Repair of an anterior fixed partial denture with a resin-bonded overcasting and a dual functional metal priming agent: A clinical report

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This clinical report describes the repair of a fixed partial denture (FPD) with fracture of porcelain using an overcasting. Porcelain veneer of a maxillary six-unit FPD made of cobalt-chromium was fractured. Veneered areas were cut with a diamond rotary instrument, and an overcasting restoration was made with gold alloy and feldspathic porcelain. The two-unit overcasting restoration was seated with a combination of the Alloy Primer conditioning agent and Super-Bond adhesive resin. The repaired FPD, overcasting, and abutments have been functioning satisfactorily for more than two years and two months. **(Int Chin J Dent 2006; 6: 17-20.)**
Key Words: adhesive, fixed partial denture, overcasting, primer, repair.

Introduction

Fracture of tooth-colored veneers in a fixed partial denture (FPD) is troublesome, especially in the anterior dentition. A technique to repair broken metal-ceramic restorations was described by Johnston et al.[1] Various methods of making an overcasting were thereafter reported.[2-14] Due to insufficient retentive structure similar to three-quarter crown restorations or saddle-shaped onlays, a strong bond between the overcasting and the undercasting is required. Several metal priming agents capable of improving the bonding of resin to casting alloys have been introduced.[15-18] This article reports the repair and bonding techniques of a six-unit FPD with a porcelain-fused-to-metal (PFM) overcasting and a dual functional metal adhesive system.

Clinical Report

Examination and treatment planning

A 63-year-old female patient presented with the chief complaint of esthetic dissatisfaction and masticatory disturbance resulting from fracture of the porcelain veneer of the right maxillary incisors. The central incisor was an intermediate retainer and the lateral incisor was a pontic of a six-unit metal-ceramic FPD (Fig. 1). The fracture was suspected to be caused by insufficient bonding between the metal substructure and sintered porcelain. There was remarkable discoloration of the metal surface and staining of the porcelain. Also, the two incisors on the left had already been repaired with a two-unit overcasting restoration. Overall, bonding between the porcelain and metal framework appeared to be unsatisfactory. Complete replacement of the prosthesis was recommended to avoid consecutive fracture of canine retainers. The patient, however, preferred conservative repair instead of replacement of the FPD. A second-time repair with an overcasting was therefore suggested and the patient consented to treatment with the overcasting technique.

Clinical and laboratory procedure

The fractured porcelain veneer was removed with a high-speed diamond rotary cutting instrument. Area of preparation included the facial, incisal, and lingual surfaces of the casting (Fig. 2). A retentive hole was prepared at the edge of the central incisor abutment (Fig. 3).

Fig. 1. Fractured porcelain veneer.

Fig. 2. Removal of porcelain.

Fig. 3. Retentive hole in the incisor.

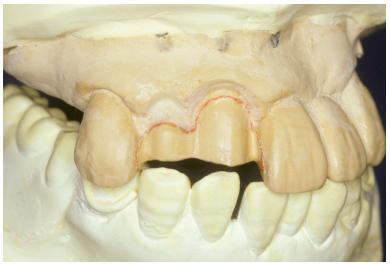


Fig. 4. Working cast.

Fig. 5. Waxing of overcasting.

Fig. 6. Gold alloy framework.

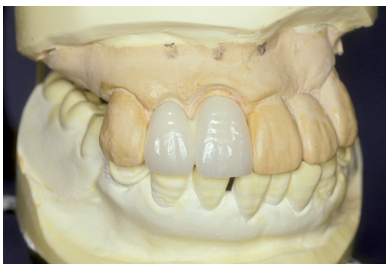


Fig. 7. Completed overcasting.

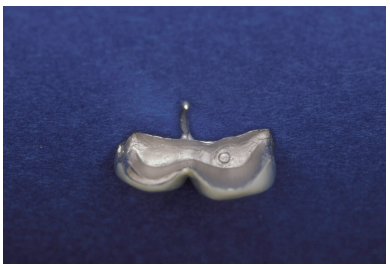


Fig. 8. Air-abrasion with alumina.

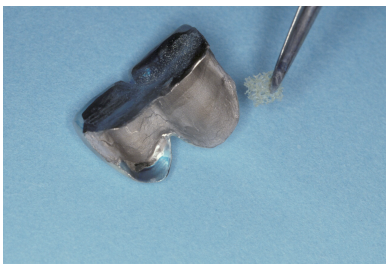


Fig. 9. Application of Alloy Primer.

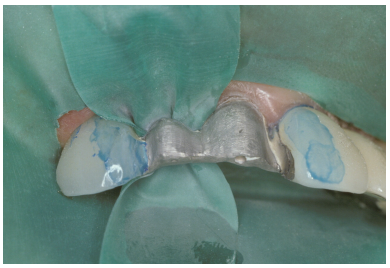
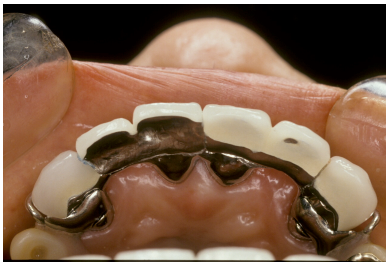


Fig. 10. Air-abraded undercasting.

Fig. 11. Application of Alloy Primer.

Fig. 12. Removing flew-out luting agent.



Figs. 13 and 14. Facial and incisal views of the seated overcasting.

Fig. 15. The repaired FPD after one year and four months.

After blocking out the embrasures and sub-pontic spaces with a cavity sealer, an impression of the entire maxilla was taken with a silicone elastomeric material (Exafine, Putty and Injection, GC Corp., Tokyo, Japan). A transitional acrylic resin restoration was seated with tooth-colored self-curing resin.

The impression was primarily poured with die stone and then with lab stone, and a working cast with removable dies stabilized with dowel pins was prepared. Embrasures and sub-pontic spaces were modified with

a die stone material (Fig. 4). A wax pattern was fabricated and the framework was cast with a gold alloy for metal-ceramic restorations (Degudent U, Degussa AG, Frankfurt, Germany) (Figs. 5 and 6). Feldspathic porcelain (VMK 68, Vita Zahnfabrik GmbH, Bad Säckingen, Germany) was applied to the casting (Fig. 7).

Seating the restoration

At the second appointment, the overcasting was tried-in, and the inner surface to be bonded was air-abraded with 70 μm alumina (Hi-Aluminas, Shofu Inc., Kyoto, Japan) by means of an airborne particle abrader (Jet-Blast II, J. Morita Corp., Suita, Japan) (Fig. 8). A single liquid metal priming agent (Alloy Primer, Kuraray Medical Inc., Tokyo, Japan) was applied to the overcasting (Fig. 9). The Alloy Primer material contained both 6-(4-vinylbenzyl-*n*-propyl) amino-1,3,5-triazine-2,4-dithiol, or dithione tautomer (VTD) and 10-methacryloyl-oxydecyl dihydrogen phosphate (MDP) in acetone. The abutment and pontic of the undercasting made of a cobalt-chromium (Co-Cr) alloy (Biocast, Rx Generic Corp., Wallingford, CT, USA) were isolated with a rubber dam. The adjacent teeth were protected against particle abrasion with a polymer-solvent coating agent (Protect Varnish, Kuraray Medical Inc.). The intraoral metal surface was also air-abraded with alumina with a hand-held air-abrader (Airbrush, Paasche Airbrush Co., Chicago, IL, USA) (Fig. 10). The Alloy Primer material was applied to the undercasting (Fig. 11). The overcasting was then seated with a tri-*n*-butylborane initiated adhesive resin (Super-Bond C&B, Sun Medical Co., Ltd., Moriyama, Japan) using a brush-dip technique (Figs. 12-14).

Clinical course

The patient was satisfied with the restoration and entered into a maintenance program. Fig. 15 shows the facial view of the overcasting restoration after one year and four months. During an observation period of two years and two months, the repaired FPD functioned satisfactorily.

Discussion

An overcasting restoration is usually applied to repair a multi-unit FPD. This technique, however, is contraindicated in cases of failure of bond between porcelain and metal substructure. Considerable staining of the fractured veneer and metal framework shown in Fig. 1 suggests that bonding between the Co-Cr alloy framework and sintered porcelain material appeared to be insufficient for this FPD. This six-unit FPD, however, was repaired twice with overcasting restorations. One of the reasons is that the canine metal-ceramic restorations had been successively and successfully functioning as abutments for both the FPD and removable partial denture. In addition, the primarily seated overcasting on the left two incisors had been functioning for more than three years without detachment or fracture. The patient, therefore, preferred a second repair with overcasting rather than dislodging and re-fabrication of the FPD.

Repair of intermediate porcelain fracture is usually accomplished with a saddle-form overcasting. This type of casting is less retentive and more difficult to stabilize than a full cast restoration or three-quarter restoration. Additional preparation of a retentive hole in the current case helped to improve retention of the overcasting.[1-3,5,6,9]

A dual functional metal priming agent (Alloy Primer) that contains both the VTD thione monomer and the MDP hydrophobic phosphate monomer was used for seating the overcasting. According to the literature concerning adhesive bonding of dental casting alloys, VTD was effective for bonding noble metal alloys,[17,18] whereas the MDP was effective for bonding base metal alloys.[16] Considering the fact that adherend materials in the current case are Co-Cr alloy and gold alloy, it is reasonable to consider that MDP in the Alloy Primer agent

is effective for bonding the Co-Cr undercasting, and VTD is substantially effective for bonding the gold alloy overcasting.

Acknowledgment

This clinical report associated with survival analysis of resin-bonded castings and bonding of dental casting alloys was supported in part by a Grant-in-Aid for Scientific Research C 17592030 (2005-2007) from the Japan Society for the Promotion of Science (JSPS), by Uemura Fund (2005), Nihon University School of Dentistry, and by the Nihon University Multidisciplinary Research Grant for 2004 (#04-017).

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Received December 22, 2005. Revised January 13, 2006. Accepted January 20, 2006.
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