IDENTIFICATION OF THE SECOND MESIOBUCCAL CANAL IN FIRST MAXILLARY MOLAR USING ULTRASONICS AND VISUALS AIDS

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ABSTRACT:

Aim: The aim of this study was to investigate the frequency of the second mesiobuccal canal in extracted permanent maxillary first molars in a Tunisian population, and to evaluate the role of the ultrasonic inserts and visual aid (binocular loupes, operatory microscope) in its localization.

Materials and methods: Eighty extracted human maxillary first molars were assessed. After location of the main canals, the second mesiobuccal canal was sought in all teeth first with k files, then with of ultrasonic inserts, after that with the aid of the binocular loupes and operatory microscopes. Finally, the mesiobuccal root was sectioned horizontally into three levels and was observed under a stereomicroscope.

Results: Using these techniques, the second mesiobuccal canal was detected in 9.46%, 16.21 %, 29.72 %, and 39.189 % respectively. Sectioning of the roots disclosed the presence of the MB2 canal in 75.67% of the teeth. According to Weine’s classification, 24% of the teeth are of type I, 47,29% of type II, 13,51% of type III and 2,70% of type IV.

The two root canals in the mesial roots ending in one foramen in 79.73% , and 20,27% ending in two apical foramen.

Conclusion: The results of this study suggested that the combined use of the operating microscope and ultrasonics increased the detection of second mesiobuccal canals in maxillary first permanent molars.

Keywords: Maxillary permanent first molar, Mesiobuccal second canal, Operatory microscope, Binocular loupe, Ultrasounds

INTRODUCTION:

Weine’s work has shown that a great number of failures in endodontic treatment of maxillary first molars due to the absence of localization, shaping and closing of the fourth canal. [¹]

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Between 2002 and 2005, a clinical study conducted by Wolcott et al in 5616 cases concludes that the absence of the second mesiobuccal canal (MB2) treatment reduced the long-term prognosis and may explain some of the pathologies observed on the maxillary molars requiring endodontic retreatment. [1]

The incidence of having two canals in the mesial root of the maxillary first molar has been well established by several authors using different approaches, such as radiographs, decalcification, sectioning, ultrasonic, loupes and dental operating microscope as illustrated [2]

The purpose of the present study was to report the incidence of two root canals in the mesial root of the extracted permanent maxillary first molars of a Tunisian population [2]; and to investigate whether the use of ultrasonics in combination with binocular loupes and an operating microscope increase the detection of the MB2 canals in extracted permanent maxillary first molar teeth. [3]

**MATERIALS AND METHODS:**

A total of 80 first permanent maxillary molars of Tunisian patients, were collected from clinical procedures performed in different Tunisian hospitals.

Before use, the teeth were stored in 5% hypochlorite solution for a week.

Then the access cavity was carried out using a cylindro-conical diamond bur giving it an optimal form approaching that ideal. The use of endo Zekrya bur eliminates all pulpal ceiling.

The access cavity is slightly mesialated to an imaginary line between the mesiobuccal canal and the palatal canal. The aim of this modification was to find a possible second mesiobuccal canal.

Clear visualization of the pulpal chamber floor as well as the main root canal orifices was attained.

After the highlighting of the three main canal, the fourth canal was found by using a probe 16 DG, files K n° 8, n° 10 and n° 15.

In teeth where the MB2 could not be identified, a dry abrasive ultrasonic insert was used to peel the dentin depending on the colors of the floor and of the mesial line connecting the MB1 to the palatal canal.

Between each action of the insert, a rinsing was carried with sodium hypochlorite; a DG16 probe was used as well as manual K files of diameter 8, 10 and 15 in an attempt to identify that canal.

When MB2 was found, the tooth was excluded from further manipulations.

As far as teeth where search for MB2 appeared more delicate, dentin removal without visual aid must not exceed a depth of 2 to 3 mm below the pulpal floor.

After that, binocular loupes were used to search MB2 in the teeth which it could
not be identified. Research of MB2 then continued using alternately the ultrasonic insert, the probe and K-files to try again to enter the canal. 

In the next step the teeth of which the MB2 was not found in the previous one, were carefully examined using an operating microscope using a magnification of 10. The same operation was then performed (using alternately the insert ultrasonic probe and limes to try again entering the canal (figure1).

During manipulations three of teeth were perforated and three other were calcified, so they had not been taken into account.

In the last step, the 74 teeth were then sectioned transversely at three different levels:

At the coronal third, middle third and apical third of the mesiovestibular root. These cuts were made using a metal disc mounted at a counter angle. This step allowed us to corroborate or not our results to the anatomical reality. Thus, root canal configuration contained in the root could be determined through the use of the stereomicroscope.

RESULTS:

We noted that the percentages were performed on only 74 teeth because three of them were perforated during handling and three are calcified, have not been taken into account. Without visual aids or ultrasonic inserts, the MB2 canal was located in seven teeth (9.46%). With the use of the ultrasonic inserts, the MB2 was located in five additional teeth shifting to a percentage of (16.21%). With the use of binocular loupes MB2 was found in ten other teeth, the percentage become (29.72%). Finally with the use of the operating microscope, the MB2 canal was located in seven additional teeth (39.18%) (table 1).

Sectioning of the mesiobuccal root disclosed the presence of a MB2 canal in twenty seven more teeth 75.67% (table 2).

According to Weine’s classification, the distribution of canal configuration of mesiobuccal canals was as follows: 18 (24.32%) were type I, 35 (47.29%) type II, 10 (13.51%) type III, and 2 (2.70%) were type IV canal configuration. Nine no defined type 12.16% correspond to mesiobuccal roots whose configuration cannot be classified in four types of Weine (Table 3).

DISCUSSION:

Percentage of MB2:

In our study it was found that 75.67% of maxillary first molar possessed a second mesiobuccal canal. This is consistent with the findings of Aysun Kara T. et al. [7] and Somma et al. [6], who found respectively a percentage of 78.18% and 80%. Other studies have found nearby results like the study of Harry H. Peeters et al. [8] and Atool Chandra B. et al. [12] who found respectively 68.5% and 65%.

In vivo studies show the lowest results of all studies, it is approximately 23% by Al-Nazhan .S [4] and Abeer S. Al-Khriesat et al. [13]

Limited access and visibility and non-constant location of the second canal as well as the risk of perforation may explain the lower incidence of having two canals in the mesial root of maxillary molars in clinical practice when compared with laboratory studies. The use of dental loupes and dental operating microscope (DOM) provides the clinician with superior lighting and magnification improving the ability to treat cases and finding extra canals [15]

There is a lack of consistency in the reported incidence of second mesiobuccal canal (MB2) in maxillary 1st molars in the literature. The differences may be due to the study design (clinical versus laboratory), method of canal identification (radiographic examination, root sectioning, canal staining and root clearing, examination with SEM or cone-beam computed tomography techniques) or true differences in the sample under investigation (racial variation) [13]

**Root canal configuration:**

According to Weine’s classification, in our study the root canal configuration was: 24.32% of type I, 47.29% of type II, 13.51% of type III, 2.70% of Type IV, 12.16% with no type defined.

Furthermore, canal configuration of mesiobuccal root of maxillary first molar teeth could be varied according to different ethnic groups.

Most studies find that class II is the most frequent, such as the study of Adnan AH done on a Syrian population. [9] with 71%, Farhana C. et al.[11] with 38.88% done on a Bangladeshi Population, Aysun Kara T. et al. [7] with 82.4% done on a Turkish population, which is consistent with our study.

Our results do not coincide with the results of B. Touré [3] was done on a Senegalese population that finds that the class I is the most frequent with 46.2%, but they are close to the class III with 19.2% and IV with 2.9%.

**Use of visual aids**

We found 12 teeth (16.21%) (before section) without visual aid. The binocular loupes have allowed to locate 10 teeth, the percentage increases (29.72%) and with the microscope 7 teeth the MB2 was found in (39.18%)of teeth. Among these 7 teeth found, two present 5 canal entrances.

Burhly et al.[15] show that the use of visual aids can detect MB2 much more easily. In fact, without visual aids, it is found in only 17.2% of the analyzed teeth. With the help of magnifiers
Binocular, the percentage increases to 62.5% and after use of the microscope procedure, the MB2 was found in 71.1% of cases.

Tayfun Alaçam et al.\cite{16} found that the combination of the operating microscope and ultrasonics detected significantly more MB2 canals (74%) than when no microscopy was utilized (67%). Sectioning of the roots disclosed the presence of the MB2 canal in 82% of the teeth.

The results of these studies suggested that the combined use of the binocular loupes, the operating microscope and ultrasonics inserts increased the detection of MB2 canals in maxillary first permanent molars.

**CONCLUSION:**

When performing endodontic therapy on maxillary first molars, the clinician should always assume that there are two canals in the mesiobuccal root, until proven differently.\cite{9}

Root canal treatment should be performed under visual aids (binocular loupes and microscopy) with the help of an ultrasonic tip. The visual aids provide good visibility and the ultrasonic tip can create a deeper trough in the dentin. Use of these devices increases the likelihood of finding MB2 orifices\cite{15,17,19}

**REFERENCES:**

9. Adnan AH. Anatomical study of the mesiobuccal root in maxillary first
TABLES:

Table 1: Percentage of the presence of MB2 for different search techniques

<table>
<thead>
<tr>
<th>Method</th>
<th>Number of teeth in the sample concerned</th>
<th>Number of MB2 detected</th>
<th>Percentage of MB2 reported to the overall sample</th>
<th>Total percentage of MB2 after each step</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without ultrasonic inserts and visual help</td>
<td>74</td>
<td>7</td>
<td>9.46%</td>
<td>9.46%</td>
</tr>
<tr>
<td>Using ultrasonic inserts</td>
<td>67</td>
<td>5</td>
<td>6.75%</td>
<td>16.21%</td>
</tr>
<tr>
<td>Using a binocular loupes</td>
<td>62</td>
<td>10</td>
<td>13.51%</td>
<td>29.72%</td>
</tr>
<tr>
<td>Under The operative microscope</td>
<td>52</td>
<td>7</td>
<td>9.46%</td>
<td>39.18%</td>
</tr>
<tr>
<td>Total</td>
<td>29</td>
<td></td>
<td></td>
<td>39.18%</td>
</tr>
</tbody>
</table>

Table 2: Percentage of MB2 after section of mesio buccal root

<table>
<thead>
<tr>
<th>Number of CMV2 found</th>
<th>56</th>
</tr>
</thead>
<tbody>
<tr>
<td>percentage</td>
<td>75.67%</td>
</tr>
</tbody>
</table>

Table 3: Types of canalar configuration and statistics

<table>
<thead>
<tr>
<th>Types according to Weine’s classification</th>
<th>Number of teeth with this type configuration</th>
<th>Percentage relative to the total sample size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type I</td>
<td>18</td>
<td>24.32%</td>
</tr>
<tr>
<td>Type II</td>
<td>35</td>
<td>47.29%</td>
</tr>
<tr>
<td>Type III</td>
<td>10</td>
<td>13.51%</td>
</tr>
<tr>
<td>Type IV</td>
<td>2</td>
<td>2.70%</td>
</tr>
<tr>
<td>No type defined</td>
<td>9</td>
<td>12.16%</td>
</tr>
</tbody>
</table>
Table 4: Percentage of MB2 of different studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Racial origin of the sample</th>
<th>Size of the sample</th>
<th>Type of study</th>
<th>Incidence of MB2</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOURE B. et al. [3] 2006</td>
<td>Senegalien population</td>
<td>114</td>
<td>in vitro study</td>
<td>51 %</td>
</tr>
<tr>
<td>Serge BAL [5] 2008</td>
<td>European</td>
<td>794</td>
<td>in vitro study</td>
<td>64.4 %</td>
</tr>
<tr>
<td>Somma et al. [6] 2009</td>
<td>Italian population</td>
<td>30</td>
<td>micro tomographic analysis: in vitro study</td>
<td>80%</td>
</tr>
<tr>
<td>Aysun Kara Tuncera [7] 2010</td>
<td>Turkish population</td>
<td>110</td>
<td>in vitro study</td>
<td>78%</td>
</tr>
<tr>
<td>Harry H. Peeters et al. [8]</td>
<td>Indonisian</td>
<td></td>
<td>in vitro study</td>
<td>68.5%</td>
</tr>
<tr>
<td>Adnan asaad Habib [9] 2014</td>
<td>Syrian</td>
<td>95</td>
<td>vivo study</td>
<td>40%</td>
</tr>
<tr>
<td>Bestoon M. et al 2014 [10]</td>
<td>Sulaimani-Iraq population</td>
<td>180</td>
<td>in vitro study</td>
<td>35.6%</td>
</tr>
<tr>
<td>Farhana Chowdhury et al. [11]</td>
<td>Bangladeshi Population</td>
<td>100</td>
<td>in vitro study</td>
<td>36%</td>
</tr>
<tr>
<td>Atool Chandra Bhuyan et al. [12]</td>
<td>Khasi population of Meghalaya</td>
<td>60</td>
<td>in vitro study</td>
<td>65%</td>
</tr>
<tr>
<td>Abeer S. Al-Khriesat et al. [13]</td>
<td>Jordanians</td>
<td>195</td>
<td>Vivo study Clinical</td>
<td>23%</td>
</tr>
<tr>
<td>Ainul Husna Abd Latib et al. [14]</td>
<td>Malay&amp; Chinese&amp; Indian</td>
<td>72</td>
<td>vivo study (CBCT)</td>
<td>28%</td>
</tr>
<tr>
<td>Present study</td>
<td>Tunisian</td>
<td>80</td>
<td>In vitro study</td>
<td>75.67%</td>
</tr>
</tbody>
</table>
Figure 1: Protocol for identification of MB2 canal

Six teeth have not been taken into account: three of them were perforated during handling and three are calcified.