MORPHOMETRIC STUDY OF BONY PALATE AMONG DRY SKULLS OF SOUTH INDIA POPULATION

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ABSTRACT

Background: Hard palate forms an important area in the skull, between the oral cavity and the nasal cavity. It is formed anteriorly by the palatine process of maxillae and posteriorly by the horizontal plates of palatine bones of both sides, forming a cruciform suture in the midline. The hard palate play a crucial role in articulation of speech and any significant variations in its morphology may lead to alterations in the speech of an individual.

Materials and Methods: The present study was conducted on 50 dry skulls of unknown sex and age obtained from the department of Anatomy, K S Hegde Medical Academy, Mangaluru. Various morphometric measurements were taken from the skull using digital vernier calipers.

Results: The length, breadth and height of the hard palate was 50.45mm±2.86mm, 39.38mm±2.28mm and 10.31mm±2.21mm respectively. The distance between the greater palatine foramen and middle maxillary suture was 14.80mm±1.14mm on right and 14.83mm±1.08mm on left side. The position of greater palatine foramen in 82% of the skulls was opposite 3rd maxillary molars and 18% was between 2nd and 3rd molars. The palatine index showed that, 66% were Leptostaphyline, 18% were Mesostaphyline and 16% were Brachystaphyline. The palatine height index showed that 56% were Chamestaphyline, and 44% were Orthostaphyline.

Conclusion: The present study identifies the commonest location of greater palatine foramen to be opposite the 3rd maxillary molars which is useful for clinicians to perform procedures on palate. The morphometry is useful in comparing the skulls of various origin.

KEY WORDS: Hard palate, Maxilla, Molar tooth, Morphometry, Skull.

INTRODUCTION

Hard palate forms an important area in the skull, between the oral cavity and the nasal cavity. It is formed anteriorly by the palatine process of maxillae and posteriorly by the horizontal plates of palatine bones of both sides, forming a cruciform suture in the midline [1]. The hard palate play a crucial role in articulation of speech and any significant variations in its morphology may lead to alterations in the speech of an individual. In the embryonic life, the palate develops as primitive palate and permanent...
palate, the junction of which is represented by
the incisive fossa. Hence, the contributions from
both these parts are of paramount importance
for the proper functioning of an individual.

Morphological studies of the cranial bones play
an important role in the analysis of skeletal
variations, in determining the population history
and classification, in studying the relationships
between population and in investigations of
adaptive and behavioural significance of bone
morphology [2].

Greater palatine foramen (GPF) forms an impor-
tant anatomical landmark along the postero-
lateral aspect of hard palate. It transmits the
greater palatine nerve, a branch of maxillary
division of fifth cranial nerve. It carries sensa-
tions from the posterior part of hard palate.
Greater palatine foramen is of critical impor-
tance to dentists, ENT surgeons and maxillo-
facial surgeons who perform a number of
procedures in this region like dental implant
placements, local anaesthetic administration, Le
Forte osteotomies, sino-nasal surgeries etc [3].

Hence, evaluation of the relative position of GPF
is important for injection of local anaesthetic
for optimal pain control in maxillofacial and
dental surgeries [4].

The aim of the present study was to measure
the dimensions of the hard palate i.e., length,
breadth and height, contribution of the pre-
maxilla and the palatine process in formation
of hard palate and position of greater palatine
foramen. The observations derived from the
present study will help the anthropologists to
understand the racial and ethnic differences and
the surgeons to localise the position of GPF for
various procedures.

MATERIALS AND METHODS

The present study was conducted on 50 dry
skulls of unknown sex and age obtained from
the department of Anatomy, K S Hegde Medical
Academy, NITTE (Deemed To Be University),
Mangaluru. All the skulls were normal and eden-
tulous. The following measurements were taken
from the skull using vernier calipers.

- Length of Pre-maxilla (a).
- Length of palatine process of maxilla (b).
- Length of hard palate (c).

- Breadth of hard palate (d).
- Height of hard palate (h).
- Distance between GPF and middle maxillary
  suture (MMS) (e).
- Position of GPF.

Length of the hard palate was the distance
between orale anteriorly (orale is the point at
the anterior end of the incisive suture located
between the sockets of the two medial
maxillary incisors) and the posterior nasal spine
posteriorly. Breadth of the hard palate was the
distance between the inner borders of the sock-
et of upper second molars, endomolaria. Height
of the hard palate was the maximum arching
from the line connecting two endomolaria.

Palatine index and palatine height index were
calculated using the following formulae.

- Palatine index = Breadth (d) / Length (c) x 100.
- Palatine height index = Height (h) / Breadth
  (d) x 100.

The results obtained were tabulated and statis-
tically analysed.

Fig. 1: Morphometric measurements of hard palate.
   a) Length of pre-maxilla. b) Length of palatine process of
   maxilla. d) Breadth of palate.

Fig. 2: Morphometric measurements of hard palate.
   c) Length of hard palate. e) Distance between greater
   palatine foramen and Middle maxillary suture.
RESULTS
The length of the pre-maxilla (a) in the present study was 10.86mm±2.06mm (Mean ± SD) and the length of palatine process of maxilla (b) was found to be 39.59mm±2.14mm (Mean ± SD) (Table 1). The length (c), breadth (d) and height (h) of the hard palate in the present study was found to be 50.45mm±2.86mm, 39.38mm±2.28mm and 10.31mm±2.21mm (Mean ± SD) respectively (Table 2).

Table 1: Contribution of pre-maxilla and palatine process of maxilla to hard palate.

<table>
<thead>
<tr>
<th></th>
<th>Mean (mm)</th>
<th>Standard Deviation (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of Pre-maxilla (a)</td>
<td>10.86</td>
<td>2.06</td>
</tr>
<tr>
<td>Length of palatine process of maxilla (b)</td>
<td>39.59</td>
<td>2.14</td>
</tr>
</tbody>
</table>

Table 2: Measurements of Hard palate.

<table>
<thead>
<tr>
<th></th>
<th>Mean (mm)</th>
<th>Standard Deviation (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of hard palate (c)</td>
<td>50.45</td>
<td>2.86</td>
</tr>
<tr>
<td>Breadth of hard palate (d)</td>
<td>39.38</td>
<td>2.28</td>
</tr>
<tr>
<td>Height of hard palate (h)</td>
<td>10.31</td>
<td>2.21</td>
</tr>
</tbody>
</table>

The distance between the GPF and MMS (e) in this study was found to be 14.80mm±1.14mm (Mean ± SD) on the right side and 14.83mm±1.08mm (Mean ± SD) (Table 3). In the present study, 82% of the skulls showed GPFs to be located opposite 3rd molars and the remaining 18% of skulls showed GPFs to be located between 2nd and 3rd molars. We dint find any skull showing GPFs located opposite 2nd molar in our study (Table 4).

Table 3: Distance between GPF and middle maxillary suture (e).

<table>
<thead>
<tr>
<th></th>
<th>Right side</th>
<th>Left side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean (mm)</td>
<td>14.80</td>
<td>14.83</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>1.14</td>
<td>1.08</td>
</tr>
</tbody>
</table>

Table 4: Position of GPF.

<table>
<thead>
<tr>
<th>Position</th>
<th>Right side</th>
<th>Left side</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opposite 3rd molars</td>
<td>40 (80%)</td>
<td>42 (84%)</td>
</tr>
<tr>
<td>Between 2nd and 3rd molars</td>
<td>10 (20%)</td>
<td>08 (16%)</td>
</tr>
<tr>
<td>Opposite 2nd molars</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>50</td>
</tr>
</tbody>
</table>

The palatine index of the present study showed that, 66% of the skulls were narrow (Leptostaphyline), 18% of the skulls were intermediate (Mesostaphyline) and 16% of skulls were wide (Brachystaphyline) (Table 5). The palatine height index of the present study showed that, 56% of the skulls were low (Chamestaphyline), and the remaining 44% of the skulls were intermediate (Orthostaphyline). We dint find any sample with high palatine height index (Hypistaphyline) (Table 6).

DISCUSSION
Among the studies in the past, Ajmani observed 64% of adult skulls had GPF located opposite 3rd molar tooth [5]. A study conducted by Saralaya and Nayak showed the same in 74% of skulls [6] while Bruno et al., observed it in 54% of skulls [7]. In our present study, GPF was found be opposite 3rd molar tooth in 82% of skulls and between 2nd and 3rd molars in 18% of skulls.

The distance between GPF and MMS in a study conducted by Ajmani was found to be 14.7mm on the right and 14.6mm on the left [5]. Saralaya reported it to be 14.7mm on both the sides [6]. Bruno R and colleagues reported the distance to be 14.68mm on the right and 14.44mm on the left side [7]. Westmoreland and Blanton had a mean of 14.8mm on the right and 15.0mm on the left [8] which was similar to the results obtained in our present study. The variation seen in the position of GPF may be attributed to the sutural growth between the maxilla and palatine bone. With the eruption of posterior teeth, the antero-posterior length of the palate increases [9].

A study by Hassanali on the African skulls of Kenya, the palatine index was found to be brachystaphyline in 43.2% of skulls. Palatine height index in the same study reported 40% of skulls to be chamestaphyline, 57% of skulls to be orthostaphyline and only 3% of skulls were hypistaphyline [10]. Study by Varalakshmi etal,
showed 66% of skulls were leptostaphyline, 18.5% were mesostaphyline and 15.5% were brachystaphyline [11] similar to the results obtained in our study. Palatine height index in a study by Varalakshmi et al showed 72.3% of skulls were chamestaphyline, 26.1% were orthostaphyline and remaining 1.6% were hypistaphyline [11]. In our study, 56% were chamestaphyline and the remaining 44% were orthostaphyline.

CONCLUSION

The present study identifies the commonest location of greater palatine foramen to be opposite the 3rd maxillary molars. This information will be useful to clinicians to block the greater palatine nerve at greater palatine foramen to perform various procedures on hard and soft palate. The knowledge on the morphometry of hard palate from the present study is useful in comparing the skulls of Indian origin with skulls of different races and ethnicity.

ACKNOWLEDGEMENTS

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Conflicts of Interests: None

REFERENCES


