Comparative Study of Navigated vs. Conventional Osteochondral Graft Transplantation of the Knee
+ 1Kendoff D, 1,2Koulalis D, 1 Citak M, 1 Stueber V, 1 O’Loughlin P F, 1 Pearle A D

+ 1 Orthopaedic Department, Hospital for Special Surgery, New York,
21st Orthopaedic Department University of Athens, University Hospital "Attikon" Chaidari, Athens, Greece
Senior author pearlea@hss.edu

Background: Osteochondral lesions of the knee are a common sports-related injury and may result in increased articular contact pressure. If left untreated, they may progress in size due to mechanical fragmentation of the surrounding articular cartilage leading to the development of synovitis, joint effusion, locking, pain and ultimately arthritis. Transplantation of autologous osteochondral grafts to focal defects of the articular surface of the knee joint is an established and popular method of treatment. One frequently employed technique is based on mosaicplasty, utilizing grafts from the unilateral knee from a non-weightbearing zone. In order to optimize postoperative outcomes, the angle of insertion of the grafts must be perpendicular to the articular surface of the joint and the chondral portion of the graft must be aligned as closely as possible to the level of the normal cartilage surrounding the defect. This is a difficult task especially when the procedure is being performed arthroscopically. Recently, computer assisted techniques have been shown to improve the precision of surgical tool placement with restricted or limited intraoperative views.

Hypothesis: The authors hypothesize that navigation improves harvesting and placement of osteochondral grafts compared to conventional free hand technique.

Study Design: Controlled Laboratory Study

Methods: Three cadaveric knees were used. Reference markers were attached to the femur and tibia and donor/recipient site guides. 15 osteochondral grafts were harvested and inserted into recipient sites with and without computer navigation. The angles of graft removal and placement as well as surface congruity (graft depth) were calculated for each surgical group.

Results: The mean angle of recipient graft removal and placement with navigation were 3.27° (SD 2.05°, range 0°-9°) and 3.6° (SD 1.96°, range 1°-9°) respectively while with conventional technique these angles were 10.73° (SD 4.96°; 2°-17°) and 10.6° (SD 4.41°; 3°-17°) respectively (Fig. 1). The difference between both harvest and placement angles between the surgical techniques was statistically significant. Mean depth with navigation was 0.25mm (SD 0.19mm, range 0-6mm) and 0.55mm (SD 0.28mm, range 0.2-1.1mm) with conventional technique (Fig. 2). The difference in depth between the techniques was statistically significant (p=0.0034).

Conclusions: Computer-assisted osteochondral graft transplantation in the knee allows for measurement and permanent visualization of the angle of recipient site preparation, the depth of the donor plug and the recipient plug as well as consistency in the angle of insertion of the graft at the recipient site. The authors have shown that this technology allows for more precise placement of the grafts in an open manner compared to a conventional technique in our cadaveric study. Significant improvement was observed in harvesting and placement of the osteochondral grafts in the navigated procedures. Future studies are needed to assess the use of a closed, arthroscopic technique, to improve our findings in a clinical set up and establish a benefit in vivo.

Clinical Relevance: Improvement in the osteochondral harvest and placement is desirable to optimize clinical outcomes in the athlete. Navigation shows great potential to improve both harvest and placement precision and accuracy thus optimizing ultimate surface congruity.

Fig. 1
Mean deviations between the angle of the graft in relation to the articular surface of navigated and conventional technique at the recipient site final plug placement.

Fig. 2
Mean results of articular surface congruity measurements with the navigated compared to the conventional technique.

Key Terms: osteochondral lesion - mosaicplasty - navigation – computer assisted surgery