NYU Langone MEDICAL CENTER

Dr. Laith M. Jazrawi
Chief, Division of Sports Medicine
Associate Professor Department of Orthopaedic Surgery

Rehabilitation After Microfracture of the Femoral Trochlea/Patella

There are two types of cartilage in the knee: meniscus and articular. One type of cartilage is the meniscus. The knee has a medial meniscus and a lateral meniscus which together are called menisci. Menisci are semi lunar wedges that sit between the femur (thigh bone) and tibia (shin bone). The menisci are primarily composed of fibrocartilage, with about 75% of the dry weight being type I collagen. The function of the menisci is to protect the other type of cartilage in the knee—the articular cartilage.

The articular cartilage is a layer of hyaline cartilage that covers the end of bones that articulate with other bones. In the knee there is articular cartilage on the end of the femur (femoral condyles), the top of the tibia (tibial plateau) and the back of the knee cap (patella). The articular cartilage has a frictional coefficient approximately 1/5 of ice on ice—i.e. rubbing articular cartilage on articular cartilage would be 5x smoother than rubbing ice on ice. This allows for a very smooth gliding surface. A large portion of articular cartilage is fluid, which provides significant resistance to compressive forces.[1]

During athletic trauma or injury, focal areas of the articular cartilage can be damaged or torn. This is referred to as an articular cartilage lesion (Figure 1[2]). When this happens the articular cartilage loses its normal smooth gliding articulation and the ability to resist compressive forces at the joint. These changes can cause pain, swelling, loss of motion, weakness and reduced function or performance.

One option for treating articular cartilage lesions is a microfracture procedure. When performing a microfracture procedure, the surgeon will start by debriding any frayed tissue or flaps at the margin of the lesion (Figure 2[2]). After this, the calcified chondral layer is debrided to expose the underlying subchondral bone (Figure 3[2]). Removing this layer allows the surgeon to pick holes into the subchondral bone with an awl. (Figure 4[2]) By picking holes in the

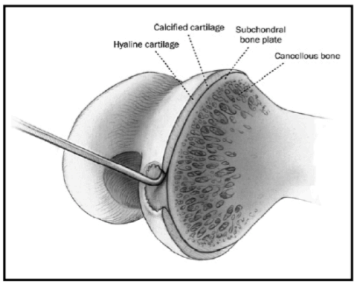

Figure 1 *Schematic drawing demonstrating the typical presentation of an articular cartilage lesion upon primary arthroscopic inspection.*

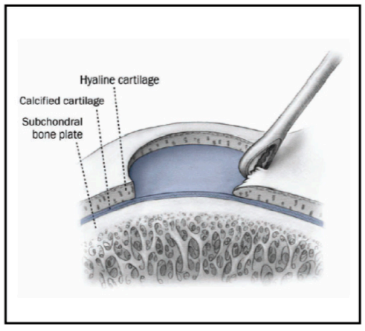

Figure 2 *Schematic drawing demonstrating débridement, with use of an arthroscopic shaver, of any loose cartilage flaps to create a stable peripheral cartilage margin.*

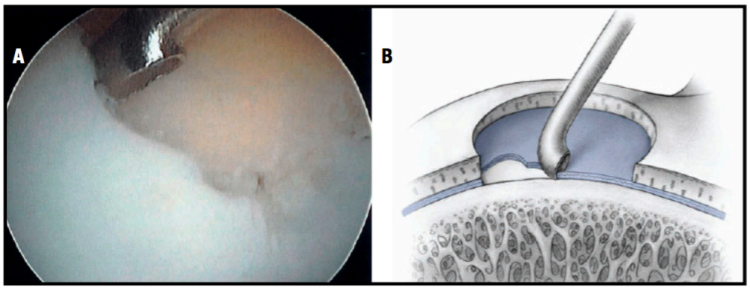

Figure 3 *Arthroscopic image (Figure 3-A) and drawing (Figure 3-B) showing the intraoperative débridement of the calcified cartilage layer with use of a curet to provide manual feedback control.*

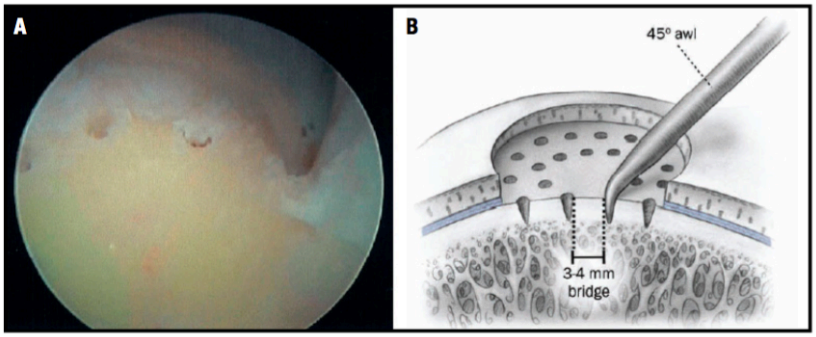

Figure 4 *Arthroscopic image (Figure 4-A) and drawing (Figure 4-B) demonstrating the adequate depth of subchondral bone penetration and width of osseous bridges between the individual microfracture holes.*

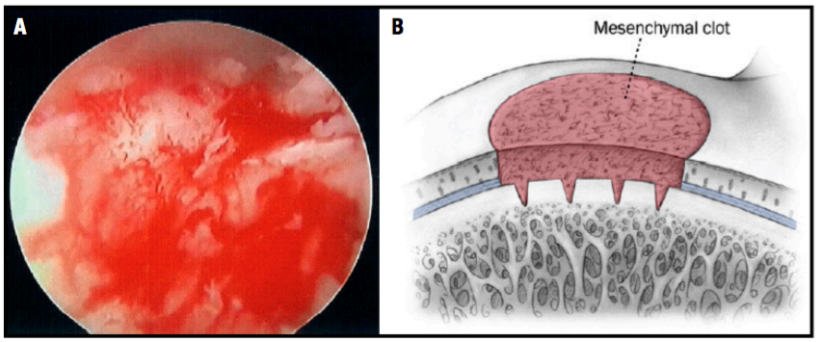

Figure 5-A *Arthroscpoic image of the treated defect after release of pump pressure, confirming the adequacy of the microfractures by noting the release of fat droplets and blood from the individual holes.* ***Figure 5-B*** *Schematic drawing showing the pooling of the mesenchymal clot in the treated cartilage defect and the anchoring effect of the microfracture penetrations.*

subchondral bone, blood and fat droplets are given a pathway to flow into the defect or lesion. This develops in to a mesenchymal clot, which will mature and form in to fibrocartilage (Figure 5[2]).

The rehabilitation process is crucial for the success of the microfracture procedure. Avoiding weight bearing exercises and engaging in frequent range of motion activities are the hallmarks of the early rehabilitation process.

Articular cartilage lesions are more accurately identified thanks to improved imaging techniques and awareness.

Many professional athletes have suffered articular cartilage injuries to the knee. Greg Oden was the first selection in the 2007 NBA draft and was diagnosed with an articular cartilage injury 4 months later. He then went on to have a microfracture procedure. This procedure has become so common in the NBA that a website has been developed that tracks the outcome of these players. The NFL also has a similar list.

The return to high impact sports after a microfracture procedure is more difficult than the return to non-impact sports and activities of daily living.[3] A successful outcome and the time it takes to return to activity is dependent on the patient's age, patient's body mass, lesion size, duration of symptoms prior to surgery, presence of arthritis, previous surgery and post-operative rehabilitation program.[2-4] Because of this, there are some patients that may not be candidates for the microfracture procedure.

Rehabilitation After Microfracture of the Femoral Trochlea/Patella

Phase I (Surgery to 8 weeks after surgery)

Precautions	○ Weight-bearing as tolerated in hinged knee brace locked in extension
	○ Hinged knee brace
	  ○ Locked in extension for ambulation
	  ○ Opened up 0 – 40° for ROM exercises

Range of Motion Exercises	○ Continuous Passive Motion (CPM) Machine for 6-8 hours per day for 6-8 weeks ○ Set CPM to 1 cycle per minute – range from 0 – 40° ○ Passive range of motion and stretching under guidance of PT
Therapeutic Exercises	○ Quadriceps/hamstring isometrics

Phase II (8 weeks to 12 weeks following surgery)

Precautions	○ Weight-bearing
	  ○ Advance to full weight-bearing as tolerated
	  ○ Discontinue crutch use
	○ **Discontinue use of hinged knee brace**

Range of Motion Exercises	○ Advance to full/painless ROM (PROM/AAROM/AROM)
Therapeutic Exercises	○ Emphasize Patellofemoral Program ○ Closed chain extension exercises ○ Hamstring curls ○ Toe raises ○ Balance exercises ○ Begin use of the stationary bicycle/elliptical

Phase III (3 months to 6 months following surgery)

Precautions	○ Weight-bearing ○ Full weight-bearing
Range of Motion Exercises	○ Full/painless ROM
Therapeutic Exercises	○ Advance closed chain strengthening exercises and proprioception activities ○ Sports-specific rehabilitation ○ Gradual return to athletic activity as tolerated – including jumping/cutting/pivoting sports ○ Maintenance program for strength and endurance

References

1. Pearle AD, Warren RF, Rodeo SA. Basic science of articular cartilage and osteoarthritis. *Clin Sports Med.* Jan 2005;24(1):1-12.
2. Mithoefer K, Williams RJ, 3rd, Warren RF, et al. The microfracture technique for the treatment of articular cartilage lesions in the knee. A prospective cohort study. *J Bone Joint Surg Am.* Sep 2005;87(9):1911-1920.
3. Mithoefer K, Williams RJ, 3rd, Warren RF, Wickiewicz TL, Marx RG. High-impact athletics after knee articular cartilage repair: a prospective evaluation of the microfracture technique. *Am J Sports Med.* Sep 2006;34(9):1413-1418.
4. Williams RJ, 3rd, Harnly HW. Microfracture: indications, technique, and results. *Instr Course Lect.* 2007;56:419-428.
5. Reinold MM, Wilk KE, Macrina LC, Dugas JR, Cain EL. Current concepts in the rehabilitation following articular cartilage repair procedures in the knee. *J Orthop Sports Phys Ther.* Oct 2006;36(10):774-794.