repair with biodegradable implants showed higher peak pressure than suture repair, particularly at the most medial location. Implants in the more posterior meniscus demonstrated smaller increases in peak pressure, and may have less potential for articular cartilage injury. These results suggest that avoidance of deep knee flexion angles postoperatively may limit increases in articular contact pressures and potential chondral injury.

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Meniscal Fixation Implants Sufficiently Reduce Gapping of Longitudinal Meniscal Tears (SS-24)

Many meniscal fixation implants provide only low pull out forces between 15 and 50 N. However, it is unknown if these forces are sufficient to withstand the loads, which occur in vivo. The aim of this laboratory study was to explore the gapping behavior of longitudinal meniscal tears. It was also investigated to what extent a fixation implant of low pull out force is able to reduce the gaps that occur in meniscal tears under different loading conditions. Methods: Longitudinal tears of 2 cm in length were set in the posterior horn of the medial menisci of 8 porcine knee joints. To observe the tears an opaque placeholder of the same shape as the original articular surface replaced the medial tibial plateau. Thus the menisci could be visualized in situ. The knees were exposed to flexion-extension cycles in a loading and motion simulator under 30 N and 200 N axial joint load, under tibial rotation moments, varus or valgus moments, and combined moments. For each load condition the maximum gap width of the tear occurring during a motion cycle was recorded. All tests were repeated after lengthening the initial tear to 2.5 cm, and subsequently to 3 cm. Finally the tears were repaired using three Meniscal Screws in each knee and the test repeated. Results: Maximum gapping of 1.6 mm (Standard deviation (SD) 0.5 mm) occurred for the 3 cm tear under 200 N axial joint load under a valgus-external tibial rotation moment. Significantly less gapping was observed under pure internal tibial rotation for all tear lengths and axial loads (between 0.1 mm (SD 0.28 mm) and 0.9 mm (SD 0.3 mm); $P < .05$). Longer tears always produced broader tear gaps ($P < .05$). Repair with three Meniscal Screws reduced the maximum width of the tear gaps significantly ($P < .05$). The gaps were very small especially at the locations of the implants with gap widths of 0.28 mm (SD 0.45 mm) under a varus moment and 200 N axial joint load. The gapping between the implants was also reduced with a maximum gap of 0.62 mm (SD 0.52 mm) under external tibial rotation and 30 N axial joint load. Discussion: From the gap widths measured in this study and the stiffness of the implant-meniscus interface determined in previous studies maximum forces of the implant-meniscus interface of 10 N can be estimated. This coincides with the findings of Kirsch et al. (J Biomech 1999;Suppl 1:104), who measured low forces in meniscal sutures. Therefore the implant pull out force seems not to be a critical parameter. In conclusion, it can be assumed that all available meniscal fixation implants provide sufficient primary stability avoiding excessive gapping even under critical joint loads like valgus and external tibial rotation. Early rehabilitation under weight bearing can therefore be recommended. Nevertheless, to avoid peak gapping of repaired meniscal tears a brace limiting external rotation can be worn.

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Complex and Horizontal Cleavage Meniscal Tears: Association With Significant Cartilage Damage (SS-25)

Experimental studies demonstrated that meniscal tears could lead to chondropathy and osteoarthritis. Clinical studies are controversial. Some authors describe the association of meniscal and articular cartilage lesions as coincidental, whereas others believe that causal link may exists. Some studies suggest that stable tears have good potential for healing and are less likely to produce osteoarthritis. Even though there are not a lot of studies to support this fact, complex tears and horizontal cleavage tears have been considered degenerative tears associated with cartilage degeneration. The objective of the present study was to evaluate whether horizontal cleavage and complex meniscal tears are associated with more significant cartilage damage, in comparison with patients having other pattern of meniscal injury. Data were collected prospectively from 1,000 consecutive knee arthroscopies. Of the 1,000 patients who had knee arthroscopy, 507 (50.7%) patients had meniscal tears and mainly these patients were included in this study. There were 359 men and 148 women with age 13 to 85 years (mean age 40.8 $\pm$ 15.2 years). Of these patients, 333 (65.6%) had medial meniscal tears and 184 (34.4%) had lateral meniscal tears. Patients details (age, sex, duration of symptoms, injuries, and possible mechanism of injury), operative details (types and number of portals, equipment used), intra-articular findings (articular, meniscal and synovial lesions, and stability characteristics) and procedures performed were recorded. Pathologic findings were recorded diagrammatically, with articular lesions being represented on accurate anatomic maps of the articular

surfaces. The articular maps were divided into different functional zones that were labeled numerically for each bony surface. Outerbridge classification was used for the evaluation of the severity of the cartilage lesions. A maximum of the 3 most significant articular lesions recorded on the data sheet was entered into the database. Of the 1,000 patients, 874 (87.4%) were noted to have chondral lesions and 507 (50.7%) to have meniscal tear. We have not found any increased incidence of chondral lesions or increased severity of chondral lesions (Outerbridge classification) in patients with meniscal tear in comparison with patients without meniscal tear. Comparing patients with horizontal cleavage and complex meniscal tears and patients with other type of meniscal tear increased incidence of chondral lesions (88.5% *v* 68.9%, respectively, $P < .001$), increased severity (type III and IV Outerbridge classification) of chondral lesions (53.4% *v* 29.1%, respectively, $P < .001$), and increased incidence of patients having more than one chondral lesion (65% *v* 32.7%, respectively, $P < .001$) was found for the first group. In conclusion, patients with meniscal tears are not associated with increased incidence and severity of chondral lesions, in comparison with patients without meniscal tear. On the contrary, complex and horizontal cleavage meniscal tears are highly associated with increased incidence and severity of cartilage degeneration, in comparison with other types of meniscal tears.

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Clinical Results of Meniscal Repair Using the Bionx Arrow (SS-26)

Purpose: The all-inside technique using the Bionx Arrow has become a popular method for repairing meniscal tears. The few published clinical studies have been promising, although their results were based on relatively small sample sizes and short-term follow-up. The present study, with longer follow-up and larger numbers, does not demonstrate encouraging results. The clinical efficacy, success and failure rates, and associated complications of meniscal repair utilizing the Arrow with a minimum follow-up of three years are described. Type of Study: consecutive series. Materials and Methods: 60 consecutive meniscal repairs (in 57 patients) exclusively utilizing the Arrow were studied. Follow-up averaged 54 months. The average age of the patients was 27 years (range 13-53). The ACL was normal in 12 knees (12 repairs). 42 patients (45 repairs) underwent concomitant ACL reconstruction. One patient (2 repairs) had radiofrequency shrinkage of the ACL. One patient (one repair) underwent concomitant arthroscopic fixation of a tibial eminence fracture. Results: Of the 60 repairs, 17 repairs (28%) were documented as failures by repeat arthroscopy or MRI. 5 of 12 repairs (42%) performed in knees with an intact ACL failed. 9 of 45 menisci (20%) repaired in conjunction with an ACL reconstruction failed. The remaining 3 failures occurred in knees with unsuccessful ACL procedures. 15 out of 57 patients (26%) underwent a second operation because of the failed primary repair, and a 16th patient whose repair had failed deferred a reoperation, as he had sustained a pulmonary embolism after the initial surgery. Conclusions: This consecutive series has the largest sample size with the longest follow-up in the literature. Contrary to previous studies with good clinical results, this series revealed a 28% failure rate and significant postoperative complications such as chondral scoring and fixator breakage. This study raises concerns regarding continued liberal use of the Bionx Arrow, leading the senior author to abandon this technique.

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FastFix Meniscal Repair (SS-27)

From August 2001 until August 2003, 91 menisci in 76 patients were repaired using the FastFix system. ACL reconstruction was performed in 64 patients (85%). Twenty-three patients had significant chondral injuries. One to six sutures (avg. 3.12) sere used in the medial meniscus repairs. One to four sutures (avg. 1.6) were used in the lateral meniscus repairs. Fifty were red/red tears and forty-one were red/white tears. Tear patterns were classified as 71 vertical longitudinal, 12 peripheral detachments, 4 bucket handle, 1 radial, and 3 combines (1 vertical longitudinal and horizontal cleavage, 1 vertical longitudinal and flap, and 1 vertical longitudinal and radial). Patients satisfaction was very high with much less morbidity than an inside out repair. Pitfalls and problems encountered with the procedure were 1) Difficulty in proper suture positioning with the straight delivery system 2) Failure of the fixation to deploy 3) Difficulty in deploying the second fixator 4) Loss of fixation purchase during knot tightening 5) A residual loop in the knot after tightening 6) Failure to reach the rim with the fixator in large bucket handle type fragments. These problems were overcome with 1) The use of a curved inserter 2) Rotating the inserter prior to deploying the fixator 3) Modifying the fixator with a thumb stop 4) Using a smooth continuous pull for initial knot pull down followed by a knot pusher for cinching 5) And not using the device for large thick bucket handle