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Full Arch Implant Supported Rehabilitation Using Hybrid Prosthesis – A Case Report

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Abstract

Esthetic and functional rehabilitation of completely edentulous maxillary arch with fixed implant supported prosthesis is a challenging task. Newer technologies such as computer assisted design computer assisted milling (CAD CAM) and cone beam conventional tomography play an important role in achieving predictable results. Full mouth porcelain fused to metal (PFM) individual crowns on CAD CAM milled titanium framework provides positive esthetic and functional outcome. This is a case report of rehabilitation of partially edentulous maxillary arch patient. Staged rehabilitation of this patient was planned. In the first stage, root canal treatment of key abutment teeth was done, nonsalvageable teeth were removed, and immediate interim overdenture was provided. In the second stage, five Nobel Biocare dental implants were placed. After integration impressions were made, CAD CAM milled titanium bar was fabricated. Individual PFM crowns were made and cemented. This method gives better esthetic compared to acrylic fused to metal hybrid prosthesis with the advantage of retrievability just like screw retained prosthesis. Hence, this technique is good for rehabilitation of patients with high esthetic demands.

Keywords: Computer assisted design, computer assisted milling, dental implants, hybrid denture, porcelain fused to metal crowns.

Introduction

The rehabilitation of maxillary arch is often challenging as compared to the mandibular arch because of high esthetic demands, type and density of bone, limited availability of bone due to the presence of sinus floor and nasal floor,[1] and anatomy of the maxillary arch which makes proper implant angulations difficult, especially in the anterior

region.[1] The angulations of implants in the anterior maxilla sometimes make the rehabilitation tricky and influence the prosthesis selection. The choice of material of final prosthesis also plays an important role in satisfactory and long-term outcome. Various methods of full-mouth rehabilitation with osseointegrated implants have been discussed. Implant-retained removable overdenture, implant-supported cement-retained bridge, and hybrid denture to name a few.[2-4] Each of these methods has their advantages and disadvantages. Implant-supported fixed rigid bridge with cementable prosthesis provides excellent esthetics since the screw access channels are not visible on the labial side. Hybrid denture allows easy retrievability of the prosthesis. Baig et al. [5] described a technique of metal-ceramic implant-supported fixed prostheses with milled titanium frameworks and individual cementable crowns. This technique has advantages of retrievability as in screw-retained prosthesis and esthetics as in cement retained bridges. This article discusses stepwise fabrication of such prosthesis prepared for maxillary arch rehabilitation.

Methodology

A partially edentulous, male patient aged 54 years reported to our dental office to get his missing teeth replaced. His chief desire was fixed teeth which would be esthetic and comfortable. Patient at no time wanted to be without teeth. Intraoral examination showed the presence of five teeth in maxillary arch (11, 12, 23, 24, and 25) [Figure 1].

Figure 1: Preoperative intraoral view

These teeth were firm but three teeth (11, 24, and 25) displayed gingival recession along with root surface caries and also the patient had removable prosthesis in the upper arch which the patient was not satisfied with and in the lower arch had fixed dental prosthesis in the right posterior region and partially edentulous space in the left posterior region. Mandibular anterior teeth were firm and had no pathology. Medical history revealed patient to be diabetic and patient was under medication for the same. The patient was also a known smoker. The patient had no other relevant medical problems. After a thorough clinical and radiographic examination, it was decided to extract maxillary teeth and fabricate a full-arch fixed implant supported bridge for the maxillary arch and implant-supported bridge to replace missing teeth in the lower arch. Since the patient was esthetically demanding and socially active, he did not want edentulous phase; hence, it was decided to fabricate maxillary tooth supported immediate overdenture which will also act a diagnostic stent for cone beam conventional tomography (CBCT) as well as a temporary denture during the healing phase of osseointegration. The patient agreed with the treatment plan and informed consent was taken for the same. A tooth supported overdenture was fabricated for the maxillary arch by retaining 12, 23. Ball abutments radicular posts (EDS AccessPost™ Overdenture) were attached to these teeth after intentional root canal

treatment. Extraction of remaining maxillary teeth was done and the housing was picked up in the denture. Radiopaque markers were placed in denture at prospective implant positions to convert the denture into a radiographic stent. The patient was sent for CBCT with the denture stent. After reading the CBCT, five prospective implant sites were identified and implants sizes were decided. The patient was evaluated and necessary blood investigations were carried out before the implant placement. The patient was also counseled for smoking cessation program before implant placement.

Implant surgical phase

Following all the sterilization protocols, standard open flap surgery was performed under local anesthesia and five dental implants(Replace Select, Nobel Biocare, Zürich, Switzerland) were placed in the maxillary arch. Sutures were removed after 7 days. During the integration phase, regular oral hygiene assessment was done. At this stage, patient decided for conventional FPDs for the mandibular arch. Hence, the missing 34, 35 were replaced with PFM FPD using conventional technique. Furthermore, existing FPD on the right side was replaced with a new one. In this case, delayed loading protocol given by Branemark was followed. The implant site was allowed to heal for 6 months and During this period a temporary tooth supported prosthesis eith soft liners was given to the patient.Following this healin phase the cover screws were removedand they were replaced by healing abutments for two weeks . After this an open tray impression was madewith transfer copings .The transfer copings were splinted with autopolymerizing resin (GC Pattern Resin, GC Corp, Tokyo, Japan) before the impression was taken [Figure 2].

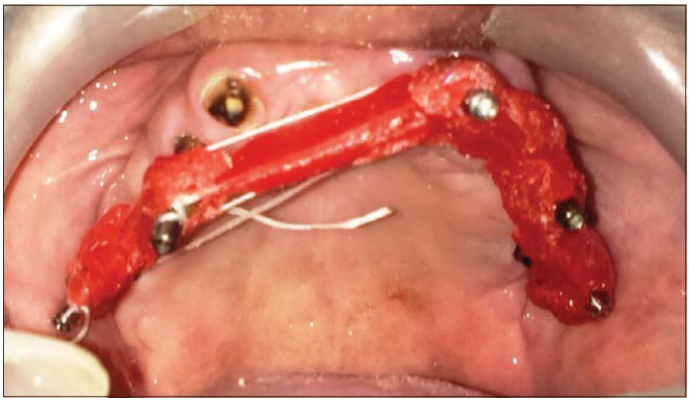

Figure 2: Impression making with open tray technique

The impression was sent to the laboratory. In the laboratory, master cast was poured in type IV dental stone with implant replicas (NobRpl, Nobel Biocare, Zürich, Switzerland). On the master cast, a verification jig was made with autopolymerizing pattern resin (GC Pattern Resin; GC Co, Alsip, IL) and this was checked in patients' mouth for passivity [Figure 3].

This step reassured the precise recording of implant positions. In a subsequent appointment, a face bow record and an interocclusal record (Occlufast Rock, Zhermack Co, Italy) were made. Master casts were mounted on a semi adjustable articulator (Artex Articulator System; Denture acrylic teeth (Pala Premium Line; Heraeus Kulzer GmbH, Hanau, Germany) were used to try-in the esthetic and functional positioning of teeth, and patient's approval was taken. Nonengaging plastic abutments then were attached to the implant replicas on the master cast. Index of buccal and occlusal surfaces of trail denture was done[Figure 4]. Following this a framework made of resin was fabricated in accordance with the profile of the trial denture with individual prepared abutment which will facilitate the placement of individual ceramic crowns. The length of the abutments were modified to provide adequate thickness of the crown. The patteren was then scanned for the CAD image and titanium bar was milled accordingly .Then the framework was checked intra orally for precise and passive fit. Once the fit of frame work was

found satisfactory , they were veneered with gingival pink porcelain to resemble soft tissue in gingival areas. Metal-ceramic cement-retained crowns then were fabricated by the conventional method on abutment component of the framework [Figure 10]. The screw retained framework was secured to the implants at 35 Ncm torque. The screw access holes were sealed with gutta percha and composite resin. The PFM crowns were tried on the titanium framework individually and also together to check for the contact points in between adjacent crowns. Occlusal adjustments were done to achieve mutually protected occlusion. PFM crowns were polished, glazed, and cemented over the framework individually using zinc polycarboxylate cement. The implant prosthesis restored lost function and provided the necessary esthetics [Figures 11]. The importance of maintaining hygiene was reinforced and use of water jet (Waterpik, Waterpik Corporation, UK) was suggested. A 2 mm thick, soft night guard was given to avoid any oblique forces due to parafunctional habits. Follow-up checkups were done and necessary occlusal adjustments were done in follow-up appointments. Patient was emphasized on need of regular follow-ups.

Figure 3: Verification jig for titanium milling

Figure 4: Index of trial denture

Figure 5: Cutback resin pattern

Figure 6: Resin template ready for scan

Figure 7: Milled titanium framework - trial

Figure 8: Orthopantomogram showing passive fitting of titanium-milled framework

Figure 9: Space for metal ceramic crown

Figure 10: Individual porcelain-fused-to-metal crowns

Figure 11: Final prosthesis - intraoral view

Discussion

Meeting patient's high esthetic demands through a maxillary full-arch implant-supported rehabilitation depends on the achievement of several biological and mechanical goals.[6,7] Conventional immediate dentures help eliminate edentulous phase, thus avoiding problems in patients social life. In this case, immediate overdenture was planned as patient desired well- retentive denture. Inaddition to retention the overdenture enhances masticatory efficiency, improved proprioception resulting in a better biofunctioal prosthesis. Fixed prosthesis for completely edentulous patients is usually done by cement retained and screw retained hybrid prosthesis.The major advantages of Screw- retained implant fixed prostheses are ease of retrievability, benefit of splinting, and low

profile retention. But lack of passive fit of the cast framework and distortion of the framework upon porcelain firing can affect the biomechanics of the prosthesis. One of the primary factor which influences the final prosthetic design and material is the opposing dentition. In this case, the patient had natural mandibular anterior teeth, and posterior teeth were rehabilitated with PFM bridges. Cross linked resin teeth of conventional hybrid denture would have shown significant wear and repeated fractures in weak resin-metal interface. The choice of materials used in such rehabilitations plays an important role in the final outcome. Porcelain veneering over gold alloys or zirconium oxide frameworks has set the standard for the materials of choice in such cases.[8] Full- arch fixed implant supported bridge which consisted of cast framework and denture teeth and gingival acrylic resin had limitations which varied from wearing off the acrylic teeth, discoloration to misfit of the cast framework which jeopardized the long- term survival of implants. This case report presents with the use of stronger material in the form of PFM crowns which would maintain the esthetics as well as the vertical dimension. Porcelain veneered single crowns and fixed dental prostheses are well known for fulfilling esthetics, biocompatibility, color stability, and resistance to wear.[9] Various methods have been tried to avoid esthetic and functional failure in cases of single edentulous arch opposing natural dentition. One way is to use a compatible material section between maxillary and mandibular arches, by combining of a maxillary ceramic prosthesis with a mandibular metal-acrylic prosthesis in full- arch rehabilitations. This reduces the overall stiffness of the prosthetic elements as a whole, dramatically reducing mechanical complications.[10] Protecting the restorations with an occlusal splint “night-guard” is another method typically used to protect restorations, particularly when parafunctional habits are present. It may also lessen the odds of porcelain chipping.[11] Implant retained fixed prosthesis with cementable abutment was also viable treatment option. These treatment options have the advantages of passively fitting frameworks and better esthetics. Custom abutment options can compensate for malaligned implants, thus improving esthetics.[12,13] However, retrievability, repair and maintenance, choice of cement, and excess cement in the sulcus remain areas of concern. The lack of resilience due to the absence of a periodontal ligament in implant-supported restorations demands the use of highly sophisticated materials when trying to overcome fatigue resistance due to occlusal loading. In a complex biomechanical system, where implants, abutments, frameworks, screws, and esthetic veneering materials share masticatory stress conduction, porcelain is the material most commonly prone to failure with immediate esthetic consequences.[10,13,14] Another method address the mechanical failure of porcelain is to design individual full-contour crowns to be cemented on a titanium alloy screw-retained bar.[15] The benefit of this concept is based on the ability to remove and repair (or even replace) an individual fractured crown without the need to remove the entire structure,[16,17] which in turn allows a lower cost. A study involving 108 patients on the outcome of metal-ceramic implant-supported fixed prostheses with milled titanium frameworks and all ceramic crowns suggested that the cumulative survival rates for the implant- supported fixed prostheses were 92.4% for the individual Procera alumina crowns cemented onto a CAD/CAM fabricated titanium framework with pink ceramic at 10 years and 100% for the individual Procera zirconia crowns cemented onto a CAD/CAM- fabricated titanium framework with pink acrylic resin that replicated the missing gingival tissues at 5 years (overall 96%).[16] Poorly controlled diabetes

negatively affects implant osseointegration; however, under optimal serum glycemic control, osseointegration can successfully occur in patients with diabetes.[18] The patient was heavy smoker. Bain[19] in 1993 was the first to evaluate the influence of smoking on the failure rate of dental implants. They compared the results between dental implants placed in smokers versus those placed in nonsmokers. The overall failure rate of 5.92% was found to be consistent with other studies; however, when patients were subdivided into smokers and nonsmokers, it was found that a significantly greater percentage of failures occurred in smokers (11.28%) than in nonsmokers (4.76%) ($P < 0.001$). The findings of this study, for the first time, identified smoking as a major factor in implant failure. Subsequently, a few other studies also implicated smoking as a leading cause of implant failure.[20-23] The patient was counseled and smoking cessation program by Bain[19] was followed. Two- stage implant procedure with delayed loading protocol given by Brain mark was followed as patient was diabetic and smoker; hence, the chances of implant failure were more. Parafunctional habits such as bruxism produce significant amount of oblique pressure on implant–bone interface. Bruxism patients are prone for prosthetic failures such as abutment screw loosening and porcelain chipping. This patient was edentulous in maxillary arch and gave no history of parafunctional habits; still occlusal guard made up of 2 mm thick vacuum formed soft acrylic was provided as a precaution till he gets adjusted to new all porcelain surface occlusion.

Result

Individual ceramic crowns on CAD-CAM milled framework has provided excellent esthetic results. This method gives better esthetic compared to acrylic fused to metal hybrid prosthesis.

Conclusion

In current day practice since there is paradigm shift towards fixed treatment options for completely edentulous patients , the implant supported prosthesis plays a pivotal role in rehabhilitation of completely edentulous patients.The evolution of CAD CAM technology helps in precise fabrication of frameworks reqired for hybrid prosthesis and this case report is one such example of CAD CAM prosthesis fabrication for full arch fixed restoration .

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