

MORPHOMETRIC STUDY OF POSTERIOR TALOFIBULAR LIGAMENT OF ANKLE

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ABSTRACT: Ankle joint (talocrural) is a hinge joint, formed by the lower end of tibia, its medial malleolus, together with the lateral malleolus of the fibula and inferior transverse tibiofibular ligament, forms a deep recess for the body of the talus. Ankle sprains are most common in athletes and in other sports like basketball, soccer, football and volleyball. Ankle sprains occur frequently during plantar flexion, adduction and inversion of foot. Injuries may be soft tissue tears or avulsion fractures. It is estimated that 15-20% of all sports injuries involve the ankle. The ligaments of the ankle joint are medial and lateral collateral ligaments. The lateral ligament has three discrete parts, Anterior Talofibular, Posterior Talofibular and Calcaneofibular ligaments. The length and width for PTFL was found to be 25.05mm and 5.88mm respectively. Right and left ankle values compared using the p- value of student t- test with the level of significance. There was no statistical significance between right and left ankle values obtained by dissection. The dimensions of lateral and medial collateral ligaments determined in this study are in general agreement with those reported by other investigators with minimal variations. This suggests that they are a reasonable reflection of population values present in the average population. The data represented in this study may be important when considering surgical repair or reconstruction of traumatized or attenuated collateral ligaments.

KEYWORDS: Ankle joint, Morphometry, Posterior Talofibular Ligament.

INTRODUCTION: "Ligament" most commonly refers to a band of tough, fibrous dense regular connective tissue bundles, made of attenuated collagenous fibers; with said bundles protected by dense connective tissue sheaths. Ligaments connect bones to other bones to form a joint. Some ligaments limit the mobility of articulations, or prevent certain movements altogether.

The ankle or talocrural region is the region where the foot and the leg meet.

The ligaments of the ankle joint are medial and lateral collateral ligaments.

The lateral ligaments has three discrete parts, Anterior Talofibular, Posterior Talofibular and Calcaneofibular ligaments.¹

The ankle includes three joints: the ankle joint proper or talocrural joint, the subtalar joint and the inferior tibiofibular joint. The movements produced at this joint are dorsiflexion and plantarflexion of the foot. In common usage, the term ankle refers exclusively to the ankle region.² The PTFL was oriented in a nearly horizontal plane. It was trapezoidal in contour. The ligament originated from the medial surface of the lateral malleolus from the lower segment of the digital fossa.

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Then, it coursed horizontally toward the lateral and posterior aspects of the talus. The majority of the fibres inserted along the lateral surface of the talus. Although PTFL was intracapsular yet it always remained extrasynovial. The ligament separated the ankle joint from the posterior subtalar joint and thus was within both joint capsules.³

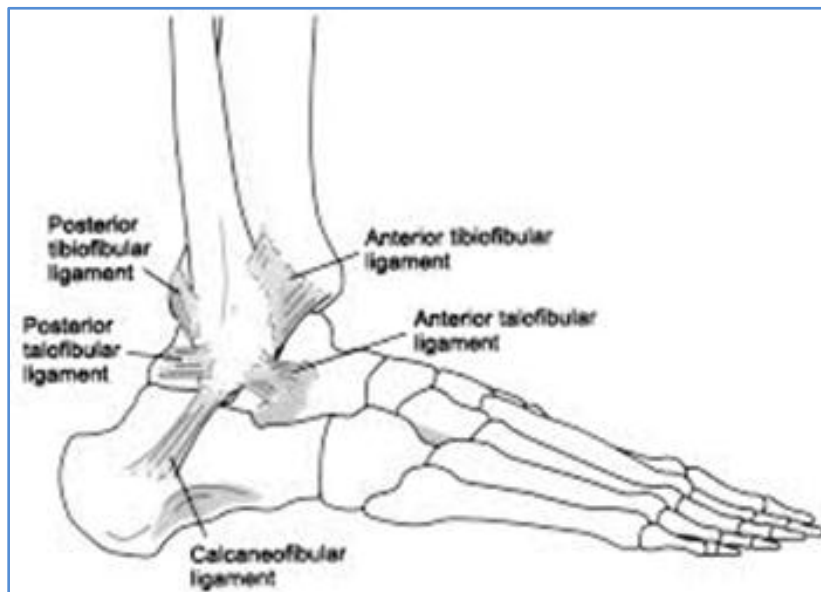


Fig. 1: Normal orientation of posterior talofibular ligament

Due to multifascicular aspect of this ligament, it inserts not just in a specific area. Fibers may insert on the posterior surface of the talus, some in the lateral talar process or os trigonum, if present. Some of its fibers contribute in forming the tunnel for the flexor hallucis longus tendon. Moreover, a group of fibers fuse with the posterior intermalleolar ligament. The posterior intermalleolar ligament has been the subject of recent studies because of its involvement in the posterior soft tissue impingement syndrome of the ankle.⁴

The measurement of the free length of PTFL is difficult because it has attachments along almost the entire non articular portion lateral face of the body of the talus. In plantar flexion and the neutral position the ligament is relaxed, whereas in dorsiflexion the ligament is tensed.²

MATERIALS AND METHODS: Study was conducted on 60 formalin fixed adult cadaveric lower limbs, irrespective of sex from the Department of Anatomy, Kempegowda Institute of Medical Sciences, and Bangalore. Cadavers with congenital abnormalities of ankle like club foot or congenital Talipes Equino Varus were excluded from the study.

The ligament length was measured from one insertion point to another on the opposite borders of the ligament, i.e., free length. Width was measured at three points; proximal insertion site, the distal insertion site and midway between the two for ATFL and CFL. It was difficult to measure the width of PTFL at three insertion points. Also thickness of PTFL couldn't be measured because of its attachment to the bone on its course.

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RESULTS: Posterior TaloFibular ligament (PTFL) extended backwards and medially from the posterior margin of the fibular malleolus to the posterior tubercle of the talus. The length and width could be measured. However, because of its bony attachment throughout its course, its thickness could not be measured.

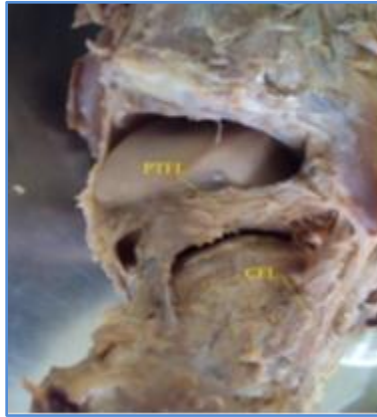


Fig. 2: Posterior Talofibular Ligament

PTFL	MIN	MAX	MEAN	< mean		> mean	
				n	%	n	%
Length	18.18	34.33	25.06	32	53	28	47
Width	3.67	7.98	5.88	31	52	29	48

Table 1: Maximum, Minimum and mean values of PTFL in dissected specimens

The mean value of length and width of PTFL was found to be 25.06 and 5.88mm respectively. About 53% and 47% of the specimens had their length below and above their mean value respectively. About 52% and 48% of the specimens had their width below and above their mean value respectively.

Parameters Of PTFL	Side	n	Mean	Std. dev	SE of mean	Mean difference	T	p value
LENGTH	Left	26	25.3	4.42	0.87	0.7	0.41	0.68
	Right	34	24.9	3.27	0.56			
WIDTH	Left	26	5.93	1.13	0.22	0.09	0.32	0.74
	Right	34	5.84	0.94	0.16			

Table 2: T test for the statistical significance of length and width of PTFL of dissection between right and left ankle

The mean difference of length and width of PTFL between right and left ankle was found to be 0.7 and 0.09 respectively. No significant differences was observed between right and left side with respect to mean of various parameters of PTFL dissection ($P > 0.05$).

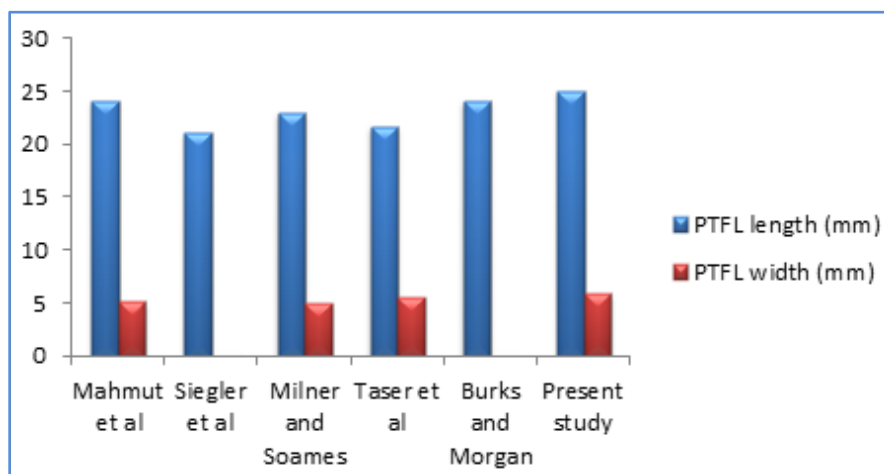
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DISCUSSION: Ankle sprains are common: one estimate is that there is one per day per 10 000 of the population. Rupture of ligaments is more common in sportsmen. It is known that the anterior talofibular ligament is almost always the first or only ligament to rupture. Brostrom² found that combined ruptures of the anterior talofibular and calcaneofibular ligaments occurred in 20% of cases and that the calcaneofibular ligament alone very rarely ruptured. Chronic instability of the ankle is likely only if both ligaments have been completely torn. The normal morphometric value of each of these ligaments helps both radiologists and orthopaedic surgeons to diagnostically evaluate the severity of ligament damage as well as in the surgical reconstruction of the torn ligament respectively.

It is one of the tough ligaments. It originates from the malleolar fossa, located on the medial surface of the lateral malleolus, located on the medial surface of the lateral malleolus. It courses almost horizontally to insert in the posterolateral talus. It has a multi fascicular structure and doesn't insert in a specific area. Fibers of this ligament inserts in the posterior surface of the talus, in the lateral process or os trigonum, if present. Some fibers can contribute in forming the tunnel for the flexor hallucis longus tendon.⁴ The comparison of the length and width of the ligament measured in the present study has been compared with the previous studies.⁵

Studies	PTFL length in mm	PTFL width in mm
Mahmut et al (2010)	24.12	5.09
Siegler et al	21.16±3.9	---
Milner and Soames (1998)	23.0±7.0	5±2.5
Taser et al (2006)	21.66±4.8	5.55±1.3
Burks and Morgan (1994)	24.1	---
Present study	25.05±3.75	5.88±1.01

Table 3: Comparison of length and width of PTFL of different studies with the present study



Graph 1: Comparison of length and width of PTFL between the present and previous studies

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CONCLUSION: The mean length, width, thickness of PTFL was found to be 22.84, 14.96 and 5.69mm respectively. The detailed anatomical knowledge of these ligaments, variations and their relations with osseous structures may provide a foundation for understanding the basic mechanism of injury, diagnosis and reconstructive procedures.

Morphometry and variations of ligaments of ankle has not been well documented in literature. Hence this study was taken up. Even though ankle sprains most frequently involves anterior talofibular ligament, total rupture involves calcaneofibular and posterior talofibular ligaments. Thus, the present study may help the reconstructive surgeons during the assessment of the amount of loss ligamentous tissue and its reconstruction subsequently.

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