A Practical Method for Chairside Repair of Debonded Porcelain Denture Teeth

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The bonding of porcelain denture teeth to polymethylmethacrylate remains a clinical problem. In this article an alternative chairside method, based on silica coating and silanization for adhesion of denture tooth porcelain to polymethylmethacrylate is described.

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PORCELAIN DENTURE teeth are typically joined to heat-polymerized acrylic resin denture bases by mechanical retentive features such as metal pins or diatoric undercuts. Because the retention is primarily mechanical, one of the most common areas of failure in a denture fabricated with porcelain teeth is between the denture tooth and the denture base.[1] A failure of this nature often requires the denture to be sent to the dental laboratory for repair where attachment of the debonded denture tooth is achieved using polymethylmethacrylate (PMMA). First, the acrylic is ground away at the gingival crevices releasing the retentive pins. The tooth is then fixed in place using wax. Then, a stone or plastic index is made. When this is set, the index and tooth are removed. The wax and debris are washed off with boiling water and detergent. The index is then coated with separating media, put in place, and the tooth is set in place. When the space is filled with repair acylic, the denture is placed in a pressure pot at 30 psi for 30 minutes. The denture is finally finished and polished. Cold-cured repairs are not as strong as heat-cured repairs; however, if a heat-cured resin is used, the denture may warp during processing.[2]

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During this process, the patient has to perform chewing and speaking functions without the denture. Depending on the workload of the dental technician and the location of the dental laboratory, receiving the denture may vary between hours to days, and costs to the patient or the dentist will vary as well.

Several attempts have been made to facilitate bonding of porcelain denture teeth to PMMA using different surface treatment methods such as etching,[3] silane coating[4,5] and use of a bonding agent, high energy abrasion, or ceramic primer application.[6] The role of surface treatment in the mechanism of adhesion revealed that surface topography alone did not account for all differences found in the comparison of such surface treatment methods.[6]

Recent developments in surface conditioning methods have resulted in improved resin-to-alloy and ceramic bond strengths. A technique (CoJet®, 3M ESPE, Seefeld, Germany) based on tribochemical silica coating provides ultra-fine mechanical retention by air particle abrasion, as well as a chemicophysical bonding between the resin composite and the alloy/ceramic surfaces using a silane coupling agent.[7-10] In this technique, the surfaces are blasted with 30 μm grain size Al_2O_3 modified with silisic acid, (CoJet®-Sand) with an intraoral air-abrasion unit (Dento-PrepTM, RØNVIG A/S, Daugaard, Denmark). As a result, silica particles are embedded on the surface rendering the substrate chemically more reactive to the resin via the silane.

This article describes an alternative technique using silica coating and silanization to facilitate chairside repair of a debonded porcelain denture

Figure 1. The view of the debonded tooth on a maxillary removable denture.

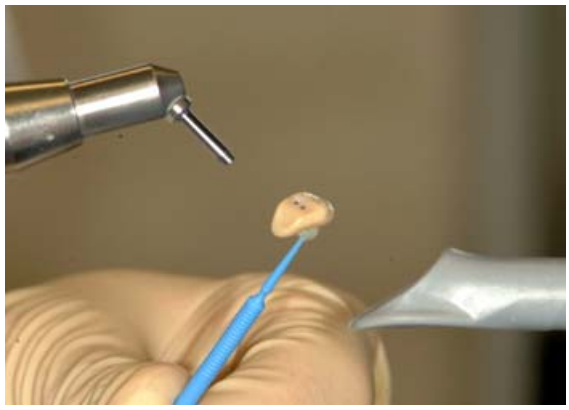

Figure 2. Air particle abrasion was performed at a nozzle distance of approximately 10 mm, and a surgical suction was used for the evacuation.

tooth, thus eliminating the laboratory time and fee.

Technique

The clinical sequence for conditioning and rebonding the porcelain denture tooth (Fig 1) should be as follows:

1. Protective eyeglasses and masks should be supplied both for the operator and the staff. Strong evacuation for CoJet®-Sand is required, therefore surgical suction should be used.
2. The denture tooth should first be attached to a microbrush using a thin adhesive resin (Heliobond, Vivadent, Liechtenstein) and light polymerized. The surface of the denture tooth should be air-abraded with an intraoral air-abrasion device (Dento-PrepTM, RØNVIG A/S, Daugaard, Denmark) using silicated particles (CoJet®-Sand, SiOx 30 μm). Based on the optimal results of pilot studies,[11] air abrasion should be employed with a nozzle distance approximately 10 mm from the surface at an angle of 90° for 13 seconds at 2.3 bar pressure on the denture tooth surface (Fig 2). The PMMA surface onto which the denture tooth is to be attached should be air-abraded with 50 μm Al_2O_3 in order to create a clean surface and to remove the possible contaminants.
3. The conditioned surface should be silanized with ESPE®-Sil (3M ESPE) using a disposable brush and be allowed to dry for 5 minutes (Fig 3). Airsyringe drying should not be used because of the possible water or oil contamination.
4. The adhesive resin (Heliobond) should be applied in a thin layer (Fig 4), excess resin removed with air, and light polymerized (Elipar, 3M ESPE) for 20 seconds with an intensity of 800 mW/cm^2 (Fig 5).
5. Low-viscosity resin cement (Variolink® II, Vivadent) should be mixed and applied to the bonding surface of the denture tooth (Fig 6),

Figure 3. Silane coupling agent was applied with a disposable brush.

Figure 4. The adhesive resin was applied in a thin layer.

and the tooth should be positioned in the PMMA denture base.

6. Excess cement should be removed from the margins with a disposable brush and the tooth should be light polymerized for 40 seconds from three different directions.
7. Finishing and polishing should be performed, and the denture repair can be completed within 15 minutes (Fig 7).

Discussion

Satisfactory bonding between porcelain denture teeth and the denture base polymer is crucial to avoid the worst-case scenario of tooth bond failure. When the bond with the denture base has already been compromised, the increase in stress concentration during function, especially in the area of inadequate bonding, enhances crack propagation and eventually detachment of the teeth is seen.

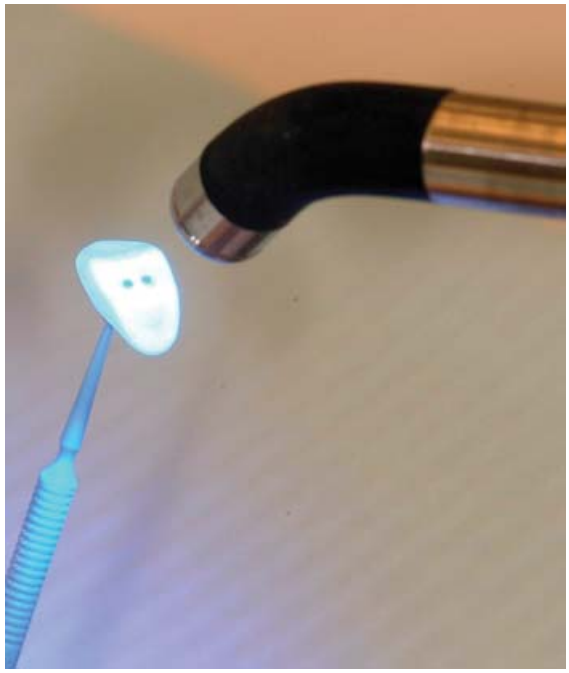

Figure 5. The adhesive resin was light polymerized for 20 seconds.

The advantages of the described technique over the conventional ones, using either cold-cured or heat-cured resin, are obvious because the added expense and complexity of laboratory procedures

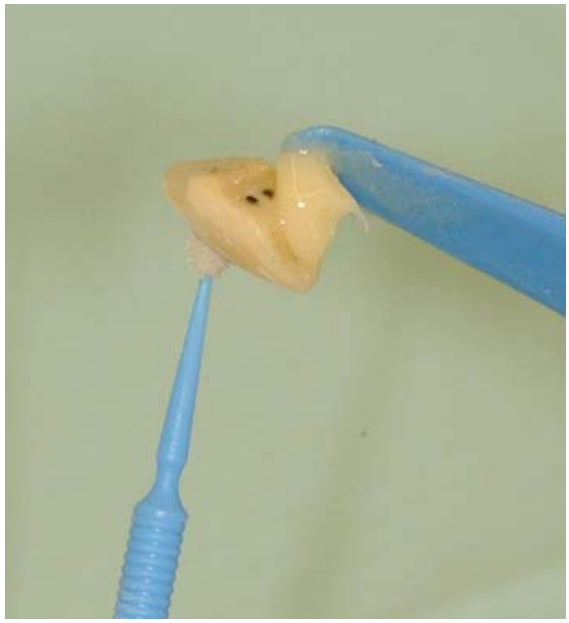

Figure 6. Resin cement was applied to the bonding surface of the denture tooth.

Figure 7. The view of denture tooth in place after the repair.

are avoided. Furthermore, light-cured resins offer several advantages over conventional autopolymerizing acrylic resin repairs. The material is convenient, neat to work with, and the dentist or technician is exposed to less free monomer. The entire process described reduces the amount of time to complete the repair and could be accomplished chairside in about 15 minutes.

Summary

A clinical technique is presented using intraoral silica coating and silanization (CoJet® System) for chairside repair of a debonded porcelain denture tooth. This technique is presented as an alternative to traditional techniques using either cold-cured or heat-cured resin.

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