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Hemisection- Split For A Fit In The Arch

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Abstract:
Advances in dentistry and technologies as well as patient's awareness to maintain their dentition have led an easier path for survival of the tooth in the dental arch. Mandibular first molars are considered as prime standpoint for occlusion with a wide pericemental area, unfortunately they are most commonly involved teeth with carious and periodontal diseases. Hemisectionwhich involves the separation and removal of only one root while preserving the other unaffected rootpresents as the best line of therapy, though daunting can be easily achieved and maintained successfully. This case report depicts a clinical situation of a hemisected teeth followed by prosthetic rehabilitation with successful outcomes of an advanced endo-perio lesion.

Keywords*: Hemisection, Endo-perio lesion, Prosthetic rehabilitation, Bone graft.*

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I. Introduction:

Newer advances in technologies and modern dentistry have increased the possibilities of preservation of tooth and healthy dentition for life. In addition there is a rapid development of awareness and patient's prospectives regarding various treatment options for the survival of dentition rather than have them extracted whenever feasible.[1]Exaction of posterior teeth following various etiological factors would lead to mesial migration of tooth, supra-eruption of opposing tooth, loss of functional occlusion and reduction in arch length as well as vertical dimension. [2]

Endodontic-periodontal disease reflects the lesions that inflict both pulpal as well as periodontal tissues of a tooth. The interrelationship as well as inception of primary lesions between periodontal and endodontic disease has aroused confusion, queries and controversy arousing difficulty in differentiating between periodontal and endodontic problems.[3] The pathways of pulpal and periodontal tissue communication can be from dentinal tubules, lateral and accessory canals, and apical foramen which was first described by Simring and Goldbergin 1964. Though controversialregarding the pathogenesis, the main etiology of endodontic-periodontal diseaseis confirmed as bacterial invasion.[4]

Various multidisciplinary treatment approaches of endo perio lesions have been described in literature which integrates comprehensive principles of endodontics, periodontics, restorative dentistry and prosthodontics. However, resective therapies offers an effective treatment option for maintaining natural tooth structure as well as reconstruction of proper proprioception. [5]

Hemisection is one such therapeutic approach, which involves surgical removal of the defect root and adherent soft tissues leaving the crown of the tooth intact and supported by remaining root, retaining the tooth's integrity within the socket.[1]It is indicated where one of the root of molar is unsalvageable due to caries, periodontitis, or iatrogenic mishaps One-half of the crown and the associated unrestorable root are also removed. It is also referred to as Tooth sectioning, Bisection Bicuspidization, Odontosection.[6]

The indications for tooth Hemisection, according to Weine are

I) Endodontic and Restorative Indications: [4]

a) Extremely destructive process: Removal of lesioned root as a result of destructive caries, Endo perio lesions, trauma, significant root perforation, furcation, or subgingival caries.

b) Endodontic failure: Hemisection is donewhen floor of pulp chamber's with endodontic involvement has been perforated by Caries or iatrogenically which has poor prognostic value with non-surgical endodontic therapy.

c) Vertical fracture of a single root: Vertical fracture of root extending onto the clinical crowncan never be survived. Hemisectionprovides hope if a vertical fracture crosses one root but leaves the other root undamaged.

d) Prosthetic failure of abutments: If a single or multiple-rooted tooth is periodontally affected within a fixed bridge, the root of the concerned tooth is excised.

II) Periodontal Indications: [4]

a) Only one root of a tooth with suffers from severe vertical bone loss as in cases of aggressive periodontitis.

b) Complete destruction of the furcation.

c) The roots of adjacent teeth are too close to one another, making it difficult to maintain proper cleanliness in close quarters.

d) Serious root exposure as a result of dehiscence.

Contraindications: [6]

a) As alternatives to hemisection, there are strong neighbouring teeth that can serve as bridge abutments.

b) Inoperable root canals should be kept.

c)Fusion of the roots makes separation impossible.

d) Non-strategic teeth.

Regeneration of osseous defect with a bioactive material have been an interest of research since decades. Though autogenous materials have served the purpose but a variety of calcium phosphate ceramics have gained popularity as an off-the-shelf artificial grafting material for the restoration of osseous defects. Newer materials like hydroxyapatite (HA) and β-tricalcium phosphate (β-TCP) have shown significant clinical improvement at grafted sites.[7]

Platelet concentrates are the trending concentrates in the field of regeneration, wound healing with autologous properties.PRF consists mainly of fibrin matrix with a large number of platelets and leukocytes, prepared by Dr.Choukroun. It consists of various growth factors, acts as a scaffold for osseous regeneration.[8]

II. Case Presentation:

A 25 yearold male patient reported to the department of conservative dentistry and endodontics, Mamata Dental College, Khammam with a chief complaint of pain and mobile teeth in his lower right back tooth area. The patient was asymptomatic 5 months, then he reported of pain which was dull and continuous and aggravated on biting in relation to offending tooth. No relevant medical/family history was reported. The patient was conscious, cooperative, and well-oriented to time, place, and person. On Clinical examination of the right mandibular first molar revealed the presence of Grade II mobile tooth which was tender on vertical percussion. A periodontal probing around the tooth revealed 7mm deep intrabony pocket on distal aspect and 6mm deep suprabony pocket on mesial aspect of 46. Electric pulp testing revealed a delayed response when compared with 36 suggestive of pulpal necrosis. Orthopantomogram (OPG) [Figure a] with respect to 46 revealed a large periapical lesion extending onto the lateral aspect of distal root. The final diagnosis was Endo Perio lesion with respect to 46.

The potential treatment plans proposed were:

1. Endodontic therapy with conjunctive Periodontal therapy followed by Hemisection of the distal root followed by fixed prosthesis using the mesial portion of the mandibular first and second molar.
2. Endodontic therapy with conjunctive Periodontal therapy followed by Hemisection of the distal root followed by fixed prosthesis using the mesial portion of the mandibularfirst and an inlay type restoration on second molar
3. Endodontic therapy with conjunctive Periodontal therapy followed by Hemisection of the distal root followed by fixed prosthesis with the mesial part of the mandibular first molar and an occlusal rest on second molar
4. Extraction followed by implant.

Patient opted for first treatment plan, as he was more concerned about the natural essence and long term survival of teeth.

Clinical procedure:

Endodontic Phase:

Ethical clearance was obtained from the institutional ethical clearance board (EC/IRB NO: MDC-R-088459). Endodontic therapy was initiated after obtaining the informed consent from the patient. During the first visit, after administrating 2% Lignocaine with 1:1,00,000 epinephrine local anaesthetic solution, endodontic access opening was performed using no. 4 Endo Access Bur under rubber dam isolation. Initial glide path was created using #10 K file. Working length was determined [Figure b] using Ingle's radiographic technique and using Apex locator consecutively. Initial apical enlargement was done up to #25 K file hand files. Biomechanical preparation was performed using ProTaperGold system files till #F2 file size in all canals. During each instrument change, canal was copiously irrigated with 2% Chlorhexidine and Saline. A combination of 2% CHX and Calcium hydroxide intracanal medicament was placed followed by temporization with Cavit.

During the second visit, after removal of temporary restoration, isolation was achieved with rubber dam. Irrigation was done using saline to remove intracanal medicament. Master cone radiograph was taken to ensure the apical fit [Figure c]. Final irrigation was performed using 2% Chlorhexidine and Saline.The canal was dried using absorbent paper points. Obturation was carried out using a zinc oxide eugenol sealer and the corresponding master cone in the mesial root only [Figure d]. The canal orifices were sealed with Miracle mix restoration.

Surgical Phase:

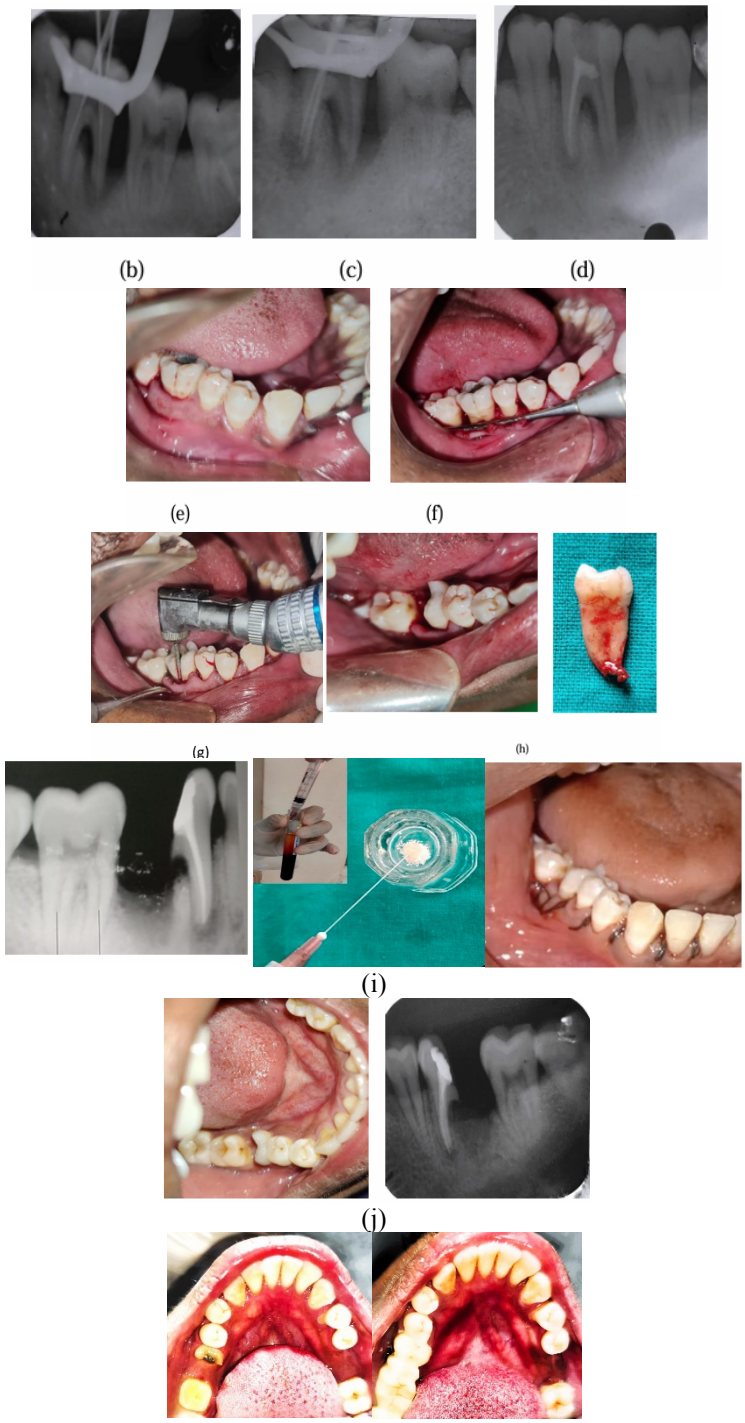
The administration of 2% Lignocaine with 1:1,00,000 epinephrine localanesthesia was done followed by full thickness crevicular incisions [Figure e] and reflection of marginal gingiva, interdental papilla with a periosteal elevator extending from the second premolar to the first molar (45, 46) [Figure f]. A tapered fissure carbide bur was used to cut a vertical segment from the buccal to the lingual [Figure g]. During reaching the furcation area, a William's probe was placed horizontally below furcation area to avoid cut into the interdental bone.Complete resection of two roots was confirmed by passing a probe. The distal root along with crown portion was removed [Figure h] and extraction site was curretaged, irrigated with sterile saline. Final shaping of retained segment was done to obtain a smooth surface.

Platelet rich Fibrin was prepared by collecting patient's own blood without addition of anticoagulant and centrifuged at 3000 rpm for 10 minutes to form three layers, the upper layer is discarded and middle layer is PRF layer which is carefully removed from the tube and placed in between two guazes to ensure a gelatin like layer. Freshly prepared PRF was mixed with commercially available Hydroxyapatite and Collagen graft (G Graft) and placed into the extracted site [Figure i].The flap was realigned and repositioned with 3-0 silk non-resorbable sutures and periodontal pack was placed for about one week [Figure i]. Sutures were evaluated and removed after one week, and patient was recalled after 1 month, 2months and 3 months interval.

Restorative Phase:

During 3month recall, there was a satisfactory healing and reduction in mobility andradiographs showed potential reduction in periapical radiolucency [Figure j]. Zirconia fixed prosthesis was planned which involves the mesial portion of mandibular first molar and second molar. Occlusal reduction was done using 265R bur, followed by proximal reduction using tapered round end 102R bur Shoulder finish line was given labially and lingually using TF30, Shoulder finish line of width 2 mm and overall reduction of 2–2.5 mm was done [Figure k]. Double-mix double-impression was recorded using putty impression material with light body impression material. Temporary crowns were fabricated using tooth coloredacryclic and cemented using temporary cement with respect to 46 and 47. A2 shade was selected. Zirconia Fixed partial denture with respect to 46 and 47was evaluated and cemented with type I GIC [Figure l].

(a)



(a) Pre operative radiograph irt 46 (b) Working length radiograph irt 46 (c)Master cone radiograph irt 46 (d) Obturationradiograph irt 46 (e)Crevicular incision(f)Mucoperiosteal flap elevation (g) Hemisectioni rt 46 (h) Resected distal root irt 46 (i) PRF along with G graft (j) 3 months recall image and radiograph irt 46 (k) Tooth preparation irt 46, 47 (l) Zirconia fixed partial dentures irt 46,47

III. Discussion:

The relation between the pulp and the periodontial areas have been extensively studied; but queries regarding the diagnosis, prognosis and treatment are raised with time. The pathways for the spread of bacteria between pulpal and periodontal tissues have been discussed with controversy but main victim has always been the bacteria. The main advantage of resective therapy is conversion of furcation involved multirooted tooth into non-furcated single-root tooth, which removes nutrition of bacteria.[9]

Hemisection involves bisecting the tooth into two separate partitions, referred to as bicuspidization orOdontosection which paves an effective alternative treatment option for extraction or implants.[10] The success of Hemisection relies onproper case selection with adequate access and curettage of root furcation, clinical knowledge, diagnosis, and prognosis as well as multidisciplinary treatment plan. In cases with the furcation invasion of a mandibular molar, many factors determine the clinician's decision to choose one treatment plan over another.

These include:
a. Local factors - Tooth anatomy, mobility, crown root ratio, severity of attachment, inter-arch and intra-arch occlusal relationship.
b. Patient factors –Age, Health of a patient, importance of the tooth, costs, and time factor, Awareness of prognostic factors
c. Clinician factors - A good case selection, diagnostic and treatment planning skills, awareness of therapeutic options and clinical insight, and skill of doctor.[11]

Park et al have proposed hemisection as aremarkable treatment option for molars with a questionable prognosis since it retains teeth without a noticeable bone loss for a protracted length of time. [12]

Carnevale et al proposed a treatment protocol for teeth with furcations out of which teeth with furcation have been successfully retained through hemisection with few negative outcomes like Anxiety and pain and reported 93% success rate over a 10-year follow-up. [13]In a retrospective study 91.1% survival rates of root-resected molars was found to be by Yuh et al which was due to furcation involved. [14]

Management of periodontal-endodontic lesion is still a tedious task in today's clinical practice. Treatment of primary periodontal with secondary endodontic lesions necessitates both endodontic and periodontal therapy for optimal healing.[6]In the present case, if merely endodontic treatment is carried out, without periodontal resective therapy lesion would not have been healed due to continuous irritation and inflammation from the lesion. This reduces the potential risk of recontamination by bacterial by-products during the initial phases of healing. Hence the endodontic therapy was initiated first in the present case.

Newell et al assessed 70 root-resected molars. When subgingival caries, residual roots, or root fractures were present in 21 (30%) of the resections, Maxillary molar failure rates were higher (33.3%) than mandibular molar failure rates (22.7%).[15]

In the present case report the resected portion was filled with a mixture of patelet rich fibrin along G Graft(Hydroxyapetite+ Collagen) which as a scaffold for growth factors needed for regeneration of osseous bone. This might also have been contributed to the satisfactory healing in 3 month interval. Kumar et al, similarly resected the mesial root and Socket was preserved by grafting with a mixture of the demineralized freeze-dried bone allograft. [16]

Prosthetic rehabilitation of resected tooth portion plays a major role in survival of resected root. In the present case report, Zirconia fixed partial denture was preferred due to its translucency, strength which was successfully managed by the patient. Shafiq et al, hemisected the tooth and mesial root was removed and a threeunit bridge combining the hemisected root and adjacent second premolar was inserted which is successfully in service for more than a year.[17]

Apart from these all factors, as the retained segment is under higher chances for vertical fractures, care must be advised to the patient to relieve occlusal disharmonies which increases the survival of resected teeth.[18]

IV. Conclusion:

Through interdisciplinary therapeutic approach involving Endodontic, Surgical and Restorative guidelines, proper case selection hemisection can be a viable treatment choice in preserving non- restorable molar teeth. It has also been suggested that hemisection should be considered as a boon and saviour over molar extraction, as it offers reliable long-term outcome.

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