CURRENT CONCEPTS IN PATELLOFEMORAL CARTILAGE RESTORATION

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There is an exciting evolution of indications and techniques for cartilage restoration in the patellofemoral (PF) joint. Improved understanding of applied surgical anatomy and biomechanics has helped surgeons to achieve outcomes equal to the treatment of the tibiofemoral joint.\(^1\) It is important to recognize and correct PF malalignment, in order to optimize the outcome of cartilage repair. Appropriate patient selection, meticulous surgical technique, and criteria-based rehabilitation are necessary ingredients for success.\(^2\)

Patellofemoral chondral and osteochondral lesions are common and present in approximately 60% of more than 25,000 arthroscopies.\(^3\) It is critical to understand that NOT all lesions require treatment. The majority of patellofemoral chondral lesions are asymptomatic and should be left alone. Similarly, surgeons must be careful not to blindly attribute symptoms to MRI findings. One study demonstrated up to 82% abnormal findings, including abnormal signal, subchondral edema, and focal defects in NBA athletes who were completely asymptomatic.\(^4\) Patients should be treated based on mechanically identifiable factors and associated chondral defects. Treating symptoms, not MRI or arthroscopic findings, can avoid turning incidental defects into debilitating clinical problems with expensive and morbid treatment options.

Non-surgical attempts, including core-to-floor rehabilitation programs, are standard practice prior to cartilage repair. It is useful to gauge patient compliance and to establish rapport prior to engaging in complex surgery. Similarly, staging arthroscopy is useful, as images often
underestimate the size of chondral lesions.\textsuperscript{5} This is a good opportunity to correlate clinical presentation, examination under anesthesia (EUA), and defect features to formulate a surgical plan. Some patients may respond to debridement alone and may not require definitive cartilage restoration.

Understanding the etiology of disease helps the surgeon formulate a treatment plan. Chondral lesions may arise from patellofemoral dislocation events, chronic maltracking, trauma (superior pole), osteochondritis dissecans, or as the first site of genetically programmed osteoarthritis. Similarly, we must treat with awareness that the “joint is an organ,” appreciating that cartilage defects cannot be successfully managed unless we correct malalignment and instability. Strict alignment correction improves outcomes of cell-based cartilage repair for the patella from 28\% to 70–80\%.\textsuperscript{6,7} Importantly, cartilage lesion mapping may allow the surgeon to treat the problem with osteotomy alone, avoiding the added morbidity and expense of cartilage restoration. For example, Fulkerson has shown excellent outcomes unloading distal and lateral chondral lesions with isolated tibial tubercle osteotomy (TTO).\textsuperscript{8} However, caution must be taken for medial, pan-patella, and bipolar lesions, as outcomes were less favorable. Combined cartilage restoration and distal realignment (i.e., TTO) are strongly considered for these situations.

Patellofemoral cartilage surgeons must also be ready to perform soft tissue balancing procedures as indicated. Lateral retinaculum lengthening is performed for lateral retinacular tightness and patella tilt (Figure 1).\textsuperscript{9} This approach also provides excellent access for cartilage restoration in the central/lateral aspect of the patellofemoral joint. Alternatively, limited medial arthrotomy may be performed for more global access. In cases of combined PF instability and cartilage restoration, medial soft tissue reconstruction (i.e., MPFL reconstruction) is an important adjunct to stabilize the soft tissue envelope and to protect the underlying cartilage restoration.\textsuperscript{10,11}

The algorithm for PF cartilage restoration continues to evolve. In general, marrow stimulation is avoided for the patella, given the high-shear environment and suboptimal outcomes that may burn bridges for the future.\textsuperscript{12} In rare situations, marrow stimulation with or without augmentation may be considered for small, well shouldered lesions of the trochlea. If microfracture is selected, meticulous technique (i.e., stable vertical walls of surrounding healthy cartilage, debridement to subchondral bone, even penetration of the subchondral plate creating narrow but deep channels, strict adherence to rehabilitation protocols) is critical to success.

Osteochondral autograft for patellofemoral lesions has good literature support regarding patient outcomes and return to sport.\textsuperscript{13,14} Benefits include the transfer of mature hyaline and rapid autograft bone healing. Concern remains regarding donor site morbidity (particularly when transferring from one aspect of the PF joint to another) and cartilage depth mismatch that limits its use for the majority of larger PF lesions.

Cell-based cartilage repair is the workhorse for the PF joint. Unique PF geometry makes cell-based repair desirable and technically easier. ACI is a two-staged procedure that has up to 20 year favorable outcomes for large lesions.\textsuperscript{15–17} The recent FDA approval of MACI in the United States brings the advantages of uniform cell distribution, improved chondrocyte viability, smaller arthrotomy, expedient surgery, and opportunity for accelerated rehabilitation. First, a cartilage biopsy is performed during routine knee arthroscopy (Figure 2). Chondrocytes are expanded, seeded on a porcine membrane, and then implanted into the patient’s knee (Figure 3). Other single stage cell-based strategies include the use of particulated juvenile allograft chondrocytes or bone marrow aspirate concentrate on a scaffold (Figure 4). There is growing evidence to support these treatment options for small to medium sized lesions of the PF joint.\textsuperscript{18–20}
Osteochondral allograft transplantation (OCA) is an excellent option, particularly for older patients (i.e., early joint space narrowing, early osteophytes), uncontained lesions, subchondral bone involvement (OCD, cystic lesions), or failed prior marrow stimulation or cell-based repair (Figure 5). Results of unipolar patella or trochlea OCA have been favorable at 10 years. Rehabilitation is uniquely tailored for each individual patient, based on concomitant procedures and the selected chondral restorative procedure. Progressive criteria-based rehabilitation is preferred. Biologic injections (i.e., PRP) may be considered to help regain joint homeostasis so that patients may rehabilitate successfully. Strict adherence to post-operative rehabilitation protocols is paramount.

Patient compliance and management of expectations is critical to maximize the chance of a good outcomes. Realistic goals should include normalization of daily life and relatively pain-free performance of low impact recreational activities. The goal of return to higher level athletics is somewhat guarded and may require prolonged timeframe for recovery. Patients and surgeons should understand that cartilage restoration is a bridging procedure that will likely not last forever. These lesions will likely require future non-operative or operative intervention throughout the patient's lifetime. For these reasons, attempts to stay low on the reconstructive pyramid with a treatment strategy that does not burning bridges is highly recommended.
REFERENCES


