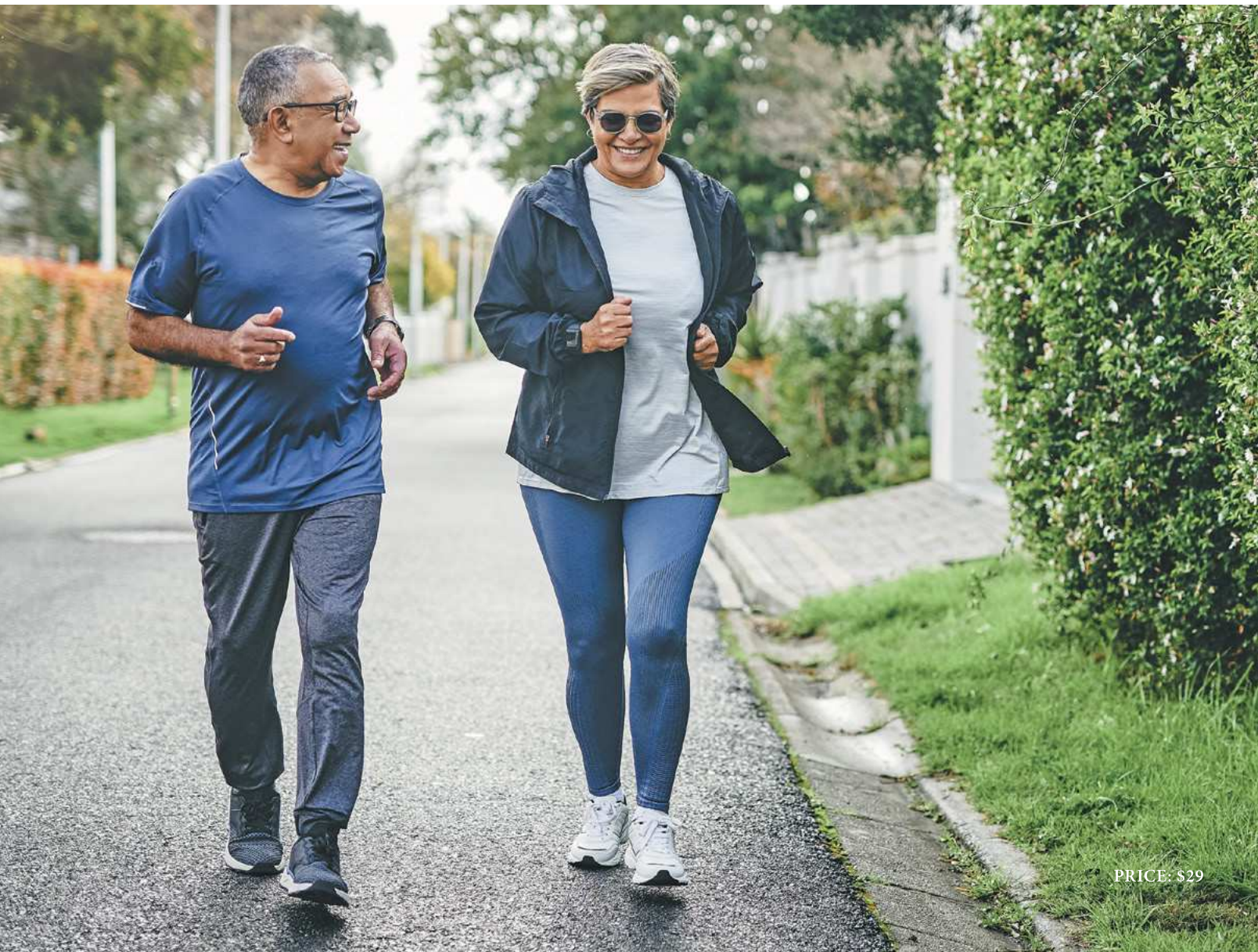




HARVARD
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Knees and Hips

A troubleshooting guide to knee and hip pain



PRICE: \$29

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KNEES AND HIPS

SPECIAL HEALTH REPORT

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Contents

Knees in motion	2
Knee anatomy 101	2
Evaluating knees	4
Overuse injuries of the knee	6
Tears in supporting tissues	10
Kneecap problems	14
Osteoarthritis of the knee	15

Hips in motion	18
Hip anatomy 101	18
Evaluating hips	19
Overuse injuries	20
Hip fracture	24
Osteoarthritis of the hip	26

Testing for knee and hip problems	27
Imaging techniques	27
Laboratory tests	28

Treating knee and hip pain	29
RICE	29
Heat	30
Therapeutic exercise	30
Ultrasound, phonophoresis, and iontophoresis	31
Weight loss	31
Medication	32
Orthobiologics	33
Complementary approaches	34
Arthroscopy	35

SPECIAL SECTION:

Knee and hip replacement	36
---	-----------

Back on track after joint replacement	47
Getting the most from rehab	47
Dealing with postsurgical pain	48
Resuming your daily activities	49

Potential complications of joint replacement	51
Revision surgery	52

Resources	53
----------------------------	-----------

Glossary	53
---------------------------	-----------



Dear Reader,

If you are reading this report, you probably have knee or hip pain. You're not alone. According to the CDC, nearly half of all Americans develop knee arthritis by age 85, and a quarter may develop hip arthritis. Injuries to these joints are also common, even at younger ages.

Your knees and hips are your largest joints, and they have a major task: supporting your weight while providing the mobility most of us take for granted. Under the circumstances, it's not surprising that they're prone to injuries and deterioration over time. Yet the importance of maintaining healthy joints is often overlooked. As an orthopedic surgeon, I see the consequences—for example, patients who have injured a joint because they've jumped too quickly into a new sport or workout routine, or have been pushed to exercise too hard. Even if you avoid injuries, you can develop arthritis and other painful conditions from the gradual wear and tear that comes with aging. I see growing numbers of patients whose joints have deteriorated because of the extra weight they carry.

Fortunately, joint pain can often be treated with physical therapy, medication, minor surgery, or some combination of these strategies. Ultimately, though, many people find that the best solution is replacing a worn-out knee or hip with a mechanical joint. In the United States, about seven million people are living with an artificial joint, and these surgeries generally help them remain independent and active. Doctors have made dramatic strides in improving the speed and recovery time of these procedures. The surgeries often involve smaller incisions than they used to. Pain relievers given directly to the surgical site reduce the need for narcotics, and patients begin to use the new joint as soon as they wake up from surgery. Many people stay just one night in the hospital, and a growing number of procedures are done as day surgeries.

These advances translate into vastly improved lives. I see many patients who resume active lifestyles after joint replacement, to the point that they may even forget they have an artificial joint.

The right strategies and treatments can help you, too. Whether you've just started to experience pain or have been battling it for years, this report will help you make informed decisions about staying active and independent for years to come.

Sincerely,

Scott D. Martin, M.D.
Medical Editor

Knees in motion

Knees suffer injury more often than any other joint. What makes them so vulnerable? One contributing factor is the pounding they take, day in and day out. Not surprisingly, overuse injuries are common, along with things like osteoarthritis and problems caused by deterioration in supporting tissues. Another contributing factor is the unique anatomy of the joint. Knowing the various parts of the knee will help you understand what can go wrong.

Knee anatomy 101

Often described as a simple hinge, the knee is actually a complicated network of bones, cartilage, muscles, tendons, and ligaments (see Figure 1, below right). Like a typical hinge, it opens in only one direction, and forcing it beyond a certain point causes damage. But unlike a basic hinge, in which any wobble is undesirable, your knee can slightly rotate or move from side to side, which allows for twisting and pivoting motions that let you move more freely. Because the bones are not interlocking, the knee is capable of more complex movement than most joints, but it is also more vulnerable to injury. Following is a closer look at the bones, ligaments, and other structures in the knee.

Bones

The knee joint is the junction of three bones:

- the thighbone (known medically as the femur)
- the shin bone (tibia), the larger of two bones in your lower leg
- the kneecap (patella).

At its bottom end, the thighbone divides into two rounded knobs called condyles. These balance on top of the shin bone, which is basically flat on top with a bump in the middle. In contrast to the beautiful fit between bones in many other joints, the knee's mismatch in shape allows for complex movement but is quite unstable, like two doorknobs balanced on an uneven plate.

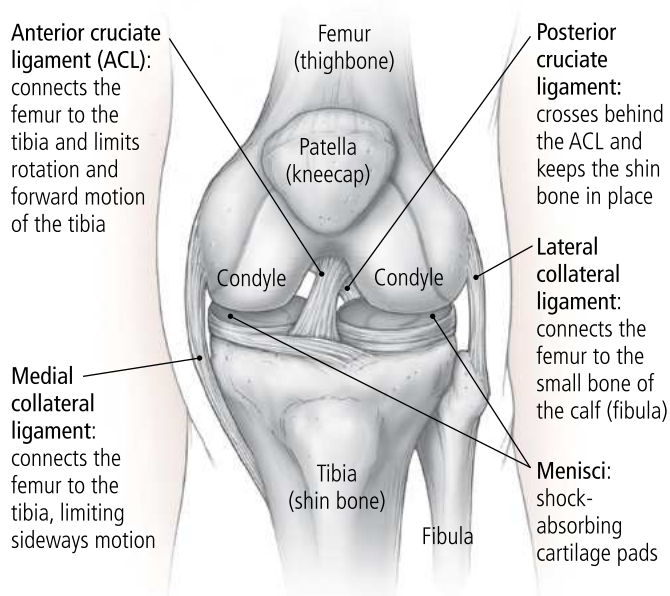
The kneecap is a small, flat bone that floats in front of the knee joint. It moves within a groove between the two condyles of the thighbone. Your kneecap protects other knee structures and applies leverage to help straighten the joint.

Cartilage

Cartilage helps cushion joints. The knees have two types of cartilage:

- Articular cartilage coats the ends of the bones; this slick tissue enables the joint to move smoothly, almost without friction.
- Two rubbery cartilage pads, each known as a meniscus (plural, menisci), separate the bones of each knee. Named for their crescent-moon shape, the menisci curve around each side of the top of the shin bone like a horseshoe, serving as shock absorbers and helping the bones fit together.

Figure 1: A look inside the knee joint



The knee is more than a simple hinge. Along with the strength to raise and lower your body weight, this joint also has supporting structures that allow you to twist and turn.

Both types of cartilage are susceptible to injuries and tears. Menisci are made of tough, elastic tissue, but they can be damaged by the pressure of the thighbone and shin bone they cushion. Articular cartilage can also be damaged by falls, sports injuries, and general wear and tear. Arthritis of the knee usually involves the degeneration of both types of cartilage. Excess body weight can accelerate degenerative changes in the joints, and studies have shown an association between obesity and arthritis of the knee.

Ligaments

Ligaments are tough, fibrous tissues that connect bones at a joint, allowing movement within a safe range. The knee requires four major ligaments to hold it together and provide stability:

- A large ligament called the medial collateral ligament, or MCL, connects the thighbone to the shin bone on the inside (big-toe side) of the knee joint, limiting sideways motion.
- The lateral collateral ligament does the same on the outside (little-toe side) of the knee, connecting the thighbone to the smaller bone of the lower leg (the fibula).
- Deep within the joint, the anterior cruciate ligament, or ACL, connects the thighbone to the shin bone in the center of the knee; it keeps the joint from rotating too far or letting your shin get out in front of your thighbone.
- Crossing behind that ligament is the posterior cruciate ligament, which keeps the shin bone from falling out of place behind the knee.

Ligaments of the knee, particularly the ACL and MCL, are common sites of injury, usually when the leg makes a twisting or pivoting motion away from the body.

Muscles

Muscles power the movement of your knees. These muscles include

- the quadriceps (often called the “quads”), a set of four muscles that run up the front of each thigh and contract when you straighten your knee, working especially hard when you get up from sitting or squatting. The inside muscle of the quadriceps,

the vastus medialis, is responsible for keeping the patella in line as the leg bends and straightens.

- the hamstrings, three muscles in the back of each thigh that contract when you bend your knees. They help support your weight as you sit down and help to extend the hip as you get up.
- the calf muscle (gastrocnemius), which helps you bend your knee and push off with your foot.

When the quadriceps and hamstrings are out of balance—meaning that some are stronger or weaker than others—this can prevent the kneecap from tracking properly and can cause both knee pain and hip pain, which comes from compensating for knee weakness.

Tendons

Tendons connect muscle to bone and transfer muscle power to the bone to create movement. For example, the quadriceps tendon connects the quadriceps muscle to the kneecap, providing the power to extend the leg. Tendons can develop inflammation or microscopic tears. This happens most often in the patellar tendon, which connects the kneecap (patella) to the shin bone. (Because the patellar tendon links two bones, it's technically a ligament, but it's called a tendon because it functions like one, helping to move the knee joint rather than simply hold it together.)

Other anatomical elements

Two other parts of knee anatomy are important to know about. They help lubricate and protect the knee.

The synovium is a layer of cells lining the baglike capsule that wraps around the entire knee, like thick plastic wrap. The synovium produces synovial fluid, a slippery liquid that lubricates the joint and minimizes friction. Synovial fluid also helps protect the joint by forming a viscous seal that enables abutting bones to slide freely against each other but resist pulling apart. This seal breaks when the joint is moved quickly or forcefully, producing the familiar sound of your knee popping.

Bursae are cushioning sacs containing a little oily lubricant; they are located in places where tendons, muscles, and bones cross paths and are subject to friction. But excess friction can cause them to become inflamed—a condition called bursitis.

Evaluating knees

Diagnosing knee problems can be complicated, in part because of the many possible causes of knee pain. It might be difficult to pinpoint the exact location of your pain, and injuries may not be clearly visible on imaging tests. In some situations, a physical examination and the information you provide are sufficient. But most diagnoses require at least an x-ray, and in some cases the doctor may recommend more advanced imaging and laboratory tests to determine the cause and extent of damage. But be aware that expensive tests such as magnetic resonance imaging (MRI) may not be conclusive or even useful (see “Testing for knee and hip problems,” page 27). X-rays can often give as much information about knee problems like arthritis. And abnormalities visible in an MRI aren’t necessarily the cause of your pain; studies show that MRI often reveals abnormalities in individuals who have no pain.

Your medical history

More important than any test is an accurate description of your symptoms. During the exam, the doctor asks many questions about your pain and other symptoms.

Where does it hurt? Try to describe the location of the pain as precisely as possible. This is not always easy. In large joints, your pain may be diffuse, radiate from one area to another, or seem to come from a nearby muscle. Your doctor may ask you to point to one spot on your knee where you feel the greatest amount of pain.

How does the pain feel? Does it ache, stab, or burn? Have you had similar pain in other joints?

When did the pain start? Did it arise gradually over time, or did it begin suddenly—for example, following a fall, another injury, an illness or fever, or a change in activity? If you were injured, did the knee pop or “give out”? Could you walk immediately afterward? Was there swelling? Mention any previous knee injuries, even if they weren’t bothersome and got better. A previous injury might have left residual damage that could be worsened by a relatively trivial event and lead to pain.

When does the pain occur? Is it “getting started” pain—worse when you first stand up and walk? Does it hurt more in the morning and then ease up? Is it

Click, clack, pop: When to worry about noisy joints

Do your hips and knees click, snap, or pop? If there’s no pain or swelling, the noises are not usually a sign of trouble. You may hear a tendon moving across a joint. Or you may have momentarily (and harmlessly) broken the seal of synovial fluid that fills the joint capsule. The sound could also be the formation of a bubble of nitrogen gas in a joint moved slightly out of position (like a cracking knuckle). It’s a different story, however, if the noise occurs at the moment of an injury, or if pain or swelling accompanies it; in that case, there may be joint damage that needs medical attention. In addition, a grating or crunching sound or sensation with joint movement, called crepitus, may be a sign of arthritis.

worse after a certain activity? After you walk a certain distance?

What helps? Does the pain bother you in bed but ease up once you’re up and about? Or, conversely, does pain with activity go away when you sit and rest?

Are there other symptoms? Do you have trouble straightening or bending your knee? Does your knee lock up or give out?

Expect also to answer questions about any other illnesses you have and medications you take, which may increase the risk of certain types of joint problems.

Examining the knee

Your doctor will look for discoloration and swelling and assess how your knees function. While you are in various positions—sitting with feet dangling, lying on your back, or lying on your stomach with knees flexed behind you—the doctor will move your legs to assess each knee’s range of motion, muscle strength, abnormal movements within the joint, and telltale pain or sounds that occur with various maneuvers. Even if only one knee hurts, the doctor will examine both for comparison. If the knee is too swollen to evaluate thoroughly, your doctor may schedule a follow-up appointment.

Your doctor may want to assess the relationship of your knees to your hips by measuring your Q-angle—the slight angle at which the thighbone slants between the hip and knee (see Figure 2, page 5). The Q-angle typically ranges from 0° to 16°, with men usually at the

lower end. An abnormally high Q-angle places you at greater risk of patellofemoral pain syndrome and certain injuries, such as tears of the ACL. The doctor will also evaluate nerve function and circulation in your legs, watch you walk, and follow up on any symptoms of general illness. You may need further tests at this point.

Women and knee vulnerability

Some knee injuries occur far more often in women than in men. One example is injuries to the ACL, the strong, stabilizing central ligament of the knee, which can be strained or torn by a sudden pivot or abrupt stop, or by landing poorly after a jump (see “Ligament damage in the knee,” page 13). According to a study in the *Journal of Orthopaedics*, ACL ruptures occur two to eight times more often in women than in men.

Several explanations for this discrepancy have been proposed, but with no definitive conclusions. Most likely, a combination of anatomy, hormones, and differences in movement and fitness training helps explain the disparity.

As a group, women’s knees are different from men’s. A groove at the bottom of the femur that helps form the knee joint, called the intercondylar notch, tends to be narrower in women than in men. Women’s hips tend to be wider relative to their bodies, so the thighbone forms a larger Q-angle at the knee, sometimes giving a slightly knock-kneed appearance. Of the four quadriceps muscles, the three extending to the outside of the hip are often stronger, tugging the kneecap in that direction—sometimes enough to cause pain (see “Patellofemoral pain syndrome,” page 14).

Estrogen is also a suspect in women’s knee vulnerability. Higher levels of estrogen and other hormones make ligaments more flexible during pregnancy. Some studies have found that female athletes injure their knees more frequently at ovulation, when estrogen levels are high, but not all studies support this finding.

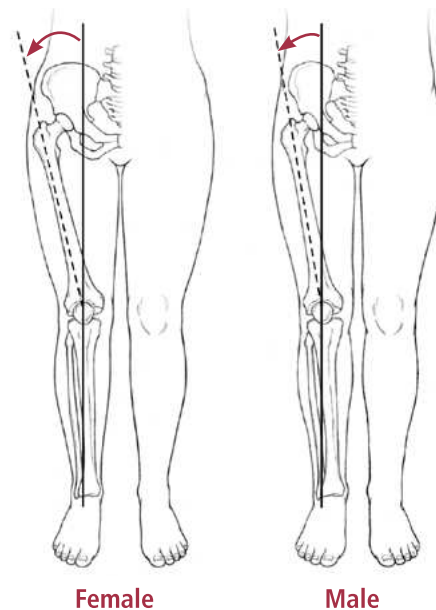
Other experts suggest that differences in biomechanics (the way the body moves) could make women more susceptible to injury. Women’s knees tend to be more flexible, and their lower-body muscles have less mass than men’s, which may give them less stability when in motion and make them more

susceptible to injury during quick movements.

Training techniques and muscle use among female athletes may be another culprit. Women tend to run in a more upright position, strongly contracting the quadriceps on the fronts of their thighs (rather than their often-weaker hamstrings) and putting more strain on their ligaments. When jumping, women tend to land more on one leg or with straighter legs.

What can women do to reduce the risk? If you have broader hips or a tendency toward knock-knees, you probably have a high Q-angle. Wearing good shoes with arch supports can reduce it somewhat, lowering your risk of injury. After exercising or when your muscles are warmed up, strengthen and stretch both your quadriceps and hamstrings. Learn to stretch your iliotibial band, which runs from your hip to your knee (see Figure 7, page 19, for one such stretch). If you’re involved in basketball or other jumping sports, find a knowledgeable coach and learn safe ways to land, pivot, and make quick stops.

Figure 2: What’s your Q-angle?



It’s not obvious, but your thighbone (femur) and your shin bone (tibia) are not positioned in a straight line. The line of the femur and the line extending from the ankle through the kneecap (patella) form what is known as the Q-angle. Women usually have a more pronounced Q-angle than men. Because a greater Q-angle is associated with a higher incidence of tears in the anterior cruciate ligament, women are more susceptible to such tears.

Body weight and your knees

Too much weight takes a toll on your knees. With each step you take on level ground, you put one to one-and-a-half times your body weight on each knee—or as much as 300 pounds of pressure per knee for a 200-pound person. Other types of actions place even greater pressure on your knees. Each knee bears two to three times your body weight when you go up and down stairs, and four to five times your body weight when you squat to tie a shoelace or pick up an item you dropped. If you're 50 pounds overweight, the simple act of climbing stairs or squatting to move clothes from the washer to the dryer puts hundreds of extra pounds of force on your knees.

With all of this in mind, it's not surprising that carrying extra weight is related to knee pain and arthritis. People with obesity are 20 times more likely to need a knee replacement than people of normal weight.

Obesity also affects the outcome of knee replacement surgeries. An analysis in *The Journal of Bone and Joint Surgery* found that people with obesity had higher rates of infections from knee replacement surgeries compared with people of normal weight, as well as a greater chance of needing further surgery to correct loosening.

If you're overweight, your primary care physician will help assess the role your weight plays in your knee pain and recommend a plan of treatment accordingly. Most likely, a weight-loss plan will be helpful. Many knee problems—including osteoarthritis—can be avoided or eased by attaining a healthy weight.

Overuse injuries of the knee

The knee can be compared to an expensive sports car—a finely tuned machine that is capable of great

Protecting your joints

Whether you're pain-free, recovering from an injury, or managing chronic arthritis, you can still protect your hips and knees and prevent additional problems by following these dos and don'ts:

Do choose low-impact exercise. A good workout doesn't need to be hard on your joints. Opting for low-impact activities can help people with arthritis or injuries stay in shape with less pain. Anyone who runs or plays high-impact sports should alternate those activities with lower-impact ones. Recommended aerobic activities, from lightest to heaviest impact, include

- swimming
- cycling on a stationary bike, or outdoors on a level path
- using an elliptical machine with low resistance
- walking on level ground
- rowing.

Do seek help for joint pain. A culture of "powering through the pain" leads many people to ignore

injured joints. Rest aching joints, and seek a doctor's advice if the pain doesn't improve.

Do use lighter weights at the gym. Strong muscles protect nearby joints. But instead of choosing the heaviest weight possible when doing lower-body exercises, choose one that lets you do a greater number of reps, to improve both stamina and strength with less stress to joints.

Do consider working with a licensed physical therapist. Physical therapists can recommend specific stretches and exercises for joint problems and will make sure you're performing them safely.

Don't follow personal trainers or exercise instructors who push too hard. Exercise classes and training sessions can help you stay motivated, but trainers are not always knowledgeable about anatomy and injury prevention. Never perform movements that cause you pain. Don't hesitate to ask for modifications that suit your health and fitness level.

Don't do deadlifts, deep lunges, or deep squats if you have joint problems. These common gym exercises put enormous stresses on the knees, hips, and lower back.

Use machines like the leg press instead (avoid locking your knees when extending your legs), or do the safer exercises shown in this report. Start out slowly and progress by adding repetitions rather than extra weight, building stamina rather than adding more stress to the joints.

Don't be inactive. Short-term injuries require rest, but if you're dealing with ongoing joint pain, don't be tempted to stay on the couch. Inactivity can make knee and hip problems worse by decreasing flexibility and weakening muscles that support and protect the joints.



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power but also highly vulnerable to breakdown. Over time, many things can go awry because of illness, mishap, and misuse of the joint. Overuse injuries occur over a period of time as a result of repeated overwork rather than after a single injury or illness. As you age, overuse injuries become more common. The normal loss of muscle mass and bone density as you age can also make you more prone to knee injury.

Bursitis

Small fluid-filled sacs called bursae cushion the movement of bones against muscle, skin, or tendons. Bursitis occurs when one or more of these sacs become inflamed because of an injury or strain. These are the three most common types of knee bursitis:

- **Prepatellar bursitis**, also called “housemaid’s knee,” affects the sac that lies between the front of your kneecap and your skin, causing swelling on top of or in front of the kneecap.
- **Infrapatellar bursitis** affects the sac just below the kneecap.
- **Pes anserine bursitis** affects the sac between your shin bone and the hamstring tendons at the inside of the knee.

Prepatellar and infrapatellar bursitis are often caused by irritation from prolonged kneeling. People who have jobs or hobbies that require kneeling for long periods of time—such as plumbers, roofers, gardeners, and housecleaners—are particularly susceptible. You can also develop prepatellar bursitis if you hit the front of your knee in an accident or dive to the ground while playing sports, and some people develop it from vigorous jumping. In addition to swelling in the affected area, prepatellar and infrapatellar bursitis can cause warmth and tenderness in the knee and pain when bending or straightening the knee.

Pes anserine bursitis is often seen in runners, particularly if they increase their mileage too quickly, train on hills, or neglect to stretch and warm up properly. Simply walking may stress the pes anserine bursa if you are obese, have tight hamstring muscles, have knees that tend to turn outward, or have changed how you walk in response to another type of joint damage (such as osteoarthritis). Repeatedly kicking a ball also irritates this bursa.

Diagnosing bursitis. To check for bursitis, your doctor will gently press on the skin over the bursa to detect tenderness. He or she may inject a bit of local anesthetic into the sac. If the pain disappears, that’s strong evidence of bursitis. You may need imaging tests to distinguish pes anserine bursitis from other conditions such as a fracture or meniscal tear. If you have symptoms of infection (fever, persistent redness, rash, or swelling) your doctor may withdraw fluid from the bursa to check for bacteria. Infection is rare in the pes anserine bursa, but the prepatellar bursa can become infected in people who spend a lot of time on their knees.

Treating bursitis. Bursitis is treated with rest, ice, and compression to reduce swelling (see “RICE,” page 29). To relieve pain, doctors typically recommend acetaminophen (Tylenol) or one of the other over-the-counter pain relievers known as nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen (Advil, Motrin) or naproxen (Aleve; see “Acetaminophen or NSAIDs for pain relief?” on page 10). The doctor may also give a corticosteroid injection into the bursa to reduce inflammation.

You’ll need to avoid activities that aggravate the condition during the healing process, which usually lasts two to six weeks. If the fluid in the bursa shows signs of infection, you’ll need to take antibiotics, and your doctor may remove (aspirate) the fluid to clear the infection. In extreme cases, the swollen bursa is removed surgically (debrided); the missing bursa will often reconstitute itself over time.

Symptoms of bursitis

For prepatellar bursitis or infrapatellar bursitis:

- Swelling on top of or in front of the kneecap (prepatellar) or below the kneecap (infrapatellar)
- Warmth and tenderness
- Pain when you bend or straighten your knee

For pes anserine bursitis:

- Pain located inside the knee, below the knee joint
- Increase in pain when you climb stairs or exercise
- Pain that radiates to the back and inside of your thigh
- Pain when your knees touch as you lie on your side

Your doctor may also recommend physical therapy to strengthen and stretch the quadriceps in the front of your thigh (see Figure 3, below) and the hamstrings at the back and inner thigh. A physical therapist can also show you how to protect your knee during sports and daily activities. If your normal stance puts pressure on the pes anserine bursa, using over-the-counter arch supports in your shoes may help. To prevent prepatellar bursitis, wear protective kneepads (such as roofer's pads or gardening pads) while kneeling or while playing sports that are likely to involve hits to the knees.

Bursitis can recur if you don't take preventive measures after it heals. For example, get up and stretch your legs regularly if you work in a kneeling position for long periods of time, stretch your legs before and after you exercise, vary your workouts to rest your knees, and elevate and ice your knees after you exercise or spend a long time on your knees.

Tendinopathy (tendinitis, tendinosis)

Tendinopathy means disease of the tendon; it's a term used to describe chronic overuse injuries in tendons, as well as damage caused by aging and certain medications, including some antibiotics. It is often referred to as tendinitis (meaning inflammation of the tendon) or tendinosis (meaning degeneration or microscopic

tears in a tendon). The affected tendon continues to function, at least for a while, but it hurts. You may develop tendinopathy in the knee if you do high-intensity activities such as running or basketball on the weekend but don't maintain your conditioning during the week. Also, excess weight puts additional stress on the knee's patellar tendon and can contribute to tendinopathy.

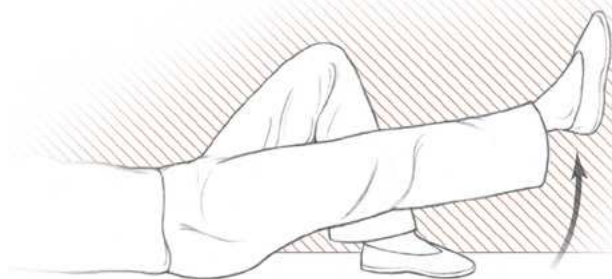
With age, tendons become stiffer and more prone to tendinopathy, while supporting muscles become weaker and less able to provide protection. Inflexible hamstrings and quadriceps make you more susceptible.

Tendinopathy in the knee most often affects the patellar tendon, although it may also occur in the quadriceps tendon, which connects the front quadriceps muscle to the kneecap. Dancers, runners who train vigorously, and athletes who jump a lot are subject to patellar tendinopathy, sometimes called "jumper's knee."

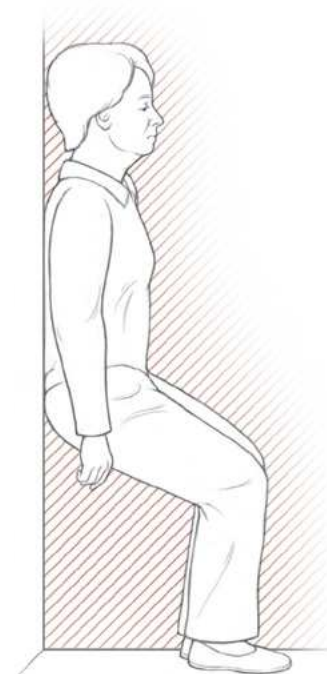
Diagnosing tendinopathy. The doctor gently stretches the tendon and probes for tenderness below and above the kneecap. Testing for characteristic muscle tightness (often in quadriceps, hamstrings, and the Achilles tendon at the back of the ankle) helps with the diagnosis and provides strategies for rehabilitation. X-rays usually aren't needed.

Figure 3: Knee-strengthening exercises

Strong muscles around a damaged knee can help support the joint. For example, a strong quadriceps—the large muscle group in the front of your thigh—can take over the shock-absorbing role usually played by the meniscus or cartilage in the knee.



Straight-leg raise: Do this exercise to strengthen your quadriceps. Lie on your back and tighten the thigh muscles of one leg with your knee fully straightened. Lift your leg several inches and hold for 10 seconds. Lower slowly. Repeat until your thigh feels fatigued, then switch to the other leg.



Wall sit: This exercise also strengthens the quadriceps. While standing with your back against the wall, bend your knees, lowering yourself into a sitting position. Hold this position for 20 seconds. Repeat.

Symptoms of tendinopathy

- Pain above or below the kneecap where the tendons attach to bone
- Swelling
- Pain that recurs with particular activities and eases with rest
- In severe cases, pain that no longer improves with rest
- In some cases, a constant ache that disrupts sleep

Treating tendinopathy. For the first few days, tendinopathy is treated with rest, ice, over-the-counter pain relievers, and often a knee support (see “RICE,” page 29). After that, you can resume gentle activities that don’t aggravate the area. If pain doesn’t improve with rest, your doctor may apply a steroid solution over the area and use electrical stimulation to help the medication reach the tendon and reduce inflammation (see “Ultrasound, phonophoresis, and iontophoresis,” page 31). In many cases, tendinopathy goes away in a few weeks or months. But if none of these remedies works and the pain persists for more than a year, surgery is sometimes performed to remove abnormal areas of the tendon.

Rehabilitation for tendinopathy includes exercises to improve flexibility and overall muscle strength without irritating the tendon. These often include “eccentric” exercises—movements in which muscles exert force and move joints while lengthening rather than contracting. Examples of eccentric exercises include slowly lowering weights that you’ve lifted, carefully lowering the heels to the ground after standing on your toes, or bending your knees into a half-squat.

You can usually resume normal activities in a few days and more demanding athletic activities in a few weeks, after the pain and swelling are gone and you have regained muscle strength.

Iliotibial band syndrome

The iliotibial (IT) band is a thick cord of tissue extending from the hip bone down the outside of the thigh to the shin bone (tibia). When the knee bends, the IT band slides over the outside knob of the thigh-bone (the greater trochanter). If the band becomes inflamed, the outside of the knee hurts.

This common condition, called IT band syndrome, often occurs in athletes who overdo it while running, cycling, skiing, or playing soccer. But it can occur in anyone, most often in those who fail to warm up properly and in those who have tight IT bands, unbalanced leg muscle strength, high or low arches, or unequal leg lengths.

Diagnosing IT band syndrome. The doctor presses on the band—either at the greater trochanter or at the outside of the knee—while you flex and extend your leg. If pain is greatest with the knee flexed about 30°, that’s a telltale sign. The IT band may also be swollen or thicker where it passes over the trochanter.

Treating IT band syndrome. The first line of treatment is resting the joint, applying ice, taking over-the-counter NSAIDs such as ibuprofen or naproxen, and reducing or eliminating the aggravating activity to allow the area to heal. Women should wear shoes with heels no higher than an inch. If pain occurs while you sleep, try a memory foam or gel mattress cover, which helps distribute the forces around the sore area to relieve pressure.

Physical therapy will help you learn to stretch your IT band (see Figure 7, page 19), improving the balance, flexibility, and strength in your quadriceps muscles and hamstrings. While you are being treated, you can maintain conditioning by substituting other activities that don’t stress the knee, such as swimming, aqua jogging, riding a stationary bike with little resistance, light walking, and using an elliptical machine. Limit strength training to the arms. Athletes such as bicyclists and runners who develop IT band syndrome may need to reduce their mileage and intensity to prevent flare-ups.

Symptoms of iliotibial band syndrome

- Pain along the iliotibial (IT) band, from the hip to below the knee
- Pain in the upper and outer part of the knee
- Pain on the outside of the hip that is worsened by pressure, such as when lying on the affected side
- Dull, sharp, or stinging pain
- Pain that arises gradually or after a single intense workout

If symptoms do not improve, the doctor may inject a corticosteroid medication into the band to relieve pain and inflammation. Depending on severity, healing may take several weeks or more. Steps you can take to help prevent recurrence include losing weight if you're overweight, cutting back on your training regimen, avoiding running on uneven surfaces or on circular tracks (which are often slanted, causing increased stretching of the IT band on the downhill leg), and stretching the outside of your thigh. Addressing an abnormal gait resulting from back or hip pain can also help.

Surgery is not usually a good option, because overuse rather than structural damage causes the problem.

Tears in supporting tissues

The tissues in and around the knee—tendons, ligaments, and menisci—can split or tear from injury or overuse.

Ruptured tendons

When you suddenly contract your quadriceps to their maximum capacity—say, if you stumble going down

stairs and catch yourself—the force can be enough to tear the quadriceps tendon, which connects the large muscle group in the front of your thigh (the quadriceps) to the kneecap. This type of injury is common in recreational athletes over age 40, particularly basketball players. Your risk is greater if you have diabetes, another hormonal disorder, or kidney failure. A ruptured tendon can be temporarily disabling and usually requires surgery. Recovery can take several months.

Less commonly ruptured is the patellar tendon, which connects the kneecap to the shin bone. Although this usually occurs in athletes landing badly after a jump, occasionally a fall unrelated to sports is to blame. The same underlying conditions raise the risk, although most patellar tendon ruptures occur in people under age 40.

Diagnosing a ruptured tendon. This injury requires immediate medical attention. To diagnose this injury, your doctor may feel the gap in the quadriceps or patellar tendon by pressing the area just above or below your kneecap. X-rays won't show the tendon well, but they may show that your kneecap is slightly

Acetaminophen or NSAIDs for pain relief?

The first line of treatment for many knee and hip problems includes taking over-the-counter pain relievers. Acetaminophen and nonsteroidal anti-inflammatory drugs (NSAIDs) such as aspirin, ibuprofen, and naproxen are the most common options. However, these medications have a variety of side effects, so it's important to discuss your personal health risks with your doctor when considering long-term use for chronic conditions such as osteoarthritis.

Acetaminophen (Tylenol and other brands) is usually effective for mild pain and is easy on the stomach. However, it is toxic to the liver at high doses. The recommended maximum per day is generally set at 4 grams (4,000 milligrams), which is the equivalent of eight extra-strength Tylenol tablets. But that dosage can cause liver problems for some people. To be safe, aim

for 3,000 milligrams or less, and be cautious of mixing multiple products containing acetaminophen, such as a pain reliever and a cold medication or a prescribed opioid. The FDA now recommends using products containing no more than 325 milligrams per pill or capsule (the equivalent of regular-strength Tylenol rather than extra-strength) in order to avoid excessive dosages. Don't take acetaminophen if you drink more than a moderate amount of alcohol on a regular basis or if you have liver disease.

NSAIDs such as aspirin, ibuprofen (Advil, Motrin), and naproxen (Aleve, Anaprox) may be more effective than acetaminophen for certain conditions because they reduce inflammation as well as relieve pain. But NSAID medications have side effects, the most common being gastric bleeding and ulcers. You can ask your doctor

about taking a proton-pump inhibitor such as esomeprazole (Nexium) or lansoprazole (Prevacid) to reduce these risks. NSAIDs also carry a slightly increased risk of heart attacks, strokes, and kidney failure, particularly when taken at high doses or for long periods of time. Women who are pregnant or planning to become pregnant should be aware the FDA recently required manufacturers of NSAIDs to add a warning on their labeling that rare but serious kidney problems can occur in babies in utero if their mothers take these medications in the second half of pregnancy.

Taking acetaminophen along with an NSAID may provide equivalent pain relief with lower doses of both medications, thus minimizing side effects. You can also alternate between the two to reduce the risk from either type of medication.

out of place because it has lost connection with the muscle. The kneecap may sit abnormally low (a condition called *patella baja*) in a quadriceps tendon rupture, or too high (*patella alta*) in a patellar tendon rupture. MRI, an imaging method that shows soft tissue, can reveal a partial or complete tear. If both tendons rupture—an unlikely occurrence—the doctor will test for underlying diseases such as kidney failure and diabetes.

Treating a ruptured tendon. At first, your doctor will place your knee in a brace to immobilize it while you rest the leg and use ice to counter pain and swelling. If the tear is partial and you can extend your leg, surgery may be unnecessary; instead, your doctor may place your leg in a locked brace for healing.

In most cases, however, ruptured tendons don't heal on their own and need to be surgically repaired. Complete ruptures probably need surgery as soon as is practical (within a week, before the muscle atrophies and the tendon shrinks and creates additional problems). The procedure involves open surgery, not the less-invasive technique known as arthroscopy. During the operation, the surgeon rejoins the tendon's torn ends and stitches them in place, often anchoring them to small holes drilled in the kneecap.

Following surgery, the leg is held straight in a brace for several weeks. A repaired tendon will be quite weak, and you'll need crutches to get around. Under the direction of a physical therapist, you can start building up strength after about a week by putting some weight on the leg—gradually, to avoid rupturing the tendon again. After three weeks, your physical therapist will show you exercises aimed at strengthening the quadriceps and calf muscles and help you slowly increase how much you bend the knee. It may be eight to 12 weeks before you can walk normally, four months before you can run again, and six months or longer before you can jump.

Torn meniscus

Among the most frequently injured parts of the knee are the shock absorbers, each called a meniscus, that provide cushioning between the thighbone (femur) and shin bone (tibia; see Figure 4, page 12).

As you age, the menisci weaken and fray, to the point that even a simple motion such as getting in and

Symptoms of a ruptured knee tendon

- Disabling pain at the top of the kneecap (for the quadriceps tendon) or the bottom of the kneecap (for the patellar tendon)
- Swelling
- Difficulty or complete inability to straighten the knee
- Feeling like the knee “gave out” and can't support your weight
- Popping or snapping at the moment of injury

out of a squatting position or rising from a low chair can tear a meniscus. MRI imaging has revealed that damage to the meniscus is extremely common and often causes no pain. About 30% of people ages 30 to 40 and about half of those over age 50 have meniscal tears without pain.

A meniscal tear can also be caused by a strong, twisting force on the knee—rounding the bases in softball, for instance, or pivoting left to throw a basketball while the feet are facing right. Damage to a meniscus often accompanies a tear of the ACL in the front of the knee (see “Ligament damage in the knee,” page 13). In people with osteoarthritis, meniscus damage can occur with no identifiable injury, as part of the gradual wearing away of cartilage. People who are genetically predisposed to getting arthritis may also be more susceptible to meniscal deterioration.

Diagnosing a torn meniscus. The doctor will ask you about pain and movement. Is your knee most comfortable when slightly flexed? Is it hard to straighten your leg? Your doctor will maneuver your legs while you're in various positions to check for pain, popping, or grinding in the meniscal area.

An MRI scan can reveal the presence of a torn meniscus, but it doesn't indicate whether a tear is new or whether it's the cause of your symptoms—in fact,

Symptoms of torn meniscus

- Stiffness and possibly swelling in the knee
- Pain and tenderness along the joint line or general knee pain
- Catching or locking of the knee

it's possible that your meniscus may have been torn for years and never bothered you. Because MRI is expensive, the test is reserved for times when the diagnosis is in doubt or the results will influence treatment.

Treating a torn meniscus. A torn meniscus can still function, and living with it may be a better option than having it surgically trimmed. Most likely, your meniscal tear will not be treated with surgery unless all of the conditions below are met:

- Your pain came on suddenly and is localized to the inside or outside of the knee, where the meniscus commonly tears.
- MRI and clinical examination both suggest a tear.
- An x-ray or MRI indicates there is little or no arthritis in your knee.
- You experience locking or catching in the knee.
- More conservative treatments such as steroid injection and physical therapy have failed.

In general, the goal of treatment is to relieve pain, restore normal motion, and preserve as much of the meniscus as possible. Initial treatment includes rest, ice, and compression, along with over-the-counter pain relievers (see “RICE,” page 29). Note that elevating the joint—the final component of RICE—is not

important for meniscal tears since they do not generally cause significant swelling, unless you also have a ligament injury, such as an ACL tear. Steroid injections may also be used. A definitive evaluation may be deferred a week or so until any swelling subsides. At that point, if your knee is stable and doesn't lock, you may need no further treatment.

Some small tears heal on their own, depending on their location. The outer rim of the meniscus is well supplied with blood and should heal on its own, while other portions have little or no blood supply and can't repair themselves.

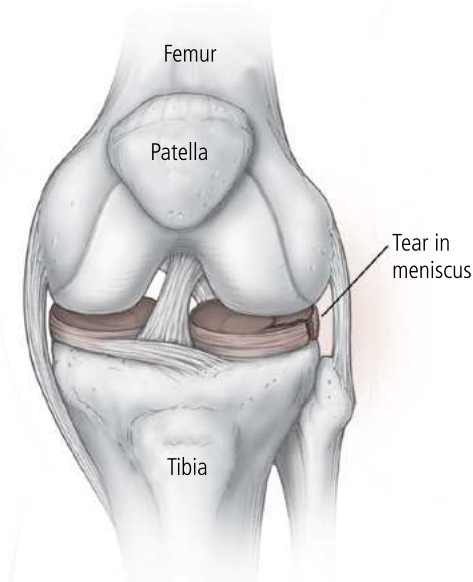
If pain persists, depending on the size and location of the tear, doctors may choose one of three surgical approaches: repair, removal, or replacement. Most surgeries can be performed using a technique called arthroscopy (see page 35), in which a surgeon makes tiny incisions to insert a miniature video camera to view the inside of the joint and other small instruments to perform the surgery. It is done on an outpatient basis and with a choice of regional or general anesthesia.

Because the shock-absorbing role of the menisci is so important, doctors remove as little as possible. Even if your menisci have weakened—and most tears in people over age 45 are not repairable because of the degeneration of the tissue—the tissue may still be worth keeping. If part of the ripped meniscus is blocking normal joint motion, the surgeon removes that section to create a stable surface that no longer catches when the knee moves.

If you have osteoarthritis as well as a torn meniscus, surgery might not help. A 2020 study in the journal *Arthritis and Rheumatology* reported five-year follow-up results of an earlier trial, in which 351 middle-aged people (45 and older) with meniscal tears and osteoarthritis were randomly assigned to either arthroscopic surgery or to more conservative treatment, such as physical therapy and pain relievers. Pain improved considerably in both groups. But during the follow-up period, more people in the arthroscopy group went on to have knee replacement.

A third, though uncommon, option currently under investigation is a meniscus transplant. It is appropriate only for certain cases, such as when a young person has a well-preserved knee joint and a

Figure 4: Torn meniscus



When the shock-absorbing cartilage in the knee is torn by injury or worn ragged by use, the result is called a torn meniscus. Stiffness and a vague sensation that the knee is not moving properly often result. This problem can also cause the knee to “catch” or “lock.”

meniscus that has already been trimmed after a tear. The transplant is performed arthroscopically with regional anesthesia, using a meniscus from a deceased human donor. The procedure seems to have a fairly high success rate but has not yet been fully evaluated in clinical trials and is currently not a viable alternative for most patients. Artificial meniscus implants are also in development but have not undergone enough follow-up research to determine how well they perform.

After surgery, you'll return home on crutches for a few days. You can resume normal activities after about a week and start more demanding activities, such as sports, in about four to six weeks. Recovery and rehabilitation take longer after a meniscal transplant; during recovery, you'll need crutches for about three to four weeks and will need to wait three to four months to resume running and possibly five to six months before returning to other recreational activities.

Rehabilitation includes exercises to improve the strength and flexibility of muscles surrounding the knee (hamstrings, quadriceps, and calf, or gastrocnemius) and the range of motion of the joint. Strengthening your quadriceps will help make up for a lack in the knee's built-in shock absorption. Light exercise that does not put a lot of weight on the knee—such as swimming, riding a stationary bike, or using an elliptical machine—can help rebuild strength.

Ligament damage in the knee

Of the four major ligaments that support the knee joint and help control knee motion (see Figure 1, page 2), two are most easily ruptured or torn: the medial collateral ligament (MCL), which connects the thighbone to the shin bone on the inside, or big-toe side, and the anterior cruciate ligament (ACL), which connects the thighbone to the shin bone in the center of the knee.

Each year, approximately 200,000 people in the United States injure an ACL. A bit less than half of those injuries are ruptures. ACL injury is sometimes accompanied by MCL injury on the inside of the knee. Women are more than twice as likely as men to experience an ACL injury. People who participate in sports such as basketball, football, skiing, and soccer—which involve changing direction rapidly, stopping suddenly, or landing awkwardly—are at high

Symptoms of ligament damage in the knee

For injury to the medial collateral ligament (MCL):

- Pain and tenderness on the inside of the knee
- Wobbling of the knee or the knee giving way
- Swelling
- Sensation of the knee "opening up" with each step (in severe injuries)

For injury to the anterior cruciate ligament (ACL):

- A popping sound at the time of injury
- Swelling, which may cause pain
- Instability, ranging from wobbling to an inability to get up

risk for an ACL injury as well. About half of ACL injuries occur together with damage to the meniscus, articular cartilage, or other ligaments. MCL injuries are common in high-level athletes in sports involving pivoting movements. These can often be treated conservatively but can take several weeks to heal before a return to activity is possible. Legendary football quarterback Tom Brady suffered an MCL injury during his last season with the New England Patriots in 2019 and finally received surgery for it after winning a Super Bowl with the Tampa Bay Buccaneers in February 2021. Basketball star Kawhi Leonard of the Los Angeles Clippers sat out much of the 2021 NBA season after surgery for a partial ACL tear.

Diagnosing ligament damage. The doctor will compare the injured knee with the uninjured one and feel for swelling, tenderness, or laxity in the ligament. Imaging tests may also be performed. Additional tests will depend on which ligament appears damaged.

Treating MCL damage. Once your knee is stabilized in a light brace, ice and elevation will help reduce swelling. Take NSAIDs to help relieve pain and inflammation. Limit physical activity until the pain and swelling go away. Surgery is rarely needed unless the ACL is also injured. Physical therapy can gradually improve your range of motion and the strength and flexibility of your quadriceps and hamstrings. Depending on the severity of the injury, it may take as little as a week or more than two months for you to return to normal activities.

Treating ACL damage. The first steps are the same as for MCL damage: use ice and compression,

and elevate your knee whenever you sit or lie down. For pain relief, start with over-the-counter NSAIDs.

To rest your knee, use a brace to keep it straight and crutches to keep weight off your leg. Although the ACL cannot heal, one in three people regains enough strength in the knee to return to nondemanding activities without surgery. However, this isn't easy. It may require a year of rehabilitation before muscles are strong enough to compensate for the loss of stability. Even so, your knee may sometimes pop out of joint. Your doctor may suggest an ACL brace to use during occasional strenuous activity. If you wish to return to activities involving jumping and pivoting, you will probably need surgery.

To determine whether you should have surgery, you and your doctor will need to consider your age, your activities, how unstable your knee is, whether your ACL is partially or completely torn, and other injuries.

ACL surgery lasts about two hours and involves the replacement of the ligament with a tendon. (The transplanted tendon essentially becomes a ligament.) The procedure is usually done using arthroscopy (see page 35). After drilling holes in the bone where the ACL attaches, the surgeon inserts either a transplanted tendon taken from your own kneecap or hamstring, known as an autograft, or a piece of tissue from a donor, called an allograft. The surgeon fits the ends of the tendon into the holes and screws them into place.

After surgery, you'll go home with crutches and may use a brace that either holds your leg straight (when locked in an extended position) or allows it to bend for sitting (when unlocked). During the first two weeks after surgery, you should ice your knee regularly to reduce swelling and pain. Physical therapy will focus on improving your strength, stability, and movement. Your muscle strength dictates when you may resume various activities, usually at least 10 weeks after surgery for normal activities and about six months for sports.

Both before and after surgery, you should participate in physical therapy to gain as much strength and range of motion as possible. Even if you don't have surgery, you must make an ongoing commitment to strengthening your knee muscles.

ACL reconstruction surgery has long-term suc-

cess rates of 82% to 95%. The reconstructed ACL fails or becomes unstable in 5% or less of cases, as long as the graft is properly selected and placed.

Kneecap problems

When you put your weight on one leg to step out of your car or go up a stair, does your knee hurt? The thighbone and kneecap must move smoothly past each other as your body weight bears down on the joint with each step up or down. When something goes wrong, pain will quickly follow.

As you bend and straighten your knee, the kneecap (patella) rides up and down a groove called the trochlea in the front of the thighbone. This movement of the kneecap within the trochlea is referred to as patellar tracking. The kneecap is covered by the quadriceps tendon and is firmly attached to the strong quadriceps muscle. At the bottom, it connects to the shin bone via the patellar tendon. A variety of conditions can throw off the kneecap's position and movement, causing pain and other symptoms.

Patellofemoral pain syndrome

Patellofemoral pain syndrome is characterized by pain in the front of the knee, under and around the kneecap. The term is often used interchangeably with "runner's knee" or "anterior knee pain." The term "runner's knee" is particularly apt; patellofemoral pain syndrome accounts for 16% to 25% of all injuries in runners. But patellofemoral pain syndrome is not restricted to athletes. In fact, it is the most common diagnosis given to nonathletes who visit their doctor's office for knee pain. The condition is more common in women over 40 and in physically active teenage girls.

Patellofemoral pain often results from the kneecap failing to stay centered in its groove as you bend and straighten the leg. Three major factors are involved, although their relative contributions can differ greatly from person to person:

- **Malalignment.** People with a high Q-angle (see Figure 2, page 5) are at higher risk, as are people whose arches flatten with each step.
- **Muscle imbalance and tightness.** Tight hamstrings, calves, and hip muscles increase the pres-

Symptoms of patellofemoral pain syndrome

- Pain in the front and center of the knee (often in both knees) during and after physical activities, especially those that repeatedly put weight on a bent leg (running, step aerobics, basketball)
- Pain from prolonged sitting
- Knee puffiness after activity

sure between the kneecap and the thighbone. Of the four muscles that make up the quadriceps, three pull the kneecap toward the outside; if the innermost quadriceps muscle is relatively weak, this can create tracking problems with the kneecap.

- **Overuse.** Bending the knee moves the kneecap tighter against the thighbone. Patellofemoral pain syndrome worsens with activities that put weight on the knee while it is bent, such as squatting or running on steps and hills.

Diagnosing patellofemoral pain syndrome.

During an exam, your doctor will feel your kneecap to look for tender spots, abnormal movements, and grinding under the kneecap as it moves (crepitus), and to determine how easily the kneecap moves out of regular alignment. The doctor assesses the alignment of both knees and legs. Your doctor may look at the bottom of your shoes to see if the sole is worn more in certain places, which may reveal whether your feet and ankles roll inward (pronation) or your feet need more arch support. X-rays and other imaging tests are used only if you fail to see improvement after several weeks of treatment.

Treating patellofemoral pain syndrome. A rehabilitation plan prescribed by a doctor or physical therapist will help you regain strength and range of motion. Rest your knee, apply ice packs, and keep your knee elevated (see “RICE,” page 29; note that compression—the third element of RICE—is not needed). Most cases do not involve dramatic swelling. Take acetaminophen or NSAIDs as needed to help relieve pain. Substitute low-impact activities—such as walking on level ground, swimming, or using a stationary bike or elliptical trainer—for high-impact activities like running or jumping. A light knee sleeve (a neoprene wrap without

clasps or Velcro that you pull up over your knee as you would pull on leggings) can be helpful during activities that do add load to the knee. After activity, ice the knee for 10 to 20 minutes. Exercise to strengthen your quadriceps muscles (see Figure 3, page 8), adding small ankle weights after two weeks. Stretch to increase the flexibility of your hamstrings, calves, and hip muscles. Your physical therapist can identify which areas need the most attention. Arch supports or better-fitting athletic shoes may be helpful as well.

It may take six weeks or more to notice an improvement. After you feel better, you may be able to gradually return to higher-impact activities. You should continue to do the exercises you learned during rehabilitation even after your condition improves. Surgical treatment for patellofemoral pain syndrome is rarely recommended.

Osteoarthritis of the knee

Osteoarthritis affects more than 30 million Americans, and one in three people over age 62 has some degree of osteoarthritis in one or both knees. This disease causes the breakdown of articular cartilage, the tissue that covers and protects the ends of bones where they come together to form joints. Although osteoarthritis can appear in any joint, the knee is particularly vulnerable because it is a weight-bearing joint that is subject to daily wear and tear as well as sudden injury. Not surprisingly, meniscal tears often occur together with osteoarthritis.

The average age at which knee osteoarthritis strikes has dropped from 69 to 56 since the 1990s. Why do some people get osteoarthritis while others don't? In part, it's genetic. If your parents or grandparents had arthritis, you are at increased risk of developing it yourself. Gender makes a difference: women have a higher risk than men for developing osteoarthritis. Weak muscles around the knees, particularly among women, can also raise osteoarthritis risk.

Other factors matter, too. Quite probably, two of these factors—rising rates of obesity and certain sports injuries—are causing osteoarthritis to strike earlier in life. One study estimated that knee osteoarthritis in older men would drop by a fifth and in older

Symptoms of knee osteoarthritis

- Intermittent or steady pain
- Stiffness when you get up from sitting or lying down
- Swelling or tenderness
- Grinding or crunching sounds

women by a third if those who are obese (defined as having a body mass index, or BMI, of 30 or higher) lost enough weight to fall into the overweight category (BMI of 25 to 29). Studies suggest that type 2 diabetes, a disease associated with obesity, is also a predictor of developing severe osteoarthritis. In addition, sports injuries such as ACL tears can raise osteoarthritis risk.

Whatever the cause, the result is pain and disability. Early in the disease process, the space between your tibia and femur decreases as the cartilage wears away (see Figure 5, below right). Once the cartilage disappears, bone rubs on bone, causing stiffness, an aching pain, or occasional flares of intense pain, and often the formation of bony growths known as bone spurs (osteophytes) around the joint. For many people with osteoarthritis, pain tends to worsen as muscles tire during the day.

Diagnosing knee osteoarthritis. To diagnose your condition, your doctor will ask you about your symptoms and medical history and may suggest laboratory tests and x-rays. If the osteoarthritis has progressed far enough, x-rays may show a reduction in the joint space in the knee or the presence of bone spurs. There is no specific blood test for osteoarthritis. If your knee is suddenly swollen for no apparent reason, your doctor may remove some of the synovial fluid in the joint to check for signs of infection or arthritis. An excess amount of normal synovial fluid or synovial fluid that is thinner or less elastic than normal may be a sign of osteoarthritis, whereas synovial fluid that is opaque and deep yellow or greenish yellow may indicate inflammation, which is characteristic of rheumatoid arthritis, a joint disease in which the body attacks its own tissues.

Treating osteoarthritis of the knee. So far, osteoarthritis has no cure. Although techniques to regrow cartilage in the laboratory are improving, implant-

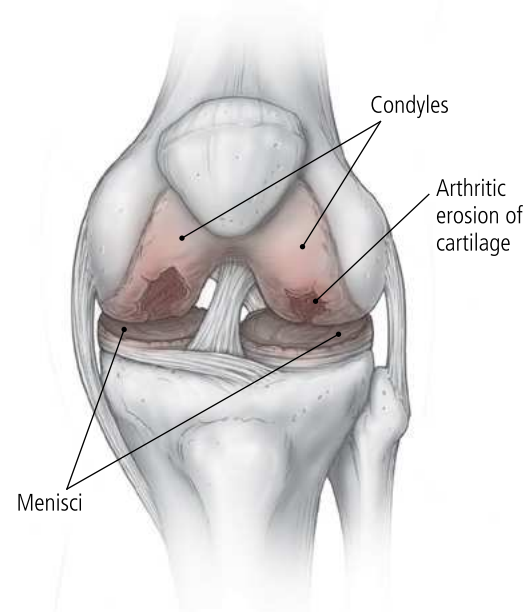
ing new cartilage and getting it to grow in an osteoarthritic knee is challenging and may depend on the amount of arthritis and its location.

Doctors focus on three things when treating osteoarthritis: relieving pain, protecting joints from further damage, and improving muscle tone with physical therapy to help stabilize joints and prevent deformity. Taking these steps will help preserve function.

For pain relief, over-the-counter pain relievers, including acetaminophen or NSAIDs, can be effective. A combination of these medications may bring more relief than using one of them alone. Do not exceed recommended dosages. Pain relievers have a variety of side effects, so it's important to discuss your personal health risks with your doctor when considering regular use. Occasionally, a doctor may inject a long-acting corticosteroid drug into a joint, often combined with a local anesthetic, to ease pain. However, repeated injections may speed degeneration of cartilage (see "Corticosteroids," page 32).

Physical therapy is an important component

Figure 5: Osteoarthritis of the knee



Age, mechanical wear and tear, genetics, and biochemical factors all contribute to the gradual degeneration of the cartilage and the meniscus. In this illustration, the articular cartilage of the condyles (knobs at the lower end of the thighbone) is degraded. Tenderness and morning pain that lasts less than 30 minutes are telltale signs of osteoarthritis.

of osteoarthritis management. It includes exercises selected to gently stretch and strengthen the muscles around the affected joint (see “Exercising with a physical therapist,” page 30). Engaging these muscles can help dampen stresses through the joint and minimize problems such as stiffness and limited motion. Most patients with osteoarthritis will benefit from physical therapy, but they may also need other treatments like NSAIDs and corticosteroid injections to reduce inflammation.

Self-help for osteoarthritis of the knee. The right kind of exercise is a crucial component of osteoarthritis treatment. It can reduce pain as well as improve your balance and your ability to walk and do everyday tasks. Regular exercise is important because the muscles surrounding the knee are prone to atrophy when not used. But choose your exercise carefully. Running on an arthritic knee may aggravate the problem. Walking can also be a problem because it puts full weight-bearing stress on your knees. It’s best to switch to an activity like bicycling or swimming that doesn’t place as much weight on the knees. Using weight machines strengthens the muscles surrounding the knees. Range-of-motion exercises help maintain joint function and relieve stiffness.

Because the knee must bear the weight of your body, weight loss can help ease the discomfort of knee osteoarthritis. You can also take weight off the knee by using a cane or another walking device. In a two-month trial, cane users had less pain and better knee function and could walk significantly farther in six minutes than those not using canes. A walking stick, like the kind used by hikers and sold at outdoor recreation stores, can also take some pressure off. Hold the cane or stick in the hand opposite the affected knee. Well-cushioned shoes can also reduce the impact on your knees.

Complementary approaches (see page 34) have not proved to be especially helpful.

Surgery. Physical therapy is the first-line treatment for knee osteoarthritis, but ultimately, knee replacement may be the best treatment for arthritic knees. The unrelenting breakdown of cartilage characteristic of the disease means that many people with osteoarthritis will eventually require knee replacement surgery. The vast majority of people who undergo total

knee replacement (replacement of the entire knee joint) have osteoarthritis. While knee replacement surgery is highly successful, artificial knees have a limited life span of 15 to 25 years. This makes it useful to delay getting an all-new knee until absolutely necessary. (For more details on knee replacement, see the Special Section, “Knee and hip replacement,” page 36.)

In certain cases, your doctor may recommend a different surgical procedure to help postpone the need for total knee replacement.

- **Arthroscopy.** This surgical procedure uses a miniature video camera and other small instruments inserted through small incisions to diagnose and repair joint problems. It can be used to surgically trim the meniscus in people with both osteoarthritis and a torn meniscus who have exhausted other conservative treatments. However, a large multicenter trial showed no benefit to the procedure over physical therapy.
- **Osteotomy.** During this procedure, the surgeon reshapes the shin bone and thighbone to improve the knee’s alignment. The result is better knee function and less pain. You may be a good candidate for osteotomy if you are young, active, or overweight; if your knee damage is correctable; if the damage is primarily confined to one part of the knee; and if the area shows no signs of inflammation.
- **Cartilage restoration.** This technique has also made advances in recent years. It involves harvesting cartilage cells from the knee, cloning and reproducing them in a lab, and then grafting them onto the knee joint. A newer technique called matrix-associated autologous chondrocyte implantation (MACI) uses a type of glue to connect the new tissue directly to the damaged area without the need for sutures. Cartilage restoration generally works best for younger people and those with limited areas of cartilage damage.
- **Radiofrequency ablation.** Another new approach uses radiofrequency energy to destroy the nerves that transmit pain signals to the brain. This procedure can provide relief for about six months, but it doesn’t reduce the stiffness, swelling, and progression of arthritis. The treatment is still being evaluated and is used only after other treatments have failed. ♥

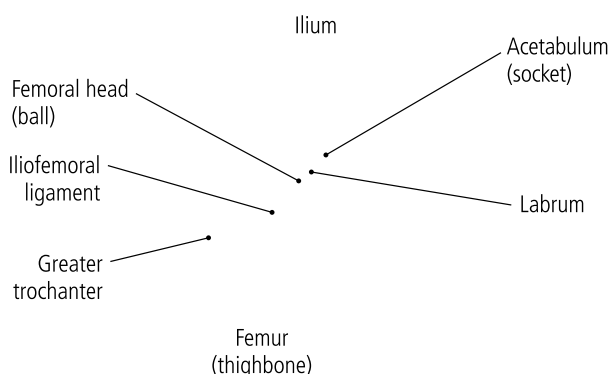
Hips in motion

The hip has a remarkable range of motion. Watch a ballet dancer or an experienced yogi, and you can appreciate how the hip allows you to move in almost any direction, if only the muscles are willing.

People tend to think of the hip as the part of the bone they can feel on the side of the body. But it is actually a large region that extends to the thigh and groin. A malfunction anywhere in this large area can cause pain and decrease mobility.

In younger people, an accident or collision is often the cause of hip damage, although anatomical abnormalities can also play a role. As people age, the gradual erosion of the cartilage that cushions the joint is the more typical cause of pain and immobility. The bone-thinning disease osteoporosis can also take a gradual toll, setting the stage for a fall that fractures the hip. This chapter covers the most common problems. But first, a brief summary of hip anatomy will help you understand the issues that can affect hips.

Figure 6: A look inside the hip joint



The hip is a ball-and-socket joint reinforced by a strong ring of cartilage (labrum) inside the socket (acetabulum). Supporting ligaments allow for a wide range of motion while the hips bear the full weight of the upper body.

Hip anatomy 101

Like the knee, the hip comprises a network of bones, cartilage, ligaments, and muscles. In contrast to the knee, however, the hip has a ball-and-socket joint—the most flexible type of joint, allowing movement in multiple directions.

Bones

Key bone structures in the hip include

- the thighbone (femur)
- the femoral head (the top end of the femur, which forms the ball of the joint; see Figure 6, below left)
- the acetabulum (the socket, deep in the pelvis)
- the ilium (the uppermost and largest part of the hip bone)
- the greater trochanter (a protrusion on the upper part of the femur, to which soft tissues attach).

Thanks to the perfect fit of the ball and socket, along with the slick cartilage coating the bones and the synovial fluid lubricating the space between them, the friction between the ball and socket in a healthy hip is less than that of two ice cubes rubbing together.

Cartilage

The hip socket formed by the acetabulum is cushioned and reinforced by a rim of strong cartilage called the labrum, which holds the femoral head securely in place.

Ligaments

The hip joint is surrounded by a strong joint capsule made up of four ligaments, the most important of which is the iliofemoral ligament. These tissues keep you from moving the hip to an extreme position that could dislocate the joint.

Muscles

Muscles in the thigh and lower back help stabilize and move the hip. The large gluteus maximus muscles in the buttocks extend the hips when you move your leg back-

ward or to the side. The hamstrings also extend the hip, while the hip flexors (a muscle complex that runs from the lower back to the front of the thigh) help flex the hip when you lift your leg to the front. Muscles of the groin and abdomen are also involved in hip movement.

Bursae

Places in the hip where tendons, muscles, and bones meet are protected by small liquid-filled sacs called bursae (see Figure 8, page 22).

Evaluating hips

During your examination, the doctor will ask you questions about pain and other symptoms. Be sure to describe sensations in the entire leg: a hip problem may cause pain in the front, side, or back of your hip, in the groin, and even in the knee. (See “Your medical history,” page 4, to help you frame your answers.) Mention any physical labor or sports you participate in and falls or injuries you have experienced. Even if you landed on your knees rather than your hip, you may have jolted your hips.

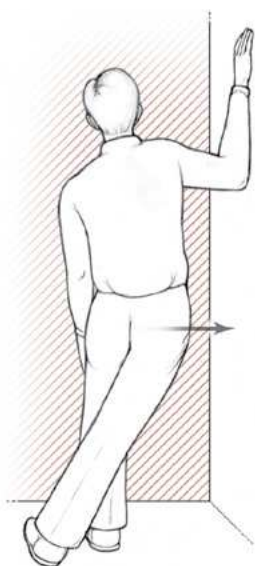
Your doctor will watch you walk to observe unevenness or changes in your gait. Hip pain or muscle weakness can change how you walk. Speak up if any portion of your stride hurts. Your doctor may examine your shoes for signs of abnormal wear. He or she will observe

how far you can flex your knee toward your chest and extend your leg out behind you, and how readily you can move your leg out to the side and across your midline. As you lie on your back, your doctor will measure how far you can rotate your hip externally (letting the knee fall toward the outside of your body) and internally (letting your knee turn toward your midline). As you move or try to resist pressure applied by your doctor during different maneuvers, the doctor will assess pain, muscle strength and restrictions, and any grinding or snapping in the joint.

Along with the hip exam, your doctor will examine the position of your pelvis, compare your leg lengths, test nerve function in your legs, and check your feet and ankles for swelling that might indicate impaired circulation. He or she will also examine your spine for curvatures or conditions (such as a pinching of the sciatic nerve) that can cause hip pain.

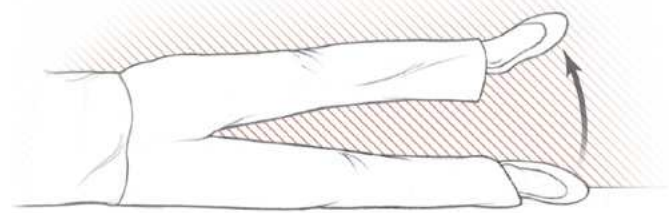
You may need imaging tests to help the doctor identify your hip problem. Two possibilities are x-rays and MRI. Sometimes an iodine-based dye is used to enhance the resolution of the MRI in order to reveal hip problems. Called an MRI arthrogram, this imaging technique may be coupled with an injection of anesthetic into the hip (anesthetic arthrogram). By allowing the doctor to judge the effect of certain maneuvers performed before and after the anesthetic is injected, this test can help pin down the diagnosis.

Figure 7: Hip stretching and strengthening exercises



Iliotibial (IT) band

stretch: It's common for people with hip problems to lose motion if the IT band is tight; stretching the IT band can increase joint flexibility. With your right arm on the wall for support, cross your right foot behind your left. With both feet on the floor, slowly lean your hip toward the wall. Hold for 20 seconds. Switch sides and repeat.



Side leg lifts: To strengthen the gluteal muscles that support the hip, lie on your side with legs straight. Lift one leg slowly and hold 10 to 20 inches off the floor. Hold for 10 seconds. Lower slowly and repeat until your muscles feel fatigued. Switch to the other leg.

Overuse injuries

Muscles of your thighs, abdomen, and buttocks attach at your hip joints. You can injure these muscles and nearby tendons when you exercise too much or participate in activities that you don't do regularly or for which you lack sufficient conditioning.

Hip muscle strains

With age, the hip muscles become prone to strains, particularly the hamstrings in the back of the thigh, the hip flexors in the front, and the adductors on the inside of the thigh. A mild strain involves overstretching the muscle; a moderate strain, mild tearing; and a severe strain, a full tear. Heavy lifting or pushing, cycling (especially if your seat isn't high enough), high kicking, martial arts, playing soccer with lots of kicking, or running with knees lifted high can all cause hip strain.

Diagnosing hip muscle strains. The doctor will look for weakness in your hip muscles—for example, by asking you to press your thigh upward against resistance—and will look for irregularities in your gait when you walk.

Treating hip muscle strains. Initial treatment consists of rest and ice along with pain medications such as acetaminophen, ibuprofen, or naproxen. If the pain is severe, you may need crutches to take weight off the area when you walk. After swelling improves, usually in several days, you can begin gentle stretches, using heat and ice as needed (see “RICE,” page 29, and “Heat,” page 30). Rehabilitation after hip muscle strain

involves strengthening and stretching the muscles, improving endurance, and training before returning to regular physical activity.

Tendinopathy (tendinitis, tendinosis)

Hip tendinopathy is a chronic disease of a tendon attached to the hip. As with knee tendinopathy, the condition is commonly referred to as either tendinitis (inflammation of the tendon) or tendinosis (damage from microscopic tears and degeneration). Tendinopathy of structures attached to a hip flexor muscle, such as the iliopsoas tendon, occurs commonly in older people whose gait has been thrown off by related problems in the spine, knees, ankles, or hips. In younger people, it develops more often in athletes, such as gymnasts and dancers, who repeatedly lift the leg while their hip is rotated out. Runners are particularly vulnerable when they train on hills and increase their mileage rapidly.

Diagnosing tendinopathy. The doctor checks for pain by pushing against your thigh as you flex your hip (moving your knee toward your chest while you sit or lie down). Tell your doctor where you feel pain and what activities seem to trigger it.

Treating tendinopathy. Initially, the goal of treatment is to reduce inflammation and make you more comfortable, using ice and acetaminophen or NSAIDs. After a few days, you can try heat. During the first few days, don't put unnecessary pressure on the area. Sleep on your unaffected side with a pillow between your legs. Once swelling has subsided, you can gently begin to exercise the area to improve the strength and flexibility of the muscles. If you know what activity led to your tendinitis, avoid it for at least 10 days or until you are pain-free. If you do begin again, start at a lower intensity. Your doctor or physical therapist may suggest exercises that emphasize eccentric contractions, in which the muscle lengthens while working (to control a movement—for example, lowering a barbell or

Symptoms of hip muscle strains

For hip flexor strain:

- Pain near the crease where the thigh meets the pelvis
- Pain or pinching when pulling your knee to your chest

For hamstring strain:

- Pain at the back of the thigh
- Swelling and sometimes bruising in the back of the thigh
- Muscle spasm of the hamstring
- Pain when walking or when bending and straightening the leg
- A popping or tearing feeling when serious injury occurs

Symptoms of tendinopathy of the hip

- Groin pain
- Pain at the side of the hip when you rise from a chair or climb stairs

descending a staircase), rather than concentric contractions, in which the muscle shortens while working (for example, lifting the barbell or climbing the stairs).

If your pain does not respond to treatment, you may need other tests to rule out a fracture or tumor.

Bursitis

Bursae sometimes become inflamed, creating stiffness and pain (see Figure 8, page 22). Hip bursitis is more common in women and in middle-aged and older people. There are multiple types of hip bursitis:

- **Trochanteric bursitis** can result from a single hard fall on your hip or the accumulation of minor stresses—such as small injuries, excess pressure on one hip when you walk or run (from scoliosis, other joint damage, or unequal leg lengths), carrying a shoulder bag that hits against the side of the hip, and even lying on one side of the body for an extended period (perhaps after another injury). In women and in middle-aged and older people, particularly those who exercise only sporadically, a tight iliotibial band is likely to cause pain in the hips (see “Iliotibial band syndrome,” page 9). The pain is usually located about one inch behind the trochanter (the bony bump at the widest part of your hip). A tight iliotibial band can mimic the symptoms of trochanteric bursitis; in some cases, it can cause it.
- **Ischial bursitis** occurs when the bursa under one of the ischia (the bones you sit on) becomes inflamed. As suggested by its nicknames, “weaver’s bottom” and “tailor’s seat,” it can occur from prolonged sitting on a hard surface, as well as from a fall or repeated friction during bicycling or rowing.
- **Iliopsoas bursitis** affects the protective sac that lies between the front of the hip joint and the iliopsoas muscle, one of the hip flexors. It can be associated with rheumatoid arthritis or osteoarthritis of the hip, or with overdoing activities that require repeated hip flexing (such as soccer, ballet, jumping hurdles, or running uphill).

Diagnosing bursitis. During your medical exam, your doctor will probably check the range of motion in your hip joint and press on the hip bursae to check for tenderness. You may have an x-ray or MRI scan to rule out conditions that sometimes cause similar symp-

Symptoms of hip bursitis

For trochanteric bursitis:

- Aching or burning on the outside of the upper thigh
- Pain that moves down the outside of the thigh to the knee
- Increasing pain when you lie on the affected side
- Pain that interferes with sleep
- Pain triggered by walking, climbing stairs, or getting up from sitting

For ischial bursitis:

- Dull or sharp pain in the lower buttock
- Pain that increases when you sit down or lie on your back
- Radiating pain in the back of the thigh

For iliopsoas bursitis:

- Pain in the front of the hip that worsens when you flex the hip
- Radiating pain down the front of your thigh
- Limping (if only one leg is involved) or taking smaller steps
- Limited range of motion in the hip

toms, such as a fracture, a bone spur, arthritic joint damage, a tumor, or an area of dead bone. If there’s a chance a bursa is infected (a rare circumstance), the doctor removes some fluid from the sac for testing.

Treating bursitis. Treatment includes rest and ice along with pain relievers such as ibuprofen or naproxen. You’ll need to reduce your activity until the symptoms subside, usually in a few weeks. Physical therapy with specific stretching and strengthening exercises may be helpful. For trochanteric bursitis, therapy may involve iliotibial band stretches (see Figure 7, page 19). For iliopsoas bursitis, you can stretch and strengthen the hip flexors and rotators. Talk with your doctor or physical therapist about how to do these exercises. For ischial bursitis, you can temporarily use a cane to take pressure off the affected hip. If needed, a single corticosteroid injection with a local anesthetic typically provides permanent pain relief.

In rare cases, the bursa remains inflamed and painful even after these nonsurgical treatments. If this happens, a doctor can surgically remove the bursa,

Figure 8: Bursitis



The hip has several fluid-filled sacs, called bursae, that help to cushion the joint. When one of these sacs becomes irritated or inflamed, the condition is known as bursitis. Inflammation of the trochanter bursa at the widest part of the hip is the most common type of bursitis in the hip. But inflammation of the iliopsoas bursa near the groin and the ischial bursa that you sit on are common, too.

since the hip can function normally without it. This is a very effective procedure that may be done on an outpatient basis arthroscopically (using small incisions and a device called an arthroscope with a light attached that allows a doctor to look inside the body).

Labral tear

The labrum is the gasket of the hip—the resilient cartilage lining of the hip socket that cushions and seals the joint. A dislocation or other injury of the hip, such as that sustained in a fall or car accident, can tear the thick cartilage (see Figure 9, page 23). In proper position, the labrum creates a vacuum seal that helps keep the hip joint properly lubricated and nearly frictionless. Losing this seal makes the hip joint move with friction, like sandpaper, which invites cartilage damage. People who do a lot of squatting, such as plumbers, are more susceptible to labral tears. A labral tear is more common in someone born with an abnormally shallow hip socket, a condition that puts more pressure on the socket's rim. And doctors have recognized that milder pivoting injuries can also cause labral tears. Sports that require rotation of the hip, including golf and hockey, increase risk, as do running and sprinting. Many labral tears are also linked to abnormalities of the hip bones—

lumps or bumps on the ball of the femur that can tear the labrum. If surgery is recommended, these abnormalities will need to be repaired at the same time as the labral tear; otherwise the tear will recur.

Labral tears are extremely common; most people have one by age 40. A labral tear may cause immediate symptoms or may not bother you, even while it sets the stage for later joint problems. An injured labrum loses some of its ability to protect and cushion the cartilage lining the socket beneath it. A roughened edge may begin to scrape against cartilage on the ball of the hip joint, leading to osteoarthritis of the hip.

Diagnosing a labral tear. Your doctor will extend

► Symptoms of labral tear

- Deep, sharp pain in the groin or the front of the hip when you deeply bend your hip joint or rotate the hip
- Pain that worsens during a high pivoting motion such as in basketball, tennis, or soccer
- Limited range of motion
- Locking or catching when pivoting or twisting
- Painful clicks and pops
- Symptoms such as back pain or groin pain that can seem unrelated to hip injury

your hip fully and put it through various motions to check for pain, clicking, and restricted movement. The hip may hurt when the doctor turns it inward, and it may click when the doctor pulls it to maximum extension. The findings are often not definitive, however, and confirming the diagnosis can be difficult. Standard x-ray and CT scans may help rule out other problems; however, the most accurate imaging technique to detect labral problems is a type of MRI called contrast MRI or arthrography, in which gadolinium (a metal contrast agent, or dye) is injected into the hip joint before the scan to increase the contrast and resolution in the image. Still more definitive is a surgical technique called arthroscopy, in which the surgeon can look directly into the joint.

Treating a labral tear. Nonsurgical treatments include pain-relief medication, physical therapy, and temporary use of crutches until symptoms subside. The tear itself will not heal or disappear, but usually your pain and other symptoms will improve. Corticosteroid injections into the hip joint, performed under x-ray or using ultrasound for guidance, can also help relieve pain and reduce inflammation.

If your condition interferes with movement or your doctor thinks it will lead to joint degeneration, you may undergo arthroscopic surgery. The surgeon confirms the diagnosis and treats the tear, usually all in the same procedure. Treatment involves either cutting

When young hips go bad

Doctors have discovered that the labrum is susceptible to damage when an irregularity or bump on the ball at the top of the thighbone or the edge of the acetabulum wears away at the labrum, causing damage. Pain, inflammation, and disability can result. This condition, known as femoroacetabular impingement (FAI), has temporarily disabled even young professional athletes. It is thought to contribute to early arthritis in young athletes. While the causes of the irregularity are not clear—it may be congenital (present from birth) or caused by an injury—surgical repair can restore the labrum and remove the irregular lumps on the ball or in the socket of the joint to help the joint function more smoothly.

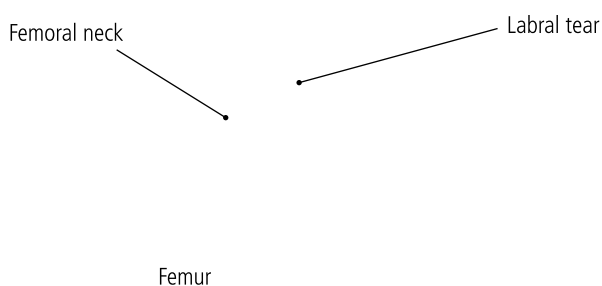
out and removing the torn and frayed areas, or repairing and reattaching the torn cartilage with sutures.

Improved techniques and better surgical instruments now allow surgeons more opportunities to save the labrum, particularly in younger people. In the case of acetabular impingement (see “When young hips go bad,” above), an experienced surgeon can repair the labrum, trim the rim of the acetabulum, and restore the ball of the hip by shaving it into the shape of a sphere. The goal is to improve the fit of the ball in the socket so that it can rotate more smoothly.

Recovery after surgery depends on the extent of the repairs made. You will need crutches for at least several days. Mild to moderate pain is common. You may be able to resume some normal activities after about two weeks and begin participating in sports at about six weeks. It may be four months before you can return to activities like soccer or basketball that involve vigorous movements.

Researchers have found that smokers have a significantly slower rate of healing after labral repairs than nonsmokers. Age and the presence of arthritis may also make a difference. A Harvard study directed by Dr. Scott D. Martin, the medical editor of this Special Health Report, looked at 177 people who had undergone arthroscopy to repair labral tears at least two years earlier. Seventy-one percent had good to excellent results over all, as did 85% of people under 40, but risk for poor outcomes was higher among people over 40 and those with signs of arthritis in the hip.

Figure 9: Labral tear



The labrum is the thick cartilage that lines your hip socket. When the labrum is torn by injury or even by mild twisting movements, it can set the stage for further cartilage damage and osteoarthritis.

Hip fracture

Every year there are over 300,000 hip fractures among people ages 65 and older in the United States—and the total number of fractures is expected to increase as the population ages, according to data from the CDC. Nine out of 10 hip fractures result from falls. Most others occur during car accidents or other traumas.

For thousands of people who break a hip, life is never the same again. As many as half will no longer be able to walk without assistance—even if they were healthy and mobile beforehand. One in five people over age 50 dies within a year of a hip fracture from ensuing health complications. Among elderly people who are institutionalized, the toll is higher—up to half die within one year. Even successfully treated fractures can take a toll: a 2021 study found that after one year, people who'd had hip fractures were less likely than their peers to drive, work, volunteer, or leave the house, and were more likely to suffer from depression.

A variety of factors can influence your risk of suffering a hip fracture. For example, the risk is higher in people with osteoporosis (see Figure 10, at right). One in eight Americans ages 50 and older has osteoporosis, and over 40% already have low bone mass (osteopenia), which in turn increases the risk for developing osteoporosis. The mere impact of walking can break the hip of a person with a severe case.

Gender, race, and age also play a role in determining your risk. Three-quarters of hip fractures occur in women, and white women are far more likely to suffer them than Black or Asian women. People ages 85 and older are 10 to 15 times more likely to fracture a hip than those ages 60 to 65. The risk is also higher for people on dialysis and remains high the first few years after a kidney transplant.

Symptoms of hip fracture

- Severe pain in the hip or groin
- A turned-out leg that may appear shorter than the other leg
- Swelling, tenderness, and bruising around the hip
- Inability to stand up (from either weakness or pain)
- Deformed appearance to the hip
- Hip too weak to lift the leg

Diagnosing hip fracture. A possible hip fracture needs immediate evaluation. An x-ray is likely to show a fracture if one exists. But if it doesn't, and your symptoms strongly suggest a fracture, MRI may reveal a break that has not moved out of place or a fracture involving the hip socket.

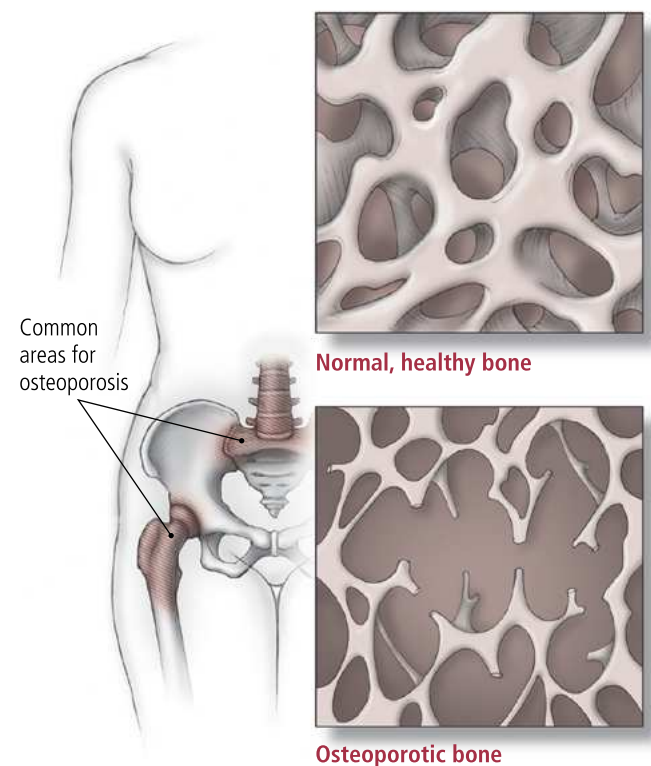
The two most common types of hip fracture involve the thighbone (femur):

- **A femoral neck fracture** occurs in the horizontal section of the thighbone, about one to two inches from the ball of the hip joint.
- **An intertrochanteric fracture** occurs in the thighbone three to four inches below the ball of the hip.

Fractures of the hip socket, which are considered to be pelvic fractures, are less common.

The severity of a hip fracture is judged by how far the bone has moved out of place, which can increase

Figure 10: A fragile state



Osteoporosis causes bone to become porous and fragile. Over time, calcium leaches from the bone, lowering bone density and depleting its strength. The result is bone that is vulnerable to breaks. Osteoporosis contributes to more than two million bone fractures a year. Spinal, wrist, and hip fractures are most common, with hip fractures being the most serious of all.

the complexity of the surgery. If the bone is completely detached at the break site, it is said to be displaced. If the bone has cracked but not separated, it is described as nondisplaced. If the bone has shifted slightly, it is classed as minimally displaced.

Treating hip fracture. The goal of treatment is to reconnect the broken bone and hold it in place so the hip works properly until it has time to heal—about three months. Surgery within 24 hours is usually necessary to make this repair. If you must wait for surgery, the hip may be held in traction (using weights to extend the muscles around the hip).

If you have a femoral neck fracture in which the pieces are not displaced, the orthopedic surgeon may connect the bone with surgical screws. If the bone has moved well out of place, or if you are older and not active, your surgeon may replace the head of the femur with a metal device, a procedure called a partial hip replacement or hemiarthroplasty. Or, if arthritis is present, the surgeon may perform a total hip replacement (see “Hip replacement procedure,” page 44). If you have an intertrochanteric fracture, the doctor will

stabilize the joint with screws and a device that holds the broken bone in place.

After surgery, it can take several months for the hip to heal completely. Initially, you’ll use crutches or a walker, putting weight on the leg only as recommended by your doctor. How soon you can put weight on the leg depends on the repair. The goal of rehabilitation is to get you back on your feet as soon as possible. To prevent another fall, your physical therapist will work to help you develop a secure, balanced gait and will suggest other safety measures. To help prevent a second fracture, you should be evaluated for osteoporosis and treated if necessary.

Your doctor may decide to prescribe a drug from a class of agents called bisphosphonates, which increase bone density by slowing the rate of bone loss. These drugs include risedronate (Actonel) and alendronate (Fosamax), both available in daily and weekly doses; ibandronate (Boniva), which comes in daily or monthly doses; and zoledronic acid (Reclast), a once-yearly treatment given intravenously. They reduce the risk of spine, wrist, and hip fractures by 40% to 50%. An FDA review of the long-term safety of these drugs included reports of several rare but serious adverse effects: unusual thighbone fractures, esophageal cancer, and weakening and crumbling bone in the jaw. More common side effects of bisphosphonates include esophagus and stomach irritation and muscle, bone, or joint pain.

The optimal duration of bisphosphonate use has not yet been established; the American College of Physicians recommends that women take the medications for five years and then re-evaluate the need for therapy with their doctors based on individual risks and benefits. The Endocrine Society recommends re-

Risk factors for hip fracture

Numerous factors can put people at risk for hip fracture.

For women and men

- osteoporosis
- a close relative with osteoporosis who broke a hip or wrist
- a diet poor in calcium and vitamin D
- excessive alcohol consumption
- smoking
- a broken bone after age 50
- overactive thyroid
- kidney failure
- sedentary lifestyle
- general poor health
- taking medications that can make bones more fragile (such as corticosteroids, anticonvulsants, aluminum-containing antacids, and thyroid medication)

For women only

- menopause before age 45
- height over 5 feet, 8 inches, at age 25
- dieting or exercising during the reproductive years to the point where menstrual periods ceased

Calculate your fracture risk

Researchers from the Women’s Health Initiative have developed a risk calculator for women who are either over age 50 or postmenopausal. It assesses a woman’s risk of breaking a hip in the next five years. Risk is calculated based on responses to questions about 11 risk factors. The calculator is available online at <http://hipcalculator.fhcrc.org>.

evaluating after three to five years of treatment, after which those at low or moderate risk could take periodic “holidays” from the drugs.

Osteoarthritis of the hip

The hip joint is one of the most common sites for osteoarthritis. The condition begins with a small amount of cartilage disintegration, resulting in some local inflammation. The process continues as the cartilage erodes and bone spurs form. While there is no ironclad way to prevent this deterioration, most doctors believe that a healthy lifestyle is the best way to avoid hip osteoarthritis—in particular, maintaining a healthy weight from early adulthood on and exercising regularly to strengthen the muscles around the joint.

Hip osteoarthritis is more common among the elderly and those who have had hip injuries, although some conditions, such as femoroacetabular impingement (see “When young hips go bad,” page 23), can contribute to hip arthritis at an earlier age. Obesity also places extra stress on the hips; in the Nurses’ Health Study, an ongoing study of thousands of women, those who were in the heaviest group at age 18 were five times as likely to develop severe hip osteoarthritis than those who were in the lightest group. Recreational physical activities, including running, have not been shown to increase the risk.

Diagnosing osteoarthritis of the hip. Your doctor will ask you about your symptoms and perform a physical exam. Although an x-ray will not show cartilage damage, it may reveal other changes related to osteoarthritis, including decreased joint space, bone spurs, and cysts. A blood test for inflammation helps rule out other possible causes of your symptoms.

Treating osteoarthritis of the hip. The first line of treatment for mild osteoarthritis of the hip is a combination of over-the-counter or prescription pain relievers. NSAIDs may be more effective than acetaminophen in treating osteoarthritis because they not only relieve pain but also reduce inflammation that contributes to pain, swelling, and stiffness. However, adding acetaminophen to ibuprofen or another NSAID makes it possible to use a lower dose and thus

Symptoms of hip osteoarthritis

- Loss of motion in the hip
- Pain radiating to your buttocks or knee
- Pain in the groin or inner thigh
- Groin pain when you get out of a chair
- Difficulty getting in and out of a car
- Inability to walk or bear weight on the leg without severe pain
- Pain when you pivot or rotate the hip inward
- Stiffness after inactivity and first thing in the morning
- Difficulty bending
- Difficulty with foot care
- Limping or other gait changes
- Apparent shortness of the leg on the affected side

minimize side effects. Steroid injections are also sometimes used to provide pain relief.

Exercise is important because it helps keep your hip joints limber. Water exercises are particularly suited for improving the hip’s range of motion and promoting strength and flexibility in the muscles surrounding it. Local chapters of the Arthritis Foundation may offer water and land fitness classes (see “Resources,” page 53). For exercise to be effective, you must make an ongoing commitment to exercise several days a week. In studies from the Netherlands, a 12-week supervised exercise program significantly improved pain and function in people with osteoarthritis of the hip or knee. However, the benefits disappeared within nine months for those who did not continue to exercise. Talk with your doctor or physical therapist about a full program of hip-strengthening exercises.

Resting the hip when you feel pain is also important. A cane or a walking stick held in the hand opposite your bad hip can take pressure off the joint as you walk or do other activities that tend to aggravate the pain. Most people limit stair climbing and cut back on walking longer distances. When showering, use a shower stool and handheld nozzle if standing hurts.

Eventually, hip replacement surgery may be necessary. (For more detail, see the Special Section, “Knee and hip replacement,” starting on page 36.) The vast majority of people who undergo total hip replacement surgery have osteoarthritis. ♥

Testing for knee and hip problems

Sometimes a physical exam and a description of your symptoms provide sufficient information for your doctor to make a diagnosis. When that's not enough, a variety of imaging techniques and laboratory tests can help clarify the situation.

Imaging techniques

Medical imaging lets your doctor see anomalies in the bones and soft tissues of the joint. Each imaging technique offers something different, and the choice will depend on the type of joint damage your doctor suspects.

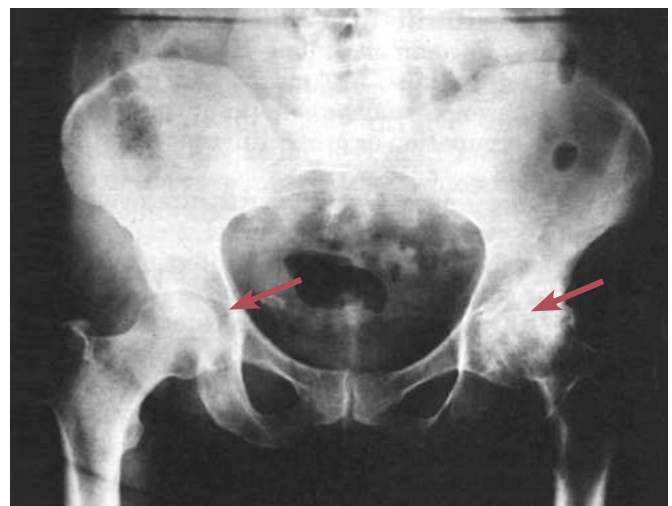
X-ray. A standard x-ray, the most commonly used imaging technique, gives a two-dimensional picture of the bones in your joints (see Figure 11, below right). X-rays can show bone fractures, spurs, loose fragments, dislocation, reduced space between bones, and bone damage from arthritis. But standard x-rays don't show cartilage, ligaments, or tendons; seeing these requires more sophisticated imaging techniques. For a standard x-ray of the knee, you may be asked to lie down or stand while a technician takes several views with your knee in different positions. For a hip x-ray, you will probably be asked to lie down. Even if only one knee or hip causes you problems, your doctor may order x-rays of both of them to compare the appearance of the joints and joint spaces.

Computed tomography (CT). A CT scan can reveal hidden fractures, bone lesions, and other structural abnormalities. A CT scan uses a rotating x-ray tube housed in a doughnut-shaped machine to take many cross-sectional x-rays of your anatomy. A computer assembles these "slices" into a three-dimensional picture. During the scan, which takes less than an hour, you lie on your back on a movable table that is raised, lowered, and moved in and out of the scanner. The equipment doesn't touch you, and the test isn't

uncomfortable. CT is expensive and involves much higher amounts of radiation than standard x-rays, but it provides an enhanced view of bone. This allows your doctor to better evaluate bone shape and diagnose some defects hidden on standard x-rays. CT does not show soft tissue.

Magnetic resonance imaging (MRI). This test does not involve radiation. Instead, MRI uses a strong magnet and radio waves to evaluate cartilage, soft tissues, and bone marrow. MRI is more expensive than CT or standard x-rays, but it's the most accurate way to detect ligament damage, cartilage damage from arthritis, or tears in the cartilage or meniscus. A type of imaging called arthrography, in which gadolinium (a metal contrast agent) is injected into the hip joint before an MRI scan to provide higher-resolution scans, is highly accurate for detecting labral problems, such as labral tears. MRI is also used to evaluate a possible pelvic fracture, tumor, or osteoporosis of the hip. If osteoarthritis is already visible on an x-ray,

Figure 11: Hip x-ray



This x-ray shows osteoarthritis of the hip. Compared with the visible outline of the ball-and-socket joint on the left side of the x-ray, the joint on the right side of the x-ray has noticeably deteriorated.

► Is a virtual visit enough?

The COVID-19 pandemic brought many changes to medical care, including a greater use of “virtual visits,” in which patients interact with clinicians or physical therapists over the phone or a Web-based video interface rather than in person. Because of its convenience, telemedicine will likely continue to have a place in routine care. Virtual visits have several drawbacks, including the inability to use touch or specialized equipment in the examination, but they have become very common for follow-up care of people with hip and knee problems, particularly if travel is difficult. Virtual visits can be useful for gathering initial information, discussing test results, tracking postoperative progress, or managing an ongoing condition. If you opt for a virtual visit, you can help it succeed by making sure you’re in a quiet, well-lit place with a good Internet connection and a steady camera you can move and adjust if needed.

MRI won’t add any more useful information. During the exam, which lasts about 45 minutes, you lie on a scanning table that slowly moves you through the machine. (Many centers have smaller MRI machines that can focus on specific body parts, so if you’re having your knee done, you may only need to insert your leg.) For a hip exam, your feet may be taped together to keep your hips in the desired position. For a knee exam, a wedge may keep your knees at the proper angle. In some cases, the radiologist may inject a dye to obtain better images. You cannot have an MRI scan if you have a pacemaker, aneurysm clips, or other metal implants.

Laboratory tests

While imaging tests can give your doctor a good view of the damage in your knees or hips, laboratory tests are sometimes needed to determine what is causing the damage and how it might be halted.

Arthrocentesis. If you have sudden or unex-

plained swelling in a knee, hip, or other joint, your doctor may remove a little synovial fluid for examination. This procedure is called arthrocentesis. Excess synovial fluid in the knee may indicate infection, injury, inflammation, or crystal deposits (uric acid crystals in the case of gout, or calcium crystals for another arthritic condition called pseudogout). Before arthrocentesis, the skin is cleaned and an anesthetic spray or injection is used to numb the area. The doctor inserts a needle with a syringe attached into the joint space (you may hear a pop) and withdraws a fluid sample, which is sent to a laboratory for analysis. If you have pain afterward, your doctor may suggest ice packs and pain-relief medication. However, the procedure may also immediately lessen pain and pressure caused by excess fluid. Although knee arthrocentesis can be done in the doctor’s office, hip arthrocentesis is performed by a radiologist, guided by fluoroscopy, a type of x-ray that shows internal structures in motion.

Rheumatoid factor. This blood test detects an antibody present in about 70% to 80% of people with rheumatoid arthritis, a systemic autoimmune disease. However, the test is not definitive: the same antibody is also present in people with certain other medical conditions and in some healthy people. In fact, roughly 10% of people who do not have rheumatoid arthritis test positive for rheumatoid factor.

Erythrocyte sedimentation and C-reactive protein. These blood tests are general measurements of inflammation of any kind; the higher the result, the more severe the inflammation. Most people with osteoarthritis have normal values, but those who have inflammatory conditions, such as rheumatoid arthritis, usually have elevated levels. High values may also be an early sign of infection after knee or hip surgery.

Serum uric acid. The serum uric acid test measures uric acid in the blood, which can reveal the presence of gout, a condition caused by the accumulation of uric acid crystals in a joint. ♥

Treating knee and hip pain

Whether it's your hip or your knee that's bothering you, your doctor is likely to recommend less invasive treatments before resorting to surgery. Simply reducing inflammation, relieving pain, protecting the joint, losing excess weight, and building strength in the muscles that support the joint can often improve joint function. The following treatments are some of the options, with the most common ones listed first.

RICE

RICE—which stands for rest, ice, compression, and elevation—is a first-aid strategy for most musculoskeletal injuries, including those involving the knees and hips. It is sometimes the only treatment you need.

Rest. Injuries and flare-ups of pain need a few days of rest in order to heal. However, rest doesn't always mean inactivity or staying off the leg entirely. Depending on the condition, it may be enough to cut back the distance you run or walk, switch to low-impact activities, or exercise using other parts of the body (see “Exercising after an injury,” at right). Using a cane can also give your injury a chance to heal while still allowing you to remain mobile. In the case of ongoing knee and hip problems, long periods of inactivity can actually make problems worse by decreasing flexibility and weakening the muscles that support and protect the joints.

Ice. Cold numbs pain and reduces swelling by constricting blood vessels. After surgery or an injury, apply an ice pack for 20 minutes, remove for 20 minutes, reapply for 20 minutes, and so on, for as long as you can comfortably tolerate it. Never go to sleep while icing an injury, however. Whenever you use an ice pack, be sure to wrap it in a towel or dishcloth. Applying ice directly to the skin can cause blistering and frostbite. Your source for cold can be as simple as a bag of frozen peas. You can also buy easy-to-secure neoprene wraps with pockets for gel packs that you

keep in the freezer. Most elaborate are electric “continuous-flow cold therapy” devices that deliver cold through pads shaped for different joints; your doctor or physical therapist may recommend such a device after surgery.

Ice helps knee injuries of all types. For hip injuries, cold can't penetrate deep into the hip joint itself, but it is still effective for hip pain stemming from problems closer to the surface, such as trochanteric bursitis.

After an injury, use ice alone periodically for 24 to 48 hours. After that, you can continue using ice, switch to heat, or alternate. Heat helps restore and maintain flexibility. You may find it beneficial to use warmth before stretching and other exercise, following with ice afterward to minimize swelling.

Compression. After a knee injury, gentle pressure can reduce swelling and hasten recovery time.

Exercising after an injury

Even if you need to give your hip or knee a rest while an injury heals, you can still remain active. Combine these options to create a routine lasting 30 minutes or longer:

- floor exercises, including abdominal curls, crunches, push-ups, or leg lifts
- hand weight routines, including repeated lifting of small hand weights in different directions
- exercise ball routines, including stretches, abdominal curls, or leg lifts
- swimming
- gentle yoga.



In the “Resources” section on page 53, you'll find information regarding *The Joint Pain Relief Workout: Healing exercises for your shoulders, hips, knees, and ankles*, a Special Health Report from Harvard Medical School that has photographs and descriptions of many exercises that are safe for people with joint pain. However, you should always check with your doctor before beginning an exercise regimen.

Wrap an injured joint in an elastic bandage, taking care that the wrap isn't so tight that the skin below the joint becomes cool or blue. Flexible neoprene knee supports provide compression and have a hole for the kneecap to prevent irritation.

Elevation. Elevating the injured area takes advantage of gravity to reduce the swelling and painful throbbing that occur when lots of blood pools in one area. This step is most useful for the knee; the hip is not generally elevated because it's located in the middle of the body. Prop your knee up on a stool with pillows to raise the height slightly, or lie down with your knee on a pillow. You can elevate it whenever you're resting or sleeping.

Heat

Heat is a good way to reduce pain and stiffness in your joints and relieve muscle spasms. After an injury, wait a day or two for swelling to go down before using heat. You can apply a heat pack directly to the painful area (be careful not to overheat the pack in the microwave), or warm your joints in a hot tub or whirlpool. A 15- to 20-minute soak in a regular bath will also work. Therapists recommend a warm shower or bath before exercising to relax joints and muscles. Heating pads are convenient, but moist heat penetrates more deeply. Dress warmly afterward to prolong the benefit.

To relieve muscle spasms, a physical therapist may use diathermy (deep heat), a technique that uses electromagnetic waves to deliver heat beneath the skin and relax muscles. Electromagnetic waves cannot be used on people with pacemakers.

Cold and heat work well in combination. You may benefit from using heat early in the morning and before exercise and using cold after exercise and at the end of the day to relieve swelling.

Therapeutic exercise

Exercise is more than just a good health habit; it's also an effective treatment for many knee and hip problems. Strong muscles around a damaged knee or hip can help support a joint by taking over some of its responsibilities. For example, your hips will have an

easier time supporting your body weight if your quadriceps, gluteals, hamstrings, and abdominal muscles are strong. Strong quadriceps and hamstrings can take over much of the shock-absorbing role usually played by the meniscus or cartilage in the knee. The proper balance of strength in the muscles can hold the joint in the most functional and least painful position. With any knee or hip problem, the first muscles to lose strength are the largest antigravity muscles—the quadriceps and gluteals—so an exercise plan for any injury is likely to focus on these.

Muscles work in pairs: one contracts while the opposing one relaxes. For example, when you straighten your knee, your quadriceps on the front of your thigh contracts, and the hamstrings on the back relax. Imbalances in the function of paired muscles can cause joint problems and invite injury. If your hamstrings are tight, your quadriceps can't contract fully and may weaken, so exercise the quadriceps and hamstrings (the opposing muscles) equally. Flexibility exercises (to stretch and relax specific muscles) are an important part of an exercise plan to improve joint function.

Generally, people who have compromised knees or hips need to choose their exercise carefully. Running or fast walking on hard sidewalks or pavement is tough on joints. If you love these activities, try doing them on a track or treadmill and wear well-cushioned shoes to lessen the impact. Better still, consider swimming or cycling, which are easier on your joints (see "Everyone into the pool!" on page 31). And do leg resistance exercises two to three times per week to strengthen supportive muscles around the knees. Strengthening muscles through these activities will dampen stresses that travel through the knee.

Exercising with a physical therapist

Physical therapy, including therapeutic exercise, is one of the most common and effective treatments for joint problems, either by itself or as a companion to other therapies. A physical therapist individualizes your treatment program to restore or maintain your physical functioning and carries out specific instructions from your orthopedist.

First, the therapist thoroughly evaluates your

pain, functional ability, strength, and endurance. He or she then recommends exercises to help treat your pain and supervises you doing the exercises. You will receive instructions for exercises you can do at home. A physical therapy session may also involve pain-relieving treatments using ice, heat, massage, or other approaches. The treatment facility may have a pool and various types of exercise equipment you can use.

Gait retraining. Knee and hip problems can disrupt your normal walk by causing pain, restricting joint movement, or weakening muscles. A person's usual pattern of standing, walking, or running may also invite joint problems if weak muscles, poor coaching advice, or bad habits throw off the gait. It may take many years of walking with an abnormal gait before joint injury occurs. Improper running leads to pain and injury more rapidly because it involves greater force with each stride.

A physical therapist analyzes your gait and helps you learn to walk more normally. Initially, the proper gait may feel odd; you will most likely need practice and continued instruction before it becomes comfort-

able. The physical therapist may suggest a change in shoes or specific exercises to strengthen muscles you may be trying to avoid using.

If you have had a knee or hip replacement, gait retraining helps you relearn to stand up straight (the tendency is to lean toward your operated leg) and use both legs evenly.

Ultrasound, phonophoresis, and iontophoresis

Therapeutic ultrasound uses sound waves to reach deep tissues in order to increase blood flow, relax muscle spasms, and aid healing. To do ultrasound therapy, the technician applies a gel to your skin and rubs an ultrasound wand over the area. In a technique called phonophoresis, medication (often hydrocortisone) is added to the gel and the ultrasound transducer is applied over it. Because the ultrasound encourages blood vessels to expand, this approach is thought to deliver more medication to the injured area. Many orthopedic physical therapists use ultrasound and phonophoresis to reduce soft-tissue inflammation (in tendinitis or bursitis, for example) or to manage pain, heal tissue, and help muscles stretch.

Another technique, iontophoresis, uses electrical currents to speed the delivery of medication to the damaged tissue, or simply to reduce muscle spasms and related irritation. Patches similar to Band-Aids are placed on the skin, and a painless, low-level current is applied for about 10 to 15 minutes. You may feel warmth or tingling during the treatment.

Weight loss

Overweight and obesity place extra stress on lower-body joints, raising the risk for osteoarthritis and paving the path toward joint replacement. A study of more than 100,000 patients in Spain found that being overweight increased risk of knee replacement by more than 40%, while obesity more than doubled the risk. Maintaining a healthy weight can help prevent joint problems from developing. If you already have joint problems and are above a healthy weight, try to lose some weight to ward off further damage.

Everyone into the pool!

Exercise in the water has special benefits:

- The water supports your weight, reducing stress on your joints.
- You can try out exercises in a supported environment before doing them on solid ground.
- An 85° F pool is comfortable for exercise and soothes joints.
- You can increase range of motion and endurance without strenuous effort or joint pain.



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The best way to lose weight is to do it gradually by making changes that you can sustain for the long term. Successful weight-loss plans involve both proper eating and exercise. Strive to eat a healthy, balanced diet—one that emphasizes unprocessed foods, vegetables, fruit, whole grains, and lean protein—while watching portions and limiting “empty calories” like added sugars. Pairing dietary changes with sufficient exercise will help. Exercise doesn’t necessarily mean gym workouts; you can keep your body active throughout the day in many ways, choosing activities you enjoy.

Another Harvard Special Health Report, *Lose Weight and Keep It Off*, includes dozens of strategies for weight loss (see “Resources,” page 53, for ordering information). If you need extra help, your doctor can refer you to a nutritionist and a physical therapist to get you on the right track. If you can drop even a modest amount of weight, your joints will thank you.

Medication

Several types of medication are used for knee and hip problems, some to control pain and inflammation and others to interfere with various disease processes.

Acetaminophen. For pain relief, acetaminophen (Tylenol, other brands) is often the first choice because it is effective and easy on the stomach. Do not exceed the recommended dosage of acetaminophen, however, because it can damage the liver, especially in heavy drinkers who may already have some liver damage. (For more detailed advice on dosage, see “Acetaminophen or NSAIDs for pain relief?” on page 10.)

NSAIDs. For pain and inflammation, nonsteroidal anti-inflammatory drugs such as aspirin, ibuprofen (Advil, Motrin), naproxen (Aleve, Anaprox), and several others may be more effective than acetaminophen, particularly during sudden flare-ups of pain, because they are superior at reducing inflammation. There are also a number of prescription NSAIDs such as diclofenac (Cataflam), nabumetone (Relafen), and oxaprozin (Daypro). Stay within recommended dosages. Regular use of NSAIDs can produce gastrointestinal bleeding and ulcers, often without warning, and may increase the risk for heart attacks and strokes.



Maintaining a healthy weight can help prevent joint problems from developing. If you already have joint problems and are above a healthy weight, try to lose some weight to ward off further trouble.

Topical NSAID gels and creams may work for some people, and they pose a lower risk of gastrointestinal complications. Use them according to directions, as it’s possible to overdose on topical treatments, just as you can with pills.

For details on using NSAIDs safely, see “Acetaminophen or NSAIDs for pain relief?” on page 10.

COX-2 inhibitor. Celecoxib (Celebrex) is in a class of prescription NSAIDs known as COX-2 inhibitors, which were designed to relieve pain with less stomach irritation than traditional NSAIDs. Because of possible cardiovascular side effects, you should use celecoxib only if you do not have heart disease, you’ve tried other pain relievers without success, and you are not taking a blood thinner (anticoagulant), such as warfarin (Coumadin).

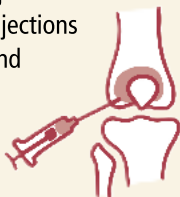
Corticosteroids. Corticosteroids, such as prednisone, relieve pain by reducing the body’s ability to generate an inflammatory reaction. But while corticosteroids are very effective at treating hip and knee problems, long-term use causes numerous side effects: bone weakening, compression fractures of the back, diabetes, increased susceptibility to infections, cataracts, high blood pressure (hypertension), and other health problems. Most side effects occur when these drugs are taken orally, but repeated corticosteroid injections into a joint can thin cartilage and weaken ligaments. When used judiciously in the appropriate situations, though, corticosteroids can provide quick and dramatic relief (see “Corticosteroid injections: How many is too many?” on page 33). It’s best

to turn to corticosteroids only after more conservative measures—such as NSAIDs, therapeutic exercise and strengthening, and weight control—have failed to manage hip and knee problems.

Opioids. Opioid medications such as codeine and oxycodone (OxyContin and others) are another large class of pain-relieving drugs. Opioids work by mimicking the body's natural painkilling substances. Opioids are sometimes prescribed for orthopedic problems such as knee and hip conditions, usually just after surgery, or for severe pain in people who are not helped by NSAIDs or are unable to tolerate them. Opioids do not reduce inflammation and should not be prescribed for arthritis. Side effects such as dizziness, constipation, nausea, and slowed breathing can make it difficult to participate in physical therapy while taking these medications. Opioids can be habit-forming, creating physical and mental dependence, and a tolerance to the drugs can develop in just a couple of weeks. Abuse of these painkillers has become a nationwide epidemic. Opioid drugs were involved in nearly 50,000 deaths in 2019, according to the CDC, and 28% of them involved a prescription opioid. For all these reasons, medications like NSAIDs and acetaminophen are the preferred options to quell pain. When opioids are prescribed after surgery, their use is typically limited to just a few days.

Corticosteroid injections: How many is too many?

For osteoarthritis, most experts recommend limiting corticosteroid injections to no more than one every three to four months—usually a maximum of three times per year in any given joint—because of potential side effects (see “Corticosteroids,” page 32). Some experts recommend a much stricter limit of three such injections in a lifetime, but the prevailing view is that since most people with osteoarthritis will eventually need joint replacement surgery, and since artificial joints have a limited life span, corticosteroid injections are an effective way to buy some time and delay surgery as long as possible. The injections often reduce inflammation and allow you to cut back on pain medications.



Orthobiologics

Orthobiologics are a class of therapies that use substances found naturally in the body to help stimulate injury repair and healing in bones and joints. The idea is to harness the body's own mechanisms for repair and regeneration to help it heal. Orthobiologics are an area of intense current academic research and industry funding. While they hold much potential to treat intractable injuries such as osteoarthritis, in most cases, there's only limited evidence yet that they work. They are considered investigational and are not yet approved by the FDA, but are given to patients at high out-of-pocket costs.

Platelet-rich plasma therapy. This investigational therapy for knee osteoarthritis or injury involves drawing some blood from an individual, spinning it in a centrifuge to isolate the platelets (cells responsible for blood clotting), and injecting plasma enriched with platelets directly into the damaged cartilage of the knee. While it has gotten a lot of hype from athletes and celebrities and is becoming increasingly common in orthopedic practices, the evidence for its effects on osteoarthritis and knee injuries is inconclusive. It's also expensive and is not covered by insurance. More rigorous studies are needed before it can be recommended over other therapies.

Stem cell therapy. Other investigational orthobiologic therapies use stem cells, a type of cell that has the ability to turn into many other cell types. Cells are harvested from a patient's fat, blood, bone marrow, or other tissue, then placed in a centrifuge to separate the stem cells from other cell types in the sample. The stem cells are then injected into a site of degeneration or injury. This approach is most commonly used to treat mild arthritis or meniscus tears in knees, but some doctors have begun to use it as a treatment for osteoarthritis of the hip as well. A 2022 study led by Dr. Scott Martin, the medical editor of this report, found that people with moderate hip arthritis who received treatment with bone marrow cells during arthroscopic hip surgery reported greater functional improvements one to two years after surgery than patients who had the same type of surgery but without the addition of bone marrow cells. Studies have shown that the cells exert anti-inflammatory

effects within joints by blocking chemokines (pro-inflammatory signaling molecules). As more research is done, scientists may better understand how the cells affect injured joints and how their activity could be enhanced.

Complementary approaches

Over the years, people have turned to a wide variety of remedies to cope with the frustrating problem of joint pain. The choices are many, because joint pain has been around for many centuries, and nearly every culture has developed ways to treat it. Many of these remedies lack scientific support. But as long as they are not harmful, there is no reason not to use therapies that seem to bring you relief. Always let your doctor know about any complementary therapies you're using. Following are a few that have at least some level of demonstrated effectiveness.

Acupuncture

This ancient Chinese technique uses slim needles to stimulate points along the body's "energy meridians" with the goal of correcting disease-causing imbalances. Western medicine views the practice somewhat differently, speculating that acupuncture may help relieve pain by stimulating the release of endorphins, natural morphine-like chemicals in the nervous system.

Acupuncture is a popular treatment for knee osteoarthritis, but studies testing its effectiveness have had mixed results. Some have found that it does not provide a significant advantage over a sham procedure, suggesting that some of the reported benefits might stem from a placebo effect. Differences in study design and size, as well as in the training and experience of practitioners, make it hard to draw conclusions about the effectiveness of acupuncture. In its 2021 guidelines for the management of knee osteoarthritis, the American Academy of Orthopaedic Surgeons found only limited evidence that acupuncture is an effective pain treatment. A 2019 guideline from the American College of Rheumatology and the Arthritis Foundation recommended acupuncture only for patients with moderate to severe

knee osteoarthritis who are unable or unwilling to undergo knee replacement surgery.

On the other hand, acupuncture does not seem to cause harm. If you decide to try it, find a certified acupuncturist.

Supplements

Hundreds of dietary supplements aimed at people with osteoarthritis are on the market. However, the search for supplements to help relieve joint pain and restore cartilage has been a roller-coaster ride of encouraging, then discouraging, study results. The two supplements described here have shown some promise, though studies on them have been mixed. Before deciding to take any supplement, bear in mind that the FDA does not evaluate their safety and effectiveness, as it does for medications.

Glucosamine and chondroitin sulfate. Glucosamine is a substance normally found in both cartilage and synovial fluid, and chondroitin sulfate is one component of a protein that makes cartilage elastic. Research has disagreed over whether taking supplements of these substances benefits people with osteoarthritis.

Several studies suggest that taking glucosamine improves arthritis pain in some patients, though the exact mechanism is unknown. However, in its 2021 recommendations for knee osteoarthritis treatment, the American Academy of Orthopaedic Surgeons found that the majority of studies on glucosamine and chondroitin supplements had failed to demonstrate effectiveness compared with placebo. If you decide to try these supplements anyway, track your pain levels and function (such as walking ability). Discontinue the supplements after six months if they haven't helped.

Common side effects include intestinal gas and softened stools. If you're taking blood-thinning medication, tell your doctor, and note if your blood is taking longer to clot. If you have a sulfa allergy, don't take supplements containing chondroitin sulfate. Glucosamine may worsen diabetes, although this connection needs further study. Glucosamine is derived from chitin found in the shells of crustaceans, so people with shellfish allergies may react to it.

Other supplements. Supplements such as turmeric and ginger extract have also been used to manage osteoarthritis pain, but evidence for their effectiveness is thin. Another treatment that has become extremely popular for joint pain is cannabidiol (CBD), a component of marijuana that does not cause intoxication. While preliminary research suggests CBD may help quell inflammation, there is no evidence yet for its effectiveness as a treatment for osteoarthritis pain.

Hyaluronic acid. This compound is found in many types of body tissue, including joints, and is an important component of cartilage. Although supplements and injections containing hyaluronic acid are sometimes used for treating joint pain, scientific evidence for their effectiveness is mixed. A 2019 guideline from the American College of Rheumatology and the Arthritis Foundation recommends against using hyaluronic acid injections for hip osteoarthritis, and advises using them as a treatment for knee osteoarthritis only when a patient and physician decide that other alternatives have failed. The American Academy of Orthopaedic Surgeons does not recommend hyaluronic acid injections for treating either hip or knee osteoarthritis. The injections are also pricey (around \$1,000) and are not covered by most health insurance plans.

Arthroscopy

In some cases, surgeons can work inside a joint and make repairs without fully opening it up. By making small incisions (each about a quarter-inch long), a surgeon can insert a tiny video camera and miniature surgical instruments into the joint and use them to find and repair abnormalities. This approach, called arthroscopy, is less invasive than traditional surgery,

Uses for arthroscopy

- Diagnosing knee or hip conditions
- Treating ligament strains and tears
- Treating rheumatoid arthritis
- Removing bone chips or cartilage pieces
- Treating cartilage tears or deterioration
- Treating certain cases of osteoarthritis

and it causes less pain and fewer complications.

Most arthroscopies are performed on individuals between 20 and 60 years old. Good candidates for the procedure are active people in their 30s and 40s who are starting to have knee pain resulting from decades of running, skiing, basketball, or other sports. The technique has transformed the field of sports medicine.

But while arthroscopy has been essential for diagnosing and repairing many kinds of knee injuries, such as meniscal tears and ACL tears, it's not recommended as a method for treating knee arthritis. Studies have found that arthroscopy is no better than placebo surgery or other nonsurgical interventions.

Arthroscopy may be performed under general, regional, or local anesthesia. The technique is used less frequently in the hip, but it is sometimes used to diagnose the cause of hip pain. If the surgeon finds a labral tear or loose pieces of bone (from a traumatic injury, for example) or cartilage during the arthroscopy, he or she can remove them during the procedure.

Recovery from arthroscopic surgery is relatively quick. You gradually get back to normal day-to-day living during the first week. In the second week, you can return to work if your job is not physically taxing. In the third week, you can begin to do light exercise. Physical therapy is usually not needed. ♥

Knee and hip replacement

About 450,000 total hip replacements and nearly a million total knee replacements are performed annually in the United States. Almost all knee replacements and the majority of hip replacements are done to treat arthritis pain. Those numbers are expected to rise steeply, as much as tripling in the next 20 years, according to one study in the *Journal of Rheumatology*. Partial knee replacement procedures, in which less of the joint is replaced, are also on the rise.

Most studies find that at least 80% of people who have total knee replacements say they're satisfied with the result. And according to the National Institute of Arthritis and Musculoskeletal and Skin Diseases, hip replacement is one of the most successful orthopedic surgeries performed. But patient satisfaction depends in part on having realistic expectations about what joint replacement surgery can and cannot do. While a new hip or knee



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When is it time for a joint replacement? The procedure is elective, so that's up to you to decide, based on how much pain you're in and how much it limits your activities.

should help you in normal activities for your age, it won't enable you to run marathons, ski on moguls, or do more than you could before you developed arthritis. And joint replacement doesn't guarantee that you will be able to move or use the joint normally.

Still, those who are willing and able to participate in physical therapy can experience great improvement in function. The major consistent benefit is substantial relief from pain—after you've healed from the surgery. Full recovery takes about three months.

For the most part, artificial joints are predictable and reliable, but problems occasionally occur.

And, like a pair of shoes, an artificial joint has a limited life span. The more demand your activities place on the new joint, the quicker it will wear out. With normal activity, most implants last 15 to 20 years. If you do regular high-impact exercise, yours won't last as long. If possible, people under 60 should delay the procedure, since having it earlier increases the likelihood they will need another surgery later in life to replace the implant—particularly if they are extremely active or overweight. Surgery to replace an implant, called revision surgery, is more difficult because there is less bone to work with after removing the first implant.

Decisions to make

Work with your doctor to decide whether replacing your knee or hip joint is a good solution for you. If so, you'll need to make other decisions, including

- whether you should have it done soon or wait a while
- who will perform the procedure
- where to have it done
- what type of implant to choose
- whether to replace one or two joints, and, if you do two, whether to do them at the same time or several months apart.

This chapter addresses all of these questions.

Do you need a new joint?

When is it time for a joint replacement? The procedure is always elective, so that's up to you. A doctor may recommend it, but you must weigh the benefits and risks and come to your own decision about whether, and when, to undergo this major surgery. Although your age is an important factor, the decision to have a joint replacement is based on your disability—how much pain you're in and how much your joint problems limit your activities. It may be time to consider knee or hip replacement if one or more of the following statements apply to you:

- You are unable to complete normal daily tasks without help.
- You have significant pain daily.
- Pain keeps you awake at night despite the use of medications.
- Nonsurgical approaches—such

as medications, the use of a cane, and diligent physical therapy—have not relieved your pain.

- Minor surgical procedures are unlikely to help.
- Pain keeps you from walking or bending over.
- Pain doesn't stop when you rest.
- You can't bend or straighten your knee, or your hip is so stiff that you can't lift your leg.
- You have osteoarthritis and feel the disease is wearing you down physically, emotionally, and mentally.
- You are suffering severe side effects from the medications for your joint symptoms.
- X-rays show advanced arthritis or other damage.

Is it possible to wait too long? Yes, according to a study by Canadian researchers. They found that waiting until joint problems have severely limited your function may lessen the benefit you get from knee or hip replacement. Two years after surgery, people who had waited longer had less pain relief and were five times as likely to need assistance with basic self-care activities. Taking into account the condition of your joints, your age, and your overall health, you and your doctor need to strike a balance between operating too soon (increasing the chance that the replacement joint will wear out during your lifetime) and waiting too long (meaning you will get less benefit from the procedure).

The average age for total knee or hip replacement is in the mid-

60s. If you are younger than 50, your doctor may recommend that you wait a few years before having joint replacement surgery.

Your weight may also be a consideration in timing a joint replacement. The American Academy of Orthopaedic Surgeons recommends that people with morbid obesity (a body mass index of 40 or higher) should consider losing weight before getting a knee replacement and should discuss weight-loss options with their physician. A study presented at the American Academy of Orthopaedic Surgeons' 2019 meeting found that people classified as morbidly obese who lost 20 pounds before a knee replacement had shorter hospital stays and lower odds of needing to stay in a nursing facility. Obesity can worsen the outcome of both knee and hip replacement surgeries, with higher rates of infections, repeat surgeries, and other unwanted results. But the impact of obesity appears to be even stronger for people undergoing a total hip replacement, as the hip is located more deeply in the body and requires larger incisions and longer operating times. People who require significant weight loss may consider bariatric surgery to reduce their weight before having a knee replacement.

Some conditions may disqualify you from having this procedure. A surgeon is unlikely to recommend joint replacement if you have any of the following issues:

- infection, either systemic (throughout the body) or confined to the damaged knee or hip
- leg circulation so poor that it will interfere with healing
- severely damaged or nonworking knee muscles or ligaments
- damaged nerves in the legs
- neuromuscular disease such as multiple sclerosis, Parkinson's disease, or stroke
- allergy to metal or plastic
- an illness that makes any major surgery risky.

As you make the decision, bear in mind that joint replacement is a major surgery and has a small but real risk of serious complications such as infection, a blood clot, or a heart attack.

Do you have the right surgeon and hospital?

Joint replacement is a complex procedure, and finding the right surgeon and hospital can make a big difference in your outcome. In general, you're likely to have a better result and fewer complications if your surgeon performs the operation frequently (at least 100 times per year) and operates in a hospital where replacements are commonplace. Don't be surprised if this rules out the most convenient hospital.

Your orthopedist, rheumatologist, primary care physician, or a friend who has undergone successful joint replacement may recommend a surgeon. Keep in mind that your insurer may restrict you

to certain specialists or require a larger copayment if you go outside your plan.

When you meet for an initial consultation, the surgeon reassesses your condition and works with you to recommend the most appropriate treatment. If it's clear that joint replacement is a good choice, try asking the following questions to be sure you're working with an experienced surgeon:

- Are you board-certified in orthopedic surgery?
- Are you fellowship-trained in joint arthroplasty?
- How often do you perform this surgery?
- What kind of results would you expect for someone in my condition?
- May I speak with any of your patients who have had this surgery?
- What complications occur most frequently, and how do you deal with them?



Finding the right surgeon can make a big difference in the outcome of your surgery. Look for a board-certified orthopedic surgeon who is highly experienced.

- Do you usually work with a particular physical therapist or rehabilitation center?

Much of your experience in the hospital and afterward will center on physical therapy, so it is worth your while to investigate this ahead of time. Look for a physical therapist who is used to working with people who have joints replaced. A good physical therapist or rehabilitation center individualizes your rehab program in consultation with your doctor, finds ways you can gain muscle strength even while joint damage limits your activity, helps keep you going even through some discomfort, and helps you reach your goals (whether that means just walking comfortably or returning to a favorite sport).

What type of implant?

There are dozens of implant designs. The best one for you will depend on your weight, bone quality, age, occupation, and activity level, as well as the surgeon's experience with a particular model or brand. Some designs have been around for decades, while others are new, but newer is not necessarily better. It takes years to determine whether a new model will last as long as those with a long-term track record, and some designs that initially seemed promising have developed problems after several years.

Both knee and hip implants are made from some combination of tough plastic, hard ceramic, and hard polished metal. All materials

that are used to construct artificial joints need to meet the following criteria:

- They must function without provoking a local or systemic (bodywide) immune response.
- They must be able to resist wear and corrosion and retain their strength and shape.
- They must mechanically duplicate the joint they are replacing. For example, they must be strong enough to withstand weight-bearing loads and flexible enough to bear stress without breaking, while allowing smooth movement.

Each of the following materials has advantages and disadvantages.

Polyethylene. The plastic parts of an artificial joint are usually ultra-high-density polyethylene. Earlier polyethylene joints had problems with wear—tiny pieces of the plastic flaked off, provoking the immune system to produce cytokines (signaling molecules that promote inflammation), enzymes, and other compounds that weaken bone tissue. As a result, the implants sometimes pulled away from the bone and had to be replaced. Two decades ago, manufacturers began modifying the carbon bonds in the plastic to make “crosslinked” polyethylene, which is believed to be more wear-resistant. Crosslinked polyethylene joints have been performing excellently. A highly crosslinked polyethylene acetabular cup combined with a metal or ceramic femoral

head is now common for total hip replacements, and improvements to the material are still being made. Although these joints are still relatively new, it’s expected that they could last for decades. In some cases, vitamin E is added to the polyethylene preparation in order to extend its life and prevent degradation, but this may come at an additional out-of-pocket cost.

Ceramic. Very hard ceramic parts can be used for one or more components in both knee and hip replacements—for example, pairing a ceramic femoral head with either a crosslinked polyethylene cup or a ceramic one. Ceramic parts have the promise of long life and durability; the rate of bone deterioration associated with wear is significantly lower for ceramic implants compared with metal/polyethylene implants. However, ceramic-on-ceramic hip implants have failed in rare cases, causing the ceramic implant to shatter; the debris must then be removed surgically. “Squeaking” has also been reported as a problem in a small percentage of ceramic-on-ceramic hip replacements. So far, the squeaking has not been associated with any clinical symptoms or abnormalities on x-rays and CT scans.

Metal. Sometimes one of the components is made from highly polished metal, such as cobalt-chromium, titanium, zirconium, or nickel. However, the use of metal-on-metal implants has been drastically scaled back because of

concerns that traces of metal can get into the bloodstream and cause pain and inflammation.

Cemented or cementless?

You and your surgeon will have a choice of using an implant that is cemented in place or one that is designed to stay put without cement. The majority of total knee replacements today are cemented, while most hip replacements are cementless. But there are reasons why these choices might not provide the best option in your particular case.

Cemented implants use acrylic cement to quickly establish a solid attachment, allowing you to get back on your feet almost immediately after surgery. Cemented joint replacements have been used successfully for decades and may last more than 20 years. A successful cemented joint replacement has a stable boundary between the implant and the cement and a durable mechanical connection between the cement and the bone. Over time, however, the cement sometimes cracks or wears out, loosening the bond between the implant and adjacent bone. If that occurs, you may feel pain as the implant rubs against the bone and wears it away. Eventually, you’ll need another joint replacement. Loosening is more likely to occur in people who are very active or very heavy. For this reason, cemented joint replacements are more commonly recommended

for individuals who are older, who have conditions such as rheumatoid arthritis, or who are younger but have compromised health or poor bone quality and density.

Cementless implants have surfaces that are semiporous, allowing bone to grow into the implant and form a solid attachment. Despite early hopes that cementless implants would be more durable than cemented implants, a review found that the longevity of cementless models is no greater than that of cemented ones.

Although cementless implants are held in place with surgical screws or pegs, they are not as secure as cemented models until bone healing occurs, so you must not put full weight on the leg for six weeks. Also, cementless knee prostheses do not attach as well to the kneecap or lower leg as they do to the thighbone. Accordingly, some doctors use a cementless attachment to the thighbone and cement the other portions of the implant, an approach called hybrid or mixed total knee replacement.

You are more likely to be offered a cementless implant if you are younger and more active. Younger bone is stronger and more readily grows into the implant, fixing it in place better.

Two at once?

If you have severe damage and pain in both knees or both hips but are otherwise in good health, you may have the option to replace two joints



It may be an option to have both knees replaced at the same time. But the decision requires careful discussion with your doctor and physical therapist.

during a single surgery (simultaneous replacement) as opposed to two separate operations several months apart (staged replacement). The decision requires careful discussion with your doctor and physical therapist. If the joints are not equally damaged, replacing only the worst joint may take pressure off the other one and delay the need to replace it.

The benefits of a simultaneous approach are a single anesthesia, shorter total hospitalization, and one prolonged rehabilitation that lets you resume normal activities sooner than two separate ones. The downside is that overall complication rates are higher, including a slightly increased risk of a heart attack or pulmonary embolism (a blood clot that travels to the lungs).

Replacing both joints at once is a good option if the condition of your joints is so poor that replacing only one joint would still leave you unable to function during physical therapy, thereby slowing

your recovery. To do well in rehabilitation after simultaneous surgery, however, you need enough arm strength to cope while you are unable to stand on either leg.

Simultaneous replacement is *not* recommended for people with underlying cardiovascular disease because of the large fluid shifts that occur with blood loss and replacement during the procedure. People over 80 and those with cardiovascular or lung disease are usually offered staged procedures. If you have any significant medical risks, you are probably better off having two separate operations.

Because you spend less time in the hospital with simultaneous joint replacement, it costs somewhat less than staged procedures. However, as long as replacement of both joints is medically necessary, Medicare and most private insurers cover either schedule.

Knee replacement options

Your surgeon may discuss some of the following additional options with you.

Fixed-bearing versus rotating-platform prosthesis. In a fixed-bearing knee prosthesis—the most common type—the part that attaches to the shin bone (called the tibial component) is topped with a flat metal piece that securely holds a polyethylene insert. When the knee is in motion, the femoral component (the part attached to the thighbone) glides across the polyethylene.

In a rotating-platform knee prosthesis, the polyethylene insert can rotate slightly, theoretically lessening stress and wear on the implant and improving movement. According to some experts, rotating-platform prostheses slightly improve on the range of motion offered by fixed-bearing prostheses, but have a slightly greater risk of complications. Long-term studies have found that the two kinds of prostheses performed similarly over the course of a decade.

Gender-specific knees. Knee implants used to come in a limited variety of shapes and sizes. Now there are implants that are specifically designed for a woman's anatomy, known as gender-specific knees. However, a 2020 systematic review of clinical trials of gender-specific knees found no evidence that they provided a benefit over

standard knee replacements.

“Custom” knees. An even more specialized product uses a CT scan of your knee to create a 3D-printed artificial knee that matches your unique anatomy. While the idea of a made-for-you joint is very attractive, these devices haven't yet been fully evaluated over time, so there's no clear evidence that they offer better results to justify their greater expense.

Partial knee replacement (“mini-knee”). If your knee damage is limited to one of the bumps (condyles) on the end of your thighbone, you may benefit from a partial (unicompartmental) replacement that leaves the rest of the joint intact. This technology has been around for decades, but it became more popular once surgeons were able to install the partial implant through a small

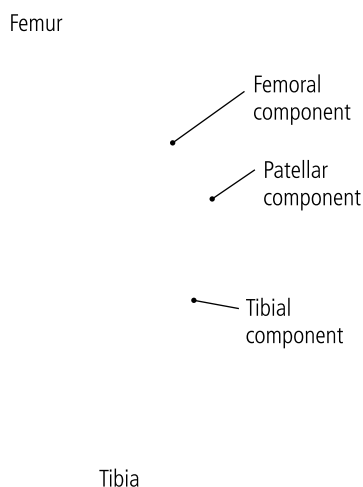
incision (about three inches rather than eight) with minimal impact on muscles and ligaments.

The potential advantages are clear: less blood loss, shorter hospitalization, and quicker recovery. However, a unicompartmental replacement lasts only about 10 years, compared with 15 to 20 years for a total knee replacement. The approach isn't well suited for people who are very bowlegged or knock-kneed. It may be right for you if damage is limited to one portion of your knee, if the damage results from a traumatic injury rather than arthritis, if your ligaments are intact, and if your knee still contains a fair amount of healthy cartilage. The ideal candidate for this surgery is an older, thinner person rather than a younger, more active one. However, if you're young and active, the doctor may suggest a mini-knee procedure to buy time before total knee replacement.

Minimally invasive knee replacement. Minimally invasive surgery accomplishes the same goal as the traditional approach, using the same types of artificial knee implants as those used in traditional knee replacement, but with much smaller incisions. Despite the name, it is still major surgery. The size of the incision depends on your size (bigger knees mean bigger incisions). On average, the incision for minimally invasive surgery is four to six inches, compared with an eight- or 10-inch incision with traditional knee replacement. Some

Figure 12: Total knee replacement surgery

The surgeon first cuts away thin slices of bone with damaged cartilage from the end of the thighbone (femur) and the top of the shin bone (tibia), making sure that the bones are cut to precisely fit the shape of the replacement pieces. The artificial joint is attached to the bones with cement or screws. A small plastic piece goes on the back of the kneecap (patella) to ride smoothly over the other parts of the artificial joint when you bend your knee.



minimally invasive techniques require small incisions to be made in the quadriceps muscle, while “quadriceps-sparing” techniques protect the quadriceps tendon and muscle. The results from several studies comparing minimally invasive surgery to traditional knee replacement have shown some benefits, including less blood loss, a shorter hospital stay, and better range of motion. However, other studies show a higher complication rate with minimally invasive surgery, including less precise placement of knee implants.

Patellar resurfacing. In some knee replacements, the kneecap is unaltered, and the artificial implant is shaped to glide easily beneath it. But in another approach, called patellar resurfacing, the surgeon attaches a separate piece to the back of the kneecap to fit smoothly with the implant. Studies of patellar resurfacing have

offered varying results: some find it reduces long-term pain, and others find it leads to more complications and a higher failure rate. A recent analysis of 31 clinical trials found that patellar resurfacing produced better outcomes over all, including a lower risk of having post operative pain or needing revision surgery. Some surgeons resurface the patella in most knee replacements; others try to avoid this step unless special circumstances warrant it. Patellar resurfacing may be a better option for younger individuals, in whom the results tend to be more predictable.

Hip replacement options

Your surgeon may discuss some of the following options with you.

Anterior versus posterior hip replacement surgery. Hip replacement surgery can be performed from the back side of the hip (posterior) or from the front side (ante-

rior). The most common type of hip replacement is a posterior procedure. Typically in this procedure, you lie on your side as the surgeon makes a 10- to 12-inch incision at the side of the hip extending back to the buttocks. (In some cases, the surgeon does a minimally invasive version of the posterior procedure, with a smaller incision.) But a different approach has been gaining popularity in recent years: anterior hip replacement, in which you lie on your back and the surgeon makes a four- to six-inch incision at the front of the hip. Proponents of anterior hip replacement say that it avoids cutting through major muscle groups, allowing quicker recovery with less pain. Both approaches have risks and benefits, and in most cases choosing one is a matter of your preference and the surgeon’s.

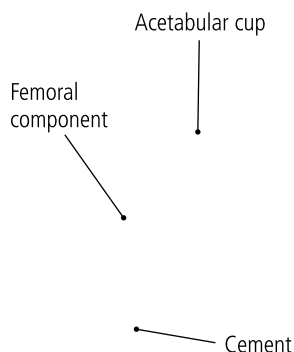
Hemiarthroplasty. Hemiarthroplasty is a partial hip replacement. It involves replacing the neck and head of the thighbone, while leaving the acetabulum intact. Hemiarthroplasty is most often used for hip fractures in which the neck of the thighbone has fractured. It may also be used in people with osteonecrosis, in which the bones lose their blood supply, or in selected individuals born with a dislocation of the hip.

Planning your surgery

You’ll schedule your joint replacement surgery several weeks or even months in advance. In the weeks before surgery, be prepared

Figure 13: Total hip replacement surgery

When rough and damaged cartilage prevents the bones of the hip from moving smoothly, an orthopedic surgeon can install an artificial joint with two parts. The head of the thighbone (femur) is replaced with an artificial ball with a long stem that fits down inside the bone. This part of the prosthesis is called the femoral component. The other part of the prosthesis, called the acetabular cup, fits inside the hip socket. Cement may be applied, depending on which type of artificial joint is used. The two pieces fit smoothly together to restore comfortable ball-in-socket movement.



to answer questions about your medical conditions and all previous operations, medications you take regularly, allergies to drugs or anesthesia, and your insurance coverage.

Your health care team will advise you on steps you can take before the operation to help ensure a successful outcome. This may involve taking oral antibiotics as directed. If you smoke, try to quit or at least cut down; smoking affects blood flow and inhibits bone healing and growth, slowing recovery. It may also increase the chances of an infection. Infections elsewhere in your body—for example, from dental cavities, open wounds, ingrown toenails, or skin ulcers—can raise your risk of getting an infection in the surgical site. Taking care of your dental health and any skin lesions before your surgery can also help you stay healthy. If you drink alcohol, you may be asked to abstain for at least 48 hours before the operation. You should also avoid taking aspirin or NSAIDs for two weeks before the procedure, unless directed otherwise by your physician. If you are taking a blood thinner like warfarin (Coumadin), you may be instructed to stop medication a few days before surgery or take an alternative drug.

Another preparatory step you may be advised to take is “prehabilitation”—that is, exercise, physical conditioning, and weight loss prior to surgery. If you are overweight,

Sign on the dotted knee

In rare instances, doctors perform surgery on the wrong part of the body (officially called “wrong site surgery”). One of the two most common mistakes is operating on the wrong leg. (The other is operating on the wrong part of the spine.)

To reduce the chances of such an error, the American Academy of Orthopaedic Surgeons has a “sign your site” protocol: surgeons are supposed to write their initials in indelible ink on the operative site as the patient watches.

So if you’re having surgery, check that your surgeon has made his or her mark. In the unlikely event that it’s not there, raise the issue with your surgeon or a nurse.

taking off some pounds before the operation can help unburden your joints and improve the results of your surgery. For all patients, engaging in strength training and exercise beforehand, particularly if you are not in good physical condition, can put your body on a better track to recovery afterward.

When the day of your surgery arrives, you will follow a standard procedure, which will include meeting with the anesthesiologist. Once you’re ready for the operation, the anesthesiologist will start an intravenous line (IV) in your arm and may give you an injection in your back, depending on the type of anesthesia used. A catheter may be inserted into your bladder to remove urine during the surgery,

but joint replacements today are usually performed without a catheter. This change has helped reduce the incidence of postsurgical urinary tract infections, while the need to empty the bladder after surgery gives patients another motivation to get up and move.

Knee replacement procedure

For this operation, you lie on your back. The orthopedic surgeon makes a cut of about eight to 10 inches over your knee (or four to six inches for a minimally invasive procedure). Moving the kneecap out of the way and taking care to do the least possible damage to the muscles and ligaments, the surgeon makes flat cuts to remove damaged sections from the top of the shin bone and the bottom of the thighbone and to carefully contour the bone to fit the implant. Precision guides ensure that the bone is shaped correctly to fit the implant, an innovation that makes knee replacement far more accurate and successful today than it was in the earlier days of the procedure.

The surgeon then puts trial implants in place and makes sure that the knee will straighten and bend without wobbling; it takes great surgical skill to properly balance the ligaments and tendons to work with the implant. The surgeon then attaches the implant components to the thighbone and shin bone with cement or screws (see Figure 12, page 41). If

your kneecap is being resurfaced, the surgeon also attaches a small oval-shaped plastic piece to the back. After the surgeon finishes your knee replacement, he or she will stitch your incisions closed. The total surgical time for a knee replacement procedure is about one to two hours, though you will be in the operating room for longer than that to allow the surgical team to prep you for the operation.

Hip replacement procedure

For this operation, you lie on your side. Pillows will help you stay in position during the operation. The surgeon makes a cut of about 10 to 12 inches along your hip (smaller for minimally invasive surgery) and separates your thighbone from the hip socket. Using a surgical saw, the surgeon removes the damaged ball at the top of your

thighbone; this is measured, and a perfectly sized implant is created from components available in the operating room. The surgeon tunnels down into the thighbone to create a space for the stem of the implant. Most hip replacements do not use cement, but the surgeon may decide to opt for cement after evaluating the quality of the bone tissue—for example, if the bone is porous due to osteoporosis. On the socket side of the joint, the surgeon shaves away damaged bone and cartilage and shapes the surface of the bone to hold the socket portion of the implant.

After the implant components are prepared, the surgeon secures them in place using cement or screws or by forcibly press-fitting them in. The surgeon then fits the new ball and socket together and stitches the incision closed

(see Figure 13, page 42). Total hip replacement takes about one-and-a-half to two-and-a-half hours, plus prep time.

Recovery in the hospital

Once you recover from the anesthesia, you're moved from the recovery room to a regular room for the duration of your stay, assuming you need to remain overnight (see "Saying goodbye to long hospital stays," below left). Unless you're young and healthy, you will likely need to remain a night or two.

When you wake up, you'll find several tubes extending from your body—a drain for the surgical area, a catheter to remove urine if one was used during your surgery, and an IV for medications. You will also have elastic stockings or compression devices on your legs to help prevent blood clots. After hip replacement, your operated leg is suspended by a sling or held in place with a special abduction pillow to keep the hip from dislocating (the ball slipping out of the socket).

Pain control. Postoperative pain is one of the biggest obstacles to recovery. But many surgeons are now getting proactive about pain control by injecting a concoction of pain medications directly into the joint as part of the joint replacement procedure. This can help control pain in the first 36 hours after surgery. Studies have also found that it reduces the need for opioid pain relievers and helps to get peo-

Saying goodbye to long hospital stays

People having knee or hip replacement used to spend days recuperating in the hospital. As recently as the 1990s, hospital stays for hip replacement averaged nine days. Happily, this is no longer the case. People who are older or who have other health complications may require two nights. However, many people now leave the next day, while younger, healthy patients frequently have the procedure on an outpatient basis, with no overnight stay at all.

This change has come about as the medical profession has become increasingly aware that extended hospital stays pose certain dangers, like the risk of hospital-acquired infections. The shift has been made possible in part by better pain control techniques—specifically, injections into the joint that can deaden pain for 36 hours or more—and by home visits from physical therapists that are now routinely authorized in the days and weeks following surgery. More extensive preparation before surgery also plays an important role. This includes both "prehabilitation" exercises (see "Planning your surgery," page 42) and strategies to make homes safer for recovery, such as installing grab bars and elevated toilet seats (see "Back on track after joint replacement," page 47).

ple moving faster after a procedure, reducing their recovery time in the hospital and ultimately helping them progress in their healing.

If you had an anesthesia line in your back, it may be left in place for a day or two to administer medication to keep your lower body pain-free. Otherwise you initially receive pain medication through an IV. If your doctor has recommended patient-controlled anesthesia, you push a button to administer painkilling drugs into your IV as you need them; the machine is programmed so you cannot use too much medication.

After a while, you switch to oral painkillers. Don't hesitate to use the medications. Pain is easier to control before it becomes intolerable. During rehabilitation, taking prescribed medication 30 to 60 minutes before physical therapy helps you perform the exercises and helps relieve pain and swelling after activity.

Breathing. After surgery, small airways in the lungs can collapse and create an ideal environment for pneumonia to develop. To keep your lungs clear, a nurse will ask you to cough several times an hour and to perform deep breathing exercises. You may be given a breathing exerciser called an incentive spirometer that lets you see how deeply you are breathing and challenges you to expand your lungs fully.

Blood clot prevention. One potential postsurgical danger is the

Innovations in joint replacement



Efforts are under way to decrease the rate of complications, extend the life of implants, and reduce the need for additional surgery. For example:

Quelling infection. Oral or intravenous antibiotics are routinely given shortly before and after joint replacement surgery to reduce the chance of infection. Still, serious infections can occur in the nooks and crannies of the artificial joint, where bacteria can collect. There are no blood vessels in the artificial joint, so the body's immune cells can't reach the infection to fight it off. Researchers are currently working on ways to put antibiotics directly into prostheses. These antibiotic-containing implants will be very expensive and might be best suited for people at highest risk for infection, including those with obesity, diabetes, or conditions requiring medications that compromise their immune systems.

Protecting surrounding bone. Breakdown of the bone supporting an implant loosens it, often prompting a need for repeat surgery. Several studies have found that bisphosphonates (a class of drugs used to prevent bone loss) may help extend the life span of total knee or hip implants by blocking bone resorption. Further research is necessary to confirm this.

formation of a blood clot, usually in the lower leg or thigh. Called a deep-vein thrombosis, the clot can break off and travel to the lung, lodging there and blocking off your breathing. This event, called a pulmonary embolism, can be deadly. To help prevent blood clots, your doctor may place compression devices around your legs and feet. These devices are hooked to a machine that regularly fills them with air to squeeze your calves, forcing blood up your legs to mimic the action that your muscles would provide if you were moving around. Elastic stockings (known as thromboembolism-deterrent, or TED, stockings) are sometimes recommended to keep pressure on your calf muscles (and thereby your legs) to enhance blood flow, but there is little evidence that they're effective.

There are several medications that can be prescribed soon after surgery to reduce the risk of blood clots, including a blood-thinning injected medication such as heparin followed by an oral anticoagulant such as warfarin (Coumadin). But there's been a recent shift toward relying on a much more familiar medication after a joint replacement: aspirin. Studies have found that aspirin is an effective, safe, and less expensive alternative to other drugs for reducing blood clot risk after joint replacement surgery, with fewer side effects. One study found that taking low-dose baby aspirin twice a day was as effective as a higher dose and easier on the stomach. Aspirin is increasingly prescribed instead of heparin and warfarin, except in people with high risk of blood clots.

Another option for reducing the risk for blood clots, if aspirin is not enough, is one of the newer anticoagulant drugs known as factor Xa inhibitors, such as rivaroxaban (Xarelto). Evidence from eight clinical trials suggests that taking one of these drugs after surgery for 21 or more days reduces the risk for blood clots, though it increases the risk for minor bleeding, compared with standard regimens of seven to 10 days.

You can also help prevent clots by moving around as much as you are allowed. While in bed, you can increase blood flow by circling your ankles or alternately flexing and pointing your feet. Report any symptoms of a possible leg clot. These include increased swelling, pain, tenderness, or redness in your calf. A clot that has reached the lung can cause shortness of breath or chest pain that comes on suddenly with coughing; if this happens, notify your doctor immediately.

Infection control. To prevent infection, people undergoing joint replacement are routinely given antibiotics shortly before surgery and for 24 hours afterward. It's important to follow your nurse's instructions about cleansing and bandaging your incision. Notify your clinician if you notice these signs of infection: redness, swelling, pain, tenderness, fever, and increasing or odorous drainage. An infection around your incision can usually be treated with

"Alarming" implants

After knee or hip replacement, your implant is likely to set off a security alarm at an airport or building entrance. Cards explaining that you have a joint replacement are no longer accepted at airports. Security personnel may ask you to step to the side so they can run a wand past the area. If the wand emits a signal, they may pat down the area as an extra precaution.



antibiotics and scrupulous cleansing and dressing of the wound. In some cases, the surgeon may have to reopen the incision to remove infected tissue.

Steps to restore mobility. Studies have found that complications following a total joint replacement are lower if you get moving sooner after surgery—often the same day. After a knee replacement, a continuous passive motion machine may be used to bend and straighten your leg by a programmed (and gradually increasing) amount. However, most clinical centers don't use them because studies don't support the benefits of using the machine over actively performing knee exercises under the guidance of a physical therapist. In other words, the device is not a substitute for physical therapy.

By the day after surgery, a nurse or physical therapist will help

you get out of bed and use crutches or a walker to move to a nearby chair. If you had a knee replacement, you may even walk the same day. If you had hip replacement, an abduction pillow between your legs keeps your hips in a safe position while you sit; for the first few nights, your leg may be returned to the sling. To prevent your hip from dislocating before the ligaments heal enough to stabilize the area, you must avoid specific movements in the hospital and for several weeks at home (see "After hip surgery: Four tips to avoid dislocation," page 52).

Before you can safely go home, you are usually expected to be able to perform the following: get into and out of bed, walk with crutches or a walker, go up and down both a curb and the number of steps you must negotiate at home, perform your rehab exercises, and show you can do necessary tasks with little or no assistance (and, after hip replacement, without violating the precautions you must take to avoid dislocating the hip). If you had a total knee replacement, you should be able to straighten your knee and bend it 90°. Depending on individual circumstances, these requirements may be altered. If you are medically cleared for discharge but not able to do these things, or if you need extra nursing care or have no assistance at home, you are discharged to a rehabilitation center. Many people who live alone choose this option. ♥

Back on track after joint replacement

A little planning and preparation before your joint replacement surgery can ease your recovery after the operation. For example:

- Set up an area in your home where you'll spend most of your time. Position a phone, laptop, remote control, reading materials, medications, and water within easy reach.
- Make sure items you need daily—clothing, toiletries, pots and pans, food—are stored at arm height, so that reaching or bending isn't necessary. Use a long-handled tool for reaching items beyond arm's length.
- Clear clutter and remove any rugs on which you might slip.
- Cook and freeze foods so you can reheat them as needed, or stock up on prepared foods.
- Find an apron with big pockets to help you carry things around your home, leaving your hands and arms free to use crutches or help you balance better.
- Purchase any assistive devices you'll need, such as a grabber stick (to reach things without bending), a long-handled shoe horn, and a sock aid (to pull on your socks).
- Install a raised seat for the toilet. Grab bars may also help.
- Apply for a temporary disabled parking permit through your state department of motor vehicles. You'll want to do this several weeks before your surgery. If you are having a right hip or knee replacement, be aware that driving is not recommended for six weeks after surgery, because your right foot controls the gas and the brake.

When you first arrive home, you'll need help—from a family member, friend, or someone you've hired—with meal preparation, cleaning, bathing, shopping, and just fetching things you need. Depending on your medical condition, a visiting nurse or home health aide may be helpful.



Getting the most from rehab

Making preparations before surgery is a good first step. But unlike many operations, joint replacement is not something you recover from passively. Once surgery is over, physical therapy begins—and ultimately, the effort you put into your therapy will determine the success of your implant, just as much as the skill of the surgeon who performed the operation.

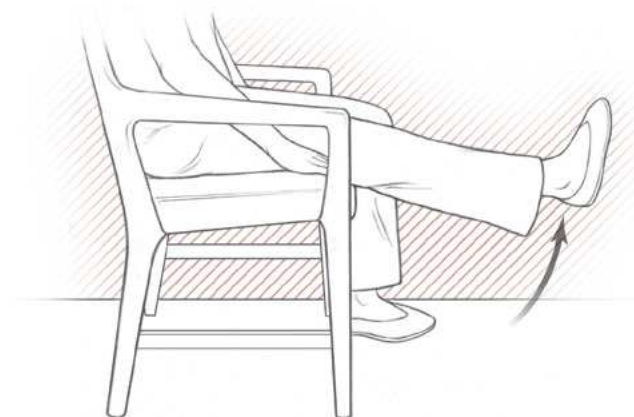
For the first few weeks, a physical therapist may come to your home or schedule regular appointments. In many cases, it's worth the effort to visit a reputable outpatient therapy center, as these facilities tend to offer more aggressive and standardized treatment to help you get on track. In addition to formal exercises, gradually increasing the distance you walk and the quantity of normal tasks you do improves your strength and stamina.

Think of yourself as an athlete training to come back from an injury. The first few weeks require much effort. Several times a day, you should perform exercises your physical therapist has recommended to restore movement in the joint and strengthen the surrounding muscles (see Figure 14, page 48, and Figure 15, page 49). You can do many of these exercises while sitting or lying down.

After a total knee replacement, a key goal of rehabilitation is regaining your full range of motion. By the first week or two, you should be moving your knee more freely than you could when it was hindered by the stiffness of osteoarthritis. By week three or four, you should have your full range of motion back. However, it can be hard to catch up if you delay regaining motion; some people continue to walk with the knee slightly flexed, which is inefficient and tiring, discouraging them further from moving.

After a hip replacement, your range of motion generally returns on its own, and the focus for rehabilitation is to strengthen muscles that support the hip (such as your gluteal muscles, hip flexors, and

Figure 14: Exercises after knee replacement



Sitting knee bends: Sit in a chair. (You may be instructed to place a towel under the operated knee.) Straighten your knee as far as possible and hold for five seconds. Repeat 10 times. Gradually work up to 25 repetitions.

hip extensors) and to retrain your gait to allow you to walk normally and fluidly.

How long you will need to use crutches or a walker to keep weight off your implant depends on your individual circumstances. You'll probably be allowed to bear weight as tolerated right away. Usually, you begin by putting just a little weight on the leg with the implant. As your postoperative pain decreases, you'll gradually build up to bearing your full weight. Younger, healthier patients should expect to be walking without crutches or a walker by four to six weeks after surgery, and others by about six weeks.

After about six weeks of healing, your rehabilitation goals shift toward restoring your ability to do normal activities, although you may still experience muscle pain and fatigue for several months as your tissues heal.

By three months after surgery, you should be regaining confidence in your movements. After six months, you should be able to function pretty normally. You can expect to have as much movement as you had before the operation, but without the pain. Just don't expect to have better mobility than you previously had. If your rehabilitation progresses well, by a year you may even forget you have an artificial joint.



Standing knee bends: Hold on to a steady surface such as a table. Bend your operated knee back as far as it will go. Hold for five seconds, then lower the leg to the floor. Repeat 10 times. Gradually work up to 25 repetitions.

Dealing with postsurgical pain

Pain is usually well controlled while you're in the hospital, since doctors and nurses are nearby and can provide powerful medications intravenously. Once you return home, the pain level is hard to predict. Some people experience very little pain and can find relief with ordinary over-the-counter drugs. Others, however, have severe pain and are reluctant to even get out of bed.

It's not always clear why a given person experiences exceptional pain. It can be a matter of perception—people's thresholds for pain vary tremendously. In other cases, there may be an underlying problem causing the pain, such as a swollen tendon or an infection.

Never suffer in silence. If your pain level is unacceptable, call your surgeon. He or she may be able to address the underlying cause. For example, pain from a swollen tendon can be alleviated with a steroid shot, and infections can be cured with antibiotics. If there is no clear cause, the surgeon can prescribe a more powerful medication, such as oxycodone (OxyContin, Percocet). This opioid drug is tightly regulated because of its potential for abuse and dependence, but it's unlikely to be misused by people in pain and is generally effective. Your primary care physician

is another good person to talk to if your pain is not being adequately managed.

Be aware that knee replacements can be more painful than hip replacements, because knees lack the extra tissue that cushions and supports the hips. Some people let mild pain and stiffness discourage them from moving and regaining their full range of motion, but this can ultimately undermine recovery. The important thing is to manage expectations and know that some discomfort is expected, but it should improve as you progress. If the pain is severe enough to hinder the important work of rehabilitation, talk with your doctor.

Resuming your daily activities

Ask your doctor and physical therapist how soon you can return to specific activities and what preparation will help you achieve those goals.

Driving. If your left knee was replaced and your car is an automatic, you may be able to drive as soon as you are off any opioid medication and feel confi-

dent in your ability. If the right knee was operated on, a wait of six weeks is typical. If pain previously hampered your ability to brake quickly, your reaction time may improve greatly after you have healed.

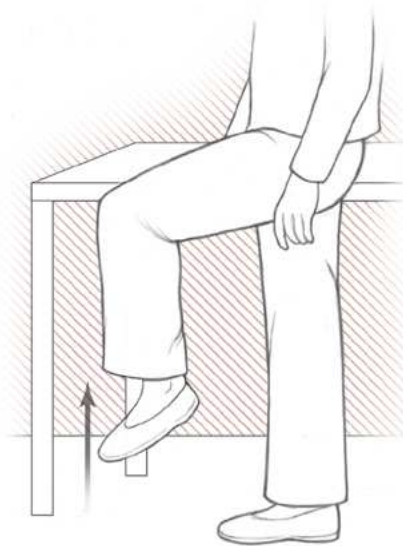
If you had a hip replaced, ask your physical therapist for guidance on getting in and out of a car and riding safely. Some vehicles are unacceptably high or low, forcing your hip into an unhealthy position. In some cars, sitting on a firm pillow can help you avoid overflexing your hip. On long drives, stop and get out at least once an hour.

To drive with a replacement hip, you need to be off opioid painkillers and blood thinners, able to put weight on your right leg (for an automatic transmission) or both legs (for a manual transmission), and able to brake without violating the precautions you've been given to avoid dislocating the hip. It usually takes about six weeks before you can drive an automatic and 12 weeks for a stick shift.

Work. After a knee replacement, it may take six to eight weeks to return to a desk job if it requires significant walking or driving to get to work; you may

Figure 15: Exercises after hip replacement

Check with your physical therapist to find out if you are ready to do the following exercises to strengthen your hip.



Hip abduction: Standing with your hand on a stable surface, lift your leg out to the side as far as you can and hold for five to 10 seconds. Keep your hip, knee, and foot pointing straight forward. Repeat until your leg feels fatigued.

Standing knee raises: Standing with the aid of a walker or holding a stable surface, lift your thigh and bend your knee. Hold for five to 10 seconds. Straighten your knee and touch the floor with your heel first. Repeat until your leg feels fatigued.

Dos and don'ts: After surgery

These tips can help ensure that your return to mobility following surgery goes smoothly.

Do eat right. Eating a healthy diet, including lots of fruits, vegetables, whole grains, and lean protein, is important to promote proper tissue healing and restore muscle strength.

Do learn the signs of blood clots. Warning signs of a leg clot include increasing pain, tenderness, redness, or swelling in your knee and leg. Signs a clot has traveled to your lung include shortness of breath and chest pain that comes on suddenly with coughing. Call your doctor if you develop any of these signs.

Do exercise wisely. Performing the exercises your physical therapist recommends is crucial to restoring movement in your new joint and strengthening the surrounding muscles.

Do look for signs of infection. These include persistent fever, shaking, chills, increasing redness or swelling of the knee, drainage from the surgical site, and increasing pain with both activity and rest.

Don't take risks that could cause you to fall. Be especially careful on stairs until your joint feels strong. Use a cane, crutches, or a walker until you have improved your balance and strength.

Don't soak your wound. Upon returning from the hospital, keep your wound dry until it has thoroughly sealed and dried.



be able to return sooner if you get transportation to work, if your workplace can accommodate limited movement, or if you have some flexibility to work from home. Returning to a job requiring lots of standing, walking, or lifting may take twice as long. Avoid heavy lifting, which places significant stress on your implant. After a hip replacement, it may be three to six months until you can return to work, depending on the physical demands of your job. If you sit at a desk, your chair should have arms and be high enough to properly position your hips.

Sex. After a knee replacement, wait until the incisions and tissues in the front of the knee heal (about six weeks). If you usually put weight on your

knees during sex, you may want to try a position that involves lying on your back or side or even sitting, until you're comfortable returning to your customary position. For a hip replacement, you need to wait until your muscles and incisions have healed. You may need to adjust your sexual positions. You might lie on your back or on your non-operated side, resting your operated leg on your partner's leg. Don't flex your hips more than 90°, and don't raise your knees higher than your hips. Avoid positions that rotate your hips out (either sitting or lying with knees wide apart). It may take about three months before you can return to customary positions.

Sports. By six weeks after a knee replacement, or about three months after a hip replacement, you may be able to resume activities such as golfing, bowling, ballroom dancing, cycling (without great hills, for people with hip implants), swimming (as long as the wounds have healed), or scuba diving. Be reasonable about what you can and cannot do. You may want to begin with a safe, controlled exercise, such as pedaling a stationary bicycle, and build up to more complicated movements. Some sports—such as running, soccer, basketball, volleyball, or other contact sports—will never be advisable with a replacement knee or hip, because most implants won't hold up to much of the jumping, twisting, or repeated jarring. And you'll want to avoid activities that require jumping or heavy lifting, that might jolt or stress your hip or knee, or that make it likely you might fall or have something (or someone) bump into your replaced joint.

That said, life is meant to be enjoyed, not just endured. So ask your doctor whether you can return to your favorite activities, perhaps with some modifications. Limited running—maybe one to two miles several times a week—may be possible, for example. Even skiing, doubles tennis, and hockey might be within reach, though such sports may shorten the life of your implant. A physical therapist can help tailor your rehab program to prepare you for the safest possible return to activities you enjoy. ♥

Potential complications of joint replacement

Eventually, your knee or hip implant may feel like it is truly your own joint. However, complications can occur that shorten the life of an implant, and you may need to take certain precautions.

Infection. Your implant can become infected years after surgery, almost always because infection elsewhere in the body has spread to the area. Seek immediate treatment if you have symptoms of an infection in the urinary tract or elsewhere, and inform all your doctors that you have a joint replacement. At least for the first couple of years, you may be advised to take antibiotics before medical procedures that often result in bacteria entering the bloodstream, such as invasive dental work (extractions, gum surgery, root canals, and any cleaning or procedure likely to result in bleeding), a colonoscopy, or any type of surgery. Your doctor can advise you on how long to continue these precautions, which are particularly important for people who have an illness or have undergone medical treatment that impairs the immune system.

Leg-length discrepancy. A difference in leg length occurs only rarely after knee replacement, but it occurs frequently after hip replacement, at least temporarily. Before surgery, one leg is often shorter than the other—or feels shorter because the joint has deteriorated. Your orthopedic surgeon chooses an implant and plans surgery so that your legs will be equal in length after healing. After hip replacement, muscle weakness or spasm and swelling around the hip may temporarily cause an abnormal tilt to your pelvis and make you feel as though your legs are unequal in length; it's fairly common for people to feel as though the leg opposite the replaced hip is longer. Stretching and strengthening exercises help restore your pelvis to its proper position (see Figure 15, page 49). It may be several months before you can know whether the discrepancy is real; if so, the problem can be corrected with a heel lift in one shoe, or surgery if it's accompanied by pain.

Dislocation. In the weeks after a hip replacement,

you'll need to take great care to keep from dislocating the implant before the surrounding tissues have healed enough to hold it in place. Even afterward, there is a chance of a painful dislocation—five out of every 100 implants dislocate after total hip replacement surgery. If your hip dislocates, your doctor gives you a sedative while he or she manipulates the implant ball back into the socket. A hip that dislocates more than once usually requires surgery to make the joint more stable.

Loosening. A replacement joint can loosen for several reasons. Perhaps the cement never secured

► More mobility = weight gain?

Many overweight people who have painful knees or hips anticipate that having a joint replacement will ultimately help them shed weight by helping them be more active. While this expectation seems plausible, in many cases people actually put on more weight after joint replacement surgery.

Researchers aren't sure why this occurs. One theory is that increased mobility after surgery leads people to eat out socially more. Another is that increased activity gives them "permission" to eat more. Weight gain may also reflect stress eating because of postoperative pain and complications. Whatever the reason, don't assume that joint replacement surgery will automatically help you slim down. To lose weight, you'll need to adhere to a regular exercise program and reduce your total calorie intake. There's reason to avoid weight gain; a study in *The Journal of Arthroplasty* found that people who gained weight after a knee replacement were more likely to need a revision surgery.



it properly or eventually wore out, or the surrounding bone never grew into the implant to create a tight attachment. Loosening may require another operation to replace the implant (revision surgery).

Bone loss. As a joint implant suffers wear and tear, it can release loose particles into the joint. As your immune system attacks these foreign particles, it can also attack surrounding bone, weakening it in a process called osteolysis. This, in turn, may loosen the bone's connection to the implant. Osteolysis is a major factor leading to revision surgery after hip and knee replacement.

Revision surgery

Artificial joints are passing the test of time: today's implants routinely last 15 years or more, with some people getting 25 years of use from an artificial hip or knee. But eventually you may need repeat surgery (known medically as revision surgery).

Many factors reduce a joint's life span, including bone loss, being very active or overweight, loosening of the implant, and gradual wearing away of the prosthesis. Knee and hip replacements typically last longer in older people, since the elderly tend to be less active than their younger counterparts, who put more wear and tear on a replacement joint.

No matter which group you are in, knee and hip replacements have a 1% failure rate per year (meaning that revision surgery is needed within a year). If your implant fails, surgery to replace it takes longer and may be more complicated than your original operation. Your surgeon will need to use a specialized revision implant, which is usually larger and bulkier, so the new implant may feel different to you. There is also more risk involved. The in-hospital death rate for revision hip replacements is more than double that of first-time total hip replacements. People who have less pain and fewer additional medical conditions before revision surgery are more likely to have better pain relief as a result of the surgery.

Look for a surgeon with experience doing both implants and revisions. Before you have revision surgery, your doctor will perform a thorough physical exam. If you're much older than you were the first

After hip surgery: Four tips to avoid dislocation

For about six weeks after hip replacement, it's important to take precautions against dislocating the new hip implant. Adopt the following measures regardless of how well you feel, since a position can be risky without causing pain.

Bend over as little as possible. Your hip should flex no more than 90°, meaning you should not bend over farther than your waist. This rules out bending over to tie your shoes normally or pick up something you've dropped. It also means you'll need a raised toilet seat and a chair or bed that is high enough that your knees don't rise above your hips when you sit.

Be careful in bed. Lying down, you mustn't pull your knee toward your chest or reach down too far to get your covers.

Rely on long-handled gadgets. The goal is to avoid awkward positions that can place stress on your hip. Four devices can be helpful: a reacher to help you pull up pants or grab items that are out of safe range; a sock aid to pull on socks without bending over; a shoehorn to put on sturdy, non-tying shoes; and a long-handled loafah or sponge to help you wash below your knees.

Avoid movements that turn the operated leg in or out. Keep your feet pointed straight ahead when you sit and stand. Don't cross your legs, even at the ankle. Sleep on your back or on your side with your abduction pillow between your legs.

time around, you may need to take more precautions, such as banking extra blood for the lengthy procedure.

During surgery, the surgeon removes the old implant and damaged bone or joint tissue surrounding it. Depending on the amount and condition of the remaining bone tissue, you may need bone repairs or a bone graft to create a stable site for the new implant. Rehabilitation is similar to the initial replacement but takes longer after revision, and the outcome is often not as good. For example, your range of motion in the joint may be more restricted or your leg alignment less even, and even after healing you may need to use a cane to take some weight off the joint.

Hopefully, with improved implant designs and newer materials such as crosslinked polyethylene, total joint replacements will last longer, making revision surgery less likely in the future. ♥

Resources

Organizations

American Academy of Orthopaedic Surgeons

847-823-7186

www.aaos.org

This professional organization for orthopedic surgeons provides fact sheets and booklets on numerous knee and hip problems. The website includes a physician locator.

American Academy of Physical Medicine and Rehabilitation

847-737-6000

www.aapmr.org

This professional organization is for physiatrists (physicians who specialize in rehabilitation). The website includes a physician locator.

American Physical Therapy Association

800-999-2782 (toll-free)

www.apta.org

This national professional organization for physical therapists provides consumer brochures and other patient information. The website includes a locator for board-certified physical therapists with additional training in specific areas.

Arthritis Foundation

800-283-7800 (toll-free)

www.arthritis.org

This national not-for-profit organization has local chapters in many states. The website has educational materials on joint surgery, arthritis, pain control, treatments, alternative therapies, and more, as well as exercise videos. Local chapters may offer joint-health exercise classes, including water exercise classes.

Publications

The following Special Health Reports from Harvard Medical School contain more detailed information about some of the points covered in this report. To order, call 877-649-9457 (toll-free), or go to www.health.harvard.edu.

Better Balance: Simple exercises to improve stability and prevent falls

Suzanne Salamon, M.D., and Brad Manor, Ph.D., Medical Editors (Harvard Medical School, 2022)

Poor balance can lead to falls and joint injuries. This report includes safe, effective exercises to improve balance, plus stretches for better range of motion and checklists for home safety to help prevent falls.

The Joint Pain Relief Workout: Healing exercises for your shoulders, hips, knees, and ankles

Lauren E. Elson, M.D., Medical Editor, and Michele Stanten, Fitness Consultant (Harvard Medical School, 2021)

This report explains how to use the right blend of exercise to ease joint pain. It includes four full workouts, for shoulders, hips, knees, and ankles, along with a mini workout for wrists and elbows. Little or no equipment is needed.

Living Well with Osteoarthritis: A guide to keeping your joints healthy

Robert H. Shmerling, M.D., Medical Editor (Harvard Medical School, 2019)

This report explains both surgical and nonsurgical approaches to treating osteoarthritis, along with lifestyle changes and joint protection strategies.

Lose Weight and Keep It Off: Smart approaches to achieving and maintaining a healthy weight

Florencia Halperin, M.D., Medical Editor, and Carrie Dennett, M.P.H., R.D.N., L.D., Nutrition Editor (Harvard Medical School, 2020)

This Special Health Report reveals two keys to successful long-term weight loss: finding a diet and exercise program that suits you, and “skill power,” a set of habits that can help you keep weight off. Equally important, it addresses emotional issues like comfort eating and cravings. It also includes information on weight-loss medications, the dangers of weight-loss supplements, and new developments in bariatric surgery.

Glossary

abduction: Movement of a body part away from the midline.

acetabulum: The socket of the hip’s ball-and-socket joint; part of the pelvic bone.

adduction: Movement of a body part toward or across the midline.

arthroplasty: Joint replacement.

arthroscopy: A surgical approach that uses miniature viewing devices and other small instruments inserted through small incisions to diagnose and repair joint problems.

articular cartilage: Tough, rubbery tissue that coats the surface of bones within joints.

bursa: A cushioning sac containing lubricating fluid located at a

point of friction between two moving structures, such as a muscle and a tendon.

bursitis: Inflammation of a bursa, causing swelling and pain.

condyles: The bony knobs of the knee joint located at the lower end of the femur.

femur: The thighbone.

fibula: The smaller bone of the lower leg, next to the tibia.

ligament: Fibrous tissue connecting bones at joints.

patella: The kneecap.

quadriceps: The group of four large muscles in the front of the thigh.

tibia: The shin bone; the large bone of the lower leg.



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