Conversion Prosthesis: A Transitional Fixed Implant-Supported Prosthesis for an Edentulous Arch—A Technical Note

Thomas J. Balshi, DDS*/Glenn J. Wolfinger, DMD**

A technique for fabricating a provisional fixed prosthesis for an edentulous arch immediately following abutment connection, termed *conversion prosthesis*, is described in detail. Advantages of the restoration include the following: it provides a fixed prosthesis immediately following stage 2 surgery with improved function, stability, and distribution of load; it protects the sutured mucosa; it serves as a prototype for the final prosthesis; it can be used as a verification jig; it preserves the original vertical dimension of occlusion; it aids in obtaining and transferring the interocclusal record; it assists long-term patient maintenance; and it reduces treatment visits. The advantages of its use clearly outweigh the disadvantages.
(INT J ORAL MAXILLOFAC IMPLANTS 1996;11:106–111)

Key words: conversion prosthesis, endosseous implant, fixed prosthesis, provisional prosthesis, transitional prosthesis

The concept of creating a biocompatible relationship with titanium in bone is based on research that began in 1952.[1] Continuing studies in the early 1960s indicated the possibility of establishing true implant anchorage in bone tissue.[2] Radiologic and histologic analyses indicated that this anchorage, termed *osseointegration* by Brånemark, could maintain prosthesis stability for 10 years.[3] Osseointegration has been defined as "a direct structural and functional connection between ordered living bone and the surface of a load carrying implant."[4] With the introduction of osseointegration in North America in 1982,[5] many advances, particularly in the prosthetic applications, have been developed.

Introduced by Balshi in 1985, the conversion prosthesis is an innovation designed to create a transitional fixed implant-supported prosthesis immediately following the placement of abutments at stage 2 surgery.[6,7] This technique permits stable function and the advantages of a fixed prosthesis. The conversion prosthesis is dependent on well-fabricated transitional dentures that provide the patient with the desirable occlusal vertical dimension, esthetics, and phonetics, as well as lip and perioral muscle support.

Prosthetic management is important to the success of osseointegration and final prosthetic reconstruction. Brånemark initially recommended that all prosthetic treatment be deferred for at least 2 weeks after the implant placement surgery.[3] Following the healing phase and after suture removal, the transitional denture should be lined with a resilient material. The critical aspect of this form of treatment is the unloaded bone healing around the implants for 3 to 6 months. Experienced clinicians recongnize that even indirect loading through mucosa may affect and even negate the osseointegration process.[8]

An increasingly popular method of avoiding direct or indirect loading on early osseointegrating implants is a modification of the Brånemark method, which maintains periodontally hopeless teeth to support a temporarily nonremovable prosthesis, suspended over the implant sites. Converting this fixed form of temporary prosthesis to a conversion prosthesis has been previously described.[9]

The purpose of the present study is to describe

*Private Practice, Prosthodontics Intermedica, Institute for Facial Esthetics, Fort Washington, Pennsylvania.
**Private Practice, Prosthodontics Intermedica, Fort Washington, Pennsylvania. Staff Prosthodontist, Veterans Administration Medical Center, Philadelphia, Pennsylvania.

Reprint requests: Dr Thomas J. Balshi, Prosthodontics Intermedica, Institute for Facial Esthetics, 467 Pennsylvania Avenue, Suite 201, Fort Washington, Pennsylvania 19034.

the conversion prosthesis process for the edentulous patient, using a two-stage implant system with recent modifications in technique.

Conversion Process Technique

Step 1: Abutment Connection. In two-stage implant systems, during administration of anesthesia for the surgical exposure of the implants, the denture is reinforced with clear acrylic resin and a wire on the facial and buccal surfaces of the teeth (Fig 1). The additional material should not interfere with the occlusion. The soft tissue is reflected to permit removal of the cover screw, the implants are tested for osseointegration, and appropriate abutments are securely connected.

Radiographic verification should be used to *(1)* assure complete seating of all the abutments on the implants,[10] especially when the junction is not clinically visible, and *(2)* evaluate the marginal bone height and peri-implant radiopacity.[11] The recommended torque should be applied to the abutments using appropriate countertorque devices to ensure that torque is delivered to the abutment screw and not to the bone implant interface.[10]

Step 2: Prosthetic Coping. Modified screw-retained, stainless steel, square impression copings (modified copings) are used as transitional prosthetic cylinders. The impression copings are modified to clear the occlusion. Guide pins are also modified to clear the occlusion or soft tissue. The modified copings and guide pins should be as long as possible to allow for the formation of tall screw access channels. In areas where interocclusal space is limited, gold prosthetic retaining screws can be used instead of the modified guide pins (Fig 2).

Step 3: Modifying the Denture. The position of the modified copings can be identified relative to the transitional denture either visually or by use of an ink stick (Dr Thompson's Sanitary Color Transfer Applicators, Great Plains Dental Products, Kingmon, KS), which is transferred to the denture.

The facial wire reinforcement permits lingual reduction of the denture while minimizing the potential for fracture. The reduction should be conservative to retain adequate thickness and strength of the base and to reduce the amount of acrylic resin necessary to join the copings to the denture, thus limiting shrinkage and distortion. Relief is completed when the denture teeth occlude with those in the opposing arch in the same manner previously designed without contacting the implant components. Soft tissue contacts are maintained to provide a vertical stop for the denture and preserve the original vertical dimension of occlusion (Fig 3).

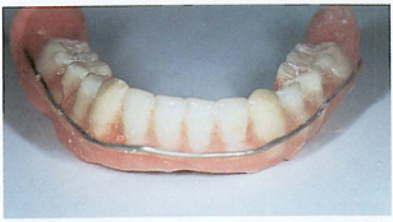


Fig 1 Wire reinforcement added to buccal and facial surfaces of denture using clear acrylic resin.

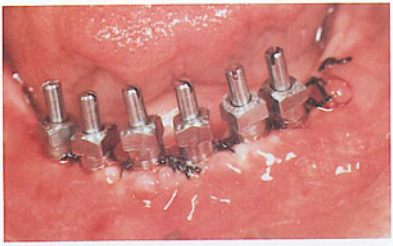


Fig 2 Modified, screw-retained, stainless steel, square impression copings and guide pins in place after abutment connection surgery and suturing of the adjacent soft tissue.

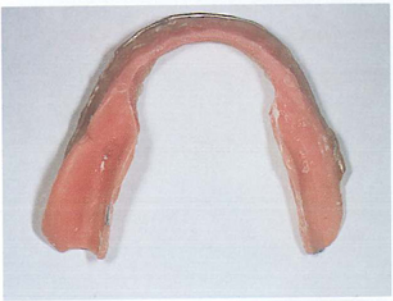


Fig 3 View from underside of denture showing wire and acrylic resin reinforcement on buccal and facial surfaces, lingual reduction in anterior section allowing space for implant components, and soft tissue contacts in posterior for preservation of vertical dimension of occlusion (vertical stops).

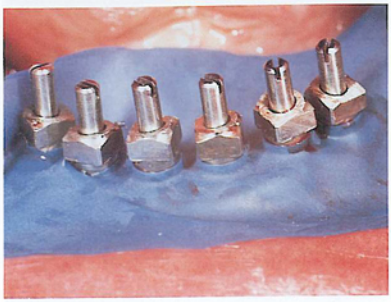


Fig 4 Margin of rubber dam located on modified impression coping, protecting abutment and freshly sutured soft tissue.

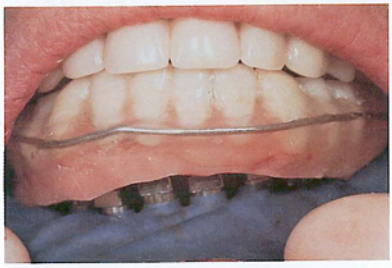


Fig 5 Facial view of relieved denture in occlusion with opposing arch.

Step 4: Soft Tissue Protection. Protecting the freshly sutured soft tissue adjacent to the modified copings will promote healing. A rubber dam is cut to cover the surgical site. It should not interfere with reseating the denture. Protective coverage should extend to the vestibule and the floor of the mouth. The transfer ink sticks are used to mark the top of either the modified impression copings or the screws. The rubber dam is pressed over the ink to identify the precise location of the holes to be punched. The rubber dam is then seated over the modified copings. The margin of the dam should be located on the modified impression coping or prosthetic cylinder, totally protecting the titanium abutment beneath (Fig 4).

Step 5: Acrylic Resin Application. With the rubber dam in place, the occlusion is verified with the denture stabilized in its appropriate arch position (Fig 5). Holding the denture in that position, the mouth is opened to check clearance of the implant components (Fig 6). When adequate clearance has been achieved, a small amount of autopolymerizing resin is placed around the modified copings using a thin mix in a modified monojet syringe (Sherwood Medical, St Louis, MO) (Fig 7). The altered denture is then repositioned, and acrylic resin is added to join the denture to the copings, filling the area where the denture was relieved. Before the acrylic resin polymerizes, the patient is asked to close into the previously established centric occlusion position. The clinician may help guide the denture into proper interocclusal contact, and the rubber dam can be raised and manipulated to help form a smooth underside to the soft resin.

The screws must be completely visible prior to resin polymerization. After the acrylic resin hardens but prior to detectable heat from the exothermic

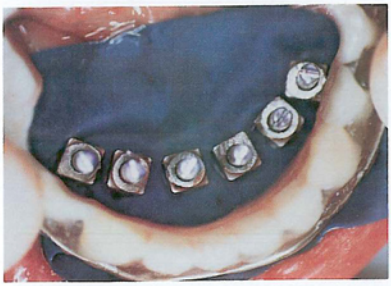


Fig 6 Verification of clearance of implant components with relieved denture in position previously established and maintained after occlusal contact.

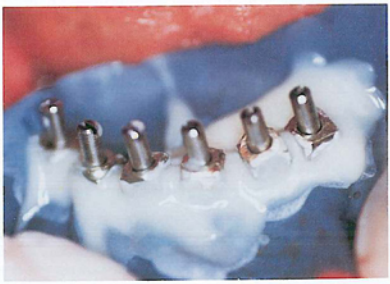


Fig 7 Thin mix of autopolymerizing resin placed around copings using a modified monojet syringe.

reaction, the screws are removed from the modified copings, allowing them to disengage the abutments.

The denture with the modified copings attached in acrylic resin is removed from the mouth and immediately placed in the chairside pressure pot for 10 minutes with water at 125°F under 30 psi of pressure.

Step 6: Reinforcement and Finishing. Close inspection of the denture will reveal areas where the acrylic resin has not been completely adapted to the modified copings. Long guide pins are used to tightly secure the brass abutment analogs to the prosthetic copings. Acrylic resin is added to fill the voids between the pick-up resin and the modified copings. Brass analogs prevent the resin from adhering to the base of the modified copings, which would interfere with the fit of the prosthesis. The long guide pins help form smooth screw access channels. The prosthesis is again placed in the pressure pot.

Only the crest of the denture base is allowed to remain in contact with the residual ridge in distal extension cantilever situations. Excessive acrylic resin, including the flanges and palate in the maxilla, is then trimmed. The conversion prosthesis can be checked both clinically and radiographically to verify the fit of the modified copings. Any misaligned copings should be removed from the conversion prosthesis, and the pick-up procedure should be repeated for that individual site. The occlusion is adjusted and the conversion prosthesis is inspected for any unusual irregularities that might prove annoying to the cheeks or tongue. The conversion prosthesis is then removed from the mouth and placed on the master cast, verifying the accuracy of the master cast.

The conversion prosthesis rigidly records the occlusal vertical dimension and facilitates occlusal registration for mounting the master cast on the articulator. The original vertical dimension of occlusion is preserved and related on the master casts with or without the use of an interocclusal recording medium (Fig 8). After the casts have been mounted, the cantilevered portions of the conversion prosthesis are reduced accordingly (Figs 9a and 9b). The prosthesis is highly polished to minimize plaque retention and is seated in the mouth. The screw access holes are covered with cotton, followed by either Cavit (Espe, Seefeld, Germany) or Fermit (Vivadent, Schaan, Liechtenstein).

Discussion

There are significant biologic and mechanical differences between the conversion prosthesis philosophy and traditional methods of prosthetic management following stage 2 surgery. Traditionally, abutments are placed at stage 2 surgery with healing caps to keep the abutment screw holes free of debris. More

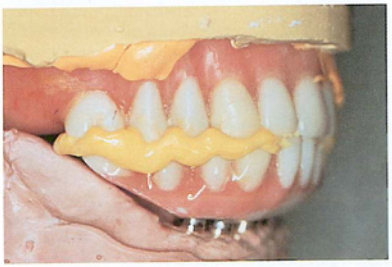
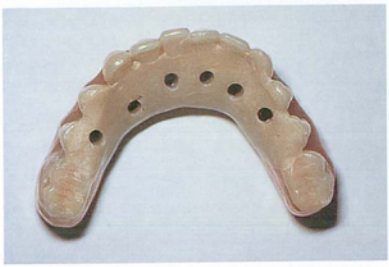
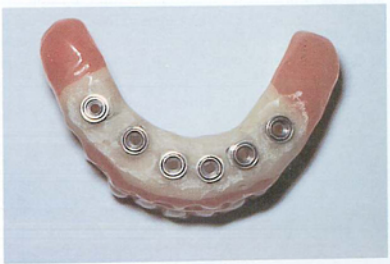


Fig 8 The conversion prosthesis and the interocclusal record are transferred to the master cast to facilitate its accurate relation to the opposing arch on the articulator.





Figs 9a and 9b Cantilevered portions are reduced accordingly, and the prosthesis is highly polished.

recently, healing abutments have been used to permit the mucosa to heal and mature. These are replaced by prosthetic abutments as a stage 3 procedure.[12] Both methods require relief of the denture, and in most instances, the use of a soft liner creating an overdenture, with its concomitant loading through the individual abutments to the implants and bone. Some clinicians have recommended that no denture be used at least during the first 3 to 4 weeks following abutment connection to allow for undisturbed soft tissue healing.[13]

The use of a conversion prosthesis is a concept of prosthetic management following stage 2 surgery that helps promote patient comfort and acceptance. It provides a fixed dentition immediately following abutment connection, thereby eliminating the need for healing abutments, healing caps, and soft liners. In effect, it reduces the time that the patient is required to function with a removable prosthesis. Its stability provides improved functional ability and allows the patient to preview the function and esthetics of a fixed implant-supported prosthesis.

Langer and Sullivan[14] have suggested that immediate coronal stability of joined implants reduces the potential rotation effect on the implants when compared to those not joined. The conversion prosthesis provides a more uniform load distribution to the implants through splinting. There may also be a benefit in maintaining the patient for a period of time with acrylic resin occlusal surfaces because this provides some load dampening to the implants.

Although the combined surgical and prosthetic procedure creates a lengthy treatment session, it reduces the overall number of treatment visits. Care is taken when fabricating the conversion prosthesis to avoid complications. A rubber dam is placed, completely covering the titanium abutment, so that the acrylic resin does not lock into the undercuts created between the abutments. Screw access holes are cleared prior to resin polymerization to avoid the use of a high-speed drill to expose the screw heads for removal. Both the rubber dam and rapid removal of the conversion prosthesis prior to the release of heat from the resin polymerization is essential to avoid trauma to the soft tissue and bone-to-implant interface.

When fabricating the conversion prosthesis, the clinician is able to visualize potential problem areas, such as screw access holes emerging in unfavorable sites, and change an abutment to improve the position of a screw access hole prior to making a final impression. An impression of the conversion prosthesis provides the laboratory with a model for fabrication of the final prosthesis. Patient preferences are noted, and correlations are made in the final prosthesis.

The conversion prosthesis provides a most stable unit upon which interocclusal records can be obtained and accurately transferred to the master cast and articulated (see Fig 8). When transferred, the prosthesis can then be used as a verification jig, similar to those described by Rasmussen[15] and Henry,[16] for verification of master cast accuracy prior to framework fabrication.

Advantages in long-term maintenance of the patient have been realized by using the conversion prosthesis. For situations in which complications have occurred with the final fixed detachable prosthesis and have required an extended period of laboratory repair time, the conversion prosthesis has been used as a provisional fixed replacement. In addition, the conversion prosthesis acts as a record to preserve the original vertical dimension of occlusion. After a period of extended function, some patients have exhibited a reduced vertical dimension of occlusion because of wear of the artificial teeth. In these situations, the conversion prosthesis has been placed on the master cast and mounted on the articulator against the opposing arch with a new interocclusal record. The final prosthesis is then placed on the master cast, and the appropriate laboratory procedures are carried out to restore or replace the worn prosthetic material while the patient continues to function with the conversion prosthesis.

Recognizing its advantages, the authors have used this prosthesis routinely for the past decade. Since its introduction, some of the technical steps have been modified. The original protocol involved the use of gold cylinders incorporated into the conversion prosthesis. This was costly since there was no intention of retrieving the cylinders after seating the final prosthesis. The gold cylinders have been replaced with modified, stainless steel, square impression copings. By using the impression copings rather than gold cylinders, a cost savings of approximately 80% has been realized. When compared to the traditional method of using healing abutments and healing caps, the savings is approximately 67%, and when compared to using healing caps only, the cost is very similar (according to Brånemark System Price List, Nobelpharma USA, effective 15 Jan 1994).

The early recommendation of using a periodontal pack beneath the conversion prosthesis to control soft tissue healing has since been abandoned. The conversion prosthesis ultimately acts as a shield to the sutured soft tissue and permits relatively undisturbed healing.

Confusion in the Literature. In an article in 1992, Rosen[17] inadvertently referred to a technique that he reported as the *conversion prosthesis*. The prosthesis he described is a "modified immediate

provisional removable prosthesis constructed with salvaged fixed prosthetic restorations and executed chairside." The conversion prosthesis that was first introduced by Balshi in 1985[6,7] is the opposite of that described by Rosen. In Rosen's version, a failing fixed prosthesis is converted to a provisional removable prosthesis; in Balshi's conversion prosthesis, a removable denture is converted to a fixed implant-supported prosthesis.

Summary

An updated technique for converting a transitional removable denture to a fixed provisional implant-supported prosthesis, termed the *conversion prosthesis*, has been described. The advantages of this technique are numerous for the patient, the restorative dentist, and the laboratory technician. This technique provides superior comfort and satisfaction and improves the quality of care provided.

References

1. Brånemark P-I. Vital microscopy of bone marrow in rabbit [thesis]. Scand J Lab Invest 1959;11(suppl 38):1–82.
2. Brånemark P-I, Bryonia U, Johansson B, Roylance PJ, Rockert H, Yoffey JM. Regeneration of bone marrow. A clinical and experimental study following removal of bone marrow by curettage. Acta Anat (Basel) 1964;59:1–46.
3. Brånemark P-I, Bryonia U, Adell R, Hansson BO, Lindstrom J, Olsson A. Intra-osseous anchorage of dental prostheses. I. Experimental studies. Scand J Plast Reconstr Surg 1969;3:81–100.
4. Brånemark P-I, Zarb GA, Albrektsson T (eds). Tissue-Integrated Prostheses: Osseointegration in Clinical Dentistry. Chicago: Quintessence, 1985:11.
5. Zarb GA (ed). Proceedings of the Toronto Conference on Osseointegration in Clinical Dentistry. St Louis, MO: Mosby, 1983:1–165.
6. Balshi TJ. The Biotes conversion prosthesis: A provisional fixed prosthesis supported by osseointegrated titanium fixtures for restoration of the edentulous jaw. Quintessence Int 1985;16:667–677.
7. Balshi T. The conversion prosthesis: A provisional fixed prosthesis supported by osseointegrated titanium fixtures. In: van Steenberghe D (ed). Tissue Integration in Oral and Maxillofacial Reconstruction [Proceedings of an International Congress, May 1985, Brussels]. Amsterdam, The Netherlands: Excerpta Medica, 1986.
8. Evasic R. Osseointegration: The cause of or the cure for the complexity of prosthetic restoration of dental implants, Part 2. Dent Today 1994 (March):54–57.
9. Balshi TJ. Osseointegration for the periodontally compromised patient. Int J Prosthodont 1988;1:51–58.
10. Adell R, Lekholm U, Rockler B, Brånemark P-I. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. Int J Oral Surg 1981;10:387–416.
11. Adell R, Lekholm U, Rockler B, Brånemark P-I, Lindhe J, Eriksson B, Sbordone L. Marginal tissue reactions at osseointegrated titanium fixtures: (I) A 3-year longitudinal prospective study. Int J Oral Maxillofac Surg 1986;15:39–52.
12. Nilson H, Lindh T. Restorative Dentist's Manual. Göteborg, Sweden: Nobelpharma AB, 1992:K9.
13. Zarb GA, Jansson T. Prosthodontic procedures. In: Brånemark P-I, Zarb GA, Albrektsson T (eds). Tissue-Integrated Prostheses: Osseointegration in Clinical Dentistry. Chicago: Quintessence, 1985:241–282.
14. Langer B, Sullivan DY. Osseointegration: Its impact on the interrelationship of periodontics and restorative dentistry. Part III. Periodontal prosthesis redefined. Int J Periodont Rest Dent 1989;9:241–261.
15. Rasmussen EJ. Alternative prosthodontic techniques for tissue integrated prostheses. J Prosthet Dent 1987;57:198–204.
16. Henry PJ. An alternative method for the reduction of accurate casts and occlusal records in osseointegrated implant rehabilitation. J Prosthet Dent 1987;58:694–697.
17. Rosen H. The conversion prosthesis: An addition to implant preparedness [interview]. Dent Implantol Update 1992;3(6):41–45.