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A Full Mouth Rehabilitation Restoring Function and Aesthetics (CASE REPORT)

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ABSTRACT:

Background: *This study presents a clinical case report of a middle-aged patient with pain in the posterior mandibular first molar, especially while eating, multiple edentulous spaces, and bleeding upon brushing. Periodontal therapy, non-surgical extraction, endodontic therapy, restorative treatment, and prosthetic treatment were all included in the multidisciplinary procedure.*

Purpose: *Restoring appropriate occlusion and enhancing appearance were the goals of the treatment plan.*

Methodology: *The patient's treatment approach was commenced by clinical and radiographical examination, including panoramic X-ray and multiple periapical X-rays, followed by diagnosis, phases of treatment, the insertion of monolithic zirconia full coverage restorations, and porcelain fused to metal fixed partial denture.*

Conclusion: *There was an improvement concerning esthetics and function. An integrated treatment strategy is crucial for achieving optimal outcomes in full-mouth rehabilitation. Appropriate treatment planning requires careful assessment of the etiology, history, and factors pertaining to the oral health condition.*

KEYWORDS:

Full Mouth Reconstruction, Minimal Invasive Approach, Restorative and Prosthetic Rehabilitation, Digital Technology.

1. INTRODUCTION

Full-mouth rehabilitation, also known as full-mouth reconstruction, is a comprehensive dental strategy intended to restore the oral cavity's overall health, function, and appearance. The goal was to enhance the patient's quality of life by addressing the ideal balance between functionality and aesthetics. Dental caries is a prevalent chronic infectious disease resulting from tooth-adherent cariogenic bacteria that metabolize sugars to produce acid, which demineralizes tooth structure and causes tooth loss. The prognosis was influenced by both the extent of dental caries and the patient's oral hygiene. Many problems, such as gum disease and tooth decay, can arise from neglecting oral hygiene practices, and these can all have a detrimental effect on an individual's life. A detailed examination, diagnostic mounting, and a sequential planning procedure were all part of the multidisciplinary approach.[1] Adhesive cementation, advanced ceramic materials, and computer-aided design/computer-assisted manufacture (CAD/CAM) technology combined provide a predictable approach for full-mouth rehabilitation.[2-3]. This case report details the application of digital technology in full-mouth reconstruction for a

patient with severe oral conditions. The patient's oral health was compromised by numerous factors, including missing teeth, being a heavy smoker, extensive decay, and inadequate previous endodontic treatments. Preventing recurrence requires highlighting the underlying etiology, which encompasses factors including individual circumstances and socioeconomic status.[1]

CASE BACKGROUND

A 43-year-old patient reported to the outpatient clinic at the Arab Academy for Science, Technology, and Maritime Transport, College of Dentistry, with primary concerns of pain while eating in the mandibular first molar on the left side, missing teeth, and bleeding while brushing. Regarding demographic details, the patient is a worker residing in El-Alamein, Egypt. The medical history revealed no significant illnesses, and his dental history included multiple previous treatments involving amalgam restorations.[4]

EXTRA-ORAL EXAMINATION

The general examination revealed facial symmetry, no lymph node tenderness, and normal mandibular movement. During the extra-oral examination, the frontal view showed equal facial thirds with parallel horizontal and vertical lines. The lateral view demonstrated a convex profile and normal nasolabial angle within the range (90–95). For the E line concept, both upper and lower lips were on the same line (the ideal upper lip was behind 4 mm and the lower lip was behind 2 mm), and the oblique profile showed no midface deformities and prominent nasolabial folds (Fig. 1). All extra and intra-oral photographs were taken by a professional DSLR Canon 800D and an external professional twin light with the aid of retractors and mirrors.

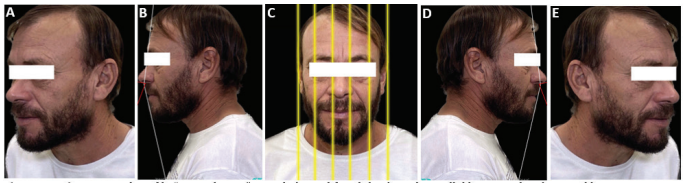

Fig. 1. Extra-oral examination photographs
(A): Left oblique view (B): Left lateral view (C): Frontal view
(D): Right lateral view (E): Right oblique view

INTRA-ORAL EXAMINATION

The frontal view revealed generalized marginal redness with rolled margins, blunt interdental papillae, brown stains, and mild fluorosis, according to Dean's fluorosis index. The occlusal view described a U-shaped arch and further highlighted multiple remaining roots (#15, and #25), several edentulous spaces, and poorly endodontic-treated teeth (#14, and #24). Additionally, there were defective amalgam fillings in teeth (#16, #37, and #47). Carious cavitation was present in teeth (#14, #17, #24, #26, #27, #36, and #45), as identified by G.V. Black. The periodontal examination indicated a probing depth of 5 mm and clinical attachment loss of 4 mm in tooth #26, with particular concern for the lingual surfaces of the mandibular anterior teeth. Mobility grade I was observed in teeth (#21, #31, #32, and #41) (Fig. 2).

On the radiographic examination, panoramic and periapical X-rays showed horizontal bone loss related to mandibular anterior teeth (#16, #17, #26, #27, #45, and #47), with widening of lamina dura and thickening of PDL space related to #36 (Fig. 3).

Fig. 2. Intra-oral examination photographs
(A): Left lateral view (B): Frontal view
(C): Right lateral view (D): Maxillary occlusal view
(E): Mandibular occlusal view

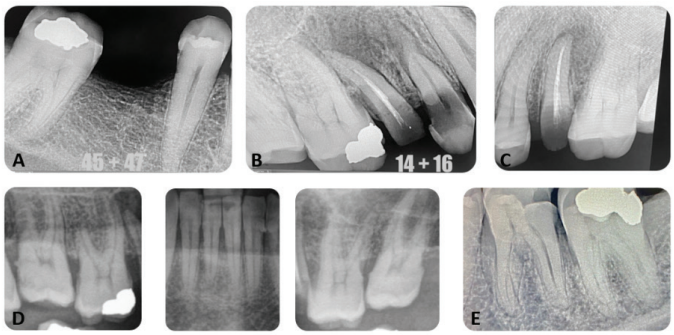

Fig. 3. Series of periapical X-rays showing
(A) (B) (C): A favorable crown to root ratio for (#45, #47), (#14, #16) and (#24, #26)
(D): Horizontal bone loss related to mandibular anterior teeth #16, #17, #26, #27, #45, and #47, with widening of lamina dura and thickening of PDL space related to #36
(E): An extensive caries for #36

2. DIAGNOSIS AND ANALYSIS

The periodontal diagnosis was generalized periodontitis stage III, grade B; the grade modifier was smoking. Bleeding on probing is an early sign of gingival inflammation; it revealed a generalized bleeding score (69/26*4 *100 = 66.3%), so the prognosis was questionable (Fig. 4).

For tooth #14, the endodontic diagnosis revealed a negative vitality test and a negative percussion test, leading to a definitive diagnosis of necrotic pulp with normal periapical tissues. In contrast, tooth #36 exhibited a positive vitality test with a

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delayed response and a positive percussion test, resulting in a definitive diagnosis of asymptomatic irreversible pulpitis accompanied by symptomatic apical periodontitis. The restorative diagnosis showed carious lesions, according to GV black, in teeth (#14 and #36). Class I: (#17, and #27); class II: (#24, #26, #36, #45), fractured amalgam in tooth #37, and recurrent caries with defective amalgam restorations in teeth (#16, #37, and #47). Finally, the prosthetic diagnosis showed multiple missing teeth (#15, #25, and #46) that needed to be replaced (Fig. 4). Thorough case analysis, a caries assessment test was conducted using the DMF and DMFS indices. (DMFT = 17, DMFS = 46), and it was found to be +9 (high caries index) by CAMBRA analysis (Fig. 5). All dental and periodontal chartings were recorded using digital software (Derec, Switzerland).

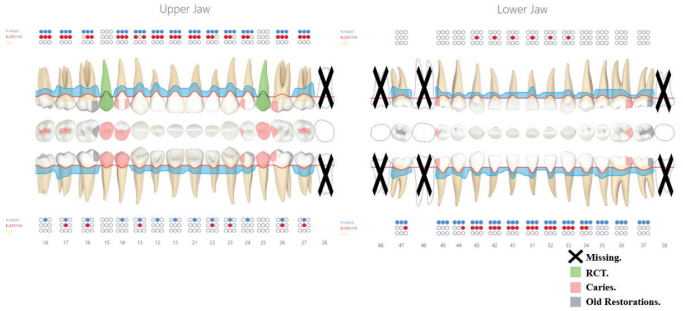

Fig. 4. Dental charting illustrates the probing depth, missing teeth, previous RCT, caries, and old amalgam restoration

		Low Risk	Moderate Risk	High Risk
Contributing Conditions		Check or Circle the conditions that apply		
I.	**Fluoride Exposure** (through drinking water, supplements, professional applications, toothpaste)	☑ Yes	☐ No	
II.	**Sugary Foods or Drinks** (including juice, carbonated or non-carbonated soft drinks, energy drinks, medicinal syrups)	Primarily at mealtimes ☐		Frequent or prolonged between meal exposures/day ☑
III.	**Caries Experience of Mother, Caregiver and/or other Siblings** (for patients ages 6-14)	No carious lesions in last 24 months ☐	Carious lesions in last 7-23 months ☐	Carious lesions in last 6 months ☑
IV.	**Dental Home**: established patient of record, receiving regular dental care in a dental office	☐ Yes	☑ No	
General Health Conditions		Check or Circle the conditions that apply		
I.	**Special Health Care Needs** (developmental, physical, medical or mental disabilities that prevent or limit performance of adequate oral health care by themselves or caregivers)	☑ No	Yes (over age 14) ☐	Yes (ages 6-14) ☐
II.	**Chemo/Radiation Therapy**	☑ No		☐ Yes
III.	**Eating Disorders**	☑ No	☐ Yes	
IV.	**Medications that Reduce Salivary Flow**	☑ No	☐ Yes	
V.	**Drug/Alcohol Abuse**	☑ No	☐ Yes	
Clinical Conditions		Check or Circle the conditions that apply		
I.	**Cavitated or Non-Cavitated** (incipient) **Carious Lesions or Restorations** (visually or radiographically evident)	No new carious lesions or restorations in last 36 months ☐	1 or 2 new carious lesions or restorations in last 36 months ☐	3 or more carious lesions or restorations in last 36 months ☑
II.	**Teeth Missing Due to Caries in past 36 months**	☐ No		☑ Yes
III.	**Visible Plaque**	☐ No	☑ Yes	
IV.	**Unusual Tooth Morphology** that compromises oral hygiene	☐ No	☑ Yes	
V.	**Interproximal Restorations - 1 or more**	☐ No	☑ Yes	
VI.	**Exposed Root Surfaces** Present	☐ No	☑ Yes	
VII.	**Restorations with Overhangs** and/or **Open Margins**; **Open Contacts** with Food Impaction	☐ No	☑ Yes	
VIII.	**Dental/Orthodontic Appliances** (fixed or removable)	☐ No	☐ Yes	
IX.	**Severe Dry Mouth** (Xerostomia)	☐ No		☑ Yes
Overall assessment of dental caries risk:		☐ Low	☐ Moderate	☑ High

Fig. 5. Caries Management by Risk Assessment (CAMBRA)

3. CLINICAL MANAGEMENT

The treatment strategy encompasses a number of crucial steps. The stabilization phase focused on initial treatment, including periodontal therapy, non-surgical interventions, and the temporization of deep cavities. The preparatory phase involved endodontic treatment of teeth (#14 and #36) and abutment preparation for final restorative and prosthetic treatments. The definitive phase included the restorative and prosthetic procedures, such as the cementation of the crown and fixed partial dentures. The goal was to entirely restore the patient's dental appearance and function. During the maintenance phase, follow-up, patient education, and reinforcement with dietary modifications were the main priorities.

3.1. Phase I "Stabilization Phase"

A primary impression was taken for both arches, followed by mounting the casts on a mean-value articulator (Fig. 6). Case analysis was conducted using the diagnostic cast, a panoramic X-ray, and multiple periapical X-rays (see Fig. 3).

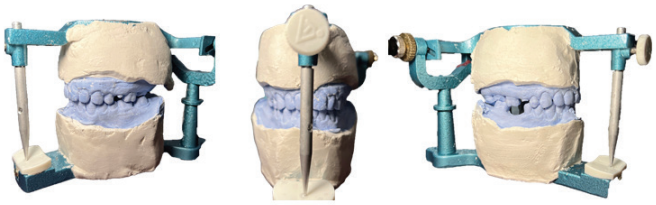

Fig. 6. Mounted cast on the mean value articulator showed adequate interarch space

3.1.1. Periodontal Therapy:

Plaque control encompasses supra- and subgingival scaling and root planing using manual scalers,[4] including a sickle scaler designed for the removal of the supragingival calculus for anterior teeth and a Jacquette scaler for posterior teeth. Subgingival calculus was removed with Columbia Curettes, which come in 2R/2L for anterior teeth and 4R/4L for posterior teeth (Nordent, USA). Pocket irrigation with tetracycline (dissolved in saline) was used to reduce inflammation[5] (Fig. 7). The patient was instructed to brush twice daily and use chlorhexidine (Hexitol, Egypt) for one week.[6] Oral hygiene practices were reinforced, and plaque levels were re-evaluated after two weeks.

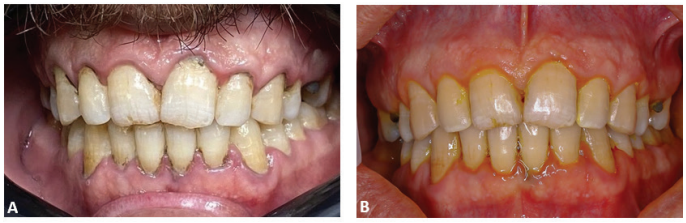

Fig. 7. (A): Preoperative photograph (B): After scaling and irrigation with tetracycline HCL

3.1.2. Non-Surgical Extraction

Non-restorable remaining roots #15, #25 were extracted using a periosteal elevator and upper remaining root forceps. After six weeks, the tooth sockets #15, #25 were healed and prepared for the construction of a fixed partial denture.

3.1.3. Restorative Treatment

All deep caries in teeth (#16, #27, #37, and #47)

were removed using ceramic burs (CeraBur, Germany) in a low-speed handpiece. Additionally, the defective amalgam restorations were sectioned using carbide burs; cavity preparation was carried out by applying a detecting dye (Seek, Ultradent, U.S.A.) for ten to fifteen seconds, which allowed for the visual differentiation between carious and healthy dentin and temporization (Fig. 8). Phase III involved the final restorations.

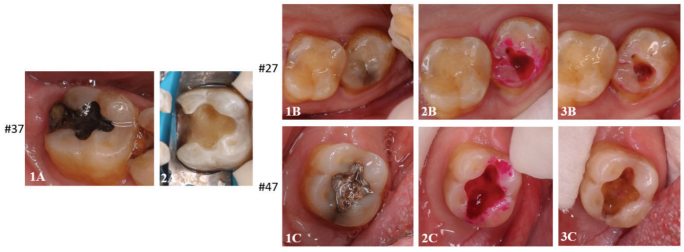

Fig. 8. Phase I "Stabilization Phase" describing
(1A, 1C, 1B): Defective amalgam restorations and undermined enamel. (2B, 2C): Application of detecting dye. (2A, 3B, 3C): After caries removal

3.2. Phase II "Preparatory Phase"

This phase was commenced by endodontic treatment of teeth #14 and #36. For tooth #14, the caries was removed, and an access opening was executed using a rose head, safe end burs, and an endo probe (DG16, Nordent) for scouting the canals. The initial step was restoring the deep lingual missing wall using "A Deep Margin Elevation Protocol." A circumferential stainless-steel matrix (TOR.VM, Russia) was applied around the tooth to seal the cervical margin. Afterwards, the deep margin was elevated using a highly-filled flowable and condensable composite restoration. Meanwhile, checking the working length, accidentally, a broken file (File 20) existed at the apical third of the buccal canal, so the option was to bypass the file using D finders and C files numbers 6, 8, and 10 (DentSply, Germany). The actual working length was confirmed using an apex locator (Dpex V from Woodpecker, China) and radiographically by "periapical X-ray" under complete isolation. Using a combination of "step back and crown down technique," the irrigation protocol was carried out with sodium hypochlorite 2.5% (Chorox, Egypt) for 5 minutes using a side-vented needle, followed by EDTA solution 17% for 5 minutes, saline solution, and the final irrigation was done by applying CHX. Master cones were verified by three techniques: clinically, tactile sensation, "true tag-back," and radiographically.[4] The obturation was done using the "cold lateral compaction technique" with a resin sealer (Nexobio T SEAL, Korea) (Fig. 9).

For the preparation of the fiber post, which was prepared using Gates Glidden and Peso Reamers, the fiber post (size two) was cemented using dual-cure resin cement (Riva, Korea), followed by core buildup using (Charm-Core, Korea) (Fig. 10).

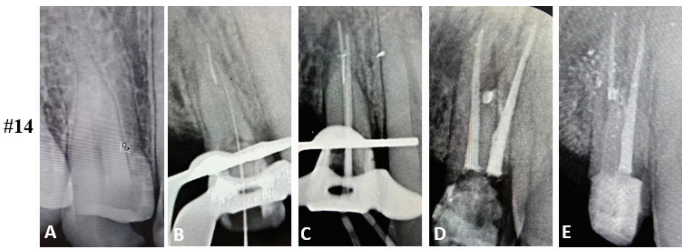

Fig. 9. Endodontic Treatment of #14
(A): A Preoperative X-ray (B): Broken file in the Buccal Canal (C): Master cone (D): Obturation (E): Post preparation

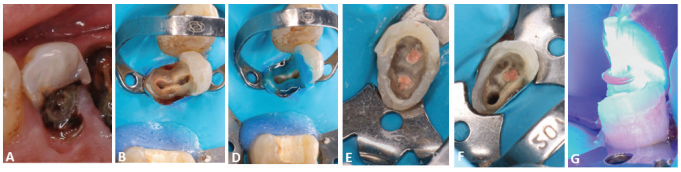

Fig. 10. Buildup of #14
(A): A Preoperative photograph (B): After caries removal (C): Applying detecting dye (D): Total-etch technique (E): After obturation (F): Post preparation (G): Cementation of fiber post

The five canals (MB, ML, DB, DL, and MD) of tooth #36 were meticulously explored. The canals were instrumented utilizing rotary files (Denjoy, China) and "the crown-down technique." The same irrigation protocol and obturation technique were applied. Subsequently, the buildup of the distal wall was executed using "the total-etch technique," followed by the application of a universal bonding agent. A nanofilled composite (NeoSpectra, DentSply, Germany) was applied using "the snow-plow technique" (Fig. 11).[6]

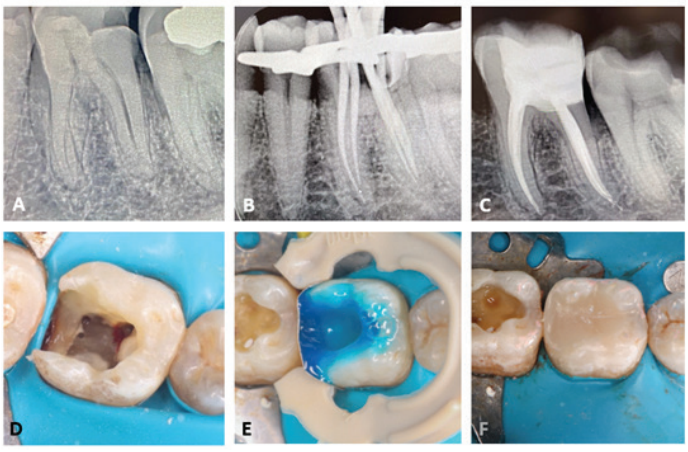

Fig. 11. Endodontic Treatment of #36
(A): A periapical X-ray confirmed deep caries, seen as a radiolucency on the distal side of tooth (B): Master cone try-in (C): After obturation and buildup (D): Access cavity (E): Total-etch technique (F): Postoperative

3.3. Phase III "Definitive Phase"

This procedure was performed under rubber dam isolation and commenced with the removal of stains and masking of fluorosis using pumice for surface cleaning, followed by the application of micro-abrasive paste (Opalustre, Ultradent, U.S.A.),

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a microabrasion paste containing hydrochloric acid and silicon carbide particles, was applied.[7] This involved gently rubbing the paste onto the affected enamel surfaces using opalcups. The microabrasion protocol was repeated four times for both the upper and lower arches. Finally, the treated surfaces were polished to enhance their aesthetics,[8] and a desensitizing agent was applied (GC Tooth Mousse, Japan) using a custom-made bleaching tray. The patient was also advised to avoid consuming coffee and tea for at least three days postoperatively (Fig. 12).

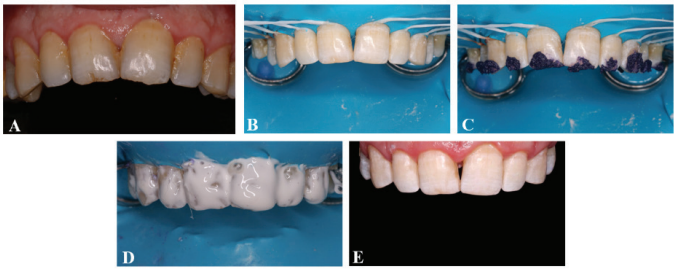

Fig. 12. Microabrasion Procedure.
(A): Preoperative photograph (B): After pumice application
(C): Opalustre application. (D) Application of GC tooth-moose
(E): Post-operative photograph

Direct composite restoration was used to restore teeth #17, #27, #37, and #47. Incremental and cusp-by-cusp methods were used. To guarantee a dry working environment, all restorative treatments commenced with the isolation of the teeth using a rubber dam, followed by the removal of temporary restorations and further excavation of any residual caries. After cavity preparation using a rose head, 245 burs in a high-speed handpiece. For tooth #27, a glass ionomer base was applied due to the depth of the cavity (Voco, Germany), followed by the application of a 37% acid etching using the "selective-etch technique" for 15 seconds, followed by rinsing and drying. Finally, two layers of an eighth-generation bonding agent (Bisco, U.S.A.) were applied for greater strength and deep penetration.[9] Subsequently, the application of composite restoration (Tetric-N-Ceram, Germany) followed by finishing and polishing using (EVE cups, Germany), in conjunction with aluminum oxide paste for lustrous surfaces (Fig. 13).

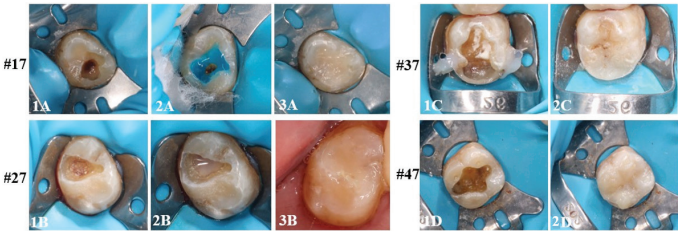

Fig. 13. Restorative Treatment of #17, #27, #37, #47
(1A, 1B, 1C, 1D): Cavity design. (2A): Selective-etch technique
(2B): Glass-ionomer application
(3A, 3B, 2C, 2D): Postoperative

3.3.1. Prosthetic Treatment

According to the guidelines for all-ceramic restorations, abutment preparation was performed with a radial shoulder finish line using a tapered diamond bur in a high-speed handpiece. The impression was taken thorough the "putty and wash technique" with condensation silicone material (Zhermack, Italy). Using a digital workflow (Exocad, Germany). In addition to a three-unit fixed partial denture that restored tooth #15, teeth #24 and #26 to restore tooth #25, and teeth #45 and #47 to restore tooth #46 using CAD/CAM workflow, the design incorporated a single crown for tooth #36 following endodontic therapy. The zirconium crown was milled from (VITA YZ-HT, Germany).[10] A zirconium cleanser (ZirClean, Bisco, U.S.A.) was used in order to improve bonding strength and eliminate salivary contamination prior to the cementation. This was followed by the implementation of the "total-etch technique," and the cementation process was carried out using a dual-cure resin cement (Fig. 14).

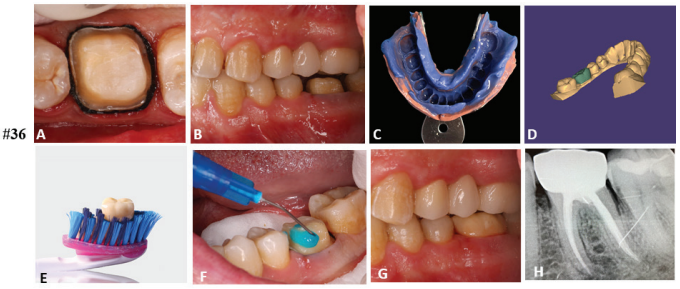

Fig. 14. Zirconium Crown on #36.
(A): Tooth preparation (B): Lateral view showing adequate clearance (C): Secondary impression
(D): Digital design on "Exocad" (C): After milling
(F): Total-etch technique (G): Cementation
(H): Post-operative radiograph

The crown-to-root ratio of zirconium fixed partial dentures was assessed using periapical X-rays for the condition of the abutments and the durability of the restoration. Prior to preparation, shade selection was taken using the (Vita shade guide, Germany). Abutments (#14, #16, #24, and #26) were prepared by reducing them to create adequate space for the zirconia fixed partial denture. The occlusal reduction was 1.5 to 2 mm, and the axial reduction was 1 to 1.5 mm with a radial shoulder finish line to provide adequate space at the cervical region so it can make the contour of the crown restoration within the contour of the natural tooth without overcontouring of the final restoration (Fig. 15. and 16).

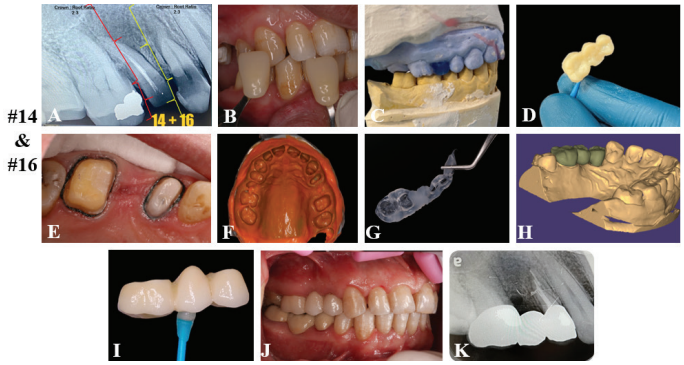

Fig. 15. Zirconium Fixed Partial Denture on #14 and #16 to restore #15
(A): Periapical radiograph (B): Shade selection
(D): Wax-up for provisional FPD (C): Provisional FPD
(E): Abutments preparation (F): Secondary impression
(G): Bite registration (H): Digital design on "Exocad"
(I): After milling (J): Cementation
(K): Postoperative radiograph

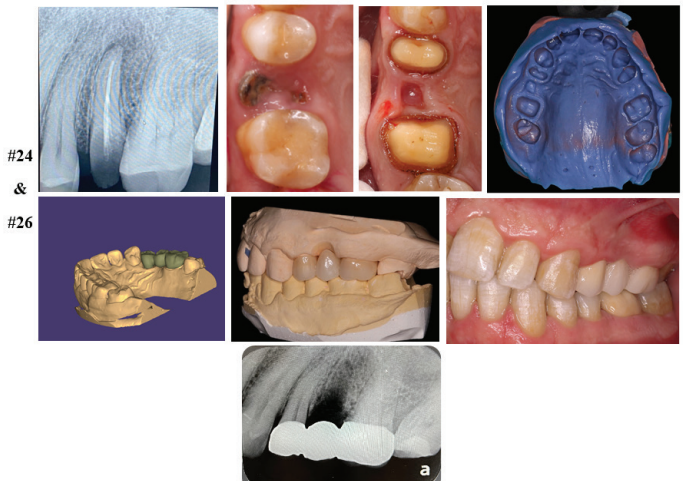

Fig. 16. Zirconium Fixed Partial Denture on #14 and #16 to restore #15

For the PFM-fixed partial denture, occlusal and axial reduction were done with a slight difference in the amount of reduction being 1.5 occlusally. Metal frameworks were fabricated, tried in, and then veneered with porcelain. Occlusal adjustments and post-operative instructions were all carried out (Fig. 17).

Fig. 17. Porcelain Fused to Metal Fixed Partial Denture on teeth #45, and #47 to restore #46

3.4. Phase IV "Maintenance Phase"

Patient education and ongoing program monitoring are included in this phase. As a result of the patient's high caries index, recall and follow-up appointments were arranged for every two to three months. The patient was instructed to brush his teeth twice daily using a soft-bristled [11] toothbrush with a zig-zag design to ensure effective cleaning and minimize gingival inflammation.[12] Additionally, the use of dental floss or alternative interdental aids such as interdental brushes or water flossers was recommended. The patient was advised to rinse twice daily for one minute with a 0.12% chlorhexidine gluconate mouthrinse for one week. Furthermore, dietary modifications were implemented to reduce high carbohydrate intake.

4. RESULTS

Post-treatment evaluation showed periodontal pockets were significantly reduced according to the probing depth measures at the end of the treatment. Teeth that underwent endodontic treatment and subsequent restorations showed no signs of periapical pathology or mobility. Functional and aesthetic outcomes of the rehabilitation revealed positive results and representative marginal adaptation; the patient reported an improvement in chewing efficiency, greatly enhancing the patient's self-esteem and satisfaction. The optical characteristics after microabrasion can disguise the staining of the enamel. In this case, the brown spots disappeared after microabrasion, resulting in a more uniform and aesthetically pleasing tooth appearance. In his own words, the patient regains his confidence and the ability to smile again. Three weeks postoperatively, regular follow-ups were scheduled for clinical and radiographical evaluation, which revealed a high rate of success (Fig. 18).

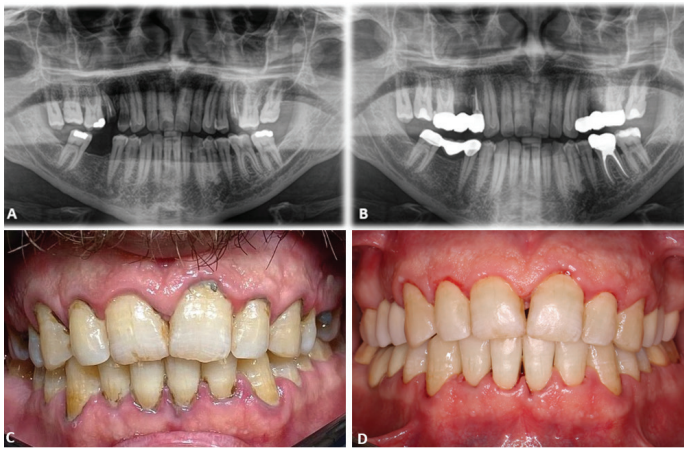

Fig. 18. (A): Preoperative X-ray (B): Postoperative X-ray
(C): Preoperative clinical photograph (D): Postoperative clinical photograph

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5. DISCUSSION

The successful outcome of this full-mouth rehabilitation case underscores the importance of comprehensive treatment. This collaborative effort ensured that all aspects of the patient's oral health were addressed, from disease control to functional and aesthetic restoration. The strategic extraction of non-restorable teeth was essential for eliminating sources of infection and inflammation.

The patient's chronic periodontitis presented a significant obstacle. Initial periodontal therapy, including supra- and subgingival scaling and root planing, was crucial in stabilizing the patient's condition, especially with the use of tetracycline irrigation. The main advantage of irrigation of periodontal pockets with tetracycline-HCl appears to be the localized concentration of the drug at the sites of disease activity. Tetracycline has an anti-collagenolytic effect and the ability to penetrate gingival crevicular fluid and soft tissues, providing an antibacterial effect compared to mechanical debridement alone. [5]

Dental caries is a multifactorial lifestyle disease where a patient's commitment to medical advice on nutrition, lifestyle, and oral hygiene practices is crucial. Dental caries can impact general health through a variety of mechanisms. Tooth loss can affect masticatory function, affecting food selection and nutrition changes.[1] There were numerous missing teeth (#15, #25, and 46) and extensive cavities in teeth (#14, #36, #17, #27, #24, #26, #36, and #45) that provided difficult restorative issues. In addition, the patient's high caries index led to the recommendation for a full-coverage restoration as a course of treatment.

Endodontic treatments preserved the remaining teeth, ensuring they could serve as reliable abutments for a crown and bridges, especially tooth #14 with severe destruction. It gave a high success rate with no sings or periapical pathosis, which is described as initial success, in addition to scheduled follow-up to confirm the 100% success rate. Multi-visit endodontics was performed in tooth #15 to ensure an aseptic condition and free symptoms before obturation, so after the endodontic treatment, it has a proven record of better healing and fewer post-operative complications.[14]

The aesthetic improvement of the patient's smile was a key treatment objective; the use of the microabrasion approach enhanced the appearance of the patient and reduced stains and fluorosis, so it can easily remove brown stains and mild to moderate fluorosis.[8] The minimally invasive approach allows good aesthetic results and a possible cost reduction for patients without causing the significant structural loss of enamel required for ceramic restorations.

Concerning the final prosthetic restorations, zirconia was chosen as it has the highest mechanical properties among all dental ceramics. It also exhibits low bacterial adherence, which is essential for the survival of the prosthesis.[4] The radial shoulder finish line was chosen due to the high fracture resistance and distribution of the occlusal forces along the margin of the restoration.

Regarding the cementation procedure, the thickness of the zirconia affects light curing and, therefore, polymerization of the dual-cure resin cements used under these structures. There is a negative correlation between the thickness of zirconia and polymerization.[15]

6. CONCLUSION

Full-mouth rehabilitation is a complex and difficult procedure that requires the proper application of interdisciplinary concepts to achieve functional and aesthetic success.[14] The treatment outcomes resulted in improved occlusal stability, masticatory efficiency, and a significant boost in the patient's self-esteem. Deep margin elevation is a novel approach that elevates the cervical margin in a conservative way, thereby facilitating field isolation, impression-taking, and cementation. Regular follow-ups and maintenance were emphasized to ensure the longevity of the treatment outcomes. This case highlighted the high success rate, and the use of advanced restorative techniques resulted in significant improvements in the patient's oral health and quality of life. To ensure consistent success, a thorough diagnostic and treatment plan are required. The ultimate goal of complete mouth rehabilitation is to restore the masticating mechanism to its natural and healthy function. [16]

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