Rehabilitation Guidelines Following Microfracture Procedures to the Knee

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.

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). 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). After this, the calcified chondral layer is debrided to expose the

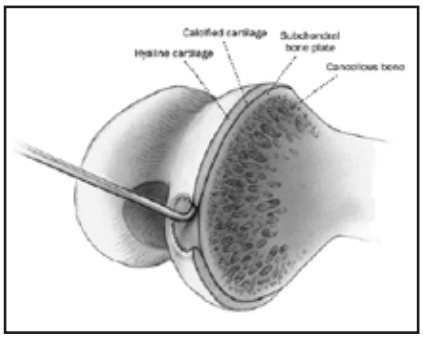

Figure 1 *Schematic drawing demonstrating the typical presentation of an articular cartilage lesion upon primary arthroscopic inspection.*

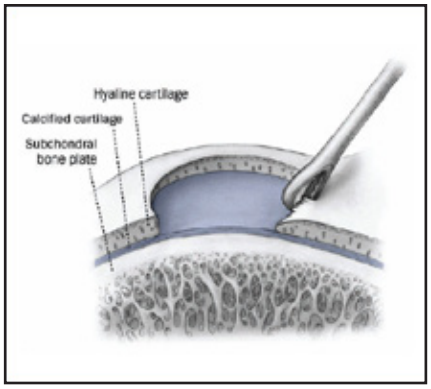

Figure 2 *Schematic drawing demonstrating débridement, with use of an arthroscopic shaver, of any loose cartilage flaps to create a stable peripheral cartilage margin.*

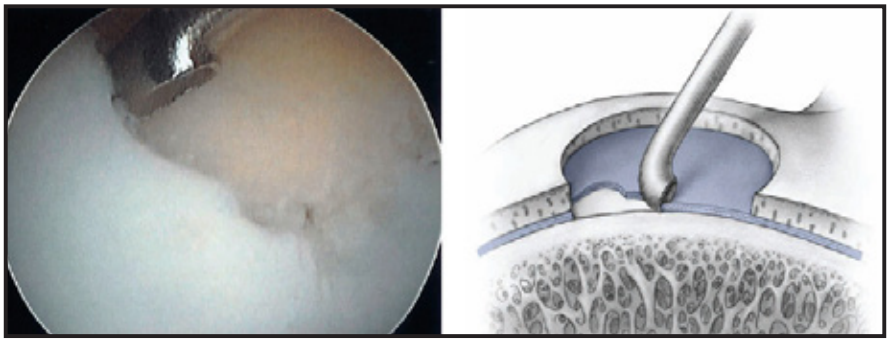

Figure 3 *Arthroscopic image (Figure 3-A) and drawing (Figure 3-B) showing the intraoperative débridement of the calcified cartilage layer with use of a curet to provide manual feedback control.*

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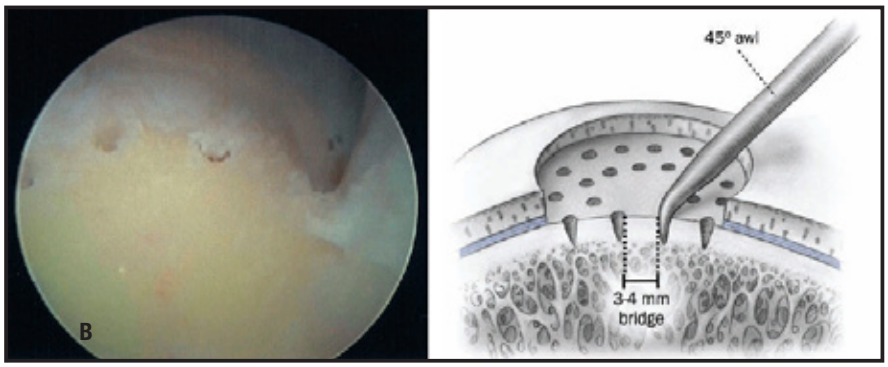

Figure 4 *Arthroscopic image (Figure 4-A) and drawing (Figure 4-B) demonstrating the adequate depth of subchondral bone penetration and width of osseous bridges between the individual microfracture holes.*

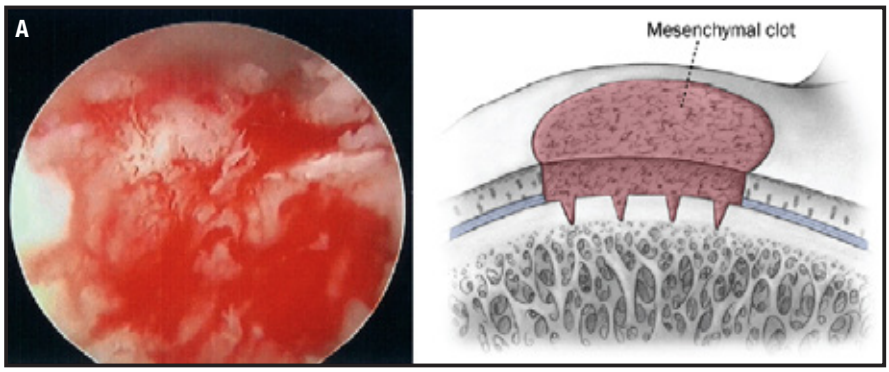

Figure 5-A *Arthroscpoic image of the treated defect after release of pump pressure, confirming the adequacy of the microfractures by noting the release of fat droplets and blood from the individual holes.* ***Figure 5-B*** *Schematic drawing showing the pooling of the mesenchymal clot in the treated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

underlying subchondral bone (Figure 3). Removing this layer allows the surgeon to pick holes into the subchondral bone with an awl. (Figure 4) By picking holes in the 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).

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 four 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. 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. Because of this, there are some patients that may not be candidates for the microfracture procedure. Post-operative rehabilitation is an important factor in achieving a successful outcome from a microfracture procedure. The UW Health Sports Medicine rehabilitation guidelines are presented in a criterion based progression. Specific time frames, restrictions and precautions are given to protect healing tissues and the surgical repair/reconstruction. General time frames are also given to reference the average rehabilitation time, but individual patients will progress at different rates depending on their age, associated injuries, pre-injury health status, rehabilitation compliance and injury severity. Injury severity refers to the size and location of the articular cartilage lesion. Individuals with lesions that are larger or are in predominantly weight bearing locations will progress more slowly than those with smaller or non weight bearing lesions. Specific attention must be given to impairments that caused the initial injury. For example; if the patient is status post medial compartment microfracture procedure with a varus alignment, post-operative rehabilitation should include correcting muscle imbalances or postures that contribute to medial compartment stress.

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Rehabilitation Guidelines Following Microfracture Procedures to the Knee

PHASE I (surgery to 6 weeks after surgery)

Appointments	• Begin rehabilitation 2-5 days post-op and continue 1 time per week
Rehabilitation Goals	• Protection of the post-surgical knee • Restore normal knee range of motion (ROM) and patellar mobility • Eliminate effusion • Restore leg control
Weight Bearing Femoral Condyle Lesions	Use axillary crutches, to follow the weight bearing guidelines below. This is essential for proper healing. For special situations and in winter months a brace may also be used. • Weeks 0-2 = non weight bearing (NWB) • Weeks 3-4 = touchdown weight bearing (TDWB) • Weeks 5-6 = weight bearing as tolerated (WBAT)
Weight Bearing Patellofemoral Lesions	Use axillary crutches, in locked knee brace for 6 weeks. Dr. Baer, Dr. Spiker and Dr. Walczak patients: • Weeks 0-2 = TDWB • Weeks 3-6 = WBAT Dr. Scerpella patients: • Weeks 0-6 = WBAT The surgeon may modify the weight bearing guidelines for specific situations
Range of Motion Exercises	• Knee extension on a bolster • Prone hangs • Supine wall slides as tolerated without pain • Passive range of motion (PROM) off the end of the table as tolerated without pain • CPM machine • Biking—use contralateral leg to create ipsalateral PROM NOTE: ROM exercises should be carried out frequently throughout the day with high repetitions to help remodel the developing fibrocartilage. The optimal goal during the first 6 weeks is to do 4-8 hours of ROM exercises per day
Suggested Therapeutic Exercise	• Quad sets • Straight leg raises • Four-way leg lifts in standing with brace on for balance and hip strength • Patellar mobilizations • Begin pool activity at the start of week 5. Exercises may include gait drills (forward walk, march walk, skate step, step and balance) with depth of water at the level of the axilla. Deep water running, vertical kicking or biking can also be included

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Cardiovascular Exercise	• Upper body circuit training or upper body ergometer (UBE)
Progression Criteria	• 6 weeks post-op • No effusion • Full knee extension

PHASE II (begin after meeting Phase I criteria)

Appointments	• Rehabilitation appointments are 1 time every 1-2 weeks
Rehabilitation Goals	• Single leg stand control • Normalize gait • Good control and no pain with functional movements, including step up/down, squat, partial lunge (staying less than 60° of knee flexion)
Precautions	• Avoid post-activity swelling • Avoid loading knee a deep flexion angles • No impact activities until 12 weeks post-op
Suggested Therapeutic Exercise	• Non-impact balance and proprioceptive drills • Stationary bike • Gait drills • Hip and core strengthening • Stretching for patient specific muscle imbalances • Quad strengthening—closed chain exercises short of 60° knee flexion • Continue pool program—alternating days with land program
Cardiovascular Exercise	• Non-impact endurance training; stationary bike, Nordic track, swimming, deep water run, cross trainer
Progression Criteria	• Normal gait on all surfaces • Full ROM • No effusion • Ability to carry out functional movements without unloading affected leg or pain, while demonstrating good control • Single leg balance greater than 15 seconds

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PHASE III (begin after meeting Phase II criteria, usually about 3 months)

Appointments	• Rehabilitation appointments are 1 time every 1-2 weeks
Rehabilitation Goals	• Good control and no pain with sport/work specific
Precautions	• Post-activity soreness should resolve within 24 hours • Avoid post-activity swelling • Avoid knee pain with impact
Suggested Therapeutic Exercise	• Impact control exercises beginning 2 feet to 2 feet, progressing from 1 foot to other and then 1 foot to same foot • Movement control exercises beginning with low velocity, single plane activities and progressing to higher velocity, multi-plane activities • Sport/work specific balance and proprioceptive drills • Hip and core strengthening • Stretching for patient specific muscle imbalances
Cardiovascular Exercise	• Replicate sport/work specific energy demands
Return to Sport/Work Criteria	• Dynamic neuromuscular control with multi-plane activities, without pain or swelling

These rehabilitation guidelines were developed collaboratively by UW Health Sports Rehabilitation and the UW Health Sports Medicine Physician group.

Updated 3/2018

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. Highimpact 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.