

Diagnosing the Impact of the Syndesmotic Injury on Lateral Ankle Stability using Dynamic Ultrasound

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Introduction/Purpose: There is a high prevalence of coexisting lateral ankle ligament injuries and syndesmotic ligamentous injuries. However, it is unclear whether syndesmotic ligaments directly contribute toward the stability of the lateral ankle. Dynamic ultrasonography (US) is an imaging modality increasingly used for the care of orthopaedic foot and ankle patients because it allows dynamic evaluation of structures at the point of care with little risk to the patient and at low-cost. The aim of this study is to assess the effect of syndesmotic injury as well as combined syndesmotic and lateral ankle injury on the stability of the lateral ankle.

Methods: Sixteen fresh frozen above-knee amputated cadaveric specimens, divided into two groups, underwent ultrasound evaluation for lateral ankle stability. In both the groups, the assessment was first done with all ligaments intact and later with sequential transection of anterior inferior tibiofibular ligament (AITFL), interosseous ligament (IOL), posterior inferior tibiofibular ligament (PITFL), anterior talofibular ligament (ATFL), calcaneofibular ligament (CFL) and posterior talofibular ligament (PTFL). In all scenarios, two loading conditions were considered: (1) Anterior drawer test: 50N and 80N and (2) Lateral clear space (LCS): 1.7Nm torque. The talar translation and LCS to the fixed tibial plafond were measured using Image J. Wilcoxon rank-sum test was used to compare the findings of each ligamentous transection state to the intact state. A p-value <0.05 was considered statistically significant.

Results: In group 1 after transection of the all syndesmotic ligament and ATFL, an increase in the anterior drawer and lateral clear space values were found as compared to the intact state. Similarly, in group 2 the anterior drawer and lateral clear space values significantly increased after transection of the AITFL and ATFL as compared to the intact state (p-values = 0.01).

Conclusion: Ultrasound can be used to evaluate the impact of the syndesmotic injury on lateral ankle stability while performing dynamic stress maneuvers. Lateral ankle instability appears after injury to all syndesmotic ligaments and ATFL, or after one syndesmotic ligament rupture (AITFL) with a concomitant anterior talofibular ligament rupture (ATFL). These findings suggest that surgeons should lower their threshold for stabilizing the syndesmosis if there is a concomitant lateral ankle ligament injury.

Table 1: Ultrasonographic comparison of sequential ligamentous transection to intact ligamentous state to assess lateral ankle stability.

Ligament Transection (Group 1)	Force (N)	Anterior Drawer Translation (mean $\pm$ SD; mm)	p-value	Torque (Nm)	Lateral clear space	p-value
Intact	50	2.06 $\pm$ 1.1	-	1.7	0.81 $\pm$ 0.71	-
	80	2.66 $\pm$ 1.18				
AITFL	50	2.27 $\pm$ 1.66	0.401	1.7	1.00 $\pm$ 0.62	0.401
	80	2.97 $\pm$ 1.38	0.463			
AITFL + IOL	50	2.48 $\pm$ 1.22	0.401	1.7	1.38 $\pm$ 1.51	0.401
	80	3.17 $\pm$ 1.36	0.889			
AITFL + IOL + PITFL	50	2.64 $\pm$ 1.40	0.674	1.7	1.47 $\pm$ 0.80	0.123
	80	3.29 $\pm$ 1.46	0.575			
AITFL + IOL + PITFL + ATFL	50	4.50 $\pm$ 2.60	0.036	1.7	3.40 $\pm$ 2.13	0.017
	80	6.01 $\pm$ 2.43	0.025			
AITFL + IOL + PITFL + ATFL + CFL	50	5.13 $\pm$ 3.32	0.025	1.7	7.18 $\pm$ 3.77	0.012
	80	7.22 $\pm$ 3.76	0.025			
AITFL + IOL + PITFL + ATFL + CFL + PTFL	50	6.61 $\pm$ 3.92	0.017	1.7	8.42 $\pm$ 5.23	0.012
	80	8.47 $\pm$ 3.94	0.012			

Ligament Transection (Group 2)	Force (N)	Anterior Drawer Translation (mean $\pm$ SD; mm)	p-value	Torque (Nm)	Lateral clear space	p-value
Intact	50	0.98 $\pm$ 0.57	-	1.7	1.1 $\pm$ 1.22	-
	80	1.38 $\pm$ 0.52				
AITFL	50	1.02 $\pm$ 0.56	0.213	1.7	1.77 $\pm$ 1.30	0.263
	80	1.41 $\pm$ 0.52	0.187			
AITFL + ATFL	50	4.16 $\pm$ 2.35	0.012	1.7	3.27 $\pm$ 1.55	0.017
	80	4.66 $\pm$ 2.41	0.012			
AITFL + ATFL + CFL	50	3.61 $\pm$ 3.46	0.012	1.7	6.34 $\pm$ 3.5	0.012
	80	4.43 $\pm$ 3.49	0.012			
AITFL + ATFL + CFL + IOL	50	5.58 $\pm$ 2.25	0.012	1.7	7.60 $\pm$ 3.92	0.012
	80	6.92 $\pm$ 2.55	0.012			
AITFL + ATFL + CFL + IOL + PTFL	50	5.73 $\pm$ 2.63	0.012	1.7	7.79 $\pm$ 4.82	0.012
	80	7.32 $\pm$ 2.66	0.012			
AITFL + ATFL + CFL + IOL + PTFL + PITFL	50	7.08 $\pm$ 3.38	0.012	1.7	12.30 $\pm$ 4.09	0.012
	80	8.71 $\pm$ 4.27	0.012			

Abbreviations: AITFL = Anterior inferior tibiofibular ligament; IOL = Interosseous ligament; PITFL = Posterior inferior tibiofibular ligament; ATFL=Anterior talofibular ligament; CFL = Calcaneofibular ligament; PTFL = Posterior talofibular ligament; SD = Standard deviation