

Simplifying Prosthetic Procedures while Converting an Interim Maxillary Removable Complete Denture to an Interim Implant-Supported Fixed Complete Denture

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Rehabilitation of a completely edentulous arch with an implantsupported fixed complete denture often requires the fabrication of a removable complete denture as an interim prosthesis.¹ Although this prosthesis will be used for a limited period of time, its fabrication should follow all guidelines governing the correct construction of a removable complete denture. In this way, an esthetically appealing, functional and biologic result can be achieved. During the provisionalization period a continuous evaluation should be performed. Additionally, the patient's concerns should be addressed, and possible modifications should be made to the prosthesis.

After the successful osseointegration of dental implants, a master impression of the dental implants and fabrication of a definitive cast are required. The articulation of these casts is a critical step. Traditionally, record bases with wax rims are fabricated on the definitive casts.¹ An alternative method involves the fabrication of a stable acrylic base with wax rims stabilized on the healing dental implant abutments² or retained by temporary implant cylinders.³ In both techniques the occlusal plane should be determined, and the occlusal vertical

Abstract

This article describes a method of converting an interim maxillary removable complete denture to an interim implant-supported fixed complete denture. The advantages of this method are that it provides the opportunity to evaluate the patient's function and esthetics, and helps the accurate transfer of the maxillomandibular relationship to the laboratory. Consequently, the fabrication of the definitive prostheses is accurate, and the final result is predictable.

dimension (OVD) should be established; however, during the construction of the interim removable complete denture prosthesis, the OVD, the occlusal plane, and the centric relation have already been determined and verified during the provisionalization period. Thus, the construction of either record bases with wax rims or of an acrylic base retained by temporary cylinders is unnecessary.

This technical report describes the conversion of a maxillary interim removable complete denture to an interim implantsupported fixed complete denture. This interim prosthesis can be used for the articulation of the definitive casts and as a template for the fabrication of the definitive prosthesis.

Background

A 62-year-old woman with generalized moderate periodontitis and localized advanced periodontitis presented for dental treatment with a request for a fixed dental prosthesis. The patient's treatment plan was established with consideration of her medical and dental history, after consultations with a periodontist and an endodontist. Extraction of all remaining maxillary teeth, placement of six dental implants along with surgical periodontal therapy in the mandible and placement of an implant at the site of the mandibular right first molar were planned and agreed upon by the patient.

Maxillary teeth were extracted, and an immediate removable complete denture prosthesis was delivered. After a 2-month period, six dental implants were placed. The intaglio surface of the removable complete denture prosthesis corresponding to the residual alveolar ridges was relieved. The part of the removable complete denture prosthesis corresponding to the hard palate was not relieved so that it could act as a stop. The removable complete denture prosthesis was then relined with a soft liner (Visco-gel; Dentsply De Trey, Kostanz, Germany), which was replaced monthly.^{4,5} Following second-stage surgery to uncover the dental implants, the removable complete denture prosthesis was again relined with soft liner material. After a minimum of 4 weeks⁶ to allow healing of the soft tissue, the conversion procedures were performed.

Technique

- (1) The soft liner (Visco-gel) was removed from the intaglio surface of the maxillary removable complete denture prosthesis. The intaglio surface areas corresponding to the dental implants were marked with a pencil (9100 $\frac{1}{2}$ Wasserstack; Faber-Castell Vertrieb GmbH, Stein, Germany). Holes were opened with a tungsten carbide bur (251EF 060; Brasseler USA, Savannah, GA) (Fig 1).
- (2) Temporary abutments (Temporary cylinder; Biomet 3i, Palm Beach Gardens, FL) were secured over the dental implants with abutment screws. The temporary abutments were then marked, removed from the mouth, and cut with a silicon carbide disc (5203; Dedeco, Long Eddy, NY) in order to be flush with the occlusal surface of the denture acrylic teeth. The temporary abutments were then fastened on the dental implants again, and plastic rods (Occlusal plug; Attachments International Inc., San Mateo, CA) lubricated with petroleum jelly were placed in the access holes, to prevent flow of polymethyl methacrylate (PMMA) acrylic resin in the access holes.
- (3) The removable complete denture prosthesis was positioned in place and held with firm hand pressure against the hard palate. Autopolymerizing PMMA acrylic resin (Lucitone Fas-Por; Dentsply International, York, PA) was then applied with a brush (Bendable brush, 3M ESPE, St. Paul, MN) in small quantities between the temporary abutments and the adjacent acrylic resin of the removable complete denture prosthesis.
- (4) After polymerization of the PMMA resin, the removable complete denture prosthesis with the incorporated temporary abutments was removed from the mouth, and the procedure was completed extraorally. Cantilever extensions were modified, taking the anteroposterior implant spread^{7,8} and the brittle nature of the acrylic resin⁹ into account. The palate portion of the removable complete

denture prosthesis was also removed with a tungsten carbide bur (251EF 060; Brasseler), and the intaglio surface of the prosthesis was shaped with tungsten carbide burs (251EF 060, 79SG 070; Brasseler) and polished with low abrasive rubber wheels (142-0302, 142-5857, 142–7678: Dedeco) and polishing paste (Abraso Star: Bredent, Senden, Germany) to facilitate oral hygiene measures (Fig 2). The maxillary provisional implantretained fixed complete denture was then returned to the patient's mouth, and the abutment screws were hand tightened. Cotton pellets and temporary restorative material (Caviton; GC Corp., Tokyo, Japan) were placed over the fastening screws. PMMA acrylic resin (Temporary Bridge Resin; Dentsply Caulk, Milford, DE) was then applied with a brush (Bendable Brush) to cover the access holes. An occlusal discrepancy was anticipated due to the different nature of the supporting elements. The soft tissues supporting the removable complete denture prosthesis are resilient, while the implants are rigidly fixed in the surrounding bone.³ The occlusion was adjusted using articulating paper (Accufilm II; Parkell, Edgewood, NY) and a diamond bur (285.5 F; Two Striper, Abrasive Technology Inc, Lewis Center, OH). The occlusal surfaces were then polished using silicon carbide and aluminum oxide stones (FL2; Shofu Inc., Kyoto, Japan), as well as low abrasive rubber points (0403, 0404, 404B; Shofu). The patient was evaluated on a regular basis regarding his function and esthetics. Concerns were registered, and modifications were made to the interim prosthesis accordingly.

- (5) A master impression of the prepared teeth of the mandibular arch was made using polyether impression material (Impregum Penta; 3M/ESPE, Seefeld, Germany). Impression copings were fastened to the dental implants and connected with autopolymerizing PMMA acrylic resin (Pattern Resin LS; GC America Inc., Alsip, IL).¹⁰ The open-tray technique with polyether impression material (Impregum Penta) was used, as there is published evidence that it provides more consistent results than the closed-tray method. The latter has shown greater variations, both rotational and vertical, in the position of the dental implant replicas.^{11–13} Alginate impressions (Blueprint Cremix; Dentsply De Trey) of the maxillary and the mandibular interim prostheses were also made.
- (6) Dental implant replicas (Biomet 3i) were connected to impression copings (Biomet 3i), and soft tissue masking material (Vestogum; 3M ESPE) was injected around the dental implant replicas and at the crest of the alveolar ridges. Type IV dental stone (Fuji Rock; GC Europe NV, Leuven, Belgium) was then mixed under vacuum (Vacuum Power Mixer Plus; Whip Mix Corp., Louisville, KY) according to the manufacturer's instructions and poured into the impression under vibration (Vibrator #200, Buffalo Dental, Syosset, NY). The alginate impressions were poured with type III dental stone (Moldano; Bayer Co, Leverkusen, Germany).
- (7) The interim prostheses of the mandibular arch were removed and sectioned with a diamond disc (340 0063 0;



Figure 1 Holes opened in the removable complete denture for the accommodation of the temporary abutments.



Figure 2 Maxillary removable complete denture converted to implantsupported fixed complete denture.

Bredent). The posterior segments were placed on the prepared teeth for the OVD to be preserved.

(8) An index fitting on the cusp tips of the mandibular canines was constructed from autopolymerizing PMMA acrylic resin (Pattern Resin LS). An acrylic jig (Pattern Resin LS) fitting on the two central incisors of the maxillary implant-retained interim prosthesis was also fabricated (Fig 3). (If mandibular central incisors were



Figure 3 Fabrication of an acrylic index for the preservation of OVD.



Figure 4 Registration of patient's centric relation.



Figure 5 Placement of the interim implant-supported fixed complete denture on the maxillary definitive cast.

present, an acrylic index between these and the central incisors of the maxillary interim prosthesis would have been made.) The posterior segments of the mandibular interim prosthesis were then removed from the prepared teeth.

(9) Poly(vinyl siloxane) (PVS) interocclusal recording medium (Exabite II NDS; GC America Inc.) was injected on the occlusal surfaces of the mandibular



Figure 6 Definitive casts articulation.



Figure 7 PVS putty material is used to register the buccal surfaces and the incisal edges of the maxillary teeth.



Figure 8 The silicone matrix provides all the information for the waxing of the metal framework.

prepared teeth, and the centric relation was registered using the bilateral manipulation technique (Fig 4).¹⁴

(10) A facebow transfer (Denar Slidematic Facebow; Waterpik Technologies, Fort Collins, CO)—with the maxillary interim prosthesis—was obtained. The maxillary interim prosthesis was then removed from the mouth, and the healing abutments were fastened on the implants. The patient remained in the clinic.



Figure 9 Fabrication of the metal framework.



Figure 10 Porcelain work is completed for both the maxillary and mandibular arches.



Figure 11 Facial view of the definitive prostheses.

(11) The maxillary interim prosthesis was fastened on the dental implant replicas of the definitive cast (Fig 5). Complete seating of the temporary abutments on the dental implant replicas was verified by lifting the soft tissue masking material. The maxillary cast was mounted on a semiadjustable articulator (Denar Mark II; Waterpik Technologies) using the facebow transfer record. The mandibular definitive cast was then mounted using



Figure 12 Esthetic appearance of the prostheses while patient's lips are relaxed.

the acrylic indices and the centric relation record (Fig 6). After complete setting of the mounting stone (Mounting Stone; Whip Mix Corp.) the mandibular definitive cast was removed, and the mandibular provisional cast was mounted by hand articulation,¹⁵ opposing the maxillary interim prosthesis. An index made of PVS putty impression material (Express; 3M ESPE) was then fabricated to register the buccal surfaces and the incisal edges of the maxillary teeth (Figs 7,8).

- (12) The maxillary interim implant-retained fixed complete denture was then returned to the patient's mouth following the procedure previously described (step 4). The mandibular interim prosthesis was reconnected with PMMA acrylic resin (Temporary Bridge Resin; Dentsply Caulk), contoured with tungsten carbide burs (H261E 023, H138E 023; Brasseler USA) and polished with flour of pumice and cemented (Temp Bond NE; Kerr USA, Orange, CA). The patient was dismissed.
- (13) Abutments were selected, and standard waxing procedures were followed for both the maxillary and the mandibular definitive prostheses. The castings were prepared (Fig 9).
- (14) The metal framework was evaluated clinically and cut.
- (15) The metal framework was reevaluated after soldering procedures.
- (16) Porcelain was applied in the standard manner (Fig 10).
- (17) Esthetics, phonetics, and occlusion were evaluated clinically. Once the patient approved the final outcome, the definitive prostheses were sent to the laboratory for glazing and finishing procedures.
- (18) The definitive prostheses were delivered following standard procedures, and instructions were given to the patient (Figs 11 and 12).

Discussion

In the traditional implant prosthodontic protocol, a set-up of acrylic teeth in wax follows the fabrication of the record bases, the registration of the maxillomandibular relationship, and the mounting of the definitive casts on an articulator.¹⁶ The set-up is eventually tried clinically, and only after the patient's approval can the wax-up of the framework commence; however, with this traditional approach, the patient does not have the opportunity to assess function. Furthermore, the decision on esthetics usually has to be made in a short session. On the other hand, with the proposed technique, a more accurate evaluation of facial and dental esthetics and of function can be accomplished. The need for gingival ceramics application in the prosthesis can also be discussed, if there is an advanced recession of the residual ridge.¹⁷

Additionally, the described method allows the accurate mounting of the definitive cast of an implant-retained fixed complete denture. It eliminates the fabrication of record bases with wax rims. Furthermore, it has the advantage of eliminating any possible errors during the determination of OVD and the establishment of the occlusal plane. The hard palate of the complete denture can act as a stop, since it is not relieved before the application of the soft liner. It should be mentioned, however, that a verification of the original OVD should always be performed, by measuring stable anatomical landmarks. The proposed transfer method is simple and accurate.

Conversion of the interim removable complete denture prosthesis to an implant-retained fixed complete denture requires an additional clinical and laboratory step, after the second-stage surgery. Nevertheless, this should not be considered as a disadvantage of the proposed method, as it enables patients to assess a planned outcome similar to that of the definitive prosthesis.

A similar technique, converting a mandibular removable complete denture prosthesis to an implant-retained complete fixed denture, has been described by Balshi and Wolfinger,^{18,19} where the conversion was performed by connecting modified square impression copings to the removable complete denture prosthesis the day of the second-stage surgery. Similar techniques using the interim removable complete dentures for articulation purposes have been presented in the literature^{20–23} since then.

This approach uses the maxillary interim fixed complete denture for mounting of the definitive cast after it has been evaluated clinically and approved by the patient. A possible disadvantage of the presented technique is the additional cost of the temporary abutments and the additional appointments required to perform the procedure.

Summary

Conversion of a maxillary removable complete denture prosthesis to an interim implant-supported fixed complete denture was performed for verification of patient's function and esthetics in preparation for fabrication of a definitive prosthesis. It was also used for the articulation of the definitive casts.

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