

Keeping Our Knees Healthy – Advances in Treating Articular Cartilage

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One of the most common reasons for a patient to seek treatment from an orthopedic surgeon is related to a problem with their knee. The problem may be related to an injury to a ligament or the meniscus, but quite commonly it is because of a problem with the joint surface. The joint surface is the articular cartilage. The articular cartilage is an amazing tissue which is designed to withstand significant forces and usually does so very well. It can, however, develop problems. When that occurs, the patient can develop symptoms such as pain and swelling of the knee. If the cartilage loss progresses, the patient can develop arthritis of the knee. Obviously, it would be extremely beneficial to patients if we had a reliable way to address this problem and some of our current means to do so will be discussed in this article.

As mentioned, articular cartilage has an excellent ability to sustain loads and avoid injury. The problem is that once it does become injured it has a very limited capacity to heal itself. One of the reasons for its poor ability to heal is it has a very poor blood supply. So since the articular cartilage cannot heal very well we need to focus on ways to minimize its risk of being injured or techniques to treat it once injured. We will discuss some of the ways the articular cartilage can be injured, as well as how to prevent those injuries, and how we are addressing them once they occur.

Injuries to the articular cartilage can occur when other structures in the knee are injured. One example is when an athlete sustains an anterior cruciate ligament tear. With this injury, when the knee “slips out of place” the joint surfaces of the knee shear across each other, often resulting in injury to the articular cartilage. Or if the meniscus is injured, it loses its “cushioning” effect and therefore is less protective to the knee which can lead to problems with the articular cartilage. Also, a patient that is significantly overweight can damage the articular cartilage due to the increased forces the articular cartilage sees.

Before we discuss ways to treat these injuries, let’s briefly discuss measures to decrease the risk of developing articular cartilage problems. Taking steps such as weight loss in a patient that is overweight can be helpful. Also, since it is known that injuries to the ACL can be related to articular cartilage problems, programs to decrease the risk of sustaining an ACL injury such as the Sportsmetric program can be beneficial. Also, once the ACL is injured, reconstructing it may have a protective effect for both the meniscus and possibly the articular cartilage.

Once the articular cartilage is damaged, it can be somewhat of a difficult problem to manage. Techniques are improving and research continues, but still the optimal treatment has not been determined. We will discuss what is currently available to manage these problems. The particular treatment that is chosen is determined by specifics of the articular cartilage lesion such as its size as well as if there are any other problems within the knee.

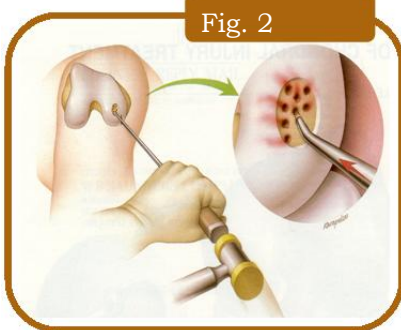
Since articular cartilage has limited ability to heal treatment approaches are directed to techniques that stimulate “new cartilage” to form or transplantation techniques. The measures that will be discussed include **Microfracture**, **OATS (osteochondral autograft transfer system)**, **ACI** and **Allograft transplantation**. In the following we will discuss these treatment options and where they may indicated in a little more detail. Prior to doing so a couple of other points merit discussion. The questions that we must consider include the following. 1) Who is a candidate for these procedures? 2) How do we access the size and type of lesion? 3) What needs to be done to give the procedure the best chance for success?

Fig. 1



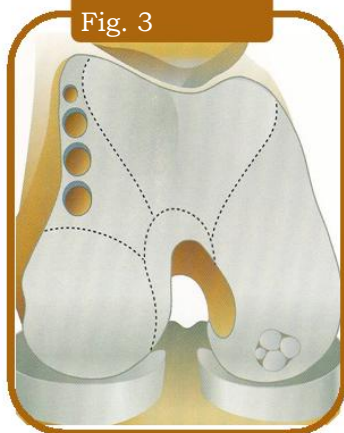
To maximize the chances of these procedures being effective the knee needs to be in proper alignment. Just as when a car tire is out of alignment increases the chances of the tire wearing out sooner than it should, if the knee is out of alignment it increases the chance that the cartilage restoration procedure will not be effective. Therefore if the knee is not in the proper alignment then that must be corrected prior to proceeding with the cartilage procedure. That is done in the form of a high tibial osteotomy (See Fig 1). It can be done at the same time as the cartilage procedure but is often done as a staged procedure.

Fig. 2



Since the type of procedure is dependent on the specifics of the area of injury to the articular cartilage, how do we know which technique to choose? There are some different ways to help make that determination. MRI can play a role as can arthroscopic evaluation of the knee. Additionally, arthroscopic debridement of the damaged portion of the knee may result in symptomatic improvement for a patient for a period of time although the results can be quite variable.

Fig. 3



Microfracture is probably the most commonly used technique to treat articular cartilage injuries. It is also referred to as marrow stimulation. The idea is to have cells that have the ability to make a new cartilage (actually fibrocartilage) fill the defect (See Fig 2) The techniques involves using specialized instruments called microfracture awls (they look like ice pics) to puncture the bone so the cells can escape from the bone marrow and cover the defect and hopefully form the new cartilage. Afterwards, it is important that the patient follow postop protocol such as being on crutches for six weeks to give the treatment the best chance to work. This technique has been shown to be effective in improving symptoms. The problem is that it results in the formation of scar cartilage which is not as durable as our normal articular cartilage so the

results can deteriorate over time.

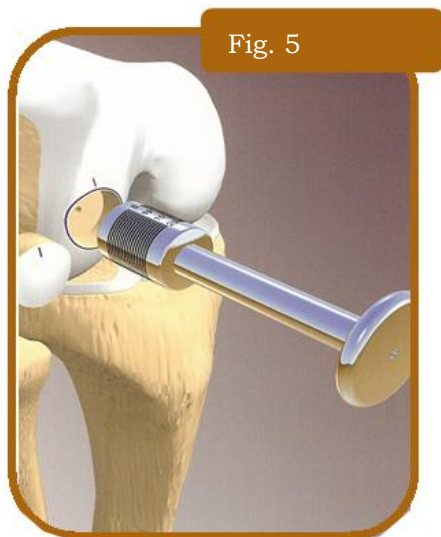
Another method to treat loss of the articular cartilage is the technique known as the **OATS** procedure (**Osteochondral Autograft Transfer System**). (See Fig. 3) In this system instruments are

used to harvest a core or cores of bone with its overlying articular cartilage. The cores are taken from an area of the knee that has limited weight bearing and placed in the area of need. This is typically to the area on the end of the femur (thigh bone) which bears the load when we walk or run. This procedure can be performed arthroscopically or through small incisions. One of its advantages is that it places essentially normal cartilage in the area where it had been lost. One of its disadvantages is that it can only replace fairly small areas of cartilage loss.

Another means of dealing with cartilage loss is through the process known as **ACI**. ACI stands for **Autologous Chondrocyte Implantation**. (See fig. 4) This process is somewhat more involved and costly. The goal is to have the body (with assistance) grow new articular cartilage where it was lost. As



mentioned the technique is more labor intensive, partly because it is a two stage procedure. The first stage involves harvesting and growing cartilage cells and the second stage placing them back in the knee. The cells once grown to a satisfactory number are placed under a flap of tissue that has been sewn over the defect in the cartilage. With time these cartilage cells form new cartilage. Unfortunately the cartilage that forms is not completely normal. It does typically result in improvement of the symptoms to help deal with the problem of articular cartilage loss.



A final current option to treat articular cartilage loss is with the technique of **allograft osteochondral** grafts. (See Fig. 5) This involves the transplantation of a core of bone with its cartilage from a donor (cadaver). It has the advantage that it can be used to address relatively large areas of cartilage loss. The disadvantages include relative difficulties in obtaining the grafts as well as potential sizing problems and timing issues regarding getting the tissue from the donor to the recipient. Also, although the risk is minimal due the fact the tissues are screened, there is the remote, yet real, risk of disease transmission.

The above has been a brief review of the current techniques that are available to help treat these difficult cartilage loss problems.

Research is continuing to help improve these techniques as well as to hopefully arrive at even better, more reliable, less invasive techniques. These procedures will not be helpful to all patients and, in fact, some patient's cartilage loss (arthritis) may progress to the point that they may require a procedure such as a partial or complete knee replacement. Hopefully, as our management of these problems continues to get better, we can avoid or at least postpone the need for arthroplasty of the knee. If you have questions on whether any of the techniques might have a role in management of problems with you or a family member's knee, the best person to ask would be your orthopedic surgeon.