

Prevalence and Distribution of Radix Paramolaris in the Mandibular First and Second Molars of an Iranian Population

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ABSTRACT

Objectives: Inability to find supernumerary roots is one of the most important reasons for root canal therapy failures in molar teeth. This research aimed to determine the incidence and distribution of radix paramolaris in permanent mandibular molars of the population of Kerman, Iran over 2016–2017.

Materials and Methods: This study was performed on a collection of 500 extracted permanent mandibular first and second molars selected by random from different dental centers in Kerman without recording the sex and age of the patients as inclusion criteria. The incidence of additional mesiobuccal root (radix paramolaris), the average root length and morphology of this root was carefully determined following the Calberson and Alexanderson classification pattern.

Results: The incidence of radix paramolaris was 1.2% in mandibular first molars (0.8% Type A and 0.4% Type B) and 0.8% in mandibular second molars (0.4% Type A and 0.4% Type B) of this population. Fischer's Exact test showed that the difference in frequency of the radix paramolaris between first and second mandibular molars of this population was not statistically significant (two-sided $P = 0.0001$). The average length for radix paramolaris was 13.05 mm in mandibular first and second molars in this study.

Conclusion: Radix paramolaris was found more frequently in mandibular first molars than in mandibular second molars in this sample of 500 mandibular molars. The rate of 1.2% in first molars seems to be higher than reported rates in European or Caucasian populations where the prevalence is typically <0.5%.

KEYWORDS: Iranian, Kerman, prevalence, radix paramolaris

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INTRODUCTION

A thorough knowledge of root canal anatomy and morphology of the teeth and the frequency of their possible anomalies is essential for having successful root canal treatments.^[1]

Many studies have reported that the root canal anatomy and morphology of the mandibular molar teeth could have many various and complex features. Due to this wide range of complexity, mandibular molar teeth are expected to be one of the most difficult teeth to treat.^[2-4] Mandibular molar teeth, normally are composed of two separate roots, one in the mesial and the second on the distal aspect of the teeth. Radix root is an additional third root which may exist on the distolingual or

mesiobuccal side of the mandibular molar teeth. If this additional root locates on the distal and lingual aspect is called radix entomolaris (RE) and if on the mesiobuccal, is termed radix paramolaris. The formation of radix molar is generally related to racial, genetic and external factors during odontogenesis. Meanwhile, gender is not expected to have an important role in the formation of the radix roots.^[5]

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In mandibular molar teeth, the supernumerary roots of RE or Radix Paramolaris (RP) can vary from a short conical root to a root of normal length. This additional root can be separate or non separate. Calberson and Alexanderson describe two different types for radix paramolaris: Type A and Type B. Type A refers to a RP in which the cervical part is located on the mesial root complex; while in Type B, the cervical part is located centrally between the mesial and distal root.^[6]

Since radix roots locate parallel to the main mesial or distal root, common and digital posteroanterior radiographies are poor to clarify these roots unless additional tube-shifted radiographies are taken to prove the existence of the third roots.^[7]

Nowadays, cone beam volumetric tomography is an excellent technology for radix root diagnosis and root canal treatment.^[8]

Past studies have shown that anatomical variations in teeth is not significantly influenced by gender. On the other hand, ethnic backgrounds have been shown to have very important role in occurring these variations. The important role of race and ethnicity in anatomical variation of the different teeth and the associated root canals makes it essential to study the root canal anatomy and morphology of the teeth in different parts of the world separately and by specific.^[9,10]

Very few studies in the past have been carried out reporting the prevalence of RP in permanent mandibular first and second molars. These studies have reported low and almost a rare incidence of radix paramolaris in mandibular molar teeth (between 0% and 1.2%).^[10-15]

This study was done to identify and report the prevalence of radix paramolaris in human permanent first and second mandibular molars of a southeastern Iranian population and compare the obtained results with the few existing reports from other geographical parts of the world.

MATERIALS AND METHODS

With the protocol approval of the institutional review board (approval No. K.93.422), 500 permanent first and second mandibular molar teeth were collected by random over 2016–2017 from different dental centers in Kerman, Iran [Figure 1]. The teeth had been extracted because of dental caries, periodontal complications or prosthetic treatment planning. Gender and age of the patients having extractions had not been recorded and assumed as criteria in this research. After excluding the teeth with separated roots or roots which had been surgically removed, a sample of 250 first and 250 second mandibular molar teeth were selected. Selected teeth

were cleaned with 2.5% sodium hypochlorite solution and then kept in normal saline until exploration for additional root.

All teeth were observed macroscopically. In cases when RP was recognized as an additional root on the mesiobuccal aspect of the distal root, the type of RP was assigned and recorded according to the Calberson classification and the root length measured from the apex to the cusp tips. In cases with root curvature, this could underestimate root length by 1 mm.^[11]

RESULTS

The incidence of radix paramolaris was 1.2% in mandibular first molars (0.8% Type A and 0.4% Type B) and 0.8% in mandibular second molars (0.4% Type A and 0.4% Type B) of this population [Figures 2 and 3]. Fischer's Exact test showed that the difference in frequency of the radix paramolaris between first and second mandibular molars of this population was not statistically significant (two-sided $P = 0.0001$). The average length for RP was 13.05 mms in mandibular first and second molars of this population. The results of this study are summarized in Table 1.

DISCUSSION

Many studies have been done to clarify the root canal anatomy of first, second, and third mandibular molar teeth in different parts of the world.^[2-4,9]

Review of the literature shows that far less attention has been focused on determining the incidence of radix paramolaris in comparison with RE, mainly because of the low or rare incidence of radix paramolaris.^[5-7,12-15] Some other studies, have just determined the prevalence of a third additional root in mandibular molar teeth without determining the type of it (RE or RP).^[10,11]



Figure 1: Bottle containers of randomly collected extracted first and second mandibular molar teeth

Table 1: Incidence and distribution of radix paramolaris in mandibular first and second molars of Kerman population over 2016-2017

	Number of samples	Number of RP	Number of type A (%)	Number of type B (%)	Average root length	Total incidence (%)
Mandibular first molars	250	3	2 (0.8)	1 (0.4)	11.6 mm	1.2
Mandibular second molars	250	2	1 (0.4)	1 (0.4)	14.5 mm	0.8

RP=Radix paramolaris

**Figure 2: Mandibular second molar showing radix paramolaris: Type A**

Schafer in a study in Germany (2009) which had been done on 524 patients, 260 females and 264 males, aged between 24 and 80 years and on a total of 1024 mandibular first molars (left molars comprised 500 teeth and right molars 524 teeth) found seven patients who had a three-rooted mandibular first molar, three females and four males ($P = 0.981$), the overall incidence of patients with three-rooted mandibular first molars was 1.35%. The incidence was 1.52% for men and 1.15% for women. All three-rooted molars occurred unilaterally. The right first molar had an incidence of 0.57% while the incidence in the left molar was 0.80%. This valuable study did not focus on determining the location of the additional root on the distolingual (RE) or on the mesiobuccal aspect of the selected teeth (RP).^[10]

Schafer's results are in agreement with previous reports on Europeans but are considerably lower in comparison with data reported for Asians.^[10,11] The most important deficiency of their study was that just the incidence of a third root was considered and the incidence of

radix entomolaris or radix paramolaris had not been determined separately and by specific in their study.

Tu *et al.* in a study which had been done on the screened periapical radiographs of a total of 731 patients with the assumption of the gender, symmetry, and frequencies of occurrence of three-rooted mandibular first molars as criteria reported a prevalence of 21.09% for three-rooted mandibular first molars in a Taiwanese population. There was a significantly higher incidence of three-rooted teeth on the right side of the mandible than on the left, but gender did not show a significant relationship with this variant prevalence.^[11]

Kuzekanani *et al.* in a recent study which was done on a total of 500 extracted mandibular first and second molar teeth in Kerman, a city in south east of Iran reported an over all incidence of 6% for mandibular first molars and 0.8% for mandibular second molars, showing RE.^[12]

Radix roots are one of the most important challenges in root canal treatments. Several studies show that many

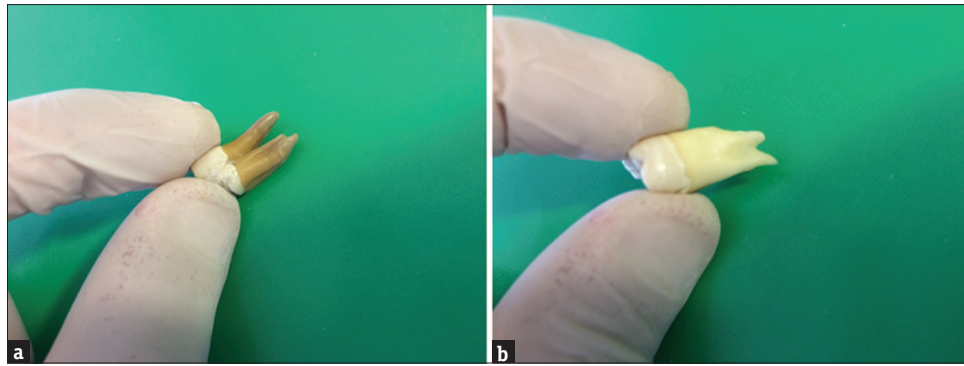


Figure 3: (a) A mandibular first molar showing radix paramolaris; Type B. (b) A mandibular first molar showing radix paramolaris; Type A

clinicians fail to find the additional root in mandibular molar root canal treatments; hence, this overlooked additional roots are one of the most important causes for Endodontic failures in mandibular molar teeth. In this study, we examined 500 extracted mandibular molar teeth with equal distribution between the first and the second mandibular molars, to determine the incidence of radix paramolaris in population of Kerman over 2016–2017.

Extracted teeth provide a three-dimensional appearance of the subjects, and as a result, they are preferable to radiographies which exhibit the pictures of the teeth, just in two dimensions.^[9]

The use of cone-beam volumetric tomography can be highly informative when anomalies in root morphology are identified on periapical radiographs. In the absence of such imaging, tube shifting with additional views taken from a more medial or distal angle of 20°–30° (Parallax technique) can help delineate the root morphology.^[7]

The incidence of radix paramolaris was 1.2% in mandibular first molars (0.8% Type A and 0.4% Type B) and 0.8% in mandibular second molars (0.4% Type A and 0.4% Type B) of this population, respectively. There was no significant difference between the rate of RP occurrence in mandibular first and second molars of this population.

The average length for the radix paramolaris cases in this study was 13.05 mms, and in Type A, they had conical shapes and calcified apical parts. Nickle Titanium Rotary instruments can highly facilitate and help to bypass the calcified apical regions of these additional roots.^[16,17]

The incidence of RP reported by Bhatia *et al.* in a study which was done on a total of 1875 extracted human permanent mandibular molars collected from different locations of Klang Valley, Malaysia, was 0.7% in first, 0.4% in second, and 0.6% in third molars. There was also no significant difference between the incidence of RP in different mandibular molar teeth of this population.^[13]

The prevalence of RP reported by Visser was 0% for the mandibular first and 0.5% for the mandibular second and 2% for the mandibular third molar.^[14,15]

Rahimi *et al.* in a study on a total of 386 cone beam computed tomography (CBCT) images from patients referred to Oral and Maxillofacial Radiology Department of Tabriz school of dentistry in northwest of Iran found that the prevalence of three-rooted mandibular first molars with an additional root was 3%, (3.53% in female and 2.50% in male patients). There was no significant relationship between gender and bilateral occurrence of three-rooted mandibular first molars. Like most previous studies, they did not assign the prevalence of RE and RP by separate in their research report.^[18]

Over discussed studies which have been done to determine the prevalence of RP, report that this anomaly is very rare and occurs less frequently than the RE. More studies in the future with higher sample sizes are recommended to determine the prevalence of RP in mandibular molar teeth using CBCTs.

CONCLUSION

Radix paramolaris was found more frequently in mandibular first molars than in mandibular second molars in this collection of 500 mandibular molar teeth. The reported rate of 1.2% in first molars seems to be higher than recorded rates in European or Caucasian populations where the prevalence is typically <0.5%. More studies with higher sample sizes are recommended in the future to determine the prevalence of RP in mandibular molar teeth using cone beam volumetric tomography.

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CONFLICTS OF INTEREST

There are no conflicts of interest.

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