

Strengthening and Skiing on the Aging Knee

"Doc, I've been skiing for 30 years and have never been injured. Now my legs feel tired, and my knees grind a bit and are sore after skiing on the hard pack or in the bumps. What is going on?"

Skiers ask their physicians this question frequently. The soreness, grinding, and fatigued feeling in the knees often is the result of both de-conditioning and early arthritic degenerative changes in the surfaces of the knee joint. Fortunately, aging athletes can prevent some of these symptoms and diminish others. By understanding new concepts in the biology of aging and by performing a few simple exercises on a regular basis, the aging skier can add years of enjoyment to the sport.

Biology of the Aging Knee

The knee joint is composed of articular cartilage, meniscus cartilage, ligaments, and a surrounding capsule. The articular cartilage covers the ends of the two major bones, the femur and the tibia, and the undersurface of the knee cap, the patella. The meniscus is a second type of cartilage that absorbs force and stabilizes the knee. The ligaments hold the bones to one another and guide the articulation of the knee joint. The joint capsule surrounds all of these structures and contains the lubricating fluid that permits smooth joint motion.

All of these knee structures are composed of collagen, the primary protein building block of all animal tissues. Collagen is constantly being broken down and produced in the body. The changes in the collagen structure and its surrounding matrix determine the major characteristics of aging.

In the knee joint, the collagen of the articular cartilage and the meniscus cartilage stiffens with age. As it becomes more brittle, its ability to absorb force decreases. Thus, the impact of a hard landing or the repeated jolting of a difficult mogul field is transmitted through the leg, into the knee joint, and up the thigh with less shock absorption.

Repetitive impact destroys the collagen matrix over time and leads to roughening of the articular surfaces and tearing of the meniscus cartilages. The grinding feeling can often be attributed to a rough eroded area of the articular cartilage, either beneath the kneecap or on the end of the femur or tibia. The sense of early fatigue can be partially attributed to the increased force the body is required to absorb. The ligaments of the knee also lose their elasticity as the collagen stiffens. This loss of elasticity causes larger

loads to be transmitted to the articular cartilage surfaces. Several recent studies have demonstrated that these tissue changes are partially reversible in response to a consistent exercise program.

Treatment of Injuries

When the collagen structures of the knee are seriously injured, specific surgical treatments can induce the body to partially restore the original anatomy. For example, when the articular surfaces are roughened, the surgeon can smooth them with an outpatient arthroscopic surgical technique. If the damage extends down to the underlying bone, drilling into that bone can induce a new blood supply, which can cause new cartilage to grow. Unfortunately, the new cartilage is not exactly the same as the original matter, although it is usually better than a rough surface.

For the meniscal cartilage, many types of tears can now be repaired arthroscopically with sutures to restore the original shape of this critical shock absorber. Also, for the athlete who has advanced degenerative arthritis with knee pain and limited motion, total knee joint replacement can be performed in ways that permit an early return to skiing.

Many patients with advanced arthritis wait too long before having definitive procedures performed. Though patients are encouraged to do certain exercises and use anti-inflammatory medications for prolonged periods before considering surgical intervention, if the knees have severe changes and the skier desires to remain physically active, it is better to treat the knee while full motion and muscle strength are present. Immediate postoperative rehabilitation exercises are crucial to ensure a return to adequate muscle strength and knee motion.

Injury Prevention

Aging skiers ask not what their knees can do for them, but what they can do for their knees! Strength and motion ability are the characteristics of the well-preserved athlete, and strong, flexible collagen tissues are less likely to be injured while skiing.

Strength is gained by year-round conditioning. The following knee exercises can be performed at home. Perform them daily, and be sure to consult your orthopaedic surgeon if pain or swelling occurs in the knee joint.

One-Third Knee Bend. Begin your knee strengthening with the one-third knee bend exercise. Assume a standing position with your feet slightly wider than your shoulders, your back straight, and your knees bent approximately 30 degrees. Slowly bend your knees until your heels start to come off of the floor. Then return to the starting position of 30 degrees of extension.

Take about one second to move down and one second to move back up, always doing the knee bends slowly and smoothly. Eventually you should build up enough tolerance and strength to perform this exercise for two minutes. Try to do three sets with a resting period of one minute between each set.

The next exercise requires you to perform the one-third knee bend exercise with one leg only. Start in the same position, but with one leg lifted slightly off of the floor and the other flexed at a 30-degree angle. Flex your knee down until the heel begins to lift, then return to the starting position. The speed is the same: one second down and one second up. Duration should be one minute long with a total of three sets and a one minute rest between sets. Finally, do one-third knee bends in a linebacker position. Start with your feet slightly wider than your shoulders, knees flexed at a 30-degree angle, and ankles flexed forward. Bend at the waist until your elbows are resting on your lower thighs and your back is horizontal. Flex your knees down to a 90-degree angle and back up to the starting position. This exercise should be slower than the previous knee bend exercises. Try to maintain duration until your quadriceps begin to burn or until you are fatigued.

Lower Extremity Stretching. One of the best ways to preserve lower extremity motion is to perform leg stretching exercises. The calf and achilles stretch, hamstring stretch, and quadriceps stretch are simple but effective ways to help you maintain full extension and full flexion.

To perform the calf stretch, stand with one leg back and one leg forward with your hands resting flat against a wall at shoulder height (Figure 2). The heel of your back leg should be flat on the floor. Lower your body toward the wall with the back knee straight. Hold this position for 30 to 60 seconds.

For the achilles stretch, assume the same position as in the calf stretch, but with your back knee bent. Lower your body toward the wall and hold the stretch for 30 to 60 seconds.

To do the hamstring stretch, place one heel up on a step or curb, keeping your knee straight. Slowly lean forward by bending at the hips, being sure to keep the back and upper pelvis level with one another until a stretch is felt. Hold for 30 to 60 seconds. A second method of the hamstring stretch is to lie flat on your back with one leg up against a wall (Figure 3). Gently flatten the back of your knee against the wall to stretch the back of your thigh, keeping the buttocks close to or touching the wall. Hold for 30 to 60 seconds.

To do the quadriceps stretch, stand in front of a chair and hold onto it with one hand for support. With the other hand, reach behind you to pull your ankle up, bringing the heel toward the buttock (Figure 4). Keep the flexed knee next to the supporting knee and maintain a straight back. Hold for 30 to 60 seconds.

Supplement these stretching exercises with cross-training to increase endurance and flexibility on the slopes. Swimming and bicycling tend to be kindest to the knee joints and provide for cardiovascular conditioning as well. Check with your physician before beginning any strenuous workout program.

Summary

Aging and skiing can be compatible, if the warning signs-soreness, grinding, and a fatigued knee-are properly diagnosed, treated, and kept in check through a year-round conditioning program. Condition for the sport, and you are sure to end up spending more time on the snow and less in your recliner.

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