Strategies

Osteochondral allograft transplantation is a surgical technique that relies on obtaining tissue from cadaveric “living” donors. The objective is to procure healthy articular cartilage from a donor and transfer it to the damaged area of the recipient’s knee. Using cadaveric tissue eliminates the donor site morbidity associated with osteochondral autografting and allows for the treatment of larger and more aggressive lesions in virtually any joint. The technique also allows for the ability to implant fully formed articular cartilage without specific limitation with respect to defect size, and it can be completed as a single-stage procedure. Issues regarding cost, graft availability, cell viability, immunogenicity, and risk of disease transmission are some of the factors that may limit the use of this technique.

The ideal patient for an osteochondral allograft is a younger patient with an isolated traumatic lesion or osteochondritis dissecans (OCD). The lesions should be at least 2–3 cm² and can have associated bone loss or compromise due to dysvascular changes (i.e., avascular necrosis, AVN). This technique may be used for larger defects – 3 cm² up to an entire hemicondyle. These grafts are most commonly used for the femoral condyle but may also be used for patella, trochlea, and tibial plateau lesions. Because the allograft contains bone, any disorder with associated bone loss (AVN, osteochondral fracture, OCD) may also be restored with this surgical technique. Prior to surgery, all patients should be evaluated for relevant comorbidities such as malalignment, ligamentous instability, and meniscal deficiency.

Availability of graft tissue varies by institution and geographic location. Most transplanted grafts are considered “fresh tissue grafts” meaning that they are procured within 24–48 h of the donor’s death, processed and serologically screened within 14 days of procurement, and transplanted within 28 days without the need for deep-frozen storage. Frozen grafts can be stored and shipped on demand, potentially alleviating scheduling issues, but these grafts lack cell viability. Prolonged cold storage method increases the “shelf-life” of the graft to at least 28 days and alleviates scheduling difficulties while maintaining cell viability, but chondrocyte suppression continues to be an issue. Overall, fresh osteochondral tissue demonstrates greater than 60% donor chondrocyte viability at biopsy (1–3).

Incorporation and healing of the allograft depends on creeping substitution of host bone to allograft bone, although the bone may also undergo some degree of necrosis and fail to definitively incorporate (4, 5). The main source of graft immunogenicity is the blood or bone marrow elements within the subchondral bone of the donor tissue. At the time of procurement, these elements are pulse-lavaged from the donor tissue to minimize the chance of immune reaction. Even though immune reaction may occur, they are self-limited and do not limit graft success (6). In order to decrease the risk of disease transmission, tissue banks must adhere to strict protocols of donor screening, sterile processing, and serological testing. When a size- and side-matched graft becomes available, the patient is notified and expeditiously scheduled for surgery.

Patient selection

Indications

- Localized, grade III and IV unipolar lesion of the femoral condyle, trochlea, or patella
- Defects due to trauma, OCD, AVN, or intra-articular tibial plateau fractures
- Young, high demand patients who are not candidates for joint replacement
- Moderate-to-large cartilage lesions 15–35 mm in diameter
- Pain and symptoms localized and due to the damaged region

Relative contraindications

- Body mass index > 30 kg/m²
- Age greater than 50 years
– Bipolar lesions
– Uncorrected malalignment, ligament insufficiency, or meniscus deficiency

**Absolute contraindications**

– Rheumatoid or osteoarthritis and corticosteroid-induced osteonecrosis
– Tumor or infection
– Medical conditions that may affect incorporation of allograft tissue (i.e., insulin-dependent diabetes mellitus)
– Unwillingness or inability to follow rehabilitation regimen

Preoperative evaluation generally includes comprehensive history, physical exam, radiographs, magnetic resonance imaging (MRI), and diagnostic arthroscopy. Historical information should include prior injuries and mechanism of injury, symptom onset, and previous surgical intervention. Acute injuries may present with mechanical symptoms or potentially a loose body, while chronic cartilage damage may result in activity-related swelling, pain, and mechanical symptoms (locking or catching). Range of motion is generally preserved in patients with focal defects; however, gait alterations are possible to reduce loading across the defect (toeing-in or toeing-out). Depending on the location of the lesion, palpation may reveal joint line or peripatellar tenderness. A radiographic series should include long-axis weight bearing, 45° posterior to anterior flexion weight bearing, lateral non-weight bearing, and patellofemoral (sunrise) views with sizing markers (Fig. 1A). All compartments should be evaluated for joint-space narrowing, osteophyte formation, and subchondral changes (sclerosis or cysts). Long axis radiographs are useful for assessing alignment and Q-angle to establish the need for concurrent osteotomy. Anteroposterior and lateral films with markers are utilized to determine the appropriate medial-lateral and anterior-posterior dimensions of the donor graft. MRI functions to evaluate the overall status of the knee (i.e., meniscal or ligament pathology). Fat-suppressed sequences are useful in detecting bone injury – sclerosis, cysts, or edema (Fig. 1B). Subchondral involvement could help preclude the use of other modalities such as autologous chondrocyte implantation.

**Surgical technique**

The patient is placed in the supine position and anesthetized via general endotracheal, epidural, spinal, or regional anesthesia. A proximal thigh tourniquet is applied prior to prepping and drap-