Root amputation: Case reports and review

Vijay Mantri #
Rahul Maria #
Sharad Kamat #
Ambar W. Raut #

ABSTRACT
Advances in dentistry, as well as the increased desire of patients to maintain their dentition, have led to treatment of teeth that once would have been removed. Furcally-involved teeth present unique challenges to the success of periodontal therapy. Anatomic and morphological complicating factors dictate modifications in treatment approaches used for managing these areas. This article describes a simple procedure of hemisection and bicuspidization in mandibular molars and its subsequent restoration.

Key learning points:
- The prognosis for the endodontic element of treatment is excellent.
- Local pathological processes may affect a patient’s general health.
- To achieve good results in periodontally diseased molars, more than 50% bone support of the remaining roots is an important factor.

Keywords: Hemisection, bisection, root fusion, root canal treatment, hybrid technique, envelop flap, barrier membranes

Introduction
Root resection is a technique for maintaining a portion of a diseased or injured molar by removal of one or more of its roots. Resection may be achieved by hemisection, in which the entire tooth is cut in half and one part is removed, or by root amputation, in which only a root or two are amputated from the remainder of the tooth. Where as Bisection or Bicuspidization is when the type of cut is the same as that used in Hemisection except the location is centered to evenly divide the crown at the centre of the furcation. The furca is then turned into an interproximal space where the tissue is more manageable by the patient. These surgical approaches may be useful in many situations.1,2

In 1894, Dr. W J. Younger while addressing the meeting of the American Medical Association on “pyorrhea alveolaris” had said about the hopelessly involved roots of molar teeth: “My treatment in these cases has been to open into these roots, remove their pulps, fill them and amputate (the involved root), then grind away enough of the articulating surface of the crown, immediately over the removal root, in order to bring the pressure in the effort of mastication upon the (solid) roots. By these means, these teeth can be made comfortable and serviceable for years, if not for a lifetime”.2

In 1930, Coolidge emphasized the importance of a well sealed root canal prior to resection.

Later, Sommer elaborated on the essentials for successful root resection and the role of proper root canal therapy in decreasing organisms and infection prior to root resection.2

Grossman referred to root amputation as dental proof of the old adage that half a better than none.3 Root amputation and hemisection procedures were reported in the literature over 100 years ago.
Early in 1960’s, the therapy involving root amputation was right on the cutting edge in periodontics and endodontics. ‘Hiat’ and ‘Amen’ contributed in the quest for salvaging teeth by comprehensively describing the indications and techniques for root amputation. In reality ‘G.V Black’ described almost the same methods in the nineteenth century and by ‘Sharp’ in 1920.4,5

“Weine”3,6,7,8 has listed the following indications for tooth resection -

**Periodontal Indications:**

- Severe vertical bone loss involving only one root of multi-rooted teeth.
- Through and through furcation destruction.
- Unfavorable proximity of roots of adjacent teeth, preventing adequate hygiene maintenance in proximal areas.
- Severe root exposure due to dehiscence.

**Endodontic and Restorative Indications**

- Prosthetic failure of abutments within a splint: If a single or multirooted tooth is periodontally involved within a fixed bridge, instead of removing the entire bridge, if the remaining abutment support is sufficient, the root of the involved tooth is extracted.
- Endodontic failure: Hemisection is useful in cases in which there is perforation through the floor of pulp chamber or pulp canal of one of the roots or an endodontically involved tooth which cannot be instrumented.
- Vertical fracture of one root: The prognosis of vertical fracture is hopeless. If vertical fracture traverses one root while the other roots are unaffected, the offending root may be amputated.
- Severe destructive process: This may occur as a result of furcation or sub gingival caries, traumatic injury and large root perforation during endodontic therapy.

**Contraindications**

- Strong adjacent teeth available for bridge abutments as alternatives to hemisection.
- Inoperable canals in root to be retained.
- Root fusion making separation impossible.

Advances in dentistry, as well as the increased desire of patients to maintain their dentition, have lead to treatment of teeth that once would have been separated. In order to carry out this present day mandate, periodontally diseased teeth with severe bone loss at furcation area may well be retained by separation of their roots. This article describes simple procedures for bicuspidization and hemisection in mandibular molars and its subsequent restoration.

**Case Reports**

**Case 1 - Hemisection**

A 27 year old male reported to the Department of Conservative Dentistry, Modern Dental College and Research Centre, Indore with the complaint of pain with left mandibular first molar. On clinical examination, a metal crown was present with 36. On radiographic examination, 36 was root canal treated with crown present and the root canals were underobturated. Severe vertical bone loss was evident surrounding the distal root and involving the furcation area. The bone support of mesial root was completely intact (Fig 1a, b).

It was decided that the distal root should be hemisected after completion of re-root canal
treatment of the tooth. Working length was determined and the canals were biomechanically prepared using hybrid technique. The canals were obturated with lateral condensation method and post obturation restoration was done with composite. Envelope flap was reflected. Upon reflection of the flap, the bony defect along the distal root became quite evident (Fig 1c). The vertical cut method was used to resect the crown (Fig 1e).

The advantages of vertical cut method are:

- Direct visualization of the bur penetration to ensure that preparation will be in the correct position.
- Removal of that portion of the crown that is over the root to prevent undesirable postoperative occlusal forces.
- Position of each cut, based on the anatomy of the furca, to allow the root to cleave along desirable angles.
- Excellent visualization of the furca after amputation to allow for any needed trimming or smoothing with long shank, tapered fissure diamond stones.

Long shank tapered fissure bur was used to make vertical cut towards bifurcation area. A fine probe was passed through the cut to ensure separation which was confirmed on the radiograph. The furcation area was trimmed to ensure that no spicules were present. The distal root was extracted and the socket was irrigated with saline (Fig 1 d, e).

Case 2: Hemisection and use of Guided Bone Regeneration

A 32 year old female patient presented to the Department of Conservative Dentistry, Modern...
Dental College and Research Centre, Indore with the chief complaint of pus discharge in lower right back tooth since a month. Patient gave a history of pain, swelling and pus discharge during last six months. On clinical examination, there was gross caries present with 46 resulting in loss of mesio-occlusal and lingual part of crown. This part of crown was occupied by a gingival polyp. An intraoral sinus was present with 46 (Fig 2a, b).

Barrier membranes are biologically inert materials that serve to protect blood clot and prevent soft tissue cells (epithelium and connective tissue) from migrating into the bone defect, allowing

After healing of the tissues, fixed bridge involving retained mesial half and mandibular second molar with sanitary pontic was given (Fig 1 g, h, i).

On radiographic examination, the lost part of crown and bone loss with mesial root and furcation area was evident (Fig 2c).
It was decided to perform hemisection with mesial root. Endodontic therapy was performed with distal root after placing calcium hydroxide as intracanal medicament for a week. Post obturation restoration was done with composite (Fig 2d, e).

Envelope flap was reflected under local anaesthesia and hemisection was done with vertical cut method (Fig 2f).

The separation was confirmed with a radiograph. The mesial root was extracted and the socket was irrigated. Bone graft (Perioglas®, NovaBone Products, USA) was placed in the mesial socket so that rapid bone formation takes place (Fig 2g).

As the particles of the graft come in contact with tissue fluids, the surface becomes coated with Hydroxy Carbonate Apatite (HCA), incorporates organic ground proteins such as chondroitin sulphate and glycosaminoglycan and attracts osteoblasts. Barrier membrane was (Biomesh-s®) was placed (Fig 2h) (a bioabsorbable collagen barrier membrane) and the flap was repositioned and sutured with 3/0 black silk sutures.

Periodontal dressing was placed and instructions given (Fig 2i).

One week follow up IOPA was taken (Fig 2j).
osteogenic cells to be established. It has added advantages like hemostasis, chemotaxis for periodontal fibroblasts, gingival fibroblasts and easy manipulation. Space can be maintained under a barrier membrane with bone graft material, thereby facilitating the regeneration of increased bone volume within a confined space.

Case 3 - Bicuspidization

A 45 year old male reported to the Department of Conservative Dentistry, Modern Dental College and Research Centre, Indore with the complaint of pus discharge and hypersensitivity with lower left mandibular molar since 2-3 months. Patient gave history of swelling and sinus. He was tobacco chewer since last 30 years. On intra-oral examination there was sinus, 6mm deep periodontal pocket around the furcation area. On radiographic examination, vertical bone loss was evident at the furcation area. Bone support of both roots was completely intact. Radiolucency indicating caries extending to the pulp with left mandibular first and molar (Fig 3a).

Root canal treatment was started with tooth number 36 and 37. Working length was determined and canals were biomechanically prepared using hybrid technique. Calcium hydroxide was placed as intracanal medicament for a week and the canals were obturated with lateral condensation methods and pulp chamber was filled with silver amalgam. (Fig 3b, c).

Silver amalgam and tooth got fractured due to tobacco chewing habit so it was replaced by composite. Under local anesthesia, full thickness envelope flap design was taken from mesial of 36 to distal of 38. A long shank tapered fissure carbide bur was used to make vertical cut toward the bifurcation area and distal root was separated with 37 (Fig 3d, e).

Discussion:

Root-resection therapy is a treatment option for molars with periodontal, endodontic, restorative, or prosthetic problems. Because root resection is
The furcation area was trimmed to ensure that no residual debris were present that could cause further periodontal irritation. Scaling and root planning of the root surfaces, which became accessible on separation was done. Flap was repositioned and sutured (Fig 3f).

Farshchian and Kaisar stated that the success of Bicuspidization depends on three factors:

- Stability of, and adequate bone support for the individual tooth sections.
- Absence of severe root fluting of the distal aspect of the mesial or mesial aspect of the distal root.
- Adequate separation of the mesial and distal roots, to enable the creation of an acceptable embrasure for effective oral hygiene.

According to Newell, the advantage of the amputation, hemisection or bisection is the retention of some or the entire tooth. It is generally necessary to endodontically treat mandibular molars before bicuspidization or hemisection.

Success of hemisection and separation procedures depends, to a large extent, on proper case selection. It is important to consider the following factors before deciding to undertake any of the root separation and resection procedures:

- Advanced bone loss around furcation area, acceptable level of bone around the remaining roots.
- Angulations and position of the tooth in the arch...
- A molar that is buccally, linguually, mesially or distally tilted, cannot be separated and resected.
- Divergence of the roots-teeth with divergent roots is easier - Closely approximated or fused roots are poor candidates.
- Length and curvature of roots - long and straight roots are more favorable for root separation and resection than short, conical roots.
- Feasibility of endodontics and restorative dentistry in the root/roots to be retained.

Root separation or resection has been used successfully to retain teeth with furcation involvement. However, there are few disadvantages associated with it. As with any surgical procedure, it can cause pain and anxiety. Root surfaces that are reshaped by grinding in the furcation or at the site of hemisection are more susceptible to caries. Often a favorable result may be negated by decay after treatment. Failure of endodontic therapy due to any reason will cause failure of the procedure. In addition, when the tooth has lost part of its root support, it will require a restoration to permit it to function independently or to serve as an abutment for a splint or bridge. Unfortunately, a restoration can contribute to periodontal destruction, if the margins are defective or if non-occlusal surfaces do not have physiologic form. Also, an improperly shaped occlusal contact area may convert acceptable forces into destructive forces and predispose the tooth to trauma from occlusion and ultimate failure of root separation and resection.

Conclusion

Root-resection therapy is still a valid treatment option for molars with furcation involvement. Root resection to treat periodontal problems showed a better prognosis than root resection performed for non-periodontal purposes.

The prognosis for Hemisection and Bicuspidization is the same as for routine endodontic procedures provided that the case selection has been correct, the endodontics has been performed adequately, and the restoration is of an acceptable design relative to the occlusal and periodontal needs of the patient. Bicuspidization and Hemisection should be considered as another weapon in the arsenal of the dental surgeon, determined to retain and not remove the natural teeth. With recent refinements in endodontics, periodontics and restorative dentistry, hemisection has acceptance as a conservative and dependable dental treatment and teeth so treated have endured the demands of function.

References: