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CASE REPORT

Prosthodontic rehabilitation of partial edentulism: Fixed-Removable approach

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Cobalt-chrome denture, Dental prostheses, Fixed-removable prostheses, Milled features, Partially edentulous

ABSTRACT

Effective history-taking and comprehensive clinical investigations play a vital role in systematic treatment planning process for a successful treatment outcome. This case report highlights prosthetic rehabilitation utilizing milled featured fixed-removable prostheses taking into account patient concerns to achieve aesthetically pleasing outcome without surgical intervention. A 68-year-old Malay female was unsatisfied with her maxillary partial acrylic denture and requested for a substitute. Several treatment options were discussed to replace the multiple missing teeth on both arches. The implant-retained prosthesis was not considered as an ideal treatment option due to the patient's financial constraint and reluctance for surgical intervention. Combination of fixed-removable prostheses were planned. The maxillary removable partial cobalt-chrome denture was fabricated with milled features of anterior fixed dental prosthesis to enhance the retention, support and stability of the prosthesis. Mandibular partial cobalt-chrome denture with composite build-up on attrited anterior teeth were fabricated as a definitive treatment plan. This prosthodontic management was able to provide satisfactory aesthetic and functional outcome thus achieving a mutually protected occlusion scheme. Regular prostheses maintenance and oral hygiene instructions will enable the patient to perform adequate plaque removal. Ultimately, meticulous case selection is essential to achieve favourable longevity of the prostheses. (IJP 2025;6(1):10-14)

Introduction

A successful treatment outcome relies on effective clinical decision. Clinical decision is facilitated by history-taking, clinical investigation process with several treatment options which leading to a sequential treatment plan based on patient's concern and agreement.[1] Therefore, prosthodontic rehabilitation is essential to restore aesthetic form and function of the patient thus contributing to the health of stomatognathic system.[2] Management of partial edentulism includes various treatment options such as from a provisional removable partial denture, a definitive cast partial denture, a resin bonded prosthesis, fixed partial denture or Osseo integrated implant prosthesis.[3] Fixed-removable approach is applicable in certain cases where fixed prosthodontics is unfavourable to perform due to clinical situations such as long span residual ridge and patient financial constraint for implant supported prosthesis.[4,5] However, analysing the nature of patient's occlusion as well as determining the type of occlusal approach is necessary in the treatment planning process. Generally, there are two types of occlusal approach such as conformative and reorganised approach. Conformative approach is adapted by providing restorations conforming to the patient's existing intercuspal position where there is sufficient space available for fixed or removable prostheses. Reorganised approach may applied either in centric relation or increase vertical dimension forms based on patient condylar position to achieve favourable inter-occlusal space for fabrication of prosthesis.[2,6,7]

The aim of this case report is to highlight the ability to utilize pre-existing oral condition in the process of full-mouth rehabilitation taking patient's perception into account. Milled features partial denture prosthesis has long been considered advantageous in dentistry as it combines fixed and removable prosthodontics in such a way as to enhance aesthetic in removable prosthesis. However, most dental professionals have largely neglected the option in the past for legitimate reasons, due to its complicated technique and high technical demand especially in treatment planning, designing and fabrication. In this case, periodontally stable abutment teeth enabled the clinician to apply the concept of milled featured prosthesis as a retainer to partial cobalt-chrome denture. Periodontal health of abutments and prosthetic factors share a close relationship in determining the success of treatment. Periodontal health reflects the longevity of restorations. Thus, it is crucial to determine the prognosis of individual tooth and overall dentition to develop treatment strategies. In this case, the periodontal stability was assessed based on general and local factors. Generally, patient is well motivated in practicing oral hygiene, no smoking habit or systemic illness which may contribute to periodontal disease. Periodontal pocket depth was examined and the deepest probing depth on all abutment teeth was

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Table 1. Basic Periodontal Examination (BPE)

2	2	2
2	2	-

Table 2. Dental charting based on the ICDAS Codes

Tooth	Findings	ICDAS Code
18	Clinically missing	99
17	Amalgam restoration on occlusal surface	40
16-11	Clinically missing	97
21-23	Temporary bridge with composite materials	80
24	Composite restoration on mesio-occlusal surfaces	30
25	Sound tooth surfaces	00
27	Amalgam restoration on occlusal surface	40
28, 38	Clinically missing	99
37-34	Clinically missing	97
33-43	Attrited composite restoration on incisal region	97
44	Attrited composite restoration on disto-occlusal region	30
45	Sound tooth surfaces	00
46	Clinically missing	98
47	Amalgam restoration on occlusal surface	40
48	Clinically missing	99

Table 3. ICDAS Codes based on caries severity, restoration status and missing conditions

Caries severity		Restoration status	
Code	Description	Code	Description
0	Sound tooth surface	0	Unrestored and unsealed
1	First visual change in enamel	1	Partial sealant - a sealant which does not cover all pits and fissures of the both surfaces
2	Distinct visual change in enamel	2	Full sealant
3	Localised enamel breakdown due to caries with no visible dentin	3	Tooth-coloured restoration
4	Underlying dark shadow from dentin (with or without enamel breakdown)	4	Amalgam restoration
5	Distinct cavity with visible dentin	5	Stainless-steel crown
6	Extensive distinct cavity with visible dentin	6	Porcelain, gold or preformed metal crown or veneer
		7	Lost or broken restoration
		8	Temporary restoration
Missing conditions			
97	Permanent tooth missing due to caries		
98	Permanent tooth missing for other reasons		
99	Unerupted tooth		

Table 4. Sensibility Test

Tooth	EPT	Cold Test	Findings
25 (c)	6.0	+	Responsive
33 (c)	5.0	+	Responsive
17(t)	8.0	+	Responsive
21(t)	7.0	+	Responsive
23(t)	8.0	+	Responsive
24(t)	11.0	+	Responsive
27(t)	10.0	+	Responsive
44(t)	13.0	+	Responsive
47(t)	9.0	+	Responsive

noted to be 3 mm. This condition is favorable as studies revealed that deep probing depths and alveolar bone resorption may be risk factors for periodontal breakdown in future.[8,9] Inability to access the deepest area for oral hygiene maintenance as well as microbial environment favoring periodontal pathogens due to opportunistic changes may led to periodontal disease. Harmonious relationship between prosthesis and periodontium is also significant in maintaining aesthetics and longevity of prosthesis.[10,11] Therefore, the design and contour of the milled features porcelain-fused to metal (PFM) fixed dental prosthesis was selected in consideration of aesthetic and the health of periodontium.

Case Report

A 68-year-old Malay female was referred from outpatient department to restorative specialist clinic for fabrication of new set of dental prosthesis. She wished to replace her current maxillary acrylic removable partial denture and her temporary bridge due to dissatisfaction with the disproportionate appearance in terms of tooth shape and size. She claimed that she had experienced with long span fixed dental prosthesis which was fabricated by general dental practitioner in private clinic several years ago. However, the abutments of the long span fixed dental prosthesis were sectioned and extracted due to undermined or subgingival caries. Patient presented to our clinic with unsatisfactory maxillary partial acrylic temporary denture with 3-unit temporary bridge from tooth 21 to 23 figure 1. Her medical history revealed that patient has osteoarthritis and was on ibuprofen (non-steroidal anti-inflammatory drugs) 400mg x BD x 1/52 or PRN basis. She has regular follow-up in government medical clinic for her medical illness and she has no history of any allergies. Previous dental history revealed that she was an irregular dental attendee and had undergone scaling, dental filling and extraction without complications. Social and family history were also noted to be unremarkable.

Extraoral examinations revealed no abnormalities. No asymmetry of the face was detected, and the lips were competent. She has a Class I skeletal pattern and the mouth opening was normal (35mm) with no enlargement or tenderness of the lymph nodes. There is no clicking or tenderness in the temporomandibular joint and no deviation upon closing and opening the mouth. Intraoral examination revealed that lips, tongue, oral pharynx, hard and soft palate appeared normal. Saliva was thick with good quality and quantity. Her oral hygiene was fair with localized bleeding on probing on tooth 17 (mesial surface) and 47 (mesial surface). 2mm gingival recession noted at 24 and 25 buccal surfaces. Thin plaque and calculus were noted on the surface of maxillary and mandibular posterior teeth. No deep pocketing, abscess, sinus and teeth mobility noted. Basic Periodontal Examination (BPE) revealed score 2 on all 5's sextant table 1.

She has maxillary and mandibular partial edentulous dentition with Kennedy Class III Modification II on the maxillary arch and Kennedy Class II Modification II on the mandibular arch figure 2. Full mouth dental charting table 2 was performed based on the International Caries Detection and Assessment System (ICDAS) table 3.

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Figure 1. Intraoral pre-operative photographs; A. Labial retracted view, B. Maxillary anterior view, C. Mandibular occlusal view



Figure 2. Radiographic assessment of periapical radiographs of maxillary and mandibular teeth



Figure 3. Post-cementation view of 3-unit PFM milled fixed dental prosthesis/bridge



Figure 4. Post-operative photographs of fixed-removable prosthesis

Space analysis and occlusal analysis were performed. The interocclusal space of the edentulous area was sufficient. There is anterior and posterior tooth contact (23 with 33, 17 with 47) and teeth 24, 25 and 27 are not overerupted. Special investigation such as sensibility test (electrical pulp test (EPT), cold test) table 4 and radiographic assessment via periapical radiographs figure 3 were taken. Teeth as control are 25 and 33 whereas teeth as test are 17, 21,23,24,27,44,47. Electrical pulp and cold test revealed positive responses on all control and test teeth.

Several periapical radiographs were taken. There is generalised maxillary and mandibular horizontal alveolar bone loss mostly at 1/3 of the coronal root length. All periodontal ligament (PDL) widening with intact lamina dura. There is no periapical radiolucency detected on all periapical areas of the teeth. Favourable crown-root ratio of all maxillary and mandibular teeth noted within 1:2 and 1:1. Radiopacity noted at crown region on teeth 17, 21-23, 24, 27,44 and 47. Based on the intraoral and radiographic findings, the diagnoses of the case are partially edentulism, normal pulp with normal apical tissues of 17, 21, 23, 24, 27, 44 and 37 based on the endodontic diagnosis by American Association of Endodontists 2013, periodontal health in reduced periodontium (Chapple 2018) and defective composite restorations on 33-44.

Assessment of restorability of the temporary bridge abutments from 21-23 was performed and resulted in favourable prognosis with no caries and pulpal involvement. There was sufficient remaining tooth structure on the abutments on 21 and 23 after temporary bridge removal. Problem lists were identified such as patient was unsatisfied with the appearance of the existing acrylic partial denture as well as maxillary anterior fixed dental prosthesis (bridge) and clinically missing several maxillary and mandibular teeth due to caries and periodontal disease. Therefore, the treatment aims of the patient may focused on prosthodontic rehabilitation. For instance, to replace the clinically missing teeth with fixed and/or removable prosthesis. Secondly, to improve aesthetic of the patient by producing the favourable anterior tooth proportion and smile of the patient. Last but not least, to restore to optimum function and rehabilitation of occlusion and to improve the quality of life (QoL) of the patient.

Several treatment options were discussed with the patients regarding the advantages and disadvantages on each treatment.

Treatment option 1 (fixed prosthesis): Implant supported fixed dental prosthesis with and/or without bone augmentation (16-14, 13-11), 26, 34-36, 46; Fixed-fixed conventional porcelain fused to metal (PFM) or porcelain fused to zirconia (PFZ) fixed dental prosthesis/bridge from 21 -23; Composite build-up to minimised the space between 32 and 31; Restore and recontour composite restorations on incisal edges from 33-43; Removal of defective composite restoration and placement of new composite restoration on 44.

Treatment option 2 (fixed-removable prosthesis):- Fixed-fixed conventional porcelain fused to metal (PFM) or porcelain fused to zirconia (PFZ) fixed dental prosthesis/bridge from 21-23 with milled features; Maxillary and mandibular partial cobalt-chrome partial dentures; Restore and recontour composite restorations on incisal edges from 33-43; Removal of defective composite restoration and placement of new composite restoration on 44; Implant therapy to replace maxillary and mandibular missing teeth may require bone augmentation and/or sinus augmentation. The patient preferred a less invasive treatment prior to implant therapy. Hence, treatment option 2 was chosen. This treatment was considered conservative, less invasive, less costly and able to provide optimum function and aesthetic for the patient. Informed consent was obtained from the patient and explained regarding the procedure. Below are the treatment phases and stages: Phase 1: Prevention. This phase consists of oral hygiene instruction (OHI) and motivation. She was advised to practice good oral hygiene care to prevent any oral diseases in the future and she was advised to brush using fluoridated toothpaste and floss the teeth regularly. She was recommended to use dental floss or super floss to clean the interproximal region; Phase 2: Diagnostic and treatment planning. This phase focused on primary impressions for study models, diagnostic wax-up, porcelain shade selection and prosthesis design for future fixed-removable prosthesis. The porcelain fused to metal fixed prosthesis with 2/3 palatal metal coverage was planned with 3-unit fixed-fixed conventional PFM bridge from 21-23 with milled features (guiding plane on mesial of 21 and palatal ledge on 21 and 23); Phase 3: Interdisciplinary intervention and maintenance. For instance, non-surgical periodontal therapy (scaling and polishing), reviewed periodontal status and reinforced oral hygiene after 2 weeks. Defective composite restoration was removed and replaced with new composite on 44. The attrited mandibular anteriors were restored with composite restorations to re-establish favourable vertical dimension.

Phase 4: Fixed prosthodontic phase involved abutments preparation for fabrication of 3-unit milled featured of PFM fixed dental prosthesis/bridge from 21-23. The triple cord gingival retraction technique was used soaked with ViscoStat™ clear haemostatic gel. The maxillary working impression was taken using the dual-phase impression technique (heavy and light-bodied consistency polyvinyl siloxane (PVS) (Aquasil, Dentsply Sirona, USA) impression materials.

An interocclusal record was taken using polyvinyl siloxane (EXABITE™, GC, USA) at centric occlusion. The working impression, interocclusal record and mandibular study model cast were sent to dental laboratory for construction of the 3-unit milled bridge.

Definitive fixed indirect restoration was tried inside the mouth. Aesthetic, marginal adaptation, occlusion and function were assessed. Surface treatment of air-particle abraded with 50- m alumina oxide of the intaglio surface of restoration was performed prior to cementation. The prosthesis was cemented using resin-based cement (Rely X™ 200, 3M ESPE, USA) following the recommendation of the cementation protocol from the manufacturer. Initial polymerization or tag cure was done for 3 seconds and the excess cement was removed by dental floss and probe. A final cure with LED curing light was performed with 20 seconds for each surfaces. Occlusion was re-assessed after cementation procedures.

Phase 5: Removable prosthodontic phase focused on the construction of maxillary and mandibular removable partial cobalt-chrome dentures. The definitive impression was made using monophase silicone impression material (Aquasil® Dentsply Sirona, USA) and sent to the dental laboratory. The maxillary and mandibular cobalt-chrome framework was tried inside the mouth. The retention, stability, extension and fit of the framework were checked and was found to be excellent. Facebow (Denar® Mark II, Whip Mix, USA) transfer and jaw relationship records were made with interocclusal recording material ((EXABITE™, GC, USA) and the occlusal wax rim. The acrylic tooth shade was determined using an acrylic tooth shade guide, and shade A3 was selected. Issue stage of the dentures involved the assessment of denture's fit, retention and stability figure 4. The occlusion was checked using an articulating paper and the high bite was trimmed accordingly. Mutually protected occlusion achieved with group function upon right and left lateral excursion and shared anterior guidance during protrusion. The fitting surface of the dentures was checked using pressure indicator paste and minor adjustment done. Final polishing of the dentures was done, and post-denture insertion instructions were given to the patient. She was pleased with the new set of dentures and confident with her new appearance.

Phase 6: Review and maintenance phase. The patient was reviewed after 1 week for any signs and symptoms. She was satisfied with the treatment outcome. Good oral hygiene and acceptable soft and hard tissue integrity around the dental restorations were successfully maintained. Overall, prognosis of the treatment is good with all the treatment aims were achieved. The patient was emphasised on denture and oral hygiene maintenance care such as tooth brushing, flossing. She was taught to use super floss to clean the area underneath bridge.

Discussion

Prosthodontic rehabilitation in achieving aesthetic and functional restorations especially in the anterior region of the maxilla can be particularly challenging. This case involved unfavourable aesthetic outcome of existing fixed dental prosthesis (bridge) and removable partial denture. Anterior dental aesthetics is primarily concerned with the appearance of the maxillary anterior six teeth. It comprises of the concept of macro aesthetic (facial aspect) and micro aesthetic (dental aspect). The concept of micro aesthetic involved tooth dimensions and proportions (white aesthetics) and its correlation

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with the periodontium (pink aesthetics).[12] Therefore, several studies have been directed towards the size, shape, shade, alignment of the maxillary incisors and canines, their relationship to each other and the antagonist dentition, and the surrounding soft tissues including the gingivae, lips and facial features.[12-15]

Fixed-removable prosthodontic management based on this case was considered a challenging procedure because it involved rehabilitation of existing restorations and patient expectations towards the future final outcome. Patient refused to have osseointegrated implants as it involved high costs and surgical procedure. Therefore, a comprehensive treatment planning was conducted and focusing on fixed and removable prosthesis design. Full mouth rehabilitation aims to achieve harmonious relationship between teeth, periodontal structures, muscle of mastication and temporomandibular joint (TMJ) mechanisms.[16] The success of prosthodontic treatment dependant on the ability to achieve posterior occlusal contacts which contribute to stabilise occlusion.[17] Conformative approach is applicable for this case as there has stable contact on posterior second molars and sufficient interocclusal space for the definitive restorations.[18] This approach allows provisional restoration to be in harmony with the existing jaw relationship.[6] For early adaptation in this situation, combination of maxillary and mandibular interim removable partial dentures and composite build-up was used to establish a stable and functional occlusal vertical dimension. This method is reversible, simple to adjust and stabilises the occlusion.[19] Combination of prosthodontic rehabilitation provide retention, stability and support on both fixed and removable prosthesis. Metal ceramic fixed dental prosthesis/ bridge for removable partial cobalt-chrome denture abutments are made with guiding plane, rest and retentive areas to optimize the biomechanics of the denture.[20] Survival rates for porcelain fused to metal fixed dental prosthesis (bridge) was 92% over ten years and 75% over 15 years. One of the contributing factors to success or failure rate of these prosthesis depends on the design of every component of the prosthesis.[21] The size, shape, type and position of the connecter can be determine the restoration's success.[22]

As part of the maintenance phase, regular follow up on oral health and prosthesis maintenance were given attention as periodontal maintenance play a vital role in reducing the occurrence of tooth loss post prosthetic therapy. Routine home care and professional maintenance therapy may provide the best solution in preserving the periodontal health of the patient. This is essential in determining the long-term success of the prosthesis.[10,11]

Conclusion

A combination of fixed and removable prosthesis able to provide favourable clinical outcome for partially edentulism case. Moreover, this treatment approach able to achieve support and stability of fixed restorations with the adaptability and simplicity of removable prosthesis. Ultimately, meticulous case selection is essential to achieve favourable longevity of the prostheses.

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