Management of Patellofemoral Arthritis Without Arthroplasty

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Management of patellofemoral arthritis without arthroplasty is a difficult but achievable task. More and more young individuals present with disabling patellofemoral chondrosis that can be treated with cartilage restoration procedures often in combination with patellofemoral alignment procedures. This chapter will focus on the key elements necessary to evaluate the young patient with patellofemoral pain and will explain the different available techniques of cartilage restoration. We demonstrate the role of distal patellofemoral alignment, single stage techniques (i.e. microfracture, mosaic/oste techniques), two stage techniques and allograft options. The most recent literature dealing with these techniques is reviewed and recommendations are being given based upon the literature and the author’s experience.

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Discussing all nonarthroplasty treatments of patellofemoral (PF) arthritis is a daunting task and cannot be covered in just 1 brief review. In this section, we will therefore focus on patients who have PF “arthritis” and have failed extensive nonoperative treatment options. The disease, “Osteoarthritis” of the PF compartment, is under consideration, and it essentially constitutes a loss of articular cartilage. In milder forms, it can be termed “chondrosis.” Cartilage surgeons use descriptions from a modified Outerbridge or International Cartilage Repair Society rating system of grade III/IV Outerbridge or grades A, B, C to note that the extensive “chondrosis” is exposed bone, whereas an arthroplasty surgeon would term the same knee pathology as arthritis or arthrosis. This semantic difference is important when deciding treatment in the reality of medical insurance policies, as many companies allow cartilage restoration of grade IV chondrosis exposed bone but not arthritic exposed bone. Regardless of terminology, treatment of PF arthritis/chondrosis requires a clear and precise diagnosis for a successful outcome. Systemic inflammatory arthritic conditions, such as rheumatoid or psoriatic arthritis are excluded from biological treatment at present, as the disease process involves the whole joint rather than a focal area. Factors that influence the surgical treatment options and cannot be disregarded include PF instability, PF malalignment, patient weight, activity level, and trauma to the PF joint. Although a specific genetic link has not been established for PF arthritis, there is clinical evidence for differing qualities of articular cartilage that can vary from patient to patient. The clinical presentation may be similar (exposed bone on the patella and trochlea), but the road to this state may be quite different. As an example, some patients experience early onset cartilage deterioration and subsequent osteoarthritic lesions in the PF compartment without any obvious malalignment or instability of the PF compartment, and some patients reach the same stage but present with severe instability and PF malalignment. In the first type of patient, cartilage restoration surgery may be at best a bridging option. For the latter patient, correction of the malalignment and instability in conjunction with a cartilage restoration surgery may be long lasting. Because of this multifactorial etiology, there is no “cookbook” treatment for PF arthritis/chondrosis. Thus, the goal is to use a demand-matched approach to these nonarthroplasty options in an attempt to optimize the course of each patient, with comprehensive attention to the underlying etiology(ies).
Lateral Facetectomy

Procedure

Surgical procedure is performed under general anesthesia with patient in prone position. The surgery is performed on one side, according to the disc involved. The incision is made over the posterior aspect of the involved facet joint. The muscles are incised and the ligamentum flavum is then elevated from the spinous process. The facet joint is identified and the capsule is incised. The articular processes are then removed using a high-speed burr. The dura mater is then identified and the spinal nerve root is decompressed. The incision is then closed in layers.

Arthroscopy/Arthroscopic

Arthroscopy is a minimally invasive surgical procedure that allows direct visualization of the interior of joints and adjacent structures. It is performed using a fiberoptic camera to visualize the joint space, allowing for precise diagnosis and treatment. The procedure is performed under general anesthesia and involves a small incision in the skin. The joint is then entered using an arthroscope, which is a special instrument with a camera at the end. The arthroscope allows the surgeon to see inside the joint and perform any necessary procedures. The incision is then closed in layers.
Cartilage Restorative Procedures

Restoration of the articular surface of the patella is considered even more challenging than cartilage restoration of the medial or lateral femoral condyle. In addition to the technical difficulty of adequately accessing and visualizing the PF joint arthroscopically, the cartilage problem is usually found in conjunction with additional underlying pathology(ies). As a result, cartilage restoration of the PF joint is typically combined with 2, 3, or more procedures to optimize the environment for the restorative tissue. Factors such as defect location, PF instability, PF malalignment, and dysplasia have to be addressed before or at the time of the cartilage restorative procedure. The surgeon treating these defects, therefore, needs to be comfortable with procedures, such as tibial tuberosity osteotomies, open and arthroscopic lateral lengthening or tibial releases, medial PF ligament shortening or repair or reconstructions, trochleoplasties, and even derotational osteotomies of the femur and/or tibia.

Cartilage restorative procedures of the PF joint can gener-

ally be divided into "single-stage" and "two-stage" procedures.

Single Stage

Microfracture

Microfracture is predominantly used on the articular surface of the femoral condyle. Although the microfracture technique is often used for small to medium defects in the femoral trochlea, there are a few reports on the use of microfracture for the treatment of articular cartilage defects on the patella. Steinwachs et al.1 noted uniformly poor microfracture outcomes of the patella, whereas the reports of others did not always differentiate condyles from the patellar outcomes. Technically, the conventional microfracture technique has
Two Stage Procedure

1. Remove the skin and subcutaneous tissues.
2. Identify and locate the tendons of the quadriceps muscle.
3. Incise the periosteum and the quadriceps tendon.
4. Insert the prosthesis into the bone.
5. Reattach the tendons and muscles to their original positions.
6. Close the incision and apply a dressing.

Orthodontic Allografting

Orthodontic allografting is a technique used to augment bone growth and facilitate tooth movement during orthodontic treatment. It involves the use of bone grafts from an appropriate donor site to provide additional bone for tooth movement. The grafts are usually harvested from the iliac crest, posterior iliac crest, or the maxillary sinuses. The bone graft is placed in the area where additional bone is needed, and a periodontal dressing is used to protect the graft during the healing process. The graft gradually integrates with the host bone, providing support for orthodontic treatment.

Autologous Chondrocyte Implantation

Autologous chondrocyte implantation (ACI) is a surgical procedure used to repair articular cartilage defects. It involves isolating chondrocytes from the patient's own cartilage, cultivating them in vitro, and then implanting them into the defect site. The cultured chondrocytes are placed in a carrier, such as a collagen matrix, and are then implanted into the cartilage defect. The chondrocytes differentiate and form new cartilage as they integrate with the surrounding tissue. This procedure is particularly useful for the repair of large or deep cartilage defects, such as those found in the knee joint.
AMZ of the tibial tubercle as described by Fulkerson\textsuperscript{20} and Farr.\textsuperscript{21}

The clinical experience has been promising. Peterson et al\textsuperscript{19} reported 11 of 17 patients with good and excellent results at 2 years and slightly better results (13/19) at 9 years, indicating a long initial postoperative recovery time with improvement over 1 year postoperatively as well as over the longevity of the repair. Minas and Bryant\textsuperscript{22} reported 71% good and excellent results in 45 patients, and over 60% of patients underwent a combined AMZ of the tibial tubercle. Henderson and Lavigne\textsuperscript{23} reported their results in a group of patients who was divided into ACI (patients with normal PF alignment) and ACI with AMZ (patients with clinically present PF malalignment). The group that was treated with AMZ and ACI had overall 86% good and excellent clinical results, whereas the patients undergoing ACI alone only showed a good or excellent result in 54% of all cases. The authors suggested that there may be patients with radiographically normal parameters that may still have a subclinical PF instability, but that article predated evaluation with the TT-TG radiographic analysis. That is, the malalignment was a clinical assessment, and more recent studies have demonstrated the difficulty predicting the TT-TG by physical examination. Niemeyer et al\textsuperscript{24} reported a separate group of patients with normal PF alignment and local chondral defects in the PF joint that was treated with ACI. This study showed 87% good and excellent results in 10 trochlear and 19 patellar ACI patients. Farr\textsuperscript{25} reported on 39 patients with a 2-year minimum follow-up. He found overall positive results with 80% of these patients rated good or excellent. Of 39 patients, 29 underwent a concomitant AMZ procedure for PF malalignment.

Overall, the ACI can be considered a valuable treatment option for the treatment of articular cartilage defects in the PF joint as long as an adequate evaluation and concomitant treatment of an underlying PF malalignment is performed.

**Fresh Osteochondral Allograft Transplantation**

Fresh osteochondral allograft transplantation has historically been performed as a salvage procedure in young patients (Fig. 4). Multiple parameters, such as patella size, shape, and side are recorded from donor and recipient to provide a close match of the graft to the recipient site. Although a major proponent of current osteochondral allograft surgery, Alan Gross, no longer supports the use of bipolar PF allografts, other authors have reported promising results with allograft for the PF compartment. Jamali et al\textsuperscript{26} reported their results of 20 fresh osteochondral allografts of the PF joint in 18 patients (including 12 patients with bipolar defects and 8 with patella defects only). They reported 5 of 18 patients as failures but noted significant clinical improvement in the survivors. Torga-Spak and Teitge\textsuperscript{27} reported similarly good results in 14 patients who underwent PF allograft replacement. Over 50% of these grafts survived more than 10 years. In the properly screened patient, acceptable positive outcomes are hopeful in restoring comfort and function without metal or plastic. Nevertheless, problems with availability and chondrocyte viability will limit the widespread use of this technique.

**Conclusion**

Overall, the nonarthroplasty treatment of early symptomatic PF arthritis is challenging but may be a realistic option. The suggested patient population typically includes young patients, often under the age of 40 years, in whom arthroplasty is typically not considered as a first option. The underlying pathology is most frequently a combination of PF instability and mild or moderate bony and/or soft tissue malalignment. The chondrosis is often a secondary pathology. To treat the chondrosis, it is therefore necessary to address all the underlying pathologies. Therefore, it is rare that a patient with marked PF chondrosis undergoes a cartilage repair procedure without a concomitant procedure. Appreciation of the complexity of this pathology continues to increase, and the available published reports are difficult to interpret. Some of the reported techniques report results on patients who did not have any concomitant surgeries to correct alignment/instability, whereas others include such patients. It is likely that there are several different patient populations who underwent these procedures. The ultimate goal of the nonarthroplasty techniques is to salvage the PF compartment. That is, the goal is to bridge the patient for a period when an arthroplasty, PF or total joint, may become necessary. In some reports, the current techniques suggest that this may be a realistic option. Additionally, these techniques prepare the compartment for a later PF arthroplasty (or total knee arthroplasty) by correcting the PF malalignment and soft-tissue imbalance.

Overall, we believe that nonarthroplasty techniques are valuable first-line treatment options in young patients who