THE PERONEAL GROOVE DEEPENING PROCEDURE: A BIOMECHANICAL ANALYSIS OF PRESSURE REDUCTION
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Introduction
While prior studies have evaluated the biomechanics of peroneal tendon excursion within the peroneal groove, none have examined pressures within the fibular tunnel itself. Our goal of this study is to identify pressure changes at various points within the peroneal groove following a groove deepening procedure.

We hypothesize that pressures within the peroneal groove will subsequently decrease following a groove deepening procedure.

Methods
12 fresh frozen cadaver foot and ankle specimens were used. The peroneal longus and brevis tendons, as well as the posterior tibial tendon, were identified and tagged. A flexible thin computerized pressure sensor strip (Tekscan), containing 4 sensor pads, was placed longitudinally within the groove between the peroneal brevis tendon and posterior fibula. These 4 sensor pads were separated from each other by a distance of 8 mm. The strip was secured such that the first sensor pad was consistently positioned overlying the calcaneofibular ligament (CFL). The remaining 3 sensor pads were, therefore, positioned more proximally, corresponding to the distal, middle, and proximal groove respectively.

A fibular groove deepening procedure was then performed. The posterior fibular wall was osteotomized as a thin osteo-fibrocartilagenous flap and retracted posteriorly. Approximately 6 mm of fibular cancellous bone was burned out. The posterior wall was then repositioned and gently tapped into the welled out fibula. The pressure sensors and peroneal tendons were then allowed to fall back into the groove. The superior peroneal retinaculum and soft tissue sheath were reapproximated to the lateral fibula with sutures through bone tunnels. Pressure recordings were then recorded again at all of the previously described ankle positions with loads applied to the foot.

Tekscan computer software generated pressure data. The pre and post procedural average pressures for each of the 4 sensor pads were compared. Pressures were recorded over a 15 second interval for each trial, with Tekscan software generating an average pressure. Each trial was repeated 3 times. The same set of recordings was repeated for each of the 5 ankle positions noted above. Statistical analysis was then performed utilizing a two tailed paired t-test. Statistical significance was set with a p-value < 0.05 .

Results
The mean pressure recordings overlying the CFL increased at all 5 ankle positions following groove deepening. However, none of these changes were statistically significant. Statistically significant decreases in pressure were noted within the distal groove at all ankle positions following the groove deepening procedure. Similarly, pressures within the middle of the tunnel significantly decreased at all ankle positions. Pressure recordings within the proximal tunnel increased at all but one position. These pressures were very low for all ankle range of motions, with a statistically significant difference noted only in neutral and plantarflexion.

Discussion
Pressures within the middle and distal fibular peroneal groove significantly decreased following a groove deepening procedure. Decreasing groove pressures in this area after a deepening procedure would diminish stresses applied to the peroneal tendons. This would potentially minimize intrasubstance tearing and translate into less pain, greater peroneal longevity, and improved clinical function.

To recreate a clinical model, the test set-up was designed to simulate the dynamic status of the mid-stance phase of gait in multiple ankle positions. However, the current findings are limited in that they are based on a cadaver model. Another limitation of the study was the need to place the computer sensor strip within the tunnel itself, which may have elevated pressure readings within the groove. The sensor strip is thin and pliable, which may have helped to minimize pressure distortions. Further, any effect on pressure resulting from the placement of the sensor in the groove presumably would be consistent before and after the procedure. Thus, relative change after the procedure should be an accurate indication of pressure change at each sensor.

In the current study, pressures within the middle and distal peroneal groove decreased after a deepening procedure. As less pressure is applied to the peroneal tendons following this procedure, it may be advantageous to perform this technique with peroneal tendon debridement for treatment of partial peroneal tendon tears or for recalcitrant peroneal tendinitis.

References