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A morphometric study on the articulating facets of talus in North Indian population

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ABSTRACT

Background: Morphometry of talus will be helpful for radiologists, orthopaedicians and surgeons for diagnosis and treatment of talar fractures and making bone prosthesis. **Aims and Objectives:** The purpose of our study is to do a morphometric analysis of talus to facilitate orthopedicians in planning surgeries for subtalar implants and foot prostheses. This will be of great use to forensic anthropologists. **Materials and Methods:** For the study, 60 dry adult human tali (24 left and 26 right) were obtained from the Department of Anatomy, SGT Medical College, Budhera. The morphometry of talar surfaces was done using a digital caliper accurate to 0.01 mm and data was recorded. **Results:** The mean values of medial, central and lateral length on the trochlear surface were 27.0cm, 28.1cm, 27.4cm on right side and 29.4cm, 27.0cm, 29.1cm on left side. Mean anterior, central and posterior widths on the trochlear surface were 27.6cm, 26.2cm, 21.1cm on right side and 27.0cm, 24.0cm, 23.1cm on left side. The mean central height and width on the lateral articular surface was 26.2 cm and 21.9 cm on the right side respectively and 23.0 cm and 16.8 cm on the left side respectively. The mean central height and central width on the medial articular surface was 13.6 cm and 25.9 cm on the right side respectively and 10.8cm and 17.9 cm on the left side respectively. **Conclusions:** The current study would be helpful as an important tool for reconstruction surgeries of hindfoot deformities and foot reconstruction procedures. Also it would be useful to orthopaedicians to design accurate talus bone prosthesis and talar implants. Morphometry of talus will be of use in objective categorization and race determination for forensic purposes.

Keywords: Talus; Articular surfaces; Morphometric analysis; Implants

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INTRODUCTION

Talus is the key bone that links the leg and foot through the ankle joint.[1] Though it carries the whole weight of the human body, it has neither tendon nor muscular attachments.[2]

There are three articulating surfaces on the talus. The superior articular or the trochlear surface of talus is concave transversely and convex parasagittally. It is wider in front. The articular surface for medial malleolus on talus is deep anteriorly and is coma shaped. The lateral talar surface is triangular and concave vertically.[3] The dimensions of these articular surfaces act as a useful in making the ankle implants and also for total ankle replacements.[4,5]

There is limited data on morphometry of the human tali in North Indian population, and this study will be of use to radiologists, sports therapists and surgeons for diagnosis and treatment of talar neck fractures and in making the talar body prosthesis. This study will be helpful in the treatment of congenital talipes equinovarus (CTEV) or club foot, to identify the degrees of pes cavus and pes planus and also will be of great help to forensic anthropologists.[6-8]

AIMS AND OBJECTIVES

The purpose of our study is to do a morphometric analysis of talus to facilitate orthopedicians in planning surgeries for subtalar implants and foot prostheses.

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MATERIALS AND METHODS

The present study was done on 60 dry adult human tali (24 left and 26 right) obtained from Department of Anatomy, SGT Medical College, Budhera. These tali were of unknown gender and age separated into right side and left side. The measurements on the articular facets on the superior, medial and lateral surfaces of body of talus were taken with digital vernier caliper. The following measurements were taken on left and right side:

- Medial, Central and Lateral length on Trochlear surface
- Anterior, Central and Posterior width on Trochlear surface
- Average central height and width on Lateral articular surface
- Average central height and width on Medial articular surface

RESULTS

On the Trochlear surface, mean values of medial, central and lateral length were 27.0cm, 28.1cm, 27.4cm on right side and 29.4cm, 27.0cm, 29.1cm on left side (Figure 1). Mean anterior, central and posterior widths were 27.6cm, 26.2cm, 21.1cm on right side and 27.0cm, 24.0cm, 23.1cm on left side (Table 1).

For the Lateral articular surface: Mean central height on the lateral articular surface was 26.2cm on the right side and 23.0cm on the left side. Mean central width on the lateral articular surface was 21.9cm on the right side and 16.8cm on the left side (Table 2 and Figure 2).

For the Medial articular surface: Mean central height on the medial articular surface was 13.6cm on the right side and 10.8cm on the left side. Mean central width on the medial articular surface was 25.9cm on the right side and 17.9cm on the left side (Table 2).

Table 1: Showing the measurements on Trochlear surface of talus

Parameters(cm)	Left side	Right side
Trochlear Surface	Mean±SD	Mean±SD
Medial length(ml)	30.18±3.37	29.87±2.93
Central length(cl)	29.97±2.11	29.87±3.14
Lateral length(ll)	29.60± 1.91	29.32±2.98
Anterior width(aw)	28.16±2.76	27.01±2.79
Central width(cw)	26.77±1.94	26.2±2.76
Posterior width(pw)	22.98±2.46	22.92±2.33

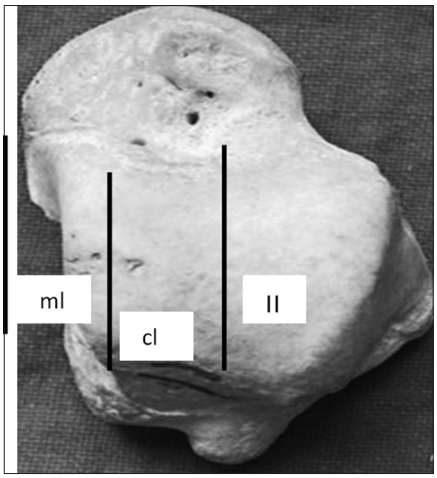

Figure 1: Showing measurement of length of Trochlear surface(ml-medial length,cl-central length,ll-lateral length)

DISCUSSION

This measurement shows that trochlear articular surface is wider in front. The comparison of the measurements taken on the superior articular surface of the body of Talus between right and left tali were almost similar. The parameters are comparable with the study done by Goda Jatin B except for central width of lateral articular surface.[9] Gautham K found in his study the mean maximum transverse width on the body of Talus was 37.94mm on the right side and 36.80mm on the left side which was higher compared to present study. Mean Trochlear length was 30.62mm on right side and 30.44mm on the left side.[10]

Ilhan Otag found that mean values of trochlear length and talar width were 33.45mm and 40.79mm on right side and 34.12mm and 43.39mm on left side respectively and these values were observed to be higher than the findings of the present study.[11]

Table 2: Showing the measurements on Lateral and Medial Articular surface of talus

	Parameters(cm)	Left side	Right side
Lateral Articular Surface		Mean±SD	Mean±SD
	Central Height (ch)	24.08±1.99	23.25±3.72
	Central width(cw)	25.05±4.3	24.84±4.08
Medial Articular Surface	Central Height (ch)	12.08±1.58	12.81±3.66
	Central width(cw)	26.43±2.75	27.21±2.56

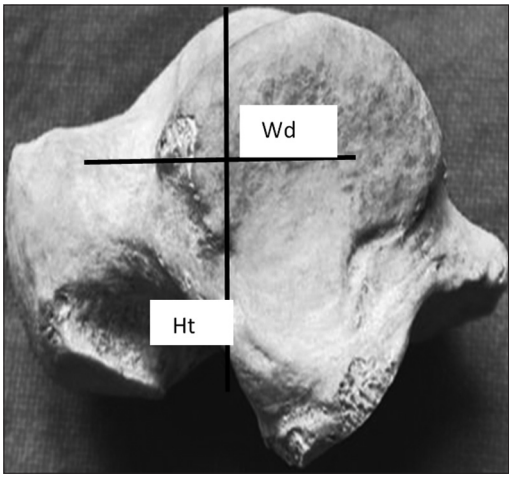

Figure 2: Showing the height (Ht) and width(Wd) of lateral surface

The measurements done by Berjina Farooq were similar to the present study except for central width of medial and lateral articular surface.[12]

The findings of the present study are similar to the study done by Veenatai J and Janaki V.[13]

In the study done by Shishirkumar in South Indian population, the medial length, central length and lateral length of talus was found to be more as compared to the present study. The anterior, central and posterior widths calculated in this study were similar to the present study.[14]

The measurements of anterior and posterior widths done by Roshi Daud et al., in European population were on higher side as compared to the present study.[15]

Also, the anterior, central and posterior widths measured by Andrea Hayer et al., in American population was also on higher side.[16]

The difference in the mean values compared to previous studies may be due to climate, nutrition genetic and environmental factors in the inherent population.

CONCLUSIONS

The morphometric parameters will be a useful tool for reconstruction surgeries of hind –foot deformities and foot rehabilitation procedures.

The measurements of opposite talus bone can be used as a control during talus bone replacement surgery, it may help surgeons to plan pre-operatively the complex talar fracture surgeries and design talus implants. This study will be of use to forensic anthropologists for age determination, sexual dimorphism, racial differences and stature identification.

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Authors Contribution:
SG-Concept and design of the study; prepared first draft of manuscript; **UV-** Interpreted the results; reviewed the literature and manuscript preparation; **AS-** Concept, coordination, review of literature and manuscript preparation; **KR-** Statistically analysed and interpreted, preparation of manuscript and revision of the manuscript

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