FULL-MOUTH REHABILITATION USING CONVENTIONAL AND DIGITAL CAD-CAM PROSTHESES – A CASE REPORT

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Abstract

Successful oral rehabilitation of partially edentulous arches requires careful treatment planning before any prosthodontic procedures are undertaken. Addressing Kennedy's Class I and II cases, especially when opposing a complete denture, presents notable challenges. In some instances, the retention of the prosthesis may be compromised due to the condition of the remaining tissues. While implant-supported prostheses are often the preferred solution, factors like the patient's overall health and financial situation may make them impractical. This report demonstrates the rehabilitation of a full mouth using both a CAD-CAM metallic removable complete denture and a CAD-CAM cast partial denture.

Key words : CAD-CAM; Metallic denture base; cast partial denture; distal extension; fixed prosthesis

Introduction

Removable partial dentures (RPDs) are a conservative and cost-effective treatment option for the rehabilitation of partially edentulous arches, leading to an overall improvement in quality of life [1,2]. However, the laboratory procedures involved in their fabrication are complex, time-consuming, and demand manual dexterity. The introduction of digital technologies has revolutionized this process by significantly reducing the overall time required for prosthesis fabrication, eliminating human errors, and optimizing both functional and aesthetic outcomes [3]. The digitization of RPD framework construction involves two primary processes: subtractive and additive techniques. Subtractive manufacturing entails milling the framework from a metal block using a computer numerical control (CNC) machine. While subtractive methods are well-suited for fixed prostheses, they are more challenging for RPD frameworks due to increased production time, the complexity of the framework, material costs, and wear [4]. Rapid prototyping (RP), also known as additive manufacturing, encompasses various technologies that quickly create precise three-dimensional (3D) models directly from computerized 3D data through a layer-by-layer building process [4,5].

This case report describes the rehabilitation of a patient with a partially edentulous mandibular arch opposing a completely edentulous maxillary arch using a combination of digital and conventional techniques.

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Case Report:

This case presents a comprehensive prosthodontic rehabilitation for a 45-year-old female patient with maxillary edentulism and mandibular partial edentulism. The patient, who had a history of diabetes and was on insulin therapy, reported difficulty in chewing and speaking, along with pain in the upper anterior region. Clinical examination revealed missing teeth in the upper arch and partial edentulism in the lower arch, with grade II mobility in the mandibular central incisors (31, 41). Additionally, multiple traumatic ulcers were observed in the maxillary anterior region due to the impingement of the lower central incisors.

Given the patient's uncontrolled diabetes, immediate extraction of the mobile teeth was deferred. Instead, a heat-cured treatment plate with a soft liner was fabricated to protect the maxillary ridge from further trauma. Primary impressions of both arches were made using alginate, (fig.1) and a wax-up with a 2mm thickness was performed before fabricating a conventional heat-cure plate. The prosthesis was trimmed, finished, polished, and inserted into the patient's mouth to facilitate healing and improve comfort. The patient was recalled after 20 days, at which point significant healing of the ulcers was noted, along with better glycemic control. With these favourable conditions, the extractions were then carried out.

After discussing various treatment options, including implant-supported prostheses and conventional removable dentures, a definitive prosthetic plan was formulated. The treatment approach consisted of a metallic complete removable denture for the maxillary arch and a fixed prosthesis in the lower arch (43-47) to close interdental spacing and create a favourable undercut for a cast partial denture (CPD) replacing 31, 41, and 35-37.

The rehabilitation process began with primary alginate impressions of the maxillary and mandibular arches, followed by pouring the primary casts in dental plaster. A custom tray was fabricated, and border molding was performed to achieve accurate impressions. The master cast was obtained, and the metallic denture base was digitally designed using CAD software and milled from a cobalt-chromium block. A metal trial was conducted to ensure proper fit and adaptation.

To establish a stable occlusal scheme in the lower arch, tooth preparations were performed on 43, 44, 45, and 47, followed by the fabrication of PFM crowns with mesial and distal rest seats on 47 and 45, respectively. These rest seats functioned as indirect retainers for the CPD framework. The framework was digitally designed, milled, and tested for passive fit in the patient's mouth. Jaw relation records were taken, and a facebow transfer was performed using a Hanau semi-adjustable articulator for precise occlusal adjustment.

Following this, teeth arrangement was carried out, and a try-in appointment was conducted to evaluate esthetics, occlusion, and vertical dimension of occlusion (VDO). Once patient approval was obtained, the wax-up was completed, and conventional dewaxing and acrylization were performed. The final prosthesis was finished and polished to ensure optimal comfort and function.

Upon insertion, the patient was given detailed post-operative instructions regarding oral hygiene maintenance, adaptation to the prosthesis, and dietary modifications. Regular follow-up visits were scheduled to monitor healing, prosthesis adaptation, and overall satisfaction. The successful rehabilitation of the patient not only restored esthetics and function but also improved oral health and overall quality of life.

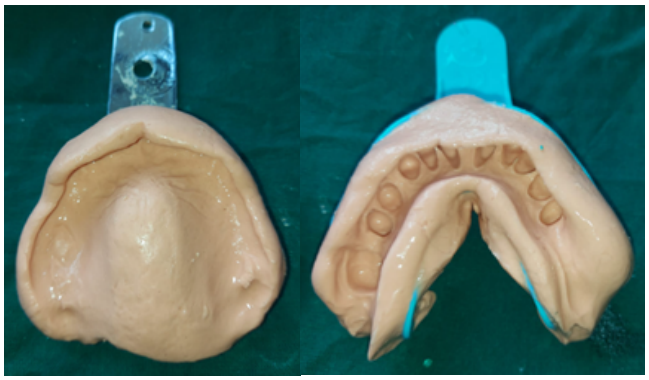

Fig.1: Primary Impressions Made With Irreversible Hydrocolloid

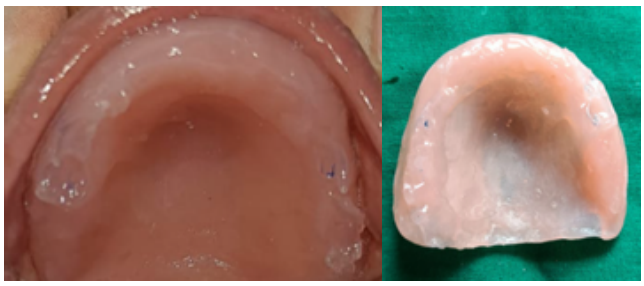

Fig 3: Heat Cure Treatment Plate Inserted With Soft-liner Application

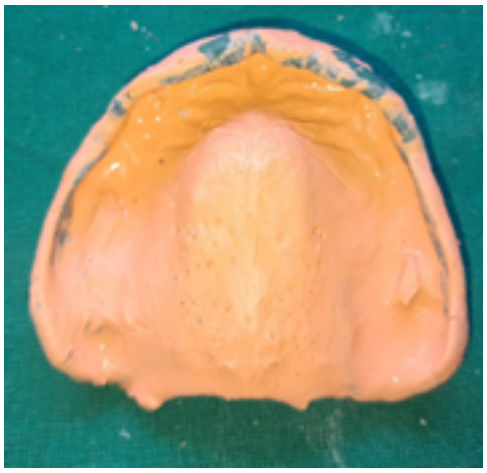

Fig. 3: Maxillary Border Molding And Final Impressions Made

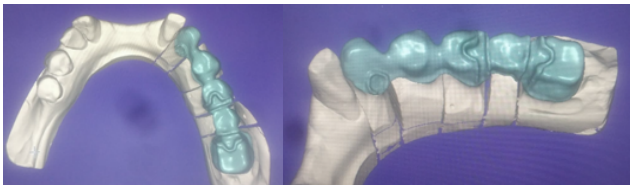

Fig. 4: Designing of of PFM Crown 33-37

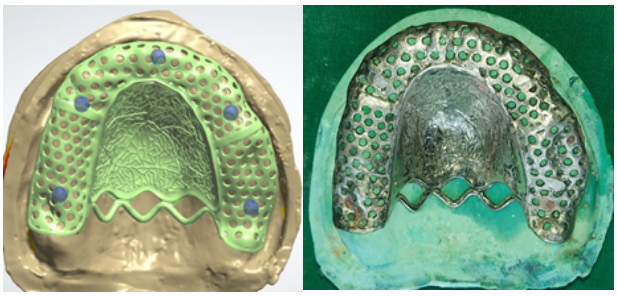

Fig. 5: Designing And Fabication Of Cad-cam Metallic Denture

Fig. 6: Designing Of Lower Cast Partial Denture And Framework Trail

Fig. 7: Facebow Transfer

Fig. 8: Try-in Done

Fig. 9: Insertion Done

Discussion:

Acrylic resin is the most commonly used material for fabricating complete dentures in clinical prosthodontics. However, fractures of acrylic denture bases can sometimes occur due to the material's mechanical properties, which may not always be sufficient to withstand masticatory forces. Jagger et al. noted that while acrylic is popular for meeting aesthetic needs, it still falls short in fulfilling the mechanical requirements of a prosthesis. The risk of fracture is higher when the denture base is thin or minimal in thickness. To address this issue, denture bases can be reinforced with cast metal, which offers greater strength, better fatigue resistance, and a lower likelihood of breaking under normal use.[6]

The main advantages of using CAD/CAM technology in the fabrication of RPD frameworks include the automatic determination of the proposed path of insertion, immediate elimination of undesirable undercuts, and quick identification of desirable undercuts. This technology not only saves time but also offers inherent repeatability, which can help reduce human errors and improve quality control in the dental laboratory.[3-6]

Metal framework-reinforced complete dentures are occasionally used in the rehabilitation of edentulous patients, especially in cases where fracture risk is a concern. Research has shown that metal frameworks can also help reduce fungal growth typically found in complete dentures.[7,9]

There are various treatment options available for partially edentulous patients, with the most appropriate plan being determined based on diagnostic factors and individual patient conditions. With the advent of advanced techniques such as CAD-CAM, precision milled and semi-precision attachments, improved impression materials, and enhanced techniques and designs, patients can now receive more effective treatment. In removable partial dentures, primary retention is primarily achieved mechanically through the placement of retaining elements on the abutment teeth, while secondary retention comes from the close relationship between the denture bases, major connector, and the underlying tissues. Stability is best attained with cast circumferential clasps due to their rigid shoulder. Wrought wire clasps offer a flexible shoulder, while bar clasps lack a shoulder, providing less stability in removable partial dentures. A lack of stability is a common issue that many patients face, often leading to reduced chewing ability. Cast partial dentures (CPD) are strong, rigid, and offer good stability, making them a preferred choice.[8]

Conclusion:

Dentists should have a thorough understanding of the properties of the various prosthodontic materials they work with, enabling them to make informed decisions when selecting materials. This knowledge is essential to ensure the effectiveness and success of the treatment. With this case report it was concluded that metallic denture opposing the Cast partial denture can be serves as a better prosthesis in terms of retention, stability, masticatory efficiency, comfort and periodontal health of abutment if there is adequate maintenance of oral and denture hygiene was done at a regular interval.

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