

Endodontic Surgery

The bevelled root surface

1986 Vertucci and Beatty Apical leakage associated with retrofilling techniques: dye study

Less leakage occurred when the cavity preparation and the bevelled root surface were coated with varnish (copalite) prior to placement of an amalgam restoration.

GP only as an apical seal produced the greatest amount of linear dye penetration. Reduced leakage if bevelled surface covered with varnish.

1989 Tidmarsh and Arrowsmith Dentinal tubules at the root ends of apicected teeth: SEM study.

The aim of this study was to establish the existence and orientation of dentinal tubules at the level at which resection is normally performed and to investigate the presence of a potential pathway through the dentine between the root canal and the external surface of the tooth.

At 3mm from apex 27,000 tubules per mm square. Older teeth displayed large numbers of tubules. At area of retrograde filling an average of 13,000 tubules per mm square were present.

Carrigan *et al.* (1984), however, demonstrated that tubule numbers decreased both with age and the proximity to the apex. Did not assess permeability though – just numbers.

Beatty (1986) concluded that significantly more leakage occurred in those roots where the apical cavity preparation did not extend to the height of the bevel. This finding gave credence to the proposal by Vertucci & Beatty (1986) that exposed dentinal tubules may constitute a potential pathway for leakage.

It is suggested that not only should the angle of the bevelled root face be kept to a minimum, but also that the retrograde root filling should extend back into the canal at least to the level of the coronal end of the bevel. Improved methods and materials need to be developed for sealing both canal orifices, and exposed dentine surfaces.

1993 Gutmann and Pitt Ford Management of the resected root end: clinical review

After resection, the root structure presents with multiple anatomical variations and consideration at both a macroscopic and microscopic level. These include root outline, canal

anatomy, dentinal tubule configuration, presence of a smear layer and root canal filling material.

A commonly performed procedure is root-end resection, often referred to as apicoectomy or apicectomy (Gutmann & Harrison 1991). The term root-end resection refers specifically to the removal of the apical portion of the root.

Reasons: removal of pathological processes, removal of anatomical variations, removal of operator errors in canal preparation, to enhance removal of the soft tissue lesion, access to canal system, reduction of root apices which have fenestrated the bone, exploration for aberrant canal anatomy or root #s.

The extent to which the removal of the root end should occur, will be dictated by the following factors (Gutmann & Harrison 1991),

- (1) Access and visibility to the surgical site,
- (2) Position and anatomy of the root within the alveolar bone.
- (3) Anatomy of the cut root surface relative to the number of canals and their configuration.
- (4) Need to place a root-end filling into sound root structure,
- (5) Presence and location of procedural errors, e.g, perforation.
- (6) Presence of an intra-alveolar root fracture.
- (7) Presence of any periodontal defects,
- (8) Anatomical considerations, such as root proximity to adjacent teeth, or level of remaining crestal bone,
- (9) The presence of significant accessory canals. Roots with a likelihood of these anatomical aberrances would be likely to receive more extensive resection

Recently, Ichesco *et al.* (1991) have shown that root-end resections in older teeth evidenced less leakage than that seen in teeth from younger patients; this corroborates with the findings of sclerosis and reduced patency in the apical dentinal tubules (Carrigan *et al.* 1984).

It is recommended that root-end resection be performed under constant irrigation, which assists the partial removal of the dentinal smear layer from the surface. Also, if diamond burs are used to resect the root, a medium grit is preferred, followed by a fine or ultrafine grit diamond.

2003 Teixeira et al A preliminary in vitro study of the incidence and position of the root canal isthmus in maxillary and mandibular 1st molars.

- MB root of max molars – 70% had 1 canal, 29.5% had 2 canals
- M root of lower molars – 41% had 1 canal, 59% had 2 canals.
- Isthmus incidence greatest 3-5mm from the apex.
- Mand molars – 22% complete, 37% partial
- Max molars – 17.3% complete, 11.7% partial

Therefore incidence of isthmus was high, especially at 3-5mm from the apex.

Stropko 1999 – MBII in 93% of 6s, 60.4% 7s

2005 Von Arx Frequency and type of canal isthmuses in first molars detected by endoscopic inspection during periradicular surgery

In maxillary first molars,

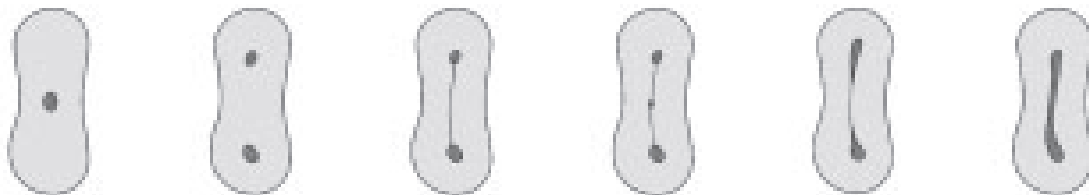
- 76% of resected mesio-buccal roots had two canals and an isthmus.
- 10% had two canals but no isthmus, and
- 14% had a single canal.

In mandibular first molars,

- 83% of mesial roots had two canals with an isthmus
- 11%, two canals but no isthmus were present, and
- 6% demonstrated a single canal.
- 64% of distal roots had a single canal and 36% had two canals with an isthmus.

Therefore a high frequency of canal isthmuses at the resection level.

Isthmuses were classified according to Hsu & Kim (1997). Type I is defined as two canals with no notable communication (Fig. 1). Type II is defined as a hair-thin connection between the two main canals (Fig. 2). Type III differs from the latter only with the presence of three canals instead of two (Fig. 3). Type IV has an isthmus with extended canals into the connection (Fig. 4). Type V is recognized as a true connection or wide corridor of tissue between the two main canals.



Conclusions

- The relatively high incidence of canal isthmuses in mesio-buccal roots of maxillary first molars, and in mesial roots of mandibular molars described in in-vitro studies was confirmed.
- None of the canal isthmuses had been obturated by orthograde canal filling.
- In mesio-buccal roots of maxillary first molars, a type II canal isthmus prevailed, whereas mesial roots of mandibular first molars most often presented with type IV or type V canal isthmuses.