

Fresh Osteochondral Allograft Transplantation: A Suitable Option for the Treatment of Patellofemoral Joint Cartilage Lesions in the Young Patient

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Commentary

Traumatic and degenerative cartilage defects occur frequently in the knee joint. Cartilage defects affect young and active patients, leading to functional limitations and loss of quality of life [1]. In the young patient population, arthroplasty is a poor option due to the necessary limitation of athletic activities, and the high revision rate and low satisfaction observed in this group of patients [2]. Osteochondral allograft (OCA) transplantation may be one potential biological treatment option for patients who have large patellofemoral defects and desire to avoid, or are not candidates for, arthroplasty.

Osteochondral allograft transplantation is a recognized treatment modality for cartilage lesions in the knee. Several studies have supported the safety and effectiveness of OCA for a variety of complex knee pathologies, including large chondral or osteochondral defects, osteonecrosis and, in select cases, osteoarthritis [3]. OCA transplantation results in the replacement of damaged articular cartilage and underlying bone with an orthotopic, allogenic whole tissue transplant. The versatility of the OCA allows this procedure to treat a wide spectrum of cartilage damage within the knee joint. The main advantages of using OCA are the lack of donor site morbidity, single-step procedure, and the transfer of mature hyaline cartilage.

The patellofemoral joint (PFJ) is considered the most challenging location for cartilage repair. Due to the complexity of the PFJ anatomy and to the multifactorial character of cartilage disease in this location, cartilage repair traditionally has resulted in less satisfactory outcomes [4]. However, recent studies of OCA transplantation for PFJ lesions have shown an improved rate of success with results comparable to femoral condyle lesions [5,6]. A reasonable explanation for this improvement may be the evolution of OCA transplantation techniques, as well as better understanding of patellofemoral biomechanics.

Historically, the first case report of osteochondral transplantation is dated from 1908 by Lexer [7] however, the modern description of osteochondral allograft use is attributed to Gross in 1975 [8]. He used large en block osteochondral allografts to treat posttraumatic loss of cartilage and bone, or to reconstruct defects after tumor resection. This technique resulted in problems pertaining to bone integration, occasionally resulting in graft collapse. Aiming to improve bone incorporation, Meyers and Convery developed a "shell graft" technique [9]. In this approach, the graft is prepared with only a small amount of residual allograft bone, demonstrating better results with less subchondral collapse. The most recent evolution of OCA transplantation is the dowel or mega-OAT technique [10]. Specific

instruments facilitate the harvesting of osteochondral plugs of variable sizes, ranging from 15 to 35 mm, from donor hemi condyles. The plugs are seated in corresponding recipient sockets and mostly secured by press-fit without additional hardware.

In the early 2000s, the FDA revised procurement and storage regulations for tissue banks, thereby contributing to the expanded use of osteochondral allografts for cartilage repair. Today, grafts are harvested within 48 hours of asystole and generally are limited to donors under the age of 40 that have passed a very involved screening process, including medical history, virology and bacteriology. The viability of chondrocytes within the graft is critical to graft survivorship and clinical outcomes. Nutrient medium and storage methods may vary among tissue banks; nevertheless, acceptable levels can be maintained for approximately 28 days [11].

Several techniques are available to treat cartilage lesions in the patellofemoral joint. Recent studies have demonstrated high rates of successful outcomes [12]. Staged cell-based cartilage repair, such as autologous chondrocyte implantation (ACI) and matrix-assisted autologous chondrocyte implantation (MACI), have shown favorable outcomes for PFJ lesions in long term follow up, with more than 80% good or excellent results [13]. Similarly, recent reports of OCA in the PFJ have demonstrated excellent results with 10-year survival: 78% for isolated patellar lesions and 92% for isolated trochlear lesions (5,6). Less encouraging results are expected in salvage procedures for osteoarthritis and specifically in bipolar lesions. Recent studies have demonstrated good results in only 60% of these patients [14]. Nevertheless, based on the complexity of this problem and the limitation of other surgical options for these cases, these results are reasonable for patients that are not candidates for arthroplasty.

For treatment of an active, young population, biological approaches are desirable. Therefore, in the absence of osteoarthritic degeneration, both ACI and OCA are viable options for the management of large cartilage defects of the PFJ. The cell-based technique has the advantage of being easily molded to complex surface areas such as the trochlear groove and the patellar ridge. For lesions that are uncontained, associated with subchondral bone edema, deep osteochondritis dissecans lesions, or failed cartilage repair, however, OCA transplantation may be preferable, since it transfers mature articular cartilage and intact subchondral bone.

OCA transplantation is the preferred biological option for salvage procedures. A bipolar shell technique is a suitable option for patients younger than 40 years old with PF arthritis. For this technique, the articular surface of the patella and trochlea are harvested from an allograft with an oscillating saw using the same principle as for PF

arthroplasty. This “Bioarthroplasty” is designed to maintain a biological joint in the setting of bipolar arthritic disease, with the goals of improving pain and function and possibly delaying or eliminating the need for future arthroplasty. However, for patients older than 50 years old with degenerative changes, PF arthroplasty should be considered.

Concurrent procedures are very common in PF cartilage repair. Patellofemoral cartilage lesions are frequently associated with maltracking of the extensor mechanism and patellar instability. One of the key points to optimizing the success of cartilage repair is the careful assessment of PF kinematics. Correction of underlying abnormalities is essential to optimizing PF function and, consequently, to maximize outcomes [15].

In summary, osteochondral allograft transplantation has been established as an effective and durable treatment for cartilage lesions of the PF joint, especially in the setting of abnormal subchondral bone or as a salvage option for degenerative changes in young patients. Successful outcomes can be achieved in more than half of arthritic patients, and OCA may be a potential biological treatment for these young patients who desire to delay arthroplasty. Additional studies will be helpful to further refine appropriate surgical indications, as well as to optimize graft viability and healing.

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