

## MOLAR 2<sup>ND</sup> CANAL: FREQUENT CAUSE OF ENDODONTIC FAILURE

### МЕЗИО-БУКАЛЕН ВТОР КАНАЛ – ЕДНА ОД ПРИЧИНИТЕ ЗА НЕУСПЕШЕН ТРЕТМАН КАЈ ГОРНИ МОЛАРИ

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#### Abstract

Endodontics is a branch of dentistry in which new challenges emerge every day. A particularly interesting and challenging topic for every endodontist are the upper molars, especially locating and shaping the second mesiobuccal canal or commonly known as the MB2. The main goal of this case report is to emphasize the frequent representation of the MB2 canal in upper molars and also the most common techniques for locating, shaping and filling of this canal, presented in two clinical cases.

**Keywords:** Maxillary molars, second mesiobuccal canal, MB2.

#### Апстракт

Ендодонцијата е гранка во стоматологијата во која секојдневно се среќаваме со нови предизвици. За секој ендодонт посебно се интересни горните молари, особено лоцирање и инструментација на вториот мезио-букален канал. Овој труд има за цел да ја потенцира големата застапеност на вториот мезио-букален канал (МБ2) кај горните молари како и техники за лоцирање, обработка и obtурирање со современи материјали преку приказ на клинички случаи. **Клучни зборови:** горни молари, втор мезио-букален канал, МБ2.

#### Introduction

Due to their complex canal morphology, the treatment of the upper molar teeth is challenging for every endodontist. A crucial factor in planning and administering root canal therapy is the knowledge of internal dental morphology<sup>1</sup>. The canal system in the mesiobuccal root, commonly presented with two canals, requires special attention and treatment, the main reason for that being the MB2 canal. Neglecting this canal may lead to endodontic treatment failure, even if the other canals are perfectly shaped, cleaned and filled. The maxillary molar is one of the teeth which require root canal therapy (RCT) quite often. RCT on the maxillary 1st molar has the tendency to fail because of the complicated root morphology and its internal anatomy such as buccally curved palatal root which cannot be assessed with radiographic examination, significant number of accessory canals at the apex of the palatal root, additional canals such as MB2 in the mesiobuccal root, radix entomolaris etc<sup>2,3</sup>.

In 1917, Dr. Hess filled the canal system of an upper first molar with vulcanized rubber and found that apart from the three commonly known canals there is a fourth one, in the mesiobuccal root, and pointed out to the existence of different kinds of anomalies such as anastomosis, ramifications and lateral canals<sup>4</sup>.

The biggest study on this topic was the one carried out by Dr. John Stropko who over a period of 8 years, implemented endodontic treatment on 1700 upper molars and established that 90% of all treated first molars had MB2 canals, whereas the respective ratio for all second molars was 60% and 20% for all third molars<sup>5</sup>. In some studies it was found that the frequency of the MB2 canal is higher in male patients compared to the female ones<sup>6</sup>.

To determine the type of the canal system, we used the classification by Vertucci, according to which the most common type for the mesiobuccal root is type II (two canals with two separate orifices where one of the canals merges with the other and they exit the root from

one apical foramen). Also, type IV is present (two canals with two separate orifices and foramina)<sup>7</sup>.

### Clinical cases

In this clinical study, two different clinical cases are presented, both of them being the result of the authors' day-to-day experience with patients. By elaborating the facts and circumstances for each case individually, conclusions are drawn and recommendations are given for successful treatment and procedures to be undertaken in identical or similar situations.

#### Clinical case 1

A 35-year old patient was referred to our dental office for an endodontic treatment of an upper first molar (fig.1). The patient had a previously initiated endodontic therapy on the same tooth. During the clinical examination the access was observed, and there was a minor swelling included. The percussion and cold tests were negative and Pulp Necrosis with Asymptomatic Apical periodontitis (AAP) was diagnosed.



Figure 1. Control X-ray

#### The endodontic therapy was done in two sessions.

During the first session, after proper rubber dam isolation, access was made and all four canals were discov-

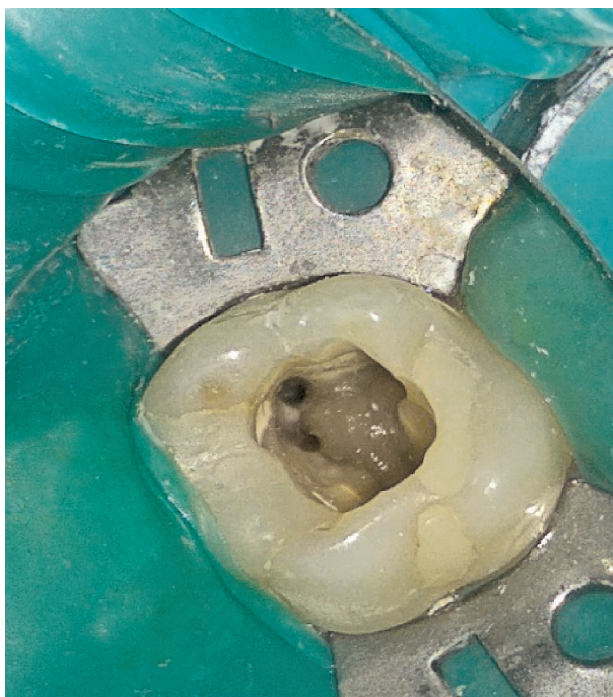


Figure 2. Access preparation



Figure 3. Merging of two canals

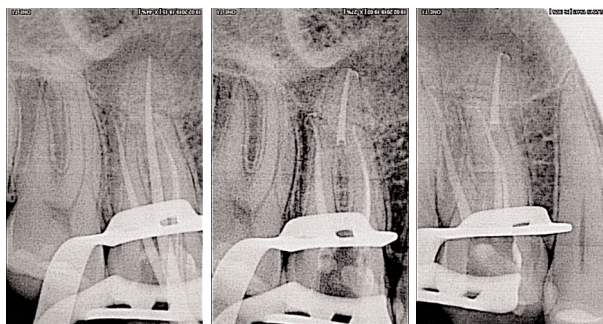
ered (fig.2). Consequently, working length was measured using #10 and #15 hand files with the help of an apex locator (Schlumbohm). The shaping procedure started with the largest canal, the palatal, proceeding with the mesiodistal and mesiobuccal canals. The shaping of the canals was done by using an endomotor (Schlumbohm) and Protaper Gold rotary files (Dentsply). During the instrumentation phase the canals were constantly flushed with 3% NaOCl and 16% EDTA using side vented needles. After shaping these three canals, what followed was the instrumentation of the MB2. Negotiation was made using #8 D-finder hand files (Mani) to working length. The Gutta percha point was placed in the mesiobuccal canal to the working length and by using a #10 hand file with the rubber stop



**Figure 4.** After shaping of MB2



**Figure 5.** NaOCl in action



**Figure 6.** Master cone and Final X-ray

placed by the previously measured working length of the MB2, we moved the file all the way until contact was made with the gutta percha. The rubber stop was then moved and that length was measured as a new working length for the MB2 (fig.3). Also, the merging point of these two canals can be checked by viewing the gutta percha under magnification and search for the notch made by the hand file. Before pulling the gutta percha we had to take out the file first, avoiding the risk of accidentally leaving the apical part of the gutta percha cone in the canal. This procedure is particularly important considering the fact that the most risky place for file separation is the one where two canals merge. After measuring the new working length, the MB2 was shaped by using Mani Silk (Mani) rotary files with smaller a taper (fig.4). When the shaping procedure was completed, all four canals were filled using calcium hydroxide (Calcpast) and Phosphate Cement was placed as provisional filing. The patient was instructed to come back in 2 weeks.

During the second session, after rubber dam isolation, the calcium hydroxide was flushed from the canals, master cones were placed in all four canals and x-ray was performed. After checking the master cones on the x-ray image, the irrigation protocol was next in line. First, 16% EDTA was placed using side vented needles for better control and activated with ultrasonics for 1 min per canal using U-files (Mani). The canals were flushed with saline afterwards and 3% NaOCl was used in all canals, also activated ultrasonically for 1 min per canal. Final flushing with saline was made; the canals were dried using paper points and then filled (fig.5). The buccal canals were obturated using the single cone technique, and the palatal, due to its bigger taper, was filled by implementing the Continuous Wave of Condensation (CWC) technique, after previously cutting 1 mm from the tip of the cone. An epoxy resin sealer Syntex (Cerkamed) was used in this case (fig.6). After obtura-

tion, flowable composite (Slow flow, Pentron) was used to seal the orificiums, and for final restoration Charisma Diamond nanocomposite was applied.

### *Clinical case 2*

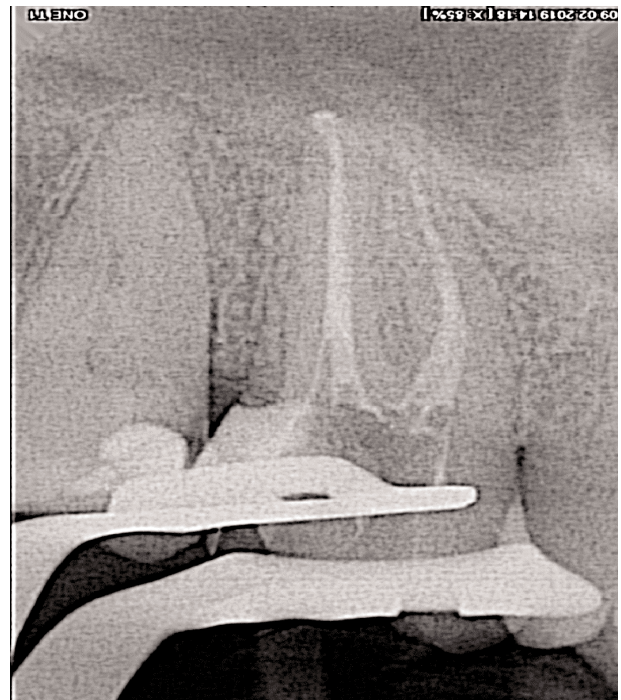
During a routine check-up, a big carious lesion was discovered on the upper-right second molar of a patient (fig.7). The patient was not responsive either on palpation or percussion tests. The cold stimuli test was also negative. According to those clinical findings Pulp Necrosis was diagnosed.



**Figure 7.** Control x-ray



**Figure 8.** Master cone x-ray



**Figure 9.** After obturation



**Figure 10.** Final x-ray

While cleaning the decay, the distal side of the tooth was lost below the margin level so appropriate steps were taken for better rubber dam isolation before the

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treatment was started. Using Thermancut burs (Dentsply), deep margin elevation was made after which composite build up (Evetric) of the distal side followed. After forming all four walls of the crown, rubber dam isolation was performed and the treatment was initiated. Similar to the previous case, the access was made and all canals were shaped by using Protaper Gold (Dentsply) rotary files. Negotiation of the MB2 was made using #08 D-finders (Mani) and then shaping was done using Mani Silk (Mani) rotary files until 20.04 taper. Master cone x-ray was performed and the position of the cones was observed (fig.8).

After instrumentation, irrigation was made using EDTA, saline and NaOCl in the same sequence as above and then activated with ultrasonics. The canals were dried using paper points and filled using epoxy resin based sealer, Syntex (Cerkamed) (fig.9). After obturation, the pulp floor was cleaned of excess sealer and gutta percha, and filled with flowable composite (Slow Flow, Pentron). For final restoration, Evetric (Dentsply) nanocomposite was used (fig.10).

## Discussion

Locating canal orifices through the pulp chamber is challenging for endodontists since orifices may have been shifted, there may be calcification or additional canals in an unusual location. (8)

For better locating and instrumenting of the MB2, in addition to good access, better knowledge of the pulp floor map is even more important. Additional tools may help in this procedure like ultrasonic tips, long shank carbide burs, dental loupes or operative microscope and CBCT.

While performing appropriate conservative access of the upper molars, we need to keep more to the mesial side of the occlusal surface. The first canal to be located is the palatal, especially in calcified treatments. The next step is to move buccally, applying care so we do not perforate the floor of the area with grey dentin, but remove from the white dentin, also known as tertiary or reparative dentin (9). Here we can use the Munce burs which have a long and thick shaft and small working head to precisely cut from one area of the pulpal floor. Equally good for performing this task are the ultrasonic tips. The key for locating the MB2 is magnification and illumination. Statistically speaking, using any kind of magnification is three times better than the naked eye (10, 11).

In almost all cases, the MB2 is located more palatally and mesially of the mesiobuccal canal. This way, if we cross the line from the mesiobuccal to the palatal in approximately 2-3 mm in palatal and mesial direction we should find the orifice of the 4 canal. First and fore-

most, we need to cut the overlying dentin that is covering the MB2, which may be the biggest reason for not being able to locate this canal. This may be done with the above mentioned diamond coated ultrasonic tips. In the attempt to locate the MB2, we can follow the isthmus starting from the mesiobuccal canal, in palatal direction, until we reach the fourth canal. We must always be careful following this isthmus since it is not always complete, sometimes it can be interrupted and then proceed to the MB2 (12). To achieve precision in this process, magnification is highly recommended.

A tip for locating the MB2 canal: If we cross the line from the mesiobuccal canal to the palatal and then draw an imaginary line from the distobuccal canal moving perpendicular to the previous line, the place where they converge may be the orifice of the MB2 canal. (13)

After finding the canal, the next step is negotiating and shaping, a procedure that is not so easy to perform due to its distally angled entry and the different type of canal morphology. In some situations, even after good access, negotiation may not be possible.

For negotiation of this canal, stiff hand files must be used like D-finders (Mani) or C-files (Dentsply). After negotiation with hand files, we may proceed with rotary.

Thus, endodontists should carefully explore the floor of the pulp chamber to prevent missing a canal and prevent perforation of the floor of the pulp chamber due to overzealous preparation in search of additional canals.

## Conclusion

The ability to locate an extra canal in the canal system is an important factor in the success of every endodontic treatment. The occurrence of a second mesiobuccal canal in the maxillary molars is very high. This paper highlights the importance of finding additional canals in the root canal system. A clinician should be aware of the variations in the canal anatomy, pre-operative assessment, careful examination of the pulpal floor and use of advanced diagnostic aids like loupes, CBCT and ultrasonics for a successful practice.

## Reference

1. Vertucci FJ. Root canal morphology and its relationship to endodontic procedures. *Endodontic Topics* 2005; 10(1):3-294502.
2. Stropko JJ. Canal morphology of maxillary molars: Clinical observations of canal configurations. *J Endod* 25, 1999, 446-50.
3. Pecora JD, Woelfel JB, Sousa Neto MD, Issa EP. Morphologic study of the maxillary molars part II: Internal anatomy. *Braz Dent J* 3, 1992, 53-7.

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4. Hess W, Zürcher E, Dolamore WH. *The Anatomy of the Root-Canals of the Teeth of the Permanent Dentition*. New York, NY: William Wood; 1925.
  5. Stropko JJ. Canal morphology of maxillary molars: clinical observations of canal configurations. *J Endod*. 1999;25:446..
  6. Hasan M, Raza Khan F. Determination of frequency of the second mesiobuccal canal in the permanent maxillary first molar teeth with magnification loupes ( $\times 3.5$ ). *Int J Biomed Sci*. 2014;10(3):201–207.
  7. Vertucci FJ. Root canal anatomy of the human permanent teeth. *Oral Surg Oral Med Oral Pathol*. 1984;58:589-59.
  8. Favieri A, Barros FG, Campos LC. Root canal therapy of a maxillary first molar with five root canals: Case report. *Braz Dent J* 2006; 17(1):75-8.
  9. Acosta Vigouroux, SA, Trugeda Bosaans, SA. Anatomy of the pulp chamber floor of the permanent maxillary first molar. *J Endodon*. 1978;4:214–219.
  10. Buhley LJ, Barrows MJ, BeGole EA, et al. Effect of magnification on locating the MB2 canal in maxillary molars. *J Endod*. 2002;28:324-327.
  11. Schwarze T, Baethge C, Stecher T, Geurtsen W. Identification of second canals in the mesiobuccal root of maxillary first and second molars using magnifying loupes or an operating microscope. *Aust Endod J* 28,2002, 57-60.
  12. Weller RN, Niemczyk SP, Kim S. Incidence and position of the canal isthmus. Part 1. Mesiobuccal root of the maxillary first molar. *J Endod*. 1995;21:380-383.
  13. Rudolf B, Michael AB. *Color atlas of dental medicine*. Endodontology 2000. p. 51-2