A Cadaveric Study: Does Deltoid Ligament Repair Impact the Quality of Syndesmotic Reduction?

Christopher R Leland, Adam Nathanael Musick, Robert Wagner, Maaz Muhammad, Carla Henriette Lehle, Thomas J Policicchio, Austin T Gregg, Marco Tulio Di Stefano, Michael G Young, Arjun Srinath, Arun Aneja

INTRODUCTION: Ankle fractures are common orthopaedic injuries that frequently involve associated ligamentous disruption, including syndesmotic and deltoid ligament injuries. Syndesmotic malreduction remains prevalent, with rates as high as 52%, and is associated with decreased patient-reported outcomes and altered joint mechanics. The deltoid ligament serves as a key stabilizer against hindfoot eversion and talar rotation, and its disruption substantially alters tibiotalar contact pressures. While deltoid ligament repair (DLR) has been shown to enhance ankle stability, its effect on syndesmotic reduction quality remains uncertain. This study compared the quality of syndesmotic reduction with and without DLR.

METHODS: Ten cadaveric ankle specimens (five donors) underwent baseline computed tomography (CT) imaging in neutral plantarflexion. A fellowship-trained orthopaedic trauma surgeon disrupted the syndesmosis and deltoid ligament of each specimen. The syndesmosis was reduced in neutral plantarflexion by hand tightening under direct visualization through an anterolateral approach and stabilized with two 0.062-inch K-wires placed lateral-to-medial in a quadricortical fashion. Postreduction CT imaging was then obtained. K-wires were removed, and DLR was performed using suture anchor fixation. The syndesmosis was again reduced and stabilized using the same technique, followed by a second postreduction CT scan. Four validated measurements were used to evaluate the quality of syndesmotic reduction. All postreduction CT scans were compared to baseline using mixed-effects linear regression to account for the nesting of ankles within donors.

RESULTS: Postreduction CT imaging demonstrated anterior translation of the fibula compared to baseline, both with DLR (6.4±1.1 mm vs. 7.7±1.5 mm, P=0.001) and without DLR (6.4±1.9 mm vs. 7.7±1.5 mm, P<0.001). The fibula was internally rotated following DLR when compared to baseline when evaluating rotation ratio (0.3±0.1 vs. 0.4±0.2, P=0.04) but not rotation angle (P>0.05). No differences were observed in lateral translation with or without DLR compared to baseline (P>0.05). Direct comparison of reductions with and without DLR showed no differences in reduction quality (P>0.05).

DISCUSSION AND CONCLUSION: In this cadaveric study, DLR did not significantly improve syndesmotic reduction quality compared to reductions performed without DLR. Relative internal rotation of the fibula was observed after DLR, perhaps due to prevention of talar external rotation and tensioning of the medial side during syndesmotic reduction. Future studies conducted under physiologic or weightbearing conditions are needed to clarify the clinical relevance of DLR in syndesmotic injuries.

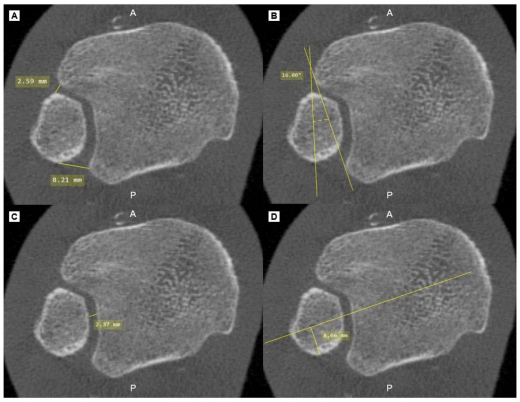

Figure 1. Evaluation of syndesmotic reduction quality using previously validated measurements: (**A**) ratio of the distances between the most anterior and posterior points on the fibula and tibia at the incisura to assess rotation; (**B**) angle between a line tangential to the anterior and posterior tibial tubercles and a line through the anterior and posterior fibular tubercles to assess rotation; (**C**) distance between the medial fibula and tibia at the incisura to assess lateral translation; and (**D**) distance from a line bisecting the incisura to the most posterior portion of the fibula to assess anterior-posterior translation.