

# The incidence of four canals in maxillary first molars

## A clinical determination

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**T**he number of root canal systems in maxillary first molars varies.<sup>1-3</sup> The incidence of a second mesiobuccal canal has been reported to range between 40 and 95 percent. Hartwell and Bellizzi<sup>4</sup> reported the number to be in the 70 to 80 percent range (in vivo studies typically report a lower frequency of two canals in the mesiobuccal root because of the clinician's inability to manipulate the tooth in hand). Smadi and Khraisat<sup>5</sup> reported that the maxillary first molar has some of the highest failure rates in endodontic treatment. The failure often is due to the presence of a second canal in the mesiobuccal root that the clinician fails to detect, débride and obturate.

Modifications in endodontic access and detection techniques, along with advancements in illumination and magnification technology, have aided in the location and treatment of the second mesiobuccal canal of maxillary first molars.<sup>6,7</sup> Stropko<sup>7</sup> reported that increased operator experience, increased time per appointment and the use of an operating microscope resulted in an increase in the number of second mesiobuccal canals located. Sempira and

## ABSTRACT

**Background.** The authors conducted an in vivo study to report the incidence of fourth root canals located and treated in maxillary first molars during a seven-month period in a postgraduate endodontic program.

**Methods.** In this retrospective study, the authors determined the number of canals treated by postgraduate students in an endodontic program. The attending postgraduate endodontic faculty member supervising the case verified the number of canals in the teeth. The authors then collected the data from each resident and compiled them.

**Results.** The residents treated a total of 121 maxillary molars, 85 (70.2 percent) of which met the criterion of having four or more canals treated. Approximately 99 percent of the fourth canals were located in the mesiobuccal root.

**Conclusions.** Overall, 70 percent of the maxillary first molars contained at least four canals that required instrumentation.

**Clinical Implications.** The results of this study demonstrate that it is imperative for any dentist performing root canal therapy on maxillary first molars to examine carefully the pulpal floor to locate all canals, especially the second mesiobuccal canal. Performing thorough examinations may increase the chance of treatment success.

**Key Words.** Root canal; mesiobuccal; maxillary first molar.

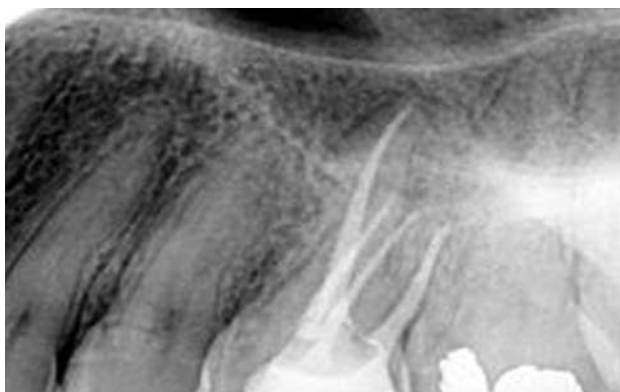
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**Figure 1.** Radiograph of maxillary left first molar with two separate mesiobuccal canals.



**Figure 2.** Radiograph of maxillary left first molar with joining mesiobuccal canals.

Hartwell<sup>8</sup> reported that the use of a microscope did not change the incidence of second mesiobuccal canals located. However, they did report that using a microscope increased clinicians' confidence while attempting to locate a fourth canal.

A general dentist's decision regarding whether to treat a patient or refer him or her to an endodontist primarily will be based on the perceived difficulty of root canal therapy and the time needed to complete it. This is especially true when evaluating the need for endodontic treatment in molars. Published reports are available regarding the average number of root canals in molars that endodontists locate and treat; however, to our knowledge, the literature contains no reports regarding the average number of root canals in molars that are located and treated by general dentists.

We felt that the general dentist's decision-making process might be helped if a more recent study were to report the incidence of locating four

or more canals by endodontists in a modern clinical setting using the modifications noted in previous studies and the latest technology.

Thus, the purpose of our *in vivo* study was to report the incidence of fourth root canals located and treated in maxillary first molars during a seven-month period in a postgraduate endodontic program.

## MATERIALS AND METHODS

This retrospective study determined the number of canals treated by 10 postgraduate students in the Endodontic Program at the University of Medicine and Dentistry of New Jersey, Newark. Five of the students were in the first year of training and five were in the second year of training. The residents treated the patients during a seven-month period from Aug. 1, 2006, to Feb. 23, 2007. Each endodontic resident had the use of a dental operating microscope, as well as ultrasonic, rotary and hand instruments necessary for access, location and negotiation of the root canal systems.

After a resident treated a patient, he or she recorded clinically relevant information on a treatment chart, including the number of canals that required instrumentation and were obturated. The resident recorded the canal as being present if it could be negotiated to at least one-half of the root length, regardless of whether it ended in its own foramen or joined with another canal (Figures 1 and 2). We included both retreatment and initial nonsurgical endodontic treatment cases in this study. The attending postgraduate endodontic faculty member supervising the case verified the number of canals in the teeth.

Three of us (C.M.A., W.W.L., M.E.G.) then collected the data from each resident and compiled them. We then tabulated the data on an electronic spreadsheet and calculated the percentage of teeth that had four canals.

## RESULTS

The residents treated a total of 121 maxillary first molars, 85 (70.2 percent) of which met the criterion of having four or more canals treated. In approximately 99 percent of the teeth, the fourth canal was in the mesiobuccal root.

## DISCUSSION

With the advent of nickel-titanium files, rotary instrumentation, digital radiography, better illumination and magnification technology, and

advanced continuing education in endodontics during the early 1990s, more endodontic therapy is being performed in general dentistry practices. Despite these advances, however, the inability to locate and thoroughly cleanse and obturate the entire root canal system can lead to treatment failure.

A small number of teeth in this study contained five canals in the form of a second distal or palatal canal. This number compares favorably with the percentage reported by Wolcott and colleagues<sup>9</sup> in a five-year study.

The goal of this study—conducted in a clinical setting using modern techniques and advanced technology—was to report the percentage of maxillary first molars that contained at least four root canals. The results demonstrate that it is imperative for a dentist performing endodontic therapy on maxillary first molars to examine carefully the pulpal floor to locate the orifices of any “extra” canals, especially the second mesiobuccal canal.

The residents who took part in this study reported that the second mesiobuccal canal often was located directly lingual to the first mesiobuccal canal. Gently sweeping the pulpal floor with a slow-speed no. 2 or no. 4 round bur or using an ultrasonic instrument in the same manner aided in finding the fourth canals. Such thorough examinations may increase the chance of treatment success and long-term retention of the tooth if endodontic treatment is followed by placement of an appropriate coronal restoration.

## CONCLUSION

One criticism of an earlier study by Sempira and Hartwell<sup>8</sup> was that an attending faculty member

did not verify the presence or absence of additional root canals in every case. We addressed that criticism in this study by having an attending faculty member verify the presence or absence of additional root canals in all cases of maxillary first molars treated by residents. In the seven years since the previous study was conducted,<sup>8</sup> a tremendous increase has occurred in the use of ultrasonic tips as an aid to locating the orifices of additional canals in all tooth groups.

This *in vivo* study serves as an update to the previous study. By modifying the verification procedures, and with the increased use of ultrasonic tips, residents located and treated significantly more root canals in this population of maxillary first molars. ■

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