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A STUDY OF MORPHOMETRY OF LIGAMENTS OF INFERIOR TIBIO-FIBULAR MORTISE:

Anatomy

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ABSTRACT

Background: The lower end of tibia along with its medial malleolus and the lateral malleolus of the fibula form a deep recess to accommodate the body of talus. The mortise formed by the lower end of tibia and the fibula is usually considered syndesmosis. The tibiofibular joints permit only slight movement. Due to the varying slope of the talar lateral malleolar surface, the fibula rotates laterally a little bit during dorsiflexion at the ankle, the bones being also slightly separated. Slight bending or torsion of the fibular shaft may permit movements at the distal tibiofibular joint. The proximal tibiofibular joint also helps. Habitual squatting has long been recognized to alter the skeletal morphology of the lower limb. Thus modifications of the neck of the talus and the distal tibia indicating their habitual contact have been taken as evidence of the extreme dorsiflexion of the ankle that occurs in squatting. This study puts in a sincere effort to find the mean morphological values of the ligaments of the inferior tibio – fibular mortise so as to be useful to the surgeons operating on these structures.

Methods: Thirty formalin fixed human ankles were dissected which was available in the department of anatomy, K.S.Hegde medical academy and was continued in Kanachur Institute of Medical Sciences which included nineteen male and eleven female specimen. Male and female ankles were categorized and also right from the left.

Results: Anterior tibiofibular ligament: It is a flat laminar, multi vesicular flat ligament. The measurements are almost similar on both sides and sexes.

Posterior tibiofibular ligament: The measurements are almost similar on both sides and sexes.

Conclusion: The study is successful in taking the measurements and hope the surgeons in reality use these measurements while correcting the above discussed ligaments.

KEYWORDS

Morphometry, Ligaments, Tibio – Fibular Mortise.

Introduction:

The lower end of tibia along with its medial malleolus and the lateral malleolus of the fibula form a deep recess to accommodate the body of talus. The mortise formed by the lower end of tibia and the fibula is usually considered syndesmosis. The tibiofibular joints permit only slight movement. Due to the varying slope of the talar lateral malleolar surface, the fibula rotates laterally a little bit during dorsiflexion at the ankle, the bones being also slightly separated. Slight bending or torsion of the fibular shaft may permit movements at the distal tibiofibular joint. The proximal tibiofibular joint also helps.

The empirical axis of ankle joint passes distal to tips of malleoli at 5 mm ± 3 mm range, (0 to 11 mm) distal to the tip of medial malleolus and 3 mm ± 2 mm range (0 to 12 mm) distal to and 8 mm ± 5 mm anterior to the tip of lateral malleolus[1]. Some workers recognized two axis to the ankle joint[2,3,4,5,6]. Habitual squatting has long been recognized to alter the skeletal morphology of the lower limb. Thus modifications of the neck of the talus and the distal tibia indicating their habitual contact have been taken as evidence of the extreme dorsiflexion of the ankle that occurs in squatting[7].

It is important to know some basic anatomy of the ligaments that attach the distal part of tibia and fibula bones.

Ligaments of the inferior tibiofibular joint:

Anterior tibiofibular ligament: It is a flat fibrous ligament. It originates from the longitudinal tubercle on the anterior border of the lateral malleolus and from the lower segment of the anterior border of the shaft of the fibula and are inserted on the anterior edge of the triangular fibular notch. Some fibres reach the anterior surface of the tibia. The fibres are directed upwards and medially.

Posterior tibiofibular ligament: It has two components, superficial and deep. The superficial component originates from the posterior border of the tubercle located above. The fibres are directed upward and medially and are inserted on the posterolateral tibial tubercle. The deep component is the transverse ligament. It has a twisted arrangement. It originates from the round posterior fibular tubercle located above the digital fossa. The fibres are directed upwards, medially and posteriorly. At the posterior border of the tibial articular surface, the fibres change the direction and have a transverse arrangement. It is inserted on the lower part of the posterior border of the tibial articular surface and reaches the medial border of the medial malleolus.

This study puts in a sincere effort to find the mean morphological values of the ligaments of the inferior tibio – fibular mortise so as to be useful to the surgeons operating on these structures.

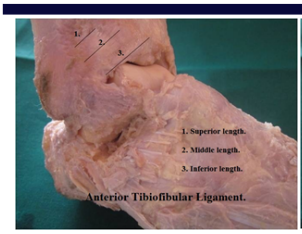
AIMS AND OBJECTIVES OF STUDY:

1. To study the anatomy and morphometry of ligaments of the inferior tibio – fibular mortise.
2. To compare the data with the standard data available.

Thirty formalin fixed human ankles were dissected which was available in the department of anatomy, K.S.Hegde medical academy and was continued in Kanachur Institute of Medical Sciences which included nineteen male and eleven female specimen. Male and female ankles were categorized and also right from the left.

Incision was made on the anterior median plane and posterior median plane from caudal one third of leg to proximal one third of foot. Skin was reflected all around the talocrural joint till the meeting of dorsal surface and plantar surface. All the soft tissues including the muscles were dissected and reflected on the anterior, posterior, medial and lateral surfaces. The soft tissue tunnel which surrounds the tendons of muscles is in intimate relation with the underlying ligaments of the talocrural joint.

On the anterior, aspect the joint capsule was reflected and anterior tibiofibular ligament was exposed. The measurement was taken. The length was taken at three levels namely superior, middle and inferior. The breadth was taken at three different levels namely medial end, middle and at the lateral end. Then the thickness was measured.



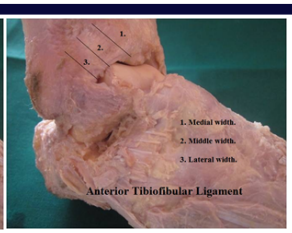
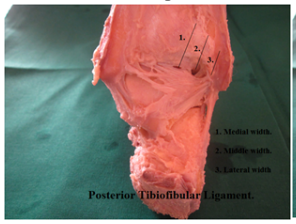


Image 1(left): Length measurements of anterior tibiofibular ligament taken at different levels.

Image 2(right): Width measurements of anterior tibiofibular ligament taken at different levels.

On the posterior aspect the capsule was reflected. The posterior tibiofibular ligament was exposed and measurements were taken. The length was taken at three levels namely superior, middle and inferior fibres. The breadth was taken at three different levels namely medial, middle and lateral aspect. Then the thickness was measured.



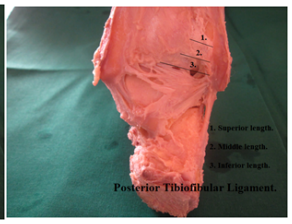


Image 7(left): Length measurements of posterior tibiofibular ligament taken at different levels.

Image 8(right): Width measurements of anterior tibiofibular ligament taken at different levels.

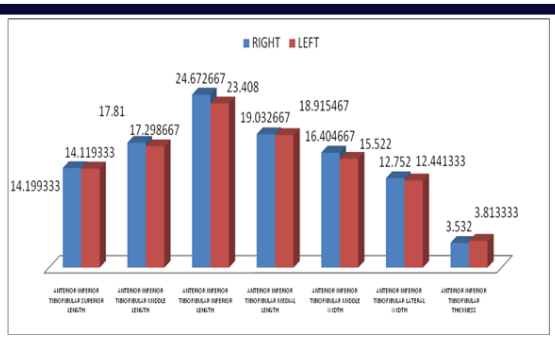
Results:

MORPHOMETRY OF LIGAMENTS OF TIBIOFIBULAR MORTISE:

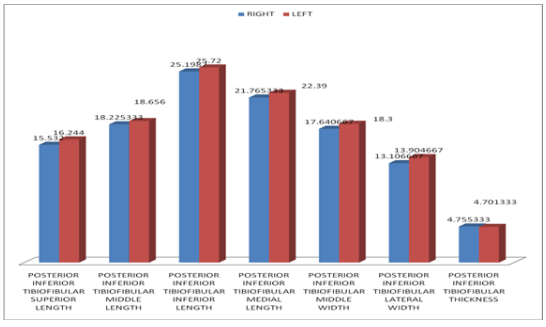
Table 21: Morphometry in each side and gender.

Ant tibio fibular	Side	Mean	Std dev	Sig	SEX	Mean	Std dev	Sig
SUPERIOR LENGTH	R	14.19	2.917	0.951	M	14.02	3.37	0.768
	L	14.11	4.00		F	14.42	3.75	
MIDDLE LENGTH	R	17.81	2.69	0.67	M	17.72	3.14	0.695
	L	17.29	3.72		F	17.22	3.47	
INFERIOR LENGTH	R	24.67	2.79	0.386	M	24.33	3.67	0.567
	L	23.40	4.78		F	23.44	4.46	
MEDIAL LENGTH	R	19.03	1.84	0.882	M	19.15	1.89	0.516
	L	18.91	2.39		F	18.61	2.53	
MIDDLE WIDTH	R	16.40	1.89	0.202	M	16.21	1.83	0.314
	L	15.52	1.80		F	15.46	1.95	
LATERAL WIDTH	R	12.75	1.57	0.62	M	12.98	1.50	0.071
	L	12.44	1.81		F	11.81	1.79	
THICKNESS	R	3.53	0.90	0.387	M	3.93	0.75	0.017
	L	3.813	0.84		F	3.14	0.88	
POSTERIOR TIBIOFIBULAR								
SUPERIOR LENGTH	R	15.53	2.92	0.574	M	16.28	3.66	0.37
	L	16.24	3.85		F	15.09	2.72	
MIDDLE LENGTH	R	18.22	3.26	0.743	M	18.76	3.81	0.481
	L	18.65	3.83		F	17.78	2.87	
INFERIOR LENGTH	R	25.19	3.53	0.68	M	25.94	3.60	0.276
	L	25.72	3.32		F	24.49	2.79	
MEDIAL LENGTH	R	21.76	2.81	0.503	M	22.67	2.46	0.064
	L	22.39	2.18		F	20.88	2.23	
MIDDLE WIDTH	R	17.64	3.39	0.52	M	18.57	2.81	0.087
	L	18.3	1.97		F	16.75	2.26	
LATERAL WIDTH	R	13.10	1.60	0.21	M	13.69	1.76	0.425
	L	13.90	1.85		F	13.13	1.76	
THICKNESS	R	4.75	1.00	0.89	M	5.05	1.01	0.016
	LEFT	4.70	1.16		F	4.08	0.88	

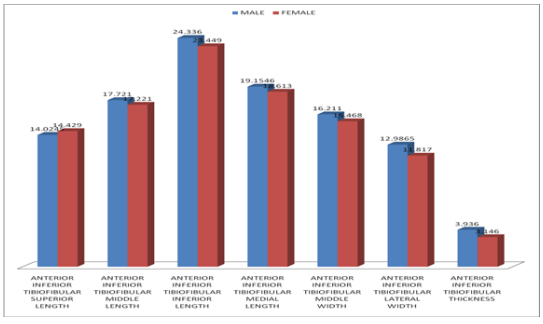
Table no. 21



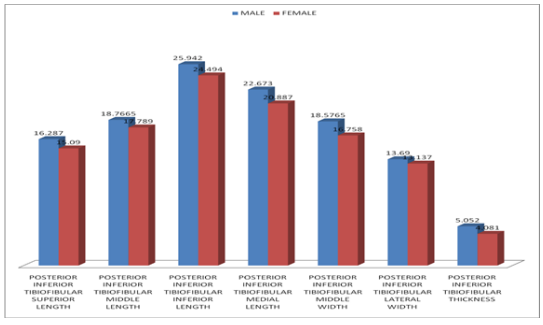
Graph 23: Side comparison in anterior tibiofibular ligament.



Graph 24: Side comparison in posterior tibiofibular ligament. X-axis: Components to be measured. Y-axis: measurement in mm.



Graph No. 25: Gender comparison in posterior tibiofibular ligament.



Graph No. 26: Gender comparison in posterior tibiofibular ligament.
X-axis: Components to be measured. Y-axis: measurement in mm.

Discussion:

ANTERIOR TIBIOFIBULAR LIGAMENT:

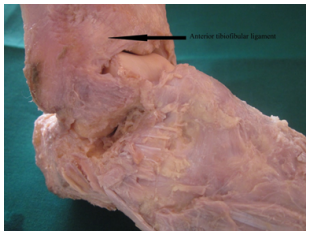


Image 51: Anterior tibiofibular ligament.

It is a flat laminar, multi vesicular flat ligament.

The measurements are similar on both sides.
The measurement is similar in both sexes except, there is a statistically significant difference in the thickness between the male and the female. The male measurement is more than the female. (p=0.017).

Chimba Mkandawire et al.[8] (2005) in their study on "The Foot and ankle ligament morphometry." in 121 bone- ligament-bone preparations from 26 cadaver feet. Anterior tibiofibular mean length was measured to be 18.89 ± 2.97 mm.

According John J Hermans et al.[9] on a study of anatomy of distal tibio-fibular syndesmosis in adults, the anterior tibio-fibular ligament measured 6 mm to 8.9 mm in length and 4 mm to 4.9 mm in width and 1.8 mm to 3 mm in thickness. In the middle it measured 12 mm to 15.5 mm in length, 8.3 mm to 10 mm in width and 2.6 mm to 4 mm in thickness. The lower part measured 17 mm to 20.6 mm in length, 3.8 mm to 4 mm in width and 2 mm to 2.2 mm in thickness.

In the study the measurements are consistently more in every aspect than the study by John J Hermans et al.[9] This may be due to practice of habitual squatting by the Indian population which exerts a stress effect on the ligaments of the tibiofibular mortise in extreme dorsiflexion.

The study is in agreement with the study of Chimba Mkandawire et al.[8]

POSTERIOR TIBIOFIBULAR LIGAMENT:

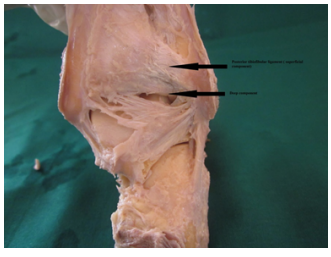


Image 52: Posterior tibiofibular ligament.
The measurements are almost similar on both sides.

The measurement is similar in both sexes except, there is a statistically significant difference in the thickness between the male and the female. The male measurement is more than the females. (p=0.016).

This may account for increased sprain in the posterior tibiofibular ligament in females.

According John J Hermans et al.[9] on a study of anatomy of distal tibio-fibular syndesmosis in adults, the posterior tibio-fibular ligament's mean length was measured to be 21.8 mm with a standard deviation of 7.5 mm and range from 6.4 mm to 32.5 mm. The mean width of the ligament measured 17.4 mm with a standard deviation of 3.5 mm and range from 11.1 mm to 21.2 mm. The thickness measured 6.4mm with a standard deviation of 1.9 mm.

The measurements in both the studies are congruent expect in the thickness. In our study the thickness is less when compared to the John J Hermans et al. This may be because of the sample population difference used in the study.

Chimba Mkandawire et al.[8] (2005) in their study on "The Foot and ankle ligament morphometry." in 121 bone- ligament- bone preparations from 26 cadaver feet. Posterior tibiofibular mean length was measured to be 26.68 ± 4.49 mm.

The study is in agreement with that of other studies.

Conclusion:

Morphomerty of ligaments of talofibular mortise

Anterior tibiofibular ligament: It is a flat laminar, multi vesicular flat ligament. The measurements are almost similar on both sides. The male measurements are similar to that of females except, there is a statistically significant difference in the thickness between the male and the female. The male measurement is more than the female. (p=0.017).

Posterior tibiofibular ligament: The measurements are similar on both sides. The male measurements are similar to that of females except, there is a statistically significant difference in the thickness between the male and the female. The male measurement is more than the females. (p=0.016).

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