Rehabilitation Following Microfracture for Chondral Injury in the Knee

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• Microfracture • Chondral injury • Rehabilitation

Full-thickness chondral defects in the knee are common, and these articular cartilage lesions may present in various clinical settings and at different ages.[1–6]

The shearing forces of the femur on the tibia as a single event can result in trauma to the articular cartilage, causing the cartilage to fracture, lacerate, and separate from the underlying subchondral bone or separate with a piece of the subchondral bone.[2,5,6] Chronic repetitive loading in excess of normal physiologic levels may also result in the fatigue and failure of the chondral surface. The single events are usually found in younger groups, whereas chronic degenerative lesions are seen more commonly in the middle-aged and older groups.[2,5–7] It has been shown that repetitive impacts can cause cartilage swelling, an increase in collagen fiber diameter, and an alteration in the relationship between collagen and proteoglycans.[5,6] Acute events, therefore, may not result in full-thickness cartilage loss but rather start a degenerative cascade that can lead to chronic full-thickness loss. The degenerative cascade typically includes early softening and fibrillation (grade I), fissures and cracks in the surface of the cartilage (grade II), severe fissures and cracks with a crab meat appearance (grade III), and, finally, exposure of the subchondral bone (grade IV).[2,5–7]

Articular cartilage defects that extend full thickness to subchondral bone rarely heal without intervention.[1–3,8–19] Some patients may not develop clinically

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significant problems from acute full-thickness chondral defects, but most eventually suffer from degenerative changes that can be debilitating.[2,3,18–20] Techniques that are used to treat chondral defects include abrasion, drilling, osteochondral autografts, osteochondral allografts, and autologous cell transplantation.[1,2,7,8,20,21] The senior author (JRS) developed the ''microfracture'' technique to enhance chondral resurfacing by providing a suitable environment for new tissue formation and taking advantage of the body's own healing potential.[8,9,11–17,20–22] The senior author's clinical experience now includes more than 3200 patients who have had the microfracture procedure.

Proper surgical technique is essential, and rehabilitation is equally important. If both are accomplished, the success rate of the microfracture procedure is high. Rehabilitation after microfracture is so important that the microfracture procedure is not performed unless the rehabilitation protocol has been discussed and agreed upon with the patient before surgery. With this combination of surgery and rehabilitation, more invasive procedures, such as osteotomy, cartilage grafting, or unicompartmental arthroplasty, are usually avoided or delayed indefinitely. The goals of this procedure and rehabilitation are to alleviate the pain and disability that can result from chondral lesions and to restore joint conformity, thereby[1,13,20] preventing late degenerative changes in the joint.

POSTOPERATIVE CARE

The postoperative program has been designed to provide the ideal physical environment for the newly recruited mesenchymal stem cells and growth factors from the bone marrow to become a satisfactory cartilage surface.[11,13–15] These differentiation and maturation processes occur slowly and are influenced by the rehabilitation environment.[23,24] Animal studies in horses have confirmed that cellular and molecular changes are an essential part of the development of a durable repair tissue.[21,22]

The authors' experience and clinical research data indicate that improvement can be expected to occur slowly but steadily for at least 2 years.[8,9,11,13,15] During this period, the repair tissue matures, pain and swelling resolve, and the patients regain confidence and comfort in their knees during increased levels of activity.[12]

These factors are critical to designing the ideal postoperative plan.

REHABILITATION PROGRAM

The rehabilitation program after microfracture for the treatment of chondral defects in the knee is crucial to optimize the results of the surgery.[11,23,24] The rehabilitation provides the optimal physical environment for the mesenchymal stem cells to differentiate and produce new cells and extracellular matrix that eventually matures into a durable repair tissue. The surgically induced marrow clot provides the basis for a chemical environment to complement the physical environment.[21,22] This newly proliferated repair cartilage then fills the original defect and matures over time.

The postoperative rehabilitation program after microfracture necessitates consideration of several factors.[11,13,14,23] Because of the variability of chondral defects, including factors such as location and size, the rehabilitation program may need to be altered to accommodate concomitant intra-articular pathology. When other intra-articular procedures, such as anterior cruciate ligament reconstruction, are done concurrently with microfracture, the rehabilitation program is altered as necessary, without interfering with the principles of microfrature healing. The 2 basic protocols that the authors use after microfracture are outlined below.