

A study of variations of Talar facets on Calcaneum in the state of Gujarat, India

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Abstract

Biomechanics of standing, walking and running like active movements occur at the ankle, talocalcaneonavicular and subtalar joints. Variations in the Calcaneal facet for Talus can influence the subtalar stability. The present study is done on dry 86 Calcaneum bones at Department of Anatomy of medical college GMERS, Gotri, Gujarat, India. A proper knowledge of the anatomy of talar facets on calcaneum and their variations in different parameters is necessary for a good clinical understanding and treatment outcome, have anatomical, medicolegal, as well as orthopaedics importance while correcting foot deformities like pesplanus and may highlights features in study of evolution in future. In present study talar facets on calcaneum according to Anbumani T L type A-41.8 percent, type B-58.2, type C found zero.¹Detail of classification and its correlation with other study is analysed and discussed.

Key Word: calcaneum, talar facets, subtalar joint, talocalcaneonavicular joint.

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talocalcaneonavicular joints is provided as a result of the bone contours and the strong ligaments. At the talocalcaneonavicular and subtalar joints ranges of movement are greater, inversion and eversion mainly occur here implanting importance of the talar facets of calcaneum, and is frequently used in active movements like standing, walking and running³. So, knowledge of talar facets on calcaneum have anatomical, medicolegal, as well as orthopaedics importance and may highlight features in study of evolution in future.

INTRODUCTION

The calcaneus the largest tarsal bone, projects as a short lever for muscles of the calf attached to its posterior surface. The middle one-third of superior surface carries the posterior talar facet, which is oval and convex anteroposteriorly. Articular facet present distal and medial to subtalar groove is often divided by a non-articular interval at the anterior limit of the sustentaculum tali, forming middle and anterior talar facets, the incidence of which varies with sex and race. Rarely, all three facets on the upper surface of the calcaneus are fused into one irregular area. The subtalar joint proper involves the convex posterior facet and the talocalcaneonavicular joint involves the middle and anterior talar facets of the calcaneus. Stability of the both of the joints subtalar and

MATERIAL AND METHOD

The present study is done on dry calcaneum bones at Department of Anatomy of our medical college GMERS, Gotri, Gujarat, India. Study was done on 86 dry calcaneum, of both genders of unknown races. The three talar articular facets were carefully examined, and classified according to Anbumani T L. Detail of classification and its correlation with other study is analysed and discussed.

OBSERVATION AND RESULT

Eighty six calcanei were classified into 3 types according to Anbumani TL based on the talar articular facets present on the superior surface of calcaneum (Table 1). Type A, Type B and Type C, based on the number of articular facets for the Talus on its superior surface.

Type A: Presence of three separate articular facets, namely anterior, middle and posterior facets(Figure 1)

Type B: Presence of two articular facets for Talus on the calcaneum. (Figure 2)

Type C: Presence of single fused articular facet for Talus on the Calcaneum.

Table 1: shows the percentage incidence of types of Calcaneum.

Types of calcaneum	No. of bones	Percentage
Type A	36	41.86%
Type B	50	58.14%
Type C	00	00%

Table 2: Percentage incidence of subtypes of Type B Calcaneum

Subtypes of Type B calcaneum	No. Of bones	Percentage
Type B1	26	30.23%
Type B2	20	23.25%
Type B3	04	04.65%
Type B4	00	00%

Type B is further classified into four subtypes as follows:

Type B1: Anterior and middle facets are completely fused (fig 2)

Type B2: Anterior and middle facets are fused with the presence of a notch in between them. (fig. 3)

Type B3: Anterior facet is absent. Only middle and posterior facets are present. (fig. 4)

Type B4: Middle and posterior facets are fused with each other. Anterior facet is separate.

The literature describes five pattern of talar facets

Pattern I: Medial and Anterior facets fused

Pattern II: Medial and Anterior facets separate

Pattern III: Anterior facet absent

Pattern IV: Anterior, Middle and Posterior facets fused

Pattern V: Middle and Posterior facets fused

Table 3: comparison with study done by other authors

Author and year of study	Countr y	Type I	Type II	Type III	Typ e IV	Typ e V
Bunning and Barnett 1965	Britain	33	67	-	-	-
Gupta Sc <i>et al</i> 1977	India	67	26	5	2	-
Francine Drayer 1993	USA	54.4	26.7	18.8	-	-
Saadeh FA <i>et al</i> 2000	Egypt	63	30.3	4.7	2	-
Muthukumara vel <i>et al</i> 2011	India	65.8	33.3	-	0.42	0.42
Present study 2019	India	53.4	41.8	4.66	-	-
		8	6			

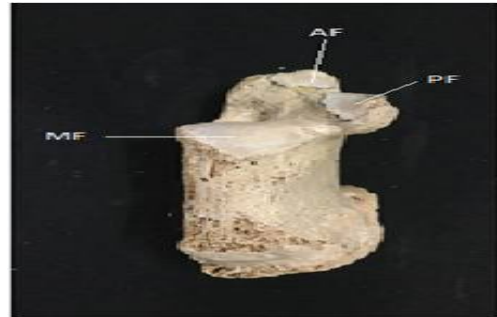


Figure 1: Left Calcaneum showing three separate articular facets for Talus. (Type A) **AF-** Anterior facet; **MF-** Middle facet; **PF-** Posterior facet



Figure 2: Right Calcaneum showing fused anterior and middle talar articular facets. (Type B1) **AF-** Anterior facet; **MF-** Middle facet; **PF-** Posterior facet



Figure 3: Right Calcaneum showing fused anterior and middle talar facets with a notch in between them. Posterior facet is separate. (Type B2) **AF-** Anterior facet; **MF-** Middle facet; **PF-** Posterior facet



Figure 4: Right Calcaneum showing middle and posterior talar facets. Anterior facet is absent. (Type B3) **MF-** Middle facet; **PF-** Posterior facet

Type B1 and B2 Calcaneii, in which the anterior and middle Talar facet are fused, is found in 46 bones which correspond to 53.48% of the bones.

DISCUSSION

The Calcaneum articulates with the Talus superiorly to form the Subtalar joint. Talar facet morphology of the Calcaneum is an important factor for the integrity of the Subtalar joint⁴. The “Osseous Tripod” pattern in which there are three articular facets for Talus on Calcaneum, gives a better stability for the Subtalar joint. The purpose of this study is to analyse the incidences of variations of types of Calcaneum in its morphology and morphometric patterns in the state of Gujarat, India. Bunning and Barnett in 1963 have reported three variations in the types of Calcaneum. Their study among British population, shows the Type A Calcaneum with three separate articular facets was more common. i.e., 67%.^{5,6} A study by Barbaix *et al*⁷ in Belgian population has also reported that Type A Calcaneum is more common, which is 64% when compared to Type B Calcaneum. Anbumani TL² in 2016 have reported Type A bones in 21.8% which is much lower than the present study of 41.86% and Type B bones in 74.5% bones which is much higher than in present study of 58.14% and Type C bones in 3.6% which is also higher than present study where no Type C bone reported. In a study by Muthukumaravel *et al*⁸ on 237 Calcaneum in Tamil Nadu, 33.33% of bones had found three separate articular facets and 65.82% had two articular facets, with fused anterior and middle facets for Talus, that corresponds to Type A (41.86%) and Type B1 and B2 (58.14%) of present study respectively. In correlation with this study and our present study both the studies have similarity in the increased incidence of two Talar articular facets when compared to three Talar articular facets on the Calcaneum, however the percentage of Type B Calcaneum is less in the present study than that of the study by Muthukumaravel *et al*⁸. However the present study correlates well with the study by Bunning and Barnett⁶ in Indian population on 78 Calcaneii, but the results is quite different on the Britain population, where the three facet morphology is more common than. the two facets Calcaneii. The racial differences of the Calcaneum have also been studied by them on the foetal Calcaneum with similar results, thereby depicting a genetic cause behind the varying facet pattern on different population. The study by El-Eishi⁹ in 200 Egyptian Calcaneii has also reported increased incidence of Type B Calcaneii (49%) than Type A(40%). However in present study the incidence of Type B calcaneii is 58.14%. The anterior articular facet for Talus is absent in 4.65% of bones (TYPE B3) in the present study, which is lower than that of Priya *et al*¹⁰ study who found 7.04% incidence. In the present study, fusion of

middle and posterior facet with separate anterior facet is not reported (TYPE B4), which is also rarely reported in other literatures. A single fused articular facet for Talus type C in the Calcaneum is not reported in the present study, which is same as study done by Priya *et al*¹⁰. In the present study, the anterior and middle Talar facets in Type B Calcaneii are fused in two different formats. In Type B1, they are fused completely (30.23%). In Type B2, there is a notch between the two facets (23.25%). The results are similar to that of a study by Jha and Singh¹¹, however the incidence of Type B2 is much higher in the present study than by Jha and Singh¹¹ study (11.87%). Bruckner's¹ hypothesis and the findings of Francine D V⁴ have stated that Talar facet morphology is the key for subtalar joint stability. The three facet morphology of the Calcaneum has better stability and is less prone for arthritis. The Osseous Tripod appearance of Talus on Calcaneum offers less mobility for the Talus over the Calcaneum, thereby preventing injuries and strain to the Talus over the Calcaneum. Various studies have reported that patients with two facet configuration with fused anterior and middle facet and separate posterior facet have lesser stability and are more prone for osteoarthritis. Also the literatures have cited that this type of configuration is dominant in Indians. Thereby Indians are more prone for osteoarthritis and also for the development of Calcaneal spur resulting in Heel pain. Thereby in the present study on the Calcaneum of Gujarat, India, the incidence of Type B Calcaneum with fused anterior, middle Talar facet and a separate posterior facet is higher, thereby correlating the relation of Subtalar Osteoarthritis and Calcaneal Spur formation to the Talar facet morphology on the Calcaneum.

CONCLUSION

A thorough knowledge of pattern of Talar facets on the Calcaneum and their variations is essential for providing the best treatment in various clinical conditions. An insight into the racial differences in facet pattern is vital in carrying out surgical procedures like Calcaneal Osteotomy. Hence this study is accomplished to contribute to the subject of Anatomy enlightening the importance of variations in the normal Anatomy.

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