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Case Report

Prefabricated Metal Mesh Reinforced Removable Complete Denture: Case Report

Arpit Sikri[1]* and Jyotsana Sikri[2]

[1]Associate Professor and Post Graduate Teacher, Department of Prosthodontics, Crown and Bridge and Oral Implantology, Bhojia Dental College and Hospital, Budh (Baddi), Himachal Pradesh, India

[2]Associate Professor and Post Graduate Teacher, Department of Conservative Dentistry and Endodontics, Bhojia Dental College and Hospital, Budh (Baddi), Himachal Pradesh, India

***Corresponding Author:** Arpit Sikri, Associate Professor and Post Graduate Teacher, Department of Prosthodontics, Crown and Bridge and Oral Implantology, Bhojia Dental College and Hospital, Budh (Baddi), Himachal Pradesh, India.

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Abstract

Fracture of the complete denture (CD) may cripple the day-to-day routine life of the patient. This may eventually be quite disappointing and frustrating for both the patient as well as the clinician. CD fractures may be attributed to a number of reasons namely: natural teeth in the opposing arch i.e. single denture opposing natural dentition or fixed dental prosthesis, extreme palatal vault depth, hard and sharp anatomic formation of the mid-palatal line, high frenal attachments, extremely thin denture base etc. Prosthodontic management of patients with previous history of complete denture fractures is a herculean task and mainly requires an unconventional approach. Conventional heat cure acrylic resins are unable to resist the occlusal loads; subsequently, leading to the complete denture fractures. An easy and an economical solution to reinforce acrylic denture bases involves incorporation of the metal reinforcements to the denture. Metal can be added to the denture bases in various forms namely the wires, bars, mesh and plates. Studies have proven a considerable beneficial effect on the fracture resistance of PMMA by incorporating metal to the PMMA matrix. This case report portrays the prosthetic rehabilitation of an edentulous patient with reinforced complete dentures using prefabricated metal mesh. The reinforcement method using prefabricated metal mesh is an easy, simple, less time consuming and relatively economical approach in unconventional edentulous situations.

Keywords: *Acrylic Resin; Complete Denture; Denture Fracture; Flexural Fatigue; Metal Grid Strengthener; Prefabricated Metal Mesh; Reinforced Denture; Sandwiched Technique*

Introduction

The use of PMMA i.e. Poly (methyl methacrylate) in the field of dentistry has always played a pivotal role as a denture base material [1]. Since its inception, it is used as a material of choice in regards to the removable prosthesis. Inspite of a number of advantages associated with acrylics, it may also have certain pitfalls. This generally includes the mechanical properties namely the fatigue resistance as well as the impact strength. Both these properties are not up to the mark. This may eventually lead to flexure and subsequently concentration of stresses within the removable complete denture. Conclusively, it may lead to the fracture of the acrylic denture base, leading to an unpleasant experience for the patient [2]. Fracture of the acrylic denture can be attributed to a number of factors namely an extremely high/deep palatal vault, high frenal attachments, an excessively thin denture base, single denture (maxillary or mandibular) opposing the natural dentition or fixed prosthesis, hard and sharp anatomic formation of the mid-palatal line or in certain cases due to the accidental reasons. This mandates the reinforcement of acrylic denture base materials to improve its mechanical properties and subsequently for the success of the removable complete dentures [3].

According to the literature reviews, midline fractures are the most common fractures in removable complete dentures. In maxil-

lary CD, it is around 46.87% and in mandibular CD, it is around 61% [4]. A plethora of strategies have been proposed in the past for the reinforcement of acrylic denture base materials [5]. They include:

- Metal reinforced complete dentures,
- Substituting PMMA with polycarbonates and polyamides,
- Chemical modification of PMMA - incorporating cross linking agents or rubber in the form of butadiene styrene,
- Strengthening of PMMA by incorporating fibers namely the carbon fibres, glass fibres, aramid fibres, Lucitone, Trevalon high, Paladon ultra,
- Using visible light polymerized (VLC) resins,
- Strengthening by incorporating metal inserts into the heat processed denture bases. Metal can be added to the denture bases in the form of wires, bars, mesh or plates,
- Incorporation of nanomaterials in acrylic resins i.e. Nano resins,
- Using polymers -PEEK (PolyEtherEtherKetone) or PEKK (PolyEtherKetoneKetone).

All the above methods of reinforcement have shown considerable increase in the resistance to the denture fractures and decrease in chances of failure of the prosthesis. Studies have proven a considerable beneficial effect on the fracture resistance of PMMA by incorporating metal to the PMMA matrix [6]. This paper presents a case report on the prosthetic rehabilitation of an edentulous patient with reinforced complete dentures using prefabricated metal mesh.

Case Report

A 65-year old completely edentulous female patient reported to the Department of Prosthodontics, Crown and Bridge and Oral Implantology, with a chief complaint of an existing fractured maxillary denture (Figure 1). She was also dissatisfied with the difference in the colour of her existing dentures (Figure 2), hence, wanted to replace them with a new one. Patient had insignificant past medical history. Her major concern was to improve her masticatory function.

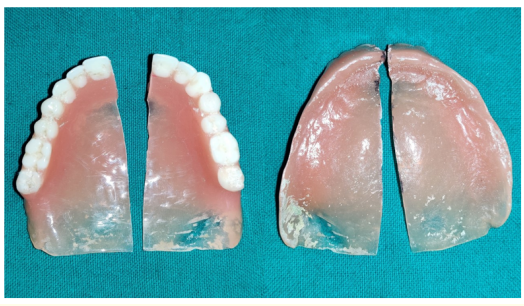

Figure 1: *Existing fractured maxillary denture - a) occlusal view, b) intaglio view.*

Figure 2: *Previous dentures - maxillary & mandibular - a) occlusal view, b) intaglio view.*

Intraoral examination revealed a normal mucosa with a U-shaped edentulous maxillary arch (Figure 3) and a V-shaped edentulous mandibular arch (Figure 4). The patient was informed about various treatment options for prosthetic rehabilitation i.e. implant supported fixed prosthesis, implant retained overdentures (both maxillary and mandibular), metal base removable complete dentures and lastly, the reinforcement of the dentures using incorporation of metal mesh or materials like fibers. After explaining the various prosthetic treatment options to the patient, she agreed upon the reinforced dentures using prefabricated metal mesh, keeping in view her financial concerns.

Figure 3: *U shaped maxillary arch.*

Figure 4: *V shaped mandibular arch.*

Procedure

The preliminary steps of complete denture fabrication remained the same:

1. Preliminary impressions of the maxillary and mandibular arches were made using medium fusing impression compound (Hiflex Impression Compound, Prevest DenPro Limited, Jammu, India) (Figure 5).

2. Beading and boxing of the primary impressions was done (MAARC Dental, Maharashtra, India) to obtain a proper primary cast using type II dental plaster (GypRock plaster, Rajkot, Gujarat, India) (Figure 6).

3. After adaptation of the wax spacer (MAARC Dental, Maharashtra, India) (Figure 7), custom (individual) trays were fabricated using autopolymerizing acylic resin (DPI RR Cold Cure, Dental Products of India, Mumbai, India) (Figure 8).

4. Border moulding was performed using low fusing green stick compound (Pinnacle Tracing Sticks, Dental Products of India, Mumbai, India) (Figure 9) and the final impressions were made using medium body polyvinyl siloxane elastomeric impression material (Aquasil Ultra Medium, Dentsply India Pvt Ltd, Mumbai, India) (Figure 10).

5. Beading and boxing of the final impressions (MAARC Dental, Maharashtra, India) were done (Figure 11) to retrieve well-formed master casts.

6. Definitive casts were poured using type III gypsum product i.e. dental stone (GypRock stone, Rajkot, Gujarat, India) (Figure 12).

7. After the definitive casts were obtained, temporary denture bases and occlusal rims were fabricated (Figure 13).

8. Orientation jaw relation was recorded using facebow (Hanau™ Springbow, Whip Mix, Kentucky, USA) followed by transfer to the semiadjustable articulator (Hanau™ Wide-Vue, Whip Mix, Kentucky, USA) (Figure 14).

9. Tentative jaw relations were carried out following the facebow transfer. After recording the centric relation record, the casts were mounted in a semiadjustable articulator. The artificial teeth were adjusted and teeth arrangement was done following the ideal principles.

10. Trial denture was assessed intra-orally, to verify the function, fit and esthetics, before its processing (Figure 15).

11. The flasking procedure was carried out for both the arches. The size of the reinforcement mesh (MAARC - CE Reinforcement Golden Mesh, Shiva Products, Thane, India) (Figure 16) was marked using a black compact disc marker, and was trimmed accordingly with the help of sharp scissors and carborundum disk (Figure 17). Following which it was adapted to the master cast by using a universal plier and kept aside to be incorporated after the dewaxing procedure.

12. The dewaxing process was completed (Figure 18). After the application of tin foil substitute (DPI Heat Cure Cold Mould Seal, Dental Products of India, Mumbai, India), the already adjusted prefabricated metal mesh was checked on the maxillary cast for any last minute corrections in its adaptation. A sort of sandwiched procedure was implemented which involved adapting some amount of the dough resin on the maxillary cast over which the metal mesh was placed accurately (Figure 19); and the denture was packed, pressed and processed in the conventional manner (DPI Heat Cure, Dental Products of India, Mumbai, India).

13. The small thickness of 0.4mm of the mesh helped in avoiding over dimensioning of the denture base.

14. The processed dentures were retrieved and cleaned using an ultrasonic cleaner.

15. The dentures were finished, polished and tried in the patient's mouth for evaluation of appropriate esthetics and occlusion (Figure 20). After the necessary occlusal corrections, the prostheses i.e. removable maxillary complete denture with prefabricated metal mesh and conventional removable mandibular complete denture, were delivered (Figure 21).

16. Patient was given instructions following the insertion of the complete dentures. Patient was evaluated after 3 recall visits i.e. after 24 hours, 1 week, and 1 month, respectively. Patient was satisfied with the esthetics, phonetics and function of the removable complete dentures.

Figure 5: *Preliminary impressions - maxillary and mandibular.*

Figure 6: *Preliminary casts - maxillary and mandibular.*

Figure 7: *Wax spacer adaptation - maxillary and mandibular.*

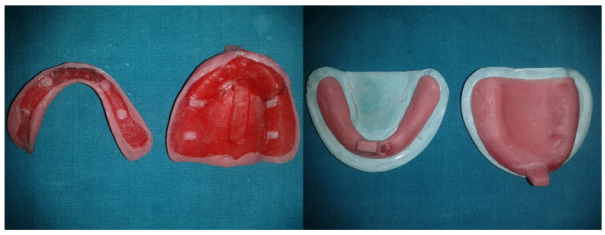

Figure 8: *Special trays - maxillary & mandibular - a) occlusal view, b) intaglio view.*

Figure 9: *Border moulding - maxillary and mandibular.*

Figure 10: *Final impressions - maxillary and mandibular.*

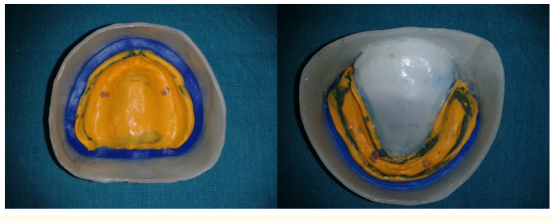

Figure 11: *Beading and boxing - maxillary and mandibular.*

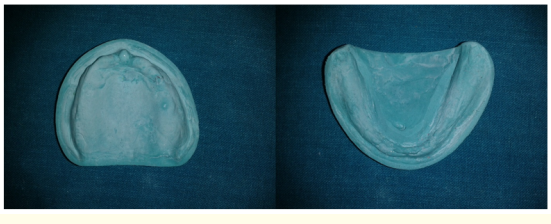

Figure 12: *Definitive cast - maxillary and mandibular.*

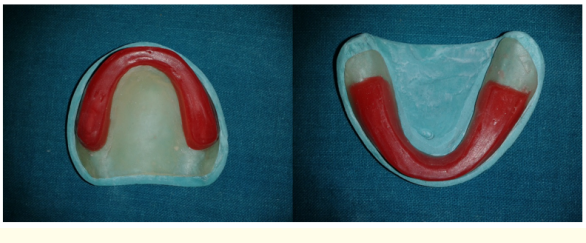

Figure 13: *Occlusal rims - maxillary and mandibular.*

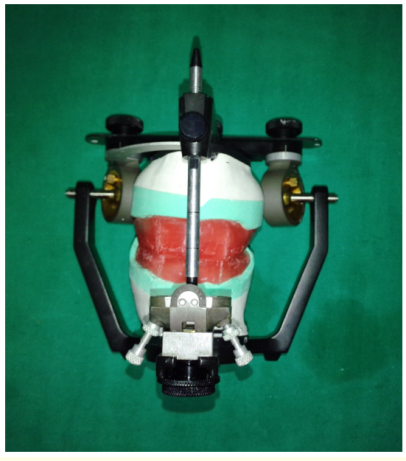

Figure 14: *Facebow transfer on Hanau wide vue articulator..*

Figure 15: *Waxed up try in.*

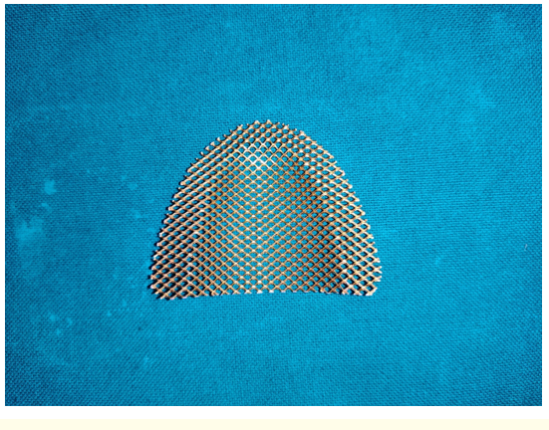

Figure 16: *Metal mesh.*

Figure 17: *Armamentarium - a) Metal mesh, b) Black CD marker, c) Sharp scissors, d) Carborundum disk, e) Universal plier.*

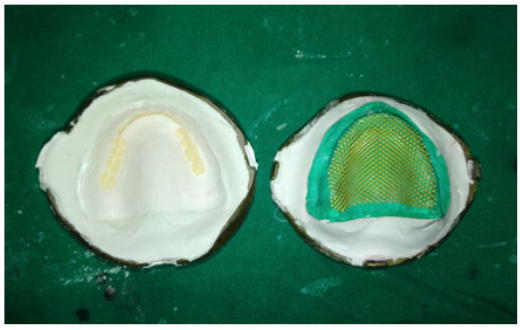

Figure 18: *Dewaxing.*

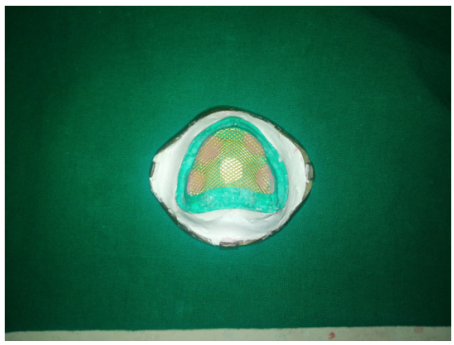

Figure 19: *Sandwiched procedure.*

Figure 20: *Final complete dentures - a) occlusal view, b) intaglio view.*

Figure 21: *Final complete dentures - in patient's mouth.*

Discussion

The fracture in the removable complete denture occurs mainly due to two types of forces i.e. impact and flexure fatigue [7]. Impact, as the name suggests, occurs due to sudden blow to the dentures or accidental dropping of the dentures from the hand of an operator, a laboratory person, or a patient. The other type of force i.e. flexure, mainly occurs due to repeated stresses of low dimension (cyclic deformation) i.e. stress concentration, resulting in the formation of micro cracks. In addition to this, some factors may also alter the stress distribution of the denture base. A fractured denture is an important problem not only for the patients but also for the dental surgeons as well as the dental laboratory personnel [8].

The fracture occurs as a result of crack initiation and propagation from areas of high stress concentration. PMMA exhibits poor mechanical properties i.e. low impact strength and low fatigue resistance. Application of heavy occlusal loads may lead to fracture of the removable complete dentures. In order to overcome this problem, various methods of reinforcements have been proposed in the literature [9].

In case of fracture of the single denture, a number of factors may be attributed namely improper occlusal plane (mandibular), high frenum, improper occlusal scheme and occlusal forces, improper denture base thickness and foundation [10]. The metal grid strengthener for heat processed PMMA denture bases is available in both stainless steel and gold plated metal. They have a thickness of 0.4mm and their mesh design helps to produce a good resin bond. Prefabricated metal mesh does not increase the weight of the prosthesis. The considerable decrease in the propagation of microcracks due to the metal reinforcement aids in reducing the chances of fracture, thereby increasing the fracture resistance of PMMA [11]. This sandwiched technique of incorporating the metal mesh aids in achieving a uniform thickness of acrylic without increasing the bulk of the denture base ultimately increasing the strength of the denture. Metal mesh, thus proves to be a viable and an economical option for the patient.

The conventionally used stock trays for impression making can be cut and modified to be used for the reinforcement of the CD [12]. However, a pronounced disadvantage of incorporating metallic components is that they are obviously unaesthetic particularly on the labial aspect of the denture especially when the patient smiles, prone to corrosion and exhibit poor adhesion to the acrylic denture base. To mask the unaesthetic look of the metallic component, a technique of coating the metallic mesh with self-cure autopolymerizing resin i.e. brush bead technique has also been mentioned in the literature [13]. This aids in masking it from the translucent heat cure resin, thereby enhancing the esthetics. In addition to this, patient may be allergic to the metal components.

Impression making in the unconventional situations i.e. impressions should be recorded in a functional form so as to record the entire denture bearing area. [14] The regions possessing a very thin or less keratinized submucosa, should be ideally relieved. Such areas need to be recorded without any displacement. The techniques for impression making is based on the difference in the resiliency of the tissues particularly in the region of palate. The ultimate aim of the same is to cause less displacement of the more resilient tissues leading to a better denture support and less chances of residual ridge resorption. Impression technique particularly the mucostatic impression technique using a low viscosity zinc oxide eugenol impression paste needs to be employed for the final impressions [15]. Establishment of balanced occlusion is always a favoured design in conventional complete denture occlusion and helps in the final preservation of the edentulous ridge for the ultimate stability of the dentures. Lack of the balanced occlusion would become a predisposing factor for the CD fracture [16].

Conclusion

Prosthetic rehabilitation of patients with previously fractured removable complete dentures is a big challenge for the prosthodontist. Reinforcements in removable conventional complete denture is the need of the hour for tackling such unconventional situations. Such reinforcements have depicted a phenomenal increase in the impact strength as well as fatigue resistance in comparison to the unreinforced or the conventional complete dentures. Incorporating the prefabricated metal mesh to the heat-cured acrylic denture provides a simple, less time consuming, viable treatment option and an economical method for reinforcing the acrylic removable complete denture, thereby offering a better impact strength and fracture resistance.

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Volume 5 Issue 2 February 2022