

“I Tore My Knee Cartilage”

Howard G. Miller

Cartilage is a very specialized tissue that is located throughout the body. Cartilage provides support that gives shape to the nose and ears, forms the surfaces that articulate as joints, and forms the separate structures known as menisci that are located between the joint surfaces. Confusion occurs when the term “cartilage” is used to refer both to the joint surface and the menisci.

Cartilage is comprised of a network of fibrous tissue called collagen, in which a rubbery matrix of protein-sugars has been deposited. Interspersed in this matrix are cartilage cells (chondrocytes). The type and arrangement of the collagen fibers determine the characteristics of the cartilage tissue. Fibrocartilage has a tissue mesh of Type I collagen, whereas hyaline cartilage has a finer mesh containing a large proportion of Type II collagen. This difference in the type of collagen in the cartilage is largely responsible for the difference in the biomechanical properties of the tissue, with fibrocartilage forming the structures known as menisci, and hyaline cartilage forming the surfaces of the joints.

When an orthopedist diagnoses a “torn cartilage”, this indicates that the structural integrity of the meniscus has been compromised. This can occur either in a linear fashion, vertically or horizontally through the tissue, or in a complex portion, which indicates loss of structure in multiple planes. The vertical tears are frequently a result of trauma, and can occur in normal cartilage, whereas the horizontal and complex tears typically occur in a meniscus that has undergone some degree of age related degeneration. Vertical tears can occur through the more central areas of the structure, known as the “white zone” because of lack of any blood supply to this portion of the meniscus, or in the more peripheral “red zone”, so described because of blood vessels that penetrate into the meniscus through its attachment to the capsular and ligamentous structures of the knee. This presence of blood vessels accounts for the possibility of healing of tears located in this red zone. Unfortunately, most meniscal tears occur in the white zone, without potential for healing, and the usual treatment for these tears is surgical removal of the damaged portion, reshaping the remaining tissue in a tapered manner to resemble the original structure, although smaller. Prior to the development of arthroscopic techniques, the usual intervention for a damaged meniscus was total removal, but this frequently led to progressive deterioration of the joint surfaces and subsequent osteoarthritis. By removing only a portion of the meniscus arthroscopically, the deterioration of the joint surfaces is usually delayed relative to the progression of degeneration if the entire meniscus had been removed.

Other cartilage injuries to the knee involve the joint surface, consisting of hyaline cartilage. This very specialized type of cartilage has no potential for healing or regeneration of identical tissue, although a fibrocartilage healing sometimes occurs. Traumatic injuries of these surfaces can result in fissuring (a fracture through the surface) or a fracture which results in a piece of that surface separating from the remainder of the joint surface, either with or without a piece of the underlying bone. If the fragment of bone is large enough, it can be secured into the bed from which it separated and if it heals, typically the attached cartilage will remain healthy and often lead to a good result. However, if there is no attached bone, then the fractured piece of cartilage will not re-adhere to the underlying bone. Options at that point include a stimulation of a fibrocartilage response by either cracking or drilling the underlying bone. This is useful in a relatively small defect where there has been no damage to the opposite surface of the joint that articulates with this injured area. Another option is to harvest a plug(s) consisting of the articular surface and underlying bone, and transferring his (these) to the defect. The indication for use of the technique, known as mosaicplasty, is narrow because of the limited areas from which the graft can be harvested, the difference in the thickness of articular surface in the graft and the

locale where it will be implanted, and the difference in the contour of surfaces at the donor and recipient sites.

Larger defects of articular cartilage of the knee can be reconstructed by use of a technique known as autogenous chondrocyte implantation (ACI). This is appropriate only for defects caused by trauma, and not for replacement of a degenerative surface. The technique involves an arthroscopic procedure to diagnose the problem and determine that ACI would be appropriate, and to harvest a specimen of the patient's cartilage. This is then forwarded to a laboratory, which extracts the cells from the cartilage tissue and then grows those cells in culture, which results in a very concentrated fluid consisting of 12-15 million cells. This culture takes four to six weeks, at which time a second operation is performed consisting of harvesting a periosteal patch from one tibia, suturing it to the defect of the joint surface (which then resembles a trampoline pulled taut across the defect), and then injecting the cultured cells beneath that patch, where some will adhere to the underlying bone and then behave like young chondrocytes, producing the collagen and matrix that closely resembles normal articular (hyaline) cartilage.

Recovery and long-term results of treatment of different types of cartilage injuries depend upon the type of pathology, the age of the patient, and the presence (or absence) of associated pathology, such as arthritis. Except in very young patients, an isolated tear of a meniscus is uncommon, as a large number of patients have coexisting degeneration of the joint surface (osteoarthritis). In these patients, it is not unusual to continue to have some symptoms after removal of a damaged meniscus, even if there were no symptoms from the osteoarthritis before the injury to the meniscus occurred.

Knee "cartilage" injuries are serious insults to the joints. Present treatments are usually successful in decreasing the symptoms from these injuries, although total resolution of the problem is usually not possible.