A multifunctional, provisional, implant-retained fixed partial denture

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This article describes the modification of a procedure for fabricating a laboratory-processed, metal-reinforced, acrylic resin provisional restoration that becomes an implant-retained fixed partial denture. The modification involves the incorporation of patrix and matrix components into a cast metal framework. The prosthesis can be used as an alternative to a removable radiologic stent and surgical guide. It can function as a surgical guide during implant placement and help retract the buccal mucogingival flap during implant placement. The prosthesis also can be used as an aid in locating the implant during stage II surgery. Finally, the pontics can be converted into an implant-supported provisional restoration immediately after the implant prosthetic components are attached to the uncovered implants. (J Prosthet Dent 2001;85:34-9.)


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The widespread use of dental implants in partially edentulous areas has brought about a need for improved techniques that will enable the restorative dentist to provide predictable, implant-supported restorations that are both functional and esthetic.1-4 Often, the restorative clinician fabricates several prostheses in the course of treatment.5,6 These include a provisional prosthesis before surgery,5,6 a radiographic stent,7-12 a surgical stent,12-16 an implant-supported provisional prosthesis,4,18 and the definitive implant-supported prosthesis.19

The provisional prosthesis should be durable and functional because it is used during the presurgical evaluation phase and the surgical healing period.6,7,20 This provisional prosthesis aids in determining the esthetics, phonetics, and occlusal relationship of the final restoration.5,6 Both removable and fixed provisional partial dentures have been used.5,20

One critical step in the ultimate success of the definitive implant prosthesis is the positioning of the implants relative to each other and to the occlusal plane.6 To determine the quality and quantity of the bone at the ideal implant sites, a removable radiographic stent often is fabricated.7-16,20 Many designs of radiographic stents for different imaging techniques have been described.7-16,20 The removable radiographic stent usually is modified to serve as a surgical stent.10,12-16,20 Improvements in the design of many removable stents include the incorporation of multiple functions.12,15,16 Stents that provide information on angulation and position10,14,15 and depth of the implant21 as well as stents that act as mouth props, tongue retractors, and occlusal rim markers have been described.13 After stage II surgery, the restorative dentist often fabricates implant-supported provisional restorations.4,18

The purpose of this article is to describe a provisional implant-supported fixed partial denture (FPD) with a removable pontic segment. The procedure for fabricating a cast metal-reinforced, heat-processed, acrylic resin provisional FPD has been described previously.22 The modification to this basic design is the incorporation of patrix-matrix components into the cast metal framework adjacent to the edentulous space. The lingual cast metal reinforcement of the pontic segment also is extended to the buccal side. The pontic of the provisional implant FPD can be modified with a radiopaque marker as an alternative to the traditional removable radiologic stent. The provisional implant FPD can be used by the surgeon as a surgical guide during implant placement. The pontic segment of the provisional implant FPD is cemented in place between stages I and II surgery. At the time of stage II surgery, the surgeon can use the prosthesis to locate the cover screws of the implants. Finally, the restorative dentist can convert the pontics into an implant-supported provisional restoration and proceed in fabricating definitive restorations.

PROCEDURE

A 41-year-old white female patient in good health was selected to demonstrate this procedure. The patient was treatment planned for metal-ceramic restorations on the maxillary left second molar and maxillary left canine and an implant-supported pros-
thesis to replace the maxillary left first premolar, second premolar, and first molar. The patient was referred to an independent radiologic clinic for a computerized tomography scan of the edentulous area between the maxillary left canine and maxillary left second molar before presentation of the final treatment plan.

1. Maxillary and mandibular complete arch impressions were made with an irreversible hydrocolloid material (L. D. Caulk Division, Dentsply International Inc, Milford, Del.) and immediately poured in type III stone (Microstone, Whip Mix Corp, Louisville, Ky.) to make diagnostic casts. The casts were mounted on a semiadjustable articulator by using an average-axis face-bow and an interocclusal centric relation record. Diagnostic wax patterns were completed and duplicated. On a duplicate of the maxillary diagnostic cast, crown preparations were simulated on the canine and second molar.

2. A metal-reinforced provisional implant FPD was fabricated as described by Emtiaz and Tarnow.\textsuperscript{22} The modification involved casting a matrix-patrix plastic pattern as an integral part of the metal framework. Any commercially available matrix-patrix pattern may be used. A dental surveyor was used to position the patrix plastic pattern at the interproximal surfaces adjacent to the edentulous space and to assure the parallelism or path of placement of the matrix component. A wax pattern of the framework was finished on the duplicate of the maxillary diagnostic cast made with simulated crown preparations (Fig. 1). The wax connector pattern should be 3 to 4 mm buccal to the gingival crest of the edentulous ridge and at least 3 mm in height. The buccal surface of the wax connector has multiple retentive beads, whereas the palatal surface is smooth.

3. Sprue formers were attached to the wax pattern, which was cast (Rexillium III, Jeneric/Pentron Inc, Wallingford, Conn.), divested, polished, and fitted to the working cast (Fig. 2). The metal was subjected to airborne particle abrasion by using 50 µm aluminum oxide and silicoated (Siloc, Heraeus Kulzer, Wehrheim, Germany) before the application of heat-polymerized hard acrylic resin material (Vitacrilic, Fricke International, Villa Park, Ill.) (Fig. 3).

4. The provisional prosthesis without the pontic segment was placed on the working cast, and the center of the desired screw access location was marked on the crest of the edentulous ridge (Fig. 4). The marking was enlarged to the full size of the implant shoulder diameter. The cast was secured on the dental surveyor adjustable table, and the table was tilted in relation to the surveyor rod at the end of the vertical spindle until the rod was at the center of the markings. The removable pontic segment was

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**Fig. 1.** Duplicate cast of maxillary diagnostic cast with underprepared left second molar and left canine. Waxed framework pattern with patrix (P) facing edentulous space. R indicates retentive beads on buccal surface of connector. C indicates smooth palatal surface of connector.

**Fig. 2.** Cast framework seated on duplicate cast. Arrows indicate matrix component (with retentive projections) fitted to patrix counterparts.

**Fig. 3.** Provisional FPD with main piece and pontic segment unconnected.
A slow-speed hand-piece with a No. 6 round bur (SS White Burs, Inc, Lakewood, N.J.) held parallel to the surveyor rod was used to remove acrylic resin material from the occlusal table toward the gingival crest tissue surface, creating a channel. The channels were filled with a radiopaque marker such as gutta percha. Amalgam may be used as an alternative (Fig. 5). The pontic segment may be painted with barium sulfate, or a metal tube may be placed into the cut channel as an alternative radiopaque marker.

After preparation of the natural teeth abutments, the processed provisional prosthesis was tried in, and the intaglio surface of the abutment retainers were relined with an autopolymerizing hard acrylic resin (TRU-KIT, H. J. Bosworth Company, Skokie, Ill.) and reseated onto the prepared abutments. Excess material was removed, and the prosthesis was polished and cemented with provisional cement (Temp-Bond, Kerr Corp, Romulus, Mich.) (Fig. 5).

The patient was referred to the radiologic clinic for presurgical imaging. If redirecting is needed after careful analysis of the radiographic images, the restorative dentist can fill the old channels with autopolymerizing hard acrylic resin and then redrill the channels on the basis of the information from the radiographic images. The new channels should be filled with the same marker, and a new radiograph should be taken to verify channel orientation. On the day of stage I implant surgery, the movable portion of the provisional FPD was separated, and the radiographic marker material was removed from the channels.

The buccal cusp was used as a reference point after the movable portion of the provisional FPD had been separated from the main piece (Fig. 6). After the mucogingival flap was raised, the surgeon used the provisional FPD as a surgical guide (Fig. 7). The movable portion was reinserted into the main piece, and the channels were widened to accommodate the small twist drill chosen by the surgeon (Fig. 8). The buccal facings were used to help retract the buccal mucogingival flap away from the bony ridge (Fig. 9). The pontic segment was removed, and a guide pin was placed to verify parallelism (Fig. 10). After the stage I surgery, the provisional FPD was recemented with a eugenol-based provisional cement (Temp-Bond, Kerr Corp). Because the edentulous ridge area had been surgically altered and sutures had been placed, some relief of acrylic resin material from the underside of the pontic segment was necessary. The removable piece (pontic) of the provisional FPD was cemented during the healing phase.

At stage II surgery, the surgeon removed the movable piece of the provisional implant FPD, again by using the buccal cusp as a reference point, to locate the implant site and remove the
soft tissue to expose the implant cover screw. After placement of healing caps, some relief on the underside of the removable piece of the provisional implant FPD was necessary.

9. After appropriate prosthetic abutment placement, the removable provisional FPD required some further modification (Fig. 11) and became an implant-supported provisional prosthesis (Fig. 12). If necessary, the buccal metal support frame may be cut off of the mesial and distal abutments’ retainer.

DISCUSSION

The proposed provisional prosthesis is made of a laboratory-processed, metal-reinforced acrylic resin. Successful treatment outcome and sequence require attention to detail before, during, and after treatment planning. The prosthesis is capable of functioning from the time of presurgical radiographic imaging through the surgical stages until insertion of the definitive fixed and implant-supported restorations. If clinicians prefer, they can custom mill their own matrix-patrix designs. This prosthesis eliminates the need to fabricate a removable partial prosthesis template for the presurgical imaging stage, a separate surgical template, and provisional restorations until the definitive prosthesis is delivered. The prosthesis pontic area does not put undue pressure on the soft tissue that covers the edentulous surgical site. When 1 implant is used to replace 1 missing tooth, the buccal cusp reference point during the surgical phase gives the surgeon ample amount of latitude.

One disadvantage of this modified design may be the cost of making the prosthesis. However, the long-term cost-effectiveness and benefit of the prosthesis far outweigh this disadvantage. In the case previously described, the design was further modified to incorporate the matrix-patrix pattern onto a resin-bonded prosthesis framework (Fig. 13). No tooth preparation is necessary with this design. It is recommended that the clinician use resin cement to bond the prosthesis to a nonetched enamel surface on the abutment teeth.

SUMMARY

A modified procedure for fabricating a multifunctional, provisional, implant-retained FPD has been described. The provisional FPD can serve as a presurgical imaging template, a surgical guide during stages I and II implant surgery, and a tooth-supported provisional FPD that can be converted into an implant-supported FPD after stage II surgery.

REFERENCES


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A comparison of laser-welded titanium and conventional cast frameworks supported by implants in the partially edentulous jaw: A 3-year prospective multicenter study
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Purpose. This study evaluated the clinical performance of laser-welded titanium implant-supported fixed partial dentures (FPDs) and compared these prostheses with conventional cast implant-supported FPDs in a prospective, multicenter study design.

Material and methods. Four prosthetic specialty centers participated in the study over 5 years. This publication covered the first 3 years of follow-up on 2 separate groups of patients. Forty-two patients were divided into 2 groups of 21 patients each. Group 1 patients exhibited bilateral posterior edentulism and were randomized. A conventional cast implant-supported FPD with porcelain veneers was inserted on one side intraorally, and a laser-welded titanium implant-supported FPD with low-fusing porcelain veneers (Procera Porcelain, Nobel Biocare) was inserted intraorally on the opposite side. The conventional cast frameworks served as controls. All group 2 patients had been provided with conventional cast implant-supported FPDs at least 1 year earlier; these prostheses were in need of replacement. The old prostheses were replaced with laser-welded titanium implant-supported FPDs with low-fusing porcelain. Patient ages ranged from 18 to 75 years at the onset of the study. No patients had received any intraoral grafts or radiation in the head or neck region, and none were drug and/or alcohol abusers. Thirty patients were smokers. The patients were provided with 170 Brånemark system implants and abutment cylinders (Nobel Biocare). Sixty-two teeth were replaced with both types of frameworks in group 1, and 68 teeth were replaced in group 2. After insertion of the prostheses, the patients were scheduled for annual follow-ups. Clinical and radiographic data from 3 years of follow-up visits were gathered and analyzed. Prosthesis and implant survival rates were evaluated by means of life table analyses. Wilcoxon’s ranked sum test was used to analyze the marginal bone loss in relation to the height of the abutment cylinder clinically. A Chi-square test was used to evaluate fractures of porcelain in both test and control prostheses. To accomplish radiographic analysis, mean values between the mesial and distal measurements were recorded.

Results. Two patients from group 1 were lost to follow-up during the first 3 years, and 1 patient from group 2 was withdrawn each consecutive year. Only 1 implant failed, and all prostheses were functioning after the third annual follow-up. Similar clinical performance was exhibited with the 2 framework designs. Few complications were noted. One abutment and 9 porcelain units fractured. Four prostheses had loose gold screws. In group 1, marginal bone loss was similar for both prosthesis designs. On average, no bone loss was observed in group 2 patients. Neither placement of the prosthesis margin nor the prosthesis design was significantly related to resultant marginal bone loss.

Conclusion. During this 3-year follow-up study of 42 partially edentulous patients, the clinical performance of laser-welded titanium implant-supported FPDs was similar to the performance of conventional cast implant-supported FPDs. 41 References. —DL Dixon