

## Case Report

# Fifteen-year clinical performance of a resin-bonded fixed partial denture seated with a thione primer and a tri-*n*-butylborane-initiated luting agent

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**Abstract:** This article reports the clinical performance of a resin-bonded fixed partial denture (FPD) made of type IV gold alloy. The retainers were air-abraded with alumina particles and primed with a single-liquid thione priming agent (Metaltite). The FPD was then seated with a tri-*n*-butylborane-initiated adhesive resin (Super-Bond). After 15 years, the FPD is still functioning satisfactorily. The present materials and techniques are applicable to minimally invasive fixed prosthodontic treatments. (J Oral Sci, 55, 263-266, 2013)

**Keywords:** adhesive; fixed partial denture; gold alloy; thione; tri-*n*-butylborane.

## Introduction

Replacement of missing anterior and posterior teeth is a critical issue in restoring the anatomic structure of dentition and oral function. Gold alloys are extensively used in fabricating fixed partial dentures (FPDs) because of their adaptability to abutments, stability in oral environments, favorable hardening characteristics, and ideal laboratory handling properties. Fortunately, several single-liquid primers capable of bonding noble metals have been developed during the last two decades, and laboratory evaluations have demonstrated the effectiveness of

single-liquid primers with organic sulfur compounds (1-5).

Although a number of prosthodontic applications have been reported for metal adhesive systems (6-9), little information is available on the combined application of a specific primer and self-polymerizing adhesive resin (7). This case report describes the long-term clinical performance of a resin-bonded FPD made of a gold alloy.

## Case Report

A 52-year-old male patient presented with masticatory disturbance due to a missing right maxillary first premolar, which had been extracted because of root fracture. Examination revealed unilateral balanced occlusion. After being presented with the relevant treatment options, the patient selected the seating of a resin-bonded FPD. The clinical procedure was explained in detail, and consent was obtained from the patient (Fig. 1).

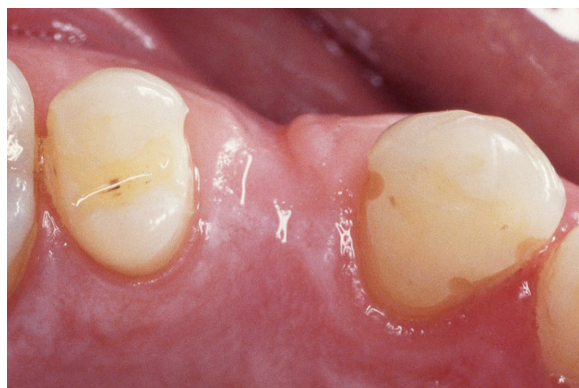
Fabrication of a three-unit FPD was planned. Reduction of premolar cusps was considered unnecessary. Pits and fissures, proximal surfaces, and lingual surfaces within the enamel of the abutment teeth were reduced using a high-speed diamond rotary instrument with water coolant. Three proximal retention grooves, in which dentin was slightly exposed, were prepared for the canine abutment (Fig. 2). An FPD consisting of two retainers and a pontic was cast from a type IV gold alloy (Casting Gold Type IV, GC Corp, Tokyo, Japan). The buccal surface of the pontic was veneered with an indirect composite material (Estenia, Kuraray Co, Ltd, Osaka, Japan) (Fig. 3).

The completed FPD was tried in at the next appointment. The surfaces to be bonded were abraded with

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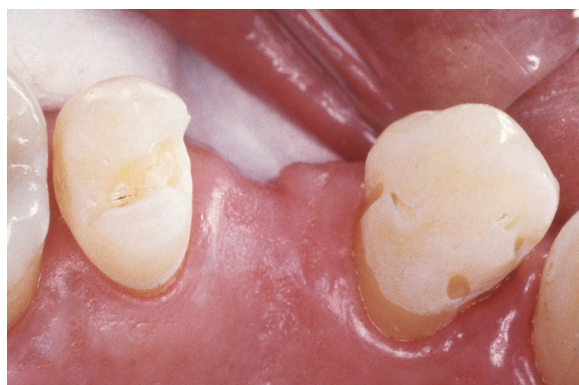
**Fig. 1** A 52-year-old man had a missing maxillary first premolar.



**Fig. 2** Reduction was limited to enamel, except for three grooves sunk into the canine abutment.



**Fig. 3** The completed FPD, with wrap-around retainers and tooth-colored buccal surface veneered with Estenia composite material.



**Fig. 4** After try in and occlusal adjustment of the FPD, the abutment surfaces to be bonded were etched with 40% phosphoric acid gel for approximately 30 s and rinsed with water.



**Fig. 5** The inner surfaces of the retainers were air-abraded with alumina particles and primed with Metaltite.



**Fig. 6** The FPD was seated with Super-Bond Opaque Ivory luting agent.

50- $\mu$ m alumina particles, using an airborne particle abrader. A single liquid primer (Metaltite, Tokuyama Dental Corp, Tokyo, Japan), which contained 6-methacryloyloxyhexyl 2-thiouracil-5-carboxylate (MTU-6) in ethanol, was applied to the blasted surfaces. The enamel surfaces of the abutment were etched with 40% phosphoric acid gel (K-Etchant, Kuraray Co, Ltd), rinsed with

water, and air-dried, after which the FPD was seated with a tri-*n*-butylborane-initiated adhesive resin (Super-Bond Opaque Ivory, Sun Medical Co, Ltd, Moriyama, Japan) (Figs. 4-8). The patient then entered a maintenance program of regular check-ups twice per year. After an observation period of 15 years, change in anatomic form due to attrition was observed at the occlusal surfaces;





**Fig. 7** Buccal view of the seated FPD (mirror image).



**Fig. 8** Lingual view of the seated FPD.



**Fig. 9** A buccal view of the FPD, 15 years after bonding, shows a wedge-shaped defect in the canine abutment (mirror image).



**Fig. 10** A lingual view, 15 years after bonding, shows attrition along the cusps.

however, the FPD continues to function satisfactorily (Figs. 9-10).

### Discussion

Several laboratory studies have shown that application of thione primers enhanced bonding between noble metal alloys and Super-Bond resin (1-5). For the current case, Metaltite was selected as a primer for retainers made of type IV gold alloy because it creates a highly durable bond with such alloys (1) and because the ethanol solvent in Metaltite is acceptable to patients and clinicians. A 40% phosphoric acid gel was used as an enamel etchant because unpublished experimental results showed that 40% phosphoric acid was superior to 65% phosphoric acid as an etchant for the enamel surface of FPD abutments.

Luting agent selection is also an important issue in the long-term success of prosthodontic treatment. Super-Bond Opaque resin was used as a luting agent in the present patient because it durably bonds to retainers made of silver-palladium-copper-gold alloy (8,9) and

because it hides the metallic color of cast retainers less than 50  $\mu\text{m}$  in thickness. The authors believe that the present 15-year follow up of gold alloy retainers seated with the Metaltite-Super-Bond system is the longest reported observation period. The clinical and laboratory evaluation of this bonding system is ongoing.

### Acknowledgments

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### References

1. Matsumura H, Kamada K, Tanoue N, Atsuta M (2000) Effect of thione primers on bonding of noble metal alloys with an adhesive resin. *J Dent* 28, 287-293.
2. Shimizu H, Tachii Y, Takahashi Y (2008) Bonding of autopolymerizing denture base resin to cast Type IV gold alloy. *Am*

- J Dent 21, 323-326.
3. Minami H, Murahara S, Suzuki S, Tanaka T (2011) Effects of metal primers on the bonding of an adhesive resin cement to noble metal ceramic alloys after thermal cycling. *J Prosthet Dent* 106, 378-385.
  4. Minami H, Murahara S, Muraguchi K, Sakoguchi K, Suzuki S, Tanaka T (2013) Effect of adhesion promoting monomer addition to MMA-TBBO resin on bonding to pure palladium. *Dent Mater J* 32, 173-180.
  5. Yamashita M, Koizumi H, Ishii T, Nakayama D, Oba Y, Matsumura H (2013) Adhesive performance of silver-palladium-copper-gold alloy and component metals bonded with organic sulfur-based priming agents and a tri-n-butylborane initiated luting material. *Acta Odontol Scand* 71, 196-204.
  6. Shimizu H, Takahashi Y (2004) Retainer design for posterior resin-bonded fixed partial dentures: a technical report. *Quintessence Int* 35, 653-654.
  7. Tanoue N, Shimoe S, Nemoto M, Matsumura H (2005) Repair and re-seating of resin-bonded fixed partial denture performed after minimal abutment reduction: a clinical report. *Int Chin J Dent* 5, 97-100.
  8. Nakamura M, Koizumi H, Matsumura H (2012) Repair of a resin-bonded fixed partial denture 16 years after seating: a case report. *Asian Pac J Dent* 12, 45-48.
  9. Minami H, Minesaki Y, Suzuki S, Tanaka T (2012) Twelve-year results of a direct-bonded partial prosthesis in a patient with advanced periodontitis: a clinical report. *J Prosthet Dent* 108, 69-73.
  10. Matsumura H, Nakamura M (1998) Characteristics and clinical application of noble metal priming agents (1). *Nippon Shika Hyoron* 673, 145-161.