Anatomic Ligament Repair Restores Ankle and Syndesmotic Rotational Stability as Much as Syndesmotic Screw Fixation

Name Credentials
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Purpose: Unstable rotational ankle fractures with concomitant syndesmotic disruption commonly occur. Currently, there is disagreement about the optimal treatment method for the syndesmotic injury component in this patient population. While transsyndesmotic screws are most often used, alternative syndesmotic stabilization strategies such as syndesmotic suture fixation and anatomic ligament repair have garnered increased interest. To date, no study has investigated the ability of an anatomic ligamentous repair strategy, consisting of posterior inferior tibiofibular ligament (PITFL) and deltoid ligament repair, to restore ankle and syndesmotic stiffness. Our hypothesis was that the anatomic ligament repair strategy would provide equivalent ankle and syndesmotic stiffness compared to a single 3.5-mm transsyndesmotic screw.

Methods: Nondestructive external rotation stresses of 4 nM were applied to 8 cadaveric limbs using a hydraulic loading frame. Four conditions were tested using a repeated-measures design: intact and three repair conditions following a destabilizing ligamentous ankle injury with syndesmotic disruption. The three repair conditions were tricortical transsyndesmotic screw fixation, PITFL repair, and combined PITFL and deltoid ligament repair. External rotation of the ankle and syndesmosis were measured using a motion capture system and compared for each test condition. Repeated-measures one-way analysis of variance (ANOVA) statistical tests were performed to compare the ankle and syndesmotic rotation findings between the three repair conditions and intact condition.

Results: Ankle stability was not fully restored by any of the three repair constructs. The intact ankle externally rotated approximately half as many degrees as the three repair conditions (Intact 10.9, Transsyndesmotic screw 17.0, PITFL 21.4, and PITFL / deltoid 15.6). Direct comparison between the transsyndesmotic screw and PITFL / deltoid repair specimens was not significantly different ($P = 0.84$). The intact condition demonstrated significantly fewer degrees of syndesmotic rotation than the repair constructs (Intact 2.4, Transsyndesmotic screw 5.2, PITFL 8.5, and PITFL / deltoid 6.9). Direct comparison between the transsyndesmotic screw and PITFL / deltoid repair groups was not significantly different ($P = 0.21$). Each of the repair constructs resulted in an externally rotated fibula compared to the intact condition prior to external rotation testing. The soft-tissue repairs (PITFL 4.3°, PITFL / deltoid 3.9°) caused twice as much external rotation compared to the syndesmotic screw (1.9°).

Conclusion: We found that combined repair of the PITFL and deltoid ligament restores an equivalent amount of ankle and syndesmotic rotational stability as transsyndesmotic screw fixation. Based on our findings, ligamentous repair can potentially be a viable treatment alternative in unstable ankle fracture patients with syndesmotic disruption. However, the

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clinical implications of a 2° greater fibular external malrotation with the ligamentous repair constructs compared to a single trans-yndesmotic screw is not known. Clinical outcome studies are needed to verify our biomechanical findings.

Table I. Summary and comparison of ankle and syndesmotic external rotation stability as well as resting fibular external rotation between intact and repair conditions

	Mean (n=8)	95% Confidence Intervals	P-value
Ankle Stability (degrees)			
Intact	10.9	6.4 – 15.4	-
Screw	17.0	11.4 – 22.6	0.008
PITFL	21.4	14.8 – 28.0	<0.001
PITFL+Deltoid	15.6	10.8 – 20.4	0.05
Syndesmotic Stability (degrees)			
Intact	2.4	1.6 – 3.2	-
Screw	5.2	3.6 – 6.8	0.013
PITFL	8.5	6.0 – 11.0	<0.001
PITFL+Deltoid	6.9	5.2 – 8.6	<0.001
Fibular External Rotation (degrees)			
Intact	-		-
Screw	1.9	1.0 – 2.9	0.016
PITFL	4.3	3.0 – 5.5	<0.001
PITFL+Deltoid	3.9	2.7 – 5.1	<0.001