A Biomechanical Analysis of Brostrom versus Brostrom-Gould Lateral Ankle Instability Repairs

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Summary
Our findings suggest that there is no statistical difference in ankle stability conferred by modifying the traditional Brostrom repair with the Gould reconstruction. These data question the ability of the retinaculum to provide any additional biomechanical support in preventing ankle instability. Our study suggests that surgeons should not assume that augmenting primary lateral ankle ligament repairs with the extensor retinaculum will prevent instability in patients who have marginal tissues.

Introduction
Ankle sprains represent the most common athletic injury. While most of these injuries respond successfully to non-operative management, 10-20% develop symptoms of chronic instability. Both the traditional Brostrom repair as well as the modified Brostrom-Gould procedure are considered historically reliable repairs of the lateral ankle ligament complex. The purpose of this study was to compare the biomechanical stability of both procedures in a cadaveric model.

Methods
Ten lower extremity cadaver specimens were obtained (mean 40 ± 12 years). Specimens were screened for gross defects and pre-existing laxity. 5 mm Steinman pin wires were inserted into the tibia and the talus, and six sensors were rigidly affixed to each of the wires to establish relative planes of movement. Specimens were placed in a Telos ankle stress apparatus (Telos, Germany) in an anterior-posterior position followed by a lateral position, while a 1.7 N-m load was applied to simulate the anterior drawer and talar tilt tests, respectively. In both circumstances, the ankle was held in 15° plantar-flexion, neutral alignment, and 15° dorsi-flexion. During this period, the movement of the sensors was measured using the Optotrak System. Differences in translation between the talus and the tibia in the loaded anterior drawer test, as well as the angle between the tibia and talus in the loaded talar tilt test, were calculated and compared to the unloaded state to determine any.

Thereafter, the anterior talofibular ligament (ATFL) and the calcaneofibular ligament (CFL) were both sectioned from their fibular origins to simulate an unstable ankle. Measurements were repeated on the specimens following sectioning. The sectioned ligaments were then repaired using two double-loaded size 3.5 mm diameter corkscrew suture anchors (Arthrex, Inc, USA) using a standard Brostrom open repair. The anchors were placed at the anatomic origins of both the ATFL and the CFL. All ankles were then loaded and tested. Following the Brostrom repair, the extensor retinaculum was then oversewn using four, size 2 fiberwire sutures to augment the repair (Gould modification). These specimens were then loaded and retested. Measurements and calculations using the Optotrak were repeated on the specimens following repair. The results of the calculations of the Brostrom repair versus the Gould modification were compared using a paired t-test.

Results
There were no statistical differences between the Brostrom procedure, the augmented Gould modification, and the intact state (p > .05). There were statistical differences between the sectioned state and both of the repair states (p < .05). Interestingly, there were no statistical differences between the traditional Brostrom repair and the modified Brostrom-Gould procedure (p > .05).
Conclusion
Our findings suggest that there is no statistical difference in ankle stability conferred by modifying the traditional Broström repair with the Gould reconstruction. These data bring into question as to whether or not the additional support provided by the retinaculum offers any added biomechanical benefit in preventing ankle instability. Our study suggests that surgeons should not assume that augmenting primary lateral ankle ligament repairs with the extensor retinaculum will prevent instability in patients who have marginal tissues.