

# Accuracy of Various Diagnostic Aids in Detection of MB2 Canal in Maxillary First Molar: *In vivo* Study

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## ABSTRACT

**Aim:** To evaluate and compare the accuracy of radiographic, visual, dye and magnification method in detection of second mesiobuccal (MB2) canal in maxillary first molar.

**Materials and methods:** One hundred males and females patients in age group of 20 to 45 years with maxillary first molar teeth indicated for root canal treatment were selected for the study. The presence of MB2 canal in maxillary first molar was observed by four independent observers using radiographic, visual, dye, magnification diagnostic aids.

**Results:** The study showed that there was a large difference in detecting MB2 canal in maxillary first molar when radiographic was compared with visual method and magnification method (i.e.,  $p < 0.01$ ). Whereas there was a nonsignificant difference when radiographic and dye method were compared (i.e.,  $p > 0.05$ ).

**Conclusion:** It was concluded that the incidence of MB2 canal in mesiobuccal roots of permanent maxillary first molars was detected most using magnification method, i.e., 87%. Accuracy of radiographic method was found to be least, i.e., 19%.

**Keywords:** Dye method, Endodontics, Magnification, MB2 canal, Radiographic, Second Mesiobuccal, Visual method.

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## INTRODUCTION

The basis of root canal therapy is mechanical and chemical debridement of necrotic pulp tissue, complete elimination of microorganisms from the root canal system and prevention of re-infection.<sup>1,2</sup> Thorough knowledge of the inherent anatomy and morphology

of the root canal is a significant element affecting the treatment outcome. The identification and access to pulp cavity is a tedious task in carrying out treatment of teeth with atypical canal configurations, one of them being maxillary molars.<sup>3,4</sup> The principle etiology of failure of endodontic treatment while treating maxillary molar is inability to complete debridement of infected pulp tissue. This occurs due to following incompetence of the clinician to detect additional root canals. In a study by Pomeranz and Fishelberg, it was stated that clinicians are aware that the mesiobuccal root often contains two canals and most of the times the second mesiobuccal (MB2) canal remains unnoticed.<sup>2</sup>

A literature review has demonstrated wide variation in the prevalence of the MB2 canal. Hess, in a classical study, reported finding of four canals in 54% of the maxillary first molar.<sup>5</sup> Weine et al evaluated maxillary first molars and located four canals in 62% of the cases.<sup>6</sup> Bjorndal and Skidmore (1983) affirmed that the difficulty in locating the mesiolingual (ML) canal during the root canal treatment may have effect on the long-term prognosis.<sup>3</sup> Neaverth et al (1987) studied roots of 228 maxillary first molars. During endodontic therapy, their canal configuration was categorized. Mesiobuccal roots in 77.2% cases were judged as having two canals. Hence, they suggested that more attention should be directed toward search of second canal in the mesiobuccal root of maxillary first molar.<sup>7,8</sup>

R Norman Weller et al (1989) studied endodontically treated maxillary first and second molars. They evaluated impact of improved access and searching techniques on detection of the mesiolingual canal in maxillary molars. It was concluded that groove extending from the mesiobuccal canal have resulted in definite increase in the number of fourth canal located and treated in maxillary molars.<sup>9</sup> Clinically, the presence or absence of the mesiolingual canal, the ability to locate the mesiolingual canal depends on the skill of the operator, the complexity of the anatomy, the use of various aids.<sup>10</sup>

The various diagnostic methods used enlist radiographic method, visual method, dye method and magnification method. The following study was carried out to evaluate and compare the accuracy of radiographic, visual, dye and magnification method in detection of MB2 canal in maxillary first molar.

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## MATERIALS AND METHODS

### Patient Selection

Patients indicated for root canal treatment were selected from the outpatient department (OPD). A detailed medical and dental history was taken. The inclusion criteria enlisted male and female patients in age group of 20 to 45 years with intact maxillary first molar teeth, teeth without calcified pulp chamber, with no modification in morphology and indicated for root canal treatment. Whereas the exclusion criterion stated male and female patients not falling in the age group of 20 to 45 years, fractured tooth, cracked tooth, teeth radiographically showing calcified pulp chamber, morphologically altered tooth and tooth not indicated for root canal treatment.

### STUDY DESIGN

The study was approved by Scientific and Ethic Committee of Dr. DY Patil Dental College and Hospital, the approval protocol number was EC/DYPDCH/CONS/03/2010. A total of 100 patients were selected for the study and informed written consent was taken from them. The research was conducted in full accordance with the World Medical Association Declaration of Helsinki. The presence of MB2 canal in maxillary first molar was observed by four independent observers using radiographic, visual, dye, magnification diagnostic aids. The method for determining the presence MB2 was as follows:

*Radiographic method:* Digital radiograph of the maxillary first molar with the bisecting angle technique was taken. Another radiograph with the mesial angulation was taken. First observer was then asked to visualize the MB2 canal from both the radiographs. The response was noted in "yes" or "no" term. After the radiographic assessment, marking was done in the master chart under the radiographic heading whether MB2 was visualized or not (Figs 1 and 2).

*Visual method:* Local anesthesia using lignocaine hydrochloride 2% was given in the region of maxillary first molar. Rubber dam was applied. Access cavity preparation was initiated with large round bur BR 31, and then with the help of nonend cutting bur access cavity was refined to its conventional shape and modified to remove the mesial shelf of dentin. Pulp tissue was debrided with the help of endodontic excavator. Access cavity was irrigated using sodium hypochlorite 3%. The pulp chamber was then dried and dentinal map was followed to locate the root canal orifice. Root canals were located with the help of endodontic explorer DG16. Second observer was then asked to locate MB2 canal. Response was noted in "yes" or "no" terms and marking was done in the master chart.

*Dye method:* Ophthalmic dye strip was used to apply dye to the area of interest. Firstly saline was collected in the dappen dish, and then ophthalmic strip was dipped in the saline solution. This strip was then placed in the access cavity for around 3 to 5 minutes. This dye was absorbed by the tissue present at the orifice. Blue curing light was then applied from the buccal aspect of the tooth. Dye which was absorbed by the tissue present at the orifice reflects fluorescent color on application of blue light. This helps in locating the MB2 canal. Third observer was then asked to locate the MB2 canal in "yes" or "no" terms and marking was done in the master chart (Fig. 3).

*Magnification method:* Operating microscope has the maximum magnification as compared to other aids used in the study, hence operating microscope would be considered as the final aid for the detection of the MB2 canal. Operating microscope of 8× magnification was used as "gold standard" for detection of MB2 canal in maxillary first molar which was marked by observer no. 4 (Figs 4 and 5).



Fig. 1: Detection of MB2 canal using digital radiograph



Fig. 2: Detection of MB2 canal using radiographic method



Fig. 3: Location of MB2 canal with dye method



Fig. 4: Location of MB2 canal with magnification method

Thus in above manner, all the 100 patients with maxillary first molar undergoing root canal treatment were identified for the presence of MB2 canal. The technique for location of MB2 canal was compiled as in Table 1.

## RESULTS

It was observed that percentage of detection of MB2 canal in maxillary first molar was maximum in operating microscope method (87%), followed by visual method (73%), dye method (28%) and by radiographic method (19%) (Table 2). In Table 3, the comparison of detection of MB2 canal in maxillary first molar using the mentioned methods has been explained. It was seen that by applying "Z" test of difference between two proportions, there was a highly significant difference in detection of MB2 canal in maxillary first molar when compared for radiographic *vs* visual method and magnification method ( $p < 0.01$ ). However, nonsignificant difference between radiographic *vs* dye method ( $p > 0.05$ ) was noted.

There was a highly significant difference between various methods of detection of MB2 canal in maxillary first molar when compared for visual *vs* dye method ( $p < 0.01$ ). There was also a significant difference between visual *vs* magnification method ( $p < 0.05$ ). There was a highly significant difference between detection of MB2 canal in maxillary first molar when dye method *vs* magnification method ( $p < 0.01$ ) was compared.

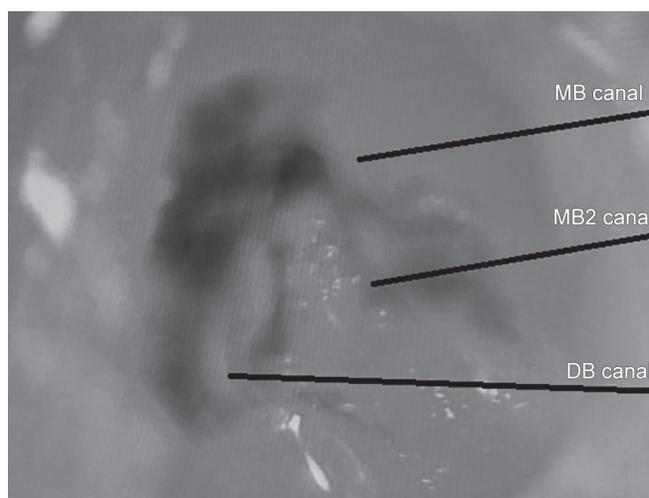


Fig. 5: Location of MB2 canal with magnification method

## DISCUSSION

Stropko reported that increased operator experience, increased time per appointment and the use of an operating microscope resulted in an increase in number of second mesiobuccal canals located. However, they did report that using a microscope increased clinician's confidence while attempting to locate a fourth canal.<sup>8</sup> Following the introduction of operating microscope in 1992, it was found that nearly 70% of all the molars have four canals.<sup>11</sup>

Visual acuity of human being is very important factor for location and determination of minute structures.

Table 1: Master chart showing various diagnostic aids

Sl. no.	Radiographic method observer 1	Visual method observer 2	Dye method observer 3	Magnification method observer 4
Patient 1	✓	—	—	✓
Patient 2	—	—	✓	✓
Patient 3	—	✓	—	✓
Patient 4	—	✓	✓	✓
Patient 5	✓	—	—	—

**Table 2:** Detection of MB2 canal in maxillary first molar using radiographic, visual, dye and magnification method

Method	Detection of MB2 canal in maxillary first molar		
	Yes no. (%)	No no. (%)	Total no. (%)
Radiographic	19 (19%)	81 (81%)	100
Visual	73 (73%)	27 (27%)	100
Dye	28 (28%)	72 (72%)	100
Magnification	87 (87%)	13 (13%)	100

**Table 3:** Comparison of detection of MB2 canal in maxillary first molar using radiographic, visual, dye and magnification method

Comparison vs	Methods for detection of MB2 canal in maxillary first molar		
	Visual	Dye	Magnification
Radiographic method	Highly significant $p < 0.01$	Not significant $p > 0.05$	Highly significant $p < 0.01$
Visual method	—	Highly significant $p < 0.01$	Significant $p < 0.05$
Dye method	—	—	Highly significant $p < 0.01$

Human being can see and recognize minute details with his visual sense. Detection of additional root canal requires a careful clinical and radiographic inspection.<sup>12</sup> Diagnostic tools, such as multiple radiographs careful examination of the pulpal floor with the sharp endodontic explorer like DG16, ophthalmic dye for better visualization using an operating microscope, are all important aids in the detection of additional root canals.<sup>13</sup> Those that are of significance have studied the use of ultraviolet induced fluorescence spectroscopy in diagnosis, pulp and root canal location as well as using fluorescent spectroscopy to measure the relative sealing efficiency of root canal sealers.<sup>14</sup>

Hence, the purpose of this study was to determine the accuracy of radiographs, modified access cavity preparation, ophthalmic dyes and magnification in location of MB2 canal in maxillary first molars.<sup>15</sup> In the present study, fluorescein sodium dye was used, number of MB2 canals located with the help of the dye was 28%. However, when the dye was applied with in the access cavity and blue curing light was also applied. When the light was applied there was better differentiation between the adjacent monochromatic dentin and the canal orifices.

In this research, accuracy of various diagnostic aids, like radiographs, dye and magnification, have been evaluated along with the visual (conventional unaided) access cavity preparation in determining the prevalence of MB2 canal in maxillary first molar. Patients requiring root canal treatment were selected for the study with the informed consent. Number of patients included in the study was 100. In this study, each patient's access cavity preparation was done using different diagnostic aids like:

- Radiographic method with radiovisiography (RVG)
- Visual method (conventional unaided method)
- Dye method (fluorescein sodium)
- Magnification with dental operating microscope (DOM).

It was observed that MB2 canals located with the help of DOM was 87% which was better when compared to any other aids used for detection of MB2 canal. It appears, in this study, that even though magnification is the gold standard for the detection of MB2 canal, the visual (unaided) method with modification in the access cavity was the another method which could help in detection when compared to remaining two methods.

It also appeared that, after troughing, the groove extending from the mesiobuccal to palatal markedly increased the incidence of location of MB2 canal. The age group of patients in the above study ranged from about 20 to 45 years of age, which also showed that the location of MB2 canal in young patients is much more easily located as compared to that of the old aged patients.

From this study, it observed that with the help of RVG 19% of the cases showed MB2 canal. Visual method recorded location of MB2 canal in 73% of cases. Dye method using fluorescein sodium showed MB2 canal in 28% of cases. However, the DOM located MB2 canal in 87% of the cases.

## CONCLUSION

It was concluded that the incidence of MB2 canal in permanent maxillary first molar was 87% using magnification. Accuracy of radiographic method in detection of MB2 canal in maxillary first molar was 19%, showing least accuracy among the four methods used. A larger population should be screened for substantiating the results of the study. But, it seems to be very clear that by having the knowhow and mastering the technique, even visual method with modified access cavity is successful in detection of MB2 canal in maxillary first molar with more predictable results by using magnification.

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## REFERENCES

1. Pawar AM, Kokate SR. Contemporary endodontic management of four rooted maxillary second molar using waveOne. *Contemp Clin Dent* 2014;5:130-133.
2. Peeters HH, Suardita K, Setijanto D. Prevalence of a second canal in the mesiobuccal root of permanent maxillary first molars from an Indonesian population. *J Oral Sci* 2011;53:489-494.
3. Theruvil R, Ganesh C, George AC. Endodontic management of a maxillary first and second premolar with three canals. *J Conserv Dent* 2014;17:88-91.
4. Chauhan R, Singh S. Endodontic management of three-rooted maxillary second premolar in a patient with bilateral occurrence of three roots in maxillary second premolars. *J Clin Exp Dent* 2012;4:e317-320.
5. Hess W. The anatomy of the root-canals of the teeth of the permanent dentition, part. New York: William Wood and Co., 1925.
6. Weine FS, Healey HJ, Gerstein H, Evanson L. Canal configuration in the mesiobuccal root of the maxillary first molar and its significance. *Oral Surg Oral Med Oral Pathol* 1969;28:419-425.
7. Taher M, Sidky E, Hassanein el-S. The use of fluorescent dye for detecting the relative sealing efficiency of various root canal sealers—II: qualitative assessment for the effect of aging. *Egypt Dent J* 1973;19:197-210.
8. Stropko JJ. Canal morphology of maxillary molars: clinical observation of clinical canal configurations. *Endodontol* 1999;25:446-450.
9. Neaverth EJ, Kotler LM, Kaltenbach RF. Clinical investigation (in vivo) of endodontically treated maxillary first molars. *J Endod* 1987;13:506-512.
10. Coutinho Filho T, La Cerda RS, Gurgel Filho ED, de Deus GA, Magalhaes KM. The influence of the surgical operating microscope in locating the mesiolingual canal orifice: a laboratory analysis. *Braz Oral Res* 2006;20:59-63.
11. Wolcott J, Ishley D, Kennedy W, Johnson S, Minnich S, Meyers J. A 5 years clinical investigation of second mesiobuccal canals in endodontically treated and retreated maxillary molars. *J Endod* 2005;31:4.
12. Park E, Chehroudi B, Coil JM. Identification of possible factors impacting dental students' ability to locate MB2 canals in maxillary molars. *J Dent Educ* 2014;78:789-795.
13. Albuquerque D, Kottoor J, Hammo M. Endodontic and clinical considerations in the management of variable anatomy in mandibular premolars: a literature review. *Biomed Res Int* 2014;2014:512574.
14. Forgel HM, Perkoff MD, Christie WH. Canal configuration in mesiobuccal root of maxillary molar: a clinical study. *J Endod* 1994;20:135-137.
15. Jafarzadeh H. Endodontic treatment of bilaterally occurring three-rooted maxillary premolars: a case report. *N Z Dent J* 2007;103:37-38.