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Original Research

Effectiveness of magnification and illumination in detecting the presence of second mesiobuccal (MB2) canal in the maxillary first molars

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ABSTRACT:
Background: To identify and locate all root canal spaces along with thorough chemomechanical preparation and to achieve a hermetic seal with an inert obturating material in all the portal of exit are the key requisites for successful endodontic therapy. The present study was conducted to evaluated the effectiveness of detecting the presence of second mesiobuccal (MB2) canal in the maxillary first molars, using magnification and illumination. **Materials & Methods:** 45 permanent maxillary first molarswerecollected and the outline of the access cavity wasfurther improved from a triangular to a rhomboidal shape toincrease the visibility of the pulpal floor. Locate the MB2 canal in five stages: Stage I (direct vision),Stage II (under ×2.5 magnifying loupes without light‑emitting diode [LED] light), Stage III (under×2.5magnifying loupes with LED light), Stage IV (under operating microscope at ×5), and Stage V (underoperating microscope at ×12.8). **Results:** Plain eyesight showed 14 MB2, magnifying loupes (×2.5) without LED light in 17, magnifying loupes (×2.5) with LED light in 24, operating microscope (×5) in 32, operating microscope (×12.8) in 35 teeth. The maximum specificity, sensitivity, positive predictive value (PPV) and negative predictive value (NPV) was seen with operating microscope (×5) and operating microscope (×12.8). **Conclusion:** Authors found that the operating microscope was most effective in the detectionof MB2 canals.
Key words: Operating microscope, Mesiobuccalcanal, Maxillary second molar

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INTRODUCTION

There has been some immense researchthat has been carried out in relation to the mesiobuccal (MB1)root of the maxillary first molar mainly because of the additionalroot canal it often possesses, i.e., second mesiobuccal (MB2)canal.[1] This canal often goes unnoticed, which can beattributed to the fact that it departs the pulp chamber at a sharpmesial inclination and is then bent again in the distal direction,making its detection highly challenging.[2]Likewise, difficultyand inability to identify the MB2 may often result in a highpercentage of endodontic failure among these teeth.[3] Studieshave shown that endodontically retreated teeth contained moreundetected MB2 canals than teeth which were treated for thefirst time, thereby leading to a high endodontic failure rateamong these teeth.[4]

To identify and locate all root canal spaces along with thorough chemomechanical preparation and to achieve a hermetic seal with an inert obturating material in all the portal of exit are the key requisites for successful endodontic therapy. Posttreatment disease can be attributed to the presence of any undetected and subsequently unfilled anatomical spaces in the root canal system which can act as a nidus for infection leading to treatment failure.[5] By

magnifying and illuminating the grooves in the pulpal floor and differentiating the color differences between the dentine of the floor and walls the surgical operating microscope (SOM), has made canal location easier.[6]The present study was conducted to evaluated the effectiveness of detecting the presence of second mesiobuccal (MB2)canal in the maxillary first molars, using magnification and illumination.

MATERIALS & METHODS

This study comprised of 45 permanent maxillary first molars. Teeth werecollected and mounted in cast stone. The teethwere accessed with sterile Endo Access Bur. The access cavity was prepared initiallywith triangular outline. MB1, distobuccal, and palatal (P) canalorifices were located with the help of an endodontic explorerand canals were negotiated with 10 or15 K- files. Handinstrumentation followed by copious irrigation with 3% sodiumhypochlorite was used to remove the contents within pulp chamberand root canal space. The outline of the access cavity wasfurther improved from a triangular to a rhomboidal shape toincrease the visibility of the pulpal floor. Locate the MB2 canal in five stages: Stage I (direct vision),Stage II (under ×2.5 magnifying loupes without light- emitting diode [LED] light), Stage III (under×2.5magnifying loupes with LED light), Stage IV (under operating microscope at ×5), and Stage V (underoperating microscope at ×12.8). Results thus obtained were subjected to statistical analysis. P value less than 0.05 was considered significant.

RESULTS

Table I Number of teeth with second MB2

Parameters	Number	P value
Plain eyesight	14	0.05
Magnifying loupes(×2.5) without LED light	17	
Magnifying loupes(×2.5) with LED light	24	
Operatingmicroscope (×5)	32	
Operatingmicroscope (×12.8)	35	

Table I, graph I shows that plain eyesight showed 14 MB2, magnifying loupes (×2.5) without LED light in 17, magnifying loupes (×2.5) with LED light in 24, operating microscope (×5) in 32, operating microscope (×12.8) in 35 teeth. The difference was significant (P< 0.05).

Graph I Number of teeth with second MB2

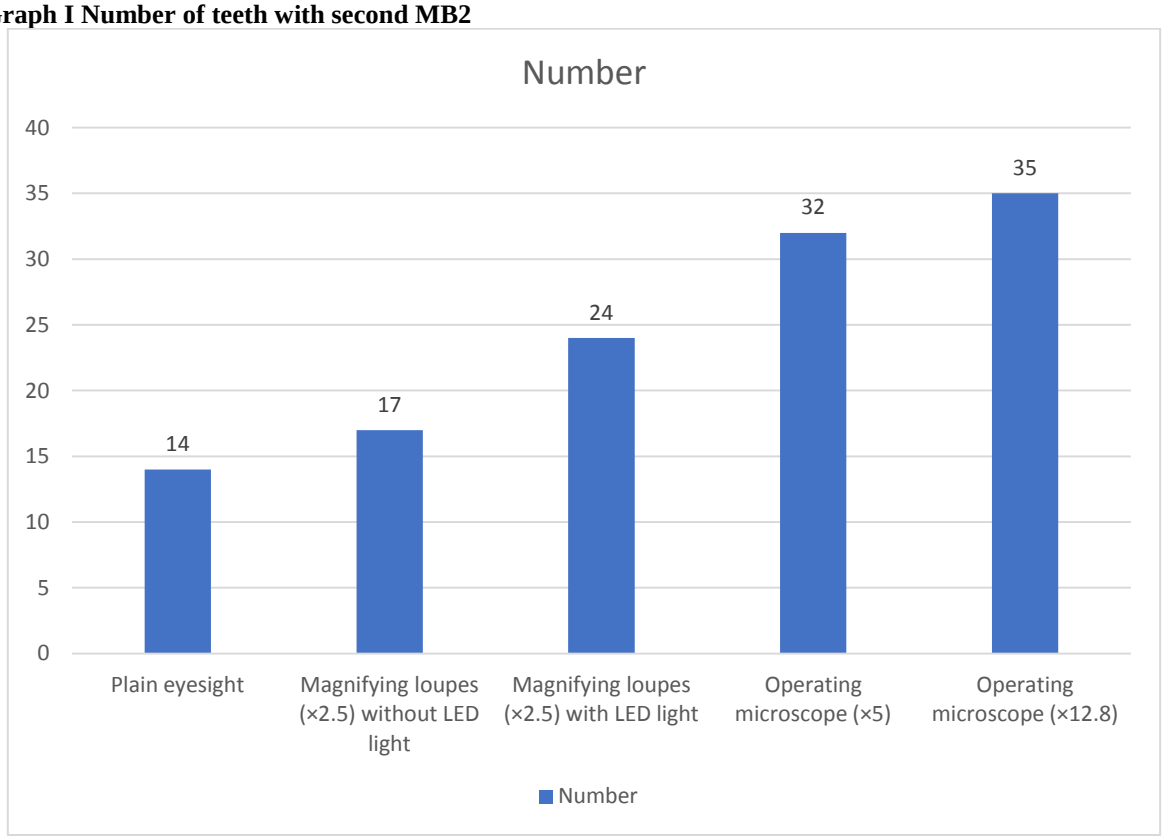

Table II Efficacy of various method

Parameters	Sensitivity	Specificity	PPV (%)	NPV (%)	P value
Plain eyesight	42%	100%	100%	65%	0.05
Magnifying loupes(×2.5) without LED light	53%	100%	100%	67%	
Magnifying loupes(×2.5) with LED light	80%	100%	100%	81%	
Operatingmicroscope (×5)	100%	100%	100%	100%	
Operatingmicroscope (×12.8)	100%	100%	100%	100%	

Table II shows that maximum specificity, sensitivity, positive predictive value (PPV) and negative predictive value (NPV) was seen with operating microscope (×5) and operating microscope (×12.8).

DISCUSSION

Maxillary molar is the tooth with the largest volume and most complex root and root canal anatomy, also possibly the most treated and least understood posterior tooth.Elusive "second mesiobuccal" (MB2) canal is one of the biggest mysteries in endodontics.[7] It has been found that endodontically retreated teeth contain more undetected MB2 canals than 1st time treated teeth, suggesting that failure to locate, debride, and fill existing MB2 canals leads to a poorer prognosis.[8]The second mesiobuccal canal orifice in maxillary molars is usually located either mesial to or in the pulpal groove connecting the main mesiobuccal canal and palatal canals, within 3.5 mm palatally and 2 mm mesially from the main mesiobuccal canal.[9]The present study was conducted to evaluated the effectiveness of detecting the presence of second mesiobuccal (MB2)canal in the maxillary first molars, using magnification and illumination.

In this study, plain eyesight showed 14 MB2, magnifying loupes (×2.5) without LED light in 17, magnifying loupes (×2.5) with LED light in 24, operating microscope (×5) in 32, operating microscope (×12.8) in 35 teeth. Das et al[10]investigated whether the combination of operating microscope and selective dentin removal increased the frequency of second mesiobuccal (MB2) canal detection in permanent maxillary first molar teeth.One hundred fifty permanent maxillary first molars indicated for root canal treatment were randomly selected from patients belonging to the age group of 18–45 years irrespective of gender. After access cavity preparation and location of main canals, the MB2 canal orifice was sought in all teeth with an endodontic explorer under direct vision (Stage I), then under magnification with the aid of operating microscope (Stage II) and finally with the combined use of operating microscope and selective dentin removal (Stage III).MB2 canals were detected in 36%, 54% and 72% of the teeth in Stages I–III, respectively.This study demonstrated that dental operating microscope when used along with adjunctive aids such as selective dentin removal/troughing and good clinical knowledge will increase the ability of dental clinician to locate MB2 canals.

We found that maximum specificity, sensitivity, positive predictive value (PPV) and negative predictive value (NPV) was seen with operating microscope (×5) and operating microscope (×12.8). Nath et al[11]evaluated the effectiveness of detecting the presence of second mesiobuccal (MB2)canal in the maxillary first molars, using magnification and illumination.Access cavities of fifty extracted human maxillary first molars were prepared, andthe floor of the pulp chamber was then explored to locate the MB2 canal in five stages: Stage I (direct vision),Stage II (under ×2.5 magnifying loupes without light‐ emitting diode [LED] light), Stage III (under ×2.5magnifying loupes with LED light), Stage IV (under operating microscope at ×5), and Stage V (underoperating microscope at ×12.8).The operating microscope at ×5 and ×12.8 gave a diagnostic accuracy of 100%, followed bymagnifying loupes with LED light which gave a diagnostic accuracy of 90% in detecting the presence ofMB2 canal. The use of magnifying loupes without LED light and plain eyesight gave a comparatively lesserdiagnostic accuracy, i.e., 76% and 68%, respectively.

Buhrley et al[12] in their study showed that the use ofmagnification increased MB2 detection rate by almost threetimes when compared to that of non-magnification.

CONCLUSION

Authors found that the operating microscope was most effective in the detectionof MB2 canals.

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