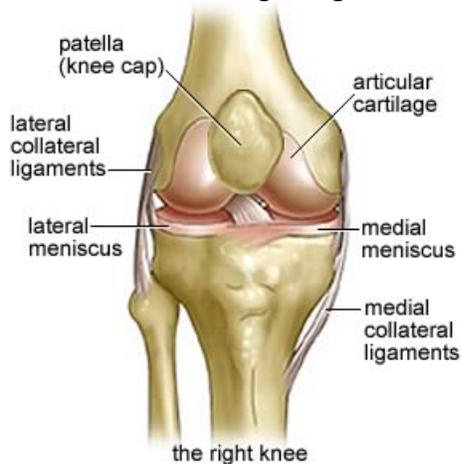


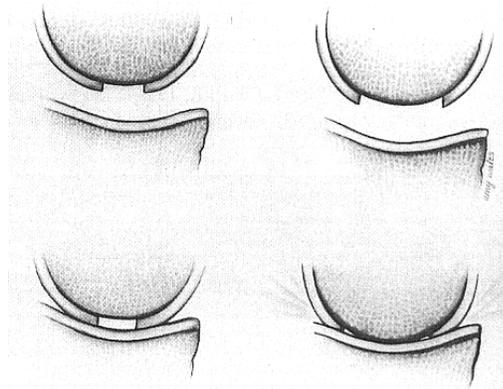
ARTICULAR CARTILAGE INJURIES & TREATMENT OPTIONS

OVERVIEW

There are two types of cartilage in the knee. The meniscus is a cartilage “cushion” between the femur and tibia, one on either side, providing support and suspension and protecting the articular cartilage. Articular cartilage is the Teflon-like coating on the ends of the bones, forming a durable low-friction gliding surface.



Since articular cartilage lacks a blood supply-it is rather nourished by the joint fluid-once injured, it has limited ability to heal. Partial thickness lesions do not heal. Full thickness lesions, on the other hand, in which there is loss of articular cartilage to the level of the subchondral bone, have some healing potential if bony bleeding occurs. By this “marrow stimulation” process (see *microfracture* technique), a blood clot with marrow cells fills the cartilage defect (pothole) and over time transforms into fibrocartilage, a mix of cartilage and scar tissue. This can create a good filler but is not as durable as the original articular cartilage.



Symptoms related to a cartilage injury are variable, and typically only symptomatic conditions require treatment. Generally there is correlation between the size and depth and stability of the lesion, the resultant symptoms, and the potential for causing pre-mature degeneration (osteoarthritis) of the affected joint compartment. Symptoms often attributed to a cartilage injury include pain, swelling, clicking or locking, and occasionally a sense of “giving way”. These symptoms often interfere with sports participation, and when more severe can even limit activities of daily living.

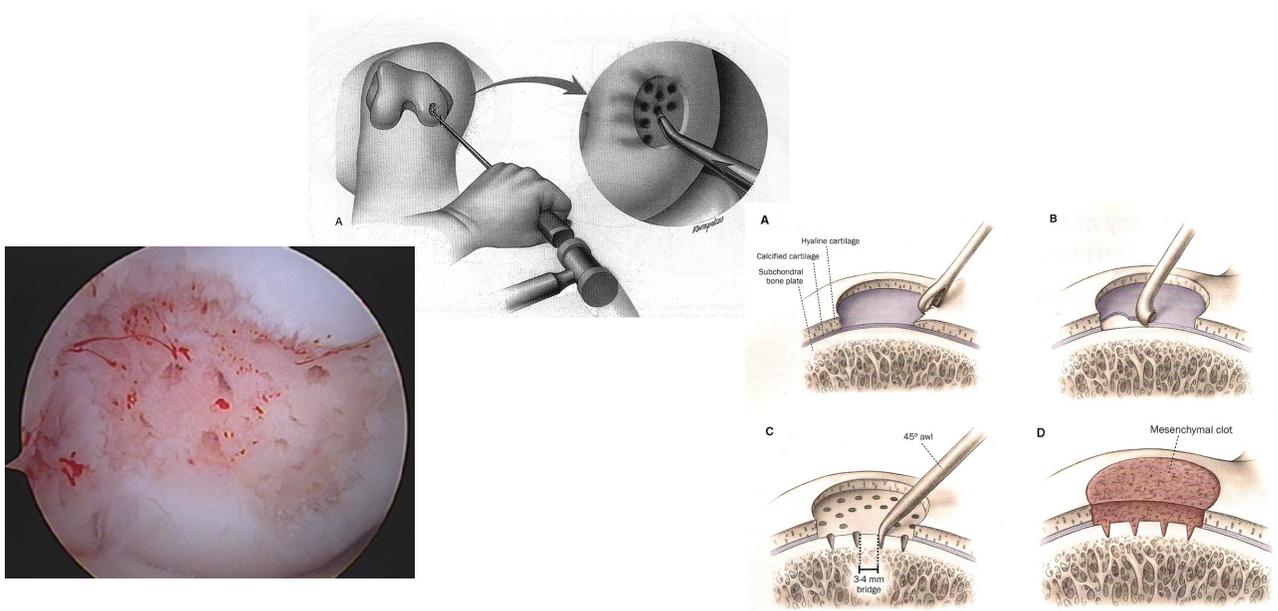
Some patients with articular cartilage injuries have other related problems affecting the joint. These factors that need to be considered during evaluation and in the process of making treatment decisions include: mal-alignment, ligament deficiencies, meniscus deficiencies, and the extent of any related osteoarthritis condition. These issues must be thoroughly identified and properly managed to optimize the environment for articular cartilage repair or transplantation.

Treatments for articular cartilage injuries have advanced over the past two decades, helping patients overcome symptoms, restore function and quality of life, and slowing progression of pre-mature degenerative joint disease. There are several options available, and the best option depends upon the size, depth, and location of the lesion.

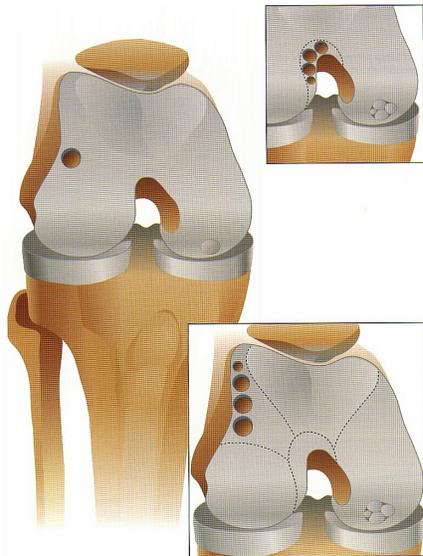
Cartilage repair or transplantation surgery is indicated for symptomatic focal articular cartilage defects. It is not being applied to generalized arthritis, and will not be used in this fashion in the foreseeable future. For that reason, most suitable candidates are young (15 and 55 years) and active. Though the knee is most commonly treated, other joints including the ankle, shoulder, elbow, and hip have been treated as well.

SPECIFIC TREATMENT OPTIONS

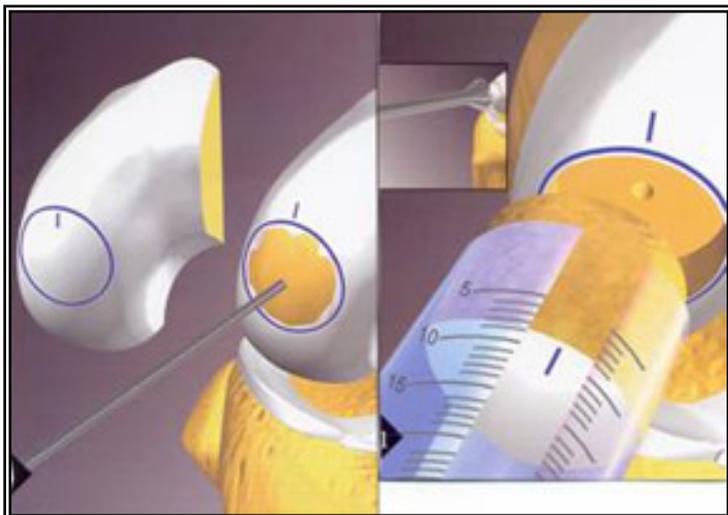
Microfracture is a marrow stimulation technique that is used for smaller full thickness defects. It involves using chondral picks or drills to make the subchondral bone bleed, and this stimulates “fibrocartilage” to fill in the defect. It is successful in 75-80% of patients who have small, well-contained lesions, more recent onset of symptoms, and are less than 40 years old. The post-surgery recovery requires 6-8 weeks of partial weight bearing, use of a continuous motion machine, and delay of return to work/sports impact activities for 6 months. Microfracture is currently the most commonly performed cartilage repair procedure.



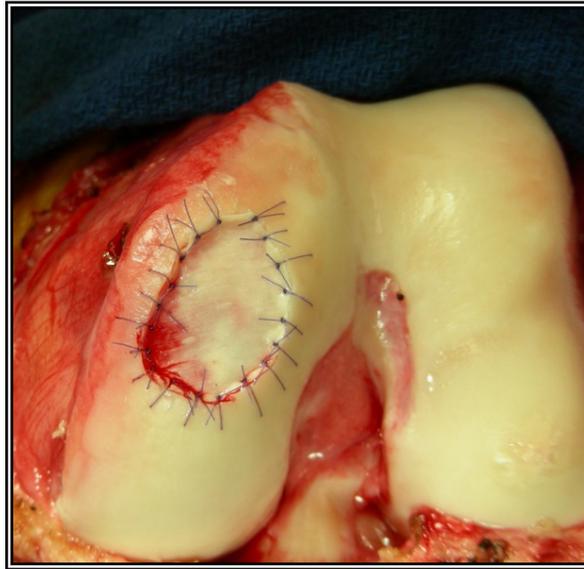
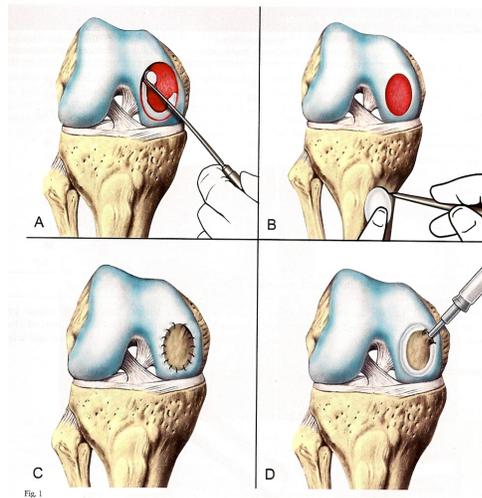
Autograft osteochondral transfer (OATS) is transferring a plug of cartilage and bone into a defect. The donor plug is harvested with special instrumentation from a joint surface not involved with load transmission, and transplanted into a defect. The donor plug has been shown to incorporate and have viable cells. The OATS technique was developed in the early 1990's, and excellent results are noted for some cartilage surfaces. However, the technique is limited by the size and number of the donor plugs, and the size of the defect.



Allograft (cadaver graft) cartilage transplants have been utilized with success, especially for large lesions that have associated bone loss. This includes a condition called “osteochondritis dissecans” or OCD, which causes the loss of blood supply to the subchondral bone, and this can jeopardize the overlying cartilage. OCD is often seen in patients in their teens or twenties. The fresh osteochondral allografts are acquired through tissue banks, and to match a patient's size and defect, this can take 6 months or possibly longer. Since the cartilage cells are viable for 4 weeks after the graft becomes available, timing is an issue. Most grafts to date function well up to 10-15 years, but then begin to degenerate and fail. High impact sports should be delayed 6-12 months after implantation.



Autologous chondrocyte implantation (ACI) are a person's own cultured cartilage cell transplants that were pioneered by Dr. Lars Peterson in Sweden the mid-1980's. Cartilage cells are harvested during a knee arthroscopy, and then sent to Genzyme Biosurgery, which grows the cartilage cells in culture. A sufficient number of cells accumulate over 4 weeks, and then the cells can be stored until a second surgery is performed. An open incision is made over the cartilage defect, and 12 million of the cultured cells are injected. A periosteal flap or a biologic matrix is used to cover the defect. The new cells are incorporated and resemble articular cartilage, but the cartilage slowly matures. High impact sports can be resumed 12-18 months after surgery, including high level amateur and professional levels. Improvements are noted in 80-85% of patients, and this depends on the location, the biologic environment, and the duration of symptoms.



Cell based cartilage treatments and transplants are expanding. *DeNovo NT* are minced juvenile allograft cartilage cells that have been used in the U.S. since 2007, and fixed with a fibrin adhesive. The early results are encouraging. Europe has many forms of cultured cartilage cell treatments that are fixed to biologic matrices, allowing easier implantation and excellent results. These are not FDA approved in the U.S. at this time.

Joint resurfacing and unicompartmental joint replacements may be used if cartilage repair is not successful. These techniques are often employed when there are cartilage defects on both sides of a joint (bipolar lesions) and isolated to one compartment. Joint resurfacing uses lower profile prosthetic components that spare the meniscus and ligaments and also preserve more bone than a conventional joint replacement.

UniCAP™ Femoral Component

- Cobalt Chrome articulating surface
- Titanium plasma spray undercoating
- Bead-blasted Titanium taper post
- Morse taper interlock



UniCAP™ Tibial Component

- Inlay cemented UHMWPE
- Meniscus preserving
- Implantation technique similar to ACL reconstruction





SUMMARY

Cartilage repair and transplantation is a challenging, exciting, and expanding field and is indicated for young, active, and pre-arthritic individuals with symptomatic focal cartilage defects in the knee and other joints. Often, combined alignment, ligament, and/or meniscus problems need to be treated concomitantly to optimize the result. Joint resurfacing is a good option for osteoarthritis isolated to a single compartment or as a salvage treatment for failed cartilage repair. Understanding and treating cartilage injuries requires a comprehensive approach, including evaluation of a patient's history (symptoms, previous treatment, affect of condition on function and lifestyle), physical exam findings, results of imaging studies, and careful consideration of different treatment options in order to determine the best option for the individual patient. The goal of treatment is to relieve pain, improve function, restore quality of life, and slow the progression of osteoarthritis.