Research Article

A study on the incidence of retromolar foramen in South Indian adult dried human mandibles and its clinical relevance

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ABSTRACT

Background: The retromolar foramen is one of the most important non-metrical anatomical variants in the mandible. The present study describes the incidence of retromolar foramen in South Indian adult dried mandibles and its clinical relevance.

Methods: One hundred South Indian adult dried mandibles of unknown sex were studied at the Department of Anatomy, MVJ Medical College, Bangalore for the presence of retromolar foramen. Its location, size, shape, distance of the foramen if present from the posterior border of socket for 3rd molar tooth, anterior border of ramus of the mandible were measured.

Results: Retromolar foramen was present in 16 (16%) of the mandibles. Out of the 16 mandibles, it was present bilaterally in 3 (3%) mandibles and unilaterally in 13 (13%) mandibles (In 3 (3%) on the right side and in 10 (10%) on the left side). The mean diameter of the foramen was 1.33 mm (range - 1.10-1.92 mm). It was oval in shape in 9 (9%) and rounded in shape in 7 (7%) mandibles. The mean distance of retromolar foramen from the posterior border of socket for 3rd molar tooth and anterior border of ramus were 6.15 mm (2.23-12.10) and 8.02 mm (3.24-13.12) respectively.

Conclusions: The knowledge about the incidence of the retromolar foramen is important for dental surgeons during various anaesthetic, implantation and surgical procedures of the mandible, especially during extraction of the lower last molar tooth.

Keywords: Mandible, Ramus of mandible, Retromolar fossa, Retromolar foramen, Retromolar canal, Third molar tooth

INTRODUCTION

The retromolar foramen is an accessory foramen of the mandible situated in the retromolar fossa. The triangular depression between the temporal crest and the anterior border of the ramus of mandible is called the retromolar fossa. Nerves may pass from the substance of temporalis to enter the mandible through the retromolar fossa, where they communicate with branches of the inferior alveolar nerve. Foramina occur in 10% of retromolar fossa and infiltration in this region can abolish sensation which occasionally remains after an inferior alveolar nerve block.1

The retromolar foramen, which is located in the retromolar fossa receives the retromolar canal which normally arises from the mandibular canal behind the third molar.2 This foramen transmits a neurovascular bundle consisting of an artery, vein and nerve that contribute to the nutrition and innervations of the pulp and periodontium of the lower teeth. This area forms an open corridor for the passage of infections arising in...
connection with the third molar, this is the so-called Chompret-L’ Hirondel abscess.\(^3\)

Ossenberg\(^4\) analysed 2500 mandibles for the retromolar foramina and stated that these foramina are more common in native populations of North America than in other part of the world namely India, Europe, Africa, & Northeast Asia. They occur more commonly unilaterally than bilaterally. He also reported peak incidence of the retromolar foramen in the adolescent cohort which might reflect increased neurovascular requirements related to the adolescent growth spurt and eruption of the wisdom teeth.

Bilecenoglu and Tuncer\(^5\) evaluated 40 mandibles from population of turkey and found retromolar foramen in 10 (25%) (Bilateral retromolar foramen in 5% and a unilateral foramen in 20%).

The variations of human mandible are important because several dental procedures are carried out like dental extraction of third molar tooth, orthognathic surgery, mandibular reconstructions, and in implantation surgery\(^6\).

The present study is undertaken to analyze the incidence of retromolar foramen in South Indian adult dried human mandibles.

**METHODS**

The present study has been carried out on 100 South Indian adult dried & complete mandibles of unknown sex which were collected from medical students in the Department of Anatomy, MVJ Medical College & Research Hospital, Bangalore. The mandibles with marked deformities or asymmetries and fractured mandibles were excluded from the study. The area behind the 3\(^{rd}\) molar tooth in all the mandibles was carefully inspected for the presence of retromolar foramen. Retromolar foramen if present was noted. Wherever the foramen was present, its location, size, shape, distance of the foramen from the posterior border of the socket for the 3\(^{rd}\) molar tooth and from the anterior border of ramus of mandible was noted with the help of vernier caliper to the nearest millimetre. The mean, range and standard deviation of all the measurements are statistically analyzed. The data obtained was recorded, analyzed and compared with the previous studies.

**RESULTS**

Out of the 100 mandibles studied, retromolar foramen was present in 16 (16%) of the mandibles. The remaining 84 (84%) mandibles did not show the presence of retromolar foramen. It was observed that out of the 16 (16%) mandibles, retromolar foramen were found to be bilateral (Figure 1) in 3 mandibles (3%) and unilateral in 13(13%) [Left: 10 (10%) (Figure 2); Right: 3 (3%) (Figure 3)] mandibles. (Table 1) It was oval in shape in 9 (9%) and rounded in shape in 7 (7%) mandibles. The mean diameter of the foramen was 1.38 mm (range-1.10- 1.92 mm). The mean distance of retromolar foramen from the posterior border of socket for 3\(^{rd}\) molar tooth and anterior border of ramus of mandible were 6.15 mm (2.23-12.10) and 8.02 mm (3.24-13.12) mm respectively (Table 2).
The incidence of retromolar foramen reported by different authors varies from 4.35% to 21.9% and is summarized in Table 3. The highest incidence was reported by Narayana (21%) and the lowest by Shantaram (4.35%). In the present study, its incidence is 16% which is within the range.

The mean diameter and distance of retromolar foramen from posterior border of socket for 3rd molar, anterior border of ramus of the mandible of the present study is compared with earlier studies and represented in Table 4.

In the present study, the distance of retromolar foramen from the posterior border of 3rd molar is 6.15 mm which is comparable with the reports published in the literature (4.3 mm - 9.71 mm). The close relation of retromolar foramen with 3rd molar tooth may damage the structures passing through it during extraction of 3rd molar tooth and causes postoperative hematomas due to rupturing of the blood vessels.

DISCUSSION

The retromolar foramen extends as a retromolar canal into the body of the mandible. Narayana and others have described three morphological types of the retromolar canals in their study using injection of radiopaque dye Angiograffin into the retromolar foramen and followed the course of the canal: Type - I was a simple canal descending vertically to the mandibular canal whereas type-II canal first descended and then coursed posteriorly and joined the mandibular canal. Type-III canal descended vertically, but another canal traversed anteriorly from the anterior aspect. They have reported a varying diameter among the three types - type-I - 1.5 mm; type-II - 3 mm; type-III - 4.35 mm.

Table 3: Showing the comparison of incidence of retromolar foramen of the present study with other studies.

<table>
<thead>
<tr>
<th>Author</th>
<th>Number of specimens</th>
<th>Total</th>
<th>Right sided</th>
<th>Left sided</th>
<th>Bilateral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Narayana (2002)</td>
<td>242</td>
<td>53 (21.9%)</td>
<td>26 (10.7%)</td>
<td>17 (7.1%)</td>
<td>10 (4.1%)</td>
</tr>
<tr>
<td>Priya Manjunath (2005)</td>
<td>157</td>
<td>28 (17.8%)</td>
<td>9 (5.7%)</td>
<td>11 (7%)</td>
<td>8 (5.1%)</td>
</tr>
<tr>
<td>Ivan (2008)</td>
<td>294</td>
<td>38 (12.9%)</td>
<td>14 (4.8%)</td>
<td>13 (4.4%)</td>
<td>11 (3.7%)</td>
</tr>
<tr>
<td>Senthil Kumar (2010)</td>
<td>150</td>
<td>26 (17.3%)</td>
<td>8 (5.3%)</td>
<td>6 (4%)</td>
<td>12 (8%)</td>
</tr>
<tr>
<td>Shantaram (2013)</td>
<td>115</td>
<td>5 (4.35%)</td>
<td>2 (1.74%)</td>
<td>2 (1.74%)</td>
<td>1 (0.87%)</td>
</tr>
<tr>
<td>Athavale (2013)</td>
<td>71</td>
<td>10 (14.08%)</td>
<td>4 (5.63%)</td>
<td>4 (5.63%)</td>
<td>2 (2.81%)</td>
</tr>
<tr>
<td>Seema Gupta (2014)</td>
<td>50</td>
<td>9 (18%)</td>
<td>3 (6%)</td>
<td>2 (4%)</td>
<td>4 (8%)</td>
</tr>
<tr>
<td>Bhagath (2014)</td>
<td>94</td>
<td>11 (11.7%)</td>
<td>5 (5.3%)</td>
<td>3 (3.2%)</td>
<td>3 (3.2%)</td>
</tr>
<tr>
<td>Present study</td>
<td>100</td>
<td>16 (16%)</td>
<td>3 (3%)</td>
<td>10 (10%)</td>
<td>3 (3%)</td>
</tr>
</tbody>
</table>
The predominant components of the retromolar foramen are the neurovascular bundle which originates from the mandibular canal. The artery in the canal is a branch from inferior alveolar artery which joined with the branches of buccal and facial artery. The nerve in the retromolar canal was a branch from the trunk of inferior alveolar nerve and supplied the third mandibular molar, the mucosa of retromolar triangle, the buccal mucosa, and the buccal gingiva in the mandibular premolar and molar region.

The nerve fibres which pass through retromolar foramen and canal also provide innervations to temporalis and buccinator. Hence, damage of these nerve fibres in retromolar canal leads to alteration in function of temporalis and buccinators.

Possible vascular excessive bleeding or postoperative hematomas can be caused by damage to the contents of the neurovascular package on this canal and foramen or the nerve injury resulting in post-anesthesia of the area if the package was injured during a surgical procedure. Furthermore, any restoration of prostheses or implants located distally to the retromolar area can lead to pain and paraesthesia.9,10

The appearance of a retromolar foramen, with or without the presence of bifid inferior alveolar nerve canals, also often predicts the presence of accessory innervation to the mandibular molars. This accessory innervation has been proposed to be responsible for failure of the traditional inferior alveolar nerve block. The nerve which is thought to provide accessory innervation in these situations is the long buccal nerve (a branch of the anterior division of the mandibular nerve) or perhaps even accessory branches of the inferior alveolar nerve.11

The dental surgeon should also be aware of occasional presence of this neurovascular bundle in retromolar area while infiltrating local anesthetic agents in the surgical procedures carried out for impacted lower third molar tooth extraction. Carcinoma in the mucosa of the retromolar trigone may require resection and radical dissection. Such surgery can put important structures at risk.

The vascular components which pass through retromolar foramen may facilitate the spread of infection and metastases from the oropharynx to the blood circulation.12,13

The presence of a retromolar neurovascular bundle may provide alternative routes whereby impulses conveying pain can continue to be transmitted even after the main trunk of inferior alveolar nerve has been blocked at the mandibular foramen. In such individuals, complete anaesthesia is obtained by supplementary infiltration of local anaesthetic into the soft tissues overlying the retromolar fossa.15

Hence the knowledge of the location and contents of retromolar foramen should be carefully considered for choosing the best plan and consequently for optimizing anaesthetic and surgery procedure during oral and maxillofacial procedures.

CONCLUSION

The present study reports the incidence of retromolar foramen and its distance from posterior border of 3rd molar, anterior border of ramus in south Indian adult population. The high incidence of retromolar foramina should alert the dental surgeon to avoid the complications during surgical extraction of lower wisdom teeth. The knowledge of the presence of neurovascular structures in the retromolar foramen is important during surgical procedures performed in retromolar area such as dieresis procedures, flap lifting, bone tissue for autologous bonegrafts, osteotomy for the surgical extraction of lower third molars, placement of osseointegrated implants for orthodontic, or during the division of the mandibular ramus in the sagittal split osteotomy surgery.

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