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Morphological And Metrical Study Of The Articular Facets On The Calcaneus Of Sourthern Nigerians

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ABSTRACT

The study was carried out using 60 Nigerian dry calcanei obtained from anatomy laboratories of University of Port Harcourt and Nnamdi Azikiwe University (NAU) Nnewi campus. The specimens were free of pathological changes and anomalies and the 1974 El- Eishi approach was used to estimate the morphological structure of the articular facets on the calcanei. The method involved preparation of bones using standard procedure and studying facets of calcanei to reveal different pattern types of articular facets ranging from type i to type iv. The diameters of the articular facets were also measured and divided by two to obtain values of r (r=radii) which in turn was used to calculate the surface area of each pattern type. The readings were used to calculate the mean range. The result showed that type i has a frequency of 61.67%, type ii 20.0%, type iii 15.0% and type iv was 3.33%. It is obvious that type i pattern of articular facets is more common in our environment. We conclude that between the morphometric and metric methods, the morphometric gave a clear and more accurate result.

Keywords: Calcanei; Articular facets, morphometric and metrical

The calcaneus or os calcis is the largest of the tarsal bones; it projects backwards beyond the bones of the leg to provide a useful lever for the muscles of calf, which are inserted into the posterior surface. It is irregularly cuboidal in shape, and its long axis is directed forwards, upwards and some worth laterally. The small articular anterior end contrast with the large roughened posterior end. The dorsal surface bears a large, articular facet about its middle which distinguishes it from the rough plantar surface. The lateral surface is flattened whereas the medial surface is hollowed out from above downwards and backwards.(Warwick et al, 1973). It has about four articulating surfaces and is characterized by the sustentaculum tali, a shelf that project from the upper border of its medial surface.

The calcaneal surfaces are six in number viz: dorsal or superior surface, anterior surface, posterior surface inferior or plantar surface, lateral surface and medial surface.

The articular facets of the talus on the calcanei present in three different forms; the anterior, medial and posterior facets which may exist separately, with anterior and middle articular facets separated by a non-articular interval (Warwick et al 1973). The anterior and middle articular facets can exist as a single facet, hence only two articular facets of talus on the calcaneous (Sinnatamby 1954). There could be a complete fusion of the anterior, middle and posterior facets forming an irregular single articular area, this occurs in 1 – 5% individuals (Arora et al 1977). There is also a variation in shape among the three articular facets on the calcaneus for talus Viz; anterior articular facets is small and oval, the middle articular facets is elongated and oval, and the posterior articular facets is convex and irregular in shape. The anterior articular facet forms the talocalcaneonavicular joint. And the posterior articular facet forms the talocalcaneal or subtalar articulation.

El – Eishi in 1974 conducted a study, which represents an assessment of the pattern type of articular facet on the caleaneus. He classified the calcanei articular facets into four distinct types; type I which has continuous middle and anterior facets, type II is made up of distinct middle and anterior facets with sub types A,B and C. In type III, the anterior facet was absent, and in type IV the posterior middle and anterior facets are confluent. In his study, frequencies of types I and III were 63.2%, 30.3% 4.4% respectively.

Forroil et al (1989) scored patterns of the articular facets into four types as mentioned above but he did not observe the presence of Type IV arrangement in his sample.

Incidence of facet pattern type is related to race (Bunning et al 1965). Type II pattern

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predominates in Europeans (British) and Spanish (Forroil et al 1989). Pattern type I dominates in Africans and Indians (Gupta et al 1977).

Sinnantamby (1954) classified the pattern articular facets based on their morphology into three types, viz; types I which has distinct anterior, middle and posterior articular facets, type II has anterior and posterior facets and type III which has the confluent anterior, middle and posterior facets. This is contrary to the previous works as it was unable to identify type II articular facet in which the anterior facet was absent.

The present study aims at determining the pattern types of calcanei in Nigeria for the purpose of identifying racial differences. The information is of great anthropological and forensic importance.

MATERIALS AND METHOD

Materials used for this study included sixty dry calcanei of Nigerian males obtained from anatomy dissecting rooms of university of Port Harcourt and Nnandi Azikiwe University, Nnewi campus,

After detaching the caleanei: from the cadaver, they were soaked in tap water at 60 – 65C for 24 hours, transferred to another tap water at 37oC for two weeks to ensure proper maceration of tissues. Disinfectant was added to prevent pathological changes. Later, fatty tissues, muscles and ligaments were scrapped off with sharp knifes. The next step was immersion into 2% caustic soda for 24hours to help in the removal of the remaining soft tissues. The bones were then rinsed in cold tap water and soaked in 10% hydrogen peroxide for 1 week. They were then allowed to dry in the sun for 2 – 3 days after which they were polished poligard polish to help in their preservation. The facet pattern types, surface areas and mean range were determined and the frequencies and percentages calculated. The values were grouped into four with reference to their pattern type, percentage frequency, mean – range and surface area.

The mean range for each pattern articular facet (MR) was calculated using the formula;

$$(MR) = \frac{\text{sum of values of diameters of each pattern type}}{\text{number of readings}}$$

while Surface area (SA) was calculated using the formula

Surface area = 4r2
Where 4 = constant
= 22/7 (constant)
Radius (r) = $\frac{\text{diameter of facets}}{2}$

RESULTS AND DISCUSSION

The present study correlates well with the data obtained by El –Eishi (1974) in Egyptians. Both studies showed four types of articulating surfaces on the calcaneus. The Type 1 showed the highest percentage of 61.67% in the present study (Table 1). The least percentage was shown by Type IV.

The observed incidence is in line with findings of El-Eishi (1974) amongst Egyptians. Although the trend is similar in both studies (table 4), the figures showed an inverse proportion between Type I and Type IV. The differences may be due to racial factors. Forroil et al (1989) reported type II in 50%, while in the present study it was observed in 20% of calcanei. Type I calcanei pattern has been found to be the dominant pattern in Africans (Bunning and Barnett 1965, 1963) and been proved authentic in the present study. From this study it is necessary to posit that having utilized the morphometric and metric methods of calculating pattern articular facets on the calcaneus, the morphometric method which involves patterning of the articular facet is most valuable and gives accurate result of individual pattern of morphological study of articular facets. Type I pattern articular facets is the most common in Nigeria. This study can be applied in the fields of anthropometrics, forensic sciences, medicine and orthopedic surgery

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TABLE I: Morphometric classification of pattern types of calcanei of Southern Nigerians.

S/N	PATTERN TYPE	FREQUENCY	%
TYPE i	Continuous middle and anterior articular facet.	37	61.67%
TYPE ii	Separate middle and anterior facets	12	20%
TYPE iii	Absent anterior articular facets	9	15%
TYPE iv	Confluent posterior, middle and anterior articular facets	2	3.33%
Total		60	100%

TABLE 2 metric analysis of pattern types of calcanei of Southern Nigerians.

S/N	PATTERN TYPE	FREQUENCY	DIAMETER	MEAN RANGE
TYPE i	Continues middle and anterior articular facets	37	327.7	8.91
TYPE ii	Separate middle and anterior articular facets	12	104	8.70
TYPE iii	Absent of anterior facets	9	66.9	7.43
TYPE iv	Confluent posterior, middle and anterior articular facets	2	117	5.85

TABLE 3 shows the radius of each pattern articular facets and the surface area.

S/N	PATTERN TYPE	DIAMETER	RADIUS	SURFACE AREA
TYPE i	Continues middle and anterior articular facets	327.7	163.8	337296.5
TYPE ii	Separate middle and anterior articular facets	104	52	33993
TYPE iii	Absent of anterior facets	66.9	33.5	14108.9
TYPE iv	Confluent posterior, middle and anterior articular facets	117	58.5	430232.2

TABLE 4 comparative data of pattern types of calcanei of Southern Nigerians.

	Authors	Type i	ii	iii	iv
Present Study	Paul et al 2008	61. 67%	20.0%	15.0%	3.33%
Egytian Study	El. Eishi 1974	63.2%	30.3%	4.4%	2.1%

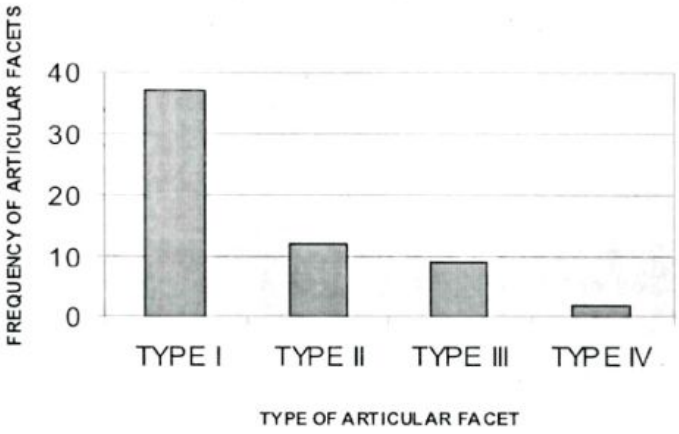

FIG I.Barchart of frequency of occurrence of pattern types of Tali facets on calcanei

Plate A-Type i

Plate B-Type ii

Plate C-Type iii

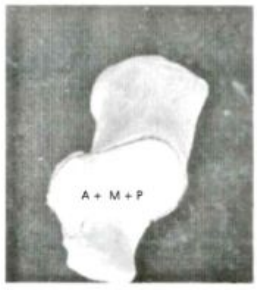

Plate D-Type iv

Fig.I:- Photographs of the superior surface of calcanei: A. right specimen, pattern type 1. B. right specimen, type II, C. right specimen, type III. D. left specimen, type IV

Plate - A – continous anterior and middle articular facets. B – separate anterior and middle articular facets. C – absent of anterior articular facets. D– confluent anterior, middle and posterior articular facets

Key- P- Posterior facet
M- Middle facet
A-Anterior facet

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