

What is the Effect of Lateral Ankle Ligament Injury on Syndesmotic Stability? Arthroscopic evaluation

Go Sato; Jirawat Saengsin, MD; Rohan Bhimani, MD, MBA; Noortje Hagemeijer, MD; Bart Lubberts, MD, PhD; Daniel Guss, MD, MBA; Gregory R. Waryasz, MD; Christopher W. DiGiovanni, MD

Category: Ankle; Arthroscopy; Sports; Trauma

Keywords: Syndesmotic Stability; Arthroscopic; Biomechanics of the Foot and Ankle

Introduction/Purpose: Numerous studies have shown a high incidence of associated lateral ankle and syndesmotic ligamentous injuries. It is unclear, however, if there is a direct contribution of the lateral ligaments towards stabilizing the syndesmosis. Using arthroscopy, we assessed to what extent lateral ankle ligaments contribute to syndesmotic stability in the coronal and sagittal plane. Our hypothesis was that lateral ankle ligament injury has effect on syndesmosis instability.

Methods: Sixteen fresh frozen above-knee amputated cadaveric specimens were divided into two groups that underwent arthroscopic evaluation for syndesmotic stability. In both the groups, the assessment was done with all syndesmotic and ankle ligaments intact and later with sequential transection of the anterior talofibular ligament (ATFL), the calcaneofibular ligament (CFL), the posterior talofibular ligament (PTFL), anterior inferior tibiofibular ligament (AITFL), the interosseous ligament (IOL) and the posterior inferior tibiofibular ligament (PITFL). In all scenarios, coronal and sagittal loading conditions were considered under 100N of direct force to fibula. The measurements of the distal tibiofibular coronal plane space at the anterior and posterior third of syndesmosis were performed using arthroscopic probes with increment of 0.2mm diameter. Further the sagittal translation were measured by arthroscopic scaled probe. Dunnett test was used to compare the findings of each ligamentous transection state to the intact state. A p-value < 0.05 was considered significantly different.

Results: Compared with the intact ligamentous state, there was no difference in coronal and sagittal stability when the lateral ankle ligaments (ATFL, CFL, PTFL) and AITFL were transected (Table I and 2, Group I). However, after subsequent transection of the IOL, or after transection of the lateral ankle ligaments (ATFL, CFL or and PTFL) alongside the AITFL and IOL, both coronal space and sagittal translation increased as compared with the intact state (p-values p<0.001 respectively) (Table I and 2, Group 2).

Conclusion: Our findings suggest that lateral ankle ligaments do not directly contribute to syndesmotic stability in the coronal and sagittal plane. In concomitant acute syndesmotic and lateral ligament injury, surgeons should pay attention to whether there is combined IOL injury to determine the fixation of syndesmosis.

Table I: Summary of the coronal plane translation measurements of the fibula (mean in mm) at the anterior and posterior third of syndesmosis for two different sequences of ligament transection.

Sequence of transection: Group 1	Coronal plane translation			Sequence of transection: Group 2	Coronal plane translation		
	Point of measurements	Mean $\pm$ SD (mm)	p-value		Point of measurements	Mean $\pm$ SD (mm)	p-value
Intact	Anterior	1.18 $\pm$ 0.46	-	Intact	Anterior	1.45 $\pm$ 0.54	-
	Posterior	1.48 $\pm$ 0.51	-		Posterior	1.75 $\pm$ 0.65	-
ATFL	Anterior	1.23 $\pm$ 0.43	1.000	AITFL	Anterior	1.70 $\pm$ 0.61	0.997
	Posterior	1.63 $\pm$ 0.59	0.999		Posterior	2.10 $\pm$ 0.85	0.979
ATFL+CFL	Anterior	1.33 $\pm$ 0.48	0.999	AITFL+ATFL	Anterior	1.92 $\pm$ 0.63	0.924
	Posterior	1.83 $\pm$ 0.67	0.961		Posterior	2.35 $\pm$ 0.95	0.806
ATFL+CFL+PTFL	Anterior	1.48 $\pm$ 0.43	0.979	AITFL+ATFL+CFL	Anterior	2.10 $\pm$ 0.72	0.764
	Posterior	1.98 $\pm$ 0.72	0.838		Posterior	2.47 $\pm$ 0.93	0.661
ATFL+CFL+PTFL +AITFL	Anterior	1.80 $\pm$ 0.50	0.663	AITFL+ATFL+CFL+IOL	Anterior	3.31 $\pm$ 1.06	0.016*
	Posterior	2.20 $\pm$ 0.68	0.539		Posterior	3.45 $\pm$ 1.05	0.028*
ATFL+CFL+PTFL +AITFL+IOL	Anterior	3.15 $\pm$ 0.78	0.002*	AITFL+ATFL+CFL+IOL +PTFL	Anterior	3.67 $\pm$ 1.18	0.003*
	Posterior	3.13 $\pm$ 0.51	0.013*		Posterior	3.82 $\pm$ 1.07	0.005*
ATFL+CFL+PTFL +AITFL+IOL+PITFL	Anterior	4.75 $\pm$ 2.35	<0.001*	AITFL+ATFL+CFL +IOL+PTFL +PITFL	Anterior	5.62 $\pm$ 2.15	<0.001*
	Posterior	5.25 $\pm$ 2.27	<0.001*		Posterior	5.52 $\pm$ 1.79	<0.001*

Table II: Summary of the sagittal plane translation measurements of the fibula (mean in mm) at the anterior to posterior direction and posterior to anterior direction for two different sequences of ligament transection.

Sequence of transection: Group 1	Sagittal plane translation			Sequence of transection: Group 2	Sagittal plane translation		
	Translation direction	Mean $\pm$ SD (mm)	p-value		Translation direction	Mean $\pm$ SD (mm)	p-value
Intact	AP	0.53 $\pm$ 0.25	-	Intact	AP	0.47 $\pm$ 0.23	-
	PA	0.44 $\pm$ 0.24	-		PA	0.48 $\pm$ 0.22	-
ATFL	AP	0.61 $\pm$ 0.21	0.999	AITFL	AP	0.66 $\pm$ 0.28	1.000
	PA	0.55 $\pm$ 0.26	0.999		PA	0.79 $\pm$ 0.20	0.981
ATFL+CFL	AP	0.71 $\pm$ 0.12	0.984	AITFL+ATFL	AP	0.80 $\pm$ 0.25	0.998
	PA	0.79 $\pm$ 0.31	0.945		PA	0.91 $\pm$ 0.40	0.917
ATFL+CFL +PTFL	AP	0.84 $\pm$ 0.22	0.829	AITFL+ATFL+CFL	AP	1.03 $\pm$ 0.20	0.982
	PA	0.91 $\pm$ 0.25	0.823		PA	0.97 $\pm$ 0.43	0.871
ATFL+CFL+PTFL +AITFL	AP	1.06 $\pm$ 0.47	0.372	AITFL+ATFL+CFL +IOL	AP	1.94 $\pm$ 0.57	0.466
	PA	1.20 $\pm$ 0.39	0.416		PA	1.59 $\pm$ 0.91	0.184
ATFL+CFL+PTFL +AITFL+IOL	AP	1.39 $\pm$ 0.51	0.044*	AITFL+ATFL+CFL +IOL+PTFL	AP	3.08 $\pm$ 0.99	0.047*
	PA	1.72 $\pm$ 0.58	0.045*		PA	2.05 $\pm$ 1.00	0.028*
ATFL+CFL+PTFL +AITFL+IOL +PITFL	AP	2.94 $\pm$ 1.48	<0.001*	AITFL+ATFL+CFL +IOL+PTFL +PITFL	AP	6.00 $\pm$ 5.00	<0.001*
	PA	3.34 $\pm$ 2.36	<0.001*		PA	4.97 $\pm$ 2.40	<0.001*

Abbreviations: AP=Anterior to Posterior, PA=Posterior to Anterior