Avicenna J Dent Res. 2013 June; 5(1): e21102. DOI: 10.17795/ajdr-21102

Published online 2013 June 28. **Research Article**

Radiographic Evaluation of Root and Canal Morphologies of Third Molar Teeth in Iranian Population

Farhad Faramarzi [1]; Shahriar Shahriari [1]; Abbas Shokri [1]; Mitra Vossoghi [1,*]; Ghafar Yaghoobi [1]

[1]Department of Endodontics, Hamadan University of Medical Sciences, Hamadan, IR Iran

*Corresponding author: Mitra Vossoghi, Department of Endodontics, Hamadan University of Medical Sciences, Shahid Fahmideh Blvd, P.O. Box: 6517838677, Hamadan, IR Iran. Tel: +98-8118381086, Fax: +98-8118381085, E-mail: Mit.Vossoghi@gmail.com

Received: November 20, 2012; **Revised:** December 22, 2012; **Accepted:** January 10, 2013

Background: Root and canal morphology of teeth has a significant role in endodontic treatment success. Third molars have strategic roles after losing first and second molars.

Objectives: This study investigated the morphology of permanent third molar using radiography in Dentistry University of Hamadan during 2011.

Materials and Methods: In this experimental study, 352 extracted molars (179 maxillary and 173 mandibular molars) were collected. After preparing access cavity and file placement in canals, to investigate the number of roots, canals and canal type periapical radiographies were taken from two directions (mesiodistal and buccolingual). The results were analyzed using SPSS version 16.0 software and descriptive statistics.

Results: According to the study on 173 mandibular third molars, 92.4%, 4.6%, and 2.89% had two, one, and three roots, respectively. Majority of them had two or three canals and most of mesial root canals were type 2; but in 179 maxillary third molars, findings showed that 67.6%, 15%, 11.7%, and 5.6% of teeth had three, one, two, and four roots, respectively, majority of which had three canals (68.7%). Canals of 100% of distobuccal and palatal roots and 91% of mesiobuccal roots were type 1.

Conclusions: However, root and canal anatomies of third molar teeth are unknown, but studies focusing on third molar teeth have shown their possibility of treatment.

Keywords: Root Canal; Molar, Third; Mandible; Maxilla

1. Background

The ability of removing bacteria and completely cleaning and shaping the root canal system are important factors of successful endodontic therapy (1). To achieve this, it is necessary to know the root and canal anatomies. Some complications of root anatomy include the number of canals in each root, orifice distances of canals, and canal types, which are covered with external root surface and are not detectable (2). Regarding the genetic factors influencing the root anatomy as well as variety of root canals systems in different species, it is necessary to evaluate the root morphology in different populations (3).

Most failures of molars root canal therapy occur because of anatomy complications, multiple canals, and canals availability, especially MB2 (4, 5). Therefore, knowing the root canal anatomy of third molar is necessary to maintain it in compromise conditions such as losing first and second molars (6, 7). There are different methods to evaluate the canals morphologies, such as conventional radiography, tooth clearing, CT, and CBCT (8); however, conventional radiography, especially periapical radiography, is the most common and simple way. Advantages of this method are availability, low dosage of required X-ray, and being inexpensive and easy to perform in clinics (9, 10).

2. Objectives

Being knowledgeable about root and canal morphologies is important for successful endodontic therapy. Researches have been conducted in different countries such as Thailand, India and China regarding this matter, but there were a few studies on Iranian populations. Therefore, we aimed to evaluate root and canal morphologies of third molars by conventional radiography.

3. Materials and Methods

In this experimental study, 352 extracted third molars (179 maxillary and 173 mandibular third molars) were collected from Hamadan population. The teeth were extracted due to caries, periodontal complications, or orthodontic needs. The collected teeth were evaluated for third molar anatomy. After preparing access cavity, the teeth were stored in 5.25% NaClO solution for five to 10 hours,

then irrigated by and stored in normal saline until initiating the test. Two initial mesiodistal and buccolingual direction radiographies were taken.

1. Mesiobuccal, 2. Computed Tomography, 3. Cone Beam Computed Tomography

In opened orifices, K files, number 0.08, were placed in canals till the root apex for demonstrating the canals; if K file number 0.08 could not penetrate to the orifice of canals, long shank diamond round bur was used till 2 mm depth of the orifice, and further, if the root canal was not opened by this method, the tooth was excluded. All the canals were filed till K file number 15. A further K file number 0.08 was placed in additive apical foramen, so it was possible to investigate the Vertucci canal types. After preparing two radiographies of mesiodistal and buccolingual directions with K file number 0.15, we could evaluate the canals numbers, types and configurations. Finally, data were analyzed by SPSS version 16.0 and descriptive statistics.

4. Results

The study was performed on 352 extracted third molar teeth, including 179 maxillary and 173 mandibular third molars. The maximum percentages were specified to two rooted mandibular and three rooted maxillary third molars (Figure 1). Most of the third molars had two canals in mandible and three canals in maxilla (Figure 2). It was considerable that all single root mandibular third molars were Vertucci type 1. In contrast, it was 85.18% in maxillary third molars, and then, 7.4% of the single-root teeth in upper jaw were Vertucci type 2. In two-rooted mandibular teeth, mesial root had single canal in 51.87% and two canals in 48.13% of species. In addition, 96.87% were single canal and 3.13% had two canals in the distal root. The canal types data are indicated in Table 1.

In three-rooted mandibular third molars, 60% of mesial roots had single canal and Vertucci type 1 and 40% had two canals with same percentages of types 2 and 4. In addition, 100% of distobuccal and distolingual canals of three-rooted mandibular third molars were Vertucci type 1. Of single roots maxillary third molars, 85.19% had only one canal and the rest (14.81%) had two. In two-rooted teeth of the same jaw, 95.78% of buccal roots had one canal with Vertucci type 1 and the rest had two canals with same percentages of Vertucci types 2 and 3. However, palatal root in 100% of cases had single canal with Vertucci type 1. Two- and three-rooted maxillary third molars had single canal palatal roots and Vertucci type 1. 100% of distobuccal roots and 91.17% of mesiobuccal roots in three-rooted maxillary third molars had one canal and Vertucci type 1. The rest of mesiobuccal roots (9.73%) were found with two canals and Vertucci types 2, 4 and 5. In four-rooted teeth, all canals such as palatal, mesiobuccal 1, mesiobuccal 2, and distobuccal, were Vertucci type 1. Furthermore, we could find 8.94% anomaly in maxillary third molars with 8.13% palatal and distobuccal roots fusion and 0.81% mesiobuccal and distobuccal roots fusion, but no anomaly was found in other species.

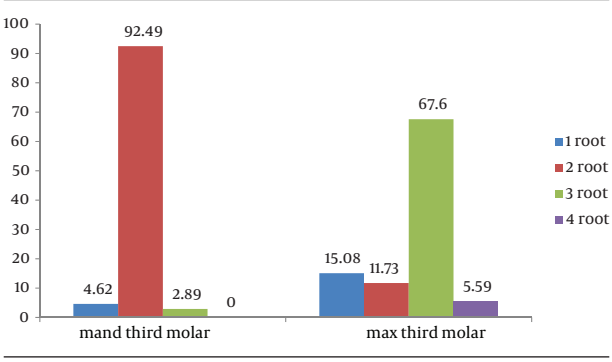

Figure 1. Root Number of Third Molar Teeth According to the Percentages

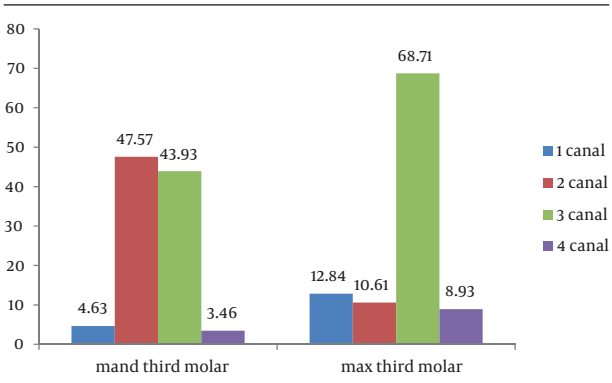

Figure 2. Canal Number of Third Molar Teeth According to the Percentages

Table 1. Canal Types of Two-Rooted Mandibular Third Molars According to the Vertucci Classification

Root type	Canal Type				
	1	2	3	4	5
Mesial	51.87	26.25	4.37	11.25	6.5
Distal	96.87	1.25	0	1.87	0

5. Discussion

There are different ways to evaluate the canal morphology; but in this study, file placement in the canals and radiography were used (11). In most studies investigating the canal morphology, Vertucci classification has been used (12-17). They showed that results were affected intensively by sex and methodology of the research (10, 17-19). Considering the classic information, maxillary third molars do not have definitive root and canal anatomies; but, in the case of losing first and second molars, third molars will have strategic roles. However, maxillary third molar studies have indicated their possibility of treatment.

Sert et al. evaluated the third molar anatomy of Turkish population with dye. Their results indicated 35.5% of maxillary third molars were one-rooted, which was 15.8% in our study. In their study, 24.9% of mandibular third molars were single-rooted, but we found it to be 4.62%. In the same study, 69.2% and 5.4% of teeth were two- and three- rooted, which

were 92.49% and 2.89% respectively in our study. The differences between the two studies could be due to differences in races, population species, and methodologies. However, majority of mandibular third molars were two-rooted and minority of them were three-rooted in both studies (20).

Sidow et al. investigated 300 third molars of the same percentage using dye, and demonstrated that 17% of mandibular third molars had one root, 77% two roots, 5% three roots and 1% four roots; in comparison, we did not find four-rooted mandibular third molars and majority of teeth (92.49%) had two roots, which was in accordance with Sidow's study. Probably, different results of two studies were because of different races and methods (21).

In two-directional radiography used by Pineda et al. (same as our study), the canal types in mesial roots of mandibular third molars were respectively type 1, type 2, and type 4 from top to bottom and the lowest was type 5. The result of two studies were exactly the same and different percentages may be due to race variations of different populations (22). In a recent study, 100% of three-rooted maxillary third molars had distobuccal and palatal roots of Vertucci type 1, while 91.17% of mesiobuccal roots were Vertucci type 1 and 9.73% type 2. Weng et al. analyzed an Indian population and concluded that 87.5%, 91.6%, and 62.5% of distobuccal, palatal, and mesiobuccal roots, respectively, were type 1. Different results might be due to different methods and race variations of different populations (23). Alavi et al. investigated the maxillary molars morphology in a Thai population. Ditobuccal and palatal roots were type 1 in 100% of cases, which was exactly similar to the present study, but the mesiobuccal root was type 1 in 54.5% of species, while we found it to be 91.17% (24).

Ng et al. evaluated root and canal morphologies of Burmese maxillary molars with majority of palatal (100%) and distobuccal roots of type 1, which was in accordance with our results (25).

In this study, root and canal morphologies of maxillary and mandibular third molars were evaluated by radiography. According to our findings, 92.4% of mandibular third molars were two-rooted, 4.6% one-rooted and 2.89% three-rooted. In addition, majority of them had two or three canals (47.5% had two and 43.9% had three canals).

Mesial roots of mandibular third molars with two canals were divided to four types of Vertucci, which were respectively type 2, 3, 4, and 5, from top to bottom. Furthermore, among 179 extracted maxillary third molars, 67.6% were three-rooted, 15% one-rooted, 11.7% two-rooted, and 5.6% four-rooted and majority of them had three canals (68.7%). Of distobuccal and palatal roots, 100% were type 1 and 91% and 9% of mesiobuccal roots were respectively types 1 and 2.

References

1. Neelakantan P, Subbarao C, Ahuja R, Subbarao CV, Gutmann JL. Cone-beam computed tomography study of root and canal morphology of maxillary first and second molars in an Indian population. *J Endod.* 2010;**36**(10):1622–7.
2. Ingle JI, Bakland LK, Baumgartner JC. *Ingle's Endodontics 6.* BC Decker; 2008.
3. Neelakantan P, Subbarao C, Subbarao CV. Comparative evaluation of modified canal staining and clearing technique, cone-beam computed tomography, peripheral quantitative computed tomography, spiral computed tomography, and plain and contrast medium-enhanced digital radiography in studying root canal morphology. *J Endod.* 2010;**36**(9):1547–51.
4. Tian YY, Guo B, Zhang R, Yu X, Wang H, Hu T, et al. Root and canal morphology of maxillary first premolars in a Chinese subpopulation evaluated using cone-beam computed tomography. *Int Endod J.* 2012;**45**(11):996–1003.
5. Prado-Simon L, Martinon-Torres M, Baca P, Olejniczak AJ, Gomez-Robles A, Lapresa M, et al. Three-dimensional evaluation of root canal morphology in lower second premolars of early and middle Pleistocene human populations from Atapuerca (Burgos, Spain). *Am J Phys Anthropol.* 2012;**147**(3):452–61.
6. Parekh V, Shah N, Joshi H. Root canal morphology and variations of mandibular premolars by clearing technique: an in vitro study. *J Contemp Dent Pract.* 2011;**12**(4):318–21.
7. Jain A, Bahuguna R. Root canal morphology of mandibular first premolar in a gujarati population - an in vitro study. *Dent Res J (Isfahan).* 2011;**8**(3):118–22.
8. Berutti E, Paolino DS, Chiandussi G, Alovisi M, Cantatore G, Castellucci A, et al. Root canal anatomy preservation of WaveOne reciprocating files with or without glide path. *J Endod.* 2012;**38**(1):101–4.
9. Yang G, Yuan G, Yun X, Zhou X, Liu B, Wu H. Effects of two nickel-titanium instrument systems, Mtwo versus ProTaper universal, on root canal geometry assessed by micro-computed tomography. *J Endod.* 2011;**37**(10):1412–6.
10. Gu Y, Lee JK, Spangberg LS, Lee Y, Park CM, Seo DG, et al. Minimum-intensity projection for in-depth morphology study of mesiobuccal root. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2011;**112**(5):671–7.
11. Jain S. Mandibular first molar with three distal canals. *J Conserv Dent.* 2011;**14**(4):438–9.
12. Li X, Liu N, Liu R, Dong Z, Liu L, Deng M. [Comparative study of root canal morphology of mandibular first premolar by micro-CT and radio visio graphy]. *Hua Xi Kou Qiang Yi Xue Za Zhi.* 2012;**30**(1):57–60.
13. Vertucci FJ. Root canal anatomy of the human permanent teeth. *Oral Surg Oral Med Oral Pathol.* 1984;**58**(5):589–99.
14. Peters OA, Laib A, Gohring TN, Barbakow F. Changes in root canal geometry after preparation assessed by high-resolution computed tomography. *J Endod.* 2001;**27**(1):1–6.
15. Peters OA, Laib A, Ruegsegger P, Barbakow F. Three-dimensional analysis of root canal geometry by high-resolution computed tomography. *J Dent Res.* 2000;**79**(6):1405–9.
16. Peters OA, Peters CI, Schonenberger K, Barbakow F. ProTaper rotary root canal preparation: assessment of torque and force in relation to canal anatomy. *Int Endod J.* 2003;**36**(2):93–9.
17. Gulabivala K, Aung TH, Alavi A, Ng YL. Root and canal morphology of Burmese mandibular molars. *Int Endod J.* 2001;**34**(5):359–70.
18. Kartal N, Yanikoglu FC. Root canal morphology of mandibular incisors. *J Endod.* 1992;**18**(11):562–4.
19. McNamara C, House K, Davies R, Barker CS, Chawla O, Sandy JR, et al. The current status of 3D imaging in dental practice. *Dent Update.* 2011;**38**(10):679-82, 684-6, 688-90.
20. Sert S, Bayirli GS. Evaluation of the root canal configurations of the mandibular and maxillary permanent teeth by gender in the Turkish population. *J Endod.* 2004;**30**(6):391–8.
21. Sidow SJ, West LA, Liewehr FR, Loushine RJ. Root canal morphology of human maxillary and mandibular third molars. *J Endod.* 2000;**26**(11):675–8.
22. Pineda F, Kuttler Y. Mesiodistal and buccolingual roentgenographic investigation of 7,275 root canals. *Oral Surg Oral Med Oral Pathol.* 1972;**33**(1):101–10.
23. Weng XL, Yu SB, Zhao SL, Wang HG, Mu T, Tang RY, et al. Root canal morphology of permanent maxillary teeth in the Han nationality in Chinese Guanzhong area: a new modified root canal staining technique. *J Endod.* 2009;**35**(5):651–6.
24. Alavi AM, Opasanon A, Ng YL, Gulabivala K. Root and canal morphology of Thai maxillary molars. *Int Endod J.* 2002;**35**(5):478–85.
25. Ng YL, Aung TH, Alavi A, Gulabivala K. Root and canal morphology of Burmese maxillary molars. *Int Endod J.* 2001;**34**(8):620–30.