

Base Metal Denture Bases - Clinical indications

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Abstract It has been more than eight decades since the introduction of polymethylmethacrylate (PMMA) in prosthetic dentistry. Despite so many advances in material science, the use of PMMA is unabated. Its ability to be molded into desired shape and biocompatibility, are significant for its success. Certain clinical conditions do however contraindicate its uses in prosthesis, and pave way for base metal alloy denture bases. These conditions are so common, yet they are missed clinically by even most astute clinicians. This case series in the form of multiple case reports provides the reader a glance into the clinical indications for metal denture bases in complete denture prosthodontics. Each case has been explained on the basis of its particular indication. The advantages and disadvantages of metal denture bases in such situations has been discussed. A case of menopause, sorption related denture changes, need for improving oral stereognostic ability and cases where poor adaptation of denture base acrylic is inevitable are key description of this article.

Keywords: complete denture, base metal alloys, denture base, major connector, polymethylmetacrylate

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1. Introduction

The functioning of a mechanical device in a biological environment requires an act of balance that depends on knowledge and understanding of both, especially the interaction of one upon the other. The biological environment of the complete denture prosthesis is not limited to the mouth since the oral mucosa that it interacts with receives input from various systems of the body. The first reaction of the oral mucosa to the complete denture prosthesis is the same as it would react to any foreign body. Besides aging, nutritional and hormonal influences affect mucosal reaction. Therefore, the response is not a static one, but it alters with time and cannot be predicted at any time of functioning. Simultaneously, the complete denture prosthesis itself is not a static entity since sorption of saliva is continuously taking place (denture base resin) and dimensional changes bring changes in occlusion. To make the matters complicated, the underlying residual alveolar bone itself keeps changing with denture use and alters the denture foundation thereby initiating a secondary response from the oral mucosa to accommodate its changes. For the last eight decades, since its introduction in 1937, [1] polymethyl methacrylate resins have been successfully used for varied dental applications since they have acceptable physical, biological and aesthetic characteristics, [2] available to a dental clinician as well as the patient at a moderate cost. There are, however relatively very less clinical indications where complete denture metal base (CDMB) is indicated over polymethyl methacrylate. Whenever, one thinks of metal

bases they are related more to fabrication of major connectors in cast partial denture. Certain designs of metal bases in removable partial denture allow accommodation of bony exostoses and tori, [3] without compromising the retentive properties. In complete dentures, the use of metal denture bases is thought mostly as a medium to strengthen the denture base where frequent denture base is breaking. Advantages of alloy denture bases include its excellent strength to volume ratios which allows the complete denture base to be made thin while still maintaining rigidity and fracture resistance, [4] high thermal conductivity [5] and less interference with phonation with complete dentures. [6]

This article in its form of multiple case reports reviews the indications of clinical cases where a metal denture base was fabricated for the mandibular complete denture. The article is in the form of case series that has been assimilated on the basis of each clinical indication. The aim of the case series is to clinically represent each indication for metal denture base. The article also discusses the scientific reason for doing so.

Case 1: Menopause

An elderly female patient aged 52 years reported with chief complaint of burning sensation while using her complete dentures that were fabricated one year back. The burning was more pronounced in the lower arch and would usually exaggerate, if she would forget to clean them over some days. The patient was a housewife by occupation and had three married children. Patients medical history was non-contributory except for the fact that she had developed xerostomia that was not related to any drug use. Patient climacteric history revealed that she had developed menopause at the age of 47 years. Dental

history revealed that the patient was completely edentulous at the age of 48 years and since then she had changed three dentures along with three different dentists. The reason for frequent changing of dentures was the burning sensation that was associated with denture use. The patient also had perceived altered taste perception with use of dentures. Examination of old dentures revealed a well fabricated denture with no evidence of any vertical dimension alteration or extension of denture flanges. Retention and stability of the existing dentures was satisfactory, while the denture hygiene was not visibly good since mandibular denture had food debris accumulation on the tissue surface. Evidence of bone resorption under the denture was also visible. Extra oral and intra oral examination revealed normal clinical findings except for the presence of bony exostoses in the maxillary posterior region. The bony protuberance was within the range of 1 cm. The mucosa overlying the bony exostoses was thin. The treatment options that were presented to her was implant supported fixed complete denture, implant supported mandibular overdenture or conventional complete denture with metal denture bases. Due to economic considerations, patient opted for mandibular complete denture metal base while maxillary was to be fabricated of PMMA resin. Routine clinical and laboratory procedures for complete denture fabrication were done except for the mandibular complete denture fabrication. The design of the metal (Wiron 99; Bego, Bremen, Germany) denture base (Figure 1A) was predetermined and was cast (Figure 1B) before the recording of jaw relations. After metal trial clinically (Figure 1C), routine laboratory procedures were followed for metal denture base fabrication (Figure 1D). With a metal denture base in the mandibular complete denture prosthesis, the patient reported to have less burning sensation without alteration of taste perception.

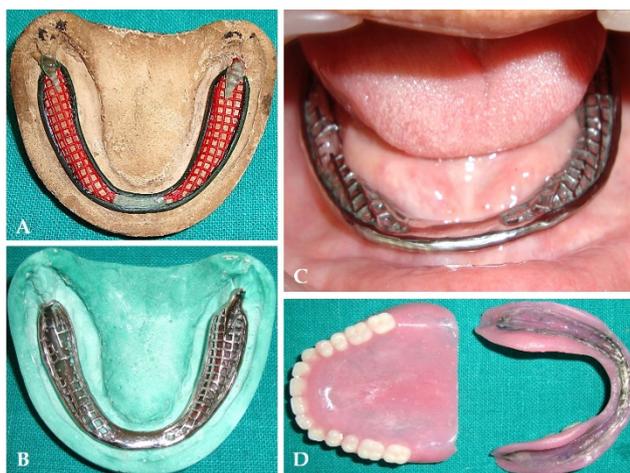


Figure 1. (A) Wax pattern on refractory cast (B) Metal denture base adaptation on master cast (C) Metal base during clinical trial (D) Final denture for maxillary and mandibular arches

Case 2: Sorption-related dimensional changes

An elderly female patient aged 64 years reported to the department of prosthodontics with a chief complaint of inability to adapt with present dentures. The patient also gave history of maladaptation and delayed adaptation with her previous two complete dentures. Her concern was that

she experienced changes in the complete denture prosthesis upon frequent usage while she was not conscious about any changes in the denture foundation. Patient's medical history revealed she was a known hypertensive since 5 years and was taking regular medication, claiming the blood pressure was under control. Social history revealed that patient was a teacher by profession who was on the verge of retirement. Dental history revealed that the patient had become completely edentulous more than 4 years back and since then she had changed multiple dentures. The first denture she was not able to adapt and discontinued after using maxillary denture for six months after fabrication. With second denture, she was able to wear the maxillary denture for a year but would only use mandibular dentures at the time of having food. The third denture had similar problems although the denture lasted for 14 months. With present dentures, the patient had same problems and attitudes and was wearing only maxillary denture. Extra oral and intra oral examination disclosed normal clinical features except for the mandibular lip being relatively short. Treatment options suggested to the patient included implant supported mandibular fixed or overdenture, conventional maxillary and mandibular complete dentures with lower denture having a metallic denture base. Routine clinical and laboratory procedures were used for fabrication of the maxillary and mandibular complete denture. Fabrication of the metal denture base (Wiron 99; Bego, Bremen, Germany) was done prior to jaw relations, and it included relieving the master cast using a wax spacer (Bego, Wilhelm-Herbst, Germany) (Figure 2A) following which a refractory cast (Bego, Germany) was prepared. The design for metal denture base included use of meshwork wax pattern (Moyco Industries, Inc, Philadelphia, PA) (Figure 2 B) which was sealed to the refractory cast. After finishing and polishing, the metal framework was tried in the patient's mouth (Figure 2 C). After jaw relations, teeth arrangement and denture trial the alloy denture base was lined with heat cure acrylic (Fortex; Lucite Intl, Durham) (Figure 2 D) and the denture was inserted. The patient was followed up regularly to help her adapt to new dentures. Patient wore mandibular denture successfully and had no such problems as with previous dentures.

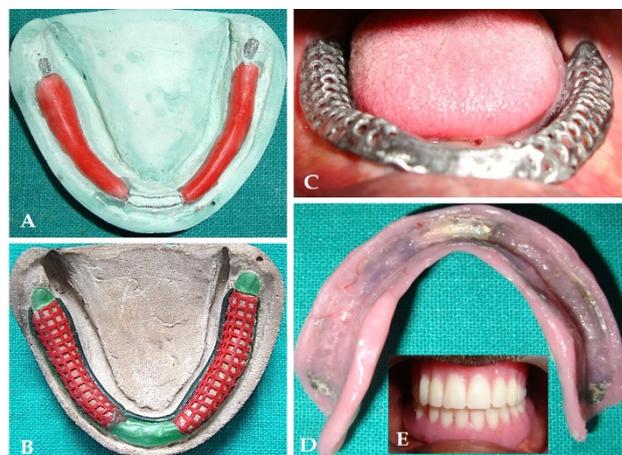


Figure 2. (A) Wax spacer to relieve residual alveolar ridge (B) Wax pattern placed on the refractory cast (C) Metal base during clinical trial (D) Final denture for maxillary and mandibular arches

Case 3: Enhancing health of tissues by thermal conductivity

An elderly male patient aged 62 years reported to department of prosthodontics with a chief complaint of annoyance over accumulation of food debris in the mandibular denture which he was wearing since last two years. The patient exclaimed that when food gets under the denture, he is not able to perceive it unless the food particles are big enough. Patient's medical, social and drug history were non-contributory to existing condition. The existing denture made of heat cure denture base resin did not seem to have any technical or clinical drawbacks. The denture was properly polished despite which food accumulation under the denture and the sides was present. Extra oral examination disclosed a severely long maxillary lip (Figure 3A) while other clinical features were within normal limits. Intra oral examination disclosed well-formed maxillary and mandibular residual alveolar ridges. Patient was presented with various treatment options that included implant supported fixed or removable complete dentures and a new conventional complete denture with mandibular metal denture base to which the patient consented unconditionally. Routine clinical procedures for complete denture and cast metal base fabrication were done. The meshwork wax pattern (Moyco Industries, Inc, Philadelphia, PA) was used as a design for cast denture base (Figure 3B) which was sprued at multiple places. The cast metal denture base was finished, polished (Figure 3C) following which routine jaw relation procedures were done. The cast alloy was incorporated into the final denture (Figure 3D) and the denture was delivered to the patient (Figure 3E). The patient was satisfied with the outcome of the denture especially non accumulation of food debris and thermal conductivity of the new dentures.

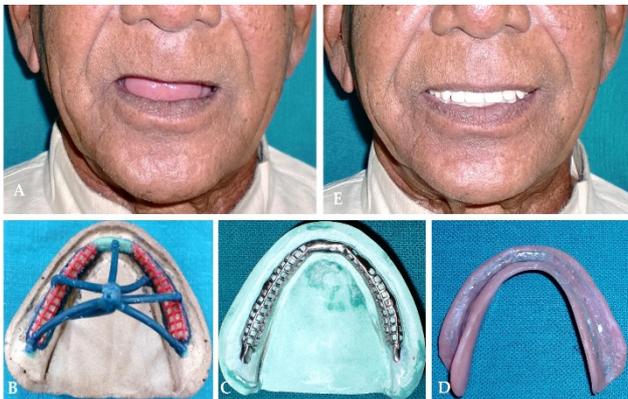


Figure 3. (A) Extra oral view showing a long maxillary lip (B) Wax pattern with multiple sprues attached (C) Metal base fitted on the master cast (D) Processed mandibular denture with metal base (E) Dentures in place

Case 4: Poor adaptation by acrylic denture base resin

A male patient aged 65 years reported to the department of prosthodontics for fabrication of a new denture. Patient's medical history did not signify any abnormality. The patient was a farmer by occupation. Patient had been completely edentulous for last 8 years and had been wearing one complete denture during his entire tenure of complete edentulism. Extra oral examination disclosed maxillary long lip while other clinical features were normal. Intra oral examination revealed well-formed

maxillary residual alveolar ridge while the mandibular ridge was resorbed. Other intra oral features were within the normal limits. The occlusal surface of the ridge was wavy with some areas higher than the other (at four places). Irregularity of the mandibular residual alveolar ridge was also present in the lateral direction. Treatment options given to the patient was an implant supported fixed or removable prosthesis which was rejected due to economic issues. The second option he consented was maxillary and mandibular complete denture with mandibular denture having a hybrid of metal and resin denture base. Routine clinical and laboratory procedures for the fabrication of complete denture were performed. A metal denture base (Wiron 99; Bego, Bremen, Germany) was tried in the patient mouth for adaptation (Figure 4A). Teeth were then arranged on casts mounted on a semi adjustable articulator (Artex; Girrbach Dental) (Figure 4B) following which a trial was done. Final denture was processed with heat cure denture base resin (DPI, India) (Figure 4C) and denture was then delivered to the patient who reported at his follow up that he was satisfied with the outcome of the treatment.

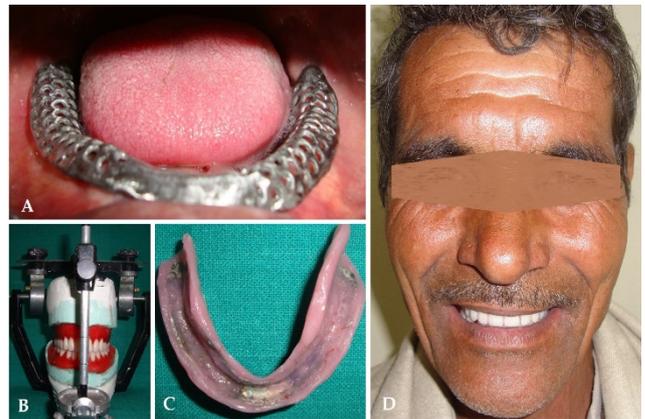


Figure 4. (A) Intra oral view showing a well-adapted metal base (B) Trial dentures mounted on semi adjustable articulator (C) Metal base fitted within the acrylic denture base (D) Dentures in place

2. Discussion

The selection of CDMB for patients needs a thorough insight into a patient's history, some details may be minute but they signify the indication for CDMB. A CDMB can be given in a complete denture patient, where the patient's complete denture undergoes frequent fracture especially when opposing teeth are natural. Most clinicians think of CDMB when strength is required, however we present four different cases where CDMB was a better choice than PMMA resin. Although all cases presented in this report are elderly, age should not be a contraindication for using a CDMB since literature tends to point out that CDMB are usually fabricated for elderly edentulous patients. [7,8] The metal used for CDMB can be either noble or non-noble alloys. [6] Economically base metal alloys like cobalt – chrome – molybdenum or cobalt-chrome alloy can be used since they have superior strength (strength to volume ratio) in thin sections, thus enhancing better phonetics, greater resistance to fatigue, biocompatible (hypoallergenic), thermal conductivity and

better adaptation than conventional denture base resins. [9] The first case presented in this article is of an elderly female patient who had undergone menopause, had already worn three dentures, was suffering from xerostomia that was physiological, and had observed that her burning sensation of mucosa would tend to increase if she wore unclean dentures. [10] The patient also presented with maxillary exostoses which were safely negotiated, although when such exostoses encroach posterior palatal seal area, fabrication of denture in such cases can be cumbersome. Menopause is characterized by oral manifestations that include burning sensation all over the oral cavity, especially in the anterior two third of tongue and hard palate. [11] as in this case, if xerostomia sets in due to aging or due to medication, wearing of prosthesis becomes difficult. [12] It is important that in extreme cases of xerostomia, the complete denture prosthesis has to be modified to accommodate a salivary reservoir. Such reservoirs can be either low or high volume types. [13] Gingivostomatitis due to menopause is characterized by gingival bleeding, change of gingiva to dry/shiny erythematous or to the atrophic pale mucosa. [14,15] Other implications for complete denture prosthesis are susceptible to osteoporosis leading to ridge resorption. [16] The use of CDMB in patients showing sensitivity after menopause avoids bacterial colonization and denture induced Candida infections, reduces burning on intake of cold foods since metal is a good thermal conductor, and more importantly eliminates the allergic response to resins thus reducing burning sensation of oral mucosa. [17]

In the second case, patient's chief complaints can be tracked to be the result of volumetric changes in complete denture as result of water sorption. Water sorption being one of the chief disadvantages of denture base resins. Most of the dimensional changes in denture base resin take place within first one month of processing and placing in water. [18] Water sorption by denture resin brings occlusal changes which need to be corrected by the dentist at follow up visits. Patient history did not reveal any sign of a patient following up or correcting her denture thus not allowing occlusal corrections. Occlusal discrepancy in centric occlusion creates trauma to the underlying mucosa resulting in oedema, which in turn makes denture wearing difficult. [19] The first few months are mandatory to promote adaptation to new dentures. Dentures are rejected if occlusal discrepancies exist, especially when the underlying mucosa is sensitive than normal.

The indications of CDMB in the third and the fourth cases presented in this article are based on the two main disadvantages of denture base resin, accumulation of food debris and poor adaptation of acrylic resin to the underlying residual alveolar ridge. Even though the dentures are polished from outside, the tissue surfaces are rough and chances of food accumulation are high. The thermal conductivity of CDMB enhances tissue health and response. [20] As put by the patient's own complaint, the food particle size when large enough, only then he would perceive their presence within the denture. Such ability to identify shapes is called as oral stereognostic ability and is due to the sensory perception of tongue and mucosa. [21] The anatomy of the residual alveolar ridge after tooth extraction should be also considered when a choice is to

be made between a metal denture base or a resin denture base. Metal denture base also allows ease in incorporation of palatine rugae which remain within the denture base irrespective of finishing and polishing procedures. [22] When the RAR is wavy and the surface presents many variations in architecture, resin base is not a good choice since the resins undergo polymerisation shrinkage and thus do not adapt to the underlying ridge. Differences in angulations over the ridge makes such adaptation more difficult which is why CDMB is a better choice than a resin base in such cases. A significant laboratory procedure involving fabrication of CDNB is accurate duplication of the master cast which in turn results in accurate refractory cast. [23] Case 3 also presented with one difficulty which was the maxillary lip being too long. Whenever, a long lip is encountered it is imperative to evaluate the freeway space that can be incorporated within the artificial denture. [24] The presence of a long maxillary lip places occlusal plane far away from the residual alveolar ridge which compromises denture retention and stability. Placing the occlusal plane close to ridge is a better option while compromising aesthetics in such cases. [25] It is imperative, that if a clinician decides to compromise visibility of teeth, the patient should be informed well in advance. In cases of long maxillary lip where the mandibular denture has to be made with a metal denture base, the recording of free-way space becomes more critical. The reason being that metal denture base occupies some thickness within the denture base, and alterations in the height of mandibular occlusal rims are less desired. Also, one should establish the freeway space uniformly throughout the entire occlusal rims. We accomplished this by using extra oral freeway space determination method described by Kumar et al. [26] Use of a rigid orthodontic stainless steel 19-gauge wire allowed us to assess the uniformity of freeway space within the vertical jaw relations.

3. Conclusion

In order to broaden the clinical scope of one's dental practice, it is important to have knowledge and understanding of certain clinical situations where conventional plastic denture bases are not indicated. There are some situations where use of metal denture base provides patient with more advantages. Clinicians must not hesitate to explore such situations and do the needful.

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