

Morphometric Study of Modifications over the Neck of Talus in Visakhapatnam Region of Andhra Pradesh State

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ABSTRACT

BACKGROUND

Talus is a very important bone among the skeleton of foot. Talus is a very common bone which undergoes some structural modifications due to prolonged habitual squatting postures. Structural alterations like squatting facets, trochlear extensions are observed over the dorsal aspect of the neck of the talus common type of squatting facets observed are medial squatting facets, lateral squatting facets, combined type of squatting facets. These are observed in specific group of people.

METHODS

Present study was conducted in 100 talus bones, which are procured from department of Anatomy, Andhra medical college, Visakhapatnam. Structural modifications like squatting facets, trochlear extensions are studied in all the bones.

RESULTS

Squatting facets are observed in most of the talus. but trochlear extensions are not observed in any of the talus. out of 100 talus, 54 tali are having lateral squatting facet, 4 tali are having a medial squatting facet, 16 tali showing combined type of squatting facet, 26 tali are not having any type of squatting facets. Out of 54 right sided taluses, 24 tali are having a lateral squatting facet, 3 tali are having medial squatting facet, 10 tali are having combined type of squatting facet, 17 tali are not having any type of squatting facet. Out of 46 left sided taluses, 30 tali are having lateral squatting facet, 1 talus is having a medial squatting facet, 6 tali are having combined type of squatting facets, 9 tali are not having any type of squatting facet.

CONCLUSIONS

Incidence of modifications over the neck of talus is very common in people who are having a rural background, those people are having a habitual squatting position. And these alterations may be due to genetic inheritance and several unexplainable reasons.

KEYWORDS

Talus, Squatting Facet, Habitual Squatting Posture, Lateral Squatting Facet, Medial Squatting Facet

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BACKGROUND

In a human being, foot plays the main role in weight bearing, locomotion and it also maintains the erect posture of a person. In humans, the foot is having 7 tarsal bones, which are very stronger & larger bones. These tarsal bones are very helpful in supporting and distributing the body weight. Among the tarsal bones, Talus is a very special bone, it's a key bone of foot & it is a 2nd largest bone among tarsals according to Last RJ,¹ McGreoger,² Strandring S,³ Talus is not having any muscular & tendinous attachments. It is homologous to scaphoid among carpals. Due to various types of abnormal positions, bones of foot undergo remodelling like alteration in outer aspect of bone, achieving the extra bony process like facets and bony extensions. Among the facets, Medial squatting facets, lateral squatting facets and combined type of squatting facets are very common. Combined type of facet is the presence of both medial squatting facets, lateral squatting facets in a single talus. Cranial deformations, sitting positions, overload bearing can alter the bone form and articular surfaces of small & large joints. Especially, habitual squatting posture results in altered morphology of bones of lower limb. In a squatting position, Hip and knee joints are hyper flexed, ankle and subtalar joints are hyperdorsiflexed.

In a habitual squatting, Neck of the talus and trochlear surface of talus show some modifications like squatting facets, trochlear extensions. These changes indicate, strong pressure & traction force over the ankle in hyperdorsiflexion position. Several researchers are performing their work, to determine several variations on surface of talus like breathnach's,⁴ Charles,⁵ Chakrabarthi's,⁶ Das,⁷ Dixit et al,⁸ Pandey et al,⁹ Sewell RB,¹⁰ Singh,¹¹ Thomson.¹²

Specially Thomson¹² [1889] is the 1st researcher, he describes the occurrence of squatting facets on upper surface of the neck of talus and distal end of tibia. Barnett¹³ [1954] also identifies 2 types of facets, [medial & lateral squatting facets over the neck of talus] and 2 types of trochlear extensions on the neck of talus. In the latter period several researchers doing their work on structural modifications over the neck of talus in various races of people, several groups of population, some of these findings are discussed in discussion part. Where is in the present study, mainly it is performed to find out any structural alterations of the neck of the talus like squatting facets, trochlear extensions, trochlear process in the Visakhapatnam and surrounding regions of Andhra Pradesh state.

Objectives

The present study, was performed to find out the type of structural modifications like presence of medial squatting facets, lateral squatting facets, combined type of squatting facets [presence of both medial squatting facet, lateral squatting facet] over the neck of talus due to abnormal squatting posture.

METHODS

Material which is used for the study is composed of 100 talus bones of unknown age from the department of Anatomy, Andhra medical college, Visakhapatnam of Andhra Pradesh State during 2019 and 2020, for a period of 2 years. Each and every talus is examined for presence of different type of squatting facets like medial squatting facets and lateral squatting facets and for any type of trochlear extension over the dorsal surface.

Lateral squatting facets are present over the lateral aspect of dorsal aspect of the neck of talus, medial squatting facets are present over the medial aspect of dorsal aspect of neck of talus and combined type of facets i.e. Medial squatting facets and Lateral squatting facets are also observed on both medial and lateral sides of talus and some of the talus are not showing any type of facets. All the 100 number of talus are numbered and photographed & labelled.

Statistical Analysis

Data is statistically analysed by using the GraphPad prism online calculator.

RESULTS

In our study, most of the tali are showing medial squatting facets, lateral squatting facets, combined type of squatting facets [presence of both medial and lateral squatting facets but even a single talus is not showing any type of trochlear extensions. Statistical analysis is performed by using GraphPad prism online calculator.

Among 100 talus, 54 tali [54%] were having lateral squatting facets, 4 [4%] are having medial squatting facet, 16 [16%] are having combined squatting facet and 26 [26%] tali are not having any type of squatting facet. P value for this result is 0.0001, it is a statistically significant observation. chi square value is 54.56, degree of freedom is 3.

Sl. No.	Type of Squatting Facet	Total No. of Talus (%)
1	Lateral squatting facet	54 (54%)
2	Medial squatting facet	4 (4%)
3	Combined squatting facet	16 (16%)
4	No facet	26 (26%)

Table 1. Number of Talus in Each Type of Squatting Facet

Type of Squatting Facet	Right[54]	Left [46]	Total [100]	Fisher Exact Statistic	P Value
Lateral squatting facet	24[24%]	30[30%]	54 [54%]	10.610	0.213
Medial squatting facet	3[3%]	1 [1%]	4 [4%]		
Combined squatting facet	10[10 %]	6[6%]	16 [16%]		
No facet	17[17%]	9[9%]	26 [26%]		

Table 2. Different Types of Squatting Facets in Right and Left Talus

Out of 100 tali bones, 54 are belongs to right side, among these right sided tali 24 [44.44%] are having lateral squatting facet, 3 [5.55%] tali are having a medial squatting facet, 10 tali [18.51%] are having combined

squatting facet and 17[31.48%] right tali are not having any type of squatting facet.

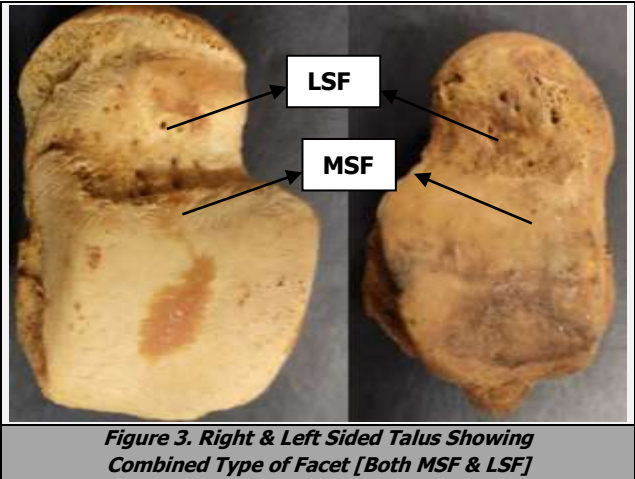
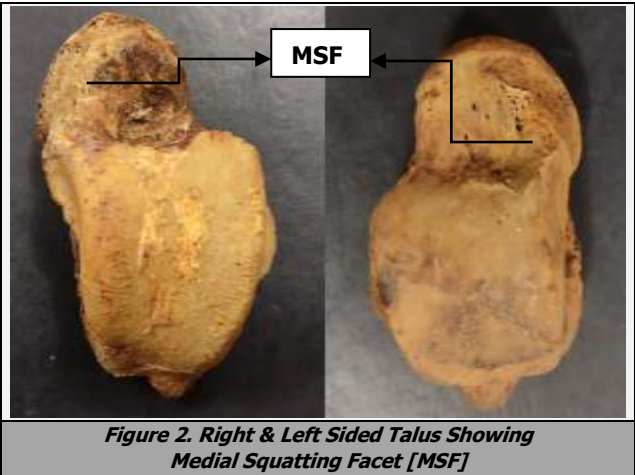
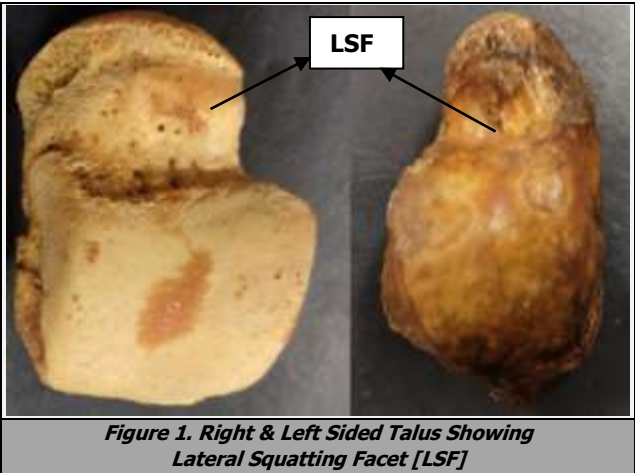
Among 100 taluses, 46taliare belongs to left side, among these 30[65.21%] tali are having lateral squatting facet,1[2.17%] talus is having a medial squatting facet, 6 [13.04%] tali are having a combined type of squatting facet and 9 [19.56%] tali are not having a squatting facet. p value for this result is 0.210769 ,it is a statistically insignificant finding.

Type of Squatting Facet	Male [56]	Female [44]	Total [100]	Fisher Exact Statistic	P Value
Lateral squatting facet	29[29%]	25 [25%]	54 [54%]	10.610	0.213
Medial squatting facet	3[3%]	1[1%]	4 [4%]		
Combined squatting facet	9[9%]	7 [7 %]	16 [16%]		
No facet	15[15%]	11 [11%]	26 [26%]		

Table 3. Different Types of Squatting Facets in Both Genders

Out of 100 taluses, 56 are male tali, among these 29 [51.78%] tali are having lateral squatting facet, 3 [5.35%] tali are having medial squatting facet, 9[16.07%] tali are having combined squatting facet, 15 [26.78%] tali are not having any squatting facet.

Among 100 tali bones,44 are female taluses, among these 25 [56.81%] tali are having lateral squatting facet, 1 [2.27%] talus is having medial squatting facet, 7[15.90%] tali are having combined squatting facet, 11 [25.00%] tali are not having any squatting facet. p value for this result is 0.865599,it is statistically insignificant finding.



DISCUSSION

Other Weight bearing bones like femur and tibia are also having articular facets which are larger when compared with articular facets of foot bones mainly talus, which is smaller in size. In relation to abnormal positions, mainly in squatting position, where severe dorsiflexion of foot is taken place which results in development of medial & lateral squatting facets, different types of trochlear extensions over the dorsum of the neck of the talus. In Indians, mainly in people belongs to rural areas have these different types of squatting facets [medial squatting facets and lateral squatting facets] very commonly, compared with town areas, metropolitan cities.

We are comparing our study results with other author results, which are depicted in the following table and widely illustrated.

Authors	Type of Population	Total no of Talus Studied	Presence of Medial Squatting Facet	Presence of Lateral Squatting Facet	Presence of Combined Squatting Facet	Absence of Squatting Facet
Thomson ¹² (1889)	European	25	-	1(4%)	-	-
Pfitzner ¹⁴ (1896)	European	840	-	1 (0.12%)	-	-
Wood ¹⁵ (1920)	European	118	2 (1.7%)	20 (17%)	-	-
Barnett ¹³ (1954)	European	100	0 (0%)	2 (2%)	-	-
Singh ¹¹ (1959)	Indian	300	0 (0%)	86 (28.6%)	-	-
Das ⁷ (1959)	Indian	200	8 (4%)	82 (41%)	6 (3%)	-
Pandey et al ⁹ (1990)	Indian (UP & BIHAR)	262	46 (17.6%)	218 (83.2%)	31(11.8%)	-
Oygucu et al ¹⁶ (1998)	Byzanthine	175	1 (0.6%)	66 (37.7%)	1(0.6%)	-
Jones et a ¹⁷ (2007)	Indian	44	14 (32%)	5 (11%)	-	-
Dixit et al ⁸ (2012)	Indian	147	12 (8.2%)	97 (65.9%)	3(2.04%)	-
Javia M et al ¹⁸ (2014)	Indian	221	6 (2.72%)	114 (51.58 %)	34(15.39%)	-
Rohingarg et al ¹⁹ [2021]	Indian	300	7.7%	136 [45.3%]	3.3%	-
Present study (2021)	Indian (Andhra Pradesh)	100	4 (4%)	54(54%)	16(16%)	26(26%)

Table 4. Showing Study Results of Different Authors

In a Thomson's¹² study, lateral squatting facet is seen only in 1 talus out of 25 [4%], whereas in present study lateral squatting facet is seen in 54 tali [54%], which is a very higher value compared with Thomson's study. In a Pfizner¹⁴ study, out of 840 taluses 1 talus [0.12%] is showing lateral squatting facet, he is not reporting any type of medial squatting facet, combined type of squatting facets, even though his study sample is larger than that is 840 in number, but in the present study 4% taluses show medial squatting facet, 54 % taluses show lateral squatting facet, 16 % taluses show combined type of squatting facet, 26 % taluses not having any type of squatting facet. In a Woods¹⁵ study, out of 118 taluses 2 taluses [1.7%] are having medial squatting facets, 20 taluses [17%] are showing lateral squatting facets, in the present study out of 100 taluses, 4 tali [4%] showing medial squatting facet, 54 [54%] tali are having lateral squatting facet, 16% taluses show combined type of squatting facet, 26 % taluses not having any type of squatting facets over the dorsal surface of neck of the talus, even though the sample of study is same in both the studies.

During 1954, in Barnett's¹³ study out of 100 taluses, 2 taluses [2%] are showing lateral squatting facets only, he is reported any other type of facets like medial squatting facets, combined type of squatting facets, but in the present study 54 tali [54%] showing lateral squatting facets, 4 tali [4%] showing medial squatting facet, 16 tali [16 %] showing combined type of squatting facet, 26 tali [26%] are not showing any type of squatting facets.

In a study by the Singh et al,¹¹ out of 300 taluses 86 taluses [28.6%] are showing lateral squatting facets even though his study sample larger, he is not reported any other modifications like medial squatting facet, combined type of squatting facets. But in the present study among 100 talus, 54 tali are having lateral squatting facets. Comparatively study sample of Singh et al is very high that is 300, but present study sample is only 100.

During 1959, in a study by the Das et al⁷ showing out of 200 taluses, 8 tali [4%] are having a medial squatting facet, 82 tali are [41%] having a lateral squatting facet, 6 [3%] taluses are having combined facets, but in present study 4 tali [4%] are having medial squatting facet, 54 tali [54%] are showing lateral squatting facet, 16 tali [16%] are having combined type of squatting facet [medial squatting facet, lateral squatting facets], 26 tali [26 %] are not having any type of squatting facets. Das study sample is 2 times to the present study sample, so study findings are correlate with the present study findings.

In a study by the Pandey et al,⁹ out of 262 taluses 46 [17.6%] are having a medial squatting facets, 218 [83.2%] are having a lateral squatting facets, 31 taluses [11.8%] are having combined squatting facets [medial squatting facets & lateral squatting facets]. Whereas in the present study 4 tali [4%] are having medial squatting facets, 54 tali [54%] are having lateral squatting facets, 16 tali [16 %] are having combined type of squatting facets [medial squatting facets and lateral squatting facets], 26 tali [26%] are not having any type of squatting facets.

In Oygucu et al¹⁶ study, out of 175 taluses, 1 talus [0.6%] is having medial squatting facet, 66 taluses [37.7%]

are having lateral squatting facets, 1 talus [0.6%] is having combined type of squatting facet [medial squatting facet, lateral squatting facet] whereas in the present study 4 tali [4%] are having medial squatting facets, 54 tali [54%] are having lateral squatting facets, 16 tali [16 %] are having combined type of squatting facets [medial squatting facets and lateral squatting facets], 26 tali [26%] are not having any type of squatting facets, Oygucu et al study findings are very close to present study finding seven though the study sample is higher.

In a study by the Jones et al,¹⁷ out of 44 taluses, 14 taluses [32%] are having medial squatting facets, 5 taluses [11%] are having lateral squatting facets. During 2012, a study by the Dixit et al⁸ showing out of 147 taluses, 12 taluses [8.2%] are having medial squatting facets, 97 taluses [65.9%] are having lateral squatting facets, 3 taluses [2.04%] are having combined type of squatting facets [medial squatting facets, lateral squatting facets]. Whereas in the present study 4 tali [4%] are having medial squatting facets, 54 tali [54%] are having lateral squatting facets, 16 tali [16 %] are having combined type of squatting facets [medial squatting facets and lateral squatting facets], 26 tali [26%] are not having any type of squatting facets.

In a study by the Mayank Javia M et al,¹⁸ out of 221 taluses, 6 taluses are [2.72%] having medial squatting facets, 114 taluses [51.58%] are having lateral squatting facets, 34 are [15.39%] having combined squatting facets [medial squatting facet and lateral squatting facets]. Javia M et al study sample is 2 times to present study sample, so the findings are much higher compare with present study. Whereas in the present study 4 tali [4%] are having medial squatting facets, 54 tali [54%] are having lateral squatting facets, 16 tali [16 %] are having combined type of squatting facets [medial squatting facets and lateral squatting facets], 26 tali [26%] are not having any type of squatting facets.

In a recent study by the Rohingarg et al,¹⁹ out of 300 taluses, lateral squatting facet was observed in 136 tali [45.3%], medial squatting was observed in 7.7% of taluses, combined type of squatting facet was observed in 3.3% of taluses.

But in the present study, out of 100 taluses, 4 tali [4%] are showing medial squatting facets, 54 [54%] tali are showing lateral squatting facets, 16 tali [16%] are showing combined type of squatting facets [medial squatting facet and lateral squatting facets], 26 tali [26 %] are not showing any type of squatting facets.

Among the right sided taluses which are 54 in number, 24 tali [44.44%] are showing lateral squatting facets, 3 tali [5.55%] are having medial squatting facets, 10 [18.51 %] tali are having combined type of squatting facets [medial squatting facet and lateral squatting facets], 17 tali [31.48 %] are not having any squatting facets.

Among left sided taluses which are 46 in number, 30 tali [65.21%] are showing lateral squatting facet, 1 talus [2.17%] is showing medial squatting facet, 6 taluses [13.04%] taluses are having combined type of squatting facet [medial squatting facet and lateral squatting facet], 9

taluses [19.56 %] are not showing any type of squatting facets.

In the Rohingarg et al study, study sample is very higher compare with the present study sample, so the incidence of presence of lateral squatting facets, medial squatting facets, combined type of squatting facet, absence of squatting facet is much higher than the present study.

In the Garg et al study, incidence of the presence of trochlear extensions [medial type, lateral type, continuous type] is higher, but in the present study, a single talus is not showing any type of trochlear extensions. Due to unknown reasons, any of the talus of study sample is not having any type of Trochlear extensions.

According to above data, presence of lateral squatting facets, medial squatting facets, combined type of facets are commonly present in Indian population compared with other countries. Particularly, in surrounding places of Visakhapatnam, which belongs to North Andhra Pradesh [Having a huge coastal area] comparatively having a little higher incidence of different types of squatting facets like lateral squatting facet, medial squatting facet, combined type of squatting facets [presence of medial squatting facets and lateral squatting facets], because they are having a more physical stress during habitual squatting posture. Due to this reason dorsal aspect of neck of talus having several types of structural modifications.

CONCLUSIONS

Presence of different type of squatting facets over the dorsum of the neck of the talus is indicating the type of lifestyle and habitual activities of people. The differences in the Presence of different types of squatting facets of a talus in different type of people may be due to migration of people, genetic inheritance, habitual squatting posture and due to any abnormal postures. They are having a more physical stress during habitual squatting posture, so they are more prone to the development of structural modifications. These observations of structural modifications are very useful to identify the race & rural background of the people of a particular region.

This type of important data is very useful for anatomists for performing different types of studies on the structural modifications of a talus, it is very useful for orthopedic surgeons because they are performing so many surgeries of a talus. This is useful for forensic experts for the identification of sex and age of a dead person / of a skeleton, this type of data is very informative to anthropologists for comparative studies.

Data sharing statement provided by the authors is available with the full text of this article at jebmh.com.

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REFERENCES

- [1] Last RJ. Osteology of the lower limb. In: Last's anatomy: regional and applied. 5th edn. The English language book society and Churchill Livingstone: Edinburgh & London 1973:p. 315.
- [2] McGregor AL, Du Plessis DJ. A synopsis of surgical anatomy, 10th edn. Chap 23. Bombay: K M Varghese Company 1969: p. 244.
- [3] Standring S. Ankle and foot. In: Gray's anatomy: the anatomical basis of clinical practice. Chap. 84. 40th edn. Elsevier Churchill Livingstone 2008: p. 1433.
- [4] Breathnach AS. The lower extremity, tibia, fibula and foot. Chap. 7. In: Frazer's anatomy of human skeleton. 6th edn. J and A Churchill Ltd 1965: p. 147.
- [5] Charles RH. Morphological peculiarities in the Punjabi and their bearing on the transmission of acquired characters. J Anat Physiol 1894;28(Pt 3):271-272.
- [6] Chakrabarti S, Chatterjee SK, Chakravarty A. Do Indians need to change their toilet habit? Annals of Indian Academy of Neurology 2000;4(3):187-189.
- [7] Das AC. Squatting facets of the talus in U.P. subjects. Journal of the Anatomical Society of India 1959;8(2):90-92.
- [8] Dixit SG, Kaur J, Kakar S. Racial variation on articular surface of talus (astragalus) in North Indian population. J Forensic Leg Med 2012;19(3):152-157.
- [9] Pandey SK, Singh S. Study of squatting facet/extension of talus in both sexes. Med Sci Law 1990;30(2):159-164.
- [10] Sewell RB. A study of the astragalus. J Anat Physiol 1904;38(Pt 3):233-47.
- [11] Singh I. Squatting facets on the talus and tibia in Indians. J Anat 1959;93(Pt 4):540-50.
- [12] Thomson A. The Influence of posture on the form of the articular surfaces of the Tibia and Astragalus in the different races of man and the higher apes. J Anat. Physiol. 1889;23(Pt 4):616-639.
- [13] Barnett CH. Squatting facets on the European talus. J Anat 1954;88(4):509-513.
- [14] Pfitzner W. Beitrage zur Kenntniss des menschlichen Extremitatenskelets VII. Morpholog. Arbeitenhrsg. V. G. Schwalbe, VI, 1896: p. 245.
- [15] Wood WQ. The tibia of the Australian aborigine. J Anat 1920;54(Pt 2-3):232-257.
- [16] Oygucu IH1, Kurt MA, Ikiz I, et al. Squatting facets on the neck of the talus and extension of the trochlear surface of the talus in late Byzantine males. J Anat 1998;192(Pt 2):287-291.
- [17] Jones K. Interpreting behavior from the human skeleton: looking at squatting facets. 2007.
- [18] Javia M, Changani M, Chudasama J, et al. Morphological study of squatting facets on the neck of the talus in Indian population. Journal of Research in Medical and Dental Science 2014;2(4):38-41.
- [19] Garg R, Shekhawat S, Mogra K, et al. Modifications on dorsum of neck of talus (Squatting Facets and Trochlear Extensions) in Indians. Acta Medica International 2015;2(1):100-104.