

## ASSESSMENT OF MORPHOMETRIC STUDY OF CALCANEUS AND ITS ARTICULAR FACETS

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### Abstract

**Background:** To assess morphometric study of calcaneus and its articular facets. **Materials and Methods:** Eighty- six dry calcaneus of both genders were taken and parameters such as type of articular facets, anteroposterior length, transverse diameter, sulcus calcanei length and sulcus calcanei width were recorded. **Result:** Types of articular facets was A1 in 4, A2 in 4, A3 in 5, A4 in 8, B1 in 20, B2 in 44 and C in 1. The difference was significant ( $P < 0.05$ ). The mean antero-posterior calcaneus length was 78.2 mm, transverse diameter was 46.3 mm, sulcus calcanei length was 33.4 mm and sulcus calcanei width were 5.9 mm. **Conclusion:** The most common type of facets on talus are type B. Assessment of morphometric parameters plays key role in reconstruction surgeries and foot rehabilitation procedures.

## INTRODUCTION

The calcaneus is the largest bone of the skeleton of the foot. There are three calcaneal facets for the talus on the upper side of the calcaneus: the anterior, middle, and posterior facet.<sup>[1]</sup> The three calcaneal facets for the talus and the three talar facets for the calcaneus participate in the construction of the talocalcaneonavicular joint and subtalar joint, and the stability of these joints depends on the facet characteristics.<sup>[2]</sup> The back side of the calcaneus corresponds to the tuber calcanei, through which most of the body weight is transferred to the surface. Anterior, middle, and posterior calcaneal facets for the talus often exhibit variability in their presence and position.<sup>[3,4]</sup>

Bunning & Barnett classified three types as type A, B and C.<sup>[5]</sup> In type-A consist of anterior and middle articular facets due to their extent of separation were again divided into four subtypes: A1 - distance between articular facets is less than 2mm, A2- distance between facets 2- 5mm, A3- distance between facets more than 5mm. A4-only one articular facet is seen. In type B – no separation between anterior and middle articular facets. Based on separation type B divided into two types. B1- separation incomplete, B2-no separation between facets. In type –C only one facet. Rarely, all three facets on the upper surface of the calcaneus fuse into a single irregular area.<sup>[6,7]</sup> We performed this study to assess morphometric analysis of calcaneus and its articular facets.

## MATERIALS AND METHODS

After considering the utility of the study and obtaining approval from ethical review committee of the institute, we selected eighty- six dry calcaneus of both genders.

Parameters such as antero-posterior length- it is the distance between the most anterior point on anterior surface and most posterior point on posterior surface, transverse width- the distance between most medial point on the medial surface and most lateral point on the lateral surface, while the width of the sulcus calcanei was taken as the distance between medial and lateral margins of the sulcus, while the length of the sulcus calcanei was taken as the distance between anterior and posterior margins of the sulcus were recorded. The results were compiled and subjected for statistical analysis using Mann Whitney U test. P value less than 0.05 was set significant.

## RESULTS

Types of articular facets was A1 in 4, A2 in 4, A3 in 5, A4 in 8, B1 in 20, B2 in 44 and C in 1. The difference was significant ( $P < 0.05$ ) [Table 1].

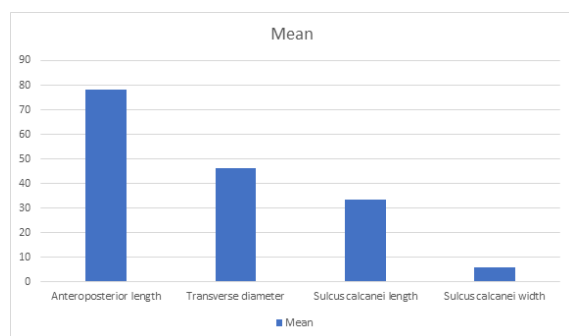
The mean anteroposterior calcaneus length was 78.2 mm, transverse diameter was 46.3 mm, sulcus calcanei length was 33.4 mm and sulcus calcanei width was 5.9 mm [Table 2, Figure 1].

**Table 1: Types of articular facets**

Types	Number	P value
A1	4	0.01
A2	4	
A3	5	
A4	8	
B1	20	
B2	44	
C	1	

**Table 2: Assessment of parameters**

Parameters (mm)	Mean	SD
Anteroposterior length	78.2	5.6
Transverse diameter	46.3	4.2
Sulcus calcanei length	33.4	3.8
Sulcus calcanei width	5.9	1.5

**Figure 1: Assessment of parameters**

## DISCUSSION

Some studies have shown that individuals with certain morphological variations of calcaneal facets for the talus have a greater predisposition to the development of subtalar arthritis. In addition to that, in the biological identification of a skeleton, the determination of sex is considered the most important step.<sup>[8,9]</sup> The bones of pelvis and skull are most often examined for this purpose. However, if these bones are damaged or missing, sex can be determined based on the morphological characteristics of the calcaneus.<sup>[10,11]</sup> We performed this study to assess morphometric analysis of calcaneus and its articular facets.

Our results showed that types of articular facets were A1 in 4, A2 in 4, A3 in 5, A4 in 8, B1 in 20, B2 in 44 and C in 1. Jyotsna et al,<sup>[12]</sup> evaluated the variations in articular facets and dimensions of ninety-eight dry calcaneus. Among the ninety-eight dry calcaneus, type-B articular facets were seen mostly. Morphometric measurements of calcaneus were similar to that of other studies. Mild variations that were observed might be due to racial or different points taken as reference for measurement. Our results showed that the mean anteroposterior calcaneus length was 78.2 mm, transverse diameter was 46.3 mm, sulcus calcanei length was 33.4 mm and sulcus calcanei width was 5.9 mm. Vucinic N et al,<sup>[13]</sup> assessed the patterns of calcaneal facets for the talus, to calculate their total area, and to analyse the data with respect to gender. The study involved 59 calcanei which were photographed. The pattern 1

was the most commonly found in the study sample (45.76%), then the pattern 2 (40.68%), and finally the pattern 3 (13.56%). That order of frequencies is the same in both sexes. The patterns 1 and 2 have a larger contact surface for the talus in comparison to the pattern 3. Male bones have a larger contact surface for the talus than female bones. The sum of the pattern 1 and pattern 3 frequencies was high.

According to Uygur et al,<sup>[14]</sup> morphometric measurements of calcaneus were anteroposterior length and transverse width of calcanei were: 77.7±5.65 mm 47.5±4.2 mm respectively. The width and length sulcus calcanei were: 6.15±2.7 mm, 30.4±3.1 mm respectively.

Garg et al,<sup>[15]</sup> found that the most common type of articular facet on tali and calcanei in the North Indian population studied was type B. Left and right tali showed the length (anterior to posterior) and width to be: 51.14 mm and 37.9 mm, respectively. The measurements on sulcus tali (left and right) included its transverse width, anteroposterior length and maximum depth and these were found to be: 6.75 mm, 18.7 mm and 5.05±0.33 mm, and 7.13 mm, 18.21 mm and 5.44 mm, respectively. Left and right calcanei showed the length (anterior to posterior) and width to be: 70.61 mm and 40.1 mm, and 71.02 mm and 41.48 mm, respectively. The measurements on sulcus calcanei (left and right) included its transverse width, anteroposterior length and maximum depth and were found to be: 6.08 mm, 46.52 mm and 3.78 mm and 5.34 mm, 45.91 mm and 3.81 mm.

Boyan et al,<sup>[16]</sup> found that the width, length and depth of left and right sulcus tali were: 5.2±1.09 mm, 21.7±2.73 mm and 5.7±0.84 mm, and 6.1±2.05 mm, 21.1±3.66 mm and 5.7±1.52 mm, respectively. For left and right calcanei length and width were; 76.1±5.44 mm 44.0±3.97 mm, and 75.7±6.76 mm and 45.9±4.21 mm, respectively. The width, length and depth of left and right sulcus calcanei were: 6.4±1.19 mm, 31.9±2.76 mm and 4.0±0.81 mm, and 5.5±1.00 mm, 32.4±3.23 mm and 4.4±1.05 mm, respectively. The articular facets on both the talus and calcaneus in the Anatolian population studied was predominantly type B.

## CONCLUSION

The most common type of facets on talus are type B. Assessment of morphometric parameters plays key role in reconstruction surgeries and foot rehabilitation procedures.

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