VALIDITY OF DIFFERENT METHODS FOR MB-2 CANAL LOCATION IN PERMANENT MAXILLARY MOLARS

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ABSTRACT

The purpose of this study was to evaluate the effectiveness of naked eye examination and Dental-operating microscope (DOM) examination for the location of second mesiobuccal canal (MB-2) in extracted maxillary first and second molars, considering the sectioning of the tooth as gold standard for the location of MB-2. This was a cross-sectional comparative study.

One hundred extracted permanent maxillary first and second molars (50 of each) were stored in 10% neutral formalin. Using high speed headpiece standard endodontic access cavities were prepared. Initially, the mesiobuccal, distobuccal and palatal canals were located. Subsequently, the location of MB-2 canal was attempted by examining the pulp chamber floor with naked eye using only an endodontic explorer and canal confirmed with 10# K-file. MB-2 canal orifice was either located or not located with this method. Teeth in which MB-2 canal was not located were further explored under DOM. Yet again MB-2 canal orifice was either located or not located. Finally the mesiobuccal roots of each tooth were sectioned. The sections were explored with endodontic explorer and 10# K file with the adjunctive use of DOM at a magnification of 12x to decide the real presence of MB-2 canal.

42% and 60% of MB-2 canals in maxillary first molar, 20% and 38% of MB-2 canals in maxillary second molar were detected with naked eye and with DOM examination respectively. While 66% and 42% of MB-2 canals were actually present in maxillary first and second molar respectively as confirmed by gold standard (sectioning of teeth).

It is concluded that DOM examination may be more effective for location of the MB-2 canal than naked eye examination.

Key Words: Maxillary molars, second mesiobuccal canal, naked eye examination, dental operating microscope examination.

INTRODUCTION

The goal of the successful endodontic therapy is thorough mechanical and chemical cleaning of the entire root canal system and its complete obturation with an inert filling material. Therefore ability to identify all the canals in this system is an important factor in determining the eventual success of the case. If a canal is not identified, it can not be cleaned and filled and it is potential cause of failure in endodontic therapy. Traditionally most endodontic canal identification methods have relied on the doctor’s tactile sensation and mental image of the canal system, the ability to visualize the canal orifices with naked eye could be severely limited specially when it is additional/ extra orifice because of its relatively small size. The additional canals are also difficult to identify with radiograph because of their superimposition over others canals.

Mesiobuccal root (MBR) of maxillary molars is the most complex root in entire dentition. It is almost clear to believe the fact that the root system of the MBR of maxillary molars frequently has a root canal system containing more than one canal since Hess and Zurcher described this in 1925, this additional
canal is now known as MB-2. The incidence of MB-2 canal has been reported to be as low as 18.6% in an in vivo study\(^5\) and as high as 95.2% in an in vitro study.\(^6\) This fact should lead to an awareness that has to be reflected in the routine practice of clinical endodontics. Weine\(^2\) in 1969 suggested that inability to identify, instrument and obturate the MB-2 canal could lead to endodontic failure in these teeth. Now it is generally accepted that a major cause for failure of root canal therapy is an inability to recognize the presence of, and to adequately treat MB-2 canal. Therefore, it is worthwhile for the practitioner to put the time and effort into properly locating and treating MB-2 canals in an attempt to increase the prognosis of endodontic therapy in maxillary molars.

Searching for the extra orifice is aided by utilization of enhanced vision systems in endodontics. The use of the surgical headlamps and dental loupes has evolved into the use of operating microscope.

Studies to date reported the use of enhanced vision with operating microscope for location of MB-2 canal is very few. It is very possible that magnification and illumination can increase one’s ability to locate MB-2 canal in maxillary molars. The purpose of this study was to determine whether the examination under dental operating microscope improved the identification of hidden MB-2 canal orifice as compared to the naked eye examination.

**METHODOLOGY**

One hundred extracted permanent maxillary first and second molars were collected from Dental Out Patient Department, Civil Hospital, Hyderabad and stored in 10% neutral formalin. No information was collected regarding reason for their extraction or the age and gender of the patient. Standard endodontic access cavities were prepared by using a high speed handpiece (NSK Japan), pulp chamber roof was penetrated with number 2 round diamond bur (Dentsply) then extended with tapering cylinder bur (Dentsply), over hangings from the walls were removed with number 2 round bur (Dentsply), the chambers were then cleaned with 2.5% sodium hypochlorite. After location the mesiobuccal, distobuccal and palatal canals, initially the location of MB-2 canal was attempted by using only endodontic explorer (DG-16-Dentsply) with naked eye and canal confirmed with 10# K-file (Dentsply). MB-2 canal orifice was either located or not located with this procedure. Teeth in which MB-2 were not located were further explored under Dental-operating microscope (YZ20P5-China) with 12x magnification at 200mm focus length using endodontic explorer (DG-16-Dentsply). Again an MB-2 canal orifice was either located or not located. Finally the mesiobuccal roots of each tooth were sectioned in a horizontal plane 6mm below the cemento-enamel junction with a crosscut fissure bur in high speed handpiece. The sections were explored with endodontic explorer and 10# K file with the adjunctive use of Dental-operating microscope at a magnification of 12x to confirm the real presence of MB-2 canal.

For the statistical analysis, the software used was Statistical Package for Social Sciences (SPSS) version 17.0, and the results were analyzed by chi-square test.

**RESULTS**

With the naked eye examination, 21 of 50 and with the (Dental operating microscope) DOM examination 30 of 50 MB-2 canal orifices were detected in maxillary first molar (Table 1). Thus, 9 MB-2 canal orifices

### TABLE 1: VALIDITY OF NAKED EYE AND DOM EXAMINATION FOR LOCATION OF MB-2 IN MAXILLARY FIRST MOLAR

<table>
<thead>
<tr>
<th>DOM Examination of First Molar</th>
<th>Total</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>21</td>
<td>60.0%</td>
</tr>
<tr>
<td>Negative</td>
<td>9</td>
<td>31.0%</td>
</tr>
<tr>
<td>Total</td>
<td>30</td>
<td>60.0%</td>
</tr>
</tbody>
</table>

### TABLE 2: VALIDITY OF NAKED EYE AND DOM EXAMINATION FOR LOCATION OF MB-2 IN MAXILLARY SECOND MOLAR

<table>
<thead>
<tr>
<th>DOM Examination of Second Molar</th>
<th>Total</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive</td>
<td>10</td>
<td>100.0%</td>
</tr>
<tr>
<td>Negative</td>
<td>11</td>
<td>27.5%</td>
</tr>
<tr>
<td>Total</td>
<td>21</td>
<td>42.0%</td>
</tr>
</tbody>
</table>
could only be located with the use of the DOM. After sectioning all teeth, 3 additional MB-2 canal orifices were located in the remaining 20 teeth, these 3 canals were located neither with the traditional methods nor with the DOM evaluation thus total 33 of 50 MB-2 canals were actually present in maxillary first molar (Table 3).

Similarly With the naked eye examination, 10 of 50 and with the DOM examination 19 of 50 MB-2 canal orifices were detected in maxillary second molar (Table 2). Thus, 9 MB-2 canal orifices could only be located with the use of the DOM. After sectioning all teeth 2 additional MB-2 canal orifices were located in the remaining 31 teeth, thus 21 MB-2 canals were actually present in maxillary second molar (Table 3).

Evaluated combinely, out of total 100 maxillary molars, MB-2 have been located in 54 teeth. Total number of MB-2 canals were less in second molars (42%) than that in first molars (66%) (Table 3).

**DISCUSSION**

Most of the clinicians feel difficulty whilst locating the MB-2 canal in maxillary molars. Recently, the Dental operating microscope was introduced to endodontics and has significantly improved magnification and illumination. In the current study, the effectiveness of DOM for detection of MB-2 canal orifices in extracted maxillary molars has been investigated. The findings of this study highlight that DOM significantly increases detection of MB-2 canals.

The results of different studies have shown the occurrence of MB-2 canal in maxillary first molar from 18.6% to 96.1% depending on the methodology used. The literature also suggests that more MB-2 canals can be found in the laboratory than clinically. Majority of clinical studies reported an incidence of MB-2 canal from 18% to 36%. However, some inherent problems with clinical studies are evident. For instance, variability in the teeth, since some teeth are more difficult to treat than others for various reasons, another problem is the negligence of some clinician to locate a hidden canal. It is possible that in some instances, the most important factor in locating the MB-2 canal is not the magnification but the persistence of the operator.

There are few studies in which operating microscope have been use for MB-2 canal location. In a study 77 out of 300 extracted teeth had MB2 canals when located with naked eye and with the use of dental loupes the number of located canals increased to 265. In the present study instead of dental loupes DOM have been use for location of MB-2 canal and it significantly improved its location. Similar to the current study, study of Ozcan et al confirmed the increasing of the location rate of the canals because of the use of the operating microscope. In another study 67% of MB-2 canals in maxillary first molar and only 39% in maxillary second molar have been found by clearing method of canal study, similarly in the present study the incidence of MB-2 canal were higher in maxillary first molar, it could be due to the high incidence of MB-2 canals in first molar than in second molars.

Experience for using DOM and instruments adapted for its location can also be another factor that influences the detection rate of MB-2 canal. Stropko reported that MB-2 canals were located in 93% of first molars and 60% of second molars in a clinical setting when the operator become experienced in DOM use, scheduled sufficient time for treatment, and employed specific instruments for micro endodontics, whilst MB-2 canals were found in 74% of first molars and 51% of second molars under conventional treatment. Sempira and Hartwell 18 mentioned that although the microscope did not significantly increase the number of MB-2 canals located, the enhanced visibility significantly increased confidence levels in using rotary burs and ultrasonic tips to remove calcific deposits (dental protuberance) covering many of the canal orifices and make its location difficult. Similar observations were obtained in the present study where rotary burs have been used at the chamber floor to remove such dentinal protuberance without a single perforation in the teeth included in the study. In present study, the MB-2 canal was often located anterior to line from the MB-1 and palatal canals. Similar observation has been reported by Weine et al. The orifices of the MB-2 canals are usually smaller, narrower, inclined more mesially and located

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**TABLE 3: NUMBER AND PERCENTAGE OF MB-2 CANAL LOCATED IN MAXILLARY MOLARS ACCORDING TO THE METHOD OF EXAMINATION USED**

<table>
<thead>
<tr>
<th>Type of Molar Examined</th>
<th>No. of Teeth Examined</th>
<th>Number (%) of MB-2 canals identified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maxillary First Molar</td>
<td>50</td>
<td>With Naked Eye Examination 31 (60%)</td>
</tr>
<tr>
<td>Maxillary Second Molar</td>
<td>50</td>
<td>10 (20%)</td>
</tr>
</tbody>
</table>

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more apically than MB-1. Sometimes, the MB-2 lies in the same orifice as MB-1. It is called the bifurcation. Similar findings noted in current study. These findings were visualized under DOM, otherwise, it would have been very difficult to locate with naked eye.

Baldassari-Cruz et al. suggested that frequency of locating the MB-2 canals can be increased with different access cavity shapes and the DOM is very handy to achieve this goal. Enhanced vision to the area in addition to operator’s knowledge about root canal system morphology and accessibility may increase the possibility of locating MB-2 canals and it was confirmed by the high prevalence of the MB-2 canal orifice found in the current study.

CONCLUSIONS

The prevalence of MB-2 canal in the present sample was 66% and 42% among maxillary first and second molars respectively. The DOM correctly identified MB-2 canals among 30 out of 33 first molars and 19 out of 21 second molars, therefore it may be speculated that Magnification and illumination of the operating field provided by dental operating microscope is more effective in detecting MB 2 canal than naked eye examination.

The management as well as the cleaning and shaping of the MB-2 canal were not part of the present study. It is assumed that a great number of these canals are impossible to be treated by methods used in endodontic nowadays, therefore this represents an interesting theme for future researches.

REFERENCES