



Original communication

## Racial variation on articular surface of talus (astragalus) in North Indian population

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### ABSTRACT

Articular morphology, especially of the lower limb, can be modified by various stresses on bone like adoption of bipedal gait and erect posture resulting in variations of the skeleton. Effects of variations in posture like squatting, which are a part of lifestyle of certain populations, were studied on 147 tali of North Indian population and examined for differences with those from other geographic regions. The modifications were classified into nine types. The lateral squatting facet was the most frequently found variation (65.9%), the medial, combined and continuous squatting facets being 8.2%, 2.04% and 4.1%, respectively. Lateral (32.7%), medial (27.2%) and continuous (4.7%), trochlear extensions, and extensions of medial (39.4%) and lateral (12.9%) articular facets were also observed in the population studied. The findings of the present study were important markers which could help in determining the race of unidentified bones.

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### 1. Introduction

The articular morphology of human skeleton can be modified by various stresses resulting in remodeling of bone. Modifications are more frequent in the skeleton of the lower limb due to adoption of bipedal gait and erect posture. During locomotion, the foot is rarely dorsiflexed sufficiently enough to bring the anterior border of distal end of tibia in contact with dorsum of neck of talus. But squatting is a posture that involves hyperflexion at the hip and knee and hyperdorsiflexion at the ankle and subtalar joint.<sup>1–5</sup>

Habitual squatting, which is a posture depending on the lifestyle of individual populations, is associated with modifications of the talus in the form of squatting facets and extensions of its trochlear and malleolar surfaces. The presence of so called squatting facets on upper surface of neck of talus and on the corresponding part of anterior margin of inferior aspect of tibia was first described by Thomson in 1889.<sup>1</sup> Since then, a number of squatting facets have been found on the neck of the talus by a number of workers. Anterior extensions of trochlear and malleolar surfaces of the talus may also be present.

The present study was undertaken to investigate the variations and incidence of different types of squatting facets on the neck of talus in North Indian population which can then be used as a racial

marker for identification of bones of unknown race. The extensions of trochlear and malleolar surfaces were also noted.

### 2. Materials and methods

The study was done on 147 tali (96 left and 51 right) in Departments of Anatomy of Medical Colleges of Delhi. There was no apparent sign of physical or pathological damage in any of the tali. The tali were classified into nine types in the following way.<sup>5</sup>

- Class I – lateral squatting facet.
- Class II – medial squatting facet.
- Class III – combined (both medial and lateral) squatting facet.
- Class IV – continuous (gutter like) squatting facet.
- Class V – lateral trochlear extension.
- Class VI – medial trochlear extension.
- Class VII – continuous (medial, lateral, central) extension.
- Class VIII – anterior extension of lateral articular (malleolar) facet.
- Class IX – anterior extension of medial articular (malleolar) facet.

Squatting facet (medial or lateral) was identified as articular/smooth area present on dorsum of the neck which did not follow the line of curvature of trochlear surface and was either separated or not separated from this surface by a transverse ridge of bone not

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covered with articular cartilage. A true squatting facet faced upwards and slightly backwards as well as the AP diameter of a facet was usually concave. Even if the squatting facets were continuous with trochlear surface, they could be identified by the fact that the concavity of the facet changed abruptly to the convexity of the trochlear surface.<sup>6</sup> Only a true squatting facet articulated with anterior margin of inferior surface of tibia.<sup>7</sup>

Medial or lateral part of trochlear surface was often prolonged anteriorly on to the neck of talus, which always continued the anteroposterior curve (convexity) of the trochlear surface. Prolongations of the trochlear surface were defined as part of the surface anterior to a line drawn across the head of the talus perpendicular to the long axis of the foot, from the superoanterior margin of the lateral malleolar to the medial malleolar surface.<sup>6</sup> Extensions of the trochlear surface faced upwards and slightly forwards. These articulated only with the inferior (under) surface of tibia unlike squatting facet.<sup>7</sup>

The prolongation of articular surfaces (medial or lateral) of talus was considered if it extended beyond the level of anterior margin of trochlear surface.

### 3. Observation and results

Table 1 shows the classification of tali into nine types. The incidence of lateral squatting facet was 65.9% (Fig 1). The frequency was higher on the left side (71.9%) as compared to the right (54.9%). Medial squatting facet, however, had a very low incidence of 8.2%, more frequently so on right (9.8%) in comparison with left (7.3%) (Fig 2). Combined squatting facet was observed only in 2.04% with none of the left tali possessing it, the right being 5.9% (Fig 3). Continuous (gutter like) squatting facet was observed in 4.1% of the tali, the incidence being nearly similar on left 4.2% and right side (3.9%) (Fig 4). Lateral trochlear extension was seen in 48(32.7%) of the tali, the incidence being higher on right side (37.3%) when compared with left side (30.2%) (Fig 5). Medial trochlear extension was found in 27.2% which was more frequent on left (28.1%) than right (25.5%) (Fig 6). While studying continuous trochlear extension, it was seen in 7 (4.7%) tali with higher incidence on right (7.8%) (Fig 7). Extension of lateral articular facet was observed in 12.9%, its presence being more frequent in right tali (7.8%) (Fig 8). Medial articular surface extended more than normal in 39.4% (Fig 4). The lateral squatting facet showed maximum incidence of 65.9% when compared to other facets.

### 4. Discussion

The present study was done on 147 tali and variations on their articular surfaces were observed. These findings were classified into nine types namely [Class I–Class IX] (Table 1). There was no

**Table 1**  
Showing classification of tali in nine types.

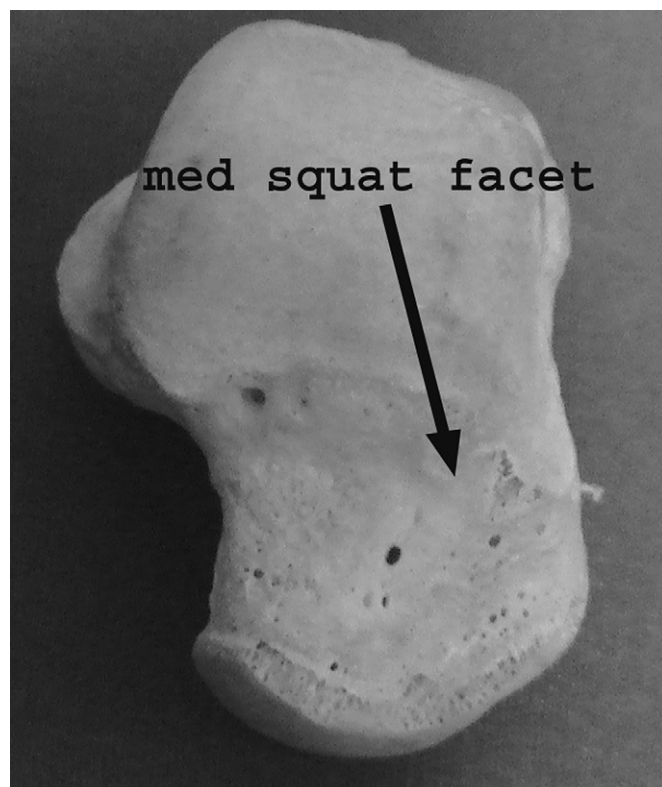
Classification	Left (96)	Right (51)	Total (147)
Class I – lateral squatting facet	69(71.9%)	28(54.9%)	97(65.9%)
Class II – medial squatting facet	7(7.3%)	5(9.8%)	12(8.2%)
Class III – combined (both medial and lateral) squatting facet	NIL	3(5.9%)	3(2.04%)
Class IV – continuous (gutter like) squatting facet	4(4.2%)	2(3.9%)	6(4.1%)
Class V – lateral trochlear extension	29(30.2%)	19(37.3%)	48(32.7%)
Class VI – medial trochlear extension	27(28.1%)	13(25.5%)	40(27.2%)
Class VII – continuous (medial, lateral, central) extension	3(3.1%)	4(7.8%)	7(4.7%)
Class VIII – lateral articular (malleolar) facet	4(4.2%)	15(29.4%)	19(12.9%)
Class IX – medial articular (malleolar) facet	31(32.3%)	27(52.9%)	58(39.4%)



**Fig. 1.** Talus showing lateral squatting facet (left side).

evidence of side dimorphism which was in accordance with the reports by Finnegan (1978) and Panteado et al. (1986) that non-metric traits of infracranial skeleton do not show any differences in observation with relation to side.<sup>8,9</sup>

Lateral squatting facet showed the maximum incidence (65.9%) in the present study similar to Das (1959) in UP population and Pandey and Singh (1990) who reported higher incidences of 41.5% and 83.2% for the same.<sup>5,10</sup> Findings of Charles in Indian and Thomson in Australian population were also in concordance with the present study (64% and 63.5%, respectively).<sup>13</sup> In contrast Singh (1959), Jeyasingh (1979) and Ogyucu et al. found a lower incidence of 28.6%, 3.5% and 37.7% in Indian and Byzantine population,



**Fig. 2.** Talus showing medial squatting facet (right side).

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