An alternate treatment method for a fixed-detachable hybrid prosthesis: A clinical report

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The inability to consistently achieve a passive fit with screw-retained implant prostheses is well documented in the literature. Cement-retained implant frameworks have been advocated for implant-retained fixed partial dentures. However, cement retention has not been routinely advocated for fixed-detachable hybrid prostheses. This article describes a method for fabricating a cement-retained fixed-detachable hybrid prosthesis. The advantages and disadvantages are discussed. (J Prosthet Dent 2003; 89:239-43.)

The inability to consistently achieve a passive fit with a multiple-implant ceramo-metal prosthesis led to the development of the fixed-detachable hybrid prosthesis.1,2 The high temperatures necessary for firing porcelain onto the metal frameworks may result in warpage and lack of passivity.2,4 Zarb and Symington4 and Lundquist and Carlsson5 developed the hybrid prosthesis by attaching denture teeth with heat-polymerized acrylic resin to a cast metal substructure. Although this technique has been used successfully for a number of years, it does have shortcomings.5,6 First, passive fit of the metal substructure may require sectioning and soldering after initial fabrication. Even then, a completely passive substructure does not always result.6,10 Second, access holes must be present to allow for screw tightening or retrieval of the prosthesis. The access holes may compromise esthetics and occlusion, especially when implants are angled or placed labially to the planned tooth position as a result of severe mandibular resorption.7 Third, the clinical and laboratory techniques are complex and generally require an experienced clinician and technician.2,3,6-8

The degree of misfit between implant frameworks and implants that will cause bone loss or failure of osseointegration clinically has yet to be determined.8 It has generally been accepted that passive seating of a prosthesis is a requirement for maintaining successful long-term osseointegration.6,7,9,10 Furthermore, the literature has implicated ill-fitting implant frameworks as a significant factor in the cause of mechanical and biologic complications.9,12,13 Loosening of screws for both prosthetic components and abutments and even fracture of various system components have been attributed to misfit.6-10,12,13 Additionally, adverse tissue reactions, pain, tenderness, marginal bone loss, and loss of osseointegration have also been listed as possible sequelae of prosthesis misfit.13-18 However, animal studies in which intentional misfits were introduced as well as clinical reports of nonpassive prostheses do not necessarily demonstrate bone loss or implant failure.19,20 It is speculated that misfit coupled with cyclical functional loading rather than constant strain would cause bone loss, but a discernible relationship between misfit and bone loss has not been established.9,20 The consensus of many studies and reports implies that some mode of biologic tolerance seems to exist between the implant and surrounding bone that permits a certain degree of misfit.9 Even so, the minimal threshold of biologic tolerance to misfit has yet to be scientifically defined or quantified.8,9 It is therefore recommended that clinical and laboratory procedures be executed in such a way to optimize the fit of screw-retained implant prostheses.2,8,9,19

Recommended clinical techniques to improve fit include the use of custom impression trays, rigid impression materials, radiographs, alternate finger pressure, direct vision and tactile sensation, one-screw test, and the use of disclosing media and various instrumentation.8 Because framework fabrication requires many steps, the cause of distortion in implant frameworks may be multifactorial.2,3,8 The factors that may introduce errors resulting in distortions include implant alignment, impression technique and materials, framework fabrication process, design configuration, and clinician and technician experience.2,3,8,10 Also, dimensional changes occur related to the chemical reactions of impression materials, dental stones, and investment materials, as well as the coefficients of thermal expansion (and contraction) for cast metals and their accompanied investment materials during the casting and cooling process.

Traditional fixed prosthodontic materials may yield clinically acceptable dimensional mismatches in short-
span (2 to 4 teeth) fixed partial dentures.\textsuperscript{21} But the criteria for optimal fit of implant abutments to implant fixtures is 10 $\mu$m or less,\textsuperscript{22} which is difficult to achieve consistently with fixed-detachable hybrid superstructures made with conventional methods and materials. The clinical/laboratory technique presented explores an approach appropriate when the previously mentioned casting size limitation is surpassed and traditional methods may yield clinically unacceptable dimensional mismatches. Furthermore, this report describes a method for constructing a fixed-detachable hybrid prosthesis with cement retention and discusses the rationale, advantages, and disadvantages of this technique.

**CLINICAL REPORT**

A 52-year-old white woman was initially seen with an existing maxillary complete denture opposing the mandibular arch with 5 implant fixtures (Standard Fixtures 3.75 $\times$ 15 mm RP; Nobel Biocare USA, Yorba Linda, Calif.) and a mandibular denture with an interim resilient liner. The patient had initiated treatment previously with a general dentist but decided to seek specialty care for the completion of her treatment.

Fabrication of a fixed-detachable hybrid prosthesis was planned for the mandibular arch and for a new maxillary complete denture. The treatment options presented to the patient also included the fabrication of an implant-supported overdenture, but the patient’s desire was to eliminate a removable prosthesis in the mandible. The following clinical and laboratory procedures were performed.

The healing abutments were removed, and impression copings were connected to the implants (Impression Coping Pick-up Type, 5 mm Profile; 3i Implant Innovations, Palm Beach Gardens, Fla.) (Fig. 1). A custom tray was used to make the final impression with heavy-bodied impression material (Exaflex Heavy Body; GC America Inc, Alsip, Ill.). The maxillary complete denture impression was made using an acrylic custom tray that was border molded with modeling plastic impression compound (ISO Functional Compound; GC America Inc) and poly-sulfide rubber base impression material (Coe-Flex Injection; GC America Inc). Master casts were recovered and trimmed, and record bases and occlusion rims were fabricated. The patient returned for recording of maxillomandibular relations and tooth selection. Master casts were then mounted on a semi-adjustable articulator (Hanau Modular Articulator System, REF: 014110-000; Waterpik Technologies Inc, Fort Collins, Colo.).

After the arrangement of the denture teeth, a wax/esthetic try-in was performed to verify the accuracy of maxillomandibular relations and to obtain patient approval of esthetics. Modifiable (prepable) abutments (PrepTite Abutment; 3i Implant Innovations) were connected to the implant analogs and evaluated for common path of insertion using a dental surveyor (Ney Surveyor; The JM Ney Company, Bloomfield, Conn.). If the path of insertion deviates considerably, then castable abutments may be used to produce the optimal angulations. The abutments were prepared with a 2- to 6-degree taper to develop the path of insertion and create adequate retention and resistance form (Fig. 2). Clearance of denture teeth was verified with a denture tooth index. The abutment screw access hole of each of prepared abutment was filled with an interim light-polymerized material (Fermit; Vivadent, Amherst, N.Y.), and 2 coats of die spacer were painted over the abutments on the master cast.

The framework design was similar to the conventional hybrid prosthesis,\textsuperscript{4-7} but it did not have screw access holes. The framework was waxed, cast, recovered, and fitted to the abutments on the master cast. Disclosing media (Kerr’s Disclosing Wax; Kerr, Romulus, Mich. and Occlude; Pascal Co Inc, Bellevue, Wash.) were used to evaluate the fit of the framework and to guide adjustment procedures. The fit was refined until the framework seated passively on the master cast. Clear-
ance of the framework with the denture teeth was verified with the tooth index (Fig. 3). The die spacer and light-polymerized interim material were removed from the abutments before the abutments were connected to the implants (Fig. 4). The metal framework was tried in to evaluate and verify a passive fit intraorally. Disclosing media was used to discern any fit discrepancies. Adjustments were performed, and abutments were removed from the implant fixtures and healing abutments reconnected.

The mandibular denture teeth were waxed to the hybrid framework, and a final wax try-in was performed to verify and correct maxillomandibular relations. At this appointment, the customized abutments were connected to the implants for the final wax try-in where they remained until final delivery of the prosthesis. A new resilient liner (Coe-Soft; GC America Inc) was placed in the existing mandibular denture after it was relieved to accommodate the height of the definitive abutments.

The maxillary complete denture was invested/flasked and processed by use of the maxillary master cast as any conventional complete denture. However, the mandibular hybrid prosthesis was invested without the master cast. The internal aspects of the casting that fit the abutments were blocked out with polyvinyl-siloxane impression material, and the prosthesis was invested directly into the lower half of the processing flask. The investing, flasking, and processing procedures were then completed (Fig. 5). The prostheses were finished and polished, a clinical remount was performed to allow for refinement of occlusal contacts, and the hybrid prosthesis was cemented onto abutments with provisional cement (Temp Bond; Kerr) (Fig. 6). Hygiene techniques were reviewed, and the patient was scheduled for recall and maintenance.

**DISCUSSION**

Producing a passive-fitting substructure for a fixed-detachable hybrid prosthesis is arguably one of the most technically complex tasks in implant dentistry. In spite of a number of techniques to prevent or correct distortions that occur during impression making, cast pouring, waxing, casting, indexing, and soldering, errors in the fit of
frameworks persist. The gap between an implant fixture and an abutment should be 10 μm or less to be considered passive. This degree of fit may be almost impossible with the geometry of most screw-retained fixed-detachable hybrid prostheses. The technique presented may not initially produce a perfectly passive framework, but use of disclosing media and adjusting the internal aspect of the casting can result in nonbinding, fully seated prostheses.

Disclosing media were used to evaluate the fit of the framework on the implant abutments in the same manner as are used to ensure complete seating and passivity for conventional fixed and removable partial dentures. Adjustments to the internal surfaces of the framework can then be made to eliminate binding as in conventional prostheses. Although the possibility exists that sectioning, indexing, and soldering may be required to obtain a passive-fitting substructure of this design, modification of the internal aspects should be sufficient in the majority of situations. On the other hand, a screw-retained prosthesis either fits passively or it does not. If it does not, the only alternative is to section and solder. Even then, the framework may not fit passively. Eliminating multiple sectioning, indexing, and soldering procedures may therefore simplify framework fabrication.

Another advantage to this technique is the elimination of screw access holes, which may improve esthetics and occlusion, yet permit retrievability of the prosthesis for hygiene and repair procedures. Furthermore, by eliminating screw-retention, the problems of fatigue, component fracture, and screw loosening are also eliminated.

There may be several disadvantages of this technique. First, selection and milling of modification (prepable) abutments requires an experienced clinician and technician working together with adequate communication. Implant angulations beyond 15 degrees may require an angled abutment or a castable abutment to achieve an acceptable path of insertion. Also, numbering or other methods of matching the correct abutment and orientation with the correct implant fixture is imperative.

Patients with limited interarch space may present several problems. Inadequate height of abutments may compromise retention and resistance form for the framework/abutment interface, or it may result in a framework with deficient thickness or insufficient space for setting denture teeth. With regard to cement retention, provisional cement should be used for easy retrieval of the prosthesis. However, cement failure may result in a loose prosthesis requiring an unscheduled patient visit. Also, meticulous removal of excess cement is essential.

SUMMARY

A design for a hybrid prosthesis with cement retention rather than screw retention is presented.

REFERENCES


Fig. 6. Definitive prostheses. A, Frontal view. B, Occlusal view demonstrating absence of access holes for optimal occlusion and esthetics.

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