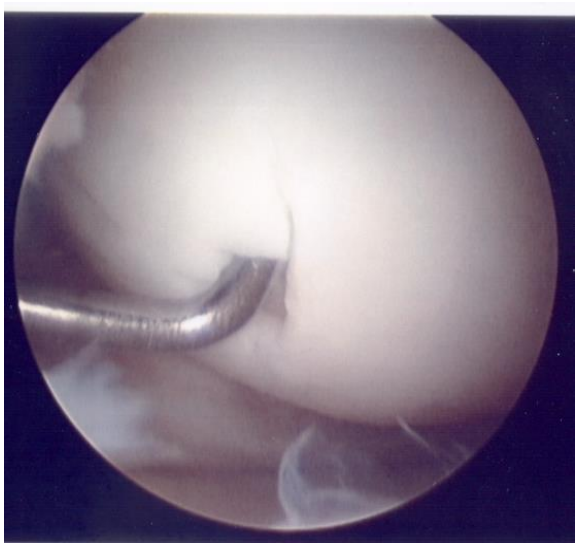
# Articular Cartilage Injury of the Knee

Focal (restricted to a limited area) injury to the articular cartilage of joint can occur following an injury. Articular cartilage is a durable, but complex, structure that covers the ends of the bones at a joint and allows the joint surfaces to slide and roll smoothly back and forth without pain during movement. Injury can result in a focal tear, split, or separation of the articular cartilage from the underlying bone. Cartilage injury can occur in any joint, although it occurs most commonly in the knee, followed by the ankle, elbow, and shoulder. Cartilage has no blood supply and therefore, no potential to heal, making articular cartilage injuries difficult to treat. The natural history of focal articular cartilage injury is to progressively get worse until arthritis occurs. Arthritis describes the condition when the articular cartilage covering the ends of the bones has worn out diffusely (over a broad area) on both sides of the joint and the ends of the bone are exposed and rubbing, producing in inflammation and pain.



Arthroscopic view of a small articular cartilage defect/injury

## Frequent Signs and Symptoms

- Swelling and pain are most common.
- Sometimes giving way, “locking,” or catching of joints occurs
- Sensation of something moving or floating free in the joint
- Painful crepitation (a crackling sound) from the joint with motion
  - Joints often make painless noise which is typically not a problem
- Often associated with injuries to the joint that result significant pain, swelling, and injuries to ligaments



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## Etiology (Causes)

Compressive, shearing, and rotational forces from direct injury to the joint are the typical cause for focal articular cartilage injury.

## Risk Factors

- Contact and collision sports
- Highly active athletes, especially adolescents, participating in competitive sports
- Other joint injuries such as knee anterior cruciate ligament (ACL) tears, shoulder dislocations, patellar dislocations, ankle sprains, and elbow dislocations or ligament injuries
- Poor physical conditioning (strength and flexibility)

## Prevention

- Wear proper protective equipment
- Wear appropriate-length cleats for playing surface
- Appropriately warm up and stretch before practice and competition
- Maintain appropriate conditioning:
  - Flexibility, strength, and endurance of muscles around joints
  - Cardiovascular fitness

## Outcomes

Small areas of articular cartilage injury may not cause problems and may not develop arthritis for some time. The larger and deeper cartilage injuries are more of a problem because the cartilage does not heal and these injuries can cause swelling, pain, functional limitations, and may worsen with time. It is likely that these injuries will progress and lead to symptomatic arthritis over time. Appropriate treatment can improve symptoms (swelling, pain, functional limitations) and allow return to activity.

## Potential Complications

- Recurrence of symptoms, resulting in persistent pain and swelling
- Progression to arthritis of the affected joint
- Loose bodies with locking of affected joint

## Treatment Considerations

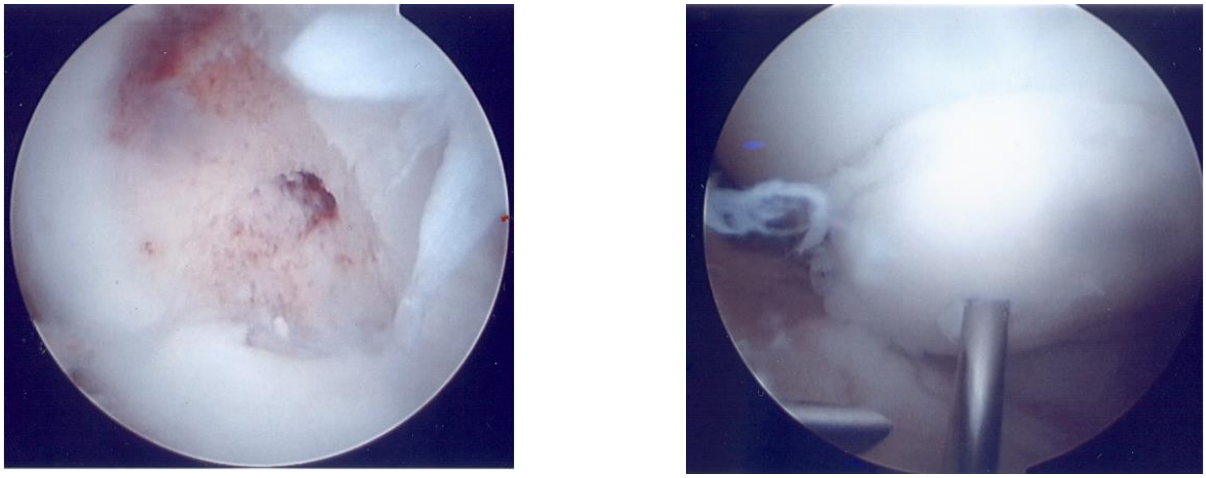
Conservative treatment consists of anti-inflammatory medication, ice, and activity restriction to relieve pain and reduce the swelling of the affected joint. Range-of-motion, stretching, and strengthening exercises may be recommended to correct any deficits and restore and optimize function of the joint. Often, referral to a physical therapist or athletic trainer is recommended. For patients with persistent symptoms (swelling, pain, functional limitations) despite conservative treatment, with loose fragments within the joint or with symptomatic cartilage injury identified on MRI, surgery to restore the function of the damaged joint surface is usually recommended.

The first line of operative treatment usually involves arthroscopic surgery to remove the unstable and/or loose cartilage fragments, stabilize the borders of the cartilage injury, and stimulate a healing or reparative process to occur in the vacant space in the cartilage with marrow techniques such as microfracture or Abrasionplasty. Microfracture refers to creating small (<2 mm diameter) perforations in the exposed bone at the base of the cartilage defect with a small arthroscopic pick or drilled pin. Abrasionplasty refers to shaving the surface of the same exposed bone down (< the 1 mm) to a fresh bleeding surface. With both techniques, blood and marrow contents are allowed to escape from the bone and fill the articular cartilage defect. With proper protection, the blood and marrow contents form a fibrin clot and eventually fill the defect with reparative tissue and relieve symptoms. The reparative tissue is not cartilage nor as mechanically durable, but surgical results are good to excellent for limited (<2 $cm^2$), well-bordered articular cartilage injuries. Sometimes, other arthroscopic or limited open procedures to re-attach the unstable or loose fragments of cartilage are possible.

Arthroscopic view of microfractures to stimulate reparative tissue growth

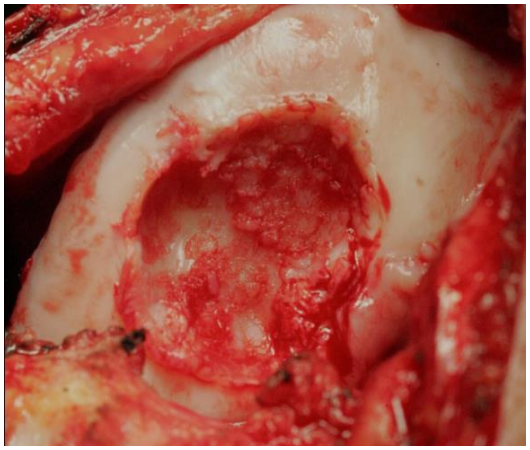
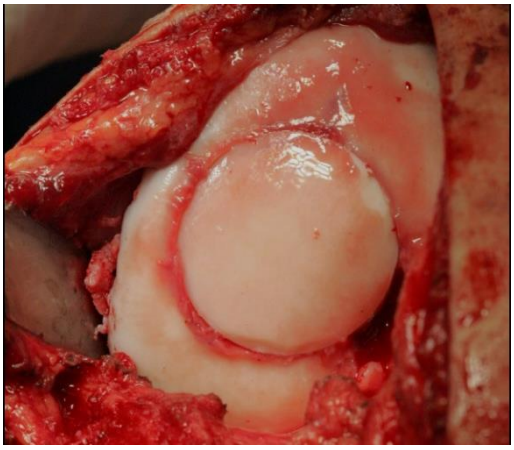
For larger articular cartilage injuries or those injuries that have failed less invasive marrow stimulating techniques, more involved cartilage restorative procedures may be indicated.

Autologous osteochondral transfer (OATS) refers to harvesting a plug of bone and cartilage from a less important site in the joint and inserting it into the symptomatic site of articular cartilage injury.



Before (left) and after (right) **transfer** of autologous bone and cartilage graft

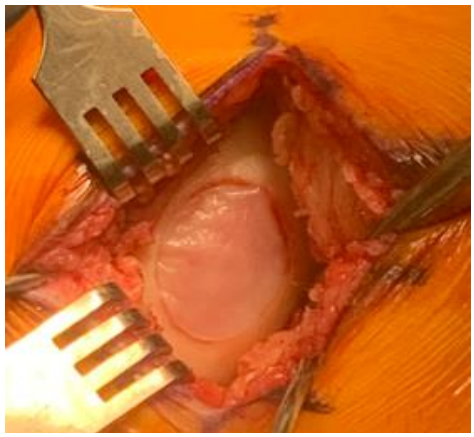
Fresh allograft osteochondral transplant refers the same procedure except the plug of bone and cartilage is harvested from a recently deceased donor and inserted in less than 21 days.

Before (left) and after (right) allograft **transplant**
*open procedure due to patient's concurrent injuries and large defect

Autologous cartilage implantation (ACI) refers to arthroscopically harvesting a small piece cartilage from a healthy portion of the joint, allowing the cartilage cells to multiply in a lab over several weeks, and then returning to the operating room to reimplant the cartilage cells into the articular cartilage defect with an artificial cartilage like matrix or with the defect covered by a patch of periosteum (special layer of tissue on the surface of bones).

Cartilage defect of the medial femoral condyle of the knee exposed and prepared



Reimplantation of autologous cultured cartilage cells on scaffold to repair the defect

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Extensive rehabilitation is required following all of these cartilage restorative procedures. Following an initial six week period of bracing, protected weight bearing, gentle passive (without using your own muscles) movement of the joint, range-of-motion, stretching, and strengthening exercises for the joint and surrounding muscles are necessary. This typically requires the assistance of a physical therapist and at least four to six months before return to athletic activities can occur.

## Possible Medications

- Nonsteroidal anti-inflammatory medications, such as aspirin and ibuprofen (do not take within seven days before surgery), or other minor pain relievers, such as acetaminophen, are often recommended. Take these as directed by your physician. Contact your physician immediately if any bleeding, stomach upset, or signs of an allergic reaction occur.
- Strong pain relievers may be prescribed following surgery. Use only as directed and only as much as you need.

## Notify my office if symptoms worsen

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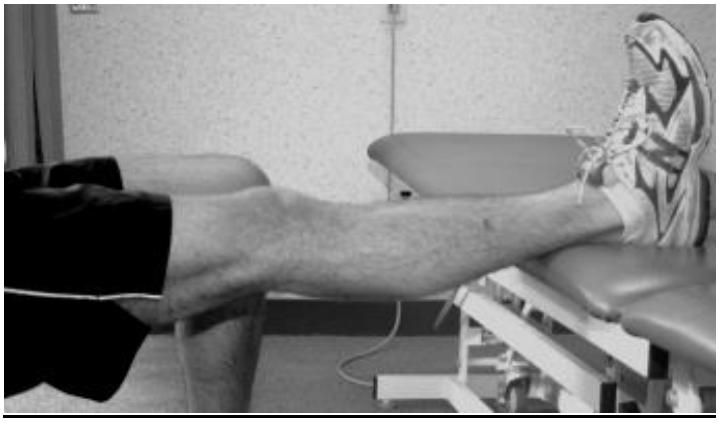
# Simple Knee Exercises

**Knee Extension**



1. Sit with affected leg propped and the knee unsupported as shown. (A couch with a coffee table will work.)
2. Straighten your knee by contracting your quadriceps (front of thigh) muscles and by placing your hand on your thigh just above the knee and pushing down.
3. Hold this position for 5-10 seconds then repeat 15-20 times 2-3 times per day.

**Quadriceps Sets**

1. Sit or lie on your back with the affected leg straight.
2. Tighten the muscles on the front of your thigh and push your knee down into the table.
3. Hold this position for 5 seconds then relax. Repeat exercise 10-15 times, 2-3 times daily.

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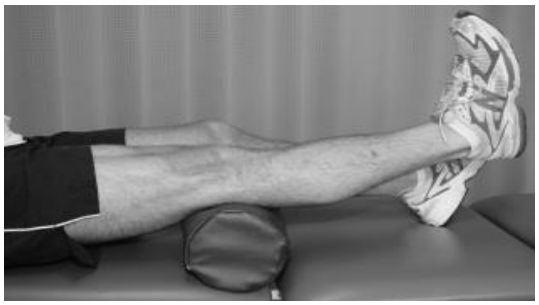
**Quadriceps Short Arc Quads**

1. Sit of lie on your back with the affected leg straight.
2. Place a rolled up towel or pillow under your knee allowing it to bend.
3. Tighten the muscles on the front of your thigh and lift your heel off the table.
4. Hold this position for 3-5 seconds then repeat 10-15 times, 2-3 times per day.

**Isometric Hamstrings (Heel Digs)**


1. Lie on your back and bend your knee to where you feel a stretch.
2. Contract your hamstrings (back of thigh) muscles, attempting to bend the knee while forcefully dig your heel into the floor or bed.
3. Hold this position for 3-4 seconds then relax.
4. Repeat this exercise 10-15 times, 2-3 times daily.

**Standing Calf Raises**


1. While standing with the ball of your foot on the flat of a low stair, slowly raise both heels.
2. Hold this position for 2-3 seconds then return to the starting position.
3. Repeat this exercise 10-15 times, 2-3 times per day.
4. **Hold on to a railing for support and balance as necessary. If you are concerned about balance, you can perform these exercises on the floor while you sit in a chair or stand with your hands on a nearby wall.**
5. **Perform this exercise in your brace if provided**

**Straight Leg Lifts**


1. Lie on your back while keeping the affected leg straight.
2. Tighten the muscles on top of your thigh then raise the leg 12-18 inches off the floor.
3. Hold for 3-5 seconds then lower the leg to the starting position.
4. Repeat this exercise 10-15 times, 2-3 times per day.
5. **Perform this exercise in your brace if provided**

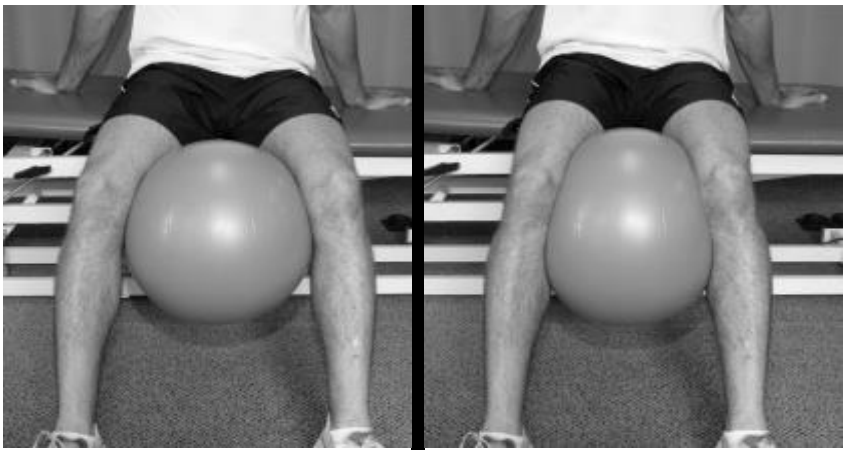
**Straight Leg Abduction (Side) Lifts**


1. Lie on your side with the affected leg on top.
2. While keeping the leg straight slowly raise it 12-18 inches.
3. Hold this position for 3-5 seconds then lower the leg to the starting position.
4. Repeat this exercise 10-15 times, 2-3 times per day.
5. **Perform this exercise in your brace if provided**

**Straight Leg Extension Lifts**


1. Lie on your stomach as shown.
2. While keeping the affected leg straight raise it 12-18 inches
3. Hold this position for 3-5 seconds then lower the leg to the starting position.
4. Repeat this exercise 10-15 times, 2-3 times per day.
5. **Perform this exercise in your brace if provided**

**Hip Adduction (Ball Squeezes)**



1. While sitting or lying on your back, place a medium sized ball or large pillow between your legs.
2. Squeeze the ball.
3. Hold this position for 3-5 seconds then relax.
4. Repeat this exercise 10-15 times, 2-3 times per day.