Chair-Side Fabrication of a Fixed Implant-Supported Prosthesis in an Edentulous Mandible From A Diagnostic Wax-Up: A Clinical Report

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INTRODUCTION

Fixed implant-supported prosthetic rehabilitation for the edentulous mandible has been extensively described in the literature.[1–5] The fixed-implant supported prosthesis can either be screw-retained or cemented over the implant abutments. The traditional screw-retained metal-resin prosthesis (hybrid denture prosthesis) is one of the most popular choices for prosthetic therapy in edentulous mandibles. Some of the advantages of this prosthesis are its long track record of success and its retrievability; it is also minimally expensive compared to porcelain for fabrication and repairs.[3–5]

With the popularity of immediate loading protocols, many clinicians now choose to convert a patient's existing complete denture or a treatment denture into an interim fixed implant-supported prosthesis.[6–9] Balshi and Wolfinger have called this procedure a ''conversion prosthesis.''[10] This procedure tremendously adds to patient function and treatment satisfaction.[8,11,12] Even in situations where immediate loading of implants is not undertaken, a clinician may choose to provide the patient with a conversion prosthesis.[13] This is generally done to allow patients to experience the satisfaction of a fixed prosthesis and to allow them to monitor their oral hygiene habits prior to insertion of the definitive prosthesis. This will also help to rectify any issues experienced by the patient and help improve the definitive prosthesis.[13]

One of the limitations to the conversion prosthesis is that it requires fabrication of a new complete denture if the patient's existing denture is unacceptable or if the patient lacks an existing denture. This will add to the treatment time and expenses. Oftentimes, patients are unwilling to pay for a prosthesis that is planned to be used only for an interim period. This may hinder a patient to have an immediately loaded prosthesis or an interim prosthesis after the healing period.

Several authors have described denture duplication techniques in order to provide the patient with a spare denture for various reasons.[14–24] Most of the older techniques are more time-consuming and technique-sensitive as they were recommended with a goal of obtaining excellent retention and stability for the duplicate complete denture.[14–19] Others involve a laboratory component, which precludes them from being done by the chair-side.[18–24]

However, a denture duplication technique, with a purpose of conversion to an

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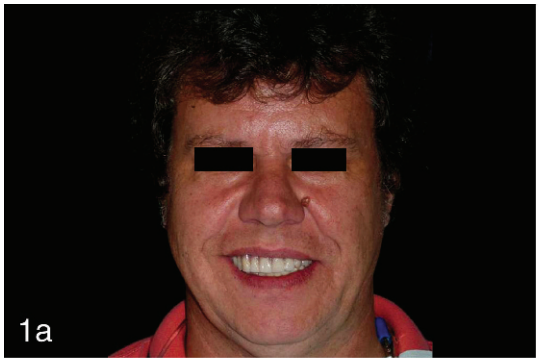

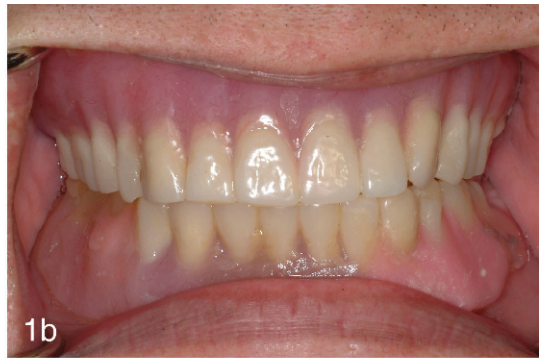

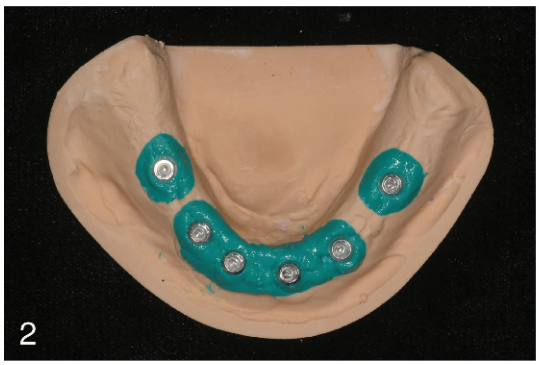

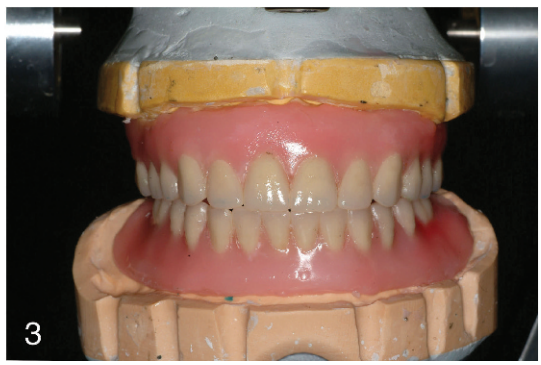

Figures 1–3. Figure 1a. Pretreatment image of the patient in smile with the existing prosthesis. **Figure 1b.** Pretreatment image of the patient's existing prosthesis. **Figure 2.** Definitive mandibular cast representing the positions of the 6 dental implants. **Figure 3.** Maxillary and mandibular trial dentures on the mounted casts. Note the notches on the mandibular cast.

implant-supported fixed prosthesis need not subscribe to the same level of technique sensitivity as for a complete denture. The main goal here is to replicate the esthetics and positions of the teeth and to obtain a stable denture base that can be positioned properly while being attached to the implants. The purpose of this clinical report is to describe the treatment of a patient with a mandibular interim fixed prosthesis fabricated by the chair-side by duplication of the diagnostic wax-up.

Clinical Report

A 50-year-old man was referred to the prosthodontist for evaluation of his implants and fabrication of a fixed implant-supported prosthesis (Figure 1a). Analysis of the patient's history revealed that he had 5 teeth extracted and 6 dental implants placed in the mandible about 2 months prior to presentation. At the time of presentation, he had been wearing maxillary and mandibular complete dentures. The mandibular complete denture appeared to have been fabricated by conversion of his previous acrylic resin partial denture to a complete denture prosthesis (Figure 1b). The patient stated that he rarely wore this prosthesis and only for certain occasions. It had been relieved over the healing abutments of the 6 dental implants. The patient stated that he had been wearing his maxillary complete denture for several years. The esthetics and fit of both dentures were deemed unsatisfactory. Clinical and radiographic examination revealed that all 6 implants were 4.1 mm in diameter (RN Standard Plus; Straumann, Waldenburg, Switzerland) and appeared to have been placed in satisfactory positions with a good anterior-posterior spread. The patient's mandible exhibited moderate amount of resorption, and it appeared that there would be no issues with prosthetic space. The healing abutments were removed and none of the

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implants demonstrated mobility, bone loss, or clinical signs of infection.

As the patient had desired a fixed implant-supported prosthesis in the mandible, the treatment planning process was relatively straightforward. He was educated about obtaining a new maxillary complete denture, as the existing denture was compromised in retention, esthetics, and occlusion. The patient consented to fabrication of a screw-retained metal-resin fixed prosthesis in the mandible and a new complete denture in the maxilla. Diagnostic casts were prepared for fabrication of custom impression trays. After border molding, a final impression of the maxilla was made using polysulfide rubber impression material (Permlastic; Kerr Dental, Orange, Calif) and an implant-level impression was made in the mandible using polyether impression material (Impregum Pentasoft; 3M ESPE Dental Products, St Paul, Minn). The mandibular definitive cast was prepared in type IV stone (Denstone; Heraeus Kulzer, South Bend, Ind) and was verified for accuracy (Figure 2). Thereafter, standard prosthodontic principles were applied to obtain facebow and maxillomandibular relationship records. The definitive casts were mounted on a semi-adjustable articulator and a diagnostic wax-up was accomplished (Figure 3). The trial dentures were tried in the patient's mouth, and esthetics and occlusion were deemed satisfactory to the patient and his family. Therefore, it was decided to use these teeth positions for fabrication of a metal bar for the definitive fixed prosthesis for the mandible.

At this stage, the patient's financial situation had suddenly changed and the treatment plan had to be modified to accommodate the new situation. As he was no longer able to afford a definitive fixed prosthesis, he requested an interim prosthesis that could utilize his existing implants and improve his function. After careful consideration of the patient's finances and expectations, it was decided to fabricate an interim prosthesis that was fixed in nature, as well as economical to fabricate by utilizing a chair-side procedure. For this purpose, it was decided to first fabricate a duplicate denture in auto-polymerizing acrylic resin using the ideal diagnostic wax-up.

The mandibular trial denture was sealed on the definitive cast using sticky wax. Vinyl polysiloxane putty material (Aquasil Easy Mix Putty; Dentsply, York, Pa) was then mixed and adapted on it extending into the notches on the land areas and sides of the definitive cast. After the material had set, the putty matrix was removed and tooth colored auto-polymerizing resin (Coldpac Tooth Acrylic; Yates Motloid, Chicago, Ill) was mixed and flown to fill up to the cervical regions of the prosthetic teeth. The matrix was placed in a warm-water bath to accelerate the polymerization process. After the material had set, small grooves were cut into the ridge lap areas representing the teeth to aid in mechanical retention for the denture base resin (Figure 4a). The horse-shoe shaped ''white'' acrylic resin structure was removed, and the facial and occlusal surfaces were lubricated with petroleum jelly before placing it back in the putty matrix. This was done to ensure easy separation of any denture base resin that could overflow on the tooth colored resin. The definitive cast was also lubricated with petroleum jelly. Auto-polymerizing denture base resin (Dentsply Repair Material; Dentsply) was then mixed and flown into the putty matrix and immediately seated on the cast using the indices on the land areas to confirm orientation. The putty matrix was secured on the definitive cast using rubber bands and placed in a pressure pot with warm water at a pressure of 30 psi for 10 minutes.

After polymerization of the material, the duplicate denture was separated from the putty matrix (Figure 4b). It was trimmed carefully to ensure smooth borders as well as stable bases in the buccal shelf areas. The

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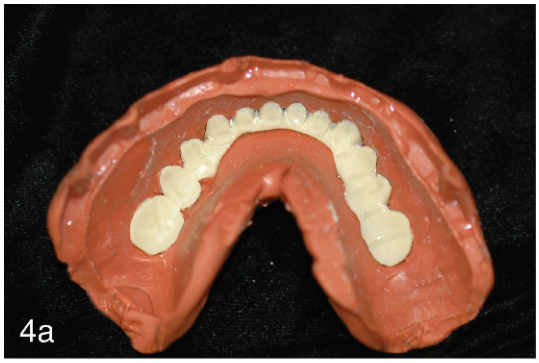

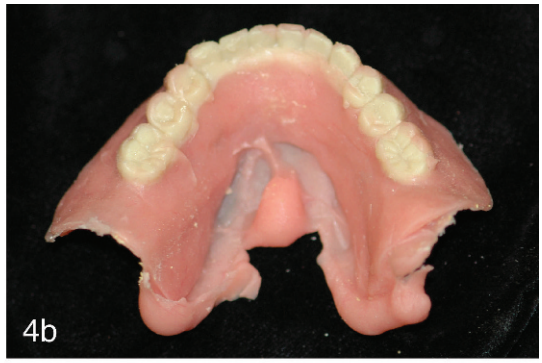

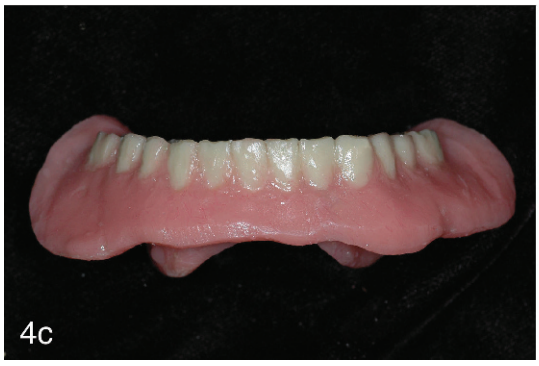

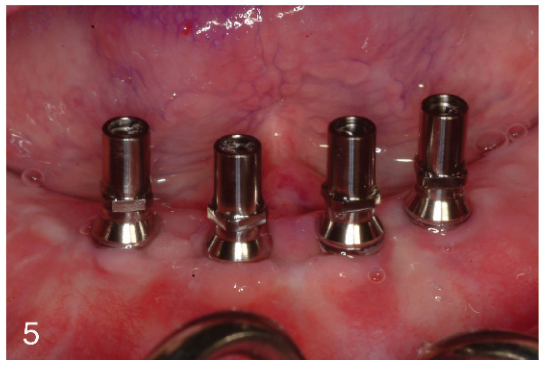

Figures 4 and 5. Figure 4a. Putty matrix of the diagnostic wax-up with tooth-colored acrylic resin. Note the impression of the notches in the putty matrix and the grooves on the teeth. **Figure 4b.** Duplicated acrylic resin denture after separation from the putty matrix. **Figure 4c.** Trimmed acrylic resin denture ready to be converted to a screw-retained interim fixed prosthesis. **Figure 5.** Temporary abutments being placed on the 4 anterior implants before being attached to the duplicate denture.

denture was made smooth but not polished at this stage (Figure 4c). It was then tried in the patient's mouth and the fit and patient comfort were verified. The occlusion of this denture against the patient's existing maxillary denture was analyzed and adjusted intra-orally. The patient's existing maxillary denture was also adjusted, and bilateral stable occlusion was obtained. Thereafter, 4 temporary abutments (RN Synocta Temporary Bridge Post, Straumann) were hand-tightened on the 4 anterior implants (Figure 5). The denture had holes drilled in these regions in order to accommodate the temporary abutments. Small pieces of rubber-dam material were used to block out the regions below the temporary abutments.[13] Auto-polymerizing resin was injected around the temporary abutments, and the patient was instructed to close his mouth and maintain the occlusion in maximum intercuspation.

After the material had set, the denture was unscrewed and additional acrylic resin material was added it to obtain a smooth and convex contour on the tissue surface. Thereafter, all excess material was trimmed away to create a horseshoe-shaped prosthesis that was smoothened and polished. It was tried on the definitive cast and a passive fit was ensured by visual and tactile methods. The prosthesis was tried in the mouth and additional acrylic resin was added to the posterior region to contact the healing abutments of the distal implants and obtain additional posterior support (Figure 6a). The 4 temporary screws were hand-tightened over the implants as per manufacturer's instructions. The screw channels were filled with silicone (Fit Checker; GC America Inc, Alsip, Ill) and sealed with composite resin after 4 weeks (Figure 6b). The patient was given postoperative cleaning instructions using superfloss, proxabrushes, and electrical

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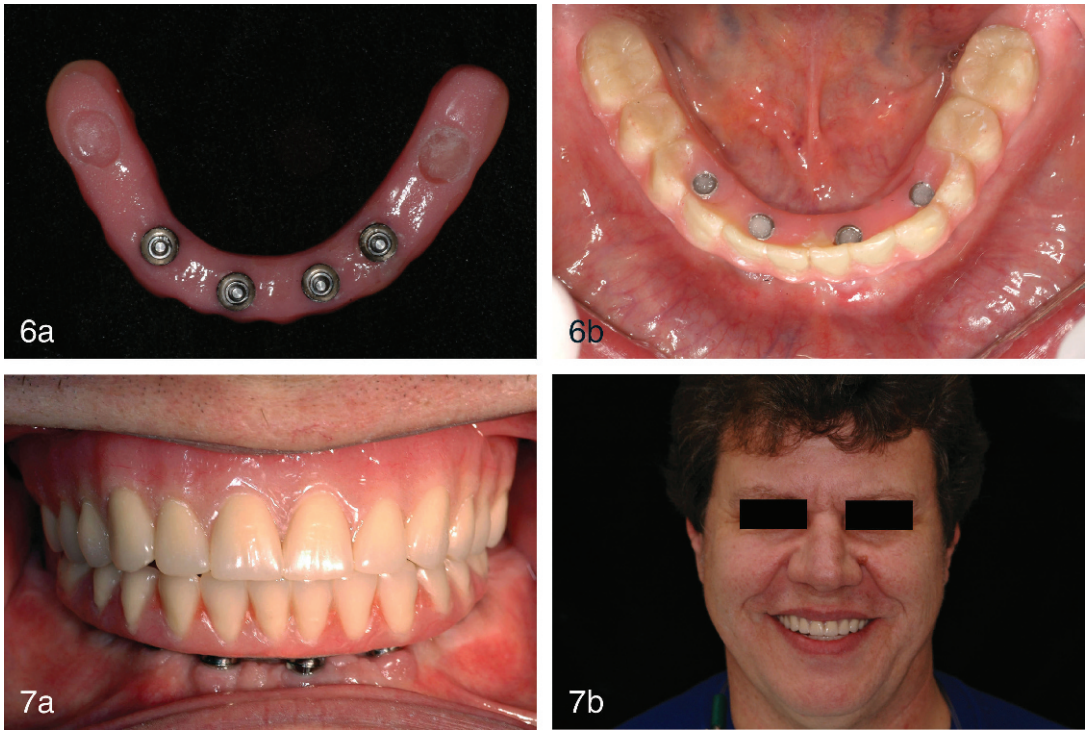

Figures 6 and 7. Figure 6a. Tissue surface of the interim fixed prosthesis showing smooth convex contours. Note the impressions of the healing abutments of the distal implants. **Figure 6b.** Screw-retained acrylic resin interim fixed prosthesis inserted in the mouth. **Figure 7a.** Frontal image of the patient with the definitive prostheses. **Figure 7b.** Full-face image of the patient in smile with the definitive prostheses.

water irrigation system. He was educated about maintenance and all potential complications related to the prosthesis. The patient was seen on a 1-month recall and reported no problems with the prosthesis. The hygiene underneath the prosthesis was satisfactory.

Eight months after initial presentation, the patient returned with a request for fabrication of definitive prostheses as his financial situation had improved. The interim mandibular fixed prosthesis was clinically examined and the patient had no complications. He remained satisfied with the esthetics and function of this prosthesis. In accordance with the treatment plan, his preserved diagnostic wax-up was sent to the laboratory for fabrication of a computer aided design/computer aided manufacturing milled titanium bar (Cam StructSure; Biomet 3i, Palm Beach, Fla) on the 6 mandibular implants. After trying the finished bar in the patient's mouth, prosthetic teeth were transferred over the bar using a prefabricated index. A final esthetic try-in was performed to confirm accurate transfer of teeth, and the final prostheses were fabricated in heat-polymerized acrylic resin (Lucitone; Dentsply). The interim fixed prosthesis was unscrewed, the definitive maxillary and mandibular prostheses were then inserted in the patient's mouth, and final occlusion was verified and adjusted (Figure 7a). The patient expressed satisfaction with regard to esthetics and occlusion of the final prostheses (Figure 7b). He was placed on annual recalls and exhibited no complications at a 1-year recall.

Discussion

Acrylic resin interim fixed prosthesis has been extensively documented in the literature, especially for use in immediate loading situations.[6–8,10] Patient satisfaction with this type of prosthesis has also been shown to be

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excellent.[11,12] Therefore, in this patient a fixed interim prosthesis was the treatment of choice as opposed to a removable one. The patient's existing mandibular denture was unacceptable to be relined over the healing abutments for use as an implant-supported overdenture. Fabrication of a new complete denture was deemed expensive, and hence the prepared diagnostic wax-up was used for duplication purposes. This resulted in lower cost because it did not include the denture teeth themselves or the laboratory expenses for denture processing. The denture teeth of the diagnostic wax-up were preserved and later used for the definitive prosthesis.

Though the patient presented with 6 implants, only 4 temporary abutments were utilized in the interim prosthesis in order to decrease expenses as well as to negotiate with lesser prosthetic screws during clinical appointments. However, care was taken to ensure that the prosthesis established contact with the healing abutments of the distal implants and to obtain additional support posteriorly. Therefore, the patient was reinforced to maintain oral hygiene underneath the prosthesis in this area. Metal reinforcement was not used in this prosthesis as it would have added to the treatment expenses and has been shown to be unnecessary for this type of prosthesis.[6,25] Furthermore, the patient had an opposing maxillary complete denture, which may not have been detrimental to the situation.

A disadvantage to this type of prosthesis is that using the duplicate denture created from an ideal diagnostic wax-up may introduce occlusal issues because of tooth positions and vertical dimension; therefore, the clinician and the patient must be prepared for adjustments of the opposing prosthesis. The finish and surface texture of auto-polymerizing acrylic resin teeth are not similar to those of manufactured denture teeth that generally have a smooth surface finish. This may affect esthetics depending upon the amount of teeth displayed by a patient in smile and in function. Long-term use of this type of prosthesis may result in accelerated wear and compromise occlusion. Additionally, auto-polymerizing resin lacks sufficient strength, and the prosthesis may fracture in situations where prosthetic space is compromised.

Summary

This clinical report described a successful and economical interim solution for a patient who desired a fixed implant-supported prosthesis in the mandible. As the patient's existing denture was unacceptable, a diagnostic wax-up made for the definitive prosthesis was duplicated and converted to an interim prosthesis by a chair-side technique. Eventually, the patient's financial situation improved and he returned for a successful fabrication of a definitive screw-retained metal-resin fixed prosthesis. The principles and techniques described in detail in this report may perhaps guide clinicians in the treatment of similar patients with economic challenges.

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