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Clinical Technique/Case Report

Minimally Retentive Gold Onlays: A Six-Year Case Report

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PURPOSE

Partial veneer gold restorations, such as gold onlays, have changed little in preparation design over the past 40 years, as evidenced by textbooks that have long been in print.[1-2] Such designs must have been based on the assumption that restorations would be luted with zinc phosphate cement but have not altered, despite the introduction of stronger luting cement classes, such as resin composite and resin-modified glass ionomer cements.[1]

It is well-established that both porcelain and base metal materials, which have been etched on the intaglio surface, can be combined with resin composite luting cements to produce restorations retained largely through adhesion. However, neither of these materials can equal the combination of minimal tooth reduction and margin adaptation that is possible with high noble gold restorative materials.

Although high noble gold alloys cannot be etched, air abrasion of the intaglio surface of restorations likely improves micromechanical retention, but it is unknown whether this, along with a strong luting cement, is sufficient to stabilize high noble gold alloys in preparations with considerably less retention and resistance form than traditional designs.

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DESCRIPTION OF TECHNIQUE

A 49 year-old male patient presented with a chief complaint of sharp, transient pain on mastication of hard foods in both maxillary posterior segments. The patient had all permanent teeth except his third molars, had a Class I occlusion with excursive function solely in the canine and premolar teeth and had no history of caries, except for pit-and-fissure caries of the molars as a child. The patient reported an ice chewing habit and had dental wear and abfraction to the extent that some form of parafunction was suspected. All of the maxillary molars had been restored many years before with medium-sized OL amalgams.

Clinical and radiographic examination disclosed no pathology, but selective loading of the facial cusps of the maxillary first molars with a crack-detecting instrument (Tooth Slooth, Professional Results, Inc, Laguna Niguel, CA, USA) reproduced the symptoms.

No signs were evident nor symptoms produced in the maxillary second molars. Based on the above, a diagnosis of cracked-tooth syndrome of the maxillary first molars was reached. The patient was interested in the most conservative restoration available, was unconcerned about a display of metal in the maxillary first molar area and consented to gold onlay restorations.

The existing OL amalgam restorations of the maxillary first molars were removed and found to have been prepared to approximately a 3 mm depth. No secondary caries or visible fracture lines were discovered. These preparations were converted to inlay preparations. The occlusal surfaces were reduced approximately 1.5 mm, yielding reduced cusps with approximately 50% of their surface area in enamel. Since the patient had no history or signs of interproximal caries, and because the occlusal embrasures were sufficiently deep after occlusal reduction to establish a margin occlusal to the proximal contact area, it was decided not to extend preparations onto the proximal surfaces. To reinforce the teeth against splitting forces and establish preparation margins of a favorable cavosurface angle, hollow-ground contrabevels were placed at the margins of the cuspal reduction at an angle of approximately 45 degrees to the long axis of the clinical crown. These contrabevels were approximately 1.5 mm in width along the facial cusps and marginal ridges, but they increased to approximately 2.5 mm along the lingual cusps, so that they would extend past the lingual extensions of the previous amalgam restorations. The resulting preparations provided only minimal mechanical stabilization for subsequent restorations, that is, the approximately 1.5-mm deep intracoronal portion of the preparations and the opposing facial and lingual contrabevels (Figure 1).

Impressions were made with an additional silicone impression material (Exaflex, GC America, Inc, Alsip, IL, USA) using both light and heavy viscosities and dies and casts fabricated from die stone (Jade Stone, Whip Mix Corp, Louisville, KY, USA). The restorations were waxed, invested in a gypsum-bonded investment (Novocast, Whip Mix Corp), then centrifugally cast in Type III gold alloy (Firmilay, Jelenko, San Diego, CA, USA). After finishing and polishing in the laboratory, occlusion was adjusted and, where access permitted, the restoration margins were refined intraorally by dressing the gold to the enamel using a hand instrument (Spratley 1, Suter Dental Manufacturing, Inc, Chico, CA, USA), white stones (Supra White Arkansas Stones, Brasseler USA, Savannah, GA, USA) and rubber points (Brownie, Greenie and Supergreenie, Shofu Dental Corporation, Menlo Park, CA, USA). After the intraoral adjustments were completed, the restorations were cleaned, then the intaglio surface of each restoration was lightly air abraded with 50 µm aluminum oxide (MicroEtcher, Danville Materials, San Ramon, CA, USA).

Based on the stability of the restorations within the preparations during try-in, it was decided that a resin-modified glass ionomer cement would be of sufficient strength to retain the restorations and offer less risk than the resin composite of bonding to adjacent teeth in areas where the margins were very near adjacent marginal ridges. Prior to cementation, the teeth were isolated using a rubber dam; all the prepared surfaces were cleaned with plain pumice, then conditioned with 10% polyacrylic acid (Dentin Conditioner, GC America, Inc), rinsed and lightly air dried. Luting of the restorations was accomplished with encapsulated Fuji PLUS (GC America, Inc), which was applied first to the intaglio surfaces of the restorations, then into the intracoronal portion of the preparations. Final seating of the restorations was accomplished using a hand instrument, with firm pressure maintained until the luting cement took its initial set, after which the excess cement was removed from the restoration margins using an explorer.

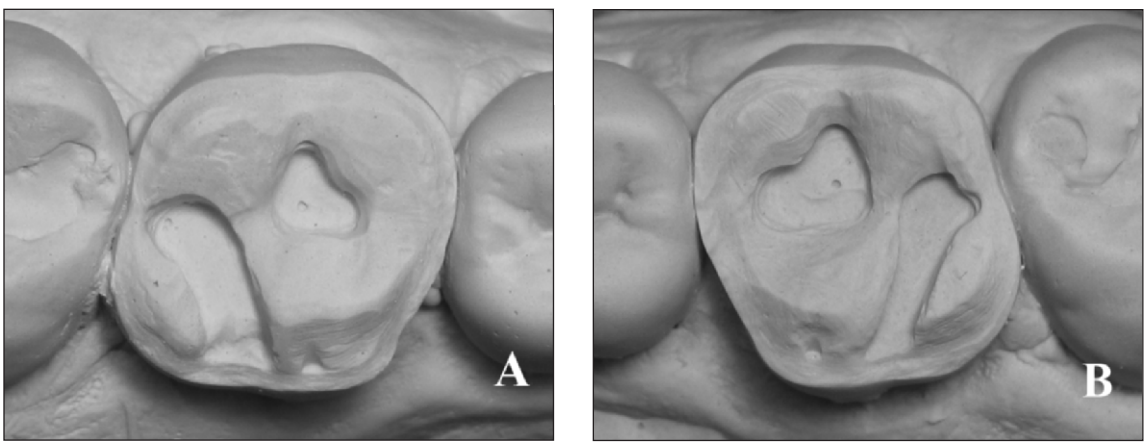

Figure 1. *Casts of preparations for Class I OL onlay restorations of maxillary first molars, tooth #14 (A) and tooth #3 (B). Images have been flipped horizontally to match the mirror-image clinical photographs in Figures 2 and 3.*

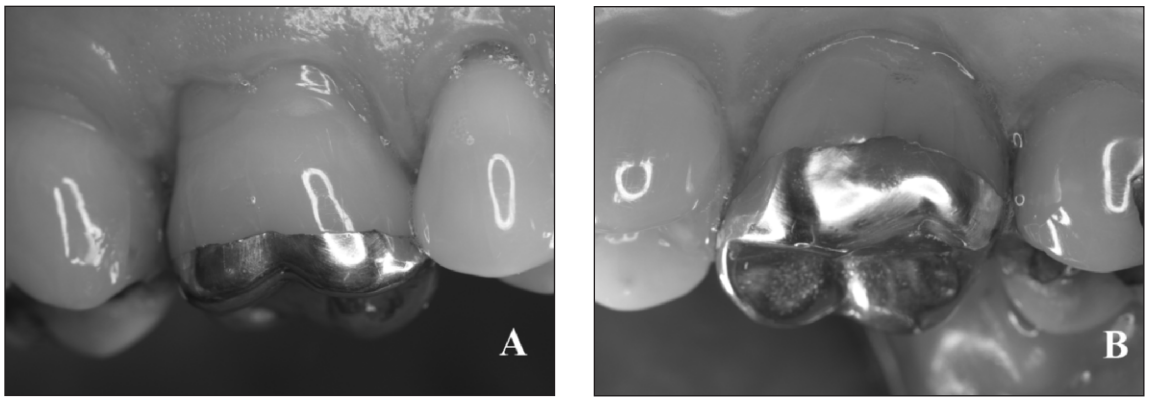

Figure 2. *Facial (A) and lingual (B) views of a six-year old restoration, tooth #14.*

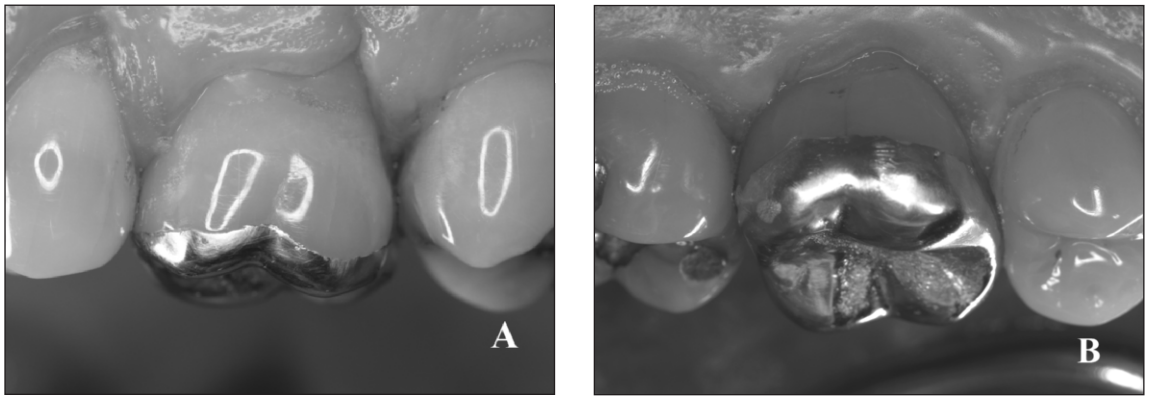

Figure 3. *Facial (A) and lingual (B) views of a six-year old restoration, tooth #3.*

The rubber dam was removed immediately after removal of the excess cement; however, to lessen the risk of damage to the layer of luting cement, the patient was prevented from occluding on the newly-cemented restorations for 15 minutes post-cementation. Minor adjustment of the occlusion was accomplished with a white stone, followed by re-polishing of the adjusted areas of the restorations with rubber points.

The patient was recalled yearly for an examination and prophylaxis, with bitewing radiographs made at every other recall. It was evident from the progression of the cervical abfraction lesions and from the appearance of a gingival cleft adjacent to one of the maxillary first molars that the patient had experienced continued parafunctional activity. After six years, the patient reports no return of symptoms, while the onlay restorations remain cemented and caries-free. No defects were observed in the restorations, except for slight occlusal wear and pitting corrosion of the gold being evident (Figures 2 and 3).

DISCUSSION

Although this restoration design was only possible because of the lack of pre-existing proximal restorations or caries and by the presence of deep occlusal embrasures that allowed reduction of marginal ridges without extension into proximal contacts, the clinical performance of the restorations indicates that current-day luting cements have the potential to extend the application of cast gold restorations beyond traditional preparation designs.

It would not have been possible to prepare these teeth for an adequate thickness of any ceramic material without extension onto the proximal surfaces. Base metal restorations would have allowed the preparations to be at least as conservative as these, and they might have provided more surface topography for micromechanical adhesion once the intaglio surface was etched, but they were not used, because minute distortions along restoration margins introduced during casting cannot be readily adjusted by burnishing.

A resin composite cement was considered for the luting of these restorations, as this cement would have been stronger than the resin-modified glass-ionomer luting cement used, and it would have bonded well to residual enamel on the occlusal surface. Ultimately, it was determined that the additional strength was unnecessary, so that the additional steps during luting and the more difficult cleanup of the resin composite

cements, along with the risk of bonding to adjacent teeth, could be avoided. Use of a resin cement will be considered, should re-cementation of these restorations prove necessary.

Finally, it should be noted that no attempt was made to minimize the facial display of gold of these restorations. Designs with a minimal reduction of the maxillary facial cusp tips[4] are available for this purpose, provided that the patient's excursive function is anterior to the tooth being restored; however, since the patient was not concerned about the appearance of the teeth after restoration, a heavier reduction and the resulting greater thickness of gold was thought to more likely minimize further fracture of tooth structure.

SUMMARY

Two Class I OL gold onlays cemented with a resin-modified glass-ionomer luting cement on the maxillary first molars of a 55-year old patient have been retained for six years, despite preparations designed with considerably less potential to mechanically stabilize the restorations compared with using traditional partial veneer cast gold preparations. This would imply that current luting cements are of sufficient strength to retain gold restorations in preparations with less resistance/retention form than traditional designs.

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