

Racial Polymorphism in Talar Articular Facets of Calcaneum

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ABSTRACT

Calcaneum is a cancellous, subcutaneous, weight bearing bone that is considered a useful indicator for sex determination, stature estimation, and determination of osteoporosis; however, the role of Calcaneum in racial evaluation is often overlooked. **Materials and methods:** In the current study a total of 350 dry calcanei were analyzed; all the bones came from adult Pakistani subjects of both sexes., and on comparison with Indian, Egyptian and Spanish patterns a definite predominance of type 1 talar articular facets was seen in Pakistani population. **Conclusion:** It is therefore proposed that the pattern of talar articular facets of Calcaneum is a useful indicator for racial differentiation.

Key words: Calcaneum, articular facets, racial parameters.

INTRODUCTION:

Calcaneum is the longest and largest of the tarsal bones, it is irregularly cuboid with its long axis inclined upwards and laterally. It articulates with overlying talus to form the talocalcaneal joint which together with the talaocalcaneo-navicular joint are clinically referred to as sub talar joint¹ where inversion and eversion of foot occur. Calcaneum has four surfaces i.e. dorsal, planter, lateral and medial. The dorsal or the superior surface is easily divisible into three parts, the posterior third is rough concavo-convex, the middle third carries the posterior talar articular facet and the anterior third is partially articular. Distal to the posterior articular facet is a rough depression that narrows into a groove on the medial side, the sulcus calcanei, which completes the sinus tarsi with talus. Distally and medially to the groove an elongated articular area covers the sustentaculum tali, this facet is often divided by a non-articular interval at the anterior limit of sustentaculum tali forming middle and anterior talar facets (Fig. 1)

Using parameters such as degree of separation, fusion, and shape several patterns of articular facets have been described in the standard text books of anatomy².

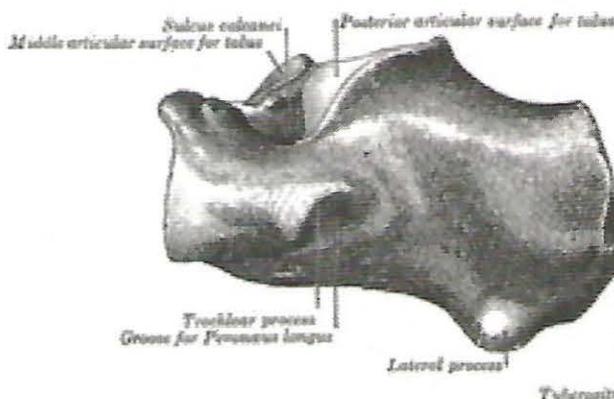


Fig.1: Talar articular facets of Calcaneum.

Type 1 pattern presents a single facet resulting from the confluence of the middle and anterior facets, in Type 2 pattern middle and anterior articular facets are separated by a distinct ridge, in Type 3 a single articular facet is present limited to the sustentaculum tali and Type 4 has a single articular facet formed by the confluence of posterior, middle and anterior facets³.

MATERIALS AND METHODS

In the current study a total of 350 dry calcanei

were analyzed; all the bones came from adult Pakistani subjects of both sexes. The specimens were free of pathological changes or anomalies. Pattern of the talar articular facets was observed under dissecting microscope 2X and 4 X magnifications and a photographic record of the specimens was kept.

RESULTS

Type 1: Calcanei with continuous middle and anterior facets were found in 220 specimens (Fig. 3)

Type 2: Calcanei with separate middle and anterior facets were found in 100 specimens (Fig.4).

Type 3: Calcaneum with articular facet limited to sustentaculum tali was not found in any specimen.



Fig. 3. Type 1 articular facets of Calcaneum



Fig. 4. Type 2 articular facets of calcaneum.

Type 4: Calcanei with distinct anterior, middle and posterior articular facets were found in 30 specimens (Fig. 5).

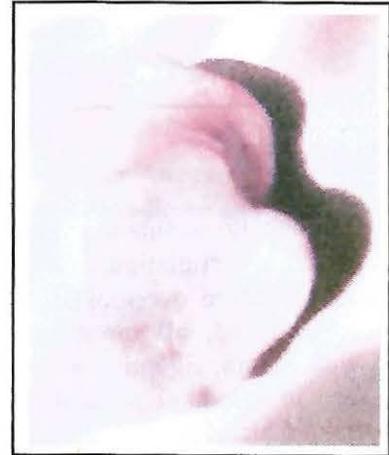


Fig. 5 Type 4 articular facets of Calcaneum..

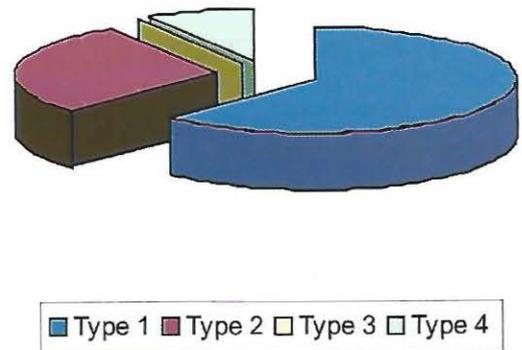


Fig. 6: Pie chart showing variability in talar articular facets in Pakistani population

Based on morph metric study of articular facets on the superior surface of calcanei, three distinct facet patterns were identified. Comparison of the occurrence of these articular facets in different races is given in Table 1.

Table 1:. Comparison of occurrence of talar articular facets.

Race	Type 1	Type 2	Type 3	Type 4
Indian ⁴	67%	26%	5%	2%
Indian ⁵	16%	78%	1%	3%
Indian ⁶	35%	65%	0%	0%
Spanish ⁷	46%	53%	-	-
Egyptian ³	63%	30.3%	4.7%	2%
Pakistani	62.9%	28.6%	-	8.6%

DISCUSSION

Forensic anthropology is a rapidly growing field and skeletal biologists are often called upon by the police to assist in personal identification from skeletal remains, that are recovered in suspected cases of homicide, suicide and mass disaster. Calcaneum is a compact bone that is able to withstand high tensile forces, it may complement radiological techniques of bone density measurement in the assessment of pediatric conditions associated with fracture risk⁸. Calcaneum indexing is an effective method of surveying osteoporosis to predict the population at risk of sustaining fractures⁹.

Calcaneum is also a useful tool in determination of sex^{10,11,12} and is long being considered useful in stature estimation¹³.

The percentages of talar articular facets of Calcaneum of different geographical zones are shown in Table 1.

Analysis of the provided data shows that Type 2 pattern predominate the Spanish population, Type 1 pattern of articular facets was found to be dominant in Egyptians; there is however controversy in the dominant pattern type in Indians as two studies claim type 2 to be the dominant type and in one study type 1 was claimed the prevailing pattern. In our study we found type 1 to be the principle pattern of articular facets in Pakistani population. The incidence of talar articular facets of Calcaneum is determined genetically, as the difference in pattern type was also observed in fetuses by Bunning and Barnett in 1965¹⁴. According to them Europeans have a predominant Type 2 pattern, Africans (Nigerians and Sudanese), Indians and Egyptians have a predominant Type 1 pattern. The results of the current study suggest a racial predominance of Type 1 pattern of talar articular facets. Riepert et al. in 1996 implied that radiographs of the ankle are a convenient, rapid, cheap and non-invasive means of estimating the sex¹⁵; it might also prove to be a convenient means for evaluation of race of an individual.

The articular facets of the sustentaculum tali have a variety of configurations that are generally viewed as nonmetric traits of little functional significance. Buckner in 1987, in contrast, has

hypothesized that sustentaculum tali facet variations are functionally important because they influence subtalar joint stability; to test this hypothesis, 191 calcanei were analysed for correlations between sustentaculum tali facet morphology and osteoarthritis of the subtalar joint by Drayer-Verhagen in 1993¹⁶. Calcanei with two separate sustentaculum tali facets had a lower frequency of arthritic changes associated with joint instability than calcanei with other facet configurations. This finding supports Buckner's hypothesis that subtalar joint facet configuration is a factor in foot mobility.

CONCLUSION

The results of this study underline the importance of talar articular facets not only in determination of sex and race of an individual but also supports the hypothesis that subtalar joint facet configuration is a factor in foot stability and mobility.

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