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Tali Articular Facets on the Calcanei of Adult Nigerians

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ABSTRACT

The patterns of articulating facets between the talus and the calcaneus have been studied in various geographic population groups (Sudanese, Indian, Egyptian, Spanish, and British populations). The posterior articulating facets on the calcaneus for the talus articulate in a regular manner. However, the anterior and middle facets on the calcaneus for the talus show variation causing various researchers to group them into types and subtypes as observed. The variation in talar articular facets on sample of 74 male adult Nigerian calcanei (aged 18 years and above) was observed and classified. Four distinct faceted patterns were seen and identified. Type 1(64.86%, 48 cases) showed a continuous facet of the middle and anterior, Type II showed a separate anterior and middle facets with variable degree of separation and thus grouped into 3 subtypes. Subtype 11A (10.8%, 8 cases) showed a moderate degree of separation, subtype 11B (8.10%, 6cases) showed a wide separation, while subtype 11C (5.4%, 4cases) showed a narrow separation. Subtype 111 (9.46%, 7cases) showed a single well-defined facet on the sustentaculum tali. Type 1V calcanei have a single facet on the sustentaculum tali extending into the anterior-medial corner of the distal part of the calcaneus, but this facet is continuous with the posterior talar facet of the calcaneus (1.35%, 1case) subsequently, the various calcanei were group into right and left and percentages of incidences calculated. This present study shows a remarkable correspondence between our Nigerian sample and those of Indians with type 1 being more frequent (64.86%, 48 cases), type 11 in second place (24.3%, 18cases), types III and IV (9.46%, 7cases) and (1.35%, 1 case) respectively.

Keywords: calcaneus, talus, facetal pattern, Nigerian.

INTRODUCTION

The tarsi consist of seven bones arranged in proximal and distal rows. The Distal row comprise of 3 cuneiforms (medial, intermediate and lateral), navicular and cuboids while the proximal row comprise of talus and calcaneus[1, 2, 3, 4]. The two articulate to form talocalcanean joint; a synovial joint. This articulation exists between the concave posterior calcanean facet on the inferior surface of the talus and the convex posterior facet on the upper surface of the calcaneus. The calcanean area is separated into two flat facets by a low ridge[2, 3, 4] dividing the facets into posterior, middle and anterior.

Variations and different patterns of the tali articulating facet on the calcaneus exist. Although the body of the talus articulates in regular manner with the posterior facet of the calcaneus, the head articulates with facets on the anterior third of the calcaneus in different manners which can be classified and described using different methods of interpretations. Using parameters such as degree of separation, fusion and shape, several works have described types and preponderance of articular facets on the anterior third of the calcaneus in several population groups like Indian, British, Egyptian and Spanish[5,6,7,8,9]

Four major types of the middle and anterior facets which show variations have been identified and classified into types 1-48. Type 1 has a confluent of the anterior and middle facets. Type 2 has the two facets separated, type 3 only one exists while in type 4 the two facets are continuous with each other and with the posterior facet. However, Bunning and Barnett5 series study on Indians6 classified them into 2 types based on the number of facets. Type A has a single continuous facet of anterior and middle while type B has two facets that are separated. Types C and D where not classified. According to degree of separation of the facets Saadeh10 classified them into four type's I-IV with type 11 having 3 subtypes and type 1 occurring most.

It can be concluded from previous studies on the talar articular facets of the calcanei that the incidence of facet

pattern type is related to race. Since these racial differences were also observed in fetal series6 they are thought to be genetically determined though without any tenable functional explanation.

MATERIALS AND METHODS

A total of 74 dry (right and left) calcanei of Nigerian origin were used for the study, 29 were already prepared while the other 46 were collected from laboratory of human anatomy, college of health sciences, University of Port Harcourt, and using standard laboratory procedures from the same department. After a long process of maceration the bones are allowed to completely dry up of the polish-polyguard polish.

The bones were then grouped into right and left calcanean bones, placing them in their appropriate anatomical position. They were critically examined and thus further grouped into types and subtypes depending on the type of variation shown by the tali facets on each calcaneus. With the aid of a marker pen, outlines were made on each calcaneus showing different variations of tali facets on the calcaneus. These marked calcanei were then numbered and or labeled and finally photographed to illustrate their variance.

During the process of bone preparation standard precautionary measures were ensured. These included careful detachment of the bones to avoid damage or injury to the important areas of the tali facets on the bone. Wearing of surgical gloves, face mask and laboratory coat to avoid direct contact of chemicals to the skin and use of antiseptics for washing to prevent infection

RESULTS

Four types of tali articulating facets were seen on the superior surface of the 74 calcanei used. Some of these types are further regrouped into subtypes as shown in figures 1, 2 and table 1 due to their observable variations. From figures1,2 and table 1, type 1 confluent anterior and middle facet (fig2a) for left calcanei has 70.30% (26 cases) and 59.50% (22 cases) for right calcanei. With 64.86% (48 cases) of the total incidences. In type 1 the middle facet on the sustentaculum tali is continuous with the anterior facet extending to the anterio-medial corner of the distal part of the calcaneus (fig2a). There is however variable shapes of such confluence.

Type 11 has two separate facets; one on the sustentaculum tali (middle facet) and the other, the anterior facet. The separation is seen as a grove in between them which comes with variable degrees, thus grouping them into subtypes A, B and C (fig 2b-d). Subtype 11A has a moderate degree of separation with the middle facet occupying larger surface area than the anterior facet (fig 2b). As shown in the table 1 subtype IIA has 13.50% (5cases) occurrences for right, 8.10% (3cases) for left and 10.80% (8cases) for the total incidence. Subtype IIB has an occurrence 8.10% (3cases) for both right and left calcanei with total incidence of 8.10% (6cases). While subtype IIC has 5.40 %(2cases) each for right and left totaling 5.40% (4cases) in the entire incidence. In subtype IIB the two separate facets middle and anterior are almost equal in size separated by a deeper and more prominent groove (fig 2c). The subtype IIC has narrow degree of separation and narrow notch with middle facet larger than anterior facet (fig 2d).

Type III has a single well defined facet on the sustentaculum tali (fig 2e) with 10.80% (4cases), 8.10% (3cases), and 9.46% (7cases) for right, left and total calcanei incidences respectively. Table 1 also shows type IV 0% (0case) for left, 2.70 %(1case) for right and 1.35% (1case) for total incidence. This as shown in fig 2f, has a single facet formed by confluence of middle, anterior and posterior facet, that is posterior, middle and anterior are continuous with one other.

Table 1: Table showing the types and subtypes observed and their percentages of incidences of right and left calcanei.

S/NO	Types	Right calcanei	Left calcanei	% of incidences
1	Type I	59.50%, 22cases	70.30%, 26cases	64.86%, 48cases
2	Type IIA Type IIB Type IIC	13.50%, 5cases 8.10%, 3cases 5.40%, 2cases	8.10%, 3cases 8.10%, 3cases 5.40%, 2cases	10.80%, 8cases 8.10%, 6cases 5.40%, 4cases
3	Type III	10.80%, 4cases	8.10%, 3cases	9.46%, 7cases
4	Type IV	2.70%, 1case	0%, 0case	1.35%, 1case

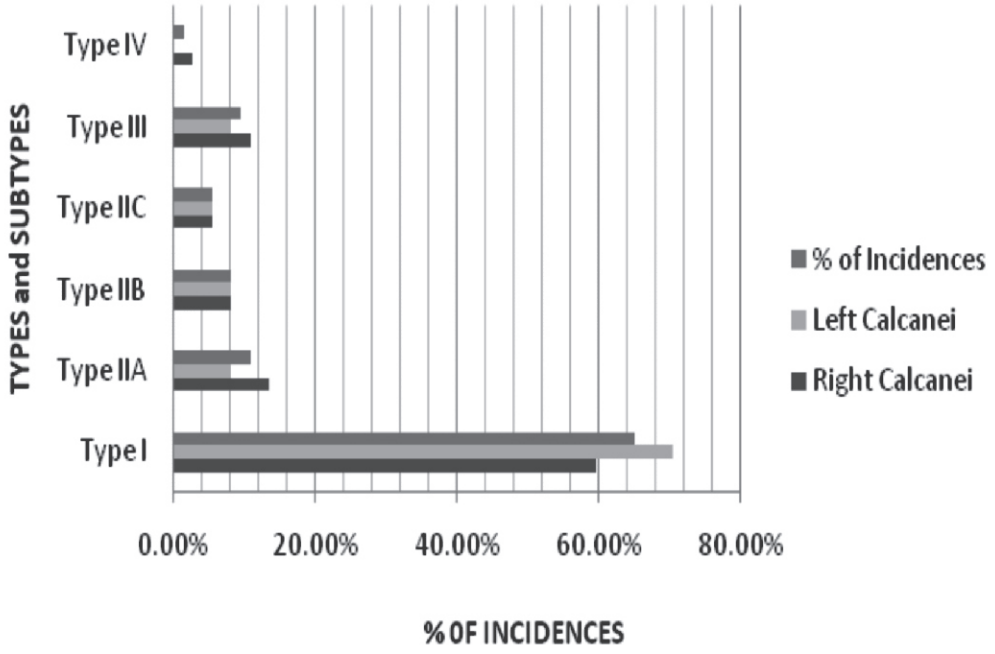

Figure 1: Bar Chart showing types observed and their % of incidences of right and left calcanei

Table 2: Table of comparative analysis of the percentage incidences of the talar articular facets

S/N	Types	Present study 74 Nigerian Calcanei	401 Indian Calcanei[8]	78 Indian Calcanei[6]	200 Egyptian Calcanei[7]	300 Egyptian Calcanei[10]
1	Type I	64.86%, 48 cases	67%, 268cases	78%, 61cases	49%, 98cases	63%, 189cases
2	Type II Subtype A Subtype B Subtype C	24.3%, 18Cases 10.8%, 8cases 8.10%, 6cases 5.40%, 4cases	26%, 104cases	22%, 17cases	40%, 80cases 10%, 20cases 14%, 28cases 16%, 32cases	30.3%, 91cases 20.3%, 60.8cases 6.7%, 20.1cases 3.40%, 10.2cases
3	Type III	9.46%, 7cases	5%, 21cases		11%, 22cases	4.70%, 14cases
4	Type IV	1.35%, 1case	2%, 8cases			2.0%, 6cases

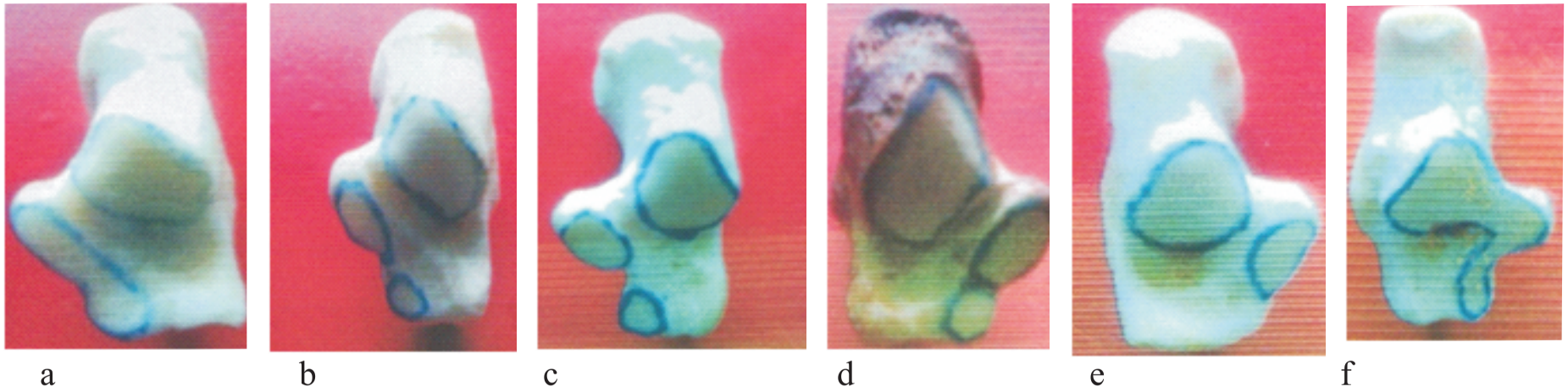

Figure 2. Six different pictures showing morphological variations of talar articular facets on the calcanei of Nigerian adults grouped into four types I-IV and subtypes IIA-C

KEYS
a=TYPE I : Confluent anterior and middle talar facet on calcaneus
b=TYPE II A: Subtype IIA facet- Moderately separated facet on the calcaneus
c=TYPE IIB: Subtype IIB facet- Widely separated facet on the calcaneus
d=TYPE IIC: Subtype IIC facet- Narrowly separated facet on the calcaneus
e=TYPE III: Single facet on the calcaneus
f=TYPE IV: Continuous posterior, anterior and middle facet on the calcaneus

DISCUSSION

The present study of talar articular facets on 74 calcnanei of Nigerian adult revealed 4 different pattern types and subtypes according to the morphology of the facets (figures 2a-f). They were collected and percentages calculated on the incidences of various types for the right and left calcanei. Irrespective of the fact that equal number of calcanei was collected for each right and left. There were still noticeable differences in the percentage incidence.

Type I (confluent anterior and middle facets) was highest for left calcanei with frequency of 70.3%, 26cases when compared to the right that had 59.50%, 22cases. Type II (separate anterior and middle facets) has various subtypes for both right and left. The subtypes show almost equal frequencies as seen in subtype IIB (wider separation) and subtype IIC (narrow separation) with frequencies of 8.10%, 3cases and 5.40%, 2cases for each right and left calcanei respectively. However, subtype IIA showed different frequencies of 13.5%, 5cases for right and 8.10%, 3cases for left. Type IV was absent in the left calcanei leaving just 2.70%, 1case for the right. Type III also had different frequencies of 10.80%, 4cases for the right and 8.10%, 3cases for the left.

The total incidence of occurrence obtained in the present work is in conformity with previous studies where 4 patterns of the talar articular facets on the calcaneus were revealed, grouping them into types 1-48,10. Type II further grouped into 3 subtypes A-C[7,10]. Type I has the highest incidence of 64.80%, 48cases, followed by type II with 24.30%, then type III with 9.46% and type IV being the least with 1.36% out of the 74 cases used in this study. This was the same trend observed by Guptal et al[8], Bunning and Barnett6, El-Eishi[7] and Saadah et al[10]. Although the figures of Guptal et al[8] and Bunning[6] were slightly higher, these might be attributed to the higher number of calcanei (401 calcanei) used by Guptal et al[8]. For Bunning and Barnett[6] they did not classify types III and IV.

The talar articular facets on calcaneus indicate that the incidence of facet pattern type is related to race. Since these racial differences were also observed in fetal series6 these are thought to be genetically determined with no tenable functional explanation. These same authors stated that type II pattern predominates in Europeans (British). Type II accounted for almost half the cases in Spanish[9]. Type I has been found to be the dominant pattern in Africans (Egyptian, Sudanese) [7, 10] also amongst Nigerians as shown in this present study. It is also dominant in Indians[6, 8]. These differences may be due to differences in structure of population, hereditary, environment, and gait as well as built of an individual. Gait in shod populations like the Europeans (British and Spanish) involves heal striking unlike landing on the balls of the foot as seen in the non-shod populations (Developing countries) [11]. Shoe wearing affects pliability of the foot; this is because shoes have an inbuilt medial arch support and narrow toe boxes[11]. This then results in incomplete movement of the transverse and longitudinal arches of the foot leading to stiffer foot which will eventually affects the biomechanics of the shod foot[11] causing alterations of the articular facets of the talus on the calcaneus as observed on the different populations.

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