severity of the cartilage damage. A maximum of the 3 most significant articular lesions was then recorded on the data sheet and subsequently entered into the database. Fisher's exact test, Pearson chi-square test, *t* test and Mann-Whitney *U* test were used for the statistical analysis. All tests were two-tailed with a confidence level of 95% ($P < .05$). An Increased incidence of articular lesions was found in patients with synovial shelves, in comparison with patients without shelves (94.7% versus 81% respectively; $P < .001$). Patients with shelves type B2-D3 were found to have increased incidence of cartilage lesions in comparison with patients with type A0-B1 shelves (96.5% versus 86.4% respectively; $P = .002$), as well as cartilage lesions with bigger size (84% versus 71.4% respectively; $P = 0.02$). Patella and F2, F3 zones of the medial femoral condyle were areas with increased incidence of cartilage lesions, in patients with synovial shelves in comparison with patients without shelves, with percentages 47.7% versus 27.5% for the patella ($P < .001$), and 80.2% versus 45% for the F2 and F3 zones ($P < .001$), respectively. In conclusion, Synovial shelves of the knee are a risk factor for cartilage lesions. Even small shelves with chronic inflammation (type B2-D3) predispose towards more frequent and larger articular lesions. Areas at risk particularly include the patella and the non-weight-bearing medial femoral condyle.

Joseph J. Christoforakis, M.D., Jordi Sanchez-Ballester, F.R.C.S., Neil Hunt, F.R.C.S., Rhidian Thomas, F.R.C.S., Robin K. Strachan, F.R.C.S.

Cartilage Resurfacing with Precut Fresh Osteochondral Core Allografts (SS-43)

Objective: To familiarize the clinician with the development of a new and simple method to resurface full-thickness cartilage defects of the knee. Methods: Large articular cartilage defects of the knee can be managed with various methods. These include mosaicplasty and chondrocyte reimplantation which can be technically difficult, associated with a prolonged recovery period and expensive. Fresh chondral allografts can now be preserved for as long as twenty one days with maintenance of chondrocyte viability. Precut full-thickness osteochondral core allografts are now available in 2 mm incremental sizes from 10 to 20 mm in diameter. The grafts are harvested from multiple sites on the donor femoral condyle to orthotopically match the recipient defect. The required size of the donor osteochondral plug is determined by prior arthroscopy or an MRI utilizing 3 plane high resolution sequencing with fast-spin echo proton density. The graft can be inserted arthroscopically or via a mini-arthrotomy on an out-patient basis. No internal fixation is required. Range of motion and early weight bearing is encouraged. Results: Twenty-three grafts have been inserted over the past 38 months. Six cases have undergone follow-up arthroscopy with visualization of the graft and cartilage biopsy. Excellent maintenance of the resurfaced cartilage site has been observed in all cases. Chondrocyte viability has been observed to be in the range of 80%. Conclusions: This new, easily reproducible process provides the simplest and most cost effective method for cartilage resurfacing of large femoral condyle defects and is associated with low morbidity and early recovery.

Richard L. Levitt, M.D., Theodore Malinin, M.D.

Chondral Osseous Replacement (COR) Technique for Femoral Defects (SS-44)

Localized, full-thickness articular cartilage defects of the femoral condyle are often found unexpectedly. An arthroscopic repair technique that transplants chondral osseous plugs to fill the defect (COR technique) offers an immediate solution for these lesions. The purpose of this study is to review the clinical and radiographic results of chondral osseous replacement for full-thickness articular cartilage lesions. Methods: A prospective two center study of full-thickness articular cartilage lesions was initiated in 1995. All knees were evaluated both pre and postoperatively by physical examination, radiographs, Lysholm and Tegner knee scores. Inclusion criteria were full-thickness femoral condyle defects >1 cm and <3.5 cm in diameter, and a minimum 24 months follow-up. Exclusion criteria were associated tibial defects, patellar defects, or generalized arthritic change. ACL tears, concurrent ACL surgery, and meniscal tears were not contraindications. Grafts harvested from the superior and lateral femoral notch were press fit into holes drilled into the defect placed adjacent to the articular cartilage margin. Cancellous bone bridges were maintained between grafts. Relook arthroscopic examinations were done when possible. Results: 39 patients met the inclusion criteria with an average follow-up of 48 months (24-89 months). The average age was 45. There were 20 males and 19 females. The MFC was involved in 30 and the LFC in 9. The average Lysholm score increased from 43 preoperatively to 84 at follow-up. The average Tegner score at follow-up was 4.9. Relook arthroscopies were obtained in 14 of the 39 and demonstrated good incorporation of the grafts in all cases. Biopsies of these grafts over time demonstrated viable chondral and osseous components at intervals out to 12 months. Radiographic examinations demonstrated early arthritic changes in some patients. Discussion: The technique successfully transplants chondral osseous grafts within the knee that remain

viable. Despite reducing symptoms, arthritic changes were observed to increase radiographically over time. It is unclear if these radiographic changes are related to the initial traumatic and what their future significance might be. The midterm clinical response was favorable for these patients. Further investigation of the long-term results is required.

F. Alan Barber, M.D., James C. Y. Chow, M.D.

Treatment of Large Osteochondral Defects in the Knee With Partial Condylar Transfer (SS-45)

This is a long-term follow-up study of about 53 patients over 5 to 15 years. Treatment of large and deep osteochondral lesions is very demanding. We use large autogenous osteochondral grafts from the most posterior partsof the lateral and medial femoral condyles as a partial condylar transfer (PCT). If necessary additional smaller grafts of the trochlea patellae can be used. Harvesting is done by a diamond cutting device. Between 1986 and 1996 we operated 53 patients with large osteochondral defects of the femoral condyles. Postoperative ingrowth control was done by MRI in all cases after 6 and 12 weeks. Only 1 case developed a wide necrosis of the transplants and had to be revised. This complication was due to technical error. Two cases showed small subchondral cysts of no clinical evidence. Clinical evaluation of the long-term follow-up was done by the Standard Cartilage Evaluation Form of the ICRS. More than 90% of the patients showed a significant improvement compared to the preoperative data. There was no morbidity of the posterior harvest side whereas the harvest side in the anterior parts cases problems in a few cases. The Kellgren and Lawrence Score was used for X-ray evaluation. There was only a mild degenerative progression in most of the cases. Patients with varus or valgus deformity showed more progression than those patients without malalignment. Advantage of our method is the possibility of immediate full weight bearing, little harvest morbidity and excellent long-term results.

Heinz Georg Laprell, M.D.

Rotator Cuff Repair With Ultrasonic Suture Welding (SS-46)

Rotator cuff repair techniques traditionally employ suture fixation of the tendon to both soft and bony tissues. The suture is tied by hand or arthroscopic knot pusher to provide secure loops to fix tissue to facilitate healing. A new technology allows the creation of secure loops with ultrasonic energy welding. This study was conducted to assess the clinical results of mini-open rotator cuff repair employing ultrasonic suture welding. Fifty consecutive patients treated by one surgeon were retrospectively evaluated with an average follow-up of 26 months. These patients were then compared to 55 patients treated by the same surgeon with a technique employing standard knot-tying with nonabsorbable suture with similar follow-up. The groups were similar in regard to age, sex, hand dominance and preoperative duration of symptoms. All procedures were performed in a hospital ambulatory surgery center in a lateral decubitus position. A glenohumeral arthroscopy and arthroscopic acromioplasty were performed in all cases. All patients were evaluated by an independent examiner using the UCLA scale; 47 of the 50 suture weld patients were available for evaluation. Preoperative UCLA score averaged 21.5 and postoperative 29.8. There were four failures in this group but two of the patients who failed had a significant postoperative traumatic events; a dislocation in one and a car accident in another. Both patients underwent revision cuff repair. At revision. both repairs had pulled through tendon without failure of the weld. 40 of the 55 patients treated with tied sutures were available for evaluation. Preoperative UCLA score averaged 13.2 and postoperative 31.6. There was one failure in this group of patients and none with postoperative trauma. Postoperative scores for the two groups did not differ significantly according to Student *t* test. An Analysis of Covariance (ANCOVA) of postoperative UCLA scores was also not statistically significant. Suture welding produces secure loops that allow for cuff repair with results similar to traditional knot-tying techniques. Welding technology may facilitate arthroscopic cuff repair by obviating the need to tie arthroscopic knots.

Louis F. McIntyre, M.D., Mirjam Norris, R.N., Bruce Weber, P.T.

Very Strong Sutures Can Still Slip: Evaluation of Five Knot Types and Two Suture Materials for Shoulder Arthroscopy (SS-47)

Persistent defects after arthroscopic rotator cuff repair may be due to the technical challenges associated with suture loop and knot security. Very strong suture materials decrease the incidence of suture breakage during knot tying, however these materials are not automatically more reliable in regard to slippage at sub-maximal loads. The purpose of this study was (1) to compare the performance of a standard suture material (No. 2 Ethibond [Ethicon]) with a newer material (No. 2 Fiberwire [Arthrex]) in regard to knot security and load to failure using multiple arthroscopic knot configurations, and (2) to evaluate the biomechanical performance of a new sliding