Root Canal Morphology of Mandibular Canine in a Kashmiri Subpopulation

Dr. Shahnaz Nabi[1*], Dr. Ajaz Masoodi[2], Prof Riyaz Farooq[3], Dr. Aamir Purra[4], Dr. Fayaz Ahmed[5]

[1,2]Lecturer, Department of conservative dentistry and endodontics, govt dental college and hospital, Srinagar, Jammu and Kashmir, India
[3]Professor, Department of conservative dentistry and endodontics, govt dental college and hospital, Srinagar, Jammu and Kashmir, India
[4]Associate Professor, Department of conservative dentistry and endodontics, govt dental college and hospital, Srinagar, Jammu and Kashmir, India
[5]Assistant professor, Department of conservative dentistry and endodontics, govt dental college and hospital, Srinagar, Jammu and Kashmir, India

Abstract	Original Research Article

Introduction: The aim of the study was to investigate the root canal morphology of mandibular canines in a Kashmiri subpopulation. *Materials and method:* For the morphological assessment of mandibular canines, 154 extracted mandibular canines were taken from patients for different reasons were used the number of roots and canal configuration was identified based on Vertucci's classification. *Results:* Most patients had one root, 99.8%, while double-rooted mandibular canines were observed in 0.2%. Moreover, Type I, II, III, and IV canal configurations were observed in mandibular canines with Type I being the most prevalent canal configuration (95.4%). *Conclusion:* Single rooted with Type I canal configuration was the most prevalent in mandibular canines in the kashmiri subpopulation. However, incidence of more than one root canal with different canal configurations was also detected.
Keywords: Morphology, kashmiri subpopulation, roots and canal, mandibular.

INTRODUCTION

The proper shaping, cleaning, and filling of the root canal system are an essential requirement for achiving success in endodontics. This necessitates a thorough understanding of the external and internal anatomy of root canal system and its morphological variations [1, 2]. These variations play an important role in determining success in endodontic therapy. Failure of treating all root canals effectively will lead to the persistence of microorganisms and necrotic tissues inside the canals and influence the treatment outcomes [3]. Different morphological variations occur in root canal systems. These have been investigated and classified by several investigators [4, 6] and the most widely used is Vertucci's classification [5]. Mandibular permanent canines usually present with single root and single root canal [7, 8] morphological. Variations have existed and are linked to various racial and genetic factors [9, 10]. Moreover, in Kashmiri population, several case reports of mandibular canines with unusual root canal morphology were reported [11, 14] The study of root canal system can be performed through different methods including the clinical evaluation during root canal treatment, canal staining and tooth clearing [5, 15], tooth sectioning [4], microscopic examination, and using three-dimensional (3D) methods such as micro-computed tomography [16, 18]. Therefore, the aim of the study was to investigate the root canal morphology of mandibular canines in a Kashmiri subpopulation using tooth clearing technique.

MATERIALS AND METHODS

A total of 154 extracted intact permanent mandibular canines from patients belonging to Kashmiri population extracted due to orthodontic or periodontic problems were included in the study. Teeth were cleaned of all debris and tissues and then stored in 10% formalin until analysis. The teeth were coded and a data form was assigned to each sample. The number of the roots and root lengths (measured in millimeters from anatomic apex to cemento enamel junction) were assessed and recorded. Then for each sample, access cavity preparation was done and the pulp chamber space was rinsed with 5.25% NaOCl solution for removal of the necrotic tissues. The root canals were subsequently irrigated with 5.25% Na OCl solution and distilled water using a 30-gauge needle. After allowing the samples to dry for 24 h, the same syringe and needle was used for injection of Indian ink. Then for complete distribution of the ink in entire root canal the teeth were stored in a vertical position by placing them in the head of high vacuum saliva ejector. Distribution of ink in the apical foramina indicated the end of the process. Decalcification process was performed by immersion of teeth in 5% nitric acid for 3 days at room temperature. The solution was refreshed daily and the teeth were

washed under running tap water for 10 min. The teeth were dehydrated by immersing subsequently in 80, 90 and 100% ethanol for 1 day. After drying with tissue paper, the samples were inserted in 50% methyl salicylate for 5 h to make them transparent. The transparent samples were evaluated using a stereomicroscope (Nikon SMZ1500, Nikon Corporation, Tokyo, Japan) under 10 × magnifications. The data were observed and recorded for the number of roots and canal configuration based on Vertucci's classification [5] as shown in Figure 1[33].
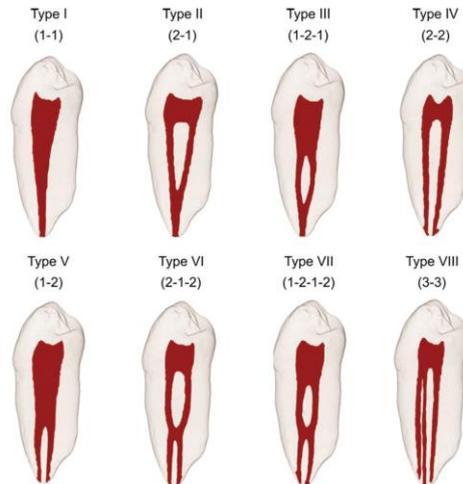

Fig-1: Vertucci's classification

RESULTS

Most of the teeth had one root (99.8%). Type I canal configuration (95.4%) was the most prevalent observation. The frequency and percentage of number of roots and canal configuration in mandibular canine teeth are shown in Table 1.

Table-1: The frequency and percentage of number of roots and canal configuration in mandibular canine teeth

No of roots	One root frequency	152(98.7%)
	Two root frequency	2(1.3%)
	Total frequency	154(100%)
Canal configuration	One canal frequency	147(95.4%)
	Two canal frequency	7(4.6%)
	Total frequency	154(100%)

DISCUSSION

The literature reveals periodic updates in the root canal morphology of teeth to learn more about their morphological variations, improve treatment techniques, and enhance treatment success rates [19]. For this purpose, different methods have been used to study the root canal morphology. Permanent mandibular canines were reported to have one root in 88.46%–100%, and double rooted in 0%–.54% [20, 21], while the number of root canals in mandibular canine was reported to be one canal in 84.9%–100%, and two canals in 0%–15.1% [5,7,10,12]. Moreover, case reports of mandibular canines with three root canals have been published [22, 23]. The most predominant root morphology in mandibular canine observed in this study was single rooted (99.8%), while double rooted was observed in 0.2%. However, the prevalence of two-rooted mandibular canines in kashmiri subpopulation in this study was higher than that in South Asian Indian population using the clearing method (0%)[14] and Hamadani population in Iran using CBCT technique (0%) [25]. A higher prevalence was reported in Iranian (4.7%)[20] and Chinese (0.7%) when the CBCT was the method used, and in Brazilian (1.7%) using clearing method [21]. The variation in root canal morphology in the literature may be attributed to the difference in patient ethnicity even within the same population which is considered as a significant factor that may affect the perception of the clinician for the suspected root canal anatomy [26]. Most mandibular canines in the present study had Type I canal configuration (95.4%), followed by Type II (2.6%), and Type III (1.8%). Type IV canal configuration was observed in one tooth (0.2%). According to Vertucci's classification [5], Type I was more frequent (78%) than the other canal configurations. These findings were similar to other studies where the prevalence of Type I was reported to be 81.5% in Mexican population [7], 80.39% in Turkish 95.4% in Hamadani population in Iran [25] and 92% in South Asian Indian population [24]. Utilization of all the available armamentarium and diagnostic techniques before and during root canal therapy including preoperative angled radiographs, good access cavity preparation, proper inspection of

pulpal floor, and a detailed examination of the interior of the tooth under magnification.

CONCLUSION

Within the limitation of this study, most mandibular canines had one root with Type I being the most predominant canal configuration in Kashmiri subpopulation.

REFERENCES

1. Vertucci FJ. Root canal morphology and its relationship to endodontic procedures. Endodontic topics. 2005 Mar;10(1):3-29.
2. Peikoff MD, Trott JR. An endodontic failure caused by an unusual anatomical anomaly. Journal of endodontics. 1977 Sep 1;3(9):356-9.
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. Journal of endodontics. 2010 Sep 1;36(9):1547-51.
4. Weine FS, Healey HJ, Gerstein H, Evanson L. Canal configuration in the mesiobuccal root of the maxillary first molar and its endodontic significance. Oral Surgery, Oral Medicine, Oral Pathology. 1969 Sep 1;28(3):419-25.
5. Vertucci FJ. Root canal anatomy of the human permanent teeth. Oral surgery, oral medicine, oral pathology. 1984 Nov 1;58(5):589-99.
6. Gulabivala K, Aung TH, Alavi A, Ng YL. Root and canal morphology of Burmese mandibular molars. International endodontic journal. 2001 Jul;34(5):359-70.
7. Pineda F, Kuttler Y. Mesiodistal and buccolingual roentgenographic investigation of 7,275 root canals. Oral Surgery, Oral Medicine, Oral Pathology. 1972 Jan 1;33(1):101-10.
8. Ouellet R. Mandibular permanent cuspids with two roots. Journal (Canadian Dental Association). 1995 Feb;61(2):159-61.
9. Cleghorn BM, Christie WH, Dong CC. Anomalous mandibular premolars: a mandibular first premolar with three roots and a mandibular second premolar with a C-shaped canal system. International endodontic journal. 2008 Nov;41(11):1005-14.
10. Somalinga Amardeep N, Raghu S, Natanasabapathy V. Root canal morphology of permanent maxillary and mandibular canines in Indian population using cone beam computed tomography. Anatomy research international. 2014;2014.
11. Rahmatulla M, Wyne AH. Bifid roots in a mandibular canine: report of an unusual case. The Saudi Dental Journal. 1993;5(2):77-8.
12. Balto HA, Al-Wakeel M. Mandibular canine with two root canals-Case Report. Egyptian Dent J. 2007; 53:2535-8.
13. Alenezi MA, Al-Hawwas AY. Permanent mandibular canine with two roots and two root canals: Two case reports. Saudi Endodontic Journal. 2016 May 1;6(2):98.
14. Alenazy MS, Alrushoud SS, Almasoud A, Al-Dayel O. Endodontic management of mandibular anterior teeth with two root canals. Saudi Endodontic Journal. 2019 May 1;9(2):140.
15. Al-Fouzan KS, AlManee A, Jan J, Al-Rejaie M. Incidence of two canals in extracted mandibular incisors teeth of Saudi Arabian samples. Saudi Endodontic Journal. 2012 May 1;2(2):65.
16. Grover C, Shetty N. Methods to study root canal morphology: A review. Endodontic Practice Today. 2012 Sep 1;6(3).
17. Cleghorn BM, Christie WH, Dong CC. Root and root canal morphology of the human permanent maxillary first molar: a literature review. Journal of endodontics. 2006 Sep 1;32(9):813-21.
18. Plotino G, Grande NM, Pecci R, Bedini R, Pameijer CH, Somma F. Three-dimensional imaging using microcomputed tomography for studying tooth macromorphology. The Journal of the American Dental Association. 2006 Nov 1;137(11):1555-61.
19. Çalişkan MK, Pehlivan Y, Sepetçioğlu F, Türkün M, Tuncer SŞ. Root canal morphology of human permanent teeth in a Turkish population. Journal of endodontics. 1995 Apr 1;21(4):200-4.
20. Aminsobhani M, Sadegh M, Meraji N, Razmi H, Kharazifard MJ. Evaluation of the root and canal morphology of mandibular permanent anterior teeth in an Iranian population by cone-beam computed tomography. Journal of Dentistry (Tehran, Iran). 2013 Jul;10(4):358.
21. Pécora JD, Sousa Neto MD, Saquy PC. Internal anatomy, direction and number of roots and size of human mandibular canines. Braz dent J. 1993 Jan;4(1):53-7.
22. Holtzman L. Root canal treatment of a mandibular canine with three root canals. Case report. International endodontic journal. 1997 Jul;30(4):291-3.
23. Heling I, Gottlieb-Dadon I, Chandler NP. Mandibular canine with two roots and three root canals. Dental Traumatology. 1995 Dec;11(6):301-2.
24. Singh S, Pawar M. Root and canal morphology of mandibular incisors and canines in South Asian Indian population by canal staining and tooth clearing technique. Endodontology. 2016 Jul 1;28(2):148.
25. Mirzaie M, Zaban P, Mohammadi P. Cone-beam computed tomography study of root canals in a hamadani population in Iran. Avic J Dent Res. 2014; 4:25-31.

26. Martins JN, Gu Y, Marques D, Francisco H, Caramês J. Differences on the root and root canal morphologies between asian and white ethnic groups analyzed by cone-beam computed tomography. J Endod. 2018; 44:1096-104.