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Resection procedures for mutilated grossly decayed tooth: A review

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Abstract

Patients now have the chance to preserve a functional dentition for the rest of their lives thanks to modern advancements in all areas of dentistry. The foundation of modern dentistry is conservation. Preserving the natural is the goal of all treatment modalities, but accurate periodontic, prosthetic, and endodontic evaluation is crucial for case selection. Therefore, instead of normal root canal therapy, which has a delayed and/or uncertain prognosis in teeth with peri-furcation infections, root excision techniques are utilized to retain as much dental structure as feasible.

Keywords: Hemisection, bicuspidization, root resection, root amputations, mutilated teeth, grossly decayed teeth, radisection

Introduction

Attempts to save existing natural tooth dates back to more than a century and now the dentistry has advanced enough to retain a well-functioning dentition for a lifetime.

Advanced periodontal disease and gross destruction of tooth structure due to caries are the most common reason for extraction. High predictability and success rate of endodontic therapy and periodontal treatment now gave us the means to save more of such teeth or at least a part of it ^[1].

Although loss of anterior tooth is more of patient concern on an aesthetic view point, loss of posterior tooth is eventful often leading to drifting of adjacent tooth, loss of arch length and loss of masticatory function. This often necessitates subsequent preventive and corrective measures ^[2].

Tooth resection is the procedure used to preserve as much tooth structure as possible rather than sacrificing the whole tooth.

The term tooth resection denotes the excision and removal of any segment of the tooth or a root with or without its accompanying crown portion ^[2]. Various resection procedures described are: root amputation, hemisection, radisection and bisection.

Hemisection

Hemisection followed by prosthetic rehabilitation may be considered as an alternative to extraction for mandibular molars with furcation involvement or gross destruction of one root. Hemisection may be considered as an alternative to extraction of periodontally or endodontically compromised tooth to retain its function. However the success of hemisection depends on many factors including oral hygiene of the patient, bone support and restorative treatment ^[1].

Hemisection refers to vertically cutting the tooth into half and removing the pathologically involved root and associated crown. This helps in retaining healthy portion of tooth along with restoration of function.

Hemisection denotes removal or separation of root with its accompanying crown portion of mandibular molars.

Hemisection procedure represents a form of conservative dentistry, aiming to retain as much of the original tooth structure as possible ^[2].

Hemisection allows for physiologic tooth mobility of the remaining root, which is thus a more suitable abutment for fixed partial dentures than an osseointegrated counterpart.

The smaller size of the occlusal tables, under-contouring of the embrasure spaces and ensuring that the crown margin encompasses the furcation are all factors in the high success rates observed with hemisection therapy [3].

Hemisection of mandibular molar may be viable treatment modality when one root has poor treatment prognosis, and the other root is healthy and that portion of tooth can be act as abutment.

When choosing to perform a hemisection procedure, consideration should be given to the morphology, clinical length, and shape of the roots of a multirrooted tooth. It is important to take into account the divergence of the roots while making a case selection.

Affected teeth with roots spread apart facilitate the clinician's ability to carry out root resection. Teeth with closely approximated or fused roots are not good choices to receive hemisection therapy.

Objectives of hemisection

1. To facilitate maintenance
2. To prevent further attachment loss
3. To obliterate furcation defects as a periodontal maintenance problem.

Appropriate endodontic therapy must be performed before hemisection to avoid intrapulpal dystrophic calcification and postoperative tooth sensitivity [4].

Root amputation

Root amputation refers to removal of one or more roots of multirrooted tooth while other roots are retained.

Root amputation procedures are a logical way to eliminate a weak, diseased root to allow the stronger to survive, whereas if retained together, they would collectively fail.

1. Radisection is removal of roots of maxillary molars.
2. Bisection / bicuspidization is the separation of mesial and distal roots of mandibular molars along with its crown portion, where both segments are then retained individually.

Selected root removal allows improved access for home care and plaque control with resultant bone formation and reduced pocket depth.

When root removal is indicated in a mandibular molar because of a vertical root fracture, therapeutic misadventure, or pathologic resorptive process, hemisection is usually the treatment of choice. Due to the difficulties noted above in attempting to perform a root amputation procedure on mandibular molars, removal of one-half the tooth is a more predictable treatment procedure [4].

This procedure is also falling out of favor as a treatment procedure today because the prognosis for success with osseointegrated implants is much better than that for hemisected teeth.

The ideal situation for performing a hemisection procedure is when one-half of a mandibular molar can be retained to occlude with and prevent the super-eruption of a maxillary molar. The root and crown structure that is retained can be restored as a premolar.

This procedure is only indicated if the remaining root has adequate periodontal support and the crown can be restored. The mesial root of a mandibular molar has more surface area so it will be more stable periodontally, but because there is generally a concavity present on the distal surface of

this root, it is more difficult to restore and cleanse with dental floss and a toothbrush.

The distal root is generally more conical in shape and is easier to restore and maintain. The procedure is contraindicated if the roots are fused; there will be inadequate bone support for the remaining root or if the tooth cannot be adequately restored [4].

Nonsurgical endodontic therapy is completed first and then core material or a post and core restoration is placed into the coronal aspect of the root to be retained.

Once the core material is set, the location of the buccal and lingual furcations is identified and selective occlusal adjustments are made so that the retained portion of tooth will not be in occlusion.

The majority of the sectioning procedure is accomplished with a surgical length fissure bur using rubber dam isolation. The initial resection should begin on the buccal surface and move in a lingual and apical direction until the furcation area is reached.

The sectioning should be accomplished at the expense of that portion of the crown that is scheduled for removal. A sufficient amount of tooth structure should be left in the furca area of the portion of the tooth that is to be retained so that a restorative finish line can be established in that area of the tooth. Once the resection has reached the furcation area, the rubber dam is removed and the final separation of the roots is completed with a fissure or tapered diamond bur.

The portion of the tooth to be removed should be gently elevated so that the retained root is not disturbed. Using the appropriate forcep, hemostat or ronguer, the loosened root is removed from the socket. The socket walls are compressed, the bone margins smoothed, and the soft tissue is repositioned and sutured [6].

Bicuspidization

Bicuspidization refers to a procedure that was once recommended for mandibular molars when a hemisection procedure was performed but both roots were to be retained. The purpose of this procedure was to create a situation in a molar tooth with a furcation defect that would be more favorable for cleansing and maintenance.

The procedure was found to have a very poor long-term prognosis and is rarely recommended as a treatment option today.

Indications for bicuspidization are following

1. Root fracture, severe bone loss affecting one or more roots untreatable with regenerative procedures.
2. Classes II or III furcation invasions or involvements.
3. Inability to successfully treat and fill the canal.
4. Root trunk fracture or decay with invasion of the biological width.

Contraindications include

1. Poor oral hygiene.
2. Fused roots.
3. Unfavorable tissue architecture.
4. Retained roots endodontically untreatable [11]

Many factors determine the clinician's decision to choose one treatment plan over another when confronted with a Class III furcation invasion of a mandibular molar. These may be enumerated in three areas:

- 1. Local factors:** Tooth anatomy, tooth mobility, crown root ratio, severity of attachment loss, inter-arch and intra-occlusal relationship, strategic dental value retention or removal.
- 2. Patient factors:** Health of a patient, importance of the tooth to the patient, cost and time factor;
- 3. Clinician factors:** A good case selection, diagnostic and treatment planning skills, awareness of therapeutic options and clinical insight or skill in providing service.

Bicuspidization is a surgical procedure performed on the mandibular molars for the separation of the mesial and distal roots with their respective crown portions; this separation eliminates the existence of a furcation and facilitates effective oral hygiene practice.

Bicuspidization has received a wide acceptance as a conservative dental treatment and teeth so treated have fulfilled the demands of function^[5].

However, there are few disadvantages associated with bicuspidization. As with any surgical procedure, it can cause pain and anxiety. An endodontic therapy failure can also cause the failure of this procedure. If the tooth is not relieved from lateral excursive forces or proper marginal adaptation is not there, the restoration may lead to periodontal destruction

Patient motivation, faithfulness in adhering to frequent maintenance appointments, various physical handicaps, and poor manual dexterity are limiting factors in keeping these areas in a state of health.

The prognosis for bicuspidization is the same as for routine endodontic procedures provided that case selection has been performed correctly and the restoration is of an acceptable design relative to the occlusal and periodontal needs of the patient as it was in this case. Subsequent follow-up showed a good bone healing response.

Farshchian and Kaiser *et al.* 1988 suggested that the success of bicuspidization depends on three factors (Which seemed to have been satisfied in the present case). They are:

- Stability and adequate bone support.
- Absence of severe root fluting.
- Adequate separation of the mesial and distal roots such that adequate embrasure can be created^[6].

The aim of any treatment modality is to preserve the natural, but proper periodontic, prosthetic, and endodontic assessment for appropriate selection of cases is important.

Root resection

Weine F has listed the following indication for root resection.

Periodontal indications

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

Endodontic and restorative indications

1. 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.

2. **Endodontic failure:** Hemisection is useful in cases, in which there is perforation through the floor of the pulp chamber, or pulp canal of one of the roots of an endodontically involved tooth which cannot be instrumented.
3. **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.
4. **Severe destructive process:** This may occur as a result of furcation or subgingival caries, traumatic injury, and large root perforation during endodontic therapy.

Contraindications

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

Bone loss caused by pulpal disease is reversible, whereas, advanced bone loss caused by periodontal disease is usually irreversible.

Multirooted, periodontally involved molars can be maintained for long periods of time with hemisection depending on their extent of bone destruction justifying that periodontal surgical therapy is required in cases where advanced periodontal bone loss has occurred and is less likely to resolve after nonsurgical therapy alone^[8].

The success of the root resection procedure depends to a large extent on proper case selection.

The treatment of furcation defects is a complex and relatively difficult job that may compromise the success of periodontal therapy. Estimation of the prognosis of molars with furcation invasion is often an annoying and disappointing experience to the dental professional and patient^[9].

Undoubtedly, the bifurcations constitute one of the zones in the oral cavity where plaque is most difficult to remove. Thorough knowledge of the root morphology and of the surrounding topography of the pocket is crucial if access to difficult areas is to be gained^[10].

Though multiple treatment modalities have been attempted to preserve teeth with moderate to severe furcation involvement, clinical success has not been accurately predictable. Bicuspidization is a valuable treatment option to save multi-rooted teeth having the hopeless prognosis in periodontal context^[11].

To accurately typify a furcation case, the following factors (Many of which are anatomical and biomechanical in nature) should be taken into considerations.

- Root divergence
- Root fusion
- Root concavity
- The size of the furcation
- The length of the root trunk
- Separation of the roots
- The ease with which hygiene of the affected furcation can be maintained
- The capacity of the patient to maintain optimum hygiene
- The remaining bone (Crown/root ratio)
- Mobility

- Occlusion (Prematurity and interferences)
- Adherence of the gum ^[7].

Conclusion

Root canal therapy with its rationale of canal debridement and disinfection, following adept chemomechanical preparation, involving shaping and cleaning procedures, and obturation is carried out as an adjunct but imperative procedure, to maintain the endodontic inertness of the remaining portion of the hemisected tooth, with the aim of controlling infection and subsequently healing the periradicular lesion, while maintaining form and function of the tooth.

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