**InternalBrace™ Ligament Augmentation Procedure in the Repair of Acute Deltoid Rupture Associated With Ankle Fracture**

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### Objective

Traditionally, acute deltoid rupture associated with ankle fracture was often left untreated surgically. This treatment philosophy, which stemmed from low-power studies, is now being challenged with growing awareness of the benefits of primary repair. The objective of this study was to compare results of primary repair with and without the InternalBrace ligament augmentation procedure in the surgical treatment of acute deltoid rupture associated with ankle fracture using matched-paired cadaveric specimens. Further, we performed tests to determine whether the InternalBrace ligament augmentation procedure affects ankle range of motion.

### Materials and Methods

Human cadaveric specimens (mean age, 55 years; all males) were used. Specimens were prepared by transecting the medial deltoid ligament of the ankle to simulate an acute disruption, which was confirmed fluoroscopically. In addition, the ankle syndesmosis was disrupted to simulate a PER 4 injury. This allowed isolated strength evaluation of the medial soft-tissue repair. In initial bench tests, FiberTape suture with one anchor in the tibia and one anchor in the talus was superior to other constructs; therefore, additional anchors in the talus or calcaneus were omitted from the construct. This study evaluates whether a single “deep-anterior” InternalBrace ligament augmentation procedure adequately augments a deltoid repair. For this reason, we compared the use of one 4.75 mm BioComposite SwiveLock anchor in the tibia and one 3.5 mm BioComposite SwiveLock anchor in the talus with FiberTape suture, consistent with standard InternalBrace ligament augmentation techniques, to a control group. The contralateral matched limb was used as a control, which consisted of deltoid primary repair using two SutureTape FiberTak anchors. For mechanical testing, the foot was oriented in 7° of valgus to simulate foot position during injury (Figure 1).

Compression force of 222N (50 lb) was applied to represent body weight, followed by internal tibial rotation torque with 400/s loading rate until failure. Mechanical data from both groups were compared. Range of motion was measured before and after the InternalBrace repair using fluoroscopy to compare the change in the long axis of the talus and tibia.

### Results

Figure 2 shows pairwise comparison between InternalBrace ligament augmentation repair and contralateral control. Statistical analysis revealed a statistically significant difference in maximum torque between the InternalBrace ligament augmentation group and the control group ($P = .028$). Table 1 and Figure 3 show mean maximum torque values for both groups. The mode of failure for all samples was either suture pull-out or suture loosening (Figure 4). There was no decrease in range of motion in any of the specimens after the InternalBrace ligament augmentation procedure (dorsiflexion range before InternalBrace repair, 0-15°; after InternalBrace repair, 0-15°).

**Figure 1.** Test setup.
Conclusion
This cadaveric biomechanical analysis provides data on the use of the InternalBrace™ ligament augmentation procedure in the setting of acute deltoid disruption. For this configuration, the tibial anchor is placed in the intercollicular groove, while the talus anchor is positioned at the insertion of the deep deltoid on the medial wall of the talus. The stay suture is used to repair the disrupted deep deltoid fibers, with the FiberTape® suture positioned over the ligament fibers with the foot in a neutral position. DX FiberTak® anchors are then used to directly repair the superficial deltoid. Compared with primary repair as the control, the InternalBrace ligament augmentation repair provided statistically significant stability before pull-out occurred. There were no significant changes in sagittal plane range of motion in either group. As the InternalBrace ligament augmentation group was identified to be superior biomechanically, this procedure may be beneficial for the repair of an acute disrupted deltoid. Clinical studies are necessary to further validate these results.

Table 1. Mean maximum torque values for both groups

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<tr>
<th>Groups</th>
<th>Mean Max. Torque (Nm) ± SD</th>
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<tr>
<td>InternalBrace Ligament Augmentation</td>
<td>24.98 ± 6.13</td>
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<tr>
<td>Control</td>
<td>19.78 ± 5.61</td>
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Figure 2. Pairwise comparison between InternalBrace (IB) ligament augmentation groups and their corresponding contralateral controls.

Figure 3. Direct comparison between the two groups.

Figure 4. Typical mode of failure in all samples.

References