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Original Research Article

MORPHOMETRIC STUDY OF BONY PALATE AMONG DRY SKULLS OF SOUTH INDIA POPULATION

Sachin K S *[1], Divya P [2], Chaitra D [3], Martin LA [4].

[*1] Associate Professor, Department of Anatomy, K.V.G Medical College, Sullia, Dakshina Kannada, India.

[2] Lecturer, Department of Anatomy, K S Hegde Medical Academy, Mangaluru, India.

[3] Lecturer, Department of Anatomy, K S Hegde Medical Academy, Mangaluru, India.

[4] Professor, Department of Anatomy, K S Hegde Medical Academy, Mangaluru, India.

ABSTRACT

Background: Hard palate forms an important area in the skull, between the oral cavity and the nasal cavity. It is formed anteriorly by the palatine process of maxillae and posteriorly by the horizontal plates of palatine bones of both sides, forming a cruciform suture in the midline. The hard palate play a crucial role in articulation of speech and any significant variations in its morphology may lead to alterations in the speech of an individual.

Materials and Methods: The present study was conducted on 50 dry skulls of unknown sex and age obtained from the department of Anatomy, K S Hegde Medical Academy, Mangaluru. Various morphometric measurments were taken from the skull using digital vernier calipers.

Results: The length, breadth and height of the hard palate was 50.45mm±2.86mm, 39.38mm±2.28mm and 10.31mm±2.21mm respectively. The distance between the greater palatine foramen and middle maxillary suture was 14.80mm±1.14mm on right and 14.83mm±1.08mm on left side. The position of greater palatine foramen in 82% of the skulls was opposite 3rd molars and 18% was between 2nd and 3rd molars. The palatine index showed that, 66% were Leptostaphyline, 18% were Mesostaphyline and 16% were Brachystaphyline The palatine height index showed that 56% were Chamestaphyline, and 44% were Orthostaphyline.

Conclusion: The present study identifies the commonest location of greater palatine foramen to be opposite the 3rd maxillary molars which is useful for clinicians to perform procedures on palate. The morphometry is useful in comparing the skulls of various origin.

KEY WORDS: Hard palate, Maxilla, Molar tooth, Morphometry, Skull.

Address for Correspondence: Dr.Sachin K S, Associate Professor, Department of Anatomy, K.V.G Medical College, Sullia, Dakshina Kannada, Karnataka - 574327. Tel No: +91-9611206205.
E-Mail: drsachinks63@gmail.com

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INTRODUCTION

Hard palate forms an important area in the skull, between the oral cavity and the nasal cavity. It is formed anteriorly by the palatine process of maxillae and posteriorly by the horizontal plates of palatine bones of both sides, forming a cruciform suture in the midline [1]. The hard palate play a crucial role in articulation of speech and any significant variations in its morphology may lead to alterations in the speech of an individual. In the embryonic life, the palate develops as primitive palate and permanent

palate, the junction of which is represented by the incisive fossa. Hence, the contributions from both these parts are of paramount importance for the proper functioning of an individual.

Morphological studies of the cranial bones play an important role in the analysis of skeletal variations, in determining the population history and classification, in studying the relationships between population and in investigations of adaptive and behavioural significance of bone morphology [2].

Greater palatine foramen (GPF) forms an important anatomical landmark along the postero-lateral aspect of hard palate. It transmits the greater palatine nerve, a branch of maxillary division of fifth cranial nerve. It carries sensations from the posterior part of hard palate. Greater palatine foramen is of critical importance to dentists, ENT surgeons and maxillofacial surgeons who perform a number of procedures in this region like dental implant placements, local anaesthetic administration, Le Forte osteotomies, sino-nasal surgeries etc [3]. Hence, evaluation of the relative position of GPF is important for injection of local anaesthetic for optimal pain control in maxillofacial and dental surgeries [4].

The aim of the present study was to measure the dimensions of the hard palate ie., length, breadth and height, contribution of the pre-maxilla and the palatine process in formation of hard palate and position of greater palatine foramen. The observations derived from the present study will help the anthropologists to understand the racial and ethnic differences and the surgeons to localise the position of GPF for various procedures.

MATERIALS AND METHODS

The present study was conducted on 50 dry skulls of unknown sex and age obtained from the department of Anatomy, K S Hegde Medical Academy, NITTE (Deemed To Be University), Mangaluru. All the skulls were normal and edentulous. The following measurments were taken from the skull using vernier calipers.

· Length of Pre-maxilla (a).

· Length of palatine process of maxilla (b).

· Length of hard palate (c).

· Breadth of hard palate (d).

· Height of hard palate (h).

· Distance between GPF and middle maxillary suture (MMS) (e).

· Position of GPF.

Length of the hard palate was the distance between orale anteriorly (orale is the point at the anterior end of the incisive suture located between the sockets of the two medial maxillary incisors) and the posterior nasal spine posteriorly. Breadth of the hard palate was the distance between the inner borders of the sockets of upper second molars, endomolaria. Height of the hard palate was the maximum arching from the line connecting two endomolaria.

Palatine index and palatine height index were calculated using the following formulae.

· Palatine index = Breadth (d) / Length (c) x 100.

· Palatine height index = Height (h) / Breadth (d) x 100.

The results obtained were tabulated and statistically analysed.

Fig.1: Morphometric measurements of hard palate. a)Length of pre-maxilla. b) Length of palatine process of maxilla. d) Breadth of palate.

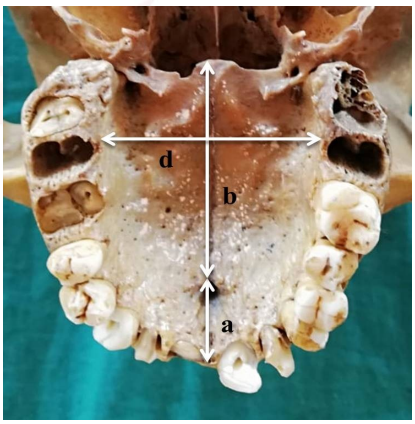
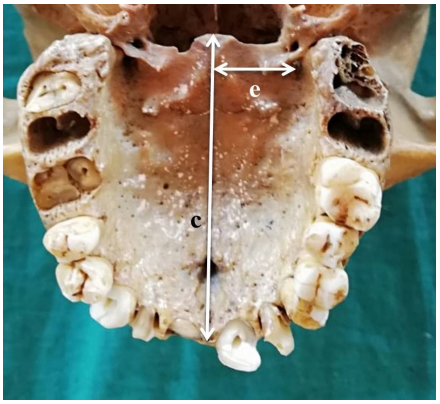


Fig. 2: Morphometric measurements of hard palate. c)Length of hard palate. e) Distance between greater palatine foramen and Middle maxillary suture.



RESULTS

The length of the pre-maxilla (a) in the present study was 10.86mm±2.06mm (Mean ± SD) and the length of palatine process of maxilla (b) was found to be 39.59mm±2.14mm (Mean ± SD) (Table 1). The length (c), breadth (d) and height (h) of the hard palate in the present study was found to be 50.45mm±2.86mm, 39.38mm± 2.28 mm and 10.31mm±2.21mm (Mean ± SD) respectively (Table 2)

Table 1: Contribution of pre-maxilla and palatine process of maxilla to hard palate.

	Mean	Standard Deviation
Length of Pre-maxilla (a)	10.86mm	2.06mm
Length of palatine process of maxilla (b)	39.59mm	2.14mm

Table 2: Measurements of Hard palate.

	Mean	Standard Deviation
Length of hard palate (c)	50.45mm	2.86mm
Breadth of hard palate (d)	39.38mm	2.28mm
Height of hard palate (h)	10.31mm	2.21mm

The distance between the GPF and MMS (e) in this study was found to be 14.80mm±1.14mm (Mean ± SD) on the right side and 14.83mm±1.08mm (Mean ± SD) (Table 3). In the present study, 82% of the skulls showed GPFs to be located opposite 3rd molars and the remaining 18% of skulls showed GPFs to be located between 2nd and 3rd molars. We dint find any skull showing GPFs located opposite 2nd molar in our study (Table 4).

Table 3: Distance between GPF and middle maxillary suture (e).

Right side		Left side	
Mean	Standard Deviation	Mean	Standard Deviation
14.80mm	1.14mm	14.83mm	1.08mm

Table 4: Position of GPF.

Position	Right side	Left side
Opposite 3rd molars	40 (80%)	42 (84%)
Between 2nd and 3rd molars	10 (20%)	08 (16%)
Opposite 2nd molars	-----	----
Total	50	50

The palatine index of the present study showed that, 66% of the skulls were narrow (Leptostaphyline), 18% of the skulls were intermediate (Mesostaphyline) and 16% of skulls were wide (Brachystaphyline) (Table 5). The palatine height index of the present study showed that, 56% of the skulls were low (Chamestaphyline), and the remaining 44% of the skulls were intermediate (Orthostaphyline). We dint find any sample with high palatine height index (Hypistaphyline) (Table 6)

Table 5: Palatine index.

	Samples (%)	Types
<80%	33 (66%)	Leptostaphyline
80-85%	09 (18%)	Mesostaphyline
>85%	08 (16%)	Brachystaphyline

Table 6: Palatine height index.

	Samples (%)	Types
<27.9%	28 (56%)	Chamestaphyline
28-39.9%	22 (44%)	Orthostaphyline
>40%	-----	Hypistaphyline

DISCUSSION

Among the studies in the past, Ajmani observed 64% of adult skulls had GPF located opposite 3rd molar tooth [5]. A study conducted by Saralaya and Nayak showed the same in 74% of skulls [6] while Bruno et al., observed it in 54% of skulls [7]. In our present study, GPF was found be opposite 3rd molar tooth in 82% of skulls and between 2nd and 3rd molars in 18% of skulls.

The distance between GPF and MMS in a study conducted by Ajmani was found to be 14.7mm on the right and 14.6mm on the left [5]. Saralaya reported it to be 14.7mm on both the sides [6]. Bruno R and colleagues reported the distance to be 14.68mm on the right and 14.44mm on the left side [7]. Westmoreland and Blanton had a mean of 14.8mm on the right and 15.0mm on the left [8] which was similar to the results obtained in our present study. The variation seen in the position of GPF may be attributed to the sutural growth between the maxilla and palatine bone. With the eruption of posterior teeth, the antero-posterior length of the palate increases [9].

A study by Hassanali on the African skulls of Kenya, the palatine index was found to be brachystaphyline in 43.2% of skulls. Palatine height index in the same study reported 40% of skulls to be chamestaphyline, 57% of skulls to be orthostaphyline and only 3% of skulls were hypistaphyline [10]. Study by Varalakshmi etal,

showed 66% of skulls were leptostaphyline, 18.5% were mesostaphyline and 15.5% were brachystaphyline [11] similar to the results obtained in our study. Palatine height index in a study by Varalakshmi etal showed 72.3% of skulls were chamestaphyline, 26.1% were orthostaphyline and remaining 1.6% were hypistaphyline [11]. In our study, 56% were chamestaphyline and the remaining 44% were orthostaphyline.

CONCLUSION

The present study identifies the commonest location of greater palatine foramen to be opposite the 3rd maxillary molars. This information will be useful to clinicians to block the greater palatine nerve at greater palatine foramen to perform various procedures on hard and soft palate. The knowledge on the morphometry of hard palate from the present study is useful in comparing the skulls of Indian origin with skulls of different races and ethnicity.

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Conflicts of Interests: None

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