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The Role of Dental Operating Microscope in Locating the Second Mesio-Buccal Canal in Maxillary Molars: an *In Vitro* Evaluation

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ABSTRACT

Objective: The purpose of this study was to evaluate the influence of using the Dental Operating Microscope (DOM) for detection of the second mesio buccal canal orifice in extracted maxillary first molars of north Indian population, compared with unaided vision.

Study Design: 520 extracted maxillary first molars were collected from different regions of north India and access cavity preparations were made in all. Attempt was made to locate the MB2 canal with unaided vision. Then the teeth in which no MB2 canal was found were examined by using a DOM along with the use of ultrasonics.

Results: MB2 canal orifices were detected in 338 teeth with unaided vision. In another 86 teeth, MB2 canal orifice was located by using the DOM. Qualitative nonparametric comparisons were used for evaluation revealing that magnification increased the chances of locating the MB2 canal by 16.5 percentage points.

Conclusion: The results of this study indicate that the DOM provides increased opportunity for the dentist to detect extra canals, thus enhancing the success rate of Endodontic therapy.

INTRODUCTION

The intricate complexity of morphology of root canal system has attracted the attention of researchers and clinicians for the past many years. This owes to realization of the fact that a thorough understanding of morphology will ensure the success of endodontic therapy. One of the goals of non-surgical root canal treatment is location and debridement of all canals whenever possible [1-3]. In the treatment of maxillary molars, locating and negotiating a second mesiobuccal (MB2) canal in the mesiobuccal (MB) root may have implications to the long-term prognosis [4].

The MB2 canal can terminate in an independent foramen, classified as type III in 10% to 71% of the teeth. Otherwise it can be rudimentary, classified as type IV, or merge with the main mesiobuccal canal, classified as type II [5-8].

Location of root canals has previously been evaluated both in vivo and in vitro in research articles by using dental loupes, fibreoptic head lamps, scanning electron microscopy, and sectioning for microscopic observation [9].

In recent years, the operating microscope has been introduced to Endodontics which has significantly improved magnification and illumination. Use of microscope facilitates the location and thereafter treatment of very fine canals, particularly the MB2 canal in maxillary molars [10-13]. The dental operating microscope has also been associated with obtaining better treatment results in various studies of endodontic surgery [14,15].

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The purpose of this study was to evaluate whether the adjunctive use of the DOM increases the detection of MB2 canal orifice in the MB root of extracted maxillary first molars as compared to the use of naked eye alone.

MATERIALS AND METHODS

520 extracted maxillary first molars were used in this study. The extracted teeth were stored in 1% thymol solution for 2 months. Without the use of magnification (unaided vision), standard endodontic access was performed by using a high speed hand-piece with a 557 fissured bur and 5% sodium hypochlorite irrigation.

After the mesiobuccal, distobuccal, and palatal canals were located, an attempt was made to locate the second mesiobuccal canal (MB2), again with unaided vision **(Figure 1)** by using only an endodontic explorer [16].

Figure 1. Diagrammatical representation of standard access preparation of maxillary first molar with typical canal locations.

Teeth in which MB2 canal orifice could not be located were segregated and were again evaluated by using a DOM (Global microscope G6) at 8 x magnification to search for the MB2 canal) using the DG 16 explorer.

Cases, in which MB2 could not be explored as such, under magnification, troughing was carried out wherein the dentine in the pulp chamber was removed within 3 mm from the MB1 canal toward the palatal canal and 1–2 mm mesially, 2 mm deep using a small round bur at low speed under magnification (×8) 12. This trench was again explored with the endodontic explorer to locate the MB2 canal. The use of ultrasonic tip was also made, wherever required. The number of samples in which the MB2 canal was located under magnification was recorded.

RESULTS

With the use of only a sharp endodontic explorer and mouth mirror (unaided vision, no adjunctive use of illumination or magnification), 338 MB2 canal orifices were detected out of the 520 teeth, representing 65 % of the sample group. After evaluation of the same teeth with the DOM, an additional 86 MB2 canal orifices were detected in the remaining teeth **(Table 1)**, increasing the percentage of samples having MB2 canals to 81.5% **(Table 2).**

Table 1. MB2 canals located in the collected sample.

Status of MB2 Canal	Number	Percentage
MB2 canals located with unaided vision	338	65.0
MB2 canals located with DOM	86	16.5
MB2 canals not located	96	18.46
Total	520	100

Table 2. Percentage distribution of MB2 canals located.

MB2 canals located with unaided vision	65.0%
MB2 canals located with DOM	16.5%
Total MB2 canals located	81.5%

DISCUSSION

The success of endodontic therapy relies on adequate cleaning and shaping of the entire root canal system16. It is imperative that the entire root canal system be cleaned well and no canal be missed. It has been observed and documented that missing the root canals forms one of the prominent reasons for endodontic failures [17].

This study was undertaken to assess the potential of DOM to facilitate the visualization of MB2 canals in maxillary molars. The use of microscope provides magnification and illumination, thus increasing the chance of locating the extra canals. The MB2 canal in MB roots of maxillary molars can sometimes be extremely challenging to locate. This can be due to the presence of calcifications on the floor of pulp chamber many a times. The use of ultrasonics under magnification is a very powerful tool in such cases, increasing the chances of locating the hidden canals [18]. Hence it was decided to use ultrasonics in our study to modify the access in order to facilitate the identification of MB2 canal under the Microscope.

There have been several studies in the past which have revealed the presence of MB2 canal in Maxillary first molar [19-21]. However, literature is also full with sufficient evidence that the incidence of MB2 canal negotiation has increased dramatically over the years, due to the use of magnification during the endodontic procedure [12,17,22].

The higher incidence of locating the MB2 canal in our sample group can directly be attributed to the use of magnification during the procedure and the simultaneous use of ultrasonics. Also, the modification of the access cavity to include a trench preparation from the mesiobuccal canal in mesial palatal direction, where the MB2 canal may typically be found, increased the frequency of MB2 canal orifice detection.

CONCLUSION

Combined with the knowledge of root canal system anatomy, magnification and illumination, along with the use of ultrasonics can definitely increase the chance of locating additional canals, thereby increasing the rate of success of endodontic therapy. Our study demonstrated that the adjunctive use of the DOM increased the ability for the dental clinician to locate MB2 canal in maxillary molars.

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