



A MORPHOMETRIC ANALYSIS OF PALATAL INDICES IN ADULT HUMAN CRANIA OF EAST INDIAN ORIGIN

Anatomy

Dr. Sanchita roy

Assistant Professor, Department of Anatomy, Nilratan Sircar Medical College, Kolkata, West Bengal.

ABSTRACT

In the present study, 96 skulls (60 male and 36 female) from different medical colleges of West Bengal were examined to obtain morphometric measurements of hard palate. The mean palatal length, breadth and height were found to be 47.26mm, 31.93mm and 8.13mm respectively. Based on palatal index, majority of skulls had narrow palates (91.6% males, 100% females). Based on palatal height index, 65.63 were chemostaphyline, 33.29% orthostaphyline and 2.08% hypsistaphyline palates. This data is not only useful in comparing skulls of various races but also bears importance in dentistry and operations of congenital malformations of palate.

KEYWORDS

Palate, Morphometry, Palatal index, Palatal height index.

INTRODUCTION:

The basal aspect of the human skull presents anteriorly with the osseous palate. The palate forms the roof of the mouth and floor of the nasal cavity, also partially separating the oral and nasal parts of the pharynx. The complete palate is characteristic of mammals, and its development is associated with the ability to suck and help in proper articulation of sounds. Developed within the superior alveolar arch it is formed by the fusion of maxillary palatine process and palatine horizontal plates that meet in a cruciform suture.

The bony palate is arched both sagittally and transversely; with variable dimensions which form an important landmark in racial comparison. This variation has attracted attention of both anthropologists and forensic experts. According to Sylvian and Mamtha¹ cephalometric studies on hard palate are especially useful for dental, plastic and paediatric surgeons in the fields of prosthetic dentistry, reconstructive faciomaxillary surgery, repair of cleft palate and treatment of obstructive sleep apnoea syndrome. Patel M² suggests that precise knowledge of palatal structure and dimensions are required for procedures such as nasopharyngoscopy and nasogastric intubation and for meticulous manipulation for better instrument designing.

The present work determines the length, breadth and height of hard palate and throws light on palatal index and palatal height index as well. Though previous works have been conducted on metric parameters of hard palate, very little emphasis has been laid on skulls of East Indian origin. This study is specially aimed to provide metrical data on palatal dimensions of East Indian skulls with the objective of ethnic, racial and sexual comparison.

MATERIALS AND METHODS:

The study design was conducted on 96 (60 male and 36 female) dry, well preserved and fairly intact adult crania available from the department of Anatomy as well as from undergraduate MBBS students of various medical colleges across West Bengal. All skulls were assumed to be from Eastern Indian origin. Skulls with broken palates were excluded. All measurements were taken by a pair of vernier calipers and values were recorded in mm up to 2 decimal point. The following parameters were measured based on the method suggested by Hassanali and Mwaniki³ in 1984.

- Palatal breadth- distance between the inner borders of the sockets of two maxillary 2nd molars.
- Palatal length- distance from the oral cavity anteriorly to the posterior nasal spine.
- Palatal height- the vertical distance of maximum arching of the palate from the line connecting the two maxillary 2nd molars which were connected by a probe.



Photograph of adult dry skull where line AB is palatal length and line CD is palatal breadth.

The palatal indices were calculated as follows:

Palatal index (PI) = palatal length/palatal breadth x 100

Palatal height index = palatal height/ palatal breadth x 100

The maximum and minimum value, mean and standard deviation (SD) of all parameters were calculated for the total sample as well as for male and female skulls separately. Values of both sexes were analyzed and p value less than 0.05 was considered significant.

Based on palatal index, skulls are classified as;

- Leptostaphyline (narrow palate)- PI < 79.9
- Mesostaphyline (intermediate palate)- PI between 80 to 84.9
- Brachystaphyline (wide palate)- PI > 85

Based on palatal height index, skulls are classified as;

- Chemostaphyline (low palate)- PHI < 27.9
- Orthostaphyline (intermediate palate)- PHI between 27.9 to 39.9
- Hypsistaphyline (deep palate)- PHI > 40

Such classification was expressed as percentage of the entire sample and also separately for both sexes. The mean and SD were recorded.

RESULTS:

The following observations of various parameters of hard palate were tabulated as below:

Table 1- The parameters and indices of hard palate

Parameter	Total Sample (n=96)	Sex		P value	Significance
		Male (n=60)	Female (n=36)		
	Mean ± SD	Mean ± SD	Mean ± SD		
Palatal breadth	31.9 ± 0.43	33.46 ± 0.35	29.53 ± 0.23	P<0.001	Highly significant
Palatal Length	47.2 ± 0.44	48.13 ± 0.36	45.7 ± 0.42	P< 0.01	Significant
Palatal height	8.13 ± 0.24	8.50 ± 0.23	7.5 ± 0.22	P<0.05	Probably significant
Palatal index (PI)	67.74 ± 7.33	69.61 ± 7.07	64.63 ± 6.71	P<0.001	Highly significant
Palatal height index (PHI)	25.58 ± 6.98	25.69 ± 6.54	25.42 ± 7.57	P<0.05	Probably significant

Table 2: Classification of hard palate based on palatal index (PI)-

Type	Palatal Index	Male skulls	Female Skulls	Total sample
Leptostaphyline	< 79.9	55/60 = 91.60%	36/36 = 100%	91/96 = 94.79%
Mesostaphyline	80 – 84.9	5/60 = 8.33%	0/36 = 0.00%	5/96 = 5.20%
Brachystaphyline	> 85	0/60 = 0.00%	0/36 = 0.00%	0/96 = 0.00%

Table 3 : Classification of hard palate based on Palatal height index (PHI)-

Type	Palatal height index	Male skulls	Female skulls	Total sample
------	----------------------	-------------	---------------	--------------

Chemestaphyline	< 27.9	39/60 = 65.00%	24/36 = 66.66%	63/96 = 65.62%
Orthostaphyline	28 – 39.9	19/60 = 31.66%	12/36 = 33.33%	31/96 = 32.29%
Hypsistaphyline	>40	2/60 = 3.33%	0/36 = 0.00%	2/96 = 2.08%

DISCUSSION:

The mean length, breadth and height of East Indian palates in the study sample were 47.26mm, 31.93mm and 8.13mm respectively. This was significantly smaller than Kenyan skulls in Hassanali's study where these parameters were recorded as 4.92cm, 4.02cm and 1.22cm respectively³. South Indian skulls studied by Varalakshmi and Sangeeta⁴ found the mean values of palatal length, breadth and height as 48.47mm, 36.00mm and 8.62mm while the same parameters stand at 43.54mm, 33.83mm and 9.87mm for studies conducted on skulls from central India by Dave and Gupta⁵. Variations in dimensions in male and female skulls in the present study were found to be statistically significant. This information on morphometry of hard palate is extremely useful in orthodontic planning such as upper tooth extraction, maxillary dental implants, hemi-maxillectomy, orthognatic surgery, Le Fort fracture management and cleft lip surgery as stated by Sarilita and Soames⁶.

This study sample of East Indian skulls found that based on palatal index, majority of skulls had Leptostaphyline or narrow palates (91.6% male; 100% female) while only 8.33% male skulls had mesostaphyline or intermediate palates. None of the skulls had brachystaphyline or wide palates. These findings stand different from studies conducted in South Indian skulls by Vasudha and Ramesh⁷ and in skulls from central India by Abhilasha and Rajeshree⁸ where brachystaphyline palates comprised of 17.95% and 4.61% respectively.

Based on palatal height index, the present study had 65.62% Chemestaphyline palates, 33.29% orthostaphyline palates and 2.08% hypsistaphyline palates. These findings bear similarity with study on South Indian skulls which showed 72.3%, 26.1% and 1.6% of chemestaphyline, orthostaphyline and hypsistaphyline palates⁴.

Knowledge of palatal index and palatal height index will be useful in comparing skulls based on race and ethnicity and are of immense importance to anthropologists and forensic experts. While variations in dimensions may be genetically predetermined, but racial variations in eating habits and environmental factors may have profound effects. Moulding by muscular activity after birth to adolescence might also influence the shape of the hard palate.

CONCLUSION:

Studies on palatal morphometry are not only useful in forensic studies, taxonomy and predicting the race and sex of individual or skeletal remains but also very significant in fabricating maxillary dentures and surgeries on congenital anomalies of palate. Although studies have been conducted in skulls of southern and central Indian origin, much focus has not been laid on northern and Eastern Indian population. This study was an attempt to throw some light on the palatometry of East Indian skulls.

REFERENCES

1. Sylvian AD, Mamtha H, Nayak J. Morphometric analysis of hard palate in South Indian skulls. *Biomed Res.* 2012;23(2):173-5
2. Patel M. A study of the hard palate in the skulls of central Indian population. *Int J PharmaBio Sci.* 2012;3(2):527-33
3. Hassanali J, Mwaniki D. Palatal analysis and osteology of the hard palate of the Kenyan African skulls. *Ant Rec* 1984;209: 273-280.
4. Varalakshmi KL, Sangeeta M, Shilpa N. Naik, Arunashri Acharya. An osteological study of morphometry of hard palate and its importance. *Int J Res Med Sci.* 2015;3(9):2210-2213.
5. Dave MR, Gupta S, Vyas K, Joshi HG. A study of palatal indices and bony prominences and grooves in the hard palate of adult human skulls. *NJIRM.* 2013;4(1):7-11.
6. Vasudha K, Ramesh BR. Palatometry in South Indian skulls and its clinical implications. *Int J Anat Res* 2017;5(1):3362-66.
7. Sarilita E, Soames R. Morphology of the hard palate: a study of dry skulls and review of the literature. *Rev Arg de Anat Clin.* 2015;7(1):34-43.
8. Abhilasha M, Rajeshree A. A study of palatal indices and foramina in the hard palate of adult human skulls in Central India region. *Int J Anat Res.* 2019; 7(2.1): 6397-03.