

Case Report

Fixed partial denture failure rehabilitation using fixed and removable partial denture designs

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ABSTRACT:

Fixed partial dentures normally fail due to secondary caries developing under a poorly designed restoration with overcontoured retainers. The secondary caries progression is different from that normally seen in natural teeth, since it initiates at a different surface. The bacterial colonies also differ due to different oral environments. We present a case of an adult female patient in her late forties, who reported losing her two maxillary posterior fixed partial dentures a few months back. Examination revealed a Kennedy Class 3 modification 1 in the maxillary arch and a Kennedy Class 1 partial edentulous arch in the mandibular arch. The treatment plan decided was remaking one maxillary FPD and a removable partial denture over the remaining maxillary and mandibular arches. A combination of single crowns, modified abutment retainers, cast partial dentures, and fixed partial dentures was used to complete oral rehabilitation. The patient was highly satisfied with her treatment outcome and continues to visit for follow-up.

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INTRODUCTION

Fixed partial dentures (FPD), also called in layman terms a bridge, are a prosthodontic treatment option that can replace missing tooth/teeth or restore a decayed tooth to primarily improve masticatory function and facial appearance related to tooth loss. However, they impart an irreversible loss of natural tooth structure, which is necessary to accommodate the restoration.¹ such irreversible loss of tooth structure comes with the hazard of tooth sensitivity, secondary caries, or periodontal problems.² For a patient, the treatment is preferred due to the nature of being fixed as compared to the removable treatment option. They are less economical to the patient than removable dentures but less intrusive than dental implants.³ However, they are not indicated for long edentulous spans, soft tissue replacement in cases of severe ridge loss, and very young patients.² FPDs, despite lasting for a long time, often fail clinically, mainly due to either biological or mechanical reasons. In reality they are often combined, as one failure leads

to the development of the other. Clinical studies show that the failure rates for traditional tooth-supported FPDs over 5 to 10 years range from 10% to 25%.^{1,2} major risk factors for FPD failure include poor oral hygiene practices, high existing caries index, parafunction, and weak abutments, while there are also iatrogenic factors, with overcontoured restorations being the most common. There are different types of FPDs depending upon different clinical situations, including single crowns (full and partial crowns, endocrowns), fixed movable and fixed removable bridges, resin-bonded (Maryland) bridges, cantilever bridges, and implant-supported prostheses.⁴⁻⁹ The choice depends on the span, the quality of the abutment, the patient's needs, and how the bridge receives its support. The traditional tooth-supported FPD, which uses retainers on abutment teeth to support pontics, is appropriate for short edentulous spans with healthy abutments. It is typically used when adjacent teeth have caries and need restorations or crowns or when implants are not an

option.¹⁰ Failure rates vary according to the FPD design, materials used, patients' characteristics, and skill and experience of the clinicians.¹¹

Developing secondary caries under a crown or a bridge is one of the common failures and is primarily developed due to overcontoured restorations that promote the collection of bacteria. These occur in cervical regions and are closely associated with the roots of natural teeth. The microbiota linked to secondary (recurrent) caries shows major differences from those of initial coronal lesions, yet there are some overlaps and differences between people.¹² Both types of caries are caused by biofilms, and mutans streptococci and lactobacilli are important acid-producing bacteria that help lesions form.¹³ These bacteria are regularly present in secondary caries locations, suggesting a common cariogenic core with original lesions. Secondary caries mainly forms at the contact between the material and the tooth. This is affected by marginal gaps at the edges, rough surfaces, and the chemistry of the restorative material, as well as diet and saliva.¹⁴ Studies indicate that bacterial colonies at the cavity-restoration interface mimic bacterial flora observed in root caries, indicating ecological transitions rather than a fixed primary-caries pattern across time.^{2,12} Limited studies indicate that mutans streptococci and lactobacilli tend to be more abundant in progressing secondary lesions, although the broader microbial community includes additional anaerobes and bridge species similar to mature biofilms on exposed root or cervical surfaces. The "secondary caries microbiota" is not defined by specific pathogens but rather by a context-altered caries biofilm, whose composition is significantly influenced by the restoration site, the materials employed, and the condition of microleakage. Irrespective of the cause, the secondary caries progresses fast, most of which is hidden under the restoration and causes gross damage to the structure of the tooth. If periodontitis does not occur, then patients usually come to know once the bacteria has reached the pulp below the FPD.

We present a case of an adult female patient who had lost two of her previous maxillary FPDs as a result of secondary caries in one and the other due to improper tooth preparation.

CASE REPORT

A female patient in her late forties reported to the department of prosthodontics with the chief complaint of inability to perform masticatory function. The patient's personal, social, and medical history didn't present any conclusive evidence of abnormality that would alter the current status of prosthodontic treatment. Dental history revealed the patient had lost multiple maxillary and mandibular posterior teeth over a period of the last 5 to 7 years and had gotten replacement of maxillary posteriors about 2 years back. Both bridges were lost after they became loose. The patient's extraoral examination also did not

present any parameter indicating disturbance in pulpal, periapical, or temporomandibular joint health. Intraoral examination disclosed a maxillary class 3 modification 1 partial edentulous situation (Figure 1A), while the mandible had a Kennedy class 1 partial edentulous situation (Figure 2A). The maxillary right side second premolar was grossly decayed, while the posterior abutment had developed severe periodontitis; however, the other side prepared abutment was in good condition and was considered for the treatment plan. The patient was presented with multiple treatment options, including implants, but she chose a more economical treatment option. The treatment plan for the maxillary arch included extraction of the right-side distal abutment, endodontic treatment of the maxillary right second premolar followed by post core and crown restoration, and a three-unit FPD of the left-side prepared abutments after evaluation of the pulp. For the mandibular arch, the treatment plan included three modified premolar metal-ceramic crowns on either side of the arch, which would have an extended occlusal rest on which a cast partial denture would be supported. A written informed consent was taken from the patient, following which all preprosthetic treatments were completed. The prosthodontic treatment started from making diagnostic impressions with irreversible hydrocolloid (CA 37; Cavex, Haarlem, Holland) and mounting diagnostic casts (Type-II dental stone, Pankaj Industries, Mumbai, India) on a programmed semi-adjustable articulator (Hanau Widevue, Waterpik, Ft. Collins, CO, USA). Since one of the maxillary posterior teeth had to be extracted, the classification changed to Kennedy Class 2 Modification 1 for the maxillary arch. A custom-made cast post-core crown was fabricated using a direct technique with pattern resin (Duralay) (Figure 1B), which was cast using nickel-chromium alloy (Remanium CSe, Dentaurum J.P. Winkelstroeter KG, Ispringen, Germany) (Figure 1C) and later cemented using zinc phosphate (Harvard, Germany) cement. Once the cast post core was cemented, the preparations were refined, and a three-unit fixed partial denture on the left and a single crown on the right second premolar were fabricated and cemented in their respective places (Figure 1D). The unilateral right-side edentulous space was restored with a heat-cured polymethyl methacrylate (DPI, India) interim partial denture (Figure 1E). For the mandibular arch, the modified crowns were fabricated and tried (Figure 2A) in the patient, following which the porcelain (VMK-95 Metall Keramik; Vita Zahnfabrik, Bad Sackingen, Germany) was built up against the crowns of opposing arches (Figures 2B and 2C). The mandibular modified crowns were cemented in place (Figure 2D), and final impressions were made with cemented crowns. The cast partial denture (Wiron 99; Bego, Bremen, Germany) was designed for a bilateral distal extension, and after fabricating the metal framework, a trial fitting was performed on the master

cast (Figure 2E). The steps of cast partial denture were then performed with a metal trial and a denture trial (Figure 3 A and B) once teeth were arranged on the framework. Once the cast partial denture was processed, the final cast partial denture was inserted in the mouth, and the patient was given instructions regarding the use and maintenance of all prostheses.

The patient was put on a regular follow-up protocol for a period of 5 years, which was scheduled as 1 day, 1 month, 3 months, and every 6 months. At subsequent follow-ups, the patient was satisfied with the overall treatment outcome and continued to perform functions efficiently (Figure 3 C).

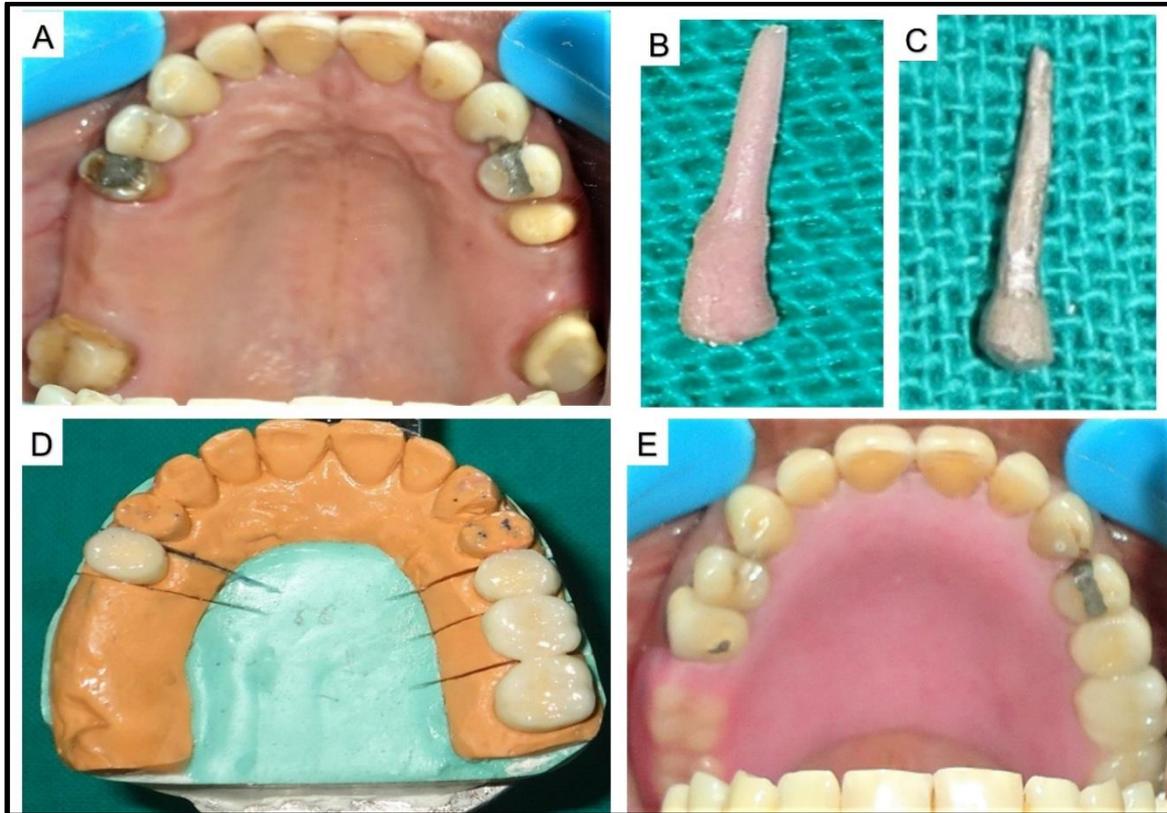


Figure 1: (A) Intra oral view of maxillary arch showing loss of FPD on left and grossly decayed premolar on right (B) Pattern resin direct pattern (C) Cast post core (D) Metal ceramic FPD and single crown for maxillary arch (E) Interim partial denture in maxillary arch.

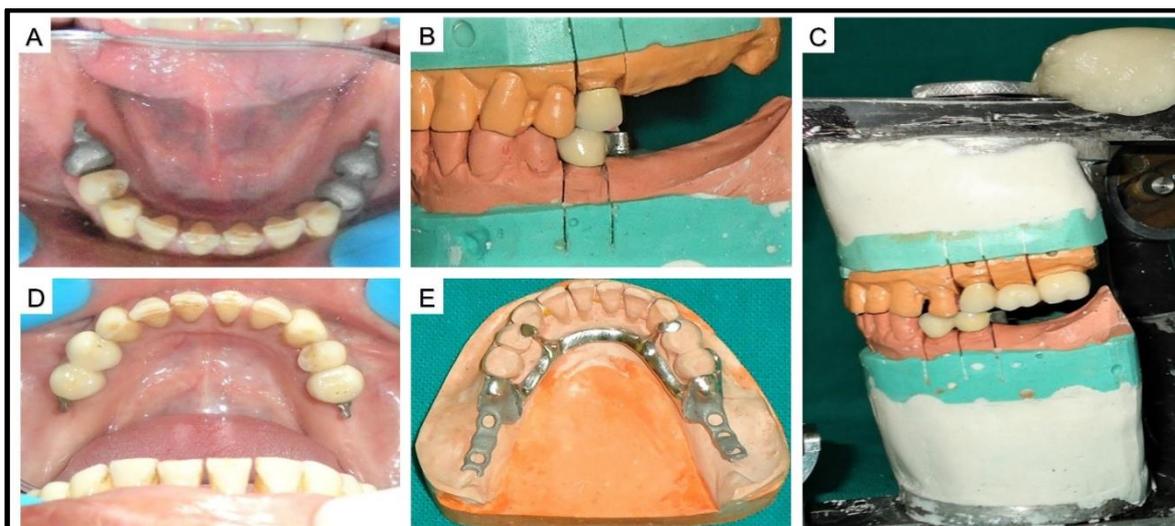


Figure 2: (A) Mandibular trial of modified crowns (B) Modification of mandibular crown in lateral view (C) Articulator relation of two opposing prosthesis (D) Modified crowns cementation (E) Cast partial denture framework design.



Figure 3: (A) Denture trial procedure in frontal view (B) Lateral view of trial mandibular denture showing occlusal relation (C) Patient at post follow up visit

DISCUSSION

A female patient who reported with two failed maxillary FPDs was successfully rehabilitated for occlusion using a combination of two different forms of FPD (single crowns and a three-unit bridge), an interim partial denture, and a definitive cast partial denture. Secondary caries in relation to an FPD or any other cervical restoration occurs through the same process as that of any type of dental caries; however, the cause in these cases is associated with overhanging or incomplete restoration margins or adaptation, marginal microgaps, and undercut areas that have the capability to retain dental plaque.¹⁵ Marginal gaps, open margins, or rough overhangs at the crown-tooth interface are ideal for accumulation of saliva, cariogenic acids, and cariogenic bacteria to infiltrate the luting cement spaces. Over a period of continuation of such an environment, degradation of the luting agent through solubility and disintegration increases microleakage, permitting more cariogenic plaque and acids to demineralize the adjacent tooth structures having different capabilities to undergo destruction, ultimately resulting in secondary carious lesions that may also proceed subgingivally.¹⁶ The design of FPD retainers, pontics, and sometimes even connectors complicates removal of plaque by individuals, particularly with overcontoured margins and poorly designed embrasures. Proper embrasures are essential for a fixed partial denture to impart a self-cleansing mechanism. All ceramic FPDs in posterior teeth with less vertical height can compromise adequate embrasure design, resulting in embrasure closures due to connector height.¹¹ Poor oral hygiene results in an oral biofilm with high cariogenic bacteria to build up over previously accumulated dental plaque, which makes the area around the tooth-restoration interface more vulnerable to acidic degradation and speeds up the

demineralization process.¹⁷ Additionally, patients with inadequate oral hygiene maintenance demonstrate an elevated rate of secondary caries, which increases with extended follow-up periods. The maxillary right premolar had undergone the same process and resulted in destruction of the coronal tooth structure. The only treatment choice left for restoring this tooth to serve as an abutment was a cast post core. Since the tooth was to serve as a future abutment for a cast partial denture, a cast post core was a better choice than a prefabricated fiber post core. A cast post core strengthens the already weakened tooth structure, while prefabricated posts still depend on the remaining tooth structure to impart strength.^{18,19} The mandibular distal extension partial denture derived its support from modified extensions from the abutment crowns. This design allowed the cast partial denture to minimize forces on the edentulous ridge while transferring them to the abutment tooth. This design allows longevity of the surveyed crowns, since none of the components are actually engaging the crown, while the function of the rest seat is provided by the modification of the crown, which extends distally.^{20,21} Cobalt-chromium alloyed denture bases used primarily for cast partial denture frameworks provide high strength at minimum desired thickness, improving fracture resistance, phonetics, and patient comfort.^{22,23} Additional advantages include better adaptation, enhanced thermal conductivity, reduced food and plaque accumulation on tissue surfaces, and potential reduction in Candida-related problems compared with conventional resin in selected patients.²⁴

Despite the case being a form of complex occlusal rehabilitation, the final outcome of the treatment largely depends upon the level of patient education and motivation imparted by the clinician. Although the patient had good oral hygiene visible in the anterior teeth, the patient at the same time had lost

multiple posterior maxillary teeth due to the poor hygiene maintenance. Posterior teeth require additional forms of oral hygiene maintenance aids like dental floss or toothpicks, both of which were missing from patients' practices. The patient started using a toothpick only once the food started impacting under the fixed partial denture.

CONCLUSION

A fixed partial denture failure is not uncommon, although there are fewer reported cases where a failed FPD was treated by FPD again. All forms of FPDs require ideal oral hygiene maintenance; therefore, both clinicians and patients need to understand that FPDs are prone to secondary caries development because of the overall marginal inaccuracies they possess.

Conflict of interest: None

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