BIOMECHANICAL COMPARISON OF THE OMNISPAN™ MENISCAL REPAIR SYSTEM AND ULTRA FasT-Fix™

Objective
The purpose of this study was to compare the point loading and articular abrasion properties of the Smith & Nephew Ultra FasT-Fix and DePuy Mitek OMNISPAN meniscal repair devices in a human cadaveric model. Our hypothesis was that devices which leave a suture knot on the meniscus will abrade cartilage as the joint is articulated and that this may be due to an increase in the point pressure. This study compares unrepaired knees, knees implanted with a device that does not leave a suture knot on the surface of the meniscus and knees implanted with a device that does leave a suture knot on the meniscus.

Methods
Two different biomechanical tests were performed on a total of three matched pairs of knees from donors aged 60 years or younger. First, both devices were arthroscopically implanted into the red/red or red/white zone of undamaged menisci (alternating which device was implanted into the lateral meniscus and which device was implanted into the medial meniscus) for two pairs of knees (Figure 1). Then each knee was placed into a custom loading fixture, which simulated walking by use of a 267 N (60 pound) compressive load and a pendulum load frame. The fulcrum was placed at the center of the knee joint. Knees were cycled from full extension to approximately 10° flexion at 1 Hz for 1000 cycles with minimal internal/external rotation. Then the knees were disarticulated and the femoral condyles were stained to increase the visual contrast between damaged and undamaged cartilage. Second, the final pair of knees was disarticulated and all soft tissue except for the menisci and their ligamentous attachments to the tibiae were carefully removed. The bare femora and meniscus-topped tibiae were then loaded onto an MTS load frame with TechScan pressure sensing film interposed at the joint line. After calibrating the TechScan software to match the output from the MTS, pressure distribution maps were generated for the menisci both in the unrepaired and repaired states.

Figure 1: View of disarticulated left knee showing arthroscopically inserted meniscal repair devices. The mattress stitch of the OMNISPAN device (left) is visible on the medial meniscus and suture knot of the Ultra FasT-Fix device (right) is visible on the lateral meniscus.

Figure 2: Femoral condyles after 1000 cycle abrasion test: unstained (left) and stained (middle and right). Red ovals show un-abraded cartilage for OMNISPAN (middle) and linear abrasion for Ultra FasT-Fix (right).
RESULTS
The stain permitted visualization of cartilage abrasions or other damage that was otherwise not necessarily evident to the human eye (Figure 2). There were some locations of preexisting femoral cartilage damage in all specimens. However, in 50% of the cases (2/4), there was a linear abrasion that matched up with the direct line of motion for the Ultra Fast-Fix knot, while there was no such damage for any of the knees implanted with OMNISPAN (0/4) (Figure 2).

For equal loads applied on the menisci, the maximum pressure increased 81% between intact and treated with OMNISPAN but 136% between intact and Ultra Fast-Fix (Figure 3). These increases in pressure over the intact case could be seen clearly with the sensors (Figure 4).

CONCLUSION
For meniscal repair devices with suture knots left remaining between the meniscus and the articular cartilage of the femur, the possibility exists for cartilage abrasion from the knot. One potential source of these linear abrasions is the higher point pressures generated by the knot compared to the intact case and a device that only leaves behind a mattress stitch-style repair.