International Journal of Research in Medical Sciences
Varalakshmi KL et al. Int J Res Med Sci. 2015 Sep;3(9):2210-2213
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20150603

Research Article

An osteological study of morphometry of hard palate and its importance

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Received: 19 June 2015
Accepted: 06 August 2015

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ABSTRACT

Background: The hard palate is an essential part of human skull, the detailed knowledge of which plays an important role in the passive articulation of speech.
Methods: The present study was conducted on 65 dry skulls from the department of anatomy, MVJMC & RH, Bangalore. With vernier caliper, palatine length, palatine breadth and heights were measured. Palatine index and palatine height index were calculated.
Results: Mean palatine length was 48.47 ± 4.66 mm. Mean palatine breadth was 36 ± 4.41 mm and height was 8.62 ± 2.76 mm. According to the palatine index range, 66% of the hard palate belongs to leptostaphyline, 18.5% belongs to mesostaphyline and 15. 5% was brachystaphyline. As per palatine height index, 72.3% of hard palate showed chamestaphyline followed by 26.1% orthostaphyline and 1.6% hypistaphyline.
Conclusions: These observations can be utilised for ethnic and racial classification of crania, anthropological studies, fabricating complete maxillary dentures for edentulous patients and performing certain surgical procedures in hard palate & soft palate.

Keywords: Hard palate, Palatine index, Palatine height index, Anthropological studies

INTRODUCTION

The palate forms the roof of the mouth and floor of nasal cavities. It is divisible into two regions namely the hard palate in front and soft palate behind. The hard palate is formed by the palatine process of the maxilla and the horizontal plates of palatine bones united by cruciform sutures.[1]

The knowledge of morphology of hard palate is important as it plays a major role in the passive articulation of speech.[2] Restricted development of hard palate is one of the cause for a condition known as sleep apnoea syndrome which is characterized by difficulty in breathing while sleeping.[3] Procedures such as nasopharyngoscopy and nasogastric intubation will need a precise knowledge of normal structure and dimensions of these regions for meticulous manipulation and better designing of instruments.[4]

Hence the present study was performed to determine the palatine length, breadth, height, and palatine index and palatine height index. These data will be useful to surgeons, clinicians, anatomists and anthropologists.

METHODS

65 adult skulls of unknown sex were procured from the department of anatomy, MVJMC & RH. With the help of

digital vernier caliper, the following measurements were taken.

1) Palatine length: Palatine length is the distance between the orale anteriorly (point at the anterior end of the incisive suture located between the sockets of two medial maxillary incisors) to posterior nasal spine posteriorly.

We measured palatine length by adding length of premaxilla and contribution from the palatine process of maxilla.

a) Length of premaxilla: is the distance from the orale to the posterior margin of incisive fossa.

b) Contribution from the palatine process of maxilla: is the distance from the posterior margin of incisive fossa to the posterior nasal spine.

2) Palatine width: distance between the inner borders of the sockets of the upper second molars (endomalaria).

3) Palatine height: is the maximum arching of palate from the line connecting the endomalaria.

4) Palatine index: was calculated by using the formula:

$$\frac{\text{Palatine breadth}}{\text{Palatine length}} \times 100$$

5) Palatine height index: was calculated by using the formula:

$$\frac{\text{Palatine height}}{\text{Palatine breadth}} \times 100$$

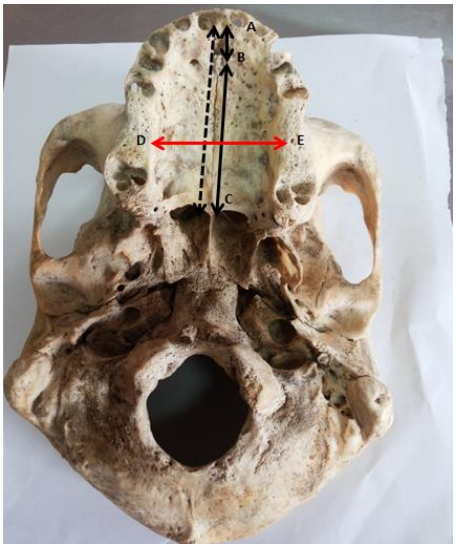

Figure 1: Showing hard palate: AB-length of premaxilla, BC-contribution from the palatine process of maxilla, AC (dotted line)-Palatine length, DE-Palatine breadth.

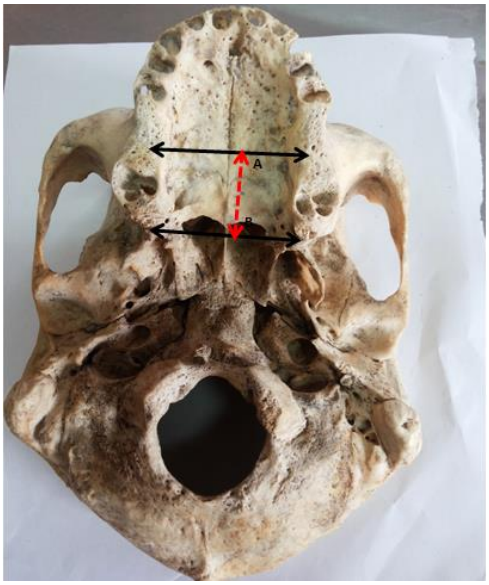

Figure 2: AB (dotted line) showing the measurement of palatine height (the maximum arching of palate from the line connecting the endomalaria).

RESULTS

In the present study the mean length of premaxilla is 8.56 ± 2.7 mm. Contribution from palatine process of maxilla for hard palate is 39.90 ± 3.85 mm. Mean total palatine length is 48.47 ± 4.66 mm. The mean breadth of hard palate is 36 ± 4.41 mm and height is 8.62 ± 2.19 mm.

The palatine index was calculated by using above formula and as per palatine index range the hard palate was classified into 3 types.

Type1: Leptostaphyline: Narrow palate with palatine index <80%.

Type 2: Mesostapyline: Intermediate palate with palatine index 80-85%.

Type 3: Brachystaphyline: Wide palate with palatine index >85%.

Table 1: Types of palatine index.

Type of palate	Number (%)
Lepto staphylline	43 (66%)
Mesostaphylline	12 (18.5%)
Brachystaphylline	10 (15.5%)

The palatine height index was calculated. According to the palatine height index there are 3 types of hard palate.

Chamestaphyline-palatine height index <27.9%.

Orthostaphyline-palatine height index between 28.0-39.9.

Hypistaphyline-palatine height >40%.

Table 2: Palatine height index.

Types of palate	Number (%)
Chamestaphyline	47 (72.3%)
Orthostaphyline	17 (26.1%)
Hypistaphyline	1 (1.6%)

DISCUSSION

The hard palate is the important part of skull forming the anterior part of base.[5] Developmentally, hard palate consist of two parts namely, primitive palate and permanent palate. The primitive palate is formed by the fusion of the globular swelling of medial nasal process and maxillary process. The permanent palate is developed from the fusion of palatine process of both maxilla across the midline.[6] In adults, the junction between primitive and permanent palate is represented by incisive fossa which may be altered in condition like cleft palate.[7] So, in the present study we have measured the length of premaxilla (primitive palate) as well as contribution from palatine process of maxilla.

The comparison of our study with the other authors suggests that our values are close to the observation by Antony Sylvian D'Souza and Badal S.

Table 3: Comparison of present study with other studies.

Palatine dimensions (mean) in mm	Antony Sylvian D'Souza	Badal et al.	Dave et al.[8]	Erli Sarilita[9]	Present study
Palatine length	49.13	49.74	43.54	52.2	48.47
Palatine Breadth	40.04	37.75	33.83	37.97	36.0
Palatine Height	8.00	-	9.87	11.54	8.62

In the present study palatine index was calculated and as per palatine index range the hard palate was classified into 3 types. Majority of hard palate in our study exhibited leptostaphyline (66%), followed by mesostaphyline (18.5%) and brachystaphyline (15.5%). These results of our study are consistent with the study by Dave et al. which showed 63% of leptostaphyline, 24% of mesostaphyline and 13% of brachystaphyline. Study by Jotania et al. and Erli Sarilita showed predominant leptostaphyline followed by equal number of mesostaphyline and brachystaphyline where as in a study by Antony Sylvian D'souza showed brachystaphyline more predominant.

The knowledge of palatine index is important because high and narrow palate has been reportedly associated with many syndromes such as Apert syndrome, Turner's syndrome, Marfan syndrome, Franceschetti-Teacher-Collins syndrome.[3]

In our study according to palatine height index, 72.3% skulls had low (chamestaphyline), 26.1% skulls had intermediate (orthostaphyline) and 1.6% had deep (hypistaphyline) palates. On a study on Kenyan African skulls by Hassanali showed showed majority of orthostphyline (57%) followed by chamestaphyline (40%) and hypistaphyline.[10]

A knowledge of palatine index and palatine height index will be helpful in comparing the Indian skulls with those from various other regions as well as skulls of different races.[8] Hard palate is preserved even in severe damages to skull for studying sexual dimorphism.[11]

CONCLUSION

Anatomical and morphometric knowledge of hard palate is advantageous in many fields of medical science. Since there are few studies available on the hard palate, it is hoped that the sharing of the present study on morphometry of hard palate may be helpful for surgeons, anatomists, anthropologists and forensic experts.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Varalakshmi KL, Sangeeta MM, Naik SN, Acharya A. An osteological study of morphometry of hard palate and its importance. Int J Res Med Sci 2015;3:2210-3.