Conservative and Esthetic Cast Gold Fixed Partial Dentures—Inlay, Onlay, and Partial Veneer Retainers, Custom Composite Pontics, and Stress Breakers: Part II: Utilization of Additional Retentive Features and Fabrication of Custom Pontic Facings

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ABSTRACT

Although in today's dental world implant restorations are considered the standard of care in the replacement of missing teeth, clinical contraindications and patient nonacceptance of implant placement can be encountered. Several scenarios are discussed here in which a single missing tooth can be restored with conservative fixed partial dentures (FPD) that employ cast gold retainers; each with a customized design in order to preserve tooth structure, maintain esthetics, and provide a long-term prognosis. The abutment teeth are prepared for conservative partial coverage restorations by using Brasseler burs (Brasseler USA, Savannah, GA, USA). Impressions are taken of the preparations, along with any retentive features, utilizing either the Vented Pin Channel technique or the Shooshan Plastic Pin technique. The latter technique utilizes Kodex twist drills and corresponding impression pins (Coltene Whaledent Inc., Mahwah, NJ, USA). The conservative FPD with non-rigid connectors is fabricated by using type III gold alloy. The pontic cage portion is chemically prepared utilizing the Panavia F2.0 cement kit (Kuraray America Inc., Houston, TX, USA) or other dual-polymerizing resin cement and restored with any type of direct composite resin material. A palette of opaquers and tints are used for chairside characterization of the esthetic pontic facing. The final polish of the pontic is completed by using FlexiDisc and FlexiBuff discs (Cosmedent Inc., Chicago, IL, USA).

CLINICAL SIGNIFICANCE

In cases where an implant restoration is contraindicated for replacement of a single tooth, a semi-precision FPD is a conservative, functional, and esthetic alternative.

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Although today implants are considered the standard of care in replacing missing teeth, several relative contraindications that prevent implants from being the appropriate treatment option exist.[1,2] Diabetes, a history of chronic heavy smoking, radiation treatment for cancer patients, and other conditions may compromise implant predictability.[1,2] Additionally, some patients elect

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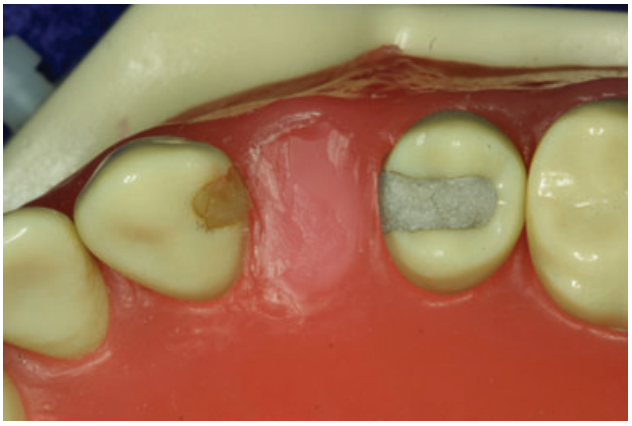

Figure 1. Proposed abutment teeth with a conservative composite in canine and large amalgam in premolar.

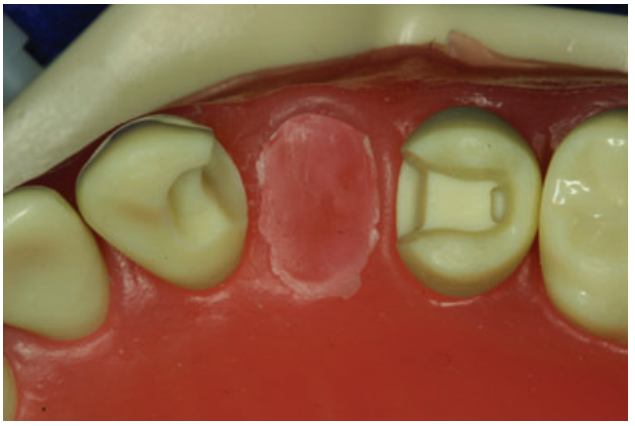

Figure 2. Abutment teeth prepared: canine is prepared for a distal hollow-grind with a lingual dovetail and gingival pin; premolar is prepared for an inlay with a slot. Note the independent lines of draw of each preparation.

Figure 3. Completed Inlay Retained FPD with non-rigid connector.

to replace teeth with more conventional options such as fixed/removable partial dentures. In selected cases, a posterior tooth may be replaced with a conservative fixed partial denture (FPD) that employs the use of cast gold retainers, which is both esthetic and functional.

Several clinical scenarios that can be treated with such conservative FPDs exist, each with a customized design in order to preserve tooth structure, maintain esthetics, and provide a long-term prognosis. Various typical cases will be discussed, each presenting various indications and levels of complexity. A clinical example will also be presented in order to depict how to create an esthetic facing on the pontic of an inlay-retained prosthesis with direct composite resin.

PIN-RETAINED INLAY RETAINERS WITH NONRIGID CONNECTOR

The following case shows a canine with a small distal composite and a premolar with a large mesiooclusal amalgam restoration. It should be noted that, if the retainers on the canines and premolar were part of a rigid FPD, both would have to be prepared in the same line of draw. A significant advantage with a stress-broken FPD is that both abutments can be prepared with an independent line of draw and, therefore, in the most conservative manner.[3] The size of each preparation will be determined by the existing restoration and extent of caries (Figures 1–3).

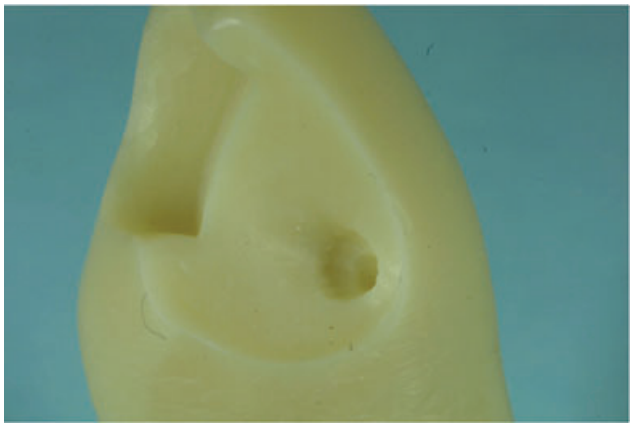

Figure 4. Distal hollow-grind with pin (note the countersink) preparation for increased retention.

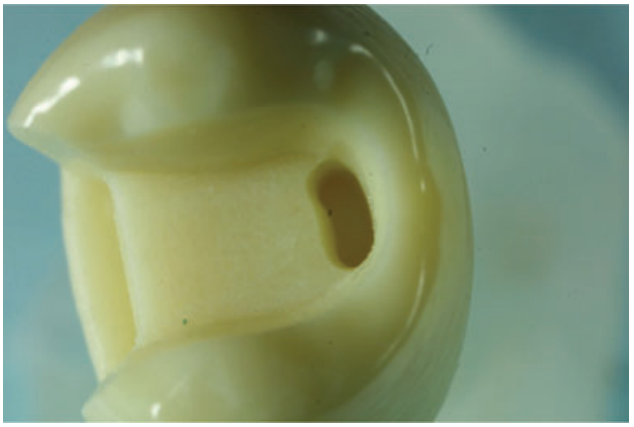

Figure 5. Mesiooccclusal inlay with slot preparation for increased retention.

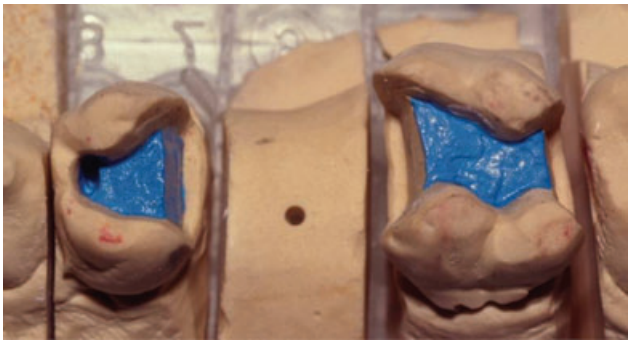

Figure 6. Cast of FPD.

The premolar contains a mesioocclusal inlay that is wide buccolingually. Therefore, a slot is placed in the distal portion of the preparation, in lieu of a more destructive preparation feature, such as a (distal) proximal box, to prevent mesial displacement.[4] As a rule of thumb, a slot (or pinhole) is placed as far from the primary retentive aspect of the preparation (the proximal box) as possible.[5] The slot must be prepared between 1.5 and 2.0 mm deep into the dentin and 2 mm wide for proper retention. For the canine, a hollow-grind is prepared in the distal by using a 7404 bur (Brasseler USA, Savannah, GA, USA) along with a lingual dovetail. For increased retention of the distoocclusal inlay, a pin is placed in the hollow-grind area, away from the lingual dovetail (the most retentive feature) of this inlay. The pin is prepared by first countersinking a concavity with a four-round bur and then preparing a hole 1.5 to 2.0 mm deep with a 0.022″ twist drill. Care should be exercised to ensure that the pin channel has the same line of draw as the remainder of the preparation (Figures 4 and 5).

Obtaining an accurate and complete impression of accessory retentive features, such as slots and pinholes, may present the clinician with a significant challenge. Several techniques that are designed to capture retentive features without air entrapment or material distortion exist. Two techniques will be utilized to accomplish this: one utilizes a direct impression of the feature (the *vented pin channel* technique),[6] and the other uses a plastic pin to serve as an analog (the *Shooshan plastic pin* technique) to record pin depth and orientation.

Figure 7. Castings of FPD.

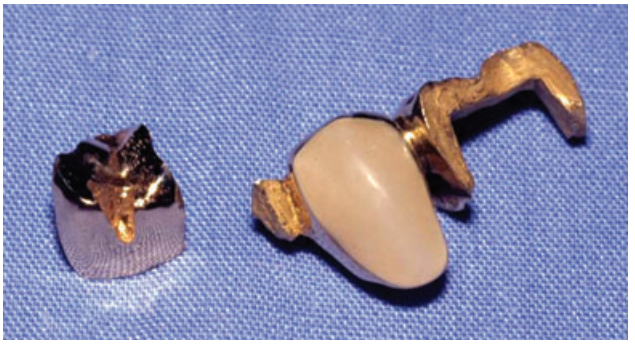

Figure 8. Segments depicting non-rigid connector design.

Figure 9. Esthetic appearance of final prosthesis.

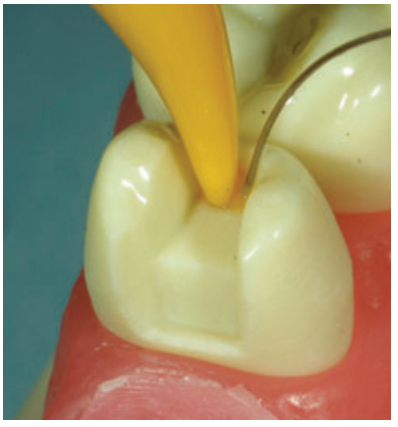

Figure 10. Vented Pin Channel Technique: utilizes a modified 30 gauge needle to capture slot preparation in final impression.

CLINICAL EXAMPLE OF FPD #12 DO INLAY WITH SLOT—#14 MOD INLAY

A clinical case is shown in Figure 6 in which the retentive slot feature is indicated. The patient presents with an existing distoocclusal restoration on #12, which is too wide buccolingually for sufficient retention for the planned abutment inlay preparation. Additional retention is achieved with the placement of a slot in the mesial portion of the distoocclusal inlay preparation. By not extending the dimensions of the preparation, the slot provides the required retention while also preserving the conservative inlay preparation. Note that the slot is once again placed in the area most distant from the primary retentive feature, the distal box. In Figures 7 and 8, the mesial and distal segments of the final FPD are shown prior to cementation. The esthetic result is seen in Figure 9 upon the patient's full smile.

Vented Pin Channel Technique

In this scenario, the slot feature is impressed with the use of a 30 gauge needle (Figure 10) that is modified by removing the bevel at the tip by bending the needle with a hemostat until it fatigues and breaks off. This will keep the lumen of the needle patent.[6]

Figure 11. Shooshan Plastic Pin Technique: pin is utilized for final impression of pin preparation (note: the pin is incorporated in the wax pattern).

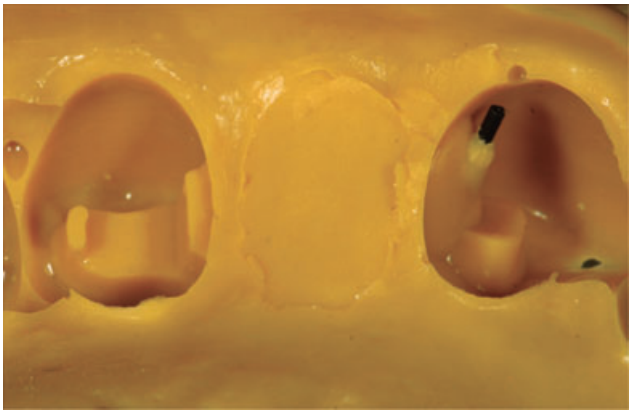

Figure 12. Final impression effectively capturing the slot preparation in the premolar and the pin preparation in the molar.

The modified needle is then placed at the base of the slot and is withdrawn, as the impression material is being injected. The needle vents the air out of the slot through the lumen, allowing the impression material to flow readily into the slot without the incorporation of air bubbles. This technique is applicable when the retentive feature (a slot, in this example) is significantly large enough to accommodate the placement of the needle and the tip of the impression syringe.

Shooshan Plastic Pin Technique (Kodex Twistdrills and Plastic Pins: K95 [0.024″ × 5 mm], K97 [0.027″ × 5 mm], K98 [0.028″ × 5 mm], Coltene Whaledent Inc., Mahwah, NJ, USA)
In this technique, the pin feature is recorded by employing plastic pins, which are inserted into the pinhole during the time of impression taking (Figure 11).[7] The pins are nontapered, comprised of nylon, and 0.001″ smaller than the final pin preparation diameter (0.022″). The plastic pins are cut with a scalpel to the desired length and placed in the pinhole for incorporation in the final impression. A dab of Vaseline (Unilever, Greenwich, CT, USA) may be placed on the pin tip prior to making the impression to help secure it on the tooth. The technician will utilize castable pin analogs (0.020″), which are smaller nylon pins, to be incorporated into the wax pattern (Figure 11).

SIMPLE INLAY RETAINERS WITH A NONRIGID CONNECTOR

The following case shows a missing tooth space adjacent to teeth with no existing restorations. Although this would be ideally restored with an implant, clinical conditions that are contraindicated for implant placement can present.[1,2] In such cases, simple inlay retained FPDs are very conservative and functional alternatives to implant restorations (Figures 13–15).

The preparation on the canine is a slot design, with exaggerated acute internal line angles to maximize retention and allow for a conservative outline preparation (Figure 17). This preparation requires the use of various hand instruments (#45S Off-angle chisel for the facial and lingual axial proximal line angles, #233 TRU-BAL gingival margin trimmer to form an acute gingival axial line angle, and #232 Tucker gingival margin trimmer for an external bevel at the gingival finish line) (Suter Hand Instuments Dental Manufacturing Company, Chico,

Figure 13. Missing tooth space with adjacent teeth having no existing restorations.

Figure 14. Premolar and canine are prepared for conservative mesioocclusal and distal slot inlays respectively.

Figure 15. Completed Inlay Retained FPD with non-rigid connector.

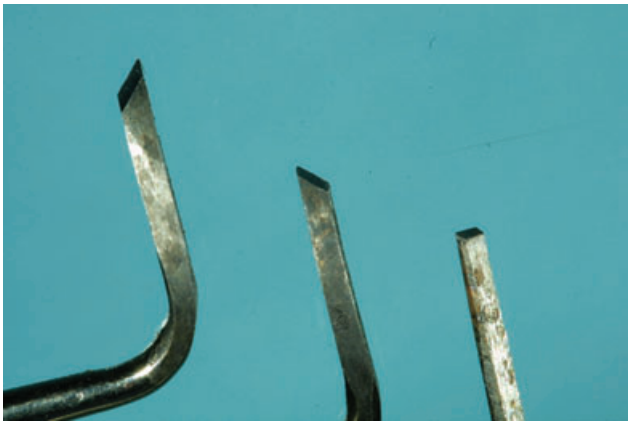

Figure 16. Carbon steel hand instruments for refinement of internal line angles and external bevel of the preparation (232 Tucker gingival margin trimmer, 233 TRU-BAL gingival margin trimmer, and 45S Off-angle chisel).

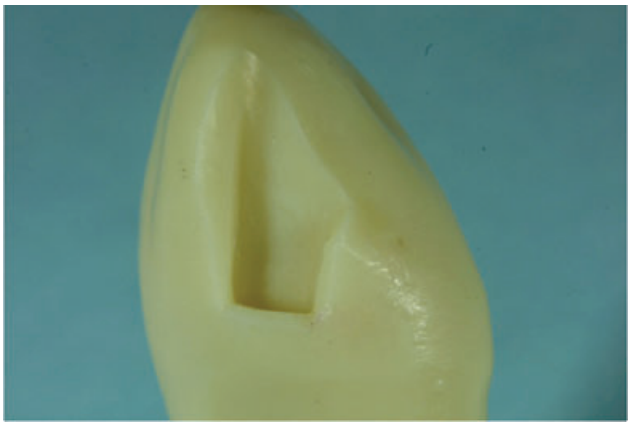

Figure 17. Slot Design for distal canine inlay (note the acute internal line angles).

Figure 18. Patient presents with missing tooth #5.

Figure 19. Teeth adjacent to the missing tooth space have existing restorations, which are removed and blocked-out with glass ionomer.

Figure 20. Abutment teeth are prepared under the isolation of a rubber dam for a slot inlay on the canine and MOD inlay on premolar.

Figure 21. Hollowed-out pontic ("cage" design) for macromechanical retention of composite for the esthetic facing. Note the sandblasted intaglio of the "cage" for micromechanical bonding of the composite.

CA, USA) (Figure 16) to properly refine the internal line angles. The lingual outline form is completed with the use of a 7404 bur.[6]

The following clinical case will illustrate the utilization of an inlay FPD with an esthetic custom-made pontic. In this example, the patient has lost a maxillary first premolar and has existing restorations on the adjacent canine and second premolar (Figure 18). The previous restorations are removed, and the preparations are "blocked out" with either glass ionomer restorative material or chemical cure composite resin. In blocking out the preparations, the depth of the cavity can be optimized, the walls of the cavity can be made smooth, and the final outline form can be kept more conservative.[6]

A slot is prepared in the distal of the canine (as described previously) with acute internal line angles, keeping the preparation very conservative. The premolar is prepared for an MOD inlay. Note the outline sizes of the previous restorations and the new preparations in Figures 19 and 20. The final restorations will be very similar in size to the previous restorations as a result of the block-out technique.[6]

The pontic will be restored chairside by the clinician with the use of composite in order to maximize the shade customization to more closely mimic the facial appearance

Figure 22. Alloy primer and primer A and B (components of Panavia F2.0 cement kit) utilized to chemically prepare pontic for micromechanical retention of esthetic composite facing.

Figure 23. Semi-precision FPD tried in mouth for shade selection.

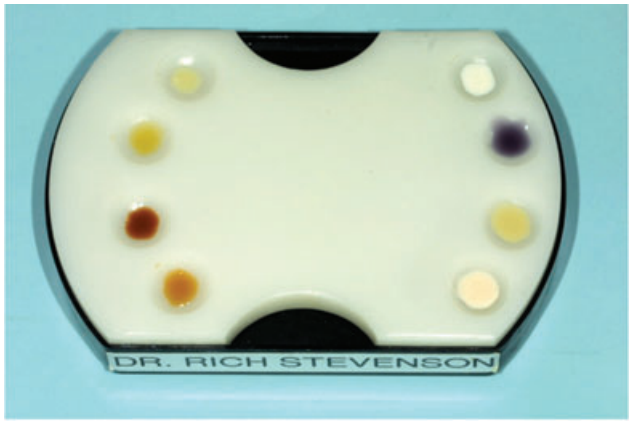

Figure 24. Palette of opaquers and tints used in the characterization of esthetic pontic facing.

of the adjacent teeth. Any composite of choice can be used to restore the pontic facing. For composite to micromechanically bond properly to the gold surface of the pontic, the intaglio of the casting must first be mechanically and chemically prepared. The surface is first sandblasted with 50 μm aluminum oxide while ensuring that the margins of the adjacent inlay retainer and polished external surfaces are protected. The metal surface is then prepared chemically utilizing the Panavia F2.0 cement kit (Kuraray America Inc., Houston, TX, USA), which contains an alloy primer bonding system so that custom composite layering can be successfully completed by the clinician. A thin layer of alloy primer is added to the surface, followed by a thin layer of a mixture of primers A and B, and a layer of Panavia cement. The surface is then finished with a thin layer of oxygen-inhibiting gel. Note, the "cage" design of the hollowed-out pontic allows for macromechanical retention of the composite (Figure 21).

The segments for the semiprecision FPD are first tried in the mouth (Figure 23). A shade is selected for the composite resin, while the segments are temporarily positioned in order to optimize final shade match (note: the hue and value of the abutment teeth change with the gold inlay retainers in place). The

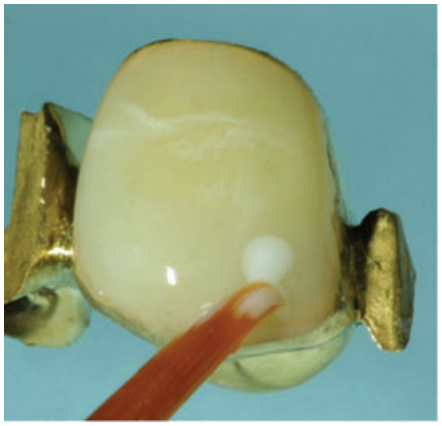

Figure 25. Chairside characterization of esthetic pontic facing.

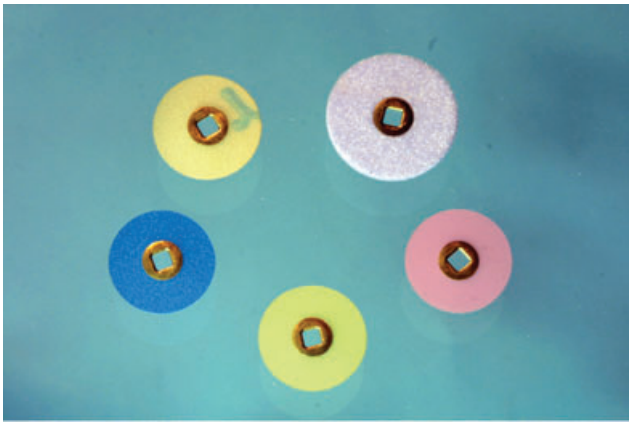

Figure 26. FlexiDisks and FlexiBuff (Cosmedent Inc., Chicago, IL, USA) disks for final polish of the composite on esthetic facing of pontic.

Figure 27. Buccal view, retracted.

Figure 28. Full smile.

Figure 29. Occlusal view: note excellent marginal adaptation and conservative extensions.

composite is added in 2-mm increments up to 1 mm of the final contour. A layer of opaque composite may be added to the marginal areas of the pontic facing in order to further conceal the gold. A palette of opaquers and tints (Figure 24) are employed as necessary to maximize the characterization of the pontic facing during the final 1 mm of composite resin placement (Figure 25).

For the composite to be polished to a smooth and natural texture,

composite finishing disks are utilized. The disks should rotate from the composite to gold surface so as not to incorporate gold particles into the composite (Figure 26).

SUMMARY

For retention in the conservative inlay abutment preparations to be increased, additional retentive features such as slots and pins can be employed. Through the use of such retentive features, a conservative preparation design is achievable without the loss of retention and resistance forms.

As seen in the clinical scenario presented, an acceptable esthetic result can be achieved with a gold inlay–retained FPD. Following the techniques described in this article, the clinician may customize the facing of pontics with layered composite. With the use of a palette of opaquers and tints, it is possible to create esthetic pontics in conjunction with conservative excellent fitting gold retainers (Figures 27–29).

By using the techniques described in this article, the objectives of tooth structure conservation, optimal marginal integrity, restoration longevity, and esthetics may be predictably achieved.

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