Application of a metal bonding system in fabrication of a collarless composite veneered fixed partial denture: A case report

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This case report describes application of a metal bonding system in fabrication of a composite resin veneered fixed partial denture (FPD) with reduced retentive structure. A four-unit framework was fabricated with a silver-palladium-copper-gold alloy (Castwell M.C.12). The surface to be veneered was air-abraded with alumina, followed by priming with a metal adhesive agent (V-Primer). The framework was then veneered with a light-polymerized composite material (Cesead). The completed FPD was seated with a glass ionomer luting agent (HY-Bond Glass Ionomer). After an observation period of five years and two months, the FPD was functioning satisfactorily. The technique described here is applicable in fabrication of composite veneered restorations for vital abutment teeth. **(Asian Pac J Dent 2012; 12: 7-10.)**
Key Words: adhesive, primer, silver-palladium-copper-gold alloy, thione

Introduction

Silver-palladium-copper-gold alloy (Ag-Pd-Cu-Au alloy) is used in prosthodontic practice due to its excellent handling properties as well as age-hardenability. The alloy is applied to single restorations, fixed partial dentures (FPDs), and removable denture frameworks. One of the problems associated with restorations made of Ag-Pd-Cu-Au alloy, however, has been insufficient bonding ability with indirect composite materials. Several metal adhesive agents are currently available to alleviate the problem. Although laboratory evaluations demonstrated improved bond strength to noble metal alloys with the use of the metal adhesive systems,[1-5] limited information is available about bonding techniques between the framework and veneering composite.[6] This article presents an adhesive veneering procedure for the Ag-Pd-Cu-Au alloy framework of a maxillary anterior FPD with a light-polymerized composite material.

Clinical Report

A 54-year-old male patient was seen with esthetic and functional disturbances as a result of a missing maxillary right lateral incisor. Several treatment options were proposed: 1) single-tooth implant; 2) FPD veneered with composite resin; 3) porcelain-fused-to-metal FPD; or 4) a removable partial denture. The patient chose the second of the proposed prostheses. The laboratory and clinical procedures were then explained in detail and consent was obtained from the patient.

Prior to fabrication of the FPD, endodontic treatment and dowel core seating were completed for the central incisors (Figs. 1-4). The dowel cores were made of a Ag-Pd-Cu-Au alloy (Castwell M.C. 12; GC Corp., Tokyo, Japan) and seated with a glass ionomer luting cement (Fuji Ionomer I; GC Corp.). Under local anesthesia for the right canine, a vital tooth, reduction was performed for the three abutment teeth by means of diamond rotary cutting instruments with water coolant (Fig. 4). An impression of the entire maxilla was made with silicone elastomeric materials (Exafine Putty and Injection; GC Corp.) using a stock tray (Fig. 5).

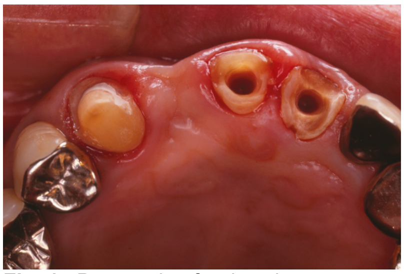
Fig. 1. Preparation for dowel cores


Fig. 2. Impression for dowel cores


Fig. 3. Provisional FPD


Fig. 4. Reduced abutments


Fig. 5. Impression for the FPD


Fig. 6. Labial view of the wax pattern

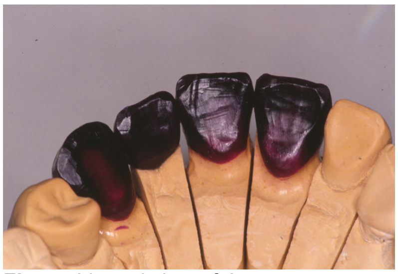
Fig. 7. Lingual view of the wax pattern


Fig. 8. Labial view of cut-back surface


Fig. 9. Lingual view of cut-back area


Fig. 10. Retentive beads adhesive


Fig. 11. Application of the adhesive


Fig. 12. Application of retentive beads


Fig. 13. Polymerization with a UV-unit

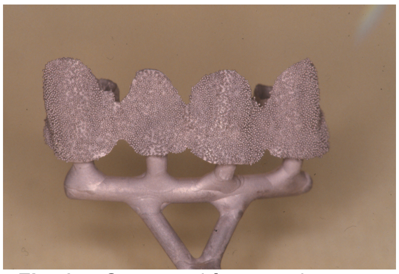
Fig. 14. Cast metal framework


Fig. 15. Reduction of framework

Die stone material (Fuji Rock; GC Corp.) was poured into the impression, and a working cast was prepared. The stone cast was mounted in an articulator with an opposing cast. The pattern of the retainer and pontic was fabricated using an inlay wax material (Inlay Wax; GC Corp.: Figs. 6 and 7). After cutting-back the labial surface (Figs. 8 and 9), a thin layer of an adhesive for retentive beads (Particle Bond; Toho Dental Products, Saitama, Japan) was applied to the wax surface (Figs. 10-11). Retentive beads 200 μm in average diameter

(Retention Beads II; GC Corp.) were next sprinkled on the adhesive layer (Fig. 12). The Particle Bond adhesive was light-polymerized with a UV-light polymerization unit for 20 s (Twinkle Q; Toho Dental Products: Fig. 13). The wax pattern was invested in a cristobalite mold material (Cristobalite Micro; GC Corp.) and Ag-Pd-Cu-Au alloy (Castwell M.C. 12; GC Corp.) was cast in the mold with a centrifugal casting apparatus. A four-unit FPD framework consisting of three retainers and a pontic was fabricated (Fig. 14). The labial metal collar and retentive structures were reduced in part with a rotary cutting instruments (Fig. 15). The surface to be veneered was air-abraded with 50- to 70-µm grain sized alumina (Hi-Aluminas; Shofu Inc., Kyoto, Japan: Fig. 16) using an airborne particle abrader (Micro Blaster MB102; Comco Inc., Burbank, CA, USA), and treated with a single liquid primer designed for noble metal alloys (V-Primer; Sun Medical Co., Ltd., Moriyama, Japan). The buccal surface of the framework was veneered with an indirect composite material (Cesead; Kuraray Co., Ltd., Osaka, Japan) according to the specification of the manufacturer (Figs. 17 and 18). A successional material of the Cesead composite is currently available as Epricord (Kuraray Medical Inc., Tokyo, Japan).


Fig. 16. Air-abrasion with alumina


Fig. 17. Completed FPD


Fig. 18. Collarless structure


Fig. 19. Seated FPD


Fig. 20. Occlusal view

On the next appointment, the completed FPD was tried-in, and seated with a glass ionomer luting cement (HY-Bond Glass Ionomer; Shofu Inc.: Figs. 19 and 20). The patient entered a maintenance program and was examined twice per year. After an observation period of five years and two months, the FPD was functioning satisfactorily.

Discussion

As shown in the laboratory procedure of the present case, indirect composite material is bonded to the framework both mechanically and chemically. Koizumi et al.[7] compared the undercuts generated with the use of two retentive beads adhesives. It was found that the ratio of diameter of bonded area and retentive bead at an identical cross section was 0.65 for the Particle Bond adhesive and 0.49 for the GC Adhesive. The authors judged the undercut generated with the use of two adhesives was acceptable in fabrication of composite veneered restorations. The clinical course of the current case supports their experimental conclusion.

Retentive structure in the present case was reduced considerably (Fig. 15). Reduction of retentive structure is effective for color reproducibility of tooth-colored materials especially for vital abutment teeth. During the observation period, retention of the composite material was not negatively affected by reduction of the retentive beads. This favorable clinical course may be derived from combined application of mechanical and chemical bonding systems. According to clinical studies, restorations veneered with the Cesead composite exhibited excellent performances[8,9] especially for the chemically bonded cases.[8] The result of the current case agrees with the previous report,[8] in which usefulness of a tin-plating chemical bonding system was reported for bonding between the Cesead composite and the Castwell Ag-Pd-Cu-Au alloy.

The remaining problem to be solved is bonding between the composite material and dentin at the labial cervical area. The authors consider that a resin based luting agent should be used for seating collarless restorations together with appropriate priming agents.

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