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A Clinical Study on the Prevalence of Additional Canals -MB_2 and MB_3in Mesiobuccal Root in Maxillary Molars

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Abstract: ***The goal of successful endodontics is the total preparation of the whole endodontic space.The success of endodontic therapy is dependent on the quality of cleaning of the entire root canal system.Varying morphology in human teeth is a common occurrence.Therefore, it is of importance to have a thorough knowledge of the dental anatomy and its variation prior to initiation of treatment.It is known that failure to find and treat these additional canals may modify the long-term prognosis of treatment. The maxillary permanent molars have been studied by many authors but the results are disparity, both as regards the number of canals found in the mesiobuccal (MB) root and in their disposition.***

Keywords: additional canals, anatomy, canal variations, mesiobuccal root, MB_2, MB_3, pulp floor.

1. Introduction

The first study describing the internal dental anatomy dates back to the 19th century [1]. The form, configuration and number of root canals present in maxillary molars have been discussed for more than half a century [2-6].It is known that failure to find and treat the additional canals may modify the long-term prognosis of treatment. Thorough knowledge of these variations is essential prior to initiation of endodontic therapy. Only by correct clinical examination and interpretation of radiographic images help the clinician to detect such variations and make him to be aware of them before and during endodontic procedures. Conservative or small access cavity preparations are not recommended because some missed canals can lead to root canal therapy failure. Modification of the access cavity to a rhomboidal shape to include a trench preparation from the mesiobuccal canal to a mesiopalatal direction, where the MB canal orifice may be typically found, increases the frequency of MB canal orifice detection. Anatomical variations, especially extra canals and roots, should always be kept in mind when treating teeth endodontically. The incidence of missed canals among retreated teeth was reported to be as high as 42%.

Baldassari-Cruz et al. [11] related that different access cavity shapes increase the frequency of locating the MB2 canal in the mesiobuccal root of the first maxillary molar. However, the discovery of this variant indicates that maxillary first molars may have more unusual anatomy than the traditionally expected 3,4 or 5 canals in MB root [12, 13, 14].

Difficulties in localization and treatment of the associated canals are related to incorrect positioning of the access cavity, laying incorrect inclination of the walls of the access cavity and pulp chamber with insufficient visibility and light to the floor of pulp injury to floor, thereby deleted natural fissures connecting orifices.All hard dental tissues and restorative materials that prevent direct access must be removed. Important requirement for cavity is it to have smooth walls without retention areas and be as friendly stuffed to hard dental tissues intact. Visual control on the floor of the pulp chamber and the appropriate armamentarium facilitate the evacuation of dentinal debris and canal contents, without creating the possibility of their migration in the apical direction. Using magnification and further increase support clinician in localizing isthmus between orifices, whose establishment and subsequent processing are of particular importance for the outcome of treatment.

Access to root canal system through precise endodontic cavity is the first clinical step. Kulild & Peters [7] and Buhrley et al. [8] reported that the used of dental operating microscope (DOM) is one important instrument that can aid in locating extra canals.In other study, Gorduysus et al. stated that the use of DOM is not critical for the location of the additional MB canals. In addition, they reported that the negotiation of the MB_2 canal was much more challenging than their location [6].Weine et al. observed that failures related to the mesiobuccal root of maxillary molars expose to danger the success of endodontic therapy and found that teeth with a fourth canal occurred more frequently that those with three canals (51,5% versus 48,5%) [3].

Hession (1977) compared the canal morphology before and after instrumentation and concluded that the number of canal usually equals the number of roots [9]. The greatest variations observed were the presence of two canals in the mesiobuccal root of maxillarymolars, canals in the furcation area and presence of lateraland accessory canals.

Studies have shown that the root of a tooth has not only one or two canals, it can also branch out on numerous side and lateral ramifications. Weine divided the position of one or two canals within one root into four categories (Weine I–IV) [3].

2. Aim

The aim of this clinical study is to specify the frequency of presence of MB_2 and MB_3 in maxillary molars.

3. Method and materials

The study analyzes and documents the *in vivo* endodontic treatment of136 maxillary molar (*n=136*), subject of primary treatment. Molars were separated in two groups - I group - 81 first maxillary molar (*n=81*)and II group- 55second maxillary molar (*n=55*).It was made preoperative and postoperative radiographic studies. Endodontic access was prepared with a bur with non-aggressive tip - # H269GK.314.016 (Komet, Brasseler, Germany).Endodontic probe EXDG (Hu Friedy, USA) was used for precise preparation of endodontic access.It was used appropriate magnification, ultrasound endotips (EMS, Switzerland,) and micro-openers (Millefer, Switzerland) for detection orifices of additional canals.After location of the main MB canal, the additional canals (MB_2, MB_3) was sought in all teeth first without microscopy, then with the aid of the dental operating microscope and finally with the combined use of the operating microscope and ultrasonics.The canals were grouped according the Vertucci's classification [5].Clinical configuration of root canals in MB root in type II and type III was established by marking one gutta-percha point through canal instrument placed in the other canal.

4. Results

The results of this study show that the use of appropriate magnification,ultrasound tips, hand and finger instruments increase detection of elusive canals. In this clinical study it was found that in 90.44% (*n=123*) of first maxillary molars have additional canals in MB root. Thus 84.56% (*n=115*) have MB_2canals and 5.88% of them (*n=8*) have MB_3. 50.91% of cases (*n=28*) of second maxillary molars have additional canals. In 50.91% of cases is detected MB2 and in 1.82% (*n=1*) of them is detected MB3 (*Figure1,2,3*).Percentage distribution of types of configurations in MB root of the upper maxillary molars is presented at ***Table 1***.

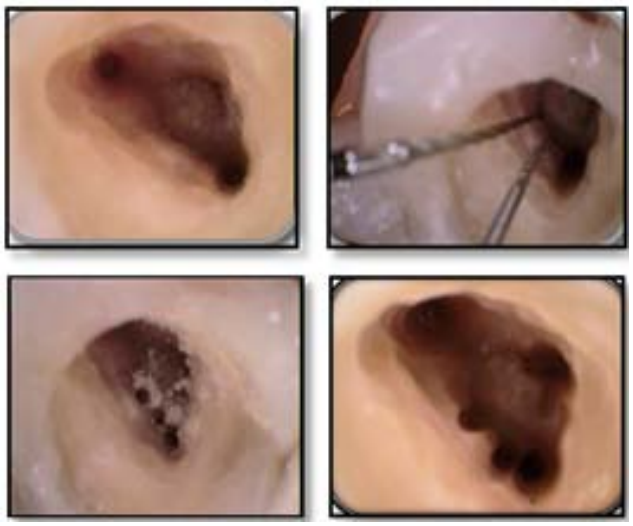

Figure1: Pulp chamber floor of tooth 17.Location of three canals in MB root - MB, MB_2, MB_3.

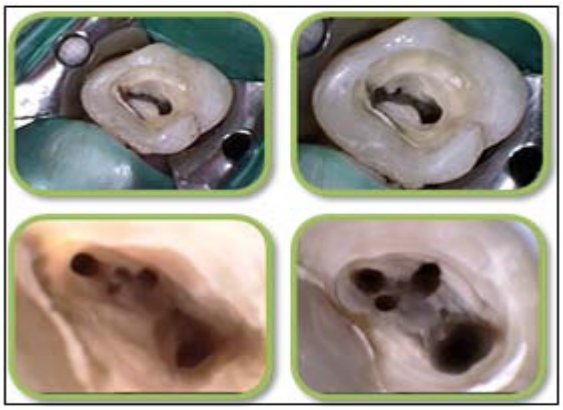

Figure 2: Pulp chamber floor of tooth 27.Location of two canals in MB root - MB, MB_2 and two furcation canals.

Table 1. Percentage distribution of types of configurations in MB root of the upper maxillary molars (*according to Vertucci 1974*).

	I type	II type	III type	IV type	V type	VI type	VII type	VIII type
M1	9.56%	34.0%	9.2%	38.0%	3.54%	-	-	5.88%
M2	49.09%	23.64%	7.27%	12.73%	5.45%	-	-	1.82%

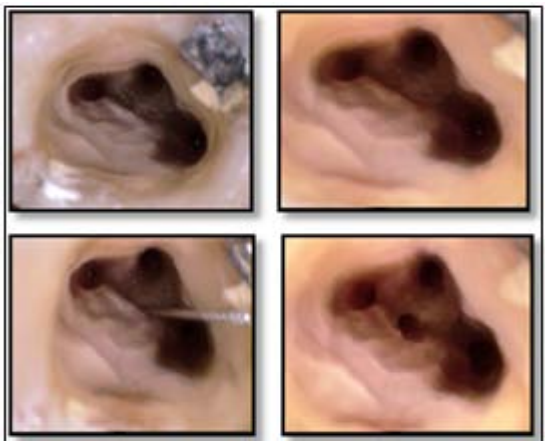

Figure 3: Pulp chamber floor of tooth 26. Location of two canals in MB root - MB, MB_2.

The clinical study of the morphology of the MB root canal is difficult, therefore it was performed in the step of adjustment of the master gutta-percha point definitive obturation of the root canal, using the classification of Vertucci (1974).Clinical configuration of root canals established by marking through endodontic instrument present at (*Figure 4*).

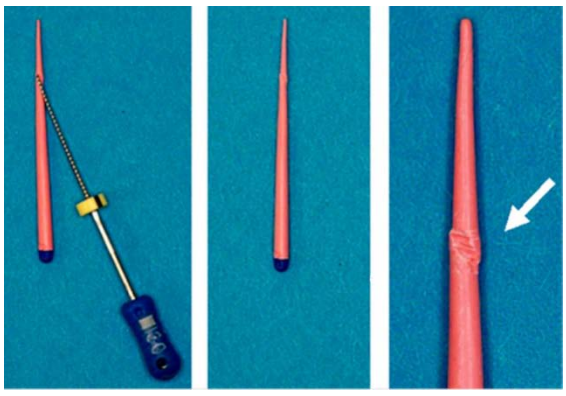

Figure 4: Establishment of root canal configuration - marking one gutta-percha point through canal instrument

placed in the other canal. Gutta-percha is marked by K-file (white arrow) /*according to A.Castelucci*/.

5. Discussion

Appropriate individual form of access cavity will eliminate many of the possible complications during treatment. Form of access cavity is a dynamic feature of the anatomy of the clinical crown; the anatomy of the pulp chamber; the number, location and characteristics of the orifices; the degree of patency of root canals; the degree of curvature and difficulty in processing of root canals and access to the apical zone. Before the start of treatment, the clinician should know well enough configuration variations of pulp chamber and canal system of the tooth, and to interpret the individual features, subject to endodontic treatment. Left untreated and unseal endodontic space is the cause of failure in the healing process. Knowledge of internal anatomy in the cervical area of the clinical crown and the floor of the pulp chamber reduces the complications of this stage of the endodontic treatment and prevents: thinning of dentin mesiobuccal direction; deformation of the pulp chamber of mineralization processes in the area of orifices, resulting in already conducted extensive treatment; perforation in furcation area; excessive expansion of orifices; diagnosis of coronary pulp stone, covering the floor of the pulp chamber. After disclosure of the pulp chamber and the complete removal of the tectum, shaped endodontic access cavity is examined with endodontic probe for the rest of dentin. At disclosure of the floor of the pulp chamber has recommended the use of magnification.

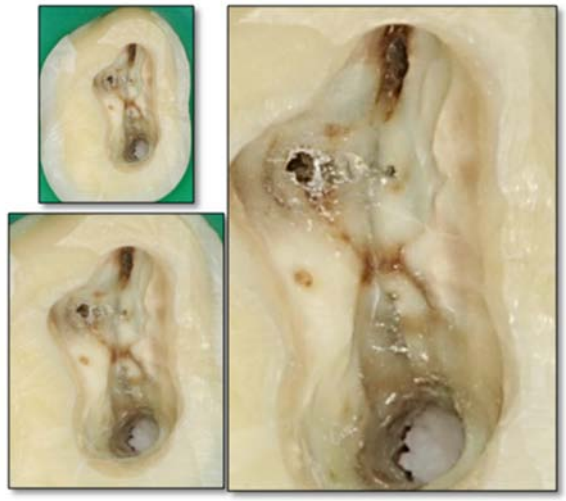

Figure5. Magnification the bottom of the pulp chamber of the tooth 16 - a/ x4; b/ x8; c/x16.

Contemporary endodontics use the magnification to enhanced the ability to detect the MB2 canals (*Figure5*). The MB2 canals could not be detected in 16.5% of the teeth, mainly because of pulpal calcification [10]. However, as the operator became more experienced, scheduled sufficient clinical time and used specific instruments adapted for microendodontics, MB2 canals were located in 93.0% of first molars and 60.4% in second molars [4].

6. Conclusion

In conclusion, knowledge of root canal configuration and its variations, the use of magnification (operating microscope) and the combined use with ultrasonics increased the detection of additional canals are all important aids that are needed for successful treatment.Endodontic science and technology are continually evolving to enable clinicians to identify, disinfectand seal root canal system predictably and efficiently.

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Author Profile

Dr. Angela Gusiyska received her degree in Dentistry (Dr. med. Dent) from the Faculty of Dental Medicine, Medical University of Sofia, Bulgaria in 1997 and she specialized in Operative Dentistry and Endodontics at the same University in 2003. Since 1998 she is Assistant Professor at the Department of Conservative Dentistry, FDM – Medical University, Sofia. Her research interests are in the area of regeneration of periapical zone, nanotechnology and bioceramics in endodontics and esthetic rehabilitation of dentition. Dr. Gusiyska presents her scientific papers on national and international dental meetings. Her practice is focused on microscopic endondontic treatments. She developed her PhD thesis titled "Orthograde Treatment of Chronic Apical Periodontics – Biological Approaches: in 2011. She is currently a member of the Bulgarian Dental Association, Bulgarian Scientific Dental Association, Bulgarian Endodontic Society, Bulgarian Society of Aesthetic Dentistry, International Team for Implantology, Bulgarian Society of Oral Implantology.