

Summary: Symptomatic full thickness chondral and osteochondral defects of the knee present a considerable treatment challenge. This study investigates the use of a biodegradable polymeric scaffold for articular cartilage repair. 26 cases were implanted over 1 year with an orthobiologic scaffold to replace tissue removed in the treatment of chondral and osteochondral defects. Mean area grafted was 1.7 cm² (range 0.6-5.7 cm²). SF-36, IKDC and Lysholm scores improved significantly when compared to preoperative status. This technology shows significant promise in the clinical treatment of relatively small chondral and osteochondral defects.

Purpose: Symptomatic full thickness chondral and osteochondral defects of the knee present a considerable treatment challenge. This study investigates the use of a biodegradable polymeric scaffold, to fill a bone void, yielding bone and articular cartilage repair and resurfacing.

Methods: Sequential patients were enrolled prospectively, following IRB approval of the study. Once a full thickness chondral or osteochondral defect was identified arthroscopically, one or more polymeric orthobiologic scaffolds, cylindrical in shape, were implanted to restore a smooth surface contour. All patients underwent preoperative and postoperative clinical and radiographic evaluation and were examined at regular intervals, systematically collecting quantified clinical outcome scores. Postoperatively all patients were maintained touch down weight bearing with axillary crutches for 6 weeks with immediate full range of motion.

Results: 26 cases were implanted over 1 year with an orthobiologic scaffold to replace tissue removed in the treatment of chondral and osteochondral defects. Mean follow up was 22 months (range 16 to 32 months). Mean age was 41 years. Mean number of grafts was 1.8 (range 1-7). Mean area grafted was 1.7 cm² (range 0.6-5.7 cm²). SF-36 Physical mean score improved from 35 pre-treatment to 47 post-surgery. On the SF-36 Mental, mean scores improved from 48 to 55. IKDC mean score improved from 29 to 62. The Lysholm mean score improved from 37 to 67. There was no radiographic evidence of bone lysis or evident complications. One patient was deemed a failure, and went on to arthroplasty for what was felt to be concurrent, unrelated pathologies. There were no other failures, and no complications related to the scaffolds identified.

Conclusions: All patients, except one, showed significant improvements post-treatment as measured by each of the scoring instruments. The use of this orthobiologic scaffold potentially eliminates the need for secondary procedures or interventions (such as autologous tissue harvesting or secondary chondrocyte implantation) re-

sulting in decreased patient pain and donor site morbidity. This technology shows significant promise in the clinical treatment of relatively small chondral and osteochondral defects.

Clinical and Microscopic Evaluation of Implanted Refrigerated and Frozen Osteochondral Allografts (SS-46). *Albert W. Pearsall, MD, Sudhakar Madanagopal, MD, J. Tucker, MD*

Summary: The purpose of the current study was to evaluate patients who underwent refrigerated or frozen allograft transplantation. No significant difference in chondrocyte viability was noted on histological or electron microscopy analysis between refrigerated and frozen allografts at the time of implantation. A trend towards greater improvement in WOMAC, KSS was noted in the frozen allograft group when compared to the refrigerated allograft group. Both refrigerated and frozen large osteochondral allografts appear to be function well clinically at 4 year follow-up.

Purpose: Treatment options for full thickness osteochondral lesions include microfracture, transplanting cultivated autologous chondrocytes, or osteochondral tissue. The use of fresh osteochondral allografts has been well documented, with "fresh" indicating graft harvest within 24 hours of the donor's death and time to implantation of < 7 days. Deep frozen allografts have also been used; however, diminished cell viability and matrix degeneration have been cited. The purpose of the current study was to clinically and radiographically evaluate patients who underwent refrigerated or frozen allograft transplantation and analyze the relationship between functional outcome and allograft histological and electron microscopic grading.

Methods: Between 1998 and 2002, 58 patients underwent transplantation for a cartilage defect of the femur and/or patella with a refrigerated or frozen allograft. Inclusion criteria were as follows: activity level of Tegner 3 or greater, a contained articular cartilage defect; damage limited to < 2 compartments, failure of conservative measures > 3 months. All patients underwent clinical evaluation including the Knee Society Score (KSS), WOMAC Score and a VAS for pain. Failure was defined as conversion to a unicompartmental/total knee arthroplasty. All failures were included in the overall analysis and also analyzed separately. Three plugs were sterilely harvested and prepared for evaluation. The following scoring system was utilized for each slide: 0 = all cells lethally injured; 1+ = majority of cells with marked-lethal injury; 2+ = minority of cells with marked-lethal injury; 3+ all cells viable. For electron microscopy the

above scoring scheme above was also applied. Statistical analyses were performed using JMP software system. Significance was determined at the 0.05 level.

Results: Among the 26 patients, analysis were available in 25 (96%). There were 11 males and 15 females. The average age was 48 years. The average follow-up was 46 months. The average BMI was 32. The average graft size was 4.5 cm². The 4 scores for histological and electron microscopy evaluation were combined into 2 grades. When pre-operative WOMAC and KSS were compared, there was no statistical difference between the 2 groups. No significant difference in chondrocyte viability was noted on histological or electron microscopy between refrigerated and frozen allografts at the time of implantation. A trend towards greater improvement in WOMAC, KSS was noted in the frozen allograft group, although not statistically significant ($p=0.07$) An improvement in knee range of motion was noted in frozen allograft patients compared to those with a refrigerated allograft ($p=0.02$). There was no correlation between post-op x-ray score and outcome. 24% were considered failures and were analyzed separately. All failures were refrigerated allografts. No failures were noted if the histology score was Grade 2 or if the electron microscopy score was Grade 2. The likelihood ratio for a patient to do well if the initial histological score was 2 was 8.4 and if the electron microscopy score was 2 was 1.4.

Conclusions: Both refrigerated and frozen large osteochondral allografts appear to be function well clinically at 4 year follow-up. Long term follow-up is further needed.

Human Knee Cytokine Synovial Fluid Analysis Correlated with Grade of Knee Arthritis (SS-47). C. Thomas Vangness, Jr., MD, Steven Narvy, MD, Wendy Burke, MD, Alex Fedenko, MD, Robert MacPhee, MD

Introduction: Cytokines profoundly affect the balance between anabolic and catabolic processes in synovial joints. The purpose of this study was to evaluate the cytokine profile of human knee synovial fluid and correlate this with the degree of articular cartilage degradation, radiographic score, and synovial histology.

Methods: With IRB approval, synovial fluid was withdrawn before knee meniscetomy in 15 subjects with varying degrees of OA. Synovial fluid was analyzed for 22 different cytokines. Articular cartilage surfaces were scored via ICRS classification and radiographs graded by Kellgren-Lawrence classification. Synovial biopsies were taken for histological analysis.

Results: Synovial tissue histology did not correlate with grade of arthritis. Overall, there was an increase in

all cytokine levels with increasing grades of O.A. Correlation with ICRS grading showed consistent elevations of IL-1 and TNF with increasing ICRS scores (IV > III > II > I). The ICRS was much more accurate than Kellgren-Lawrence for correlating levels of cytokine activity.

Conclusions: This is the first study to extensively evaluate cytokine concentrations and correlate this with grade of human O.A. knee. Immunoassay profile proved to be sensitive and capable of yielding highly reproducible patterns of cytokine panels. This data demonstrated the molecular basis of disease progression and can assist in understanding the inflammatory response with OA progression. Cytokine biomarkers will help monitor disease progression and assist in future pharmacologic or surgical intervention.

Outcomes of Full-thickness Articular Cartilage Injuries of the Shoulder Treated with the Microfracture (SS-48). Benjamin H. Huffard, MD, Marilee P. Horan, BS, Peter J. Millett, MD, Richard J. Hawkins, MD

Introduction: Microfracture (Mcfx) has been an effective treatment for chondral lesions in the knee, but there is little evidence to support its use for chondral defects in the shoulder. The best treatment for articular cartilage defects in the shoulder remains unknown. The purpose of this study was to determine the pain and functional outcomes after microfracture in shoulder. The Mcfx procedure can improve function and pain in shoulders with symptomatic, full thickness chondral defects.

Methods: Mcfx was performed in shoulders with full thickness chondral lesions of the glenohumeral joint. Concomitant procedures for synovitis, loose bodies, partial cuff tear debridement, acromioplasty and instability were performed as indicated. Patients over 60 years of age and those with complete rotator cuff tears were excluded. Excluded from follow-up were 6 subjects that had subsequent surgery which were considered failures and 2 patients that died. Eighteen patients had two year subjective follow-up. Included were 16 men and 2 women with an average age of 45 years (range 24-59). Patient's pain and functional outcomes were measures using the American Shoulder and Elbow Surgeon Score (ASES) and patient satisfaction level (1 = unsatisfied, 10 = very satisfied). Data were analyzed using paired t-tests and regression analysis.

Results: Average follow-up was 40 months (range 25 – 67). Mean pain scores decreased from 3.6 preoperatively to 1.3 postoperatively (0 = no pain, 10 = worst pain). Patients' ability to work, ADL and sports activity had a significant improvement postoperatively ($p < 0.05$). Patient's painless use of their arm improved post-