

Clinical

Three-canal maxillary premolar teeth: a common clinical reality

Sashi Nallapati explains how to identify three-canal maxillary premolar teeth and treat them predictably

Most maxillary premolars have one or two root canals (*Pathways of the Pulp*, 8th edition), but a small percentage have three. One study reported three canals in 6% of the cases studied (Cairns and Skidmore, 1997) (see Figures 1 to 4).

If one is to treat three-canal maxillary premolar teeth predictably, it is necessary to be aware of the clinical and radiographic anatomy. These teeth may also require special shaping and obturating techniques.

A genetic component exists in the configuration of tooth forms. Three-canal maxillary premolars are fairly common in certain patient populations. In the author's private practice in Jamaica, which consists largely of black Jamaicans and Jamaicans of mixed ethnicity, treatment of these teeth is a frequent occurrence. Over 25% of the maxillary first bicusps the author has treated since the introduction of a surgical operating microscope to his practice have three canals.

The purpose of this article is to discuss how these teeth may be identified and the treatment modifications that are necessary for successful results.

Diagnosis: radiographic interpretation

Accurate preoperative radiographs using paralleling techniques are essential in providing clues as to the number of roots that exist (Silha RE, 1968).

In three-canal maxillary premolars, the cervical half of the root is generally wider than usual, with little or no taper (see Figure 5).

Root canals may not be evident radiographically or may look unusual. Careful interpretation of the periodontal ligament space may suggest the presence of an extra root.

Mesial and distal angled views will often reveal the presence of two buccal roots (see Figures 6 to 12).

Diagnosis: clinical appearance

Clinical presentation is frequently atypical. A flattened buccal gingival collar is common, as opposed to a normal parabolic shape (see Figure 13). This may reflect the furcal morphology in these teeth and, thus, hint at the presence of two buccal roots.

Probing the buccal sulcus to feel the root eminences and furcal anatomy may also help to identify the presence of two buccal roots. The use of magnification and fiber-optic illumination offers a tremendous advantage in locating and treating extra canals (Carr

GB, 1983; Ruddle CJ, 1997). The dental operating microscope has been found to be particularly helpful by the author. Perhaps it is most important always to be on the look out for additional canals.

Tooth anatomy varies, but several features are commonly witnessed. In the author's practice, there were two buccal canals and one palatal canal in every instance.

The division of the buccal canals was located either just above the cemento-enamel junction (most common) or in the mid-root area. For those teeth that separated in the mid root, it was necessary to enlarge the single buccal orifice and explore the mid-root

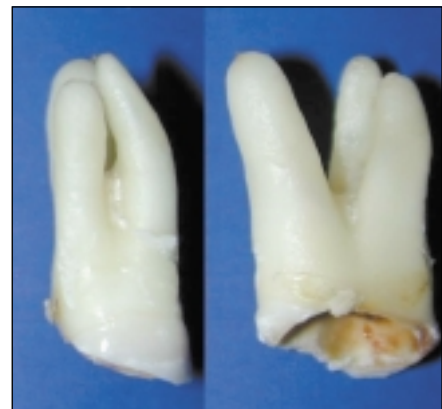


Figure 1: Three-rooted maxillary first premolar

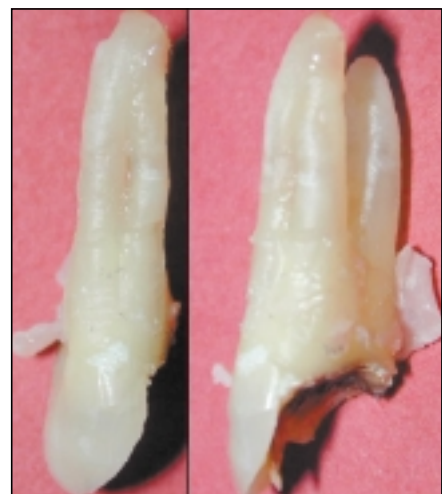


Figure 2: Three-rooted maxillary second premolar

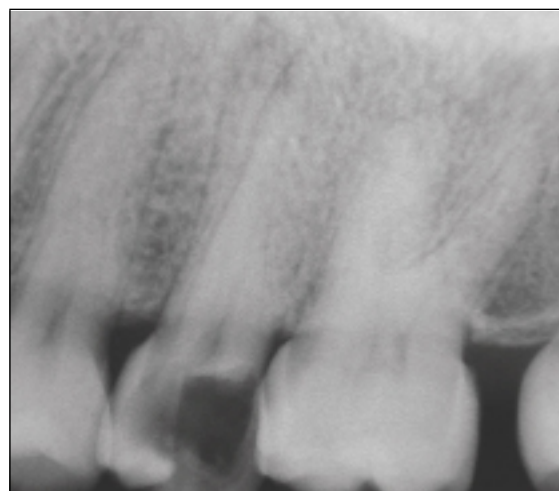


Figure 3: Radiograph of the extracted maxillary second premolar shown in Figure 2

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Figure 4: Three-canal maxillary first premolar with radiograph

How to find these canals

Unobstructed visualization, knowledge of normal anatomy and looking for the aberrant anatomy are the keys to finding 'occult canals' consistently. Optimum opening of the access cavity and establishment of straight-line access to the canals is absolutely necessary. If there is a slight eccentricity in the alignment of the buccal and palatal canal orifices, this will provide a clue that there may be a second buccal canal.

As stated earlier, it may be

to find the second buccal canal. In this situation a canal can easily be missed. Occasionally, the buccal canals rejoined in the apical third (see Figures 14 to 19).

In the author's practice, these teeth were commonly found to be bilateral, as described by Sabala (1994).

necessary to enlarge the buccal canal orifice and search in the mid-root for the second canal.

During the initial placement of scouting files (hand files #6, 8 or 10) in the buccal canal, one may encounter an obstruction and the file may deflect to the mesial or distal before it travels any further. This may indicate a canal division. It is important thereafter to develop a sense of tactile feel and direction with appropriately pre-curved scouting files to enter the two buccal canals consistently.

The use of 5.25% NaOCl as an irrigant during root canal treatment is well documented and highly recommended for its tissue digesting properties and other desirable properties (Hasselgren G, Olsson B, Cvek M, 1998). When working with a surgical operating microscope, one can often see the NaOCl bubbling in the extra canal, marking its presence (Carr GB, 1998; Ruddle CJ, 1997).

On occasion, dyes or trans-illumination may be helpful in locating additional canals.

How to prepare these canals

The author has learned several techniques that are helpful during instrumentation. As with any root canal, the access

Figure 7: Maxillary first and second premolars with three roots. Notice the distinct division of the buccal roots. Note the presence of maxillary torus superimposed on the roots of the maxillary teeth

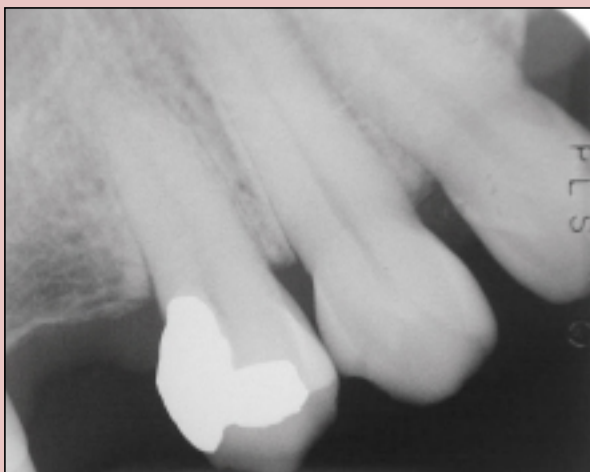
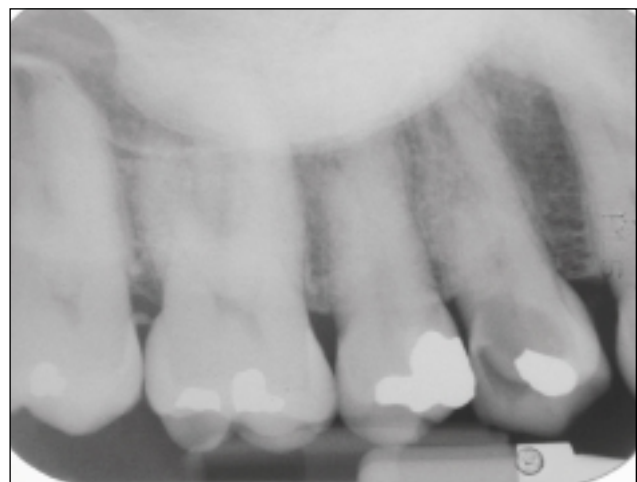


Figure 5: Three-canal maxillary first premolar. Roots are broad mesio-distally, with little taper



Figure 6: Maxillary first premolar with three roots. Note the broad buccal root

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cavity is prepared with straight-line access to both the buccal and palatal canals (Ruddle CJ, 2001).

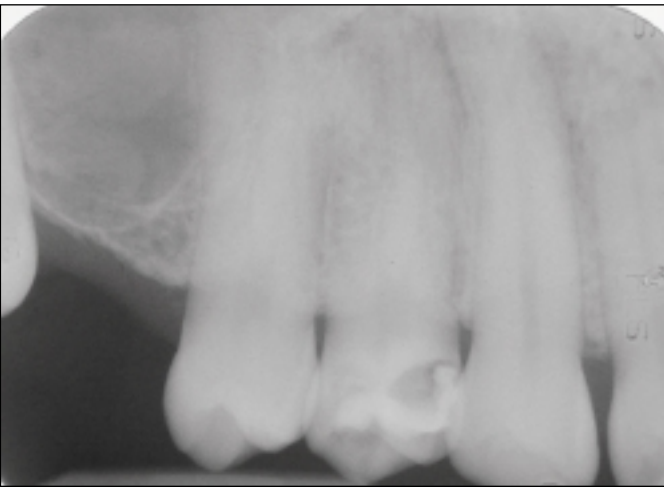
Once it has been established that there are two buccal canals, it is important to measure the distance between the occlusal reference point and the division of the two buccal canals. This can be accomplished by placing a hand K-file (ISO size 30 or 35) with the rubber stop in the buccal orifice to the point of obstruction beyond which only a pre-curved file would traverse. Measure the distance. This helps in the accurate enlargement of the buccal orifice with Gates-Glidden drills or orifice openers of choice to obtain straight-line access to each of the two buccal canals.

Gates-Glidden #4, 3, 2 drills set on a slow handpiece rotating at 750-1000 rpm may be utilized in a crown down fashion (Machtou P, 1993). These drills should be withdrawn against the canal wall that is away from the root concavities.

The objective of this exercise is to provide additional space within the limits of safety from the pulpal floor to the point where the buccal canals divide, and establish straight-line access to both canals. This will reduce stress on the files used to shape the canals and minimize the risk of instrument separation and canal transportation (Ruddle CJ, 2001).

The working length may be determined using radiographs and electronic apex locators. Small, slightly pre-curved K-files or nickel titanium hand files are used to debride the canals and to

Figure 8: Maxillary first premolar with three roots. Careful interpretation of the periodontal ligament space reveals the presence of the extra root



establish a glide path to the working length. Multiple recapitulations, copious irrigation and maintaining canal patency help clean the canals more effectively (Ruddle CJ, 2001).

Once straight-line access and a glide path are established, cautious use of rotary or hand nickel titanium files prepares the canals to a predetermined shape. After gauging the apical third of the canals, additional preparation is performed if necessary, after which the canals are ready for obturation (Buchanan LS, 1989).

How to obturate these canals

One of the most challenging aspects of treating three-canal maxillary premolars is the predictable obturation of the canal system. There is a tendency in buccal canals that divide apically for the obturating material in one canal to block the other canal. One method of obturation that has helped the author avoid this problem is described below.

Select and fit master cones to each canal. It may be difficult to place both cones at once because of the limited space in the coronal third (see Figure 20). Apply sealer to the tip of the each cone. Pre-fit a heat carrying plugger (Touch 'N Heat, Sybron Endo, Orange, California or System B Unit, Sybron Endo, Orange, California) in each of the canals so that it binds 3mm short of the working length.

Figure 9: Notice the distinct presence of two buccal roots in maxillary second premolar with three roots

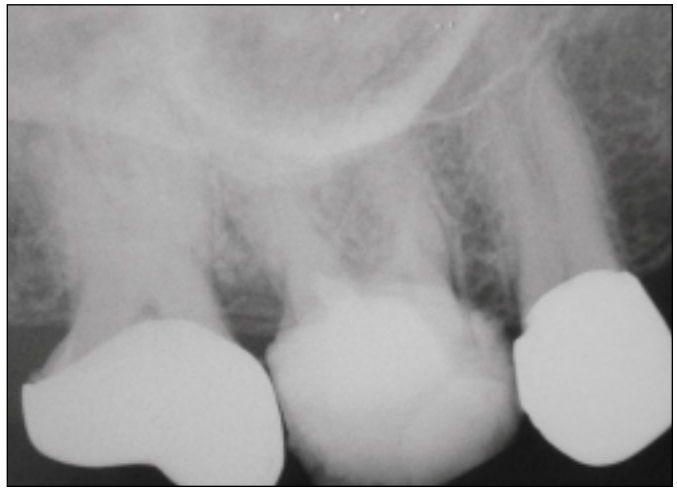


Figure 10: Maxillary first premolar with three roots. Note the width of the buccal root and the lack of taper in the cervical third of the root



Figure 11: Atypical radiographic presentation of maxillary first premolar with three roots



Figure 12: Atypical radiographic presentation of maxillary first premolar with three roots



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Seat the master cone and sever it with multiple heat bursts to below the level of division of the buccal canals (see Figure 21). Once the gutta percha is severed in the first canal, choose an appropriately sized hand plugger to pack lightly the coronal end of the gutta percha.

Place the other master cone with sealer in the second buccal canal and repeat the procedure just discussed (see Figures 22 and

23). This will ensure that, if there is any communication between the buccal canals, the sealer or warm gutta percha will not flow into the other buccal canal during the down pack.

Insert the pre-fit heat carrying plugger into one of the buccal canals, activate it, and down pack to within 4mm of the apex. When the plugger reaches this depth, release the switch and maintain the pressure. The plugger will continue to progress apically for another

Figure 13: Clinical view showing the flattened buccal gingival collar



Figure 14: Buccal canals dividing in the cervical third of the roots

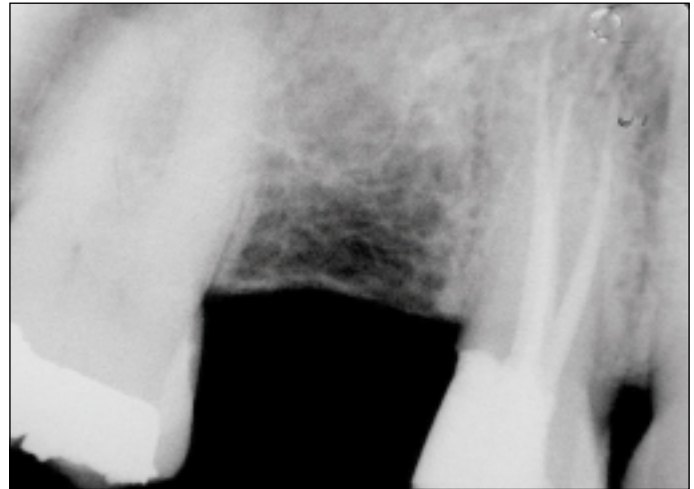


Figure 15: Buccal canals dividing mid-root to join again apically



Figure 16: Buccal canals dividing just above the cervical line

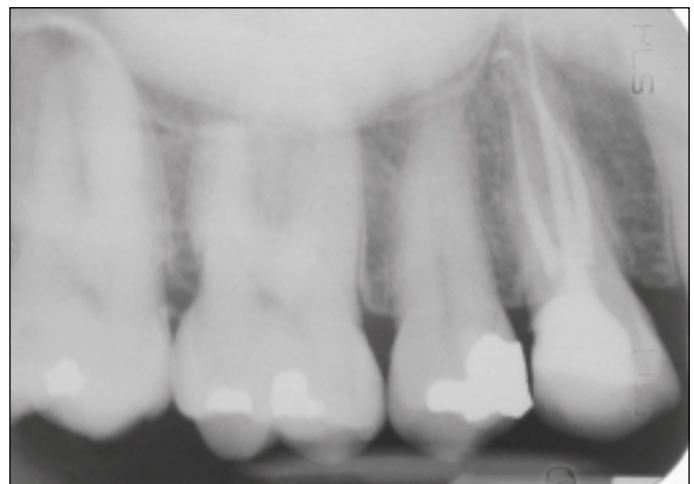
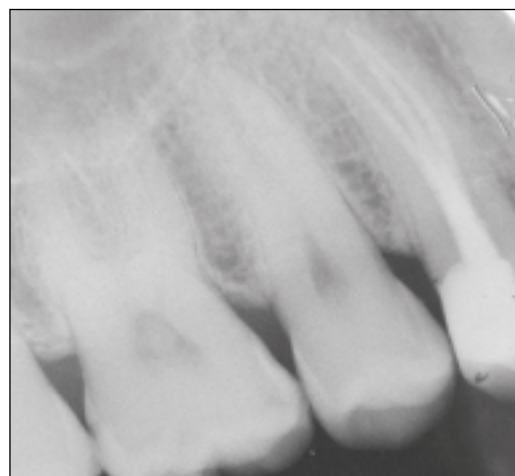


Figure 17: Buccal canals division in the apical third



Figure 18: Buccal canal division in the middle third



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Figure 19: Buccal canal division in the cervical third

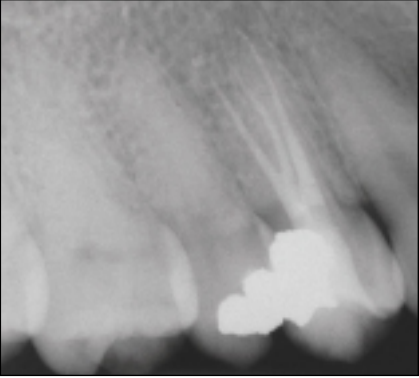


Figure 20: Master cone coated with sealer placed in the disto-buccal canal



Figure 21: Master cone severed below the level of division of the canals



Figure 22: Master cone coated with sealer placed in the mesio-buccal canal



Figure 23: Master cone severed below the level of division of the canals



Figure 24: After the down pack of gutta percha in both the buccal canals

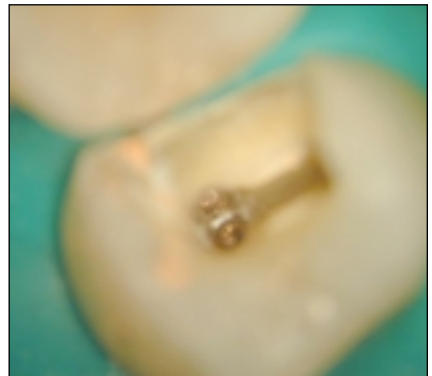


Figure 25: Back-filling of the buccal canals



Figure 26: After back-filling to the point of division of the buccal canals

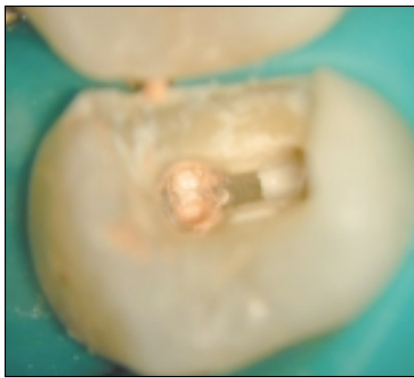


Figure 27: Complete obturation of all the canals

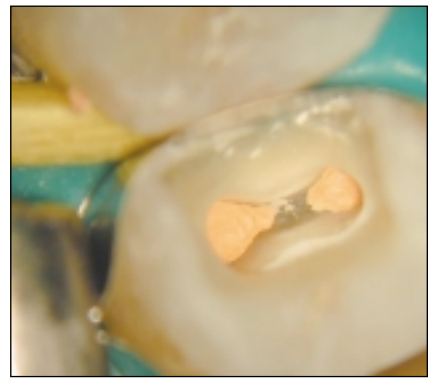


Figure 28a: Preoperative occlusal view of a three-canal maxillary first bicuspid



Figure 28b: Straight-line access to both buccal canals



Figure 29c: Sodium hypochlorite 5.25% bubbling in the mesio-buccal canal



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Figure 29d: Cleaning and shaping finished



Figure 30a: Initial access

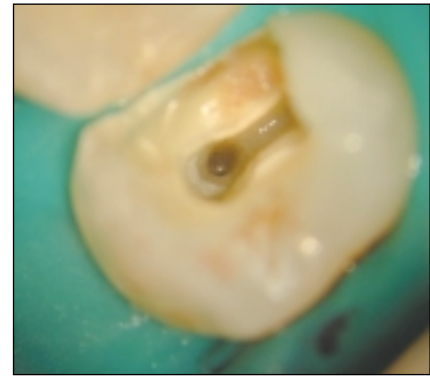


Figure 29e: Obturation of all the canals

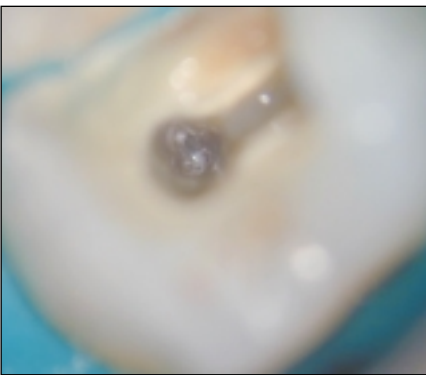


Figure 30b: Second buccal canal uncovered



Figure 30c: Straight line access to both of the buccal canals



Figure 30d: Both buccal canals cleaned and shaped



Figure 30e: Both buccal canals obturated millimeter where it will come in contact with the canal walls. Hold it in place with light pressure for 10 seconds to compensate for the gutta percha shrinkage while cooling, and then remove it along with the excess gutta percha. Gently compact the gutta percha in the apical 3mm with appropriately sized hand pluggers. Repeat the procedure in the second buccal canal (see Figure 24).

Backfill each of the canals to the level of bifurcation with the Obtura II (Obtura Corp, Fenton, MO) and compact the warm gutta percha with hand pluggers (see Figures 25 and 26). The rest of the buccal canal space is obturated as a single canal with Obtura II (see Figures 27). Successful and predictable endodontic treatment

requires knowledge of biology, physiology and radicular anatomy. It also requires proper instruments and the knowledge to use these instruments effectively. Teeth with extra roots and/or canals pose a particular challenge. This article discussed how to identify three-canal maxillary premolars and some modifications to standard clinical techniques that can help produce successful treatment (see Figures 28a to 28e and 29a to 29e).

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Acknowledgements

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