

Pattern of Talar Articular Facet of Human Calcaneum Bone

Chavan SK¹, Satpute ST², Wabale RN³

^{1,2,3}Department of Anatomy, Rmc Pims Loni India

Abstract: Calcaneum is the largest and longest tarsal bone in the foot. It forms talocalcaneal joint with talus. The joint maintains eversion and inversion of foot and named as subtalar joint. In superior aspect of calcaneum three important facets are anterior, middle and posterior. The individual and racial differences of the anatomic construction of calcaneal articular facets play key role in static and kinetic dynamics of foot. Therefore, this study is important for science of anatomy to understand variations in facets, treatment, diagnostic and surgical procedure.

Key words: calcaneum, articular facets, interfacetal distance, calcaneal length, facetal pattern

I. Introduction

Calcaneum is the largest and longest tarsal bone in the foot. It forms talocalcaneal and calcaneocuboid joint that help in inversion and eversion movements of the foot [1]. The superior surface of the calcaneum shows three facets for articulation with talus, they are anterior, middle, and posterior. Researcher have noted a considerable variation in the pattern of these talar articular facets brought about by morphological changes due to the evolutionary forces, they play a key role in the static and dynamic balance of the foot. During treatment of the congenital clubfoot, severe pronation cases, valgus deformities, subtalar instability and for development of subtalar implants, the relation of calcaneum facets with each other and talus should be well defined [2,3]. The study is important for science of anatomy, treatment, and diagnostic procedures in orthopedic surgery.

II. Aim And Objective

To find variation in articular facet on superior surface of calcaneum bone and compare the incidence of various types of facets between right and left sides.

III. Material And Method

Sixty unpaired dry calcanei, thirty of each side available in the department of anatomy, Rural Medical College, Loni were studied. Observation made with naked eye. Blue marker was used to encircle the facetal margins to clearly mark the separation between the facets. The distance between them measured with help of vernier caliper. Following patterns observed:

- 1.1) Pattern I: Anterior and middle fused and posterior separate.
- 1.2) Pattern II: Anterior, middle, and posterior facets separate.
- 1.3) Pattern III: Anterior facet absent, middle and posterior are separate.
- 1.4) Pattern IV: Anterior, middle, and posterior facets fused.
- 1.5) Pattern V: Anterior facet absent, middle and posterior facet fused

We measured the length of calcanei of right side and left side and various interfaced distance. Total length of calcaneum measured between anterior points of upper part of articular facets to posterior rough bony part for the attachment of tendocalcaneus.

When articular facets are separate entity the distance between them measured with the help of vernier caliper in mm scale. Distance between anterior and middle facets. Distance between middle and posterior facets. Distance between anterior and posterior facets.

IV. Observations And Results

Total length of calcanei of right side ranged (6.4 to 11.1cm) and mean was 8.8cm left side ranged (6.9-10.5cm) and mean was 9.0cm.

Various interfaced distance between anterior and middle facets (0.2 to 1 mm) on right side and (0.3-0.9 mm) on left side. Distance between middle and posterior facets (0.5 to 2.4 mm) on right and (0.5-2.8 mm) on left side. Distance between anterior and posterior facets (0.7 to 2.4 mm) on right and (0.3 to 2.5 mm) on left side. We found the positive correlation between length of calcanei and various interfaced distances.

Patterns of articular facets (Fig 1, 2, 3, 4, 5, and 6) and their percentage of occurrences that we found are shown in **TABLE I**. Pattern I-(Fig 1&2) anterior and middle facets fused. Pattern II- (Fig 3&4) anterior, middle and posterior facets separate. Pattern III-Fig 5& 6) Anterior facet absent and other two are present.

Table 1: Comparative Table Of Various Types Of Talar Articular Facets Of Calcaneum

Sr.no	Pattern	Right side	Left side
1.	I – Anterior and middle facet fused	23(76.67 %)	18(60 %)
2.	II- Anterior, middle and posterior facet separate	6(20 %)	9(30%)
3 .	III-Anterior facet absent and other two are present	1(3.3%)	3(10 %)
4.	IV-Anterior, middle, and posterior facets fused.	0	0
5.	V-Anterior facet absent Middle and posterior facets fused	0	0

Table 2: Comparative Finding For Pattern I By Different Workers.

Sr.no	Authors	Right side	Left side
1.	Nagar SK	204(78.5 %)	200(74 %)
2.	Mini Mol P	22(88 %)	15(60%)
3.	Present study	23(76%)	18(60 %)

Table 3: Present Study Campared With The Incidence Of Previous Study

Study	year	Contrary	N*	I%	II%	III%	IV%	V%
	1977	Indian	401	67	26	5	2	00
Campos Pellicio et al	1989	Spain	176	53.41	39.77	6.82	00	00
Priya R et al	2006	South indian	71	67.6	25.35	7.04	00	00
Mini Mol	2012	Indian	50	74	26	00	00	00
Rohan Garg	2012	Ragastan	310	72.26	24.42	1.3	1.6	0.32
Present study	2014	Indian	60	68.33	25	6.66	00	00

V. Discussion

To expand the knowledge base and the intricacies of morphology, it is necessary to document differences in occurrences, however small they might seem to be. The racial variation and sexual variation in the morphology of talar articular facets of calcaneum is well documented by earlier workers. [4] But none of the earlier authors seems to have noted the difference of occurrence of the facets between right and left side. The difference found to occur in pattern, which is the commonest morphological occurrence amongst all the types. The difference found to be statistically significant in our study. There was a visible difference in the same type in previous studies [TABLE 2]. Though previous authors did not mention the statistical significance of the difference between two sides, from our observation we could note that right side was always greater than left side. We attribute the difference to the following possible reasons. Right lower limb is the initiator of any attempt at the locomotion; hence, the skeletal elements of the right foot have to share the maximum load of forces while inertia is being broken to gain momentum. Right lower limb share proportionately more weight bearing time than left limb. This affects the facet development on the talus and calcaneus.

The commonest pattern found in our study was Pattern - I. There is great variability in pattern - I variation of talar articular facet on calcaneum amongst studies belonging to different regions. Our study correlated well with studies belonging to our region. In type pattern-I, comparable pattern in a Spanish study [TABLE-3] showed difference which is notable; it is 54 % in Spanish population while it is 76.6% in our study. Amongst the many reasons cited, gait of person, standing & walking habits, bodily built and place of living (hilly region or a plateau region) are some of the reasons given [5].

Pattern II was found in 25% in present study but in Spanish population pattern II was found to be 39.7%, thus there is less chance of osteoarthritis and for calcaneal lengthening by osteotomy the, is extraarticular nature of the site i.e. the interval between anterior and middle facet pattern-II, is beneficial. However, in case of pattern I, because of fused facets, the osteotomy becomes an intrarticular procedure; hence, an alternative treatment plan is required. A fused articular facet predisposes an individual to osteoarthritis [4]. Also, in case of fused anterior and middle facet the articulation becomes more mobile due to increased surface area available for extended gliding of joint surfaces[f].

Pattern III was rarely found in the previous studies. In present studies, there was no incidence of pattern IV and V. A positive correlation was found between total length of calcaneum and interarticular facet distance. Advanced treatment procedures require detailed anatomical assessment of an individual; this is possible today with the aid of improvement of the technology, detailed anatomic information is important for advanced treatment procedures.

VI. Conclusion

There appears to be a significant difference between right and left side talar facets on calcaneum. To prove or disprove the hypothesis that right leggedness affects the facet development on the calcaneus needs investigation by including more specimens.

References

- [1]. Uygur M, Atamaz F, Celik S, Pinar Y, The types of talar articular facets and morphometric measurements of the calcaneus bone on Turkish race. Arch orthop trauma surg; 2009; 129:909-914
- [2]. Campos FF, Pellico LG. Talar articular facets (Facies articulares talares) in human calcanei. Acta Anat; 1989; 134:124-127.
- [3]. Brekke MK, Lieberman R, Wright E, Green DR. Posterior facet talocalcaneal coalition. J Am Podiatr Med Assoc; 2001; 91(8):422-426.
- [4]. R. Garg, S. Babuta, K. Mogra, R. Parashar, S. Shekhawat. Study of Variations in Pattern of Calcaneal Articular Facets in Human Tali in the Population of Rajasthan (India) People's Journal of Scientific Research Vol. 6(2), July 2013
- [5]. Kaur M, Kalsey G, Laxmi V: Morphological classification of tali on the basis of calcanean articular facets. PB Journal of Orthopedics; 2011; 12(1):57-60.
- [6]. Bruckner JS: Variations in the Human Subtalar Joint; Journal of Orthopaedic & Sports Physical Therapy; 1987; 8(10):489-494.

Result:



Fig 1 Pattern I (Right side) shows Anterior and middle Facets are continuous with each other & found in 23(76.67%)



Fig 2 Pattern I (Left side) shows Anterior & middle facets are continuous with each other & found in 18(60%)



Fig 3 Pattern II (Right side) shows anterior, middle and posterior facets are separate & found in 6(20%)



Fig 4 Pattern II (Left side) shows anterior, Middle and posterior facets are separate & found in 9(30%)



Fig 5 Pattern III (Right side) shows anterior facet is absent and middle and posterior are present found in 1(3.33%)



Fig 6 Pattern III (Left side) shows anterior facet are absent and middle and posterior are present found in 3(10%)