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Articular Cartilage Injuries of the Knee

There are two very important types of cartilage in the knee: the articular cartilage and the meniscus cartilage. The articular cartilage is the most important cartilage as it covers the ends of the bones that make up the knee joint. This cartilage is very smooth and slippery and allows for fluid movement of the knee. It is the same structure with which we are all familiar, the white shiny surface on the end of a chicken or turkey bone. When this cartilage is healthy and intact, it allows for pain-free normal motion of the knee. However, when injured, it can be very painful and can lead to progressive limitation in function. Fortunately there are very good treatment options for these injuries.

Articular cartilage injuries in the knee are common and can occur several ways. Often the culprit is a twisting injury or traumatic impact to the knee. However, at times the articular cartilage can be injured without any known cause as in the common conditions of *osteochondritis dessicans* and *avascular necrosis* (AVN). In both of these conditions, the bone beneath the articular cartilage is unhealthy, and often a fragment of the bone and cartilage may separate from the remaining healthy bone and cartilage. This is referred to as an *osteochondral fragment* or *defect* (OCD), resulting in a “loose body” of cartilage and bone floating around the knee. A “loose body” may cause additional pain, functional limitation, and further damage to the otherwise healthy surrounding cartilage. When there is a defect in the articular cartilage, the contour of the joint is no longer smooth, and pain, stiffness, and further cartilage damage may result.

Degenerative changes can also occur in the articular cartilage at any age, but usually occur over time and represent “wear and tear” of this cartilage. As the degeneration worsens, the knee becomes arthritic as in the common condition of osteoarthritis or degenerative joint disease. Initially the cartilage becomes soft compared to the healthy articular cartilage. In this stage there does not appear to be any visible tear of the cartilage, and all of the damage occurs on a microscopic level. These injuries progress from surface “fraying” to fissuring or “cracking” of the cartilage and eventual separation of the cartilage from the underlying bone.

Diagnosis:

The first step in diagnosis of an articular cartilage injury is a good history and physical examination by a physician well trained in diagnosis and treatment of knee injuries. X-ray images of the knee are necessary to help determine a diagnosis. After these initial steps, a Magnetic Resonance Image (MRI) is often helpful in reaching a diagnosis. Some times both the x-ray and MRI do not show an articular cartilage lesion, but one is

suspected by the history and the physical examination. In these cases, the best diagnostic study is a small surgical procedure called arthroscopy, which is described below.

Treatment:

To date, there are no medicines that can grow cartilage. Some dietary supplements are available over the counter; however scientific studies have only been able to show that they may have a small, pain-reducing effect. They have never been shown to restore, replace, re-grow, or heal articular cartilage injuries.

Surgical Treatments:

Because of the importance of the articular cartilage to the normal painless function of the knee, innovative treatments have been developed which are aimed at joint restoration and preservation. The goal of treatment is to restore a smooth normal contour of the articular surface, which will ultimately lead to more normal and pain-free motion. When the articular cartilage injury is isolated and does not affect the entire joint, these techniques of joint restoration and preservation can be used. Which treatment is used depends on the size, shape and location of the injury, as well as the patient's specific goals and expectations.

Arthroscopy:

Many of these treatments can be performed through a minimally invasive surgery called arthroscopy. Arthroscopy is an outpatient surgery, performed through small punctures in the skin and allows the surgeon to see the entire cartilage surface of the knee. The surgery is performed using a small camera and specialized instruments that are only a few millimeters wide. Patients are able to walk the same day and go home on the day of surgery. We do encourage patients to start physical therapy the next day after surgery. Often we require a short period of time, up to six weeks, on crutches after this surgery in order to protect the site of treatment and allow it to have the best chance of growing new cartilage.

It is important to remember that once the articular cartilage injury is too severe, diffuse, or widespread throughout the joint, these techniques are no longer effective, and joint replacement becomes the only option for effective and long lasting treatment.

Microfracture:

Microfracture, a controlled process of creating small holes in the bone that is exposed due to the articular cartilage injury, is another excellent technique. These small holes in the bone serve as channels for blood to flow into the site of injury and bring in cells which have the potential to grow new cartilage and fill in the defect left from the original injury. While this new cartilage is not exactly the same as normal articular cartilage, it still provides good pain relief and allows the patient to regain more normal function about 80% of the time. This procedure is performed using arthroscopy as described above.

Osteochondral Autograft, Allograft, or Synthetic Plugs:

Another excellent technique used to treat isolated lesions of the articular cartilage is *osteochondral autograft transfer (OAT)* or *osteochondral allograft transplantation*. In

the OAT technique, a plug of bone and cartilage is taken from a part of the knee that does not need the cartilage (donor site) and is transferred to the articular cartilage defect at the site of injury. This replaces the injured cartilage with the patient's own natural cartilage. In some situations a plug of bone and cartilage from a cadaver knee (*osteochondral allograft transplantation*) can be used, and this has very similar results. Both techniques are highly effective and have excellent results greater than 80% of the time.

A new technique that is emerging is the use of synthetic cartilage scaffolds or plugs. These synthetic materials are manufactured to mimic bone and cartilage and serve as a structure in which the body's own bone and cartilage cells can grow. In the long run, the body lays down new bone and cartilage and ultimately fills in the defect. The benefit to the use of the scaffolds is that the surgery can be performed in a more minimally invasive manner through all arthroscopic technique and usually does not require an open incision around the knee. The rehabilitation is significantly shorter, and people tend to return to their normal activities much more quickly than with the other described techniques.

Cartilage Cell Implantation or Transplantation:

Several new techniques have been developed in an attempt to grow more normal articular cartilage, and one technique has begun to show good results. *Autologous cartilage implantation* (ACI) is a surgery in which a patient's own cartilage is biopsied, grown in a laboratory, and then implanted into the defect at the site of injury. The implanted cells have been shown to reliably fill in the defect with new cartilage. This technique has the longest track record of all cartilage implantation techniques and is thought to significantly reduce pain and improve function about 80% of the time.

Lastly, the new technique of cartilage cell transplantation involves transplantation of donated young cadaver cartilage cells specially prepared by the manufacturers. These cartilage cells have the potential to grow and replace cartilage defects at the site of injury. One advantage of this technique is that it can be performed with a single surgery and without the process of growing the cells in a laboratory. Both of the cartilage cell implantation or transplantation techniques described are usually performed through an open approach to the knee and are not arthroscopic surgeries.

Summary:

Articular cartilage injuries of the knee are very common. Isolated lesions can be treated with selective techniques depending on the size, location, and severity of the injury. Many of these techniques can be performed using minimally invasive arthroscopy. The goal of treatment is to restore a smooth normal contour of the articular surface, which will ultimately lead to more normal and pain-free motion. Early treatment of these injuries is important to help prevent further degeneration of the cartilage, which eventually leads to severe arthritis of the knee.

For more information: If you would like more information about knee injuries and or would like an appointment please call Dr. Levi's office at the Orthopaedic and Rehabilitation Centers, 773-878-6233.