OSTEOARTICULAR AUTOGRRAFT AND ALLOGRAFT TRANSPLANTATION OF THE KNEE: 3 YEAR FOLLOW-UP EVALUATION

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Introduction: The treatment of full thickness cartilage lesions of the knee remains a challenge, with morbidity rates as high as 50% reported. Left untreated, partial-thickness, and full-thickness cartilage defects can enlarge and potentially lead to osteoarthritis. An alternative approach to repairing joint surfaces consists of transplanting cultivated autologous chondrocytes, chondrogenic tissue, or osteochondral tissue. The use of fresh osteochondral allografts in the treatment of full thickness articular cartilage defects of has been well documented. Recently, excellent chondrocyte viability of refrigerated allografts has been reported. Various authors have described their experience with small osteochondral autologous grafts. Hangody et al reported excellent results at 5 year follow-up after autologous osteoarticular transplantation. At the University of South Alabama approximately 62 autologous, fresh or frozen osteoarticular transplants have been performed over the last 4 years. The purpose of this study was a prospective analysis of our first 43 patients (minimum 2 year follow-up) who underwent autologous, fresh or frozen allograft transplantation for a full thickness articular cartilage lesion of the knee using standardized clinical outcome measures.

Methods: 64 patients underwent osteoarticular transplantation between 1998 and 2001 for large single or multiple full thickness defects. 43 patients (male = 23; female = 20; BMI = 31.4 kg/m² [range, 17.5 to 51.5 kg/m²]) with an average age of 44.7 years (range, 11 to 71 years) were treated with autograft (n = 21) or allograft [fresh (n = 13) or frozen (n =9)] grafts and were available for a minimum 2 year follow up. All patients underwent clinical evaluation pre-operatively and at yearly intervals. Assessment included demographics, clinical examination, surgical findings and Western Ontario and McMaster Osteoarthritis Index (WOMAC) and Knee Society Clinical Rating System (KSCRS) questionnaires. Statistical analysis included paired t-tests and MANOVA (significance at p < 0.05).

Results: Average follow-up was 36 months (range, 24 to 60 months). The average total defect area was 10.2cm² (range, 0.20 to 55.4 cm²). The preoperative WOMAC and KSCRS values ranged from 3.12 to 96.9 (average 58.7) and from 12 to 195 (average 115.2), respectively. Postoperative WOMAC and KSCRS values ranged from 26 to 100 (average 74.3) and from 35 to 200 (average 155.5), respectively. Paired t-tests revealed a significant improvement between pre-post scores for the WOMAC (p = .0006) and KSCRS (p = .0001). 10 patients did not improve and/or required subsequent surgery. One-way MANOVA evaluated the effects of age, sex, BMI, type of graft, and size and site of defect on improvement of pain, function, and total scores for WOMAC and KSCRS. Significant effects (p < .05) were found among age, BMI, and type of graft. Post Hoc analysis revealed significant improvements (p < .05) in pain, stiffness, and function scores in patients younger than 35 years, those with a BMI less than 25, and those who received an autograft when compared to patients older than 35 years, BMI > 30, and those who received an allograft.

Discussion: Articular cartilage is a complex tissue that serves to minimize stress on subchondral bone and reduce friction on the bearing surfaces of synovial joints. Although the type II collagen associated with repair tissue after a full-thickness injury may remain hyaline-like up to 24 months, the repair surface soon begins to fibrillate and eventually resembles changes seen in osteoarthritis. Jackson et al, however, demonstrated that a 6mm diameter full thickness untreated lesion created in a goat model progresses over time with an abortive spontaneous repair process. The incidence of localized traumatic articular cartilage and osteochondral lesions is unknown. Ithas been suggested that as many as 10% of patients presenting with an acute knee hemarthrosis after injury may have a full thickness chondral injury. Curl et al, reviewed over 31,000 knee arthroscopies and reported chondral injuries in 63% of patients. Among patients younger than 40 years of age, 5% were noted to have Outerbridge Grade IV lesions of the medial femoral condyle.

The use of fresh and frozen allografts for the treatment of full thickness articular and osteoarticular defects is well documented. Reported success rates with the use of a fresh allograft ranges from 95% at 5 years to 66% at 20 years. The use of deep frozen allografts in the treatment of osteoarticular defects has also been reported, with cited failure rates as high as 25%. Currently, fresh osteochondral shell allografts (< 1 cm of subchondral bone) provide the greatest likelihood of chondrocyte survivability, while reducing immunogenicity by decreasing the exposure of white cells found in cancellous bone.

Autologous osteochondral tissue transfer has been reported in the past for treatment of full thickness articular cartilage defects. Yamashita and others have reported the use of autologous OATS for osteochondritis and in conjunction with ACL surgery. Recently, Garrett has reported the use of fresh OATS for large osteochondral defects. The data reported in the current study with improved WOMAC pain, function and stiffness scores are in agreement with others that have reported the use of fresh and autologous osteoarticular transplantation for full thickness cartilage defects.

There are several weaknesses in the current study. With the number of patients in this study, it is difficult to find true significant difference in functional outcome based on different graft types, size and location of the defect. Also, time to average follow-up is only 36 months. Currently, we are still performing both autograft and allograft OATS and plan to report long-term follow-up.

Conclusions: In conclusion, the current results support the use of osteoarticular transplant surgery as a viable option to treat full thickness cartilage defects. Seventy-seven percent of patients undergoing osteoarticular transplantation for large cartilage defects demonstrated improvement at an average of 36 months. Age less than 35 years, BMI less than 25 and use of autograft were associated with improved functional outcome. Compared to other cartilage replacement procedures such as chondrocyte transplantation, osteochondral transfer has the advantage of being able to be done arthroscopically in many cases, requiring only one surgical procedure, and costing less. Moreover, up to 5 plugs can be placed arthroscopically by surgeons skilled in this procedure. Histological analysis of transplanted autologous grafts have shown the transplanted hyaline cartilage to be viable, while several intermediate follow-up clinical studies have indicated as high as 90% pain relief and return to normal function.