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Interdisciplinary Strategies In The Management Of A Hopeless Tooth

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ABSTRACT

The management of hopeless teeth with extensive loss of supporting bone, deep pocket depths, Grade 3 furcation involvement, and hypermobility presents a significant challenge in dental practice. This comprehensive review explores various interdisciplinary approaches to improve the prognosis and survival rates of such compromised teeth. The decision-making process relies on effective diagnosis and risk assessment, with innovative decision tree algorithms aiding in treatment planning.

Detailed discussions on endodontic-periodontic interventions such as root resection and intentional replantation are presented, highlighting their efficacy in salvaging compromised teeth.

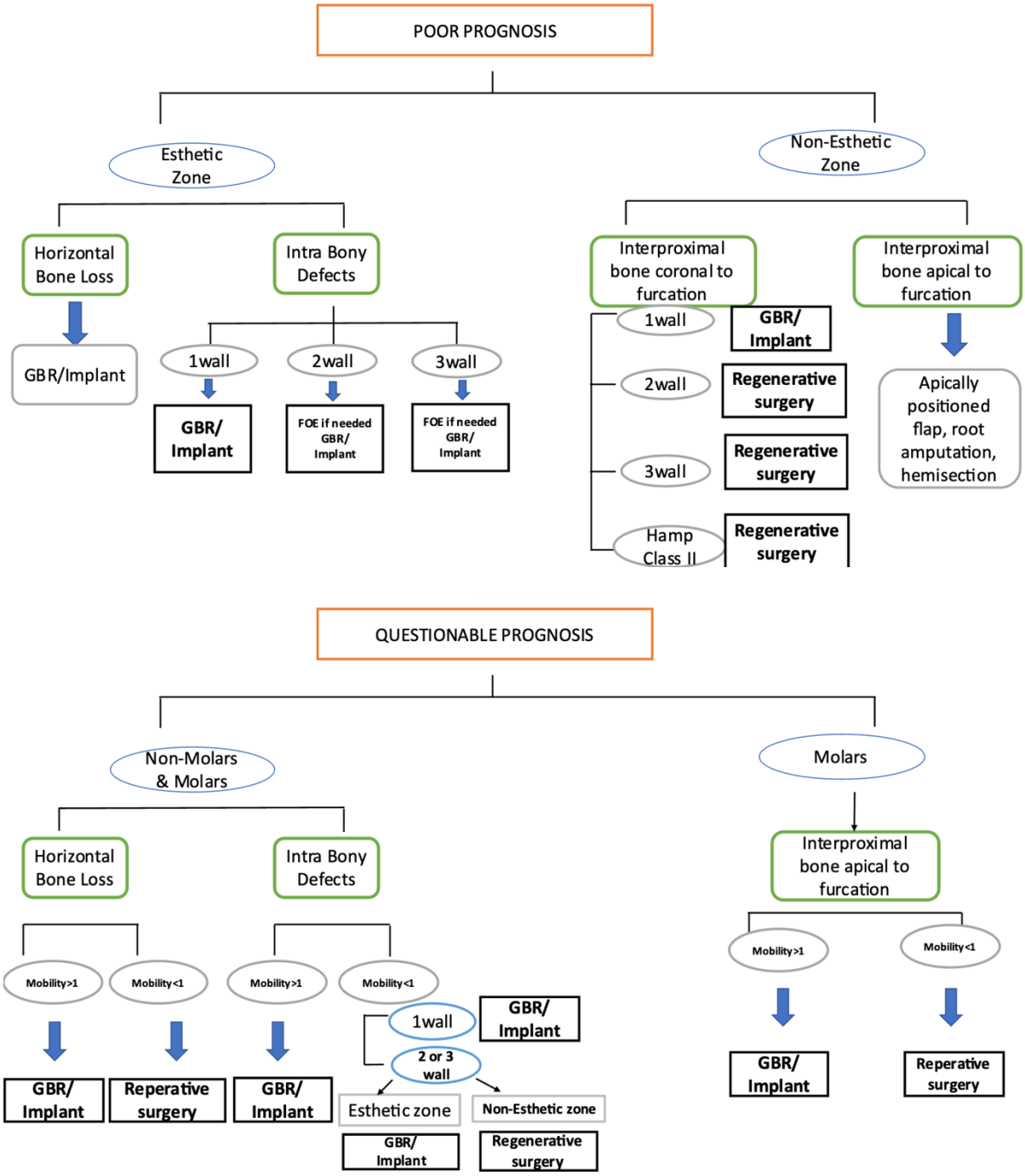
The review emphasizes the importance of regenerative approaches, incorporating bone grafts, guided tissue regeneration, and regenerative endodontics. The use of innovative techniques, including 3D-printed scaffolds and pluripotent stem cells, holds promise for achieving favorable outcomes in severely compromised teeth with severe periodontal conditions.

In conclusion, the decision to save natural teeth depends on a careful risk-to-benefit assessment, giving priority to an interdisciplinary approach that integrates periodontics, endodontics, and prosthodontics. This comprehensive overview serves as a valuable resource for dental practitioners faced with the challenging task of managing hopeless teeth.

1. INTRODUCTION

Hopeless tooth is the tooth with extensive loss of more thanthree-fourth of supporting boneand pocket depths more than 8mm with Grade3 furcation involvement and hypermobilitywhich needs challenging treatment plan to improve the success rate of its survival.**(1)**According to Becker et al,a tooth could be considered as hopelessas described above.

Decision making on rehabilitation of poor tooth depends on an effective diagnosis and risk factors assessment. Innovative decision tree algorithms have been proposed by Mandel et al (figure 1)who evaluated the endodontic, restorative, and periodontal assessments with new evidence-based studies to achieve efficient decision making in the management of hopeless/bad tooth.**(2)**Clinical status has to be approached in multidimensional ways to achieve proper prediction of prognosis. According to retrospective studies, over 90% of teeth with uncertain periodontal prognosis were successfully preserved through the implementation of a rigorous follow-up protocol.(3)



(Courtesy-Mandel et al 2013)

The Dental Practicality Index (DPI) can be used to describe the clinical level of decision making on the 'practicality' of restorative treatment. The DPI expedites a structured and meticulous analysis of the multiple interplaying factors that should be analysed in the decision-making process of interdisciplinary approach. Scoring has been categorised on the structural, periodontal, endodontic rehabilitation.(figure 2) (4)

Table 1 The categories that the tooth should be assessed in; structural integrity, periodontal and endodontic treatment need as well as context are summarised in the grey shaded columns. Each row shows examples of different levels (0,1,2,6) of complexity for each category. An overall DPI score of >6 indicates that treatment may be impractical, this is reduced to 4 if the tooth to be treated is to be used as a bridge abutment

Weighting	Structure integrity	Periodontal treatment need	Endodontic treatment need	Context
0 No treatment required	Unrestored or existing well-adapted restoration	Probing <3.5 mm (BPE 0-2) previously successfully treated periodontal disease	Vital pulp previously successfully treated endodontic disease	Local: Isolated dental problems where adjacent teeth are healthy General: Replacing of a strategic tooth may be excessively complex History of IV bisphosphonates, head & neck radiotherapy
1 Simple treatment required	Simple (in)direct restoration	Probing 3.5-5.5 mm (BPE 3) root surface debridement indicated	Simple root canal system with endodontic disease (eg, radiographically easily identifiable root canal[s], easily retrievable root canal filling material)	Local: Prosthodontic treatment planned of neighbouring teeth which may influence treatment plan for tooth being assessed Tooth to be used as a bridge abutment General: Radiotherapy of head and neck region planned Immunocrompromised patient
2 Complex treatment required	Minimal residual sound tooth structure (eg subgingival margins, post-core restoration required etc)	Probing >5.5 mm (BPE 4) compromised support (eg short root, crown lengthening required, grade 2 mobility). Grade 2-3 furcation involvement	Complex root canal system with endodontic disease (eg, sclerosed root canal, acute curvatures. Complex re-root canal treatment (eg, fracture instrument removal, perforations) Difficulty in obtaining anaesthesia	Local: Prosthodontic treatment planned of multiple, including adjacent teeth General: High caries rate Poor oral hygiene Parafunctional habits, extensive tooth surface loss Active periodontal disease
6 Impractical to treat	Inadequate structure for ferrule	Untreatable periodontal disease	Untreatable root canal system	Local: Retention of the tooth being assessed would constrain and/or compromise an otherwise simple and predicable treatment plan (for example extensive bridge work) General: Potentially life threatening medical conditions which should be managed in tertiary care

(Courtesy: Dawood.A et al 2017)

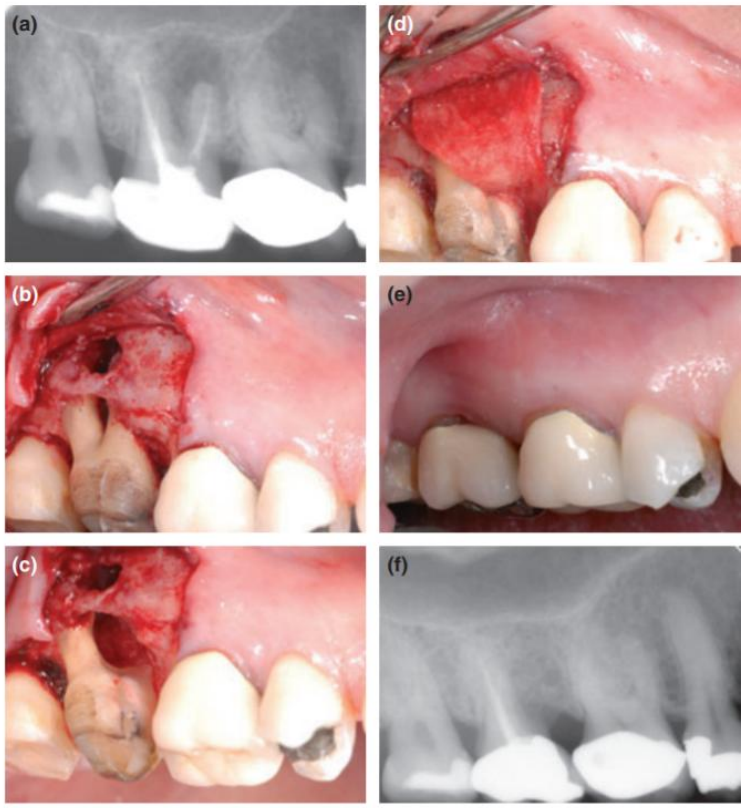
2. INTERDISCIPLINARYMANAGEMENT STRATEGIES

Salvaging of hopeless teeth by an interdisciplinary approach such as endodontic-periodontic, endodontic-prosthodontic, endodontic-periodontic-prosthodontic management is the main key for successful treatment outcome

ENDO - PERIODONTAL APPROACH

Root resection (amputation)

Root resection (amputation)entails the surgical extraction of the most infected root and granulation tissues, while preserving the crown of the tooth, supported by the remaining root or roots. Multiple studies have examined the extended-term efficacy of root-amputated teeth, revealing failure rates for root amputations in molars that vary between 25% and 38%.(6)

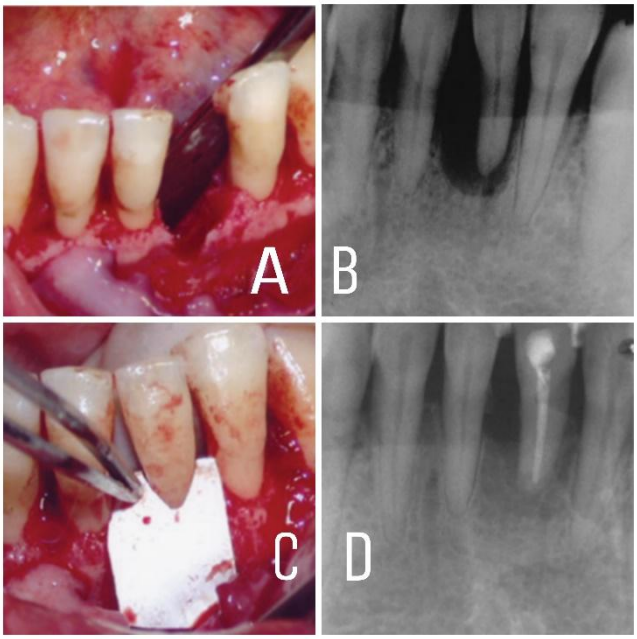


(Pic Courtesy: Se-Lim et al 2012)

(a) Preoperative radiograph reveals periapical radiolucency around the mesiobuccal root of maxillary right second molar. (b) On flap elevation, involvement of buccal furcation is seen. (c) The mesiobuccal root is amputated and curettage is done. (d) A bone graft material is placed with a resorbable membrane. (e) Final prosthesis fitted 6 months later. (f) Follow-up radiograph 15 months after the periodontal surgery.

Intentional Replantation

It is advised as the preferred treatment, particularly in cases where accessibility for apical surgery is challenging, such as when the mental foramen is positioned directly over the apex of premolars or when the apex is close to the mandibular canal. This approach is recommended when patients express reluctance towards periradicular surgery, in instances of failures following apical surgery, or when performing surgery would lead to the creation of a periodontal pocket due to extensive removal of bone.(7)



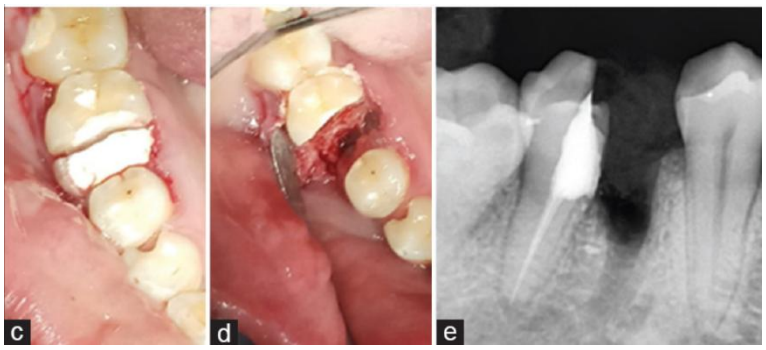
(Pic courtesy: Demir B et al)

A)Pre-operative clinical picture with crater shaped bony defect and no buccal & lingual walls B)Radiograph of 31 showing severe bone loss C) Placement of PTFE membrane between mucoperiosteal flap and defect D) Post-operative 1year follow-up radiograph with no radiolucency and bone-fill on apical, mesial and distal sides.

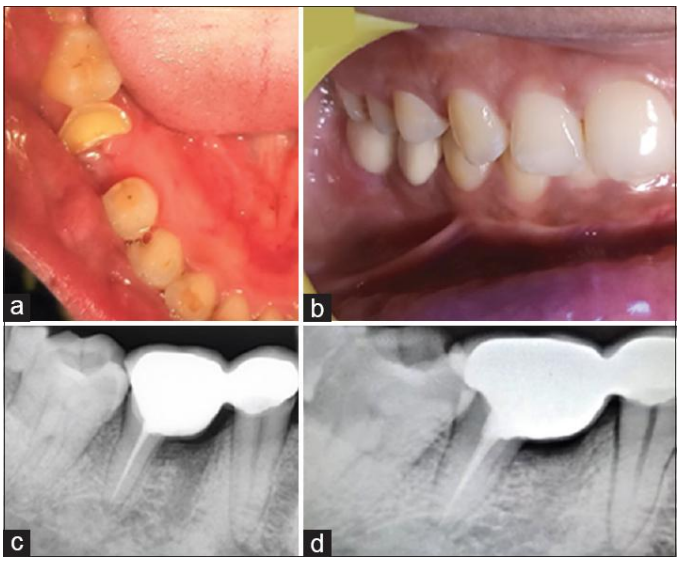
3. ENDO – PERIODONTAL- PROSTHETIC APPROACH

Hemisection

Hemisection refers to the extraction or division of a root along with the corresponding portion of the crown. This procedure is recommended when issues such as extensive caries, perforation, resorption, or periodontal damage are confined to single root of a multirooted tooth. The purpose of hemisection is to enable the placement of a fixed prosthetic bridge.**(8)**It prevents numerous undesirable sequelaesuch as alveolar bone loss, tooth drifting, vertical dimension collapse, supra-eruption of opposing teeth and a decrease in chewing efficiency. It also maintains the proprioception of the periodontal ligament.



(c) Vertical cut in relation to 46. (d) Atraumatic extraction of the mesial root. (e) Radiograph after root resection



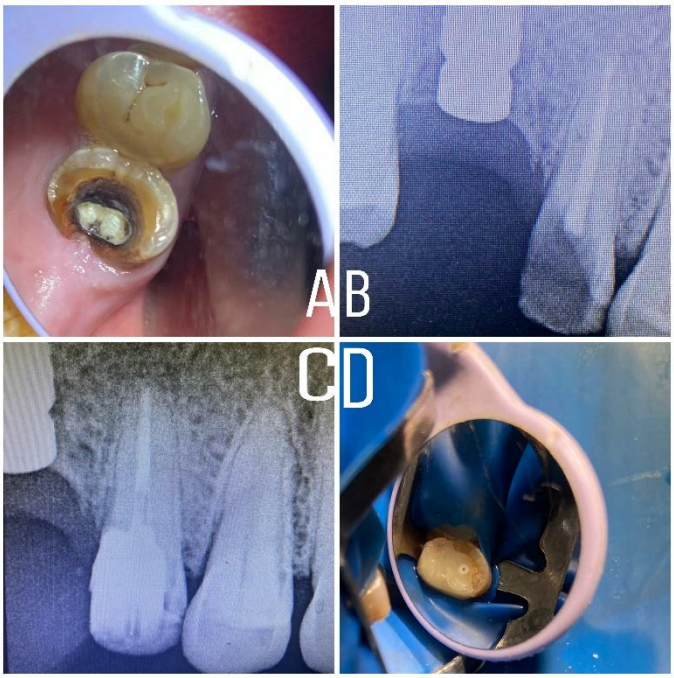
(Pic Courtesy: Sravanthi et al 2020)

(a) Healed site after 1 month. (b) Clinical image showing FPD i.r.t 45,46. (c) Follow-up radiograph after 1 month. (d) Follow-up radiograph after 1 year follow-up radiograph

4. ENDODONTIC – PROSTHODONTIC APPROACH

Fiberpost

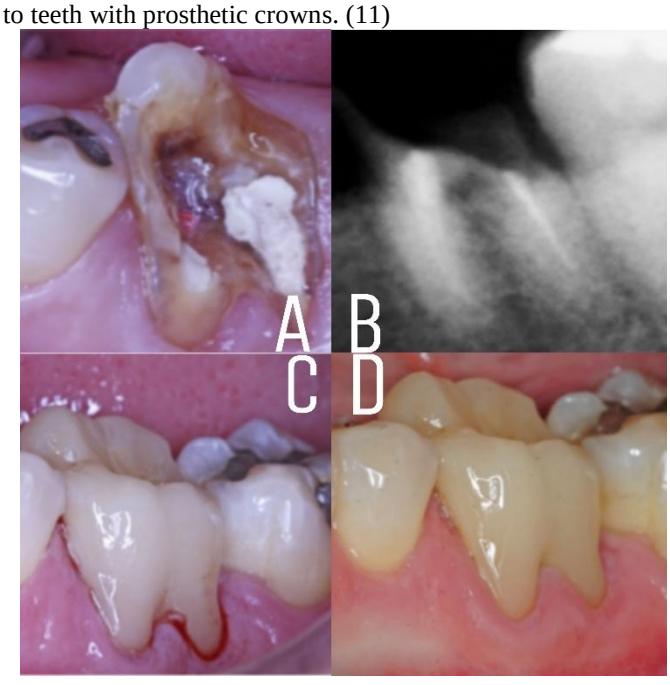
Endodontically treated which is severely compromised, featuring minimal residual root dentin thickness, often necessitate substantial restoration using diverse post-core foundation materials. This is crucial for supporting a full crown, particularly in applications with high stress. The objective is to attain a positive restorative outcome by reinforcing both the root and crown. Commonly used posts are traditional and abbreviated glass fiber posts, possessing elastic moduli akin to dentin.(9) The application of fiber posts, as evidenced by Topçuoglu et al, has demonstrated superior fracture resistance for significantly compromised teeth. The key lies in the capacity of fiber posts to establish a satisfactory bond with the substrate through adhesive cement. This, combined with the mono-block concept and the establishment of a comprehensive apical fluidtight seal using adhesive fiber post materials, proves advantageous in rejuvenating seemingly irreparable teeth.(10)



A)Clinical picture of 15 B)Pre-operative radiograph of 15 C)Post-operative radiograph after obturation and post placement D) Post-operative clinical picture after crown build-up

Endocrown

Endocrowns present a viable prosthetic solution for the restoration of molars with extensive coronal destruction, particularly in cases where interproximal space is limited. In situations where traditional rehabilitation with a post and crown is impractical due to insufficient ceramic thickness, endocrowns offer a suitable alternative. This technique involves the application of total porcelain crowns fixed onto endodontically treated posterior teeth, commonly referred to as the mono-block porcelain technique. The anchorage of endocrowns within the internal part of the pulp chamber and along the cavity margins is achieved by establishing macromechanicalretention through the surrounding pulpal walls. Additionally, micromechanical retention is attained through adhesive cementation. Notably, endocrowns exhibit lower stress levels compared to teeth with prosthetic crowns. (11)



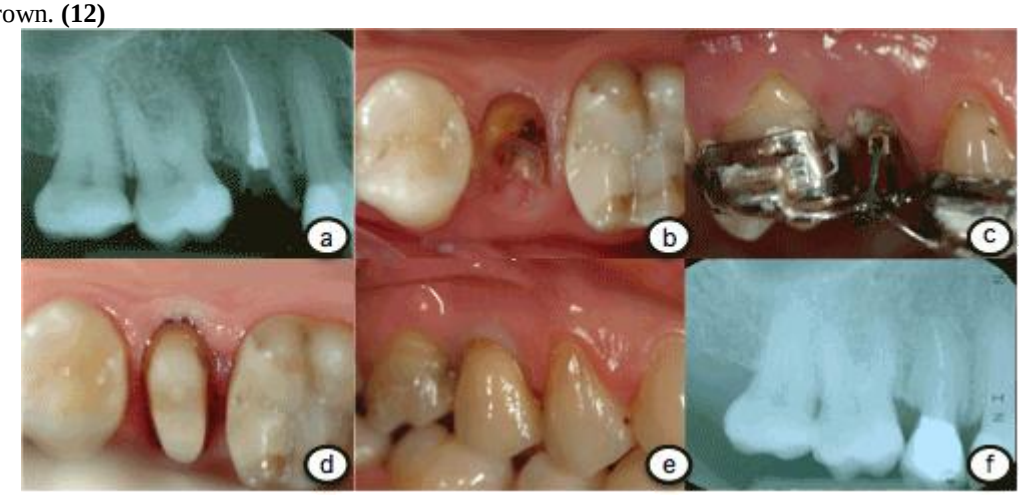
(Pic Courtesy: Biachi et al 2013)

A) Preoperative picture of the left mandibular first molar. B) Preoperative radiograph of the tooth which is endodontically treated C) Cementation of endocrown in the prepared tooth. D) Three years follow up ofendocrown after cementation.

5. PERIO-ORTHODONTIC APPROACH

Forced Orthodontic extrusion

The orthodontic extrusion of severely damaged teeth with minimal crown structure represents a non-surgical and non-invasive technique. This approach aims to increase the apposition of new 'endogenous residual bone.' During the extrusion process, the gingival margins move coronally, while the level of the mucogingival junction remains unchanged. This technique results in the augmentation of both soft and hard tissues, a feat that is challenging to accomplish even with contemporary regenerative procedures. Following the extrusion, the tooth can be restored through post and core build-ups, ultimately leading to the placement of a crown. **(12)**



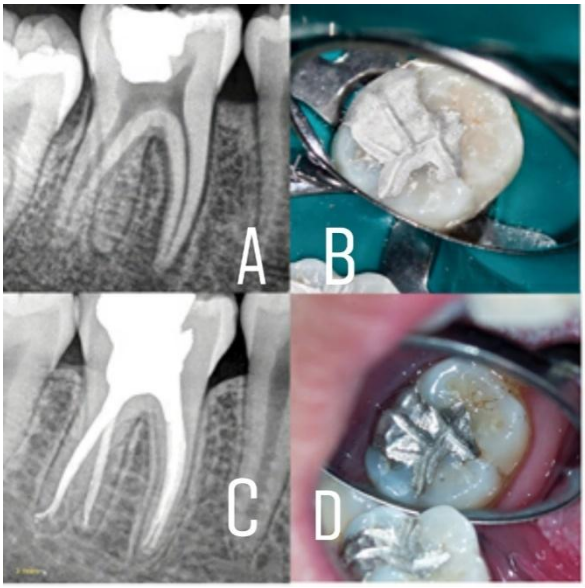
(Pic Courtesy: Giuseppe et al 2016)

a) A preoperative X ray underlines the deep caries disease in the uppersecondpremolar destroying the whole tooth crown. **b)** Occlusal view of the uppersecondpremolar with gingival growth on the lesion **c)**Orthodontic extrusion of the residual reconstructed tooth has been performed**d)**A prosthetic abutment is prepared and the residual gap has been covered by endodontic indirect post**e)** Final ceramic crown cemented **f)** Preoperative X ray after the endodontic treatment performed on the previous destroyed tooth.

6. RESTORATIVE APPROACH

Amalcore Restorations

This procedure involves the placement of an endodontically treated tooth with an amalgam core into the pulpal chamber, extending 2 - 4 mm into the canal. This approach is recommended for teeth lacking sufficient bulk and is secured by an amalgam restoration and studies, both in laboratory and clinical settings, have demonstrated the success of this restoration method.(13)



Case of Dr. Viraj Vora. A. Lower right molar with pulp necrosis. B. Post-operative amalgam restoration. Three year C. radiographic andD. clinical follow-up.

Shortened Dental Arch Concept(SDA)

The term 'shortened dental arch,' as proposed by Kayser, refers to the minimum number of occluding pairs of teeth necessary to maintain satisfactory oral function. This concept becomes relevant when contemplating the retention of posterior tooth roots and the application of protective surface coping. In managing a specific category of elderly patients, the outcomes of shortened dental arch management have generally been deemed satisfactory. (14)

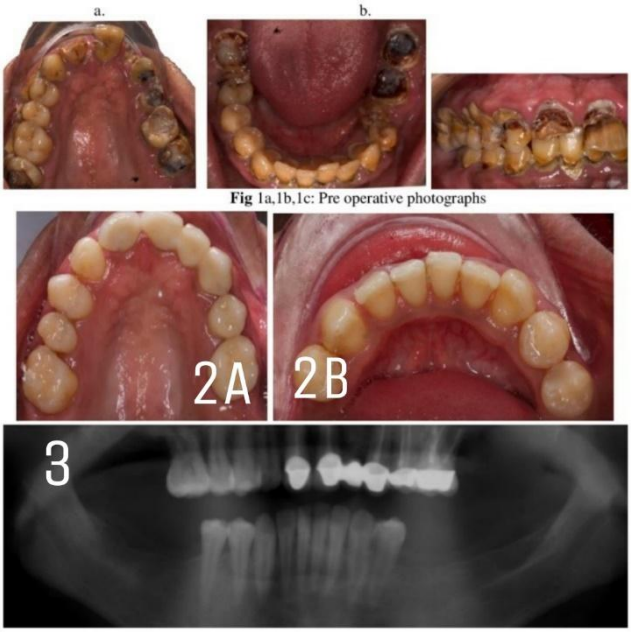


Fig 1a,1b,1c: Pre operative photographs

(Pic Courtesy: Basutkar et al 2019)

1a&1b)Pre-operative radiographs 2A& 2B) One year follow-up Post-operative radiographs 3)Post operative 1year follow-up orthopantograph



Modified Root Submergence Technique

This procedure involves the surgical removal of the crown of a tooth, leaving the root submerged at or below the alveolar crest instead of extracting the entire tooth. This technique aims to preserve alveolar bone and prevent resorption, thereby maintaining the soft tissue profile and achieving a more aesthetically favorable outcome. This approach is particularly suitable for teeth deemed hopeless, provided they exhibit no periapical pathology, as submerging the root remnant helps preserve the surrounding periodontal tissue.(15)

Figure 1: Pre operative intraoral view

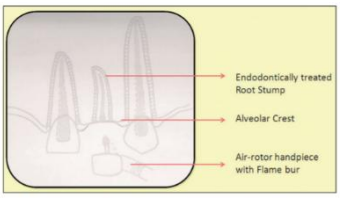


Figure 3: Illustrative diagram depicting endodontically treated Root Stump being submerged

Figure 2: Pre operative OPG

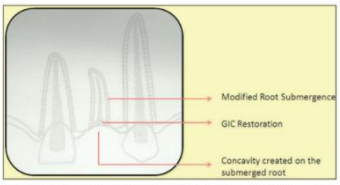


Figure 4: Illustrative diagram depicting submerged root with an occlusal concavity

Figure 5: Post operative intraoral view

Figure 6: 1 year post op follow up radiograph showing maintained alveolar bone around submerged root

(Pic Courtesy: Kumar S et al 2015)

Copings for overdentures

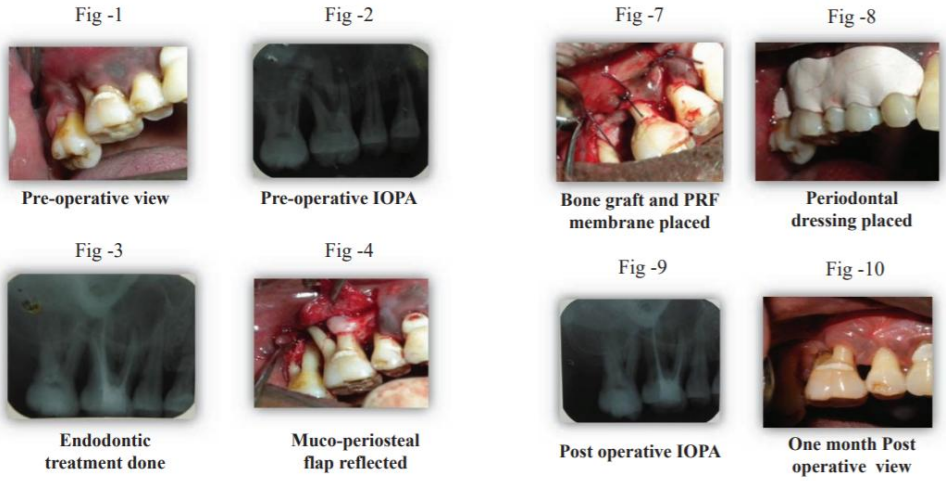
Protective copings can be applied easily over severely compromised tooth stumps using adhesive restorative materials, serving as an effective means to retain the remaining root structure. This method helps prevent hastened bone loss and restores occlusion. Root surface copings open the possibility of overdentures, which offer superior function compared to complete soft tissue-borne dentures across various parameters. This includes enhanced biting force, improved chewing efficiency, and increased speed of controlled mandibular movement.(3)

(Pic Courtesy: Baskan S Z et al 2009)

A)Pre-operative intraoral view B)Metal copings C) Post-operative view

7. ENDO PERIODONTAL- REGENERATIVE APPROACH

The promotion of periodontal regeneration often involves employing techniques such as bone grafts, bone substitutes, and guided tissue regeneration (GTR) in the surgical area. Various materials, including autografts, allografts, xenografts, and alloplasts, have proven successful in supporting periodontal healing in compromised teeth. (16) Additionally, regenerative endodontics presents a biologically based approach. This method induces bleeding from the periapical region into the canal, forming pulpal vital tissue to rehabilitate the root canal in cases of necrotic apical regions.(17)



The concept of tissue engineering holds promise for achieving more favorable outcomes, including the formation of new bone, cementum, pulp tissue, and periodontal ligament (PDL) in cases of severely damaged periodontium and pathological root apex.(18) Looking ahead, future perspectives in this field involve exploring homing procedures, the utilization of 3D-printed scaffolds, pluripotent stem cells and the application of exogenous stem cells. These advancements offer potential avenues for rehabilitating severely compromised teeth in the context of severe periodontal conditions.(19)

8. CONCLUSION:

Treatment decision should consider a risk to benefit ratio for every case selection. Priority to save the natural teeth depends on the the benefits of integrating periodontics,endodontic, and prosthodontics disciplines which can restore esthetic, structural and functional health of the hopeless tooth.

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