

# Periodontal root amputations and hemisections

## Indications, technique and restorative considerations

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*Root amputation and tooth hemisection therapy involves an interrelated treatment approach encompassing the disciplines of endodontics, periodontics and prosthodontics. Since the application of this treatment modality often becomes complicated, the clinician should be critical of case selection in order to ensure a successful result. The major areas of concern are highlighted and offered as a guideline, and future reference.*

Root amputations and tooth hemisections are sophisticated dental treatment possibilities when other therapeutic measures cannot overcome the defects created by advanced periodontal disease, severe dental caries, or pulpal death. Clinicians can resort to the treatment regimen as an alternative to tooth extraction, especially when teeth of strategic importance are in question. Root amputation and hemisection require an interrelated multi-disciplinary approach towards treatment, encompassing the realms of endodontics, periodontics and prosthodontics. Since this treatment option is fairly involved, the clinician should be critical of case selection in order to ensure successful therapy. Ultimate success depends on: A) the total elimination of plaque retentive areas in bi- and tri-furcation regions (i.e. pocket elimination) and B) meticulous oral hygiene in conjunction with regular scaling and polishing of teeth (1,2).

### Indications (3,4,5)

#### I. Periodontal:

- 1) severe vertical bone loss not amenable to reattachment procedures;
- 2) advanced furcation invasion such that odontoplasty or osteoplasty will not be corrective;
- 3) unfavourable root proximity problems;

- 4) severe recession associated with mucogingival involvement (including dehiscence).

#### II. Endodontic:

- 1) When an adequate apical seal cannot be established either by conventional therapy or retrograde surgical procedures due to:
  - A) partial calcification of root canals;
  - B) severe dilaceration at root apex;
  - C) non-recoverable instrument separation within the root canal;
  - D) non-treatable perforation;
  - E) non-treatable internal or external root resorption;
- 2) long-standing combined periodontal-endodontic infections.

#### III. Restorative:

- 1) severe non-restorable decay;
- 2) non-restorable vertical or horizontal root fracture;
- 3) when abutment teeth or piers within a fixed bridge or splint are involved periodontally and the prognosis for them is otherwise hopeless.

#### Contra-indications (3,4,5)

- 1) decreased bone support on all roots;
- 2) fused roots;
- 3) endodontically inoperable canals in roots intended to be retained;
- 4) poor root form;
- 5) limited prosthodontic possibilities (number and distribution of remaining teeth and roots);
- 6) economic and oral hygiene limitations.

#### Timing considerations and general principles

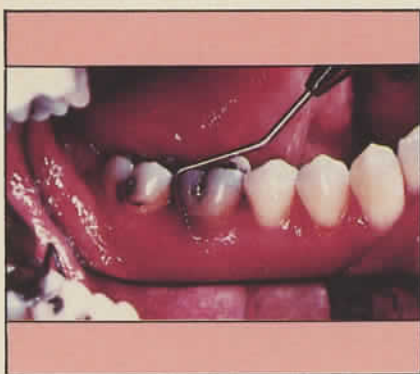
Since radiographic and clinical interpretations of osseous defects are often inconclusive, the final decision for root removal may have to await surgical exposure (1,3,4,6,7,9). Upon achieving surgical exposure, the choice of which root to resect depends on the above listed factors.

In general, the greatest degree of success with maxillary molars is achieved when only one of the buccal roots is amputated. Also, it is more desirable to remove the mesial root of mandibular molars since the distal root is stronger mechanically, more easily accessible endodontically, and is less prone to have interseptal developmental grooves (3,7).

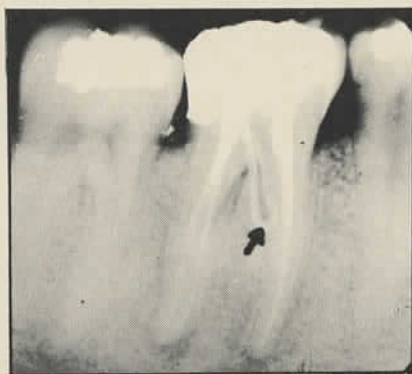
#### Vital root amputation?

The vital root resection has received strong criticism lately (4). Proponents of this technique advocate a high degree of clinical success spanning an

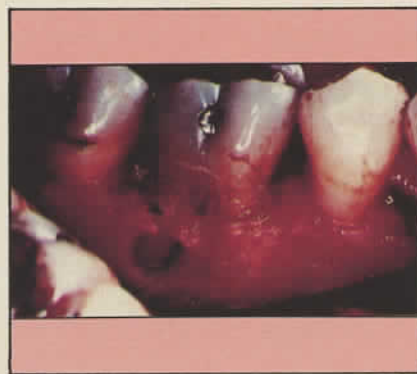
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**Fig. 1** — Photograph demonstrating an isolated, deep pocket pointing into the furcation area of tooth 36.



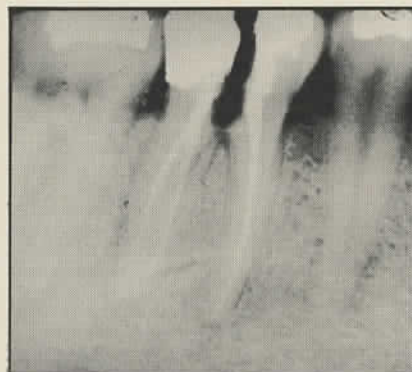
**Fig. 2** — Gutta percha cone radiograph points in the furcation area, but curling towards the mesial root (arrow). In general, alveolar bone support appears favourable for tooth 36.



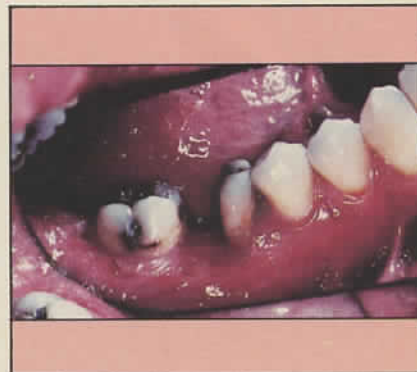
**Fig. 3** — Surgical exposure reveals localized bone loss and a longitudinal root fracture of the distal root (arrow).



**Fig. 4** — Separation of both root fragments is complete, and the root fracture is seen more clearly (arrow).



**Fig. 5** — Radiograph demonstrating separation of root to, and not beyond the crest of bone in the furcation area.



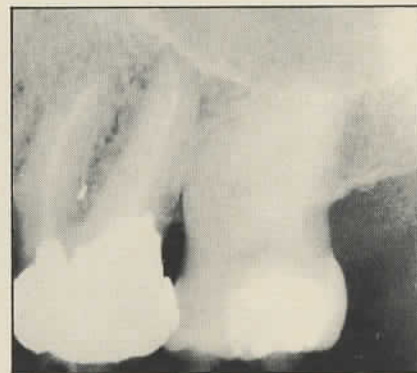
**Fig. 6** — Six-week post-operative healing experience. The mesial root has the appearance of the bicuspid tooth and gingival tissues are healed.



**Fig. 7** — Six-week post-operative radiograph showing alveolar bone level with the furcation and bone fill in the extraction site.



**Fig. 8** — Photograph demonstrating a "bottomless" periodontal pocket with tooth 16, a result of a chronic periodontal-endodontic problem.



**Fig. 9** — Radiograph once endodontic therapy is completed. The palatal root is "hidden" behind the buccal roots of tooth 16.

average of 3.8 years (8) in spite of the fact that root amputation, pulp capping and amalgam restorations are placed in a non-sterile environment. Sepsis often leads to a compromised blood supply to the pulp tissue. It is

apparent that most vital root resections ultimately require future endodontic therapy or even extraction (8). Histologic investigation of the pulp tissue reveal several degenerative changes including dystrophic calcifi-

cation, pulp stones, scarring and atrophy of odontoblasts. Vital root resections therefore should only be considered an interim procedure between periodontal and endodontic therapies (4,9).

In general then, endodontic therapy is recommended before root amputation. Since the decision for root removal must often await surgical exposure, pre-surgical extirpation should be performed and definitive endodontic therapy completed at a later date.

### Clinical case presentations

Various applications of root amputation and tooth hemisection therapy exist. The most common forms are described below:

#### I – Mandibular molar tooth hemisection (Figures 1-7)

The patient presented with localized 7 mm buccal periodontal pocketing towards the furcation area of tooth 36 (Figure 1), which had received endodontic treatment two years previously. The pretreatment radiograph (Figure 2) demonstrated good bone support, however the gutta percha cone placed through the 7 mm sinus communication (Figure 2 (arrow)) curled in the furcation region towards the mesial root. Upon surgical exposure (Figure 3), circumferential bone loss was uncovered around the distal root, where a longitudinal fracture line was noticed (Figure 3 and 4 (arrows)). A decision was made to retain the mesial root which demonstrated good bone support and favourable root morphology.

#### Technique

- 1) A cross-cut fissure bur or long tapering diamond bur in high speed handpiece is used to separate the root fragments through the furcation region (Figures 4 and 5). Care is used to minimize excessive bone removal in the furcation region (Figure 5).
- 2) The fractured root segment is removed with surgical elevators and forceps as atraumatically as possible to facilitate healing and minimizing bone resorption to the adjacent roots (Figures 6 and 7).
- 3) The furcation region must be reshaped to avoid shelf, or residual ledge formation (Figure 7). If left alone, these areas become sites of inflammation and trap food

debris (ref.: 11).

- 4) The occlusal table is reduced so that the remaining mesial root will take the appearance of a bicuspid tooth (Figures 6 and 7). This adjustment balances the forces of occlusion on the remaining root (ref.: 4, 7, 10) (both in centric relation and in lateral excursions), and facilitates future prosthetic restoration of the molar bicuspid segment with a 3 or 4-unit fixed bridge.

#### II – Maxillary palatal root amputation (Figures 8-15)

This patient presented with a periodontal-endodontic abscess situation in association with a "bottomless" (12+mm) pocket adjacent to the palatal root of tooth 16 (Figure 8). The tooth failed to respond to endodontic therapy in combination with subgingival curettage and the radiographs concealed any definite osseous periodontal pathology (Figure 9). Surgical exposure revealed Grade III furcation involvement around the palatal root (Figure 10) which had lost alveolar bone support to the root apex. The remaining roots were solid and without furcation involvement.

#### Technique

The sequence is similar to that outlined above. In short, the palatal root was sectioned mesio-distally through the crown and furcation region (Figure 11). The furcation region was smoothed to avoid residual ledge or shelf creation, and the occlusion adjusted to take the buccolingual form of a long bicuspid tooth. The existing partial denture facilitated retention of the periodontal dressing (Figure 12). Six weeks later, the gingiva was healed (Figure 13) and alveolar bone surrounded the remaining roots (Figure 14). A two-unit fixed splint was tentatively postponed for this patient, but a quick solution was provided by acrylic relining of the existing cast partial (Figure 15).

#### III – Mesio-buccal root Amputation of maxillary molars (Figures 16-21)

The patient presented with severe recession overlying the mesiobuccal root of tooth 26 (Figures 16 and 17). The apex was protruding through the mucogingival junction (Figure 17). The advanced periodontal defect was not clearly visible in the radiograph (Figure 18), and surprisingly, the tooth tested vital to the pulp tester. In view of close root proximity with tooth 2.7 and the uncertain prognosis of tooth 26, pulpectomy with initial debridement alone was the only endodontic treatment provided before periodontal surgery.

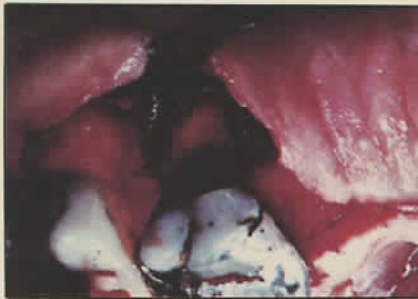
#### Technique

Following the four steps of root amputation protocol listed above, the mesiobuccal root of tooth 26 was sectioned through the furcation region (Figure 19), revealing favourable osseous support around the remaining roots. Once it was certain that no residual ledges or shelves were left in the furcation areas (Figure 20), a lateral pedicle flap was transposed into the root amputated region. The occlusal table of tooth 26 was reduced to balance the forces of occlusion. Four weeks later, the pedicle graft had healed, restoring aesthetics and function to the area (Figure 21). Endodontic therapy can now be completed. The maxillary left segment can be restored with a bridge, or at least a crown, as long as occlusal modifications to the abutment molar are kept in mind (see reference 5).

#### Restorative considerations

During root amputation and hemisection therapy, it is extremely important to visualize the final prosthetic result. This would include taking into consideration the principle of biologic width, and occlusal modification depending on remaining root morphology (7). In general, the following principles apply:

- 1) soft tissue are stable after 6-8 weeks (12);
- 2) crowns are advisable to decrease risk of tooth fracture (4, 7, 13, 16);
- 3) splinting is not always necessary for single tooth treatments where adjacent teeth are present;
- 4) crowns should receive an undercontoured embrasure space and



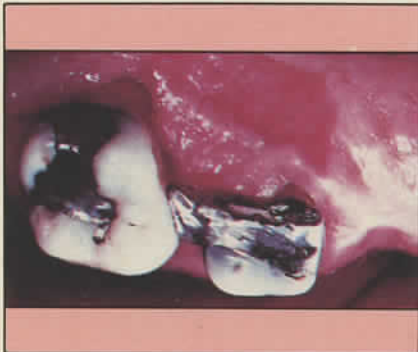
**Fig. 10** — Surgical exposure reveals advanced bone loss and Grade III furcation involvement with the palatal root.



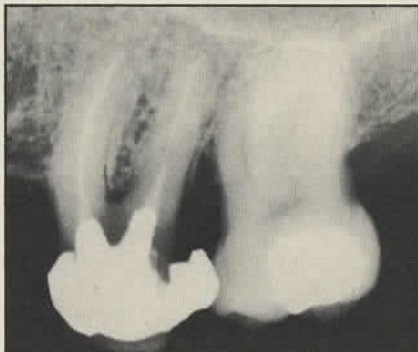
**Fig. 11** — Palatal root sectioned through the furcation area. The palatal portion of the crown is also sectioned.



**Fig. 12** — The existing cast partial denture serves as a periodontal dressing retainer.



**Fig. 13** — Six weeks post-operatively, the gingival tissues are healed and stable. The molar now takes the appearance of a long bicuspid tooth.



**Fig. 14** — Radiograph taken 6 weeks post-operatively demonstrates sound bone support and a patent furcation.



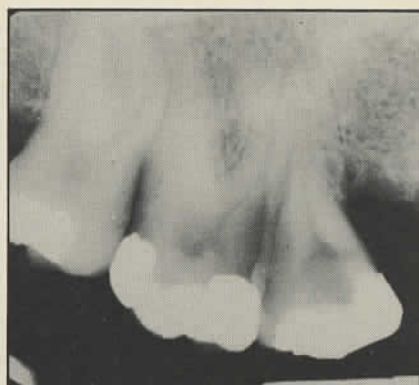
**Fig. 15** — Relined cast partial temporarily restores stability to the abutment teeth.



**Fig. 16** — Photographs demonstrating a case of severe gingival recession and bone loss overlying the mesio-buccal root of tooth 26.



**Fig. 17** — Close-up reveals that the apex of the mesio-buccal root is protruding into the buccal vestibule.



**Fig. 18** — Although the radiograph demonstrates close root proximity with adjacent molar tooth, it camouflages the severity of periodontal involvement around tooth 26.

narrowed occlusal table and the crown margins must encompass the furcation area (4, 7, 16).

**Expected success**

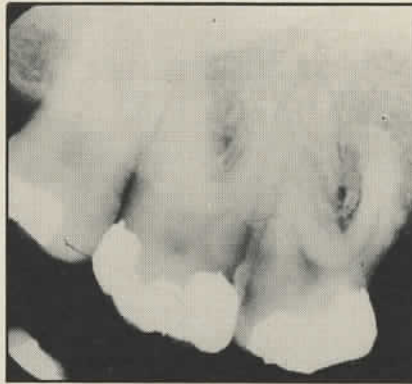
In general, the most successful results

are achieved when only one of the buccal roots of maxillary molars are amputated (14), or hemisected mandibular molars are used as abutments for small bridges (15). Most failures

of root amputated teeth occur within five years for reasons other than inflammatory periodontal disease (14, 15). Root fracture appears to be the main cause of failure following



**Fig. 19** — The mesio-buccal root is sectioned before a lateral pedicle graft is placed over the defect.




**Fig. 20** — Radiograph taken during surgery to ensure that all ledges and shelves in the furcation area were smoothed.



**Fig. 21** — Four weeks post-operatively, the periodontal tissues are stable and endodontic therapy can now be completed followed by full crown coverage.

extensive, long span, multi-unit prosthetic reconstruction (14, 15). A recent study pooled the results of previous publications accounting for 300 cases of root amputations and tooth hemisection. Over a span of 1-11 years, it was found that the failure rate approached 16.3%. Root fracture accounted for 6% of these failures, progression of periodontal disease accounted for 4.6% and recurring periapical pathology for 4.6% (4). This study may not reflect failure rate accurately because results from a variety of sources with varying techniques were included instead of a single technique (14, 15). In all cases, maintenance of a high standard of plaque control and restoration of a stable occlusion are instrumental in

order to achieve any degree of success with root amputation and tooth hemisection therapy. 




#### References

- Hamp, S.E., Nyman, S. and Lindhe, J. Periodontal treatment of multi-rooted teeth. Results after 5 years. *J. Clin. Periodont.* 2:126-135, 1975.
- Lindhe, J. and Nyman, S. The effect of plaque control and surgical pocket elimination on the establishment and maintenance of periodontal health. A longitudinal study of periodontal therapy in cases of advanced disease. *J. Clin. Periodont.* 2:67-77, 1975.
- Basaraba, N. Root amputation and tooth hemisection. *DCNA* 13:121-132, 1969.
- Eastman, J.R. and Backmayer, J. A review of the periodontal, endodontic, and prosthetic considerations in odontogenous resection procedures. *Int. J. Perio. Rest. Dent.* 6(2):34-51, 1986.
- Kryshalskyj, E. Root amputation and hemisection: Indications, technique and restoration. *CDAJ* 52:307-308, 1986.
- Abrams, L. and Trachtenberg, D.L. Hemisection in technique and restoration. *DCNA* 18:415-444, 1977.
- Keough, B. Root resection. *Int. J. Perio. Rest. Dent.* 2(1):17-27, 1982.
- Haskell, E.W. and Stanley, H.R. A review of vital root resection. *Int. J. Perio. Rest. Dent.* 2(6):29-49, 1982.
- Gerstein, K.A. The role of vital root resection in periodontics. *J. Periodont.* 48:478-483, 1977.
- Polson, A.M. Periodontal considerations for functional utilization of a retained root after furcation management. *J. Clin. Periodont.* 4:223-230, 1977.
- Backman, K.J. The incomplete root section — case presentations. *Int. J. Perio. Rest. Dent.* 2(3):61-71, 1982.
- Rosen, H. and Gitnick, P.J. Separation and splinting of the roots of multi-rooted teeth. *J. Prosth. Dent.* 21:34-38, 1969.
- Appleton, I.E. Restoration of root resected teeth. *J. Prosth. Dent.* 44:150-153, 1980.
- Langer, B., Stein, S.S. and Wagenberg, B. An evaluation of root resections — a ten year study. *J. Periodont.* 54:719-722, 1981.
- Erpenstein, H. A 3 year study of hemisectioned molars. *J. Clin. Periodont.* 10:1-10, 1983.
- Fagin, M.D. Restoration of endodontically treated teeth. *Int. J. Perio. Rest. Dent.* 1(3):9-29, 1981.

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