

Cast Metal Denture Bases with Ceramic Denture Teeth for Rehabilitation of A Completely Edentulous Patient: A Case Report

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Abstract

Rehabilitating a young patient with complete edentulism can be challenging because the prosthesis must provide satisfactory function and appearance while also being comfortable and suitable for long-term use. Although implant-supported treatment can offer excellent retention and stability, the financial burden associated with implant therapy may make it unsuitable for some patients. In such situations, a removable complete denture remains a practical treatment option. The use of a cast metal denture base can provide a rigid and dimensionally stable foundation, while ceramic denture teeth can be used to achieve a natural and esthetically pleasing appearance. This case demonstrates a practical and cost-conscious approach for rehabilitating a young completely edentulous patient when implant-supported treatment is not feasible. The combination of cast cobalt-chromium denture bases, ceramic denture teeth, and preservation of the endodontically treated premolar as an overdenture abutment provided a comprehensive removable prosthetic solution with an emphasis on rigidity, durability, esthetics, and preservation of the remaining natural tooth structure.

Keywords: complete denture; cast metal denture base; cobalt-chromium alloy; ceramic denture teeth; overdenture; retained root; edentulism; prosthodontic rehabilitation.

INTRODUCTION

Complete loss of teeth can have a profound effect on a person's oral function and quality of life. In addition to compromising mastication and speech, edentulism can affect facial support and appearance, often resulting in reduced confidence and difficulty in performing everyday oral functions. The primary objective of complete denture treatment is therefore not simply to replace the missing teeth but to restore function, facial appearance, phonetics, comfort, and overall patient satisfaction. Conventional complete

dentures continue to be an important treatment option, particularly for patients with financial limitations, anatomical considerations, medical factors, or personal preferences. Patient satisfaction with complete dentures is influenced by several factors, including retention, stability, masticatory ability, comfort, and esthetic appearance.¹

The denture base plays a fundamental role in the performance of a complete denture. It provides the foundation for the artificial teeth and contributes to support, stability, adaptation, and distribution of functional forces to the underlying tissues. Polymethyl methacrylate (PMMA) has traditionally been the most commonly used denture base material because it is relatively economical and can be easily processed, adjusted, repaired, and relined. However, acrylic resin bases may undergo dimensional changes and deformation under functional conditions. Cast metal bases, particularly those fabricated from cobalt-chromium alloys, offer an alternative because of their high rigidity, strength, and dimensional stability. Studies evaluating different denture base materials have reported favorable dimensional stability with cobalt-chromium bases compared with conventional acrylic resin bases.^{2,3} In addition, experimental investigations have demonstrated that cobalt-chromium denture bases may undergo less functional deformation than acrylic resin bases in maxillary complete dentures.⁴

Another important consideration in the management of an edentulous patient is whether any remaining natural tooth or root can be preserved. When a strategically positioned tooth is suitable for endodontic and restorative management, it may be incorporated into an overdenture rather than being routinely extracted. Retaining a natural root beneath an overdenture can provide additional support and may contribute to improved denture stability. It may also help in maintaining the supporting alveolar bone and reducing the rate of residual ridge resorption.⁷ Therefore, preservation of a suitable remaining tooth can be particularly valuable when designing a removable prosthesis for a patient with limited remaining dentition.

Esthetic requirements also become increasingly important when treating younger edentulous patients. The artificial teeth should be selected and arranged in a manner that complements the patient's age, facial form, lip support, and overall appearance. Successful denture esthetics depends on several factors, including tooth size, shape, shade, position, arrangement, and the relationship of the teeth with the lips and surrounding facial structures. Ceramic or porcelain denture teeth have been used as an alternative to acrylic resin teeth and are recognized for their favorable resistance to wear.⁸ Their use may therefore be considered when both esthetic requirements and long-term tooth surface durability are important considerations.

The present case describes the rehabilitation of a young patient with complete mandibular edentulism and a single remaining maxillary premolar. A removable prosthetic approach was selected. The remaining premolar was endodontically treated and preserved as an overdenture abutment. Cast cobalt-chromium denture bases were fabricated for both arches, and ceramic denture teeth were selected and arranged to address the patient's esthetic requirements. This treatment approach aimed to provide a durable and rigid removable prosthesis while preserving the remaining natural tooth and offering an affordable alternative to implant-supported rehabilitation.

Case Report

A 31 years old patient reported to the Department of Prosthodontics and Crown & Bridge, Jaipur Dental College, Jaipur, Rajasthan with the complaint of the missing teeth in both the maxillary and mandibular arches.. Intraoral examination revealed complete absence of teeth in the mandibular arch, while only a single premolar remained in the maxillary arch[Figure 1]. The remaining premolar was assessed for its suitability as an overdenture abutment. The patient's young age and the anticipated need for a prosthesis

that could serve satisfactorily over an extended period were considered during treatment planning. Implant-supported rehabilitation was considered; however, financial limitations made implant therapy unsuitable for the patient. After discussing the available treatment alternatives, a removable prosthetic rehabilitation was selected. Considering the patient's age and the need for a durable prosthesis, cast metal denture bases were planned for both the maxillary and mandibular arches. A cobalt-chromium alloy was selected for the metal bases because of its rigidity and dimensional stability. Ceramic denture teeth were chosen to fulfill the patient's esthetic requirements and provide a durable artificial tooth material. The remaining maxillary premolar was retained as an overdenture abutment. Following endodontic treatment, the clinical crown was reduced to the gingival level and appropriately contoured so that the remaining tooth structure could be incorporated beneath the maxillary prosthesis.

Clinical Procedure

The remaining maxillary premolar was evaluated and considered suitable for use as an overdenture abutment. Endodontic treatment was completed, after which the clinical crown was reduced to the level of the gingival margin. The remaining tooth structure was rounded and contoured appropriately. Primary impressions of both the maxillary and mandibular arches were made using impression compound [Figure 2]. The primary impressions were subsequently poured to obtain preliminary casts, which were used for fabrication of the custom trays. Border molding was then performed using green stick compound to record the functional extent of the peripheral tissues and establish appropriate denture border extension [Figure 3]. After the completion of border molding, definitive impressions of the maxillary and mandibular arches were made using monophase elastomeric impression material [Figure 4]. The impressions were removed carefully and examined for adequate reproduction of the denture-bearing tissues and peripheral borders. Definitive casts were then obtained from the final impressions.

The definitive casts were examined and prepared for duplication. Undercut areas that were not required for the planned metal denture base were blocked out appropriately [Figure 5]. This step was performed to prevent undesirable undercuts from interfering with the subsequent duplication and fabrication of the metal denture bases. The prepared maxillary and mandibular casts were duplicated using agar-agar reversible hydrocolloid duplicating material [Figure 6]. The agar-agar moulds were filled with suitable investment material to obtain refractory casts corresponding to the maxillary and mandibular definitive casts. After setting, the refractory casts were carefully removed from the duplicating moulds and inspected for completeness and accuracy before fabrication of the wax patterns. Wax patterns for the maxillary and mandibular metal denture bases were fabricated directly on the refractory casts.

The wax was adapted carefully to reproduce the planned denture-bearing area and the required extension of the denture bases. The patterns were shaped to provide adequate rigidity and appropriate space for the subsequent acrylic resin and artificial teeth. The wax patterns were carefully finished and inspected before the spruing procedure [Figure 7].

Sprues were attached to the completed wax patterns at appropriate locations to facilitate the flow of molten alloy during the casting procedure [Figure 8]. The sprued wax patterns were then invested using a suitable investment material compatible with the selected cobalt-chromium alloy [Figure 9 & 10]. After the investment had adequately set, the moulds were prepared for elimination of the wax patterns.

The invested wax patterns were subjected to the required burnout procedure to eliminate the wax and create the mould space for the metal denture bases. The maxillary and mandibular denture bases were subsequently cast using cobalt-chromium alloy. Following completion of casting, the investment was

removed and the cast metal bases were retrieved. The castings were examined for defects and completeness. Sprues were removed, and the metal surfaces were subsequently finished and polished to obtain smooth and appropriately contoured denture bases [Figure 11].

After completion of the metal denture bases, trial bases were fabricated using cold-cure acrylic resin. Occlusion rims were then constructed over the trial bases. Jaw relation was recorded. Ceramic denture teeth were selected based on the patient's age, facial characteristics, available space, and desired esthetic appearance. Arrangement of artificial teeth was done on the Hanau articulator. The ceramic teeth were selected to provide the desired esthetic appearance and a durable artificial tooth material. The maxillary and mandibular dentures were tried intraorally [Figure 12]. Once the esthetic and functional aspects were considered satisfactory, the dentures were prepared for final processing. The dentures were processed according to conventional complete denture laboratory procedures. The processed maxillary and mandibular complete dentures were finished and polished [Figure 13]. The completed denture bases were carefully seated in the patient's mouth and evaluated for tissue adaptation, border extension, retention, stability and occlusal relationship. Any necessary occlusal adjustments were performed before final delivery [Figure 14].



Figure 1. Intraoral view showing completely edentulous maxillary and mandibular arches.

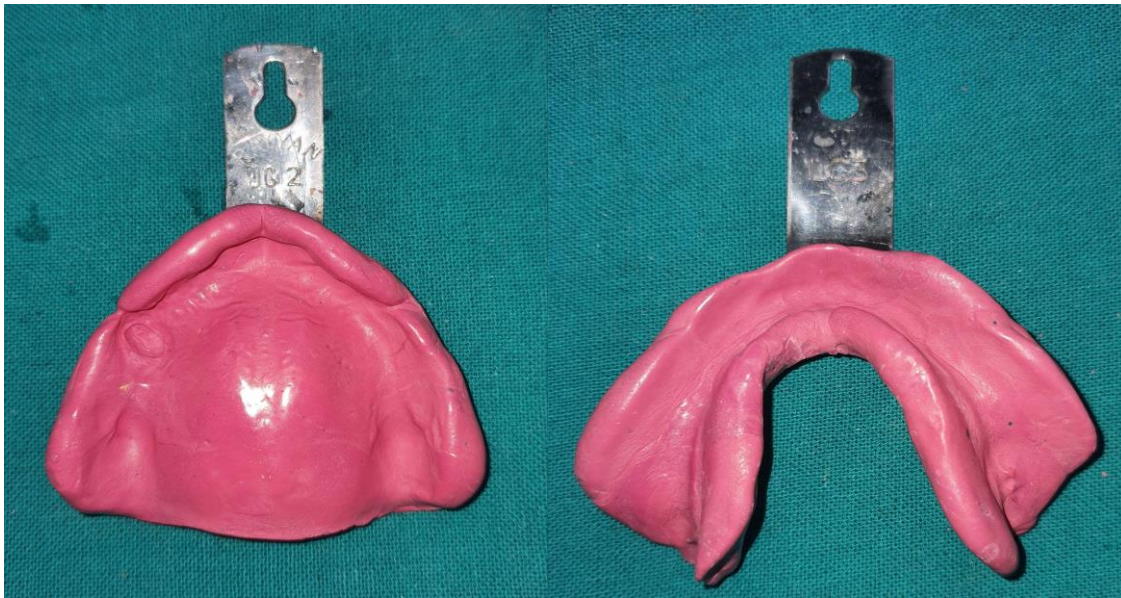


Figure 2. Preliminary maxillary and mandibular impressions.



Figure 3. Border moulding of maxillary and mandibular custom trays using green stick compound.



Figure 4. Definitive impressions of maxillary and mandibular arches using monophase.



Figure 5. Maxillary and mandibular definitive casts with wax relief.



Figure 6. Agar-agar moulds for duplication of casts.



Figure 7. Maxillary and mandibular refractory casts with metal denture base designing.



Figure 8. Sprue attachment.



Figure 9. Placement of maxillary and mandibular refractory casts inside casting ring.



Figure 10. Investment Procedure.

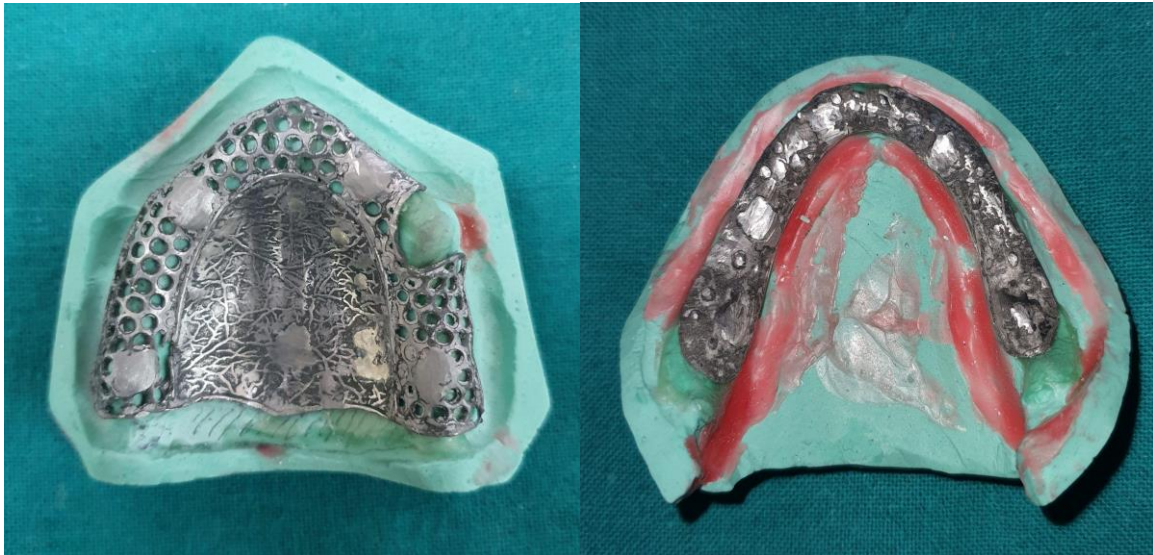


Figure 11. Maxillary and mandibular metal denture bases.



Figure 12. Intraoral Clinical Try-in.

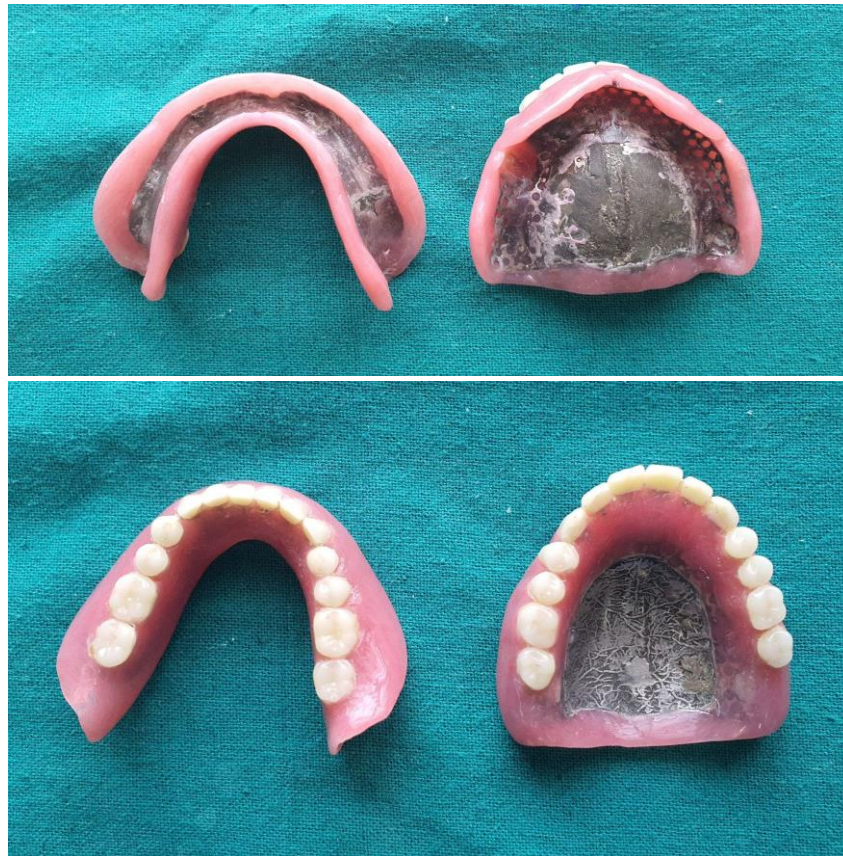


Figure 13. Processed maxillary and mandibular denture bases.



Figure 14. Final inserted maxillary and mandibular complete dentures.

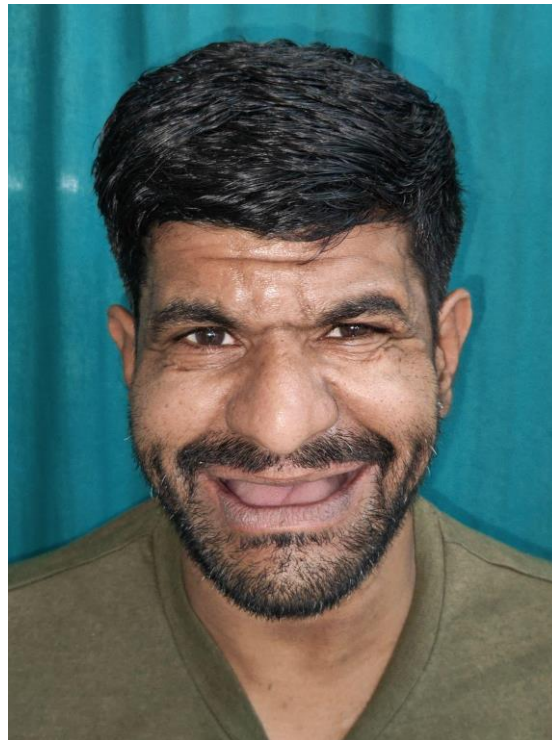


Figure 15. Pre Op Profile Photo.

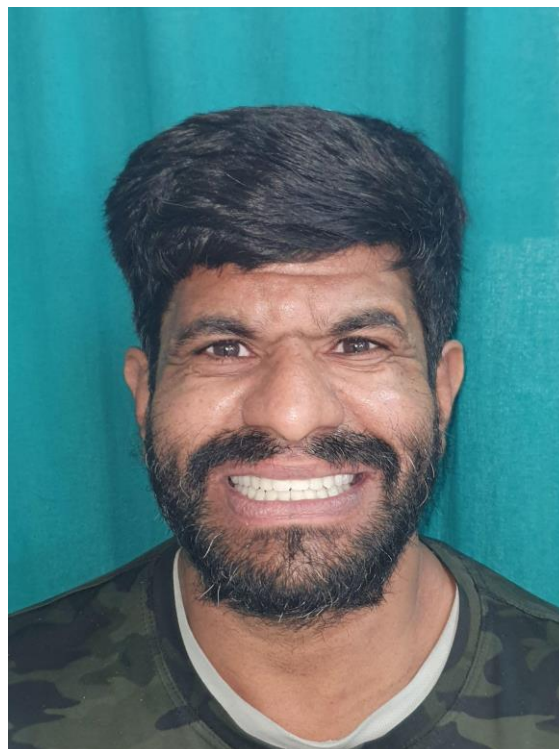


Figure 16. Post Op Profile Photo.

Discussion

Rehabilitating a young patient with complete edentulism can be particularly demanding because the prosthesis is expected to restore function while also meeting high expectations regarding appearance, comfort, speech, stability, and long-term serviceability. Tooth loss at a younger age can also have social

and psychological consequences, making the esthetic and functional aspects of treatment especially important. Therefore, successful complete denture rehabilitation requires an individualized approach that considers both the patient's clinical needs and personal expectations.

The patient's young age was an important consideration in selecting the denture base material. Rather than using a conventional acrylic resin base alone, a cast cobalt-chromium base was selected for both arches. Cobalt-chromium alloys provide a rigid foundation and demonstrate favorable dimensional stability, making them suitable for situations in which a durable and stable denture base is desired. Previous investigations have reported greater dimensional stability of cobalt-chromium denture bases compared with conventional acrylic resin bases.⁶ The rigidity of the metal base can also allow the denture to maintain its form under functional loading.

The behavior of the denture base during mastication is particularly relevant because functional forces can produce deformation of the prosthesis. Clinical research evaluating maxillary complete dentures has demonstrated that cobalt-chromium denture bases may undergo less functional deformation than acrylic resin bases and may consequently alter the transmission of functional forces to the supporting tissues.^{5,6} These properties provide a rationale for selecting a cast metal base when rigidity and dimensional stability are considered important, particularly in a young patient who may require the prosthesis for an extended period.

Despite these advantages, cast metal denture bases are not without limitations. Their fabrication is more technique-sensitive than that of conventional acrylic resin bases and requires several additional laboratory stages, including duplication of the definitive cast, preparation of the refractory cast, wax-pattern fabrication, spruing, investing, burnout, and casting. Modification, relining, or repair may also be more complicated once the metal base has been fabricated. In addition, the additional laboratory procedures can increase treatment complexity and cost. Preservation of the remaining maxillary premolar was another significant component of the treatment plan. When a remaining tooth is suitable for endodontic and prosthodontic management, retaining the root beneath an overdenture can provide an additional source of support and may contribute to preservation of the underlying residual ridge. The overdenture concept has traditionally emphasized the value of retaining suitable roots rather than extracting all remaining teeth, particularly because the retained roots can provide support and help maintain the supporting tissues. Subsequent clinical reports have also described the use of retained teeth as a means of improving the foundation and stability of removable overdentures.⁷

The use of ceramic denture teeth was another distinctive feature of the rehabilitation. Esthetic considerations are particularly important when treating younger edentulous patients, and the artificial teeth must be selected and positioned to create a harmonious relationship with the patient's facial features. Tooth size, shape, shade, position, arrangement, lip support, and facial proportions all contribute to the final appearance of a complete denture. In the present case, ceramic teeth were selected to meet the desired esthetic requirements and to provide a tooth material with favorable wear resistance.

Ceramic denture teeth have established resistance to wear and can provide satisfactory optical characteristics. However, their greater hardness compared with conventional acrylic resin teeth should also be considered during occlusal adjustment. Previous investigations into denture tooth wear have demonstrated that both porcelain and resin teeth are subject to wear under different loading conditions.⁸ Therefore, careful establishment and verification of the occlusion are important when ceramic teeth are used, particularly when they are opposed by another set of artificial teeth.

The laboratory sequence used in this case also illustrates the importance of coordinating the metal and acrylic components of the prosthesis. Duplication of the definitive casts and preparation of refractory casts permitted fabrication of the cobalt-chromium denture bases using the conventional lost-wax casting technique. Trial bases and occlusion rims were then used for recording the jaw relationship, while the ceramic teeth were arranged and evaluated before definitive processing. This sequential approach allowed the different stages of prosthesis fabrication to be assessed before the final dentures were completed.

The significance of this case lies primarily in the combination of several treatment strategies rather than in the use of any single material. Preservation of the remaining premolar provided a retained biological foundation for the maxillary prosthesis. The cobalt-chromium denture bases were selected to provide rigidity and dimensional stability, while ceramic denture teeth were incorporated to address the esthetic requirements of a young patient. However, the findings of this case should be interpreted within the limitations of a single case report. The clinical outcome of one patient cannot establish that cast metal denture bases or ceramic denture teeth are superior to conventional acrylic resin dentures. Long-term follow-up is also important to assess the clinical performance of the prostheses, including the condition of the metal-acrylic junction, wear or fracture of the ceramic teeth, stability of the dentures, and the health of the retained premolar and surrounding tissues.

Conclusion

This case presents the rehabilitation of a young patient with complete mandibular edentulism and a single remaining maxillary premolar using cast cobalt-chromium denture bases and ceramic denture teeth. The treatment provided a removable and cost-conscious alternative to implant-supported rehabilitation while addressing the functional and esthetic requirements of the patient. The use of cast metal bases provided a rigid foundation, while the ceramic teeth were selected to meet the desired esthetic requirements. Preservation of the endodontically treated premolar also allowed the remaining natural tooth structure to be utilized as part of the prosthetic rehabilitation. Although the immediate clinical result was satisfactory, long-term follow-up is required to assess the durability and clinical performance of the prostheses.

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