



## A STUDY OF NORMAL ANATOMY OF HARD PALATE IN SOUTH INDIAN POPULATION

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### ABSTRACT

The hard palate is an essential part of human skull. It forms the roof of the mouth and floor of nasal cavities. The detailed knowledge of hard palate plays an important role in the passive articulation of speech. The present study was conducted on 30 skulls of which 17 were male cases and 13 female cases collected from the department of Anatomy, Gandhi Medical College, Secunderabad, Telangana state, India. The measurements of palatine length, breadth and height were recorded. Palatine index and palatine height index were calculated using standard formulae. Mean palatine length in male and female cases were 54.18 and 48.0mm respectively. Mean palatine breadth was 34.0 and 32.54mm and height 15.76 and 13.15mm respectively. Mean palatal length showed a highly significant difference between male and female cases. Palatal breadth and height showed no significant difference between both sexes. However, the average values of palatine length, breadth and height in male cases were higher compared to female cases. Palatal Index and Palatal Height Index showed no significant differences between both genders.

**KEY WORDS:** Hard palate, palatine index, palatine height index.



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## INTRODUCTION

The palate forms the roof of the mouth and floor of nasal cavities. It separates the oral and nasal cavities as well as the nasopharynx. It extends posteriorward into the pharynx. It consists of two parts: hard palate and soft palate. Anterior two thirds is represented by the hard palate and the posterior one third by the soft palate. The hard palate is formed by the palatine process of the maxilla and the horizontal plates of palatine bones united by cruciform sutures<sup>1</sup>. It is a bony structure that forms the division between the oral and nasal cavities<sup>2</sup>. The harmonious growth of the face and the proper development of breathing, sucking, chewing, swallowing and speech depend on the balance of the hard palate with the other structures of the sensory-motor-oral system. The knowledge of morphology of hard palate is important as it plays a major role in the passive articulation of speech<sup>3</sup>, therefore osteological and morphological variations in the bony palate is of great clinical significance. Abnormal development of the hard palate is one of the causes for a condition known as sleep apnoea syndrome which is characterized by difficulty in breathing while sleeping<sup>4</sup>. For the formation of the palate both premaxilla and permanent palate contribution is paramount<sup>5</sup>; which may be altered in conditions like cleft palate. The objective of the present study was to measure the osteometric data for Indian population and to find out any sexual dimorphism in the hard palate of the skulls. In view of this it is aimed to measure the length, breadth and height of the bony palate. It was found that data regarding the measurements of palate are scanty. Therefore the

current study was undertaken. In the present study various dimensions such as palatine length, breadth and height were measured and palatine index and palatine height index were determined. This data may be useful to surgeons, clinicians, anatomists and anthropologists. Measurements were made to the nearest millimeter. The instruments used in present study for the measurements were a metallic scale (having calibrations of 0.5 millimeter), Vernier Calipers and protractor.

## MATERIALS AND METHODS

The present study was conducted in the department of Anatomy, Gandhi Medical College, Musheerabad, Secunderabad, Telangana state, India. The present study was conducted in 30 skulls of Indian population with normal hard palate. The specimens were collected from the Department of Anatomy, Gandhi Medical College, Secunderabad, Telangana, India. With the help of various traits, we have first determined the probable sex of the skull. When the skull revealed more points in favour of male, it was considered male and the same criteria was followed for female skull. Out of 30 (N = 30) specimens 17 (N = 17) were male skulls and 13 (N = 13) female and they were designated as S1, S2, S3, --- up to S30 for each specimen. Various parameters of the hard palate viz., length, breadth and height were taken using digital Vernier Calipers with 0.01 mm of resolution and  $\pm 0.02$  mm of precision. In addition, two indices were calculated using palatal breadth, height and length<sup>6</sup>. Local ethical committee approval was obtained for the study.

Palatine index was determined by using the formula:  $\text{Breadth/Length} \times 100$ .

Palatine height index was determined using the formula:  $\text{Height/Breadth} \times 100$ .

Each reading was repeated twice to rule out any manual error. All the findings were tabulated and statistically analyzed.

## RESULTS

The mean, minimum and maximum values of the observations of length, breadth and height recorded in male and female palates are presented in Table 1.

**Table 1**  
**Mean palatal length, breadth, height in male (N = 17) and female (N = 13) palates of Indian population**

Sex	Male (N = 17)			Female (N = 13)		
	Mean	Min	Max	Mean	Min	Max
Length (mm)	54.18	52.0	56.0	48.0	46.0	51.0
Breadth (mm)	34.0	32.0	35.0	32.54	32.0	33.0
Height (mm)	15.76	13.0	17.0	13.15	11.0	15.0

*Min- minimum, max- maximum.*

The average palatal length presented in Table 1 shows that the average values for male and female cases were 54.18 and 48.0mm respectively. The range for male cases was 52.0 to 56.0mm and for female 46.0 to 51.0mm. The average value for male cases was significantly higher as compared with the female cases ( $p < 0.05$ ). The average of palatal breadth presented in

Table 1 indicates that the average values of male and female cases were 34.0 and 32.54mm respectively. The range for male cases was 32.0 to 35.0mm while for female it was 32.0 to 33.0mm. The average value for male cases was not significantly higher compared with the female cases ( $P > 0.05$ ). The average values for height of male and female cases were 15.76mm and

13.15mm respectively. The range for male cases was 13.0 to 17.0mm and for female it was 11.0 to 15.0mm.

The average value for male cases was not significantly higher compared with the female cases ( $p > 0.05$ ).

**Table 2**  
**Mean Palatal Index in male and female palates (N = 30)**

Sex	N	Mean	Minimum	Maximum
Male	17	62.75	59.25	65.38
Female	13	67.79	64.70	69.56

*N = number of specimens*

The average palatal index presented in Table 2 shows that the average values for male and female cases were 62.75 and 67.79 respectively. The range for male cases was 59.25 to 65.38 while for female it was 64.70 to 69.56. There was no statistically significant difference observed in the palatal index of male and female cases ( $P > 0.05$ ).

**Table 3**  
**Mean Palatal height Index in male and female palates (N = 30)**

Sex	N	Mean	Minimum	Maximum
Male	17	46.35	40.63	48.57
Female	13	40.41	34.38	45.45

*N = number of specimens*

The average palatal height index presented in Table 3 indicates that the average values for male and female cases were 46.35 and 40.41 respectively. The range for male cases was 40.63 to 48.57 and for female it was 34.38 to 45.45. No significant difference was found in the palatal index of male and female cases ( $P > 0.05$ ).

## DISCUSSION

The present study was conducted on thirty skulls of South Indian region. Various measurements of the hard palate viz., length, breadth and height were recorded. The purpose of this study was to stabilize the data collected from South Indian population and find out if there is any sexual dimorphism. Clinical significance of this study will be advantageous for the better assessment of anatomy of the bony palatal inadequacy patients, with speech problems, which result from abnormalities in the palate and the velopharyngeal port. The hard palate is very important part of the skull forming the anterior part of base<sup>7</sup>. Developmentally, the hard palate consists 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 hard palate is important for feeding and speech. Mammals with a defective hard palate due to inability to suckle may die shortly after birth. It is also involved in mastication in many species. The interaction between the tongue and the hard palate is essential in the formation of certain speech sounds. Significant differences were recorded between male and female in mean palatal length, ranging from 52.0 to 56.0mm and 46.0 to 51.0mm respectively (Table 1). However, no significant differences were observed in palatal breadth and palatal height among both genders. Palatine index and palatal

height index recorded in the present study are consistent with the observations of Hassanali and Mwaniki<sup>8</sup> and Dave, Gupta, Vyas and Joshi<sup>9</sup>.<sup>10</sup> Robert, Sandman, Burton, Shaprio and Robert, Gorlin also studied the palatal measurements in Minnesota. They considered the palatal index measurements in the adults were significantly different between male and female cases. In present study the palatal length showed statistically significant sexual dimorphism. The other parameters studied also showed higher values in male skulls compared to those of female skulls however, showed no statistical significant difference. The values are presented in the Tables 1-3. 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<sup>9</sup>. Hard palate is preserved even in severe damages to skull for studying sexual dimorphism<sup>11</sup>.

## CONCLUSION

In many fields of medical science anatomical and morphometric knowledge of hard palate is advantageous. Since there are few studies available on the hard palate, it is hoped that the present study on morphometry of hard palate may be helpful for surgeons, anatomists, anthropologists and forensic experts. The present study results showed that the mean palatal, length, breadth and height of the hard palate in the skulls of Indian population were slightly different from those mentioned in the earlier studies. The length of the hard palate was found to be significantly higher in male cases compared to those of female cases of Indian population. However, there was no significant difference observed in the palatal index and palatal height index of male and female cases.

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