Available online freely at www.isisn.org

Bioscience Research

Print ISSN: 1811-9506 Online ISSN: 2218-3973

Journal by Innovative Scientific Information & Services Network

RESEARCH ARTICLE BIOSCIENCE RESEARCH, 2020 17(2): 1475-1483. OPEN ACCESS

CBCT analysis of the prevalence and descriptive characteristics of RMF and RMC in a sample of Egyptian population

Omniya Abu El-Dahab

Department of Oral and Maxillofacial Radiology, Faculty of Dentistry, Cairo University, **Egypt**
Department of Oral Radiology, College of Dentistry, King Saud Bin Abdulaziz University for Health Science**, Saudi Arabia**

***Correspondence:** omniyagold@yahoo.com **Received 30-04-2020, Revised: 22-06-2020, Accepted: 24-06-2020 e-Published: 29-06-2020**

The current work was perfumed with objectives 1) to carry out analysis for the prevalence and gender predilection of RMF(retromolar foramen) and RMC (retromolar canal) in a sample of adult Egyptian population using CBCT, 2) To determine the location and adjacency of the RMF to the lower 2nd molars, 3) To assess the height and suggest for morphological classification of the RMC.CBCT scans of one hundred and fifty two adult participants (60 male and 92 female) showing the entire retromolar region of the mandible bilaterally were analyzed carefully to detect the existence of retromolar foramens and morphology of the retromolar canals. The distance between the RMF and the CEJ of the second molar and the length of the RMC were measured. The prevalence of RMF in a sample of Egyptian population was (3.9%). All the foramina were detected unilaterally with no statistical significance between right and left sides. The curved course with horizontal branch was more common (Type VIII, B2). Although the prevalence of RMF and RMC in our population is low, however, their assessment is highly recommended to avoid surgical and anesthetic complications.

Keywords: CBCT, RMF, RMC

INTRODUCTION

Mandible is the largest and strongest bone of the face which provides support to the lower teeth and contains channels for nerves and vessels. The mandible is pierced by a number of accessory foramina, but 'retromolar foramen' is the most frequently occurred one. (Rodella et al., 2012, Shantharam et al., 2013 and Ahuja et al., 2018)

Retromolar foramen (RMF) is usually found on the alveolar surface of a triangular depressed area behind the socket for the lower last molar teeth. This triangular area is known as retromolar fossa or trigone which is pitted in appearance and bounded medially by temporal crest and laterally by the anterior border of the mandibular ramus. This foramen is a termination of a canal which diverges from the mandibular canal called the retromolar canal (RMC). This canal transmits the branches of inferior alveolar vessels and nerves. (Kawai et al., 2012, Rossi et al 2012, Shantharam et al., 2013, Potu et al., 2014, Alvesz and Deana, 2015, Ahuja et al., 2018, Kikuta et al., 2018, Palma and Lombardi, 2018 and Laçin et al., 2019) Despite of the fact that the presence of these anatomic structures is well known and mentioned in the literature, some anatomy textbooks of dentistry do not report their appearance in anatomical details and many surgeons neglect them. Additionally, these foramina and canals couldn't be shown clearly on conventional panoramic radiographs.

(Taisuke et al., 2012, Lizio et al 2013, Han and Hwang, 2014, Ahuja et al., 2018 and Palma and Lombardi, 2018) Detailed knowledge about the presence and location of both RMF and RMC is a must as their presence and content are clinically critical in many surgical procedures that may involve the retromolar region such as extraction of third molar, orthognathic surgery, implant placement, mandibular reconstruction, biopsies and harvesting bone grafts. It could pose a challenge in complete blockage of the inferior alveolar nerve while performing conventional anaesthetic techniques. Injury to this nerve may result in paresthesia, and traumatic neuroma. Finally, the risk of an excessive bleeding resulting from an injury of the contained blood vessels has to be considered as it can reduce the vision of the surgical field and harm the patient. (Boronat and Penarrocha, 2006, Kumar and Kesavi, 2010, von Arx et al., 2011, Khan et al., 2013, Filo et al., 2015, Ahuja et al., 2018, Kikuta et al., 2018, Laçin et al., 2019 and Uner et al, 2019) Imaging is a highly essential aid to explore human anatomy. Cross sectional imaging techniques such as CT and CBCT provide three-dimensional (3D) high quality images and permit view and interactive display modes, so these techniques can overcome the limitations of panoramic radiography and act as a “Third eye” to visualize the hidden and mini structures of the human body bones that could not be observed on panoramic radiographs. (Naitoh et al., 2009, von Arx et al., 2011, Patil et al., 2013, Han and Hwang, 2014, Kawai et al., 2014, Ahuja et al., 2018 and Laçin et al., 2019)

The results of RMF and RMC investigation were greatly affected by the population studied, sample size and methodology used for examination (cadavers, dried mandibles, panoramic radiography, CBCT). A majority of the earlier studies have investigated the prevalence of RMF and RMC postmortem, i.e., on dried mandibles and on cadavers, however, fewer studies have been carried out in living subjects [using panoramic radiographs, computed tomography (CT) and CBCT]. In the last few years there has been a great interest in the study of these structures (RMC/ RMF) in living subjects using CBCT. (von Arx et al., 2011, Taisuke et al., 2012, Lizio et al., 2013, Patil et al., 2013, Han and Hwang, 2014 and Ahuja et al., 2018)

MATERIALS AND METHODS

This retrospective study enrolled CBCT scans for a sample of subjects that were attending Al-Kasr El Einy Dental Hospital, Cairo University with age range (20-60) years old and referred to Radiology department for preoperative CBCT scan for various purposes. In most cases CBCT recordings served for a preoperative evaluation of mandibular third molars. Other indications were examinations of cystic lesions, bone pathologies, retained and displaced teeth, and planning of dental implants.

In this retrospective study, CBCT scans of one hundred and fifty two adult participants (60 male and 92 female) showing the entire retromolar region of the mandible bilaterally were selected from the CBCT system. These scans were performed with Planmeca Dimax3 Digital X-Ray machine.

The selected scans of participants were free from resorbed or fractured mandible, marked deformities, missing or incomplete depiction of the retromolar region (missing data volume), recognizable pathologies in the region (cysts, osteomyelitis, etc.), past orthopedic or surgical treatment procedures in the mandible. The images with prominent recording artifacts (motion and radiation artifacts) were excluded from this study and high quality images were only examined.

Accurate analysis for CBCT scans was performed carefully to detect the existence of retromolar foramens and course of the retromolar canals. In each CBCT scan sagittal cuts were used for examination of the RMC of the respective side of the mandible. The examiner was freely selected the exact position of the observational plane then the area behind the last molar tooth was carefully inspected for the presence of RM foramina and canals in right and left sides. Adjustment of the contrast, brightness and sharpness was carried out to display the best visualization of the RM foramen and canal. Coronal sections were examined to confirm the presence of the RM foramen and to observe the region of exit of retromolar canals in the retromolar fossa by dividing the retromolar fossa into the buccal half and lingual half (Fig. 1). The side of existence of the RMF in the mandible as well as the demographic data (age and gender) were reported.

The following linear measurements were carried out with one experienced radiographer (more than 15 years) in order to aid in the localization of the RMF in relation to the lower second molar and to the inferior alveolar canal:

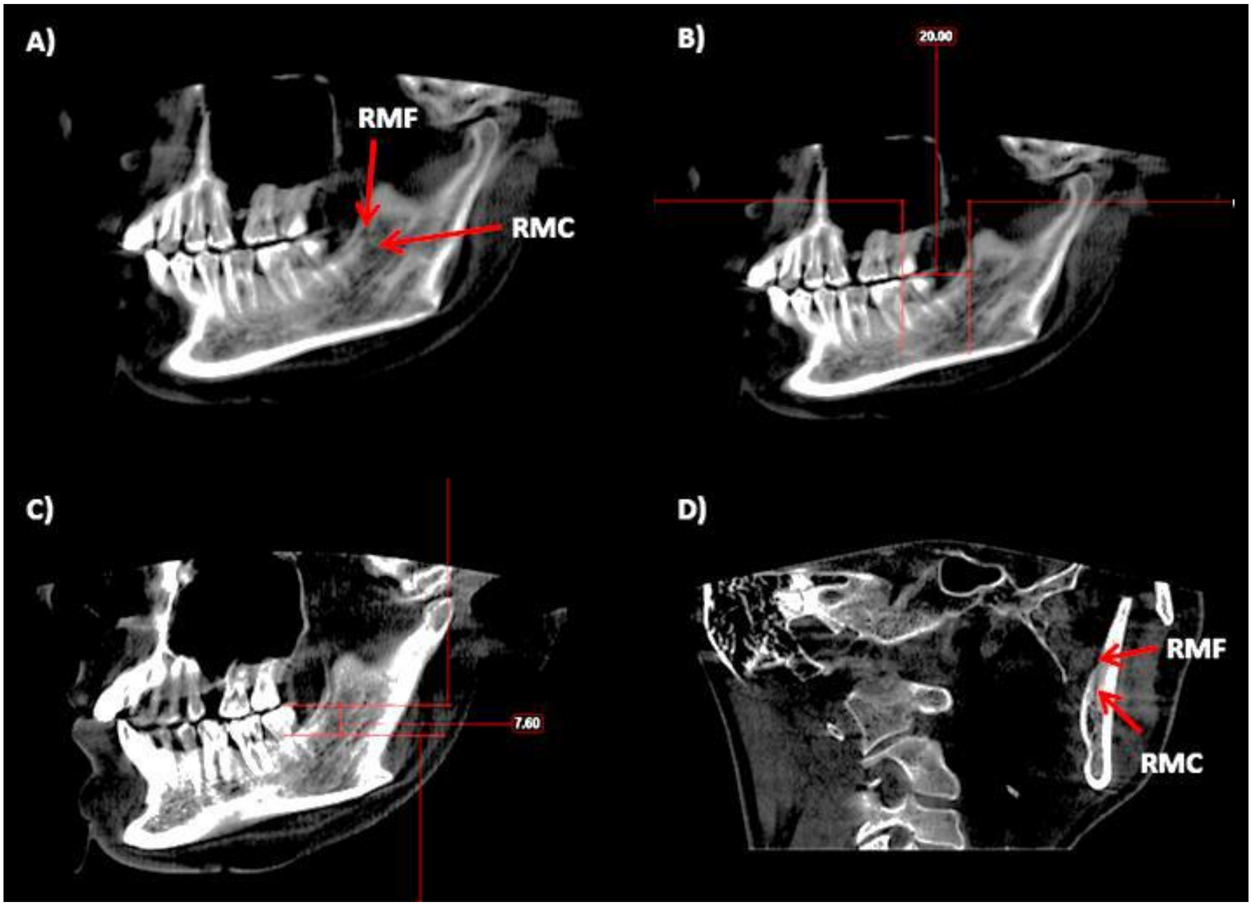

Figure. 1: CBCT sections in one of our cases showing A) A retromolar canal and retromolar foramen in sagittal section on left side. B) Measurement of the distance between the RMF and the lower 2nd molar, C) RMC length D) showing the Retromolar canal in coronal section.

Distance of RMC to ipsilateral second molar: the horizontal distance from the center of the RMF to the distal cemento-enamel junction of the second molar (Fig. 1).

Height of RMC: the vertical distance from the center of the RMF to the upper margin of the MC (Fig. 1)

To ensure the precision of the linear measurements they were repeated 2 weeks later confirming a high correlation. Thus, the first measurements were used for further analysis.

The types of retromolar canals were classified according to Sisman et al., (2015) based on the course and morphology into 9 categories. Type I: The retromolar canal has a vertical course (Narayana et al., 2002) ; Type II: The retromolar canal has a vertical course with additional horizontal branch (von Arx et al., 2011); Type III: The retromolar canal has a vertical course and then extending posterosuperiorly toward the retromolar fossa (Sisman et al., 2015); Type IV: Temporal crest canal (Ossenberg, 1987); Type V: Curved course of retromolar canal branching mandibular foramen (Sisman et al., 2015); Type VI: A retromolar canal with a curved course branching mandibular canal (Sisman et al., 2015); Type VII: Retromolar canal extending from the retromolar fossa and opening into the periodontal ligament space (Patil et al., 2013); Type VIII: the canal is anteriorly directed for some distance and then coursing posterosuperiorly toward the retromolar fossa foramen (Sisman et al., 2015).

Type IX: anterior course of the canal for some distance and then running postero-superiorly toward the retromolar fossa foramen with additional horizontal branch foramen (Sisman et al., 2015) (Fig. 2).

Another classification by (von Arx et al., 2011) was also used to accurately describe the course of the RMC, classified into five types (Figs. 3):

— Type A1: vertical course

— Type A2: vertical course with horizontal branch

— Type B1: curved course

— Type B2: curved course with horizontal branch

— Type C: horizontal course

It should be noted that the above type C category included canals of both type II (deep horizontal course in the area of the mandibular angle) and type III (high horizontal course at the base of the coronoid process) according to Sisman et al 2015 [18, 23].

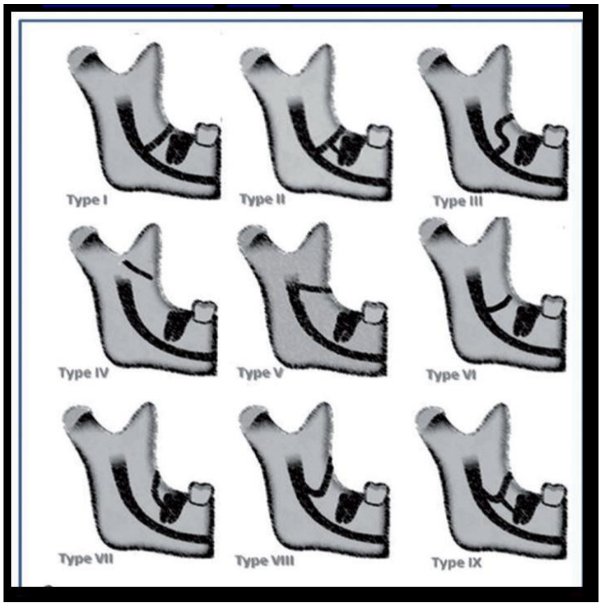

Figure 2: Schematic illustrations of different types of the retromolar canal. (Sisman et al., 2015)

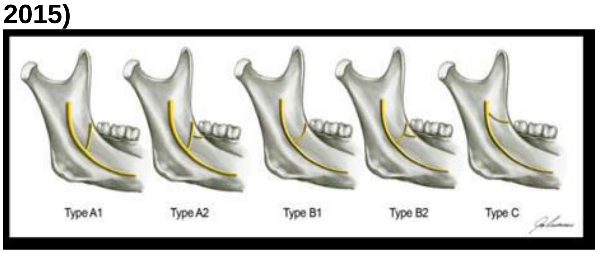

Figure 3: Schematic representation of the various types of the retromolar canal (RMC) according to von Arx et al., (2011): Type A1 (vertical course); type A2 (vertical course with horizontal branch); type B1 (curved course); type B2 (curved course with horizontal branch); type C (horizontal course) (Filo et al 2015)

Descriptive statistics was used for analyzing and presenting the data. Mean, median and standard deviations were calculated to determine the distance between the midpoint of RMF to the distal CEJ of the second molars and the height of the RMC. P value was also determined for the gender and affected side of the mandible to assess the statistical significance.

RESULTS

The collected data indicated that the prevalence of the RMF in a sample of Egyptian population was (3.9%), referred to the total number of 152 patients, the retromolar foramen was detected in six patients, the gender distribution reported 5 cases out of 92 were females (5.4% of female patients and 3.2% of all cases) and one male out of 60 male patients (1.7% of male cases and 0.7% of the total number of patients). The chi-square statistic is 1.36. The p-value is 0.24. The result is not significant (at $p < 0.05$) (Table. 1**)**.

In all of the detected cases (3.9%) the foramen was detected unilaterally (2 cases (1.3%) in the left side of the mandible and in other four cases the retromolar foramen was detected in the right side of the mandible 2.6%) so according to the evaluated records, the RMF foramen was detected in the right side in two third of the visible cases. The chi-square statistic is 0.6801. The *p*-value is 0.4. There is no statistical significance between right and left sides (at $p < 0.05$) (Table. 1).

Descriptive characteristics of retromolar canal

By Measuring the distance from distal CEJ of the second molar tooth to the midpoint of the RMF, the retromolar foramina were located at a distance range from 8.8 - 18.8 mm with mean distance of 13.7mm for the right side and 14.2mm for the left side The median was 13.6 mm for the right side and 14.2 for the left side and SD was 4.8 for right side and 5.8 for the left side, the left retromolar foramina were located more posterior than the right ones so the RMF doesn't has a constant location (Table. 2).

Considering the height of the retromolar canal (vertical distance from retromolar foramen to mandibular canal) the range was from 5.82- 20.8 mm with mean length 11.4 mm for the right side and 6.71mm for the left side. The median was 9mm for the right side and 6.71 for the left side and standard deviation was 5.7 for right side and 0.89 for left side (Table. 2).

Table1: Absolute and relative frequency of the retromolar canal as a function of mandibular side and gender

		Absolute frequency	Relative Frequency
Side	Right	4 patients out of 152	1.3%
	Left	2 patients out of 152	2.6%
	Bilateral	0 patients out of 152	0%
Gender	Male	1 patients out of 60 (1.7%)	0.7%
	Female	5 patients out of 76(5.4%)	3.2%

Table 2: Statistical parameters regarding the height of the retromolar canal (RMC), and the distance of the RMC to the distal cemento-enamel junction of the adjacent second molar as well as respective means and standard deviations (SD)

	Height of RMC (mm)		Distance to CEJ of M2 (mm)	
	Right	Left	Right	Left
Mean	11.4	6.71	13.7	14.2
Median	9	6.71	13.6	14.2
Minimum	6.8	5.82	8.8	8.4
Maximum	20.8	7.6	18.8	20
Standard deviation	5.7	0.89	4.8	5.8

In regard to the canal morphology according to (Sisman et al., 2015) and (von Arx et al., 2011) classifications respectively, it was observed that the curved course with horizontal branch was more common : three cases out of six (50% of the detected retromolar canals) 1.95% of all cases reported (Type VIII, B2), one case (16.7% of the detected retromolar canals) (0.65%) of all cases showed (Type I, A2), one case (16.7% of the detected retromolar canals) 0.65% of all cases showed (Type VI, C) and the last case (16.7% of the detected retromolar canals) 0.65% of all cases demonstrated (Type IX, B2) (Fig.4).

DISCUSSION

The RMF is one of accessory foramena that perforates and occasionally identified on the alveolar surface of the retromolar triangle. This foramen is the termination to the RMC, which originates from the mandibular canal. (Mendenhall et al., 2011 and Ahuja et al., 2018)

Adequate knowledge of the anatomical variations present in the retromolar triangle such as the RMC and RMF may inhibit complications in the anesthesia and surgical procedures and act as an anatomical landmark to aid in ethnic identification. Available data about these structures in anatomy and surgical textbooks are limited until recent researches in this region. Thus, further research concerning a descriptive analysis of these structures would be required.

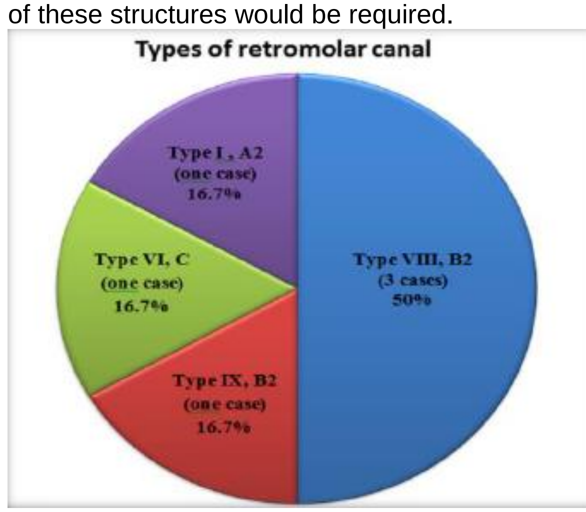

Figure. 4: Relative frequency of canal types classification according to two classifications (Sisman et al., 2015 and von Arx et al., 2011)

Earlier studies in India have been performed on regional population using dry mandibles/cadavers to assess these structures but the foramen may be lost as a result of atrophic changes in dried bone. Thus, CBCT allows evaluation in living subjects with favorable results compared to postmortem studies on cadavers. CBCT scan is a convenient imaging method to clarify variations in the location of the RMF and the course of RMC as it provides three dimensional images with high resolution and relatively low radiation doses. (von Arx et al., 2011, Taisuke et al., 2012, Han and Hwang, 2014, Tapas, 2014, Capote et al., 2015, Motamedi et al., 2016, Ahuja et al., 2018 and Üner et al., 2018)

According to these controversies and limited descriptive data of these structures present in the literature and considering great variation in the incidence of RMF among different populations, the aim of this study was to investigate the prevalence and location of RMF and morphology and length of RMC in a sample of Egyptian population through analysis of their CBCT scans

Regardless the methodological variation, the absolute frequency of RFs and RCs demonstrated in previous studies exhibits a large variation(0-72%) as follows: 21.9% (Narayana et al., 2002); 25% (Bilecenoglu and Tuncer, 2006); 25.6% (von Arx et al., 2011); 52% (Kawai et al., 2012); 26.58% (Rossi et al., 2012); 16% (Lizio et al., 2013); 65% (Patil et al., 2013); 8.5% (Han and Hwag, 2014); 11.7% (Potu et al., 2014); 18.6% (Alves and Deana, 2015); 8.8% (Capote et al., 2015); 16.12% (Filo et al., 2015); 26.7% (sisman et al., 2015); 23.4% (Palma and Lombardi, 2018) and 11.42% (Laçin et al., 2019)**.**

Our finding was 3.9% which reports a very low frequency similar to the result of Ahuja et al., (2018) reported (3.8%). This large variation in frequency of RMF can be attributed the difference in the method of evaluation (CBCT, panoramic, dry mandible, and cadavers) and the population studied. Hence, a direct comparison of the findings is not possible.

Considering gender distribution, this study reported RMF and RMC in 5 cases out of 92 females (5.4% of female patients and 3.2% of all cases) and one male case was detected out of 60 male patients (1.7% of male cases and 0.7% of the total number of patients). (P-value = 0.24 [P >0.05 which is nonsignificant]).These results are in consistence with the majority of previous studies (Patil et al., 2013, Han and Hwang, 2014, Alves and Deana, 2015, Mohamadi et al., 2015 and Laçin et al., 2019) who detected RMF in females more than males but with no statistical significance.

Ahuja et al., (2018) showed that the presence of RMC was more in males 20.4% than females 19.35% were; however, this difference was not statistically significant (P = 0.91). von Arx et al., (2011) also reported that the retro-molar foramen was more prevalent in males.

When focusing on the side of occurrence only, higher prevalence of these retromolar structures has been demonstrated in a unilateral disposition either on the right as documented by Narayana et al., (2002), Han and Hwag, (2014), Alves and Deana, (2015) and Capote et al., (2015) or left side as described by Priya et al., (2005), Bilecenoglu and Tuncer, (2006), , Motta-Junior et al., (2012) and Rossi et al., (2012). These facts are in agreement with those indicated in this study as all of the detected RMFs (3.9%) were located unilaterally (2 cases (1.3%) in the left side of the mandible and in other four cases the retromolar foramen was detected in the right side of the mandible 2.6%) so the evaluated records suggested high prevalence of the RMF foramen in the right side with no significant difference (The p-value is 0.4). The result is *not* significant at $p < .05$).

Supporting our results, Ahuja et al., (2018) also detected 13.8% of unilateral RMCs compared to 6.2% of bilateral RMCs with no significant difference was noted between right and left sides. Similarly, Laçin et al., (2019) reported 3.14% bilateral RMC and 8.28% unilateral existence of RMC with no difference between right and left (P>0.05). Rossi et al., (2012) and Alves and Deana, (2015) affirmed the retromolar foramen was more frequent unilaterally than bilaterally with no side predilection. On the other hand, Filo et al., (2015) also showed a statistically non-significant preference of the left (17.21%) as against the right (15.02%) side.

Versus our results, Mohamadi et al., (2016) and Palma and Lombardi, (2018) described a high prevalence of bilateral existence of these structures. However, von Arx et al., (2011) have reported bilateral disposition being as frequent as unilateral on the right side.

In regard to the canal morphology according to von Arx et al., (2011) and Sisman et al., (2015) classifications respectively, the present study discovered that the curved course with horizontal branch was more common : three cases out of six (50% of the detected retromolar canals) 1.95% of all cases reported (Type VIII, B2), one case (16.7% of the detected retromolar canals) (0.65%) of all cases showed (Type I , A2), one case (16.7% of the detected retromolar canals) 0.65% of all cases showed (Type VI, C) and the last case (16.7% of the detected retromolar canals) 0.65% of all cases demonstrated (Type IX, B2).

Against our results, In Ahuja et al., (2018) study, vertical and angular canals were most often followed course by the canal followed by horizontal. According to von Arx et al., (2011) most canals had a vertical course (type A1, 41.9%

and A2, 16.1%) followed by curved course (type B1, 29% and B2, 12.9%). Type C, i.e. horizontal course was never identified. A very similar distribution in the same sequence was also arrived at by Filo et al., (2015) study who found the type A1 of the RMC (vertical course) occurred most frequently (39.82%), then types B1 (24.07%), A2 (18.98%), B2 (11.11%) and finally C (6.02%).

Patil et al., (2013) described a frequency of 85.27% regarding canal type B, but these authors used a deviating classification. The type B of Patil et al., (2013) approximately corresponds to our type B1. It should be observed that the final comparison with the literature concerning canal morphologies is somewhat difficult due to different, non-compatible classifications used. (Narayana et al 2002, von Arx et al., 2011, Filo et al., 2015 and Patil et al., 2018)

Turning to the height of the retromolar canal (vertical distance from retromolar foramen to mandibular canal), our results indicated that the range was from 5.82- 20.8 mm with mean height 11.4 mm for the right side and 6.71mm for the left side. The median was 9mm for the right side and 6.71 for the left side and standard deviation was 5.7 for right side and 0.89 for left side. The data assumed from this study can improve understanding of the anatomy of RMC as there is deficiency in information on RMC height in previous studies.

Ahuja et al., (2018) reported the mean length of 10 RMC on the right side to be 9.292 mm and 9.3136 mm for 11 canals on the left side. The results are away from our results. This difference can be explained with the variation in the tool and method used to measure the length of the curved canals (tapeline tool). Related to Filo et al., (2015) reports, the average canal height of 10.19 mm (SD = 2.64 mm) was also in good agreement with the value obtained by von Arx et al., (2011) using the same method of measurement.

By Measuring the distance from distal CEJ of the second molar tooth to the midpoint of the RMF, the retromolar foramina were located at a distance range from 8.8 - 18.8 mm with mean distance of 13.7mm for the right side and 14.2mm for the left side. The median was 13.6 mm for the right side and 14.2 for the left side, finally, the SD was 4.8 for right side and 5.8 for the left side, so the left retromolar foramina were located more posterior than the right ones so the RMF doesn't has a constant location.

Away from our results, Ahuja et al., (2018) reported higher mean distance from the midpoint of RMF to the CEJ of the second molars (21.19 mm). Kawai et al., (2012) reported less mean distance from the second molars. The position of the teeth and jaw size may be the influencing factors affecting the results.

Close to our results, von Arx et al., (2011) reported the distance to distal aspect of 2nd molar as 15.2 ± 2.39 mm and Patil et al., (2013) found the distance to distal aspect of 2nd molar as 11.9–15.2 mm. Filo et al., (2015) assessed that the mean distance from the RMF to the second molar and assumed that this distance is longer in patients with third molars absent (15.4 mm) than patients with the wisdom teeth present (15.1 mm), but the difference was not statistically significant. (Laçin et al., 2019)

Bilecenoglu and Tuncer, (2006) reported that the approximate location of the RMF from the distal edges of the second molars in Turkish was 11.9mm (SD = 6.71 mm) with a range of 9.50–24.27 mm and third molars was 4.23 mm which is slightly lower than our results. However, this measurement was made from the mesial margin of the RMF to the distal edge of the second molar not from the center of the RMF to the CEJ (shorter distance).

In other investigations, Narayana et al., (2002) have documented a range of distance as 2- 24 mms. In Shantharam et al., (2013) study the mean distance was 9.71mm.

CONCLUSION

According to the descriptive analysis made in this study on a sample of Egyptian population, the prevalence of RMF was very minor 3.9%, with more female predilection (no statistical significance). Unilateral existence of RMF was reported. The distance of RMF from second molar is also found to be higher on the left side.

Although the prevalence of RMF and RMC in our population is low, however, the assessment of these structures shouldn't be neglected and it is highly recommended to avoid surgical and anesthetic complications

CONFLICT OF INTEREST

This study was performed in absence of any conflict of interest.

ACKNOWLEGEMENT

No funding sources (There is no acknowledgment

AUTHOR CONTRIBUTIONS

OMA designed and performleed the radiographic Omniya Abu El-Dahab CBCT analysis of RMF and RMC examination of all CBCT images, data analysis and also wrote the manuscript.

REFERENCES

Ahuja SB, Bhardwaj NS, Dang V, Ahuja R and Mathur H. Prevalence of retromolar canal and foramen: A cone beam computed tomography study. *J Indian Acad Oral Med Radiol* 2018; 30:216-22.

Alves N and Deana NF. Anatomical and radiographical study of the retromolar canal and retromolar foramen in macerated mandibles. *Int J Clin Exp Med.* 2015; 8(3):4292-6.

Bilecenoglu B and Tuncer N. Clinical and anatomical study of retromolar foramen and canal. *J Oral Maxillofac Surg* 2006; 64: 1493-1497.

Boronat A and Penarrocha M. Failure of locoregional anesthesia in dental practice. Review of the literature. *Med Oral Pathol Oral Cir Bucal.* 2006; 11:e510–3.

Capote TS, Gonçalves Mde A and Campos JA. Retromolar canal associated with age, side, sex, bifid mandibular canal, and accessory mental foramen in panoramic radiographs of Brazilians. *Anat Res Int.* 2015; 2015:434083.

Filo K, Schneider T, Kruse AL, Locher M, Grätz KW and Lübbers HT. Frequency and anatomy of the retromolar canal – implications for the dental practice. *Swiss Dental Journal* 2015; 125(3): 278-292.

Han SS and Hwang YS. Cone beam CT findings of retromolar canals in a Korean population. *Surg Radiol Anat*. 2014 Nov; 36(9):871-6.

Kawai T, Asaumi R, Kumazawa Y, Sato I and Yosue T. Observation of the temporal crest canal in the mandibular ramus by cone beam computed tomography and macroscopic study. *Int J Comput As-sist Radiol Surg* 2014; 9:295-299

Kawai T, Asaumi R, Sato I, Kumazawa Y and Yosue T. Observation of the retromolar foramen and canal of the mandible: a CBCT and macroscopic study. *Oral Radiol.* 2012; 28:10-14.

Khan MA, Agarwal S and Mandloi RS: Prevalence of retromolar foramen in dried mandible along with morphometric and analytical study in North India. *National Journal of Medical and Dental Research*, October-December 2013; 2(1):11-14.

Kikuta S, Iwanaga J, Nakamura K, Hino K, Nakamura M and Kusukawa J. The retromolar canals and foramina: radiographic observation and application to oral surgery. *Surg Radiol Anat* 2018; 40: 647.

Kumar SS and Kesavi D: A study on the incidence of retromolar foramen and canal in Indian dried human mandibles and its Clinical Significance. *International Journal of Anatomical Sciences* 2010; 1:14-16.

Laçin N, Tatar B, Veli İ and Aytuğar E. Evaluation of the retromolar canal and foramina of the mandible with cone-beam computed tomography. *Harran Üniversitesi Tıp Fakültesi Dergisi (Journal of Harran University Medical Faculty)* 2019; 16(1):139-142.

Lizio G, Pelliccioni GA, Ghigi G, Fanelli A and Marchetti C. Radiographic assessment of the mandibular retromolar canal using cone-beam computed tomography. *Acta Odontol Scand*. 2013; 71(3-4):650-5.

Mendenhall WM, Werning JW and Pfister DG. Treatment of head and neck cancer. In: DeVita VT Jr, Lawrence TS, Rosenberg SA: Cancer: Principles and Practice of Oncology. 9th ed. Philadelphia, Pa: Lippincott Williams & Wilkins; 2011.

Motamedi MH, Gharedaghi J, Mehralizadeh S, Navi F, Badkoobeh A, Valaei N and Azizi T. Anthropomorphic assessment of the retromolar foramen and retromolar nerve: anomaly or variation of normal anatomy? *International J of Oral and Maxillofacial Surgery* 2016 Feb; 45(2):241-4.

Motta-Junior J, Ferreira ML, Matheus RA and Stabile GAV. Forame retromolar: sua repercussão clínica e avaliação de 35 mandíbulas secas. *Rev Odontol* UNESP 2012; 41: 164-168.

Naitoh M, Hiraiwa Y, Aimiya H and Ariji E. Observation of bifid mandibular canal using cone-beam computerized tomography. *Int J Oral Maxillofac Implants* 2009; 24:155-9.

Narayana K, Nayak UA, Ahmed WN, Bhat JG and Devaiah BA. The retromolar foramen and canal in South Indian dry mandibles. *Eur J Anat* 2002; 6:141-6.

Ossenberg NS. Retromolar foramen of the human mandible. *Am J Phys Anthropol.* 1987; 73:119-28.

Palma LF and Lombardi LA. Anatomical description of retromolar foramina in dry human mandibles: incidence, morphometry, and topography. *RGO, Rev Gaúch Odontol, Porto Alegre.* 2018 Abr-Jun; 66(2):136-140.

Patil S, Matsuda Y, Nakajima K, Araki K and Okano T. Retromolar canals as observed on cone-beam computed tomography: Their incidence, course, and characteristics. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2013; 115:692-9.

Potu BK, Kumar V, Salem AH and Abu-Hijleh M. Occurrence of the retromolar foramen in dry mandibles of South-eastern part of India: a morphological study with review of the literature. *Anat*

Priya R, Manjunath KY and Balasubramanyam V. Retromolar foramen. *Indian J Dent Res* 2005; 16: 15-16.

Res Int. 2014; 296717.

Rodella LF, Buffoli B, Labanca M and Rezzani R. A review of the mandibular and maxillary nerve supplies and their clinical relevance. *Arch Oral Biol* 2012; 57:323-34.

Rossi AC, Freire AR, Prado GB, Prado FB, Botacin PR and Caria PHF. Incidence of retromolar foramen in human mandibles: ethnic and clinical aspects. *Int J Morphol*. 2012; 30:1074-8.

Shantharam V .Manjunath K.Y .Aruna N and Shastri D. Retromolar foramen in South Indian mandibles. *Anatomica Karnataka* 2013; 7 (1):34-37.

Sisman Y, Ercan-Sekerci A, Payveren-Arikan M and Sahman H. Diagnostic accuracy of cone-beam CT compared with panoramic images in predicting retromolar canal during extraction of impacted mandibular third molars. *Med Oral Patol Oral Cir Bucal.* 2015 Jan 1; 20(1):e74-81.

Taisuke K, Rieko A, Iwao S, Yasuo K and Takas Y. Observation of the retromolar foramen and canal of the mandible: A CBCT and macroscopic study. *Oral Radiol* 2012; 28:10-4.

Tapas S. Morphological variations of coronoid process in dry adult human mandibles. *Indian J Basic Appl Med Res*. 2014; 3:401-5.

Uner DD, Izol BS and Gorus Z. Correlation between buccal and alveolar bone widths at the central incisors according to cone-beam-computed tomography. *Niger J Clin Pract* 2019; 22:79-84.

Üner DD, Izol BS and Ipek F. The evaluation of the prevalence and localizations and of antral septa in people living in and around Di-yarbakir using cone beam computed tomography. *J Oral Maxillo-fac Radiol* 2018; 6:3-8.

Von Arx T, Hanni A, Sendi P, Buser D and Bornstein MM. Radiographic study of the mandibular retromolar canal: an anatomic structure with clinical importance. *J Endod.* 2011b Dec; 37(12):1630-5.