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Morphometry of deltoid ligament

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Abstract

The medial collateral ligament also called as the deltoid ligament is a strong, triangular band, attached to the apex and to the anterior and posterior borders of the medial malleolus. Of its superficial fibres, the anterior also called the tibionavicular, passes forward to the navicular tuberosity, behind they blend with the medial margin of the plantar calcaneonavicular ligament. Intermediate also called the tibiocalcaneal fibres descend almost vertically to the entire length of the sustentaculum tali. Posterior fibres also called the posterior tibiotalar, passes posterolaterally to the medial side of the talus and its medial tubercle. The deep fibres (anterior tibiotalar) pass from the tip of the medial malleolus to the non-articular part of the medial talar surface.

Aims and Objectives: To study the morphometry of Deltoid Ligament.

Materials and Methods: Ten ankle joints were dissected and the measurements were taken.

Results: There is no statistical variation when compared in the sides and sexes.

Conclusion: Further large scale study is needed.

Keywords: Morphometry, ligaments, deltoid, ankle

Introduction

The talocrural joint is a major weight bearing joint of the body. The weight of the body is transmitted from the tibia and fibula to the talus which distributes the weight anteriorly and posteriorly within the foot. One sixth of the static load of the leg is carried by the fibula at the tibiofibular joint [1]. These require a high degree of stability which is determined by the passive and dynamic factors [2]. The passive stability depends on the contour of the articular surfaces, the integrity of the collateral ligaments, the integrity of the distal tibiofibular ligaments, the reticular system around the ankle and the crossing and attached tendon tunnels. The dynamic stability is conferred by gravity, muscle action, and the reaction between the foot and the ground.

Talocrural joint is an approximately uniaxial joint [3]. Although it is considered to be a simple hinge, its axis of rotation slightly changes, during dorsiflexion and plantar flexion. Starting from the plantigrade position, the normal range of dorsiflexion is 10° when the knee is straight and 30° with the knee flexed. The range of normal plantar flexion is 30°. Dorsiflexion results in the joint adopting the ‘close-packed' position [7], with maximal congruence and ligamentous tension; from this position. All major thrusting movements are exerted, in walking, running and jumping. The malleoli grip the talus and even in relaxation no

appreciable lateral movement can occur without stretch of the inferior tibiofibular syndesmosis and slight bending of the fibula. The superior talar surface is broader in front, and in dorsiflexion the malleolar gap is increased by slight lateral rotation of the fibula, by 'give' at the inferior tibiofibular syndesmosis and gliding at the superior tibiofibular joint.
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 [3]. The axis is inclined downwards and laterally in the frontal plane and is rotated posterolaterally in the horizontal or transverse plane. In the frontal plane, the angle between empirical axis of the ankle and midline of the tibia is 82.7 degrees ± 3.7 degrees, with a range of 74 to 94 degrees in the transverse plane, the angle of ankle axis with the transverse axis of the knee is 20 to 30 degrees. Some workers recognized two axis to the ankle joint [4, 5, 6, 8]. A dorsiflexion axis inclined downwards and laterally and a plantar flexion axis included downward and medially. The changeover occurs within a few degrees of the neutral position of the talus.
Habitual squatting has long been recognized to alter the skeletal morphology of the lower limb. Squatting is a resting postural complex that involves hyperflexion at the hip and knee and hyperdorsiflexion at the ankle and subtalar joints. During locomotion, the foot is rarely dorsiflexed sufficiently to bring the anterior border of the inferior extremity of the tibia into contact with the dorsum of the neck of the talus. 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 [9]. This study puts in an effort to find the morphometry of Deltoid Ligament.

Aims and Objectives

To study the morphometry of Deltoid Ligament.

Materials and Methods

Ten ankle joints were dissected and the measurements were taken.
This study was done in the Department of Anatomy, Karuna Medical College, Palakkad and Kerala.
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.

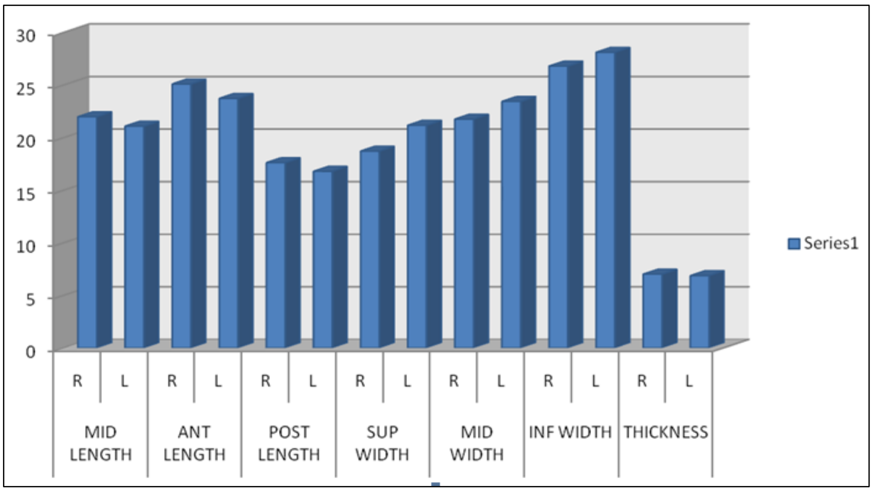
Inclusion criteria

5 male and 5 female cadavers

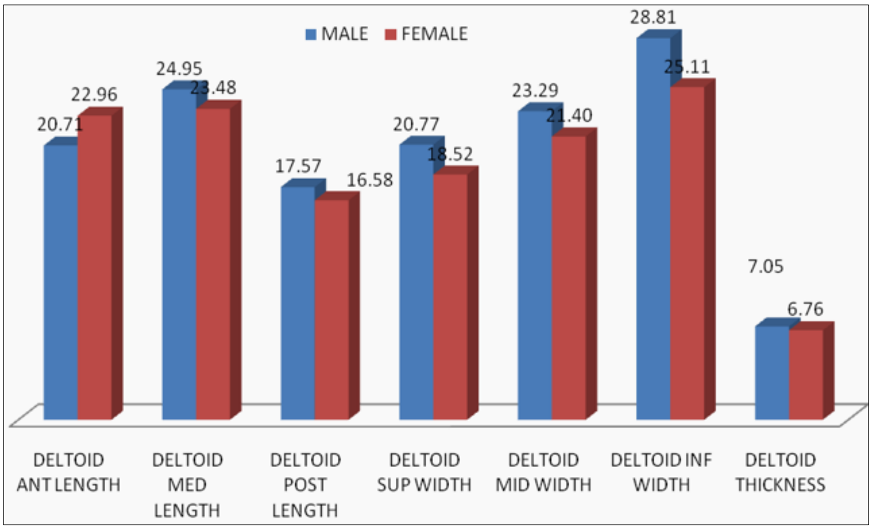
Exclusion criteria

Deformed leg.
All statistical analysis was done using the latest SPSS.

Results



Graph 1: Side comparison in morphometry of deltoid ligament. X-axis: Components to be measured. Y-axis: measurement in mm



Graph 2: Gender comparison in morphometry of deltoid ligament. X-axis: Components to be measured. Y-axis: measurement in mm

Discussion

According to Rodrigo Sepulveda *et al.* [10] Study (2012) on morphometric study and anatomical relations of the medial ligament of the talo-crural joint, it was found that three forms of the superficial deltoid ligament were present, namely the trapezoid, rectangular and triangular forms. In trapezoid form, the mean anterior and posterior length was 30.6mm with a standard deviation of 10.3 mm and 28.5 mm with a standard deviation of 8.5 mm. The mean superior width was 22.5 mm with a standard deviation of 3.4 mm and inferior width was 48.4 mm with a standard deviation of 8.9 mm. In rectangular form, the mean anterior and posterior length was 21 mm with a standard deviation of 7.2 mm and 24.8 mm with a standard deviation of 7.3 4mm. The mean superior width was 22.7 mm with a standard deviation of 6.9 mm and inferior width was 28.2 mm with a standard deviation of 7.6 mm. In triangular form, the mean anterior and posterior length was 37 mm with a standard deviation of 10.6 mm and 37.8 mm with a standard deviation of 3.9 mm. The mean superior width was 00 mm with a standard deviation of 00 mm and inferior width was 48.3 mm with a standard deviation of 6.4 mm. The deep layer is present in 100 percent of cases. In the study it closely resembles the trapezoid variety in majority of the cases but the measurements were very less when compared to the study of Rodrigo Sepulveda *et al*. [10] this may be due to population difference. This may also be due to the fact that our study was in formalin embalmed cadavers and the study by Rodrigo Sepulveda *et al*. [10] were on embalmed bodies. The study is in agreement with that of other study.

Conclusion

This study forms a base for future studies and finally a meta-analysis could be done so that it would be useful for building prosthesis and reconstruction surgeries in the local population.

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