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PRESERVATION OVER EXTRACTION: A REVIEW OF HEMISECTION AND BICUSPIDIZATION TECHNIQUES IN ENDODONTICS

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ABSTRACT : Hemisection and bicuspidization are conservative surgical procedures employed in endodontics and periodontics to preserve multirooted teeth with compromised individual roots due to periodontal, endodontic, structural, or iatrogenic causes. These procedures offer a functional and cost-effective alternative to extraction and implant placement, particularly in molars where one root remains healthy. Hemisection involves the removal of a diseased root along with its associated crown portion, while bicuspidization splits a molar into two independent units, each with its own crown and root. Proper case selection, interdisciplinary coordination, and meticulous surgical and restorative execution are critical to the long-term success of these treatments. This review outlines the indications, techniques, clinical considerations, advantages, limitations, and success rates associated with hemisection and bicuspidization. Despite the rise of implantology, these procedures remain valuable tools in the endodontist's armamentarium for preserving natural dentition and maintaining oral function.

KEYORDS- Root Amputation, Hemisection, Radisection, Bisection

INTRODUCTION

Over a century has passed since attempts to preserve natural teeth began, and modern dentistry has progressed to the point that people can maintain a healthy dentition for the rest of their lives. The most frequent reasons for extraction are severe caries-induced tooth structural deterioration and advanced periodontal disease. One We now have the capacity to keep more of these teeth, or at least a portion of them, thanks to the high

predictability and success rate of endodontic therapy and periodontal treatment. The loss of a posterior tooth is significant because it frequently results in the drifting of adjacent teeth, loss of arch length, and loss of masticatory function, whereas the loss of an anterior tooth is more concerning to patients from an aesthetic standpoint.[1]

This frequently calls for further preventative and remedial actions. In restorative and periodontal therapy, multirooted teeth with impaired individual roots or furcation involvement present a major difficulty. Conservative alternatives to extraction that maintain the tooth's functionality are hemisected and bicuspidized.[2] The rationale, methods, benefits, drawbacks, and clinical results of hemisection and bicuspidization treatments in endodontics are examined in this study, which is backed by current research.

TOOTH RESECTION

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 is the process of cutting the tooth in half vertically and extracting the pathologically affected root and crown. This aids in both function restoration and the preservation of the tooth's healthy section. It indicates that the mandibular molars' root and crown section have been removed or separated. The goal of the hemisected technique, a type of conservative dentistry, is to preserve as much of the natural tooth structure as possible. 2. For mandibular molars with furcation involvement or severe root loss, hemisected mandibular molars followed by prosthetic rehabilitation may be a viable option to extraction. In order to preserve the function of a tooth that has been affected by the periodontal or endodontic processes, hemisected teeth may be an option to extraction.. However the success of hemisection depends on many factors including oral hygiene of the patient, bone support and restorative treatment.[3]

ROOT AMPUTATION

Root amputation refers to removal of one or more roots of multirooted 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.

RADISECTION is removal of roots of maxillary molars.

BISECTION / BICUSPIDIZATION

It involves separating the mandibular molars' mesial and distal roots as well as the crown section, after which each segment is kept separately. With the resulting bone growth and decreased pocket depth, selective root removal improves access for at-home care and plaque reduction.

Hemisection is typically the preferred treatment when root excision is necessary for a mandibular molar due to a vertical root fracture, therapeutic mishap, or pathologic resorption process. Removing half of the tooth is a more predictable treatment method because of the challenges mentioned above when trying to perform a root amputation operation on mandibular molars.[4]

Because osseointegrated implants have a far better chance of success, this operation is likewise losing favor as a treatment. 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 supereruption of a maxillary molar The root and crown structure that is retained can be restored as a premolar. Only if the crown can be repaired and the remaining root has sufficient periodontal support is this surgery recommended. A mandibular molar's mesial root will be more stable periodontally due to its larger surface area; nevertheless, because the distal surface of this root typically has a concavity, it is more challenging to clean and restore with a toothbrush and dental floss.[5]

In general, the distal root has a more conical form and is simpler to maintain and repair. If the roots are fused, the surgery is not recommended since the remaining root will not have enough bone support or the tooth cannot be properly rebuilt.

Core material or a post and core restoration is inserted into the coronal aspect of the root to be preserved after nonsurgical endodontic therapy is finished. Following the setting of the core material, the buccal and lingual furcations are located, and specific occlusal adjustments are done to prevent the retained tooth from being in occlusion.

Rubber dam isolation is used with a surgical length fissure bur to complete most of the sectioning process. Starting on the buccal surface, the initial resection should proceed lingually and apically until it reaches the furcation area.

The part of the crown that is scheduled for removal should be sacrificed in order to complete the sectioningFor the purpose of establishing a restorative finish line in the furcal region of the tooth that is to be retained, a significant quantity of tooth structure should be left there. A fissure or tapered diamond bur is used to achieve the final root separation once the resection has reached the furcation area and the rubber dam has been removed.[6]

To avoid disturbing the retained root, the part of the tooth that needs to be removed should be carefully raised. The loose root is extracted from the socket using the proper forcep, hemostat, or ronguer. The soft tissue is moved and sutured, the bone borders are smoothed, and the socket walls are compressed.[6]

Hemisection is a better abutment for fixed partial dentures than its osseointegrated equivalent because it permits the remaining root to move physiologically. The high success rates seen with hemisection therapy can be attributed to a number of reasons, including the lower size of the occlusal tables, under-contouring of the embrasure spaces, and making sure that the crown margin includes the furcation.[3]

When one root has a poor prognosis and the other root is healthy and that part of the tooth can serve as an abutment, hemisoming of the mandibular molar may be a feasible therapeutic option.

The morphology, clinical length, and shape of a multirooted tooth's roots should all be taken into account when deciding whether to undergo a hemisection operation.. 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]

BICUSPIDIZATION

When hemisection was done on mandibular molars but both roots were to be kept, a process known as "bicuspidization" was previously advised. The objective of this surgery was to improve the cleaning and maintenance conditions of a molar tooth with a furcation problem. Today, the operation is rarely advised as a therapy option due to its extremely poor long-term prognosis.[6]

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.

In order to remove a furcation and promote good oral hygiene, the mandibular molars undergo a surgical treatment called "bicuspidization," which separates the mesial and distal roots from their corresponding crown sections.

Bicuspidization is widely accepted as a conservative dental procedure, and teeth that have undergone this treatment meet functional requirements.[5] The drawbacks of bicuspidization are minimal, otherwise. It may induce discomfort and worry, just like any other medical operation. This technique may also fail due to a failure of endodontic therapy. The restoration may result in periodontal damage if the tooth is not alleviated of lateral excursive stresses or if appropriate marginal adaptation is absent.

Limiting considerations in maintaining the health of these areas include patient motivation, fidelity in making regular maintenance appointments, a variety of physical disabilities, and poor manual dexterity. As long as case selection is done appropriately and the restoration is of a design that is appropriate for the patient's occlusal and periodontal needs, as it was in this instance, the prognosis for bicuspidization is the same as for standard endodontic operations. A positive bone healing response was observed during the next follow-up. Bicuspidization should be explored with patients when weighing treatment alternatives because it may be a good substitute for extraction and implant therapy, particularly for First Permanent Molar in young children.[11]

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]

Although maintaining the natural state is the goal of all treatment modalities, it is crucial to do appropriate periodontic, prosthetic, and endodontic evaluations in order to choose the right cases. As an adjunct but necessary procedure, root canal therapy, with its rationale of canal debridement and disinfection, follows skilled chemomechanical preparation, which includes shaping and cleaning procedures, and obturation. This is done to maintain the endodontic inertness of the remaining portion of the hemisected tooth in order to control infection and subsequently heal the periradicular lesion, all the while preserving the tooth's form and function.

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 [8]

1. Abutment failure in a prosthetic: When a single or multiple-rooted tooth is periodontally involved in a fixed bridge, the root of the affected tooth is excised if the remaining abutment support is adequate, rather than the entire bridge.

2. Endodontic failure: Hemisection is helpful when there is a pulp canal in one of the roots of an endodontically affected tooth that cannot be instrumented, or when there is a rupture through the pulp chamber floor.

3. One root fractured vertically: There is no chance of recovery. One root may be severed if a vertical fracture passes through it while the other roots remain intact.

4. Severe destructive process: This may occur as a result of furcation or subgingival caries, traumatic injury, and large root perforation during endodontic therapy.[11]

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.

While extensive bone loss brought on by periodontal disease is typically irreversible, bone loss brought on by pulpal disease is reversible.

In cases where advanced periodontal bone loss has occurred and is unlikely to resolve with nonsurgical therapy alone, periodontal surgical therapy is necessary. Multirooted, periodontally involved molars can be maintained for extended periods of time with hemisection, depending on the extent of bone destruction.

Appropriate case selection is crucial to the root resection procedure's success. The outcome of periodontal therapy may be jeopardized by the intricate and challenging task of treating furcation problems. For both the patient and the dentist, estimating the prognosis of molars with furcation invasion is frequently a frustrating and upsetting experience. Without a doubt, one of the areas of the oral cavity where plaque is hardest to eliminate is the bifurcations. Gaining access to challenging places requires a thorough understanding of the pocket's surrounding geography and root morphology. Clinical success has not been reliably predicted, despite the fact that several treatment approaches have been tried to preserve teeth with moderate to severe furcation involvement. Bicuspidization is a valuable treatment option to save multi-rooted teeth having the hopeless prognosis in periodontal context. To accurately typify a furcation case, the following factors (many of which are anatomical and biomechanical in nature) should be taken into considerations. [13]

- 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

In conclusion, finding the optimal answer is a difficult process that depends on a wide range of factors. One of the most difficult issues a restorative dentist faces is restoring a tooth that has had endodontic treatment. One of the two explanations listed below is the primary cause of endodontic tooth failure:
1) An ongoing infection inside the radicle
2) Difficulties with postendodontic restoration
To enable the pulpless tooth to function as an essential component of the oral masticatory apparatus, a successful endodontic treatment must be combined with a sufficient postendodontic repair.
Understanding the physical and biomechanical characteristics of the teeth, their anatomy, and the fundamentals of endodontics, periodontics, restorative dentistry, and occlusal anatomy are all necessary for the effective restoration of endodontically treated teeth.
Bicuspidization should be explored with patients when weighing their treatment options because it may be a good substitute for extraction and implant therapy, particularly for First Permanent Molar in young children.[14]
Hemisection is a good substitute for extraction and need to be discussed with patients when they are weighing their options for treatment.
A cautious dentist should prioritize saving a severely decaying multirooted tooth. Thus, it can be concluded that a well-thought-out post-endodontic restoration can greatly extend the tooth's lifespan.
Therefore, in order to deliver high-quality care, it is crucial for every dentist to be knowledgeable about the newest materials and treatments. Surgical endodontic techniques called hemispexion and bicuspidization are used to treat multirooted teeth that have structural, endodontic, or periodontal issues. When traditional endodontic and periodontal therapy alone is not enough, these techniques seek to preserve the natural teeth and restore functionality.[15] Even though implantology has become more popular, it is still very important to preserve natural teeth using these conservative techniques, especially when there is good root and bone support.

REFERRENCES

1. Theodore M Roberson, Harald O.Heymann, Edward J.Swift Sturdevant's Art and Science of Operative Dentistry Mosby Elsevier Philadelphia 2002 5th Edition:809-841.
2. Jain A, Bahuguna R,arwal V: Hemisection as an alternative Treatment for resorbed Multirooted Tooth- A Case Report Asian J Oral Health Allied Sci. 2011;1(1):44-46
3. Saad MN, Moreno J, Crawford C Hemisection as an Alternative Treatment for Decayed Multirooted Terminal Abutment: A Case Report *J* Can Dent Assoc. 2009; 75(5):387-390.
4. Arora A, Arya A, Singhal RK, Khatana R: Hemisection: A conservative Approach: Indian J Dent Sci. 2017;9(3):206-209.
5. Sharma A, Mishra P, Singh M, Singh P: Bicuspidization: conservation for prevention.: Int J Contemp Med Surg Radio. 2016 ;1(1):3-4.
6. Koduganti RR, Jandhyala S, Sandeep N., Reddy PVN Effective management of mandibular Grade III furcation: A dicey issue J Oral Res Rev. 2014; 6(1):21-24
7. Sahoo S, Sethi K, Kumar P, Bansal A: Management of periodontal furcation defects employing molar bisection; a case report with review of the literature Dent Hypotheses 2013;4 (3):97-101.
8. Franklin S. Weine . Endodontic therapy. 6th ED. Mosby 2003: 546-584.
9. Hargreaves, Cohen. Cohen's Pathways of the pulp, Elsevier, Missouri, 2011,10th Edition: 786-821.
10. V. Gopikrishna , B Suresh Chandra . Grossman's endodontic practice,Wolters Kluwer, Delhi ,2014, 13th edition:398-417.
11. M.A.Marzouk, AL. Simonton, RD Gross Operative Dentistry Modern theory and Practice AIPD, Delhi 1985; 205-236
12. Morimoto S, Vieira GF, Agra CM, Sesma N, Gil Fracture Strength of Teeth Restored with Ceramic Inlays and Overlays. Braz Dent J, 2009;20(2): 143-148
13. Simon JHS, Lythgoe JB. Bicuspidization: a therapeutic alternative. J Am Dent Assoc. 1980;101(5):791–3.
14. Carnevale G, Di Febo G, Tonetti M. Management of furcation-involved teeth. Periodontol 2000. 1995;9:69–89.
15. Tamse A. Vertical root fractures in endodontically treated teeth: diagnostic signs and clinical management. Endod Topics. 2006;13(1):84–94.
16. Rankow H, Krasner P. Endodontic-periodontal interrelationships. Dent Clin North Am. 1992;36(3):491–507.
17. Al-Hezaimi K, et al. Management of endodontic-periodontal lesions. Int J Dent. 2012;2012:920495.
18. Seltzer S, Bender IB, Ziontz M. The interrelationship of pulp and periodontal disease. Oral Surg Oral Med Oral Pathol. 1963;16(12):1474–90.
19. Newman MG, Takei HH, Klokkevold PR, Carranza FA. Carranza's Clinical Periodontology. 13th ed. St Louis: Elsevier; 2019.
20. Langer B, Stein SD, Wagenberg B. An evaluation of root resections: a ten-year study. J Periodontol. 1981;52(12):719–22.

21. Butcher EO. The effects of tooth extraction on alveolar bone and residual ridge in man. J Am Dent Assoc. 1956;53(6):630–4.
22. Nyman S, Lindhe J. A longitudinal study of combined periodontal and prosthetic treatment of patients with advanced periodontal disease. J Periodontol. 1979;50(4):163–9.
23. Fugazzotto PA. Periodontal-restorative interrelationships: maximizing treatment outcomes. Periodontol 2000. 2001;25:173–9.
24. Glickman I. Clinical Periodontology. 4th ed. Philadelphia: WB Saunders; 1972.
25. Morris ML, Mccall JO. Tooth hemisection. J Am Dent Assoc. 1925;12(3):393–8.
26. Cohen S, Burns RC. Pathways of the Pulp. 9th ed. St Louis: Mosby; 2006.
27. Sharma A, Sharma A. Hemisection: A Conservative Management of Periodontally Involved Molar Tooth. J Clin Diagn Res. 2012;6(6):1042–5.
28. Bühler H. Evaluation of root-resected teeth. J Periodontol. 1988;59(12):805–10.
29. Saud A, et al. Clinical Evaluation of Hemisection in Molar Teeth. J Int Oral Health. 2015;7(Suppl 1):1–3.
30. Pecora G, Andreana S. Tooth hemisection: a predictable procedure for preserving compromised teeth. Compend Contin Educ Dent. 1993;14(5):618–23.