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Prosthetic Rehabilitation of Mandibular Partially Edentulous Arch with Titanium Cast Partial Denture. – A Case Report

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Abstract

The rehabilitation of partially edentulous arches insists on a broad prosthodontic approach that balances the esthetics, comfort, function, and material biocompatibility. The case report presents the prosthodontic restoration of a patient with a partially edentulous arch with missing mandibular teeth with a history of extensive endodontic treatment. The treatment plan involved fabrication of titanium mandibular cast partial denture and over an existing a maxillary metal-ceramic fixed dental prosthesis with attachment prosthesis. The use of titanium as the framework material for the mandibular partial denture provided a lightweight and durable solution, significantly improving patient comfort. The case report highlights the practicality and advantages of incorporating titanium frameworks in complex partially edentulous situations for accomplishing long-term functional and esthetic outcomes.

Keywords: Titanium, Cast partial denture, partially edentulous, Prosthetic rehabilitation, Removal partial denture

1. Introduction

The management of partially edentulous patients is vital and basic component of prosthodontic practice. Among the choices from Fixed dental prosthesis (FDP), implants and removable prosthesis the treatment options must be personalized to individual patient requirements, systemic health, oral situations, and financial limitations. Removable partial dentures (RPDs) is a dependable and conservative solution among the other treatment choices, especially when extensive rehabilitation methods or implant therapy are less achievable. [1,2] An ideally designed RPD preserves the remaining natural teeth, support the soft tissue health and most importantly the changes are reversible with the removable of the dentures. Conversely, long-standing success depends on biomechanics, design, material selection, and fabrication accuracy. [3,4]

Conventionally, cobalt-chromium alloys have been used in the fabrication of cast partial denture (CPD) due to their strength, rigidity, and economics. Conversely, newer materials such as titanium have been increasing used in CPD for their excellent biocompatibility, low weight characteristics, and corrosion resistance. Titanium is non-allergenic, making it specifically useful in patients with metal sensitivities. The low density of the materials decreases the weight of the prosthesis, that enhances patient comfort and compliance. Though the fabrication procedures are technique-sensitive and involves specialized casting equipment, the developments have made titanium more accessible in clinical practice.[5 -7]

This case report rationalizes the rehabilitation of a patient with missing mandibular posterior teeth with a titanium CPD along with a maxillary metal-ceramic FDP encompassing an attachment prosthesis. The management involved detailed treatment planning, surveying, mouth preparations, altered cast techniques, casting titanium CPD and FDP to enhance the functional and esthetic outcomes. This clinical report aligns with the United Nations Sustainable Development Goal (SDG) 3 – Good Health and Well-being, by promoting improved oral function, comfort, and quality of life through advanced prosthetic rehabilitation. The use of titanium as a framework material also reflects SDG 9 – Industry, Innovation and Infrastructure, by integrating innovative and biocompatible materials that enhance the durability and sustainability of dental prostheses.

2. Case description

A 54-year-old female patient reported to the department with the major complaint of missing teeth in the lower posterior region and that significantly affected her mastication. The patient expressed a strong desire for a prosthetic solution that was both functional and esthetically acceptable. The examinations revealed the absence of mandibular teeth 35, 36, and 37. Additionally the complete clinical and radiological investigations revealed missing teeth between 14 -17 and multiple teeth in both arches -13, 12, 11, 21, 22, 23, 25, 26, 27,33 and 46 were root canal treated (RCT). Impacted 18 and 28 were observed radiographically. FDP was observed in the maxillary arch, extending from 13 to 27, with semi precision attachment prostheses for the missing posterior teeth 14-17. The RCT of treated teeth in the maxillary arch comparatively displayed favorable periodontal support.

The patient's major concern was to replace the missing mandibular teeth and improve the masticatory efficiency. A titanium CPD was planned for the mandibular region with additional restorations on teeth 33 and 46. The prosthetic treatment plan also included an interim acrylic partial denture to maintain function during the fabrication stages.

Primary impressions were recorded using irreversible hydrocolloid material, and diagnostic casts were poured in Type III dental stone. (Figure 1) These casts were surveyed to determine favorable undercuts and guide plane areas. (Figure 2) Medium survey lines were observed on teeth 33 and 45, with usable 0.01-inch mesial undercuts. Block-out procedures were done arbitrarily on the anterior -labial and lingual ridge areas and in the posterior buccal and lingual surfaces to achieve the appropriate path of insertion. Shaped block-outs were made around the mesial surfaces of 33 and 45.

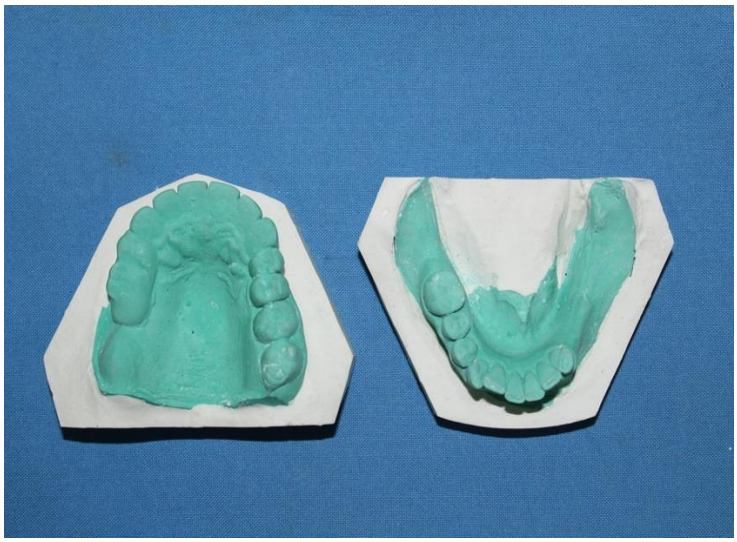

Figure 1: Diagnostic Cast

Figure 2: Surveying of cast

Figure 3: Mouth preparation

Figure 4: Titanium casted framework

A full metal crown in 33 and 46 was prepared. 33 was designed to support I bar retainer and 46 to support embrasure clasp with mesial rest in 46 and distal occlusal rest in 45. An indirect retainer was planned in the form of a cingulum rest on tooth 43. (Figure 3) Lingual bar major connector was included in CPD design. The minor connectors connected the direct retainers, rests, and lattice-type denture base to the major connector. The direct retainers in the design comprised of an embrasure clasp assembly engaging the distal of 45 and mesial of 46, and an I-bar retainer on 33. The cingulum rest on 33 and 43 acted as an indirect retainer. Anatomic form of artificial teeth was used for functional occlusion, and the denture base was designed to be a combination of titanium framework veneered with heat-cured acrylic resin.

The definitive impression for the mandibular arch was made using elastomeric impression material, capturing fine details of the prepared abutments and edentulous ridge. The cast partial denture framework was waxed and cast in titanium. (Figure 4) After retrieval, the framework was finished and polished, and a try-in was performed intraorally to confirm passive fit. The altered cast technique was employed to optimize tissue adaptation. The denture base was relined with a functional impression and the altered cast poured. (Figure 5) Teeth arrangement and wax try-in were completed, followed by final processing (Figure 6). The fabricated titanium CPD was inserted and post-insertion adjustments were made. (Figure 7 and 8)

Figure 5: Secondary impression for altered cast

Figure 6: wax try-in

Figure 7: Post operative intra oral

Figure 8: Post operative radiograph

3. Discussion

The use of titanium in CPD has exhibited encouraging outcomes in recent years due to its superior biological and physical properties. [5] Titanium is the most biocompatible material and it is non-allergenic and presently it is the safest material for long-term intraoral use. The corrosion resistance aids in the longevity of the framework even in challenging oral conditions. [6,7]

The major advantage of titanium is its low density, that makes the prosthesis lighter than conventional metal alloy frameworks, improving patient comfort without compromising strength. The density is comparatively one-fourth to that of gold alloys and approximately half that of cobalt-chromium alloys. Additionally, the hardness of titanium approximately closer to that of gold alloys, providing good wear resistance and being gentler on teeth than other base metal alloys.[8-10]

The use of titanium for the mandibular CPD was influenced by the patient's restoration history, need for lesser weight prosthesis, and biocompatibility. The incorporation of an FDP with attachment in the maxillary arch improved the functional and esthetic outcomes and the prosthesis remained stable under function. [1,2,5]

Casting titanium presents laboratory challenges due to its high melting point and reactivity but the gains in comfort, light weight, material longevity and clinical performance outweigh these lesser limitations.[7,9] The advancements in technologies shall make the use of titanium more feasible in routine prosthodontic practice.

4. Conclusion

The rehabilitation of a partially edentulous mandible using a titanium cast partial denture with a maxillary attachment-supported fixed prosthesis exhibited good clinical success. Titanium CPD was light in weight, biocompatible, and strong alternative to conventional CPD alloys. This case report demonstrates the use of titanium CPD in providing, appreciable patient-centered solutions

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