-perpetuating cycle of pain, inactivity worsens the condition, which leads to more pain. However, even small improvements in exercise can make clinically meaningful improvements in pain, movement, endurance, and quality of life. Providers should encourage patients to exercise regardless of what has come first—the knee and hip pain or increased sedentary behavior and decreased physical activity. Not exercising continues the cycle and prolongs the problem. Patients who need more supervision and those who try the exercises and have pain while doing them should be referred to a physical therapist for specific modification of their exercises. Practitioners should educate the patient that mild discomfort during exercise is acceptable as long as it does not last for more than 24 hours and that sharp pain with exercise is never acceptable. The patient should inform the practitioner if they have difficulty with the exercise plan. Additionally, we recommend scheduling follow-ups on the initial encounter with patients and then using actual patient-derived data through activity trackers like FitBit (San Francisco, CA), Apple Watch (Apple, Cupertino, CA), and other similar devices to objectively gauge change in physical activity amount. Not capturing these data is a lost opportunity to provide better feedback for practitioners and track progress. In overweight and obese patients, weight loss represents an important goal in improving functional ability. Finding exercises that patients enjoy will affect adherence to new or increased exercise regimens, so encourage patients to provide feedback and participate in exercise they enjoy.

**Supplementary Data**

Supplementary tables associated with this article can be found in the online version at https://doi.org/10.1016/j.nurpra.2018.12.029.

**References**


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In compliance with national ethical guidelines, the authors report no relationships with business or industry that would pose a conflict of interest.
Supplementary Figure 1. Hamstring stretch.

Supplementary Figure 2. Modified hamstring stretch.

Supplementary Figure 3. Gastrocnemius stretch.

Supplementary Figure 4. Rectus femoris stretch.

Supplementary Figure 5. Heel wall slide.

Supplementary Figure 6. Quadriceps stretch.
Supplementary Figure 7. Hip flexor stretch.

Supplementary Figure 8. Knee flexion.

Supplementary Figure 9. Long arc quads.

Supplementary Figure 10. Heel raises.

Supplementary Figure 11. Sit-to-stand from chair.

Supplementary Figure 12. Mini-squats.
Supplementary Figure 13. Standing hip abduction.

Supplementary Figure 14. Standing hip extension.

Supplementary Figure 15. Seated marches.

Supplementary Figure 16. Side stepping.