

MORPHOLOGICAL AND MORPHOMETRIC ANALYSIS OF THE HARD PALATE AND THE GREATER PALATINE FORAMEN IN DRY ADULT SOUTH INDIAN SKULLS

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ABSTRACT

Introduction: The morphometric measurements of the hard palate is very much essential while performing orthognathic surgeries, cleft palate surgery, for preoperative evaluation of patients with uvulopalatopharyngoplasty, Naso pharyngoscopy and nasogastric intubation. The precise knowledge on the location of greater palatine foramen is essential to block the maxillary nerve in pterygopalatine fossa for various diagnostic and therapeutic purposes. Thus the study was conducted on the morphometric analysis of the hard palate and greater palatine foramen.

Materials and Methods: The study sample was consisting of 58 adult South Indian skulls. The length and width of hard palate were measured by using digital vernier calipers. The Palatine index, palatine size was calculated from the length and width. The distance from the center of the greater palatine foramen to the mid sagittal plane and the distance from the center of the greater palatine foramen to posterior border of the hard palate was also measured and recorded.

Results: The average length and width of the hard palate was 49.87 ± 3.54 mm 34.42 ± 2.09 mm respectively. In the present study, 95% of the palates were leptostaphyline type and only 5% were mesostaphyline type. The average distance between the center of greater palatine foramen to the mid sagittal plane was 14.78 ± 1.08 mm and 14.75 ± 1.03 mm respectively on the right and left sides. There was no statistically significant difference between the right and the left sides.

Conclusion: The precise knowledge on the morphometry of hard palate and the location of the greater palatine foramen would be useful in dental and surgical practices while dealing with oral and maxillofacial region.

KEY WORDS: Hard Palate, Greater Palatine Foramen, Maxillary Nerve, Pterygopalatine Fossa, Palatine Index.

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INTRODUCTION

The palate forms the roof of the mouth and consisting of bony (Hard) palate anteriorly and

soft palate posteriorly. The bony palate is formed by the palatine processes of the maxillae anteriorly and the horizontal plates of the palatine

bones posteriorly. It is bounded by tooth bearing superior alveolar arch on its anterolaterally. The intermaxillary suture is present between the two palatine processes of the maxilla, the interpalatine suture is present between the two horizontal plates of palatine bone and the palatomaxillary suture is present between the palatine processes of the maxilla and horizontal palate of the palatine bones which together form the cruciform suture. The greater palatine foramen is located posterolaterally on either side of the bony palate which represents the lower end of the greater palatine canal. It transmits the greater palatine vessels and nerve from the pterygopalatine fossa [1].

Morphometry of the palate forms the fundamental basis for the treatment planning of orthodontic conditions such as orthognathic surgeries, maxillary dental implants, Hemi- maxillectomy, Le Fort fracture management, cleft palate surgery and also useful for preoperative evaluation of patients with uvulopalato pharyngoplasty [2,3]. The proper knowledge of the normal size and structure of this region is needed while performing some meticulous procedures such as Naso pharyngoscopy and nasogastric intubation and also needed for the better designing of instruments [4].

Several methods are in use to produce regional anesthesia of the maxillary arch in which the most commonly described method is that the needle is inserted into the greater palatine foramen and injecting the local anesthetic solution into the pterygopalatine fossa where the trunk of the maxillary nerve lies [5-7]. By depositing anesthetic solution in the pterygopalatine fossa the sensations of the maxillary nerve would be blocked and provides anesthesia of the area distributed by its branches especially maxillary teeth, the maxillary palate and gingival tissues of the upper jaw, as well as the skin of the mid face, nasal cavity, and sinus. Blocking of maxillary nerve would be preferred in the diagnosis and treatment of maxillary trauma, oral and maxillofacial pain syndromes. The infections in this region may be contraindicated for the simple infiltration of anesthetic solution into the buccal sulcus, adjacent to the tooth.⁸ Thus the present study was carried out on the morphometry of hard palate and the

location of the greater palatine foramen which would be used in dental and surgical practices.

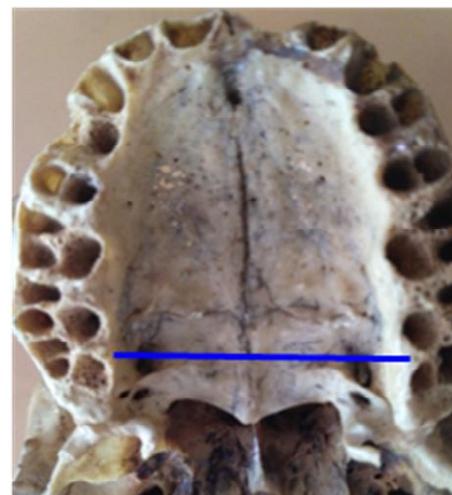
MATERIALS AND METHODS

The study sample was consisting of 58 adult South Indian skulls. All the skulls were looked for any damage or pathology of the hard palate and those skulls were excluded from the study. The length and width of hard palate were measured by using digital vernier calipers. The length of the hard palate was measured from the Orale to the Staphylion (Figure 1). The orale is the point located between the two medial maxillary incisors on the median plane. Staphylion is the point on the posterior nasal spine where a straight line joining the deepest notches of the posterior margin of the palate which cuts the midsagittal plane). The width of the palate was measured from the inner borders of the sockets of upper second molars to the endomolaria (Figure 2).

Fig. 1: The black line showing the length of the hard palate.



Fig. 2: The blue line showing the width of the hard palate.

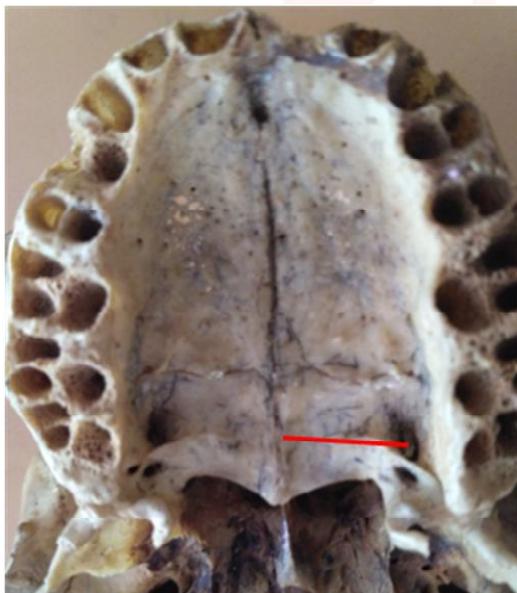


Palatine index: The Palatine index (PI) was calculated by Palatine width/ Palatine length X100. The PI was classified according to the Hassanali and Mwaniki method. The PI is the ratio of the palatine width to the palatine length expressed as a percentage. Based on the PI the palates were classified as leptostaphyline, mesosta-phyline and brachystaphyline. Leptostaphyline is the narrow palate where the PI range was 79% or less. Mesostaphyline is the intermediate type where the PI range was 80–84.9%, and Brachystaphyline is the wider palate where the PI range was 85% or more.

Palatine size: The Palatine size was calculated by palatine length X palatine width / 100.

Greater palatine foramen: The distance from the center of the greater palatine foramen to the mid sagittal plane was measured and recorded (Figure 3).

Fig. 3: The red line showing the distance between the mid sagittal plane and the center of the greater palatine foramen.



RESULTS

The length of the hard palate was ranging from 42.83 to 57.26mm with an average length of 49.87 ± 3.54 mm. The width of the hard palate was ranging from 29.62 to 39.03mm with an average width of 34.42 ± 2.09 mm. The Palatine index was ranging from 63.40 to 80.00 with an average index of 69.88 ± 3.76 and the Palatine size was ranging between 12.68 and 21.32 with an average of 17.15 ± 2.04 . In the present study, 95% of the palates were leptostaphyline type and only 5% were mesostaphyline type.

The distance between the center of greater palatine foramen to the mid sagittal plane was ranging from 12.72mm to 16.58mm on its right side and 13.23mm to 16.77mm on its left side. The average distance between the center of greater palatine foramen to the mid sagittal plane was 14.78 ± 1.08 mm on right side and 14.75 ± 1.03 mm on the left side. There was no statistically significant difference between the right and the left sides.

DISCUSSION

Morphometric parameters measured and analyzed in the present study is very important to determine the race of human skull and also useful for surgical repair of cleft palate, for maxillary nerve block for the maxillo-facial surgeries and for orthodontic procedures [10]. The previous studies reported that the hard palate was narrow in mouth breathing children when compared to nose breathing children. An increase in the hard palate depth in the canine teeth was also observed in habitual mouth-breathing children. Thus quantitative assessment of dimensions of hard palate would help in diagnosis of morphological changes in hard palate [11].

Majority of the palates were of leptostaphyline type (Narrow palate) which was coinciding with Erli Sarilita et al., where they found it in 84% skulls. Vasudha Kulkarni et al., found Brachystaphylin type (Broad palate) in 86.9% skulls. The average length of the palate was 49.87 ± 3.54 mm and the width was 34.42 ± 2.09 mm which was similar to the study by Erli Sarilita et al., where they have found it as 52.2 ± 3.2 mm and 37.97 ± 3.32 mm respectively. Vasudha Kulkarni et al., reported the palatal length and breadth as 40.4mm and 44.2mm respectively. In the present study the length was more than the breadth but Vasudha Kulkarni et al., have reported that the length of the palate was shorter than the breadth [12,13].

Location of the greater palatine foramen may vary due to the sutural growth occurring between the maxilla and palatine bones and also the anteroposterior dimension of the palate increases with the eruption of the posterior teeth [14]. In the present study, the average distance between the center of greater palatine foramen

to the mid sagittal plane was $14.78 \pm 1.08\text{mm}$ on right side and $14.75 \pm 1.03\text{mm}$ on the left side which is similar to the other Indian studies by Saralaya and Nayak where they have found it as 14.7mm on the both sides [15]. Ajmani reported a distance of 14.7mm on the right and 14.6mm on the left in Indian skulls and of 15.4mm from the sagittal plane in Nigerian skulls which is little larger than the Indians [16]. Bruno R Chrcanovic reported 14.68mm on the right side and 14.44mm on the left side in Brazilian skulls which were similar to the present study and also coinciding with another south Indian study by Antony Sylvan D'Souza where they have found it as $14.6 \pm 1.47\text{mm}$ on the right side and $14.4 \pm 1.40\text{mm}$ on the left side [17,18].

CONCLUSION

The quantitative assessment of dimensions of the hard palate and the location of greater palatine foramen would help in dental and maxilla facial surgical practices while dealing with oral and maxillofacial surgeries and orthodontic procedures.

Conflicts of Interests: None

REFERENCES

- [1]. Standring S, Borley NR, Collins P, Crossman AR, Gatzoulis MA, Healy JC, Johnson D, Mahadevan V, Newell RL, Wigley K. Gray's anatomy: the anatomical basis of clinical practice. Chapter 26 & 30 External Skull & Oral cavity, 40th ed. London: Churchill Livingstone; 2008:414&502.
- [2]. 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.
- [3]. Sean M. Caples, James A. Rowley, Jeffrey R. Prinsell, John F. Pallanch, Mohamed B. Elamin, Sheri G. Katz, and John D. Harwick. Surgical Modifications of the Upper Airway for Obstructive Sleep Apnea in Adults: A Systematic Review and Meta-Analysis *Sleep.* 2010;33(10):1396–1407.
- [4]. Patel M. A study of the hard palate in the skulls of central Indian population. *Int J Pharma Bio Sci.* 2012;3(2):527-33.
- [5]. Baddour, H. M.; Hubbard, A. M. & Tilson, H. B. Maxillary nerve block used prior to awake nasal intubation. *Anesth. Prog.,* 1979;26(2):43-5.
- [6]. Malamed, S. F. & Trieger, N. Intraoral maxillary nerve block: an anatomical and clinical study. *Anesth. Prog.,* 1983;30(2):44-8.
- [7]. Mercuri, L. G. Intraoral second division nerve block. *Oral Surg. Oral Med. Oral Pathol.,* 1979;47(2):109-13.
- [8]. Howard-Swirzinski K, Edwards PC, Saini TS, Norton NS. Length and geometric patterns of the greater palatine canal observed in cone beam computed tomography. *Int J Dent* 2010;143–149. Article ID 292753
- [9]. Hassanali J, Mwaniki D. Palatal analysis and osteology of the hard palate of the Kenyan African skulls. *Anat Rec* 1984;209:273–280.
- [10]. Stanley F Malamed, Norman Trieger. Intraoral Maxillary Nerve Block: an anatomical and clinical study. *Anesthesia progress.* 1983;44-48.
- [11]. Luana Cristina Berwig, Ana Maria Toniolo da Silva, Eliane Castilhos Rodrigues Côrrea, Anaelena Bragança de Moraes, Márlon Munhoz Montenegro. Hard palate dimensions in nasal and mouth breathers from different etiologies. *J Soc Bras Fonoaudiol.* 2011;23(4):308-14.
- [12]. Vasudha Kulkarni, Ramesh BR. Palatometry in South Indian skulls and its clinical implications. *Int J Anat Res.* 2017;5(1):3362-66
- [13]. 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.
- [14]. Slavkin HC, Canter MR, Canter SR. An anatomical study of the pterygomaxillary region in the craniums of infants and children. *Oral Surg* 1966;21:225-235.
- [15]. Saralaya V, Nayak SR .The relative position of the greater palatine foramen in dry Indian skulls. *Singapore Med J* 2007;48:1143-1146.
- [16]. Ajmani ML. Anatomical variation in position of the greater palatine foramen in the adult human skulls. *J Anat* 1994;184:635-637.
- [17]. Bruno R. Chrcanovic, Antonio L. N. Custodio. Anatomical variation in the position of the greater palatine foramen. *Journal of Oral Science* 2010;52(1):109-113.
- [18]. Antony Sylvan D'Souza, H. Mamatha, Nayak Jyothi. Morphometric analysis of hard palate in south Indian skulls. *Biomedical Research* 2012;23(2):173-175.

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