INTRODUCTION

Talus is the key bone that links the leg and foot through the ankle joint. Though it carries the whole weight of the human body, it has neither tendon nor muscular attachments. 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. The dimensions of these articular surfaces act as a useful in making the ankle implants and also for total ankle replacements. 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.

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.
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).

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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{11}

![Figure 1: Showing measurement of length of Trochlear surface(ml-medial length,cl-central length,ll-lateral length)](image1)

![Figure 2: Showing the height (Ht) and width(Wd) of lateral surface)](image2)
The measurements done by Berjina Farooq were similar to the present study except for central width of medial and lateral articular surface.\textsuperscript{12}

The findings of the present study are similar to the study done by Veenatai J and Janaki V.\textsuperscript{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.\textsuperscript{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.\textsuperscript{15}

Also, the anterior, central and posterior widths measured by Andrea Hayer et al., in American population was also on higher side.\textsuperscript{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 talus 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.

**REFERENCES**

1. Williams PL, Bannister LH, Berry MM, et al. (Eds.), Gray’s Anatomy, 38\textsuperscript{th} edn. Edinburgh: Churchill Livingstone, 1999.
2. Last RJ. Anatomy Regional and Applied, 4th edn. English Language Book Society and J.A. Churchill, Edinburgh, 1970, pp 303-305.
3. Gray’s Anatomy. The Anatomical Basis of clinical practice. 40th edition, Elsevier Churchill Livingstone.2008, pp 4279.
4. Motagi MV, Kottapurath SR and Kavitaratii D. Morphometric analyses of human dry tali of South Indian origin. International Journal of Medical Sciences and Public Health.2015; 4(2): 237-240. https://doi.org/10.4103/ijms.ph.2015.300921443
5. Khadija I, Sundus A and Shirza N. Anatomical variations of trochlear surface of talus. Journal of University Medical and Dental College.2012; 3(1): 38-41.
6. Ughade HM, Bhele AV and Shaik S. Morphometric study of human talus - a cross sectional study. International Journal of Anatomy and Research.2017; 5(3.2):4265-4268. https://doi.org/10.16965/ijar.2017.302
7. Peeters K, Schreuer J, Burg F, Behets C, Van Bouwel S, Dereymaeker G, et al. Altered talar and navicular bone morphology is associated with pes planus deformity: A CT-scan study. Journal of Orthopaedic and Research.2013; 31(2):282-287. https://doi.org/10.1002/jor.22225
8. Yu-Chi Huang, The relationship between the flexible flatfoot and plantar fasciitis: Ultrasonographic evaluation. Chang Gung Medical Journal.2004; 27:443-447.
9. Goda Jatin B , Patel Shailesh M, Parmar Ajay M and Agarwal GC. Morphometry of the Articular Facets on the superior, medial and lateral surfaces of the body of talus and its clinical relevance. International Journal of Medical Research and Health Sciences.2015; 4(3):531-534. https://doi.org/10.9598/2319-5886.2015.0102.2
10. Gautham K, Clarista MQ,Sheela N and Vidyashambhava P. Morphometric Analysis of The Human Tali. CIBTech Journal of Surgery.2013; 2(2): 64-68.
11. Otag I and Cimen M. Morphometric measures of talus bone in skeleton remains belonging to Anatolian geography. Indian Journal of Applied Research.2003; 3(8):530-531. https://doi.org/10.15373/2249555X/AUG2013/168
12. Naqshi BF, Shah AB and Gupta S. Morphometry of articular facets of talus and anatomical variations of the trochlear surface in North Indian population. International Journal of Science and Research. 2018; 7(2):39-40
13. Veenatai J,Janaki V. Morphometry of Articular facets of the body of talus. IOSR-Journal of Dental and Medical Sciences 2017;16(5):19-21. https://doi.org/10.9790/8853-1605031921
14. Shishirkumar, Dr. Nambiar S, Dr. Arunachalam Kumar, Dr. Patil GV. Morphometric Analysis of Superior Articulating surface of Talus International Journal of science and research 2014; 3(6): 2387-2391
15. Daud R, Abdul Kadir MR, Izman S, Md Saad AP, Lee MH, Ahmad AC. Three-dimensional morphometric study of the trapezium shape of the trochlea tali. Journal of Foot and Ankle Surgery 2013; 1-6. https://doi.org/10.1053/j.jfas.2013.03.007
16. Hayes A, Tochigi Y, Saltzman CL. Ankle morphometry on 3d-ct images. Iowa Orthopaedics Journal 2006; 26: 1-4.