

## MORPHOLOGICAL STUDY OF OCCURRENCE OF RETROMOLAR FORAMEN IN DRY HUMAN MANDIBLES OF SOUTH INDIA – A MANDIBULAR VARIANT

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### Abstract

**Background:** Retromandibular foramen (RMF) is small external orifice of the retromolar canal (RMC), located in the retromolar fossa of the mandible. Knowledge about the location of the RMF and the route of the RMC within the mandible is significant for clinical practice due to a high risk of injury during oral and craniomaxillary and facial surgeries. The objective is to carry out morphometric, topographic, incidence analysis of retromolar foramen in dry adult human mandibles and relate the findings to dental and surgical practices. **Materials and Methods:** 400 mandibles were evaluated simultaneously by two researchers. With the aid of Digital Vernier calipers distance from third molars were calculated. **Result:** Retromolar foramen were observed in 9.5% of cases with a higher bilateral incidence. **Conclusion:** The clinical importance and implications of the retromolar foramen has been discussed as it is of paramount importance to the dental surgeons, anaesthetist and the physicians.

## INTRODUCTION

Mandibular foramen lies a little above the centre of medial surface of ramus at the level of occlusal surfaces of the teeth. It leads into the mandibular canal which descends into the body of the mandible and opens at the mental foramen. Inferior alveolar nerve and vessels enter the mandibular canal through the mandibular foramen and run forwards with in the canal.

The retromolar triangle is a space also known as Retro molar fossa is located at the posterior part of a mandible between the back of the last molar and the anterior edge of the ascending ramus where it crosses the alveolar margin.<sup>[1]</sup>

Mandible is pierced by many smaller accessory foramina, but retromolar foramen is an variable structure present in retromolar triangle behind the last molar teeth socket, which is bounded medially by temporal crest and laterally by anterior border of ramus of mandible. This foramen leads to a canal communicating with the mandibular canal.<sup>[2]</sup>

The retro molar foramen is a variant foramen which has got high clinical and surgical implications as it leads to mandibular canal and inferior alveolar nerve and vessels can be injured while performing intra oral procedures such as 3rd molar extraction, autologous bone harvesting, sagittal split ramus osteotomy and other surgeries.<sup>[3]</sup>

Studies have also suggested that before the branches of the inferior alveolar nerve penetrates into the mandibular foramen, they may assume a descended trajectory and reach the mandibular canal through the retromolar foramen or that the branches of the buccal nerve also enter into the mandibular canal through the retromolar foramen and retromolar canal.<sup>[4]</sup>

Surgical procedures such as extraction, orthognathic surgery, implant placemen, mandibular reconstruction, biopsies and bone tissue donation for grafts are extremely common in the retromolar region and thus knowledge about the structures and anatomic variations present are of great interest to surgeons.<sup>[5]</sup>

Against this background, the purpose of this individual study is to analyze the prevalence an occurrence of Retromolar foramen in a sample of dry mandibles in South Indian population.

## MATERIALS AND METHODS

Four hundred adult dried mandibles of unknown sex available in the Department of Anatomy, JJM Medical College, Davangere were collected and used for this present study. The selection criteria are set forth below ;

### Inclusion Criteria

Complete mandibles are selected.

### Exclusion Criteria

- Presence of fracture

- Presence of marked deformities or asymmetries.

**Morphological analysis:** The mandibles were visually evaluated simultaneously by two researchers one Anatomist and one Dentist who always obtained complete agreement between them. In 400 mandibles, the presence of retromolar foramen were noted. Wherever foramina were noticed, their sizes and the distance from the socket of third molar were also measured with a digital vernier caliper to the nearest millimeter.

All the measurements were performed independently by two researchers for three times and averaged to arrive at accurate data. The mean, range of all the measurements were statistically analyzed. This study was approved by the Research Ethical Committee.



**Figure 1: Shows the different variables of mandibles.**

## RESULTS



**Figure 2: Shows unilateral single retromolar foramen in mandible.**



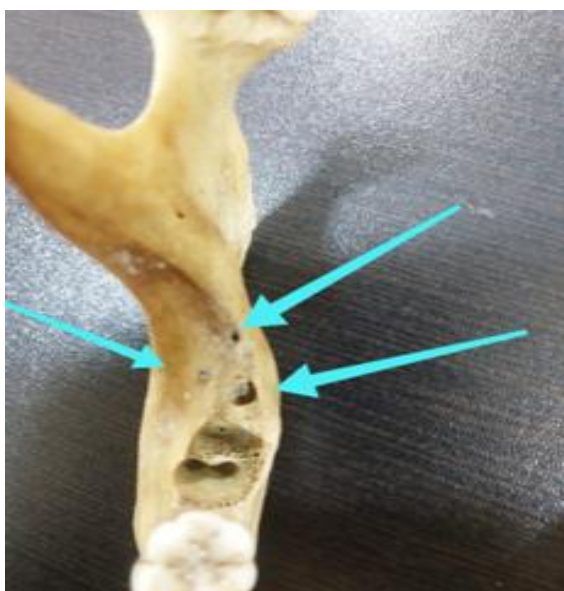
**Figure 3: Shows Retromolar foramen in right side.**



**Figure 4: Shows bilateral foramen present in the mandible.**



**Figure 5: Shows 2 retromolar foramen in left side and 1 retromolar foramen in right side of the mandible.**



**Figure 6:** Shows 3 retromolar foramen in this mandible.

**Table 1: Occurrence of Retromolar foramen**

Total No of mandibles	RMF present	Percentage
400	38	9.5%

Out of 400 specimens included in the study, in 38 (9.5%) mandibles retromolar foramen were found, which is statistically significant.

**Table 2: Distribution of RMF according to side**

Mandibles	Number	Percentage
Right	24	6%
Left	6	1.5%
Bilateral	8	2%
Total	38	9.5%

Out of 400 specimens study conducted, in 24 mandibles the RMF were found on right side, in 6 specimens it was found on left side and in 8 mandibles RMF was present on both sides bilaterally.

**Table 3: Mean diameter (mm) of RMF**

Number of mandibles	Mean diameter (mm)
38	3.02mm (Range- 1.5- 3.45mm)

**Sizes of foramina:** The mean diameter of the foramina was 3.02 mm (Range- 1.5- 3.45mm ).

**Distance from the last molar tooth:** The retromolar foramen were located at a distance of 4 to 12 mm from the 3rd molar tooth.

In one mandible 3 retro molar foramen was found.

In two mandibles 2 retromolar foramen was found.

**Table 4: Occurrence of Retromolar foramen in various population according to literature review**

Author & year	Population group	Number of mandibles	Percentage
Shantaram V, Manjunth KY, 2013	South India	115	3.48%
Bilecenoglu, Tancer 2006	Turkish	40	2.5%
Sawyer, Kiely 1991	American	234	7.7%
Bhagat kumarpotu, Vinodkumar 2014	South eastern of India	94	11.7%
Kawai et al 2012	Japanese	46	12%
Lizio et al 2013	Italian	233	14.6%
Present study	South India	400	9.5%

## DISCUSSION

The location of RMF is not constant, ranging a distance from 4-12 mm from 3 rd molar teeth. The nerve fibres which branch from mandibular canal and

exit through RMF may prevent complete anaesthesia of the mandibular buccal gingival. The nerves which exit from RMF may innervate the temporalis tendon, buccinators muscle, posterior part of mandible, 3<sup>rd</sup> molars, gingival of mandibular molars and pre molars and the mucosa of retromolar pad.

Local anaesthesia is a very essential procedure for treating many dental and oral disorders however many types of anatomical variations are seen in nervous system development that interfere with achieving complete block. Such anomalies includes (1) Before its entry into the mandibular foramen, the inferior alveolar nerve gives rise to nerve to mylohyoid muscles, primarily a motor nerve, which carries both afferent and efferent fibres and is the main cause for anaesthetic failure. (2) Accessory mylohyoid nerve (3) Retro molar foramen with or without the presence of bifid inferior alveolar nerve.<sup>[6]</sup>

The artery in the retromolar canal bifurcates into facial and buccal branches after exiting the retromolar foramen. Injury to this artery in the perimandibular retromolar region during surgery may lead to excessive bleeding in the presence of retro molar canal and foramen.<sup>[7]</sup>

Shantaram and Manjunath KY have dissected 115 adult mandibles at Salem, Tamilnadu and found retromolar foramen in 3.48% of population. Also noted RMF bilaterally in one mandible and in one of the mandibles on the right side there were two foramina.<sup>[1]</sup>

Bilecenoglu and Tancer conducted similar study and found RMF in 25% of Turkish population. They found the inferior alveolar neurovascular bundle traversing through the mandibular canal. After emerging the artery anastomosed with the buccal and facial artery branches. Narayana et al have described three morphological types of the retro molar canals. Type 1- was a simple canal descending vertically to the mandibular canal whereas Type 2- canal was first descended and then coursed posteriorly and joined the mandibular canal. Type 3- canal descended vertically, but another canal traversed anteriorly from the anterior aspect.<sup>[8]</sup>

Bilecenoglu and Tancer performed a biopsy on the content of a patients retromolar canal and observed neurovascular bundles with striated muscle fibres, thin myelinated nerve fibres, numerous venules and a muscular artery with a lumen measuring from 120 to 130 micron meters. In spite of a great deal having been discussed about the eventual origins and terminals of the contents, it is evident that they assume very much clinical importance. It may be difficult to obtain anaesthesia of the retromolar region, adjacent jugal mucosa or molar teeth due to nerve bundles that escape the classical pterygomandibular block. In invasive procedure in the region, such as the extraction of third molar teeth, mandibular sagittal osteotomies or bone tissue collection for grafts, the retromolar foramen and retromolar canals may be violated, resulting in excessive bleeding, temporary or permanent neurosensory disturbances and even traumatic neuromas. Moreover there also a pathway of tumour propagation and infections and even interfere in the placement of dental implants and fabrication of dental prosthesis.<sup>[8]</sup>

Sawyer and Kiely et al found 7.7 % of RMF in a study conducted using American 234 mandibles. Lizio et al found 14.6 % of RMF in Italian 233 mandibles.<sup>[2]</sup>

Kawai et al have quoted a range of distance was 9.71 mm. In the study by Senthil Kumar et al the distance between posterior third molar to retromolar foramen and canal was found to be an average of 4.5 mm on the right side and 4mm on the left side.<sup>[9,10]</sup>

Von Arx et al also distinguish three types of retromolar canal type A- vertical, type B- slightly curved, type C- horizontal. They also found out two subtypes of type A and B canals, mainly (1) without an additional mandibular canal and (2) with an additional mandibular canal. Von Arx's classification is the most popular system among researchers, who adopted in their studies.<sup>[6]</sup>

## CONCLUSION

The present study on retromolar foramen – a mandibular variant showed its presence, which is statistically significant. In 8 mandibles the foramen was observed bilaterally. In 24 mandibles it was present on right and in 6 it was on left side. In one mandible there were 3 RMF and in 2 mandibles 2 RMF was found.

In the present study, an attempt has been made to study the mandibular variant common being retromolar foramen and with these findings We conclude that the variations do occur at particular frequency. So it is prudent to do pre-operative studies of the mandibular foramen and variants, to prevent possible post- operative complications in oral surgeries.

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