

THE MORPHOMETRIC STUDY OF GREATER PALATINE FORAMEN IN DRY ADULT SKULLS

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ABSTRACT

Blocking of the maxillary division of the trigeminal nerve or its branches for local anaesthesia is a common practice in maxillofacial surgery. The route utilized in the oral cavity is through the GPF to enter the palatine canal, which contains palatine nerves and vessels. Hence the accurate knowledge about the localisation of the greater palatine foramen is important for maxillofacial and dental surgeons.

The study was carried out on 100 adult dry human unsexed skulls in the North Karnataka State and the direction of the opening, shape, position (in relation to maxillary molar teeth) of the GPF (Greater Palatine Foramen) and the mean distances of GPF from the MMS (Midline Maxillary Suture), IF (Incisive Fossa) and PBHP (Posterior Border of Hard Palate) were studied and the number of Lesser palatine foramen were also noted. All the measurements were taken bilaterally. The measurements were taken with the help of Vernier calliper. The Mean Distance of GPF from the MMS(shortest perpendicular distance), IF, PBHP were 14.23mm(millimetre), 34.3mm, 4mm respectively. In 74.5% of cases the GPF was situated in the anterior half of third Maxillary Molar teeth. In 68% of cases the foramen was opening in anteromedial direction and in 96% of cases Ovoid shaped GPF is observed. The number of LPF (Lesser Palatine Foramen) varied from 1-3 bilaterally and in about 6% of cases the LPF was absent on right side. These data will be helpful for Surgeons while performing maxillofacial surgeries, also anaesthetist while performing a maxillary nerve block and also useful for anthropological, racial and ethnic studies

Keywords: Greater Palatine Foramen, Maxillofacial Surgeries

INTRODUCTION

The hard palate is situated within the superior alveolar arch, the palatine processes of the maxillae and the horizontal plates of the palatine bone together form the Hard palate. The greater palatine foramina which are two in number lie near the lateral palatal border of the transverse palatine suture. The greater palatine foramen (GPF) conducts the greater palatine vessels and nerve. The knowledge of the position of the greater palatine foramen (GPF) is important for maxillofacial and dental surgeons, since posterior palate is anaesthetised for various surgical procedures

Blocking of the maxillary division of the trigeminal nerve or its branches for local anaesthesia is a common practice in maxillofacial surgery. The maxillary nerve block is also an effective method of achieving profound anaesthesia of the hemimaxilla.

The following 3 techniques may be used to perform a maxillary nerve block:

- High tuberosity approach
- Greater palatine canal approach through Greater palatine foramina
- Coronoid approach

The greater palatine canal approach blocks the maxillary nerve as it travels through the pterygopalatine fossa. This approach is associated with a higher rate of success; however, it is contraindicated if the canal cannot be located or negotiated. Hence the detailed knowledge about the position of the greater palatine foramen (GPF) is important for enhancing the anaesthetic injection technique in the posterior palate for optimal pain control in maxillofacial and dental surgeries. Therefore this study is aimed at determining the relative distance, direction and variations location of GPF to the midline.

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MATERIALS AND METHODS

The present study was conducted in the Department of Anatomy, KBN Medical College Gulbarga. The study was carried out on 100 adult dry human unsexed skulls which were collected from KBN Medical College as well as from M.R Medical College Gulbarga. All the skulls had fully erupted third molar teeth, and were free of any pathological changes. All the measurements were taken bilaterally with the help of Vernier caliper and the values mentioned are in (millimetre) mm. The direction of the opening of the GPF into the oral cavity was found with the help of a flexible steel wire. After collecting all data, results were analyzed and values of mean & standard deviation [SD] were calculated using Microsoft Office Excel 2007.

The following measurements were taken

1. The shortest perpendicular distance from greater palatine foramen (GPF) to midline maxillary suture (MMS)
2. The distance of GPF from the incisive fossa (IF)
3. Distance of GPF from the posterior border of the hard palate (PBHP)
4. Relationship of the GPF with maxillary molar teeth
5. Direction of opening of the GPF into the oral cavity
6. Shape of the GPF
7. Number of lesser palatine foramina (LPF)

RESULTS AND DISCUSSION

Table 1: Showing the mean and standard deviation (SD) of the distances of GPF from the MMS, IF, PBHP and the number of lesser palatine foramen on the right and left side

Measurements	Right		Left		Total	
n-100	Mean	±SD	Mean	±SD	Mean	±SD
GPF to MMS(mm)	14.18	1.3	14.28	1.37	14.23	1.33
GPF to IF(mm)	34.25	2.23	34.28	2.16	34.3	2.19
GPF to PBHP(mm)	3.92	0.85	4	0.85	4	0.85
Number of LPF	1.48	0.76	1.58	0.57	1.53	0.67

Table 2: Showing the relationship of the GPF with maxilla molar

Relation to maxillary molars N = 100	Right n%	Left n%	Total n-%
Anterior half of 3 rd molar	76%	73%	74.5%
Between 2 nd & 3 rd molar	12%	10%	11%
Anterior half of 2 nd molar	02%	04%	3%
Posterior half of 3 rd molar	10%	13%	11.5%
Total	100	100	200

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Table 3: Direction of opening of the GPF into the oral cavity

Directions of GPF	Right n_ %	Left n_ %	Total n_ %
Anteromedial	66	70	68
Anterior	30	30	30
Anterolateral	4	-	2

Results

Table-1 Shows the mean and standard deviation (SD) of the distances of GPF from the MMS, IF, PBHP and the number of Lesser palatine foramen on the right and left side. The mean distance of GPF to the MMS on the right was 14.18mm and left side is 14.28mm. The mean distance of GPF to IF on the right side was 34.25mm and on the left side 34.28mm. While the distance of the GPF from the PBHP on the right side was 3.92mm and on left side was 4mm. The above mentioned values clearly show that values on the left side are higher than that on the right side. The number of LPF on right side were 1.48 and on left side 1.58. The lesser palatine foramen on both sides were not symmetrical and varied from 1-3 on both sides and in 6% cases the LPF was absent on Right side.

Table- 2 Shows the relationship of GPF to the maxillary molars. In majority of the skulls (74.5%), the GPF was found in the anterior half of the 3rd maxillary molar tooth. In 11% of the skulls, the GPF was located between 2nd and 3rd molar teeth. In 11.5% cases the foramen was situated behind the 3rd molar tooth and in only 3% of the skulls, the GPF was present at the level of anterior half of 2nd maxillary molar.

Table- 3 Shows the direction of opening of GPF into oral cavity. In about 68% of the skulls, the direction of the foramen was anteromedial. In 30% of the skulls, the direction was anterior and in only 2% of the skulls, the direction of foramen was anterolateral.

Discussion

Table 4: The mean distance between MMS to GPF

Author	Right	Left
Westmoreland <i>et al.</i> , (1982)	14.8	15
Ajmani (1994)	14.7	14.6
Methathrathip <i>et al.</i> , (2005)	16.2	16.2
Saralaya <i>et al.</i> , (2007)	14.7	14.7
Vinay K.V.((2012)	14.8	14.8
Present study (2013)	14.2	14.3

Table- 4: Westmoreland *et al.*, (1982) reported the distance from GPF to MMS as 14.8mm on the right side and 15.0mm on the left side. Ajmani (1994) reported a distance 14.7mm on the right and 14.6mm on the left side in Indian skulls. Methathrathip *et al.*, (2005) reported 16.2mm (Thai skulls), Saralaya *et al.*, (2007), 14.7mm and Vinay (2012), 14.8mm on both right and left side. The present study values are less

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when compared to other studies. From the above data we can clearly say that the GPF is consistently located 14–15mm from the middle maxillary suture in the Indian skulls.

Table: 5 The mean distance between IF to GPF

Author	Right	Left
Saralaya <i>et al.</i> , (2007)	37.2	37.3
Vinay K.V.(2012)	36.6	35.7
Present study (2013)	34.25	34.28

Table- 5: The present study values are slightly less when compared with the values of Saralaya *et al.*, (2007) and Vinay *et al.*, (2012)

Table: 6 The mean distance between GPF to PBHP

Author	Right	Left	Total
Westmoreland <i>et al.</i> , (1982)	-	-	1.9
Ajmani (1994)	-	-	3.7
Methathrathip <i>et al.</i> , (2005)	-	-	2.1
Saralaya <i>et al.</i> , (2007)	4.2	4.2	4.2
Vinay K.V.(2012)	3.58	3.56	
Present study (2013)	3.92	4	4

Table- 6: Westmoreland *et al.*, (1982) found a mean distance of GPF from the PBHP as 1.9mm, Ajmani, (1994) reported as 3.7mm in Indian skulls, Saralaya *et al.*, (2007) as 4.2mm and Methathrathip *et al.*, (2005) as 2.1mm whereas Vinay *et al.*, (2012) reported 3.58mm on right and 3.56mm on left side. In the present study the mean distance on the right side was 3.92mm and on the left side it was 4mm. Here the present study values comparable with the values of Saralaya *et al.*, (2007).

The LPF was present bilaterally in 94% skulls whereas in 6% cases the LPF was absent on Right side. The number of LPF ranged between 1 and 3, with an average of 1.48 and 1.58 on the Right and Left sides, respectively. The corresponding findings of Saralaya *et al.*, (2007) were slightly higher (1.8 on Right side and 1.9 on Left side) when compared with our values, whereas our mean values were a bit higher when compared with Namita and Garud (2013) who reported the mean value 1.39 to 1.43 on the right and left side.

Saralaya *et al.*, (2007) reported the unilateral absence of LPF on Left side in 2 skulls where as Namita and Garud (2013) reported bilateral absence of LPF in 2 skulls and unilateral absence in 12 skulls.

Table: 7 Relationship of the GPF with maxilla molar

Author n- %	Opposite 3 rd Molar	Between 2 nd 3 rd Molar	& Posterior 3 rd Molar	to Posterior to 2 nd Molar
Ajmani (1994)	64.69	32.35	0	2.9
Methathrathip <i>et al.</i> , (2005)	64.40	23.10	6.9	5.6
Saralaya <i>et al.</i> , (2007)	74.60	24.20	0.4	0.80
Vinay K V(2012)	76	19	1.33	3.67
Present Study	76	12	10	2

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Table- 7: Our present values are comparable with Saralaya *et al.*, (2007) and Vinay *et al.*, (2012) that in majority of the cases(<74%) the position of GPF is opposite to 3rd molar and then in about 20% it was between 2nd & 3rd molar.

Regarding the shape of GPF, the ovoid pattern is predominant in the present study (96%) and round in only 4% cases, when compared with others, Methathrathip *et al.*, (2005) reported; 82.4% ovoid, 12.8% lancet or slit and 4.8% round-shaped GPF in Thai skulls whereas Jaffar & Hamadah, (2003); reported 97.08% ovoid-shaped GPF in Caucasian skulls. By this we can say that ovoid shape of GPF is the most predominant one.

The direction of opening of GPF in the present study is anteromedial in 68%, anterior in 30% and anterolateral in 2% of cases. Ajmani (1994) reported, the opening of GPF anteromedially in 91.4% of Indian skulls whereas Saralaya *et al.*, (2007) reported, the opening of GPF anteromedially in 46.2% and anterior in 41.3% cases.

CONCLUSION

Since a significant difference in the different parameters were found in studies when compared with other authors from different region of world, this clearly indicates that anthropologically, the positions of the GPF differ among ethnic groups. Even the studies carried out in India by (Westmoreland *et al.*, (1982); Ajmani, (1994) Saralaya *et al.*, (2007) in different regions of the country, variations are seen among the different parameters. This indicates that a large anatomical variation may also exist in the same population. This data will be helpful in comparing the skulls with those from various other regions as well as skulls of different races. The data of the present study will also be helpful for clinicians anaesthetists and as well as for maxillofacial surgeons.

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