

MORPHOMETRIC ANALYSIS OF MEDIAL MALLEOLUS IN DRY HUMAN TIBIA

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Abstract

Background: Medial malleolus in tibia is smaller but strong process and it has crescentric smooth lateral articular surface. It articulate with the medial surface of talus and take part in forming ankle joint. **Materials and Methods:** 44 dry and processed human tibia respective of side right and left, adult age, unknown sex, fully ossifies tibia bones were collected from anatomy department of government medical collage Bhavnagar and various measurement of the articular surface of medial malleolus ware measure by using vernier caliper and statistical analysis of the parameter was done. **Result:** Lateral articular surface of medial malleolus shape found crescentric in all bone, and left side bone, mean±SD anteroposterior diameters (21.25±2.34), superoinferior anterior part (12.90±1.50), posterior part (5.92±0.66) and right side bone, anteroposterior diameters (18.82±2.08), superoinferior anterior part (11.31±2.19), posterior part (5.60±1.04) respectively. **Conclusion:** Ankle is one of the most commonly injured joint in lower limb, so the morphometric study will useful for orthopedics surgeons and manufacture the implant of various dimensions of lateral articular surface of medial malleolus.

INTRODUCTION

The medial side of the lower end of tibia projects downwards beyond the rest of the bone. The projection is called the medial malleolus. The medial malleolus is a short but strong process which projects downwards from the medial surface of the lower end of tibia. It forms a subcutaneous prominence on the medial side of the ankle.^[1-4]

The anterior surface of the lower end has an upper smooth part, and lower rough and grooved part. The medial surface is subcutaneous and is continuous with the medial surface of the medial malleolus. The lateral surface of the lower end present a triangular fibular notch to which the lower end of the fibula is attached. The upper part of the notch is rough. The lower part is smooth and may be covered with hyaline cartilage. And deltoid ligament also attached to the lower margin of medial malleolus. The medial malleolus, along with the lower end of tibia and lateral malleolus of fibula, creates a deep recess that accommodates the body of the talus. The mortise formed by the inferior end of tibia and fibula is typically regarded as modified syndesmosis.^[5-8]

The inferior surface of the lower end is articular. It articulates with the superior trochlear surface of the talus and takes part in forming the ankle joint. Medially the articular surface extends on to the medial malleolus.^[9,10]

MATERIALS AND METHODS

The present study was done on 44 dry and processed human tibia respective of side right and left, adult age, unknown sex, fully ossifies tibia bones were collected from anatomy department of government medical collage Bhavnagar and various measurement of the articular surface of medial malleolus ware measure by using vernier caliper and statistical analysis of the parameter was done. And following parameter of medial malleolus was measure using appropriate instrument and standardized protocols.



Figure 1: Shape of lateral articular surface of medial malleolus.

Morphological Parameter

- Shape of lateral articular surface of medial malleolus.

Morphometric Parameter

- Anteroposterior diameter lateral articular surface of medial malleolus.
- Superoinferior diameter lateral articular surface of medial malleolus on the anterior side.
- Superoinferior diameter lateral articular surface of medial malleolus on the posterior side.



Figure 2: Anteroposterior diameter lateral articular surface of medial malleolus.



Figure 3: Superoinferior diameter lateral articular surface of medial malleolus on the anterior and posterior side.

RESULTS

Morphological Analysis

The analysis revealed a different shape of lateral articular surface of medial malleolus among the specimens studied.

Shape	Percentage
Crescentric	100%
Square	0%
Triangular	0%
Round	0%

Morphometric Analysis

Table 1: Anteroposterior diameter lateral articular surface of medial malleolus.

Diameter	Side	MEAN+SD	Range
Anteroposterior	Right	20.82 + 2.08	17.17 - 26.31
	Left	21.25 + 2.34	17.75 - 27.76

Table 2: Superoinferior diameter lateral articular surface of medial malleolus on the anterior side and posterior side.

Diameter	Side	Mean + SD	Range
Superoinferior	Anterior side	Right	13.31 + 1.19
		Left	14.09 + 1.50
	Posterior side	Right	5.60 + 1.04
		Left	5.92 + 0.66

[Table 1] Shows mean value of Anteroposterior diameter of lateral articular surface of medial malleolus on both sides. Right side value found to be (20.82 + 2.08mm), and Range was (17.17 – 26.31mm). Respectively value on the left side was (21.25 + 2.34mm) and Range was (17.75 – 27.76mm). When correlate with right and left side, the value were moderately more on left side.

[Table 2] Superoinferior diameter lateral articular surface of medial malleolus on the anterior side: on the right side it was found to be (13.31 + 1.19 mm) and range (9.13 – 18.85mm) respectively value on left side was (14.90 + 1.50mm) and range was (11.18 – 19.59) when correlate with right and left side, the value were moderately more on left side.

[Table 2] Superoinferior diameter lateral articular surface of medial malleolus on the posterior side: as we can see in table 2 mean value on the right side was 5.60 + 1.04mm and the range was 3.85 – 8.65mm and respectively value on left side was 5.92 + 0.66mm and range was 4.55 – 7.45mm, When correlate with right and left side, the value were moderately more on left side, Superoinferior diameter lateral articular surface of medial malleolus in anterior side more than the posterior side.

DISCUSSION

Morphological parameter: Shape of the lateral articular surface of medial malleolus was found to

be crescentic shape in all case of present study as described by the Standring S et al.

Variability in Anteroposterior diameter of lateral articular surface across the study

Table 3: Anteroposterior diameter of lateral articular surface of medial malleolus.

Diameter	Side	Present study Mean + SD	Chandni Gupta Mean + SD	Simriti Mean + SD	Vivekanand Mean + SD	Yogi Anupkumar Mean +SD	Musa Misiani Mean + SD
AP	Right	20.82 + 2.08	23.6 + 2.5	20.90 + 1.87	21.88 + 2.22	23.09 + 1.55	21.88 + 2.22
	Left	21.25 + 2.24	24.1 + 2.9	22.21 + 2.40			

Variability in Superoinferior diameter of lateral articular surface across the study

Table 4: Superoinferior diameter of lateral articular surface of medial malleolus on the anterior side and posterior side.

Diameter	Side	Present study Mean + SD	Simriti	Vivekanad	Yogi Anupkumar	Musa Misiani
Superoinferior	Ant. Side	Right	13.31 + 1.19	13.72 + 1.41	14.19 + 1.89	13.03 + 1.76
		Left	14.09 + 1.50	15.43 + 1.68		
	Post. Side	Right	5.60 + 1.04	5.85 + 1	-	-
		Left	5.92 + 0.66	6.15 + 0.90	-	-

The measurement of distal end of the tibia and fibula is crucial for assessing ankle joint stability, designing of prostheses, and performing diagnostic imaging of ankle joint.

Variability in Anteroposterior diameter of lateral articular surface

Chandni Gupta and Simriti found total mean value of anteroposterior diameter of lateral articular surface no right side 23.6 mm and 20.90 mm, and on left side 24.1 mm and 22.21 mm, while in our study we found value as 20.82 mm and 21.25 mm.

Vivekanand and Yogi Anupkumar and Musa Misiani found total mean value of anteroposterior diameter lateral articular surface irrespective of right and left side 21.88 mm, 23.09 mm, 21.88 mm.

Variability in Superoinferior diameter of lateral articular surface

Simriti found total mean value of Superoinferior diameter of lateral articular surface on anterior side 13.72 mm on right side and 15.43 mm on left side. On posterior side 5.85 mm on the right and 6.15 mm on the left. While in our study we found value on anterior side 13.31 mm on right and 14.01 mm on left. While posterior side 5.60 mm on right and 5.92 mm on left.

Vivekanand and Yogi Anupkumar and Musa Misiani found total mean value of Superoinferior diameter of lateral articular surface on anterior side irrespective of right and left side 14.19 mm, 13.03 mm, 14.19 mm.

In addition, these morphometric studies are also clinically important for the imaging diagnosis of medial malleolus fractures.

CONCLUSION

In this study, we conducted a thorough examination of 44 human tibia and assess morphological and morphometric parameters of the tibia bone. By

carefully observing and analyzing, we gained significant insights into the anatomical variation of the tibia.

In our study, revealed Lateral articular surface of medial malleolus shape found crescentic in all bone in this study.

The mean value of Anteroposterior diameter of lateral articular surface of medial malleolus on both sides. Right side value found to be 20.82 + 2.08mm respectively value on the left side was 21.25 + 2.34mm.

The mean value of Superoinferior diameter lateral articular surface of medial malleolus on the anterior side: on the right side it was found to be 11.31 + 2.19 mm. respectively value on left side was found to be 12.90 + 1.50mm.

The knowledge of the morphological and morphometric value of medial malleolus with the deltoid ligament provide stability of ankle joint, and its most common structure to fractured. Different parameters of medial malleolus in dry human tibia that help orthopedics surgeons and implant manufacturers to design ankle prosthesis to fix the ankle joint base on data obtained.

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