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Vestibular Rehabilitation

If you sometimes feel dizzy or lose your balance, your doctor may have referred you to a therapist for vestibular rehabilitation. For some, an episode of dizziness comes and goes, but for many, it is a chronic problem that doesn't go away. If this is a persistent concern for you, vestibular rehabilitation may help (**Box 1**).

The vestibular system controls your balance

To keep your balance, your brain uses the signals from your eyes to see where you are, your proprioception (the sensors in your muscles and joints) to feel where you are, and your vestibular organs (the balance organs in your inner ears) to sense when your head moves. The vestibular system internally tells the brain where your head is oriented in space.

Balance is a complex system that begins in your inner ear (**Fig. 1**). In addition to hearing, your inner ear controls your equilibrium by serving as a sensory organ for your orientation and head movement. You have small balance organs within the inner ear that work with your visual system, which is processed by your brain to give you a sense of your body's position. These systems help keep objects from blurring when you move your head. You also have sensory receptors in your skin, joints, and muscles that send balance-related signals to your brain. Your brain receives information from these different body systems all at once.



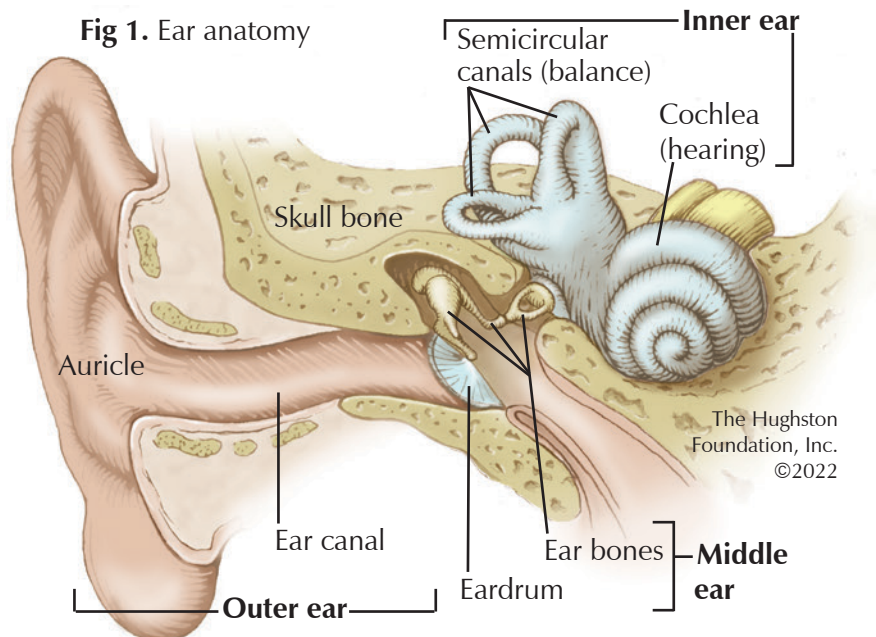
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Box 1. Some causes of dizziness and balance disorders:

- | | |
|-------------|------------------------------|
| Head injury | Stroke |
| Medications | Low blood pressure |
| Age | Ear infection |
| Neck injury | Upper respiratory infections |

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Fig 1. Ear anatomy



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If changes in the inner ear occur—for example, aging, illnesses, infection, or trauma—one or several components of this system may not work properly, causing you to suffer from loss of balance. Concussion, blows to the head or ear, and whiplash are frequent causes of balance disorder and dizziness. Illness, such as ear infections, upper respiratory infections, stroke, and low blood pressure can also lead to vestibular disorders (Box 1).

Is there a cure?

For most people who have a vestibular disorder the problem is permanent because your body is limited in its ability to repair damage to the vestibular organs. The good news is that your body often compensates for a vestibular problem by retraining the part of the brain that interprets balance; therefore, treatment can help reduce the symptoms and improve your balance. Some of the recalibration can happen naturally, but for many, vestibular rehabilitation is necessary to avoid symptoms and a risk of injury.

Aging doesn't make it easier

Older people are more likely to experience a balance disorder because as you get older, a collection of problems can affect your balance. Declining hearing and vision, cataracts, muscle weakness, or other health problems like diabetes and blood pressure can contribute to a balance disorder.

The natural aging process can affect your senses and the brain's ability to interpret them, resulting in a slower reaction. For example, you may not respond fast enough to catch yourself if you trip on something or be able to keep your balance on uneven ground or rough terrain. A persistent sense of imbalance, or what some might call “a loss of surefootedness,” can cause a fear of falling as well.

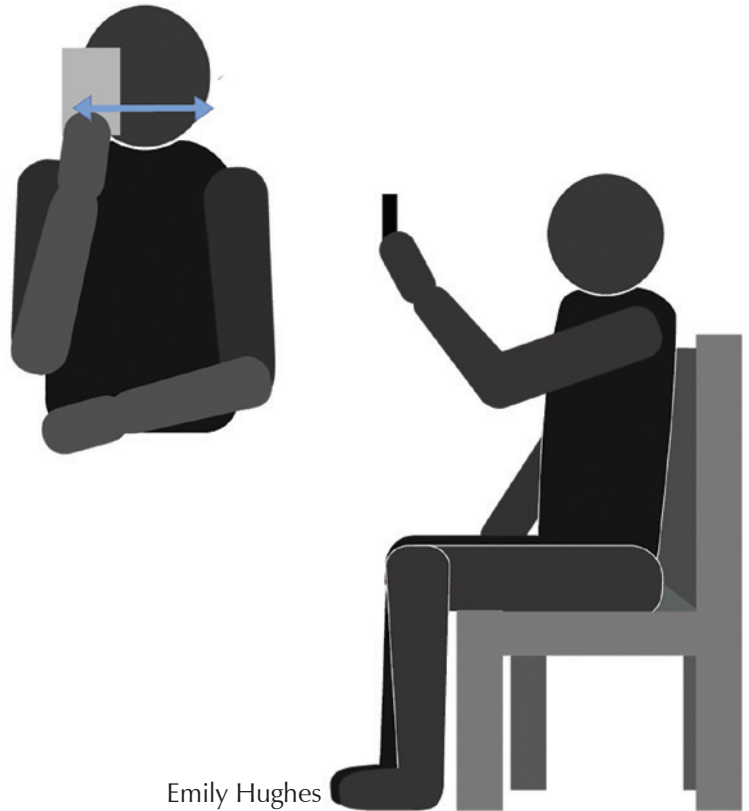
Box 2. Balance disorders are difficult to diagnose, so you should discuss your symptoms with your physician.

Let your doctor know if:

- You feel unsteady
- You sometimes feel as if the room is spinning around you
- You feel as if you're moving when you know you are standing or sitting still
- You lose your balance and fall
- You feel as if you're falling
- You feel lightheaded, or as if you might faint
- Your vision becomes blurred
- You sometimes feel disoriented, losing your sense of time or place

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Fig. 2. Visual tracking exercise. Individual holds a card at eye level and moves it side-to-side while tracking with their eyes but not moving their head.



Emily Hughes
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How is this problem diagnosed?

The first step to improving your balance is to see your doctor for a physical exam and diagnosis (**Box 2**). Your doctor can assess whether your symptoms are from a serious problem, such as a blood or heart condition or if it is a vestibular problem. If an inner ear disorder is likely, your doctor may refer you to a specialist, such as an otolaryngologist (a doctor with expertise in the ear, nose, and throat). You may receive a hearing test, a balance test, and possibly an imaging study of your brain, such as a magnetic resonance imaging (MRI) scan.

History of vestibular rehabilitation

Although vestibular rehabilitation has only recently gained wide attention, the concept of head movement and coordinated eye exercises as a treatment for vestibular disorders is actually over 80 years old (**Fig. 2**). As far back as the mid 1940's, a British otolaryngologist name Sir Terence Edward Cawthorne observed that some patients improved or recovered sooner from dizziness after performing rapid head movements. In cooperation with a physiotherapist named Cooksey, they developed a regime of exercises to help reduce dizziness and restore balance. With some modifications, physical therapists continue to use the Cawthorne-Cooksey exercises today.

How vestibular rehabilitation exercises help

Unfortunately, your body is limited in its ability to repair damage to the vestibular organs. However, some of the recalibration can happen naturally, but the recovery process can be accelerated and the degree of recovery increased by regularly practicing specific exercises. The exercises include eye, head, and body movements to stimulate your balance system. They are simple and designed so you can do them under the supervision of a therapist and at home.

What can you expect?

Vestibular rehabilitation exercises will make you feel slightly dizzy while you are doing them, which is why you need a trained therapist to help you. The dizziness you feel is normal and it is a sign that your brain needs practice making the movements to help recalibrate your balance system. If the balance exercises make you feel extremely dizzy and unwell, then your therapist may instruct you in exercises that are easier or slower.

Meeting with your therapist

A therapist who specializes in vestibular rehabilitation develops an individualized treatment plan based on your symptoms and needs. At your initial appointment, your therapist will evaluate your condition and help you set realistic goals to improve your symptoms (**Box 3**). Among the different types of vestibular rehabilitation exercises, your therapist will determine which is best for you.

What are the exercises?

Your exercise-based program will help you improve balance and reduce dizziness. Here are the different types of exercises that your physical therapist may use:

- **Adaptation exercises** improve your balance system by resetting how your brain controls your eye movements in response to your balance organs.
- **Habituation exercises** involve repeating movements to reduce symptoms.
- **Proprioception exercises** focus on detection of movement and body position, which are important cues for maintaining your balance.
- **Substitution exercises** help with discovering the strongest and weakest part of your balance system and relying more on the areas that can help you regain function.
- **Canalith repositioning** is a maneuver performed by a trained therapist who gently repositions crystals in the inner ear that have become dislodged and float within the ear canal.

Box 3. Does this sometimes happen to you?

Yes <input type="checkbox"/>	No <input type="checkbox"/>	Do you have a feeling of movement, spinning, or falling when you move your head rapidly?
Yes <input type="checkbox"/>	No <input type="checkbox"/>	Do you have trouble or are you uncomfortable trying to move in the dark?
Yes <input type="checkbox"/>	No <input type="checkbox"/>	Do your feet tend to go in a direction other than what you want?
Yes <input type="checkbox"/>	No <input type="checkbox"/>	Do you have a sense of unsteadiness?
Yes <input type="checkbox"/>	No <input type="checkbox"/>	Do you have a fear of falling or stumbling?
Yes <input type="checkbox"/>	No <input type="checkbox"/>	Does looking at moving objects make you queasy?
Yes <input type="checkbox"/>	No <input type="checkbox"/>	Do you have trouble keeping your balance as you walk on different surfaces?
Yes <input type="checkbox"/>	No <input type="checkbox"/>	Do you feel like you are drifting or being pulled to one side while walking?

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*If you answered YES to one or more of these questions, you should consider an evaluation.

Therapy includes practical solutions to improve your life

For older adults, or if you have balance problems, you will work on practical solutions to help with walking on uneven surfaces, moving unencumbered on ramps, climbing stairs, and how to move safely in the dark. Fall prevention, movement coordination, and participation in everyday activities are major areas you will work toward improving. You may have 2 to 3 sessions for an hour each week for 8 to 12 weeks. As you progress, you will be given more exercises to perform at home to help you improve.

A specialized rehabilitation therapist can give you a set of head, body, and eye exercises to help reduce dizziness and nausea. The duration of your treatment, depends on the diagnosis and clinical symptoms you experience. Some patients may only need 8 to 10 visits while other may require sessions for 3 to 4 months.

Get back on your feet

Unfortunately, many people adopt a sedentary life to avoid bringing on a dizzy spell or imbalance episode. Fear from falling can keep you inactive, resulting in decreased stamina, flexibility, and muscle strength, which also causes joint stiffness and other aches and pains. Vestibular rehabilitation can help you avoid these problems through proven treatment strategies that get you back on your feet and living your life again.

Ariz S. Amaria, PT, MS, OMT-C, AIB-VR/CON
Columbus, Georgia

ACL Injuries

There is a good chance that you or someone you know has experienced an injury to the anterior cruciate ligament (ACL). ACL tears represent more than 50% of knee injuries and affect more than 200,000 people in the US each year, with direct and indirect costs greater than \$7 billion annually.¹ The ACL is the most commonly torn ligament of the knee and has been responsible for many career-ending injuries for athletes.² Amateur and professional athletes dread the thought of experiencing this injury. However, improved research in treatment and advanced surgical techniques have made it possible to treat the injury effectively with both operative and nonoperative management.

Anatomy of the knee

To understand ACL injuries, we must first understand the anatomy of the knee and the function of the ACL in stabilizing the knee (**Fig. 1**). One of the largest joints in the body, the knee region is where the femur (thighbone) and the tibia (shinbone) meet. Covering the ends of these bones is articular cartilage that protects the bones from rubbing together while bending the knee. Crescent shaped disks of fibrocartilage—the medial meniscus and lateral meniscus—are also in between these 2 bones and function as shock absorbers during activities such as standing,

running, and jumping. The patella (kneecap) sits on top of the joint and slides through a groove in the femur.

For the knee to bend, the bones must be attached in a dynamic, yet stable fashion. This is where ligaments are useful. A ligament is tough connective tissue that connects 2 bones to each other and allows structural support while maintaining slight elasticity for movement. The knee joint has 4 main stabilizing ligaments: anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), medial collateral ligament (MCL), and lateral collateral ligament (LCL). They all function in opposing ways to stabilize the knee throughout flexion (bending) and extension (straightening) of the joint. The ACL and PCL make a crisscross pattern and together they keep the knee joint stable during back and forth movement. The ACL keeps the tibia from slipping too far in front of the femur. Although ligaments, cartilage, and tendons (tissue that connects muscle to bone) provide great stability to the knee joint, they also allow tremendous power transfer through the leg for physical activity.

Injury

Most ACL injuries occur as a low velocity, noncontact injury, such as during a decelerating and pivoting motion. For example, this can happen when a soccer player is running in one direction, plants his or her foot, and quickly reverses direction to cut back across the field. The foot and lower leg remain still while the upper body turns with the knee in a flexed position (**Fig 2**). Athletes who experience

Fig. 1. Normal left knee anatomy (front view)

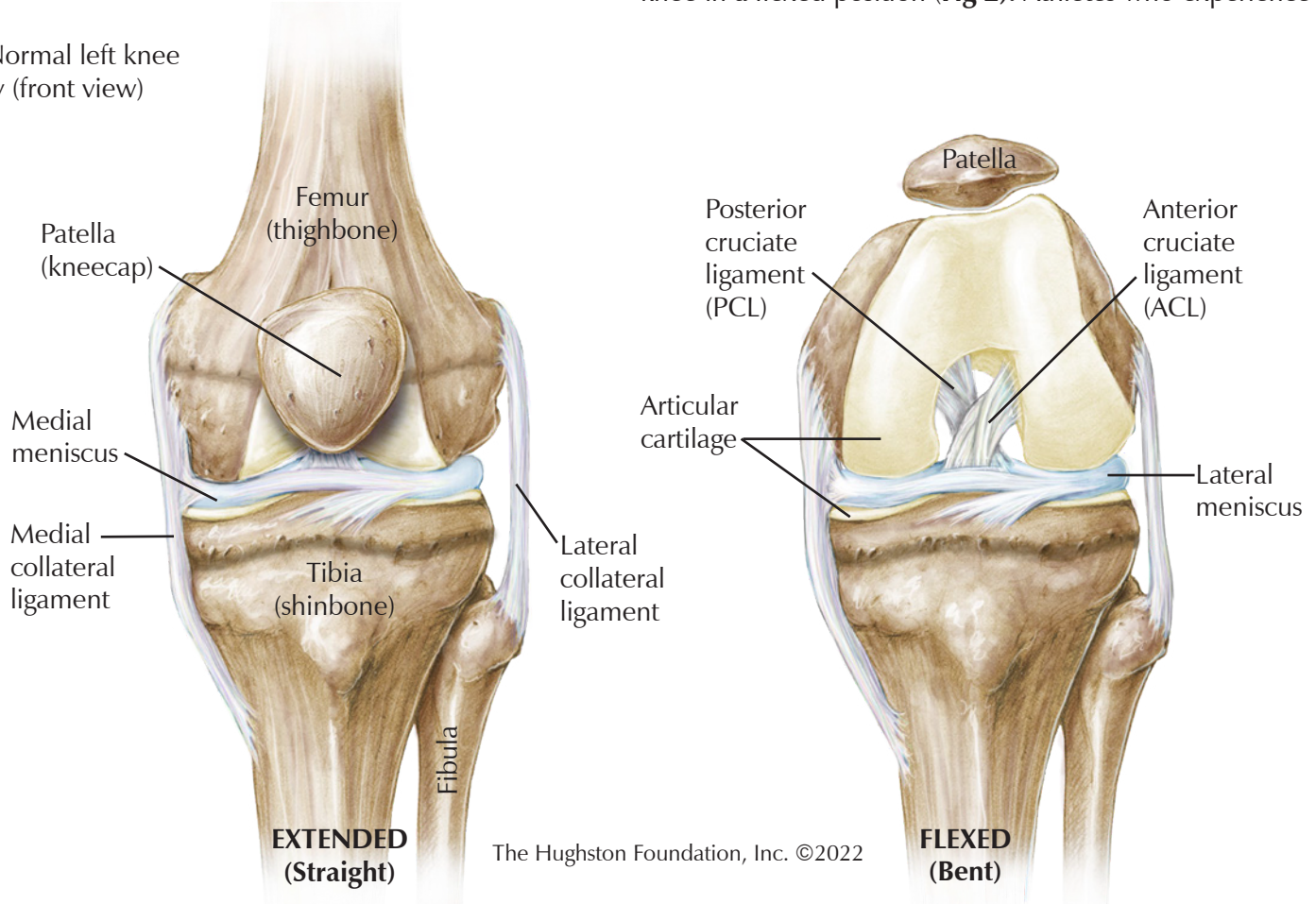
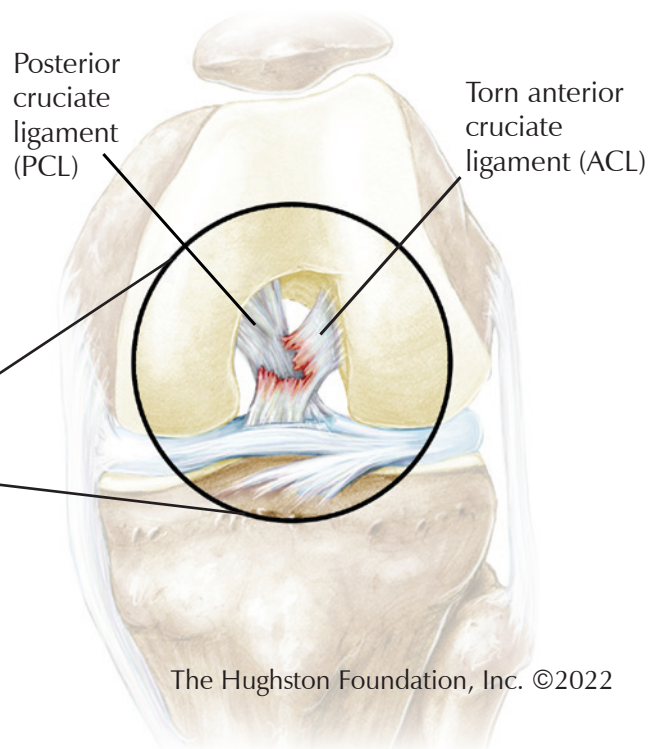


Fig. 2. Soccer player planting their foot and pivoting can possibly tear ACL.



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Fig. 3. Injured anterior cruciate ligament (ACL)



ACL injuries usually describe a popping sound or sensation just prior to the onset of symptoms. While some patients experience minimal or no pain, most experience excruciating pain deep inside the knee joint with a feeling of instability, particularly when the knee is in full extension (**Fig 3**). Pain followed by significant swelling and stiffness typically occurs during the next 24 hours.

ACL injury is best evaluated immediately after injury. If you have an athletic trainer or sports medicine physician nearby, you may notice them maneuvering the knee to test the integrity of the ligaments and cartilage of the knee. Trained medical professionals can assess the injury from the physical exam, but doctors often use magnetic resonance imaging (MRI, a test that shows the bones, muscles, tendons, and ligaments) to confirm the diagnosis and evaluate the extent of the injury.

Who is at risk for injury?

Adolescents aged 16 to 18 years old and particularly those who participate in more vigorous intensity sports with little down time³ are at the highest risk for injury. Females are 3 times as likely to experience an ACL tear as their male counterparts.⁴ When considering specific sports, females are at a greater risk playing soccer, while males are at a greater risk playing football.¹

Treatment options

There are both operative and nonoperative methods to treating ACL injuries. Athletes who want to return to a high level of competition are ideal surgical candidates. Often, patients worry that an ACL tear must be repaired

immediately to avoid future complications. Data on the timing of surgery does not indicate that immediate repair is superior to delayed repair. Since it is not imperative to go to surgery urgently, the physician may recommend a trial of nonoperative treatment with close follow-up for 3 months. If there is no improvement after 3 to 6 months, surgery may be an option.

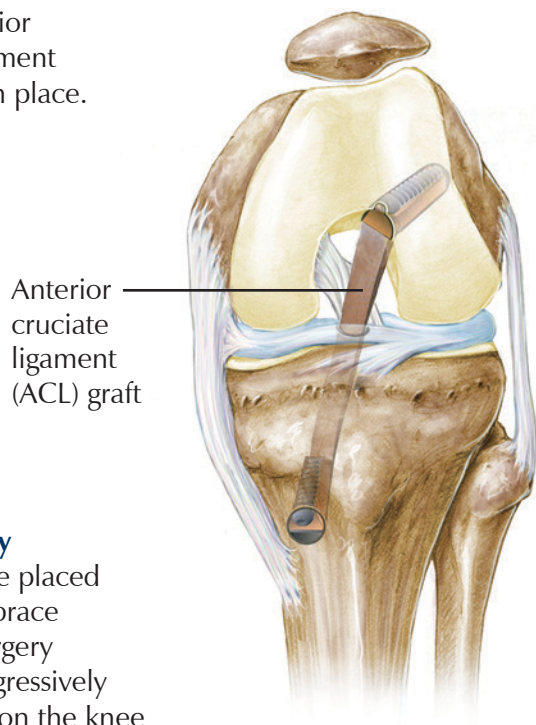
Nonoperative treatment

An orthopaedic surgeon considers nonoperative treatment for patients with a low activity demand and no significant instability. Nonoperative treatment typically involves a combination of physical therapy, bracing, and lifestyle modifications. The physician will continue to evaluate the injury every few weeks to ensure progress is being made. Emergence of symptoms such as the knee “buckling” or “giving way” signifies instability. At any time nonoperative management fails, surgery is often recommended to prevent further injury to the knee.

Operative treatment

ACL reconstruction surgery is typically an outpatient procedure, which means you will arrive at the hospital, have the procedure, and go home on the same day. Once the torn ACL is removed, a “new” ACL, called a graft, will be inserted in its place (**Fig 4**). A graft can come from the patient (an autograft) using the hamstring tendon, patellar tendon, or quadriceps tendon, or from an organ donor, which is called an allograft. Once the new ACL graft is in position and the remaining structures evaluated, the incision is closed, and the patient is taken to the recovery room.

Fig. 4. Anterior cruciate ligament (ACL) graft in place.



After surgery

Patients are placed in a hinged brace following surgery and will progressively weight bear on the knee over the next 6 weeks. During the first 6 weeks, physical therapists direct rehabilitation exercises with a focus on pain and swelling control, patellar mobilization, and quadriceps muscle activation. During weeks 6 to 12, the therapist will focus more on strengthening the leg muscles and increasing stability and endurance. Often, the goal for returning to sport is a minimum of 6 months, but the timeline varies between athletes.

Returning to the playing field

ACL injuries can be a scary and painful experience for many athletes, but current surgical procedures have been successful in returning many to the playing field. If you have experienced an ACL injury and want to return to a high activity level, a tendon graft is a reliable way to restore knee stability. Be sure to express your desired activity level when discussing treatment options with an orthopedic surgeon who is experienced in ACL reconstruction.

*Christopher Rogers, BS
Columbus, Georgia*

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Return to Sport after ACL Reconstruction

Sport participation after anterior cruciate ligament reconstruction (ACLR) surgery can be quite challenging for anyone; however, it can be especially difficult for young athletes. Short- and long-term effects of an ACL injury can include muscle weakness, poor knee function, and knee osteoarthritis (degenerative joint disease) later in life. Returning to sport after ACLR surgery can also be a grueling and painful process and it puts the athlete at a much higher risk for reinjury. Some researchers have found that as many as one-third of patients who have had ACLR surgery experience a second ACL tear,¹ while others have found successful participation without injury with the right timing and knee function. Getting back in the game should be a progressive and patient-tailored process that helps to decrease the risk of reinjury or injury to the healthy knee. This article aims to outline some of the most important pieces of the puzzle that can help a young athlete return to sport safely and without reinjuring the ligament.

How can we reduce the risk of reinjury?

An athlete's return to the sports field should entail a multifaceted approach that requires the athlete, physical therapist, athletic trainer, and surgeon to all be on the same page. The criteria for a safe return are, but not limited to, psychological readiness, functional and strength tests, physical readiness, and timing.

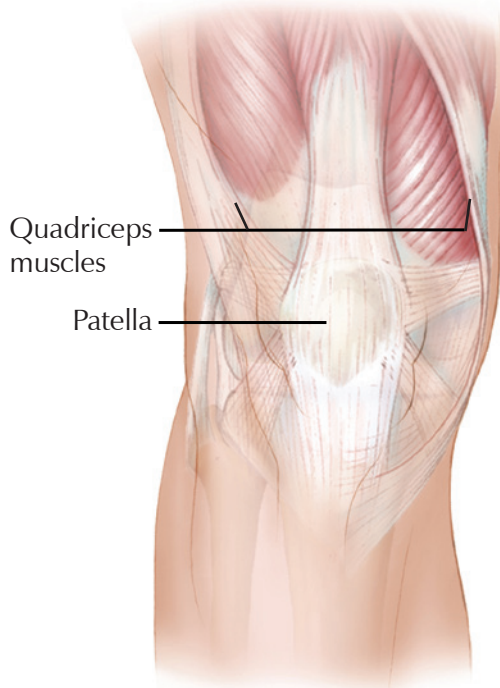
Psychological readiness

The athlete's psychological readiness plays a crucial role in determining when to resume competition. The athlete should feel ready and have confidence in his or her knee function. Fear of reinjury can lead to decreased motivation and activity, which can be related to poorer performances on functional and strength tests.² A progressive patient-tailored rehabilitation program can help the athlete begin to trust their knee stability. The process occurs over time while completing the exercises and experiencing the progress each week.

Functional and strength testing

A comprehensive rehabilitation program designed by a physical therapist and directed by the surgeon, and then followed by an athletic trainer, often proves the most successful. Early physical therapy often focuses on exercises that do not place excess stress on the graft. During the first 4 to 6 weeks, the goals are to minimize pain and swelling, restore patellar (kneecap) mobility, restore quadriceps activation, and to normalize motion (**Fig.**). During the 6 to 12 week phase, the patient will work to develop strength, stability, and endurance. Often symmetrical quadriceps strength and the single-leg hop test, where the athlete hops and lands on the same leg without swinging their arms or needing extra hops after landing, are the cornerstones of the criteria. Depending on when the athlete is ready, more sport specific tests and exercises are performed in the late phase of rehabilitation.

Fig. Right knee anatomy



Readiness of the athlete

Once the athlete is ready to return to sport-specific activities, a gradual increase in training load⁴ ensures that the athlete is prepared to return to a competitive level. A gradual return to activity is a vital part of the rehabilitation process. The athlete needs exposure to a training stimulus and stress appropriate for their current physical shape, which allows adaptation to take place. Some athletes tend to believe that “more is better,” and, therefore need protecting from their overzealousness. If the training is too strenuous and if the athlete does not recover appropriately, it can lead to increased risk of injury. Different sports present diverse demands on the knee; therefore, sport-specific exercises to improve function and build confidence are necessary. For example, in pivoting sports, such as football or soccer, players who can perform a specific motion prior to returning to sport have a much lower risk of reinjury.

The perfect time

Our bodies need time to heal, so when recovering from ACLR, time is an important part of the treatment plan to reduce the risk of reinjury. Previously, physicians often considered a 6-month mark as an adequate timeframe given the rehabilitation program also proved the athlete ready. However, recent research has found that for young athletes returning to sport before 9 months increases their risk of reinjury by up to 7 times. An additional study found that delaying return decreases risk of injury by 51% for each month before the 9-month mark.^{3,5} This does not mean that the athlete can sit on the couch for 9 months and then go set a single-season rushing record in the NFL like Adrian Peterson did. Delaying sport participation up to 9 months can definitely reduce risk of reinjury significantly, but there is a need to complete a gradual, progressive rehabilitation program.

Minimizing the risk

After ACL reconstruction, returning to sport too soon, or being ill prepared can cause devastating consequences. Unfortunately, we cannot eliminate the risk of reinjury completely when getting back into the swing of things; however, with a collaborative, thoughtful effort of the athlete and the treatment team, we can aim to minimize the risk as much as possible.

Malte Krapp, BS
Columbus, Georgia

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Send inquiries to Medical Writing, The Hughston Foundation, Inc.,
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