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Technique for Removing Cement between a Fixed Prosthesis and Its Substructure

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Keywords
Loose screw-retained implant prosthesis; debonded cast dowel-core crowns or dowel-core restorations; adhesive luting cements; cement-retained prostheses.

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Accepted February 11, 2008

doi: 10.1111/j.1532-849X.2008.00397.x

Abstract

Failed restorations diagnosed with salvageable and subsequently reusable metal substructures that demand their separation can be clinically challenging to undertake without the risk of damaging either the super- or substructures. This article describes a technique to safely separate them from each other in order for the respective substructure to be reused in the fabrication of a newly reconstructed restoration and for the existing restoration to be reused as a provisional where appropriately indicated.

Many present-day implant systems have screw-retained abutments onto which restorations can be cemented. There are situations when a patient presents with an otherwise clinically successful, cement-retained fixed prosthesis that needs to be separated from its respective metallic substructure. This is most often the case when an implant abutment screw loosening has occurred under a cemented restoration due to inadequate torque, or when a cast dowel and core-retained restoration has developed an incipient recurrent caries between the preparation finish line and the prosthetic margin. In both cases, there may or may not be an indication for the fabrication of a new restoration. Some of the traditional methods used to separate cemented retainers from their respective metallic abutments are to physically pull them apart or to use an ultrasonic vibration device to disturb the cement interface.[1] The technique described here is a more "predictable" practical procedure with the least damaging effect on the restoration or its respective substructure. One of the main advantages of this procedure is that the retrieved prosthesis and its metallic substructure can be salvaged and subsequently reused either definitively or provisionally. The technique described below is illustrated through its application in two cases with different clinical presentations.

Technique

Clinical scenario case 1

1. A patient presents with a loose, implant-retained fixed partial denture (FPD) cemented on screw-retained abutments. An intraoral radiograph is made as a preoperative guide. Upon examination, clinical findings are that the abutments screws are loose and require retightening.
2. The entry to each screw head is carefully gained through access channels prepared from the palatal aspect, using a high-speed diamond bur to cut through porcelain to maintain its integrity and then multifluted carbide burs (SS White, Lakewood, NJ) to cut through the metal substructure (Fig 1).
3. The width of the screw-access channels are kept slightly larger than the screw head diameter for un-impeded straight-line access to each screw head.
4. The screw heads are exposed after the screw access channel filling material is removed.
5. Using the appropriate implant system screwdriver, the abutment screws are removed through the access channels, and the FPD is retrieved with its cemented abutments (Fig 2).

Figure 1 Screw access channels are prepared from the palatal aspect to retrieve the prosthesis and its respective substructures.

Figure 2 Ceramometal implant-retained FPD with its associated abutments is retrieved from the implants.

Figure 3 The cemented FPD is separated from its screw-retained implant abutments through cement disintegration.

Figure 5 Lower root-treated right first molar preparation following recurrent caries removal, remargination, and dowel space clean-up.

6. In this particular situation, the fabrication of a new FPD is planned for two reasons. One, the screw access chamber is overenlarged following preparation while trying to gain direct straight-line access for the screwdriver to the screw head. With the concern that this channel will weaken the porcelain structural integrity and establish unstable occlusal contact[2] that may compromise the

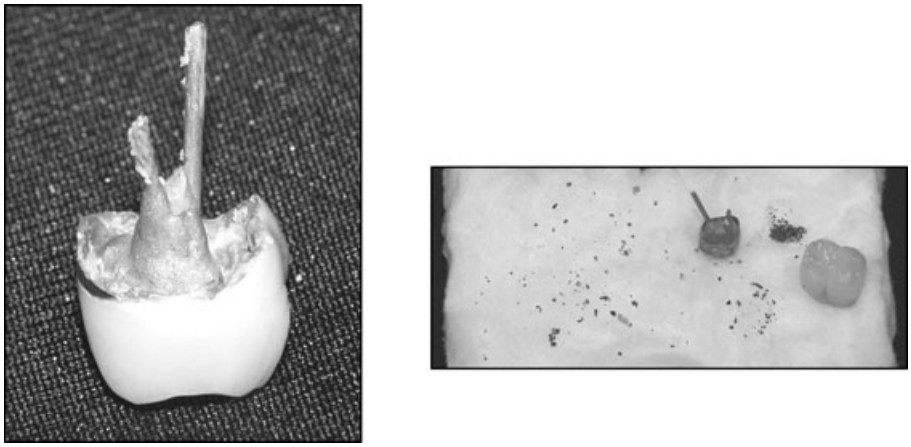

Figure 4 Retrieved PFM crown with custom cast dowel and core still cemented. The right picture shows the crown separated from its cast dowel-core substructure through cement disintegration.

long-term prognosis of the prosthesis, a new FPD is advisable. Second, a new prosthesis is warranted due to the patient's insistence for a cement-retained prosthesis without the esthetic compromise of the filled screw access holes.

7. After disinfection, the retrieved FPD with its associated abutments is placed in the ceramic furnace tray on a fibrous firing support pad (Vita Zahnfabrik, Bad Sackingen, Germany).
8. The ceramic furnace (Programat P80, Ivoclar, Vita Zahnfabrik) is programmed using the following schedule:
   (1) Firing at 650°C (or equivalent) as the high temperature,
   (2) No vacuum used,
   (3) One minute preheat time,
   (4) One minute holding time at the maximum temperature,
   (5) Allow to cool on firing tray at room temperature. This firing sequence resulted in the disintegration of the cement layer, leaving the abutment detached from the prosthesis (Fig 3).
9. The retrieved abutments' supramarginal areas are carefully air-abraded with 50 μm medium grit lead-free soda particles of glass beads (Perlablast micro, Bego, Bremen, Germany) at 2 bar air pressure to remove the superficial passive postfiring titanium oxide layer, to remove remnants of the old cement, and to increase the surface area necessary to optimize cement adhesion. This mechanical (nonacid) treatment is recommended for base-metal castings instead of pickling (chemical) treatment.[3] With the use of glass bead particles, there is no metal loss, because the surface is compacted rather than abraded. This will maintain the integrity of the machined precision friction-fit of the manufactured plastic or metal coping used in the fabrication of the permanent restoration. The final cleaning step is done by immersing the abutments in a container of distilled water and either cleaned ultrasonically (BioSonic UC100, Coltene Whaledent AG, Altstatten, Switzerland) or steam cleaned (Impulse, Jacger, Weinsheim, Germany) for 10 to 15 minutes.[4]
10. The abutments are tightened to their recommended torque value of 35 N cm.
11. An impression is made for the fabrication of the new FPD in the conventional manner.
12. The retrieved FPD is cleaned before it is recemented with interim cement as a provisional prosthesis. Screw access channels are sealed with Fermit (Ivoclar North America, Amherst, NY).

Clinical scenario case 2

1. The patient presented for his recare visit with a finding of early stage recurrent caries along the finish line of a first molar crown.
2. Bite-wing radiographic analysis revealed a root canal-treated tooth with a cast dowel and core foundation and loss of restoration marginal integrity with natural tooth due to caries.
3. An attempt to remove the crown alone without disturbing its cast dowel and core system was unsuccessful. In this particular case, among other etiological factors, this could be due to intraradicular cement insufficiency, cement adhesion bond failure between the dowel and core system with the root dentine, or poor cementation technique. Inadequate dowel/core system design (e.g., short tapered post) is ruled out.
4. The same laboratory procedure described above (step 8) is used to carefully separate the dowel/core system from its restoration after disinfection (Fig 4).
5. The cast dowel and core is air-abraded with 50 μm aluminum oxide particles at 1 to 2 bar air pressure. It is then chemically treated (cleaned) by immersion in nonfuming hot pickling agent (Jet Pak, JF Jelenko, Armonk, NY) in an ultrasonic bath for several minutes.[5]
6. The existing custom-made cast dowel and core system is recemented after the root canal system is conservatively filed, irrigated, and cleaned of the old residual cement.
7. Following caries removal and remargination, the prepared tooth is impressed for the fabrication of a new crown (Fig 5).
8. The existing crown is finally luted with interim cement (Tempbond NE, Kerr, West Collins Orange, CA) and used as a provisional after it has been cleaned and relined intraorally. Due to the near-precise fit of the existing PFM crown used as provisional, and to not disturb the cemented cast dowel and core, the Tempbond NE modifier has been added to the base before it is mixed with the accelerator to make the crown easier to remove thereafter.

In the alternative procedure, if following residual cement removal and canal clean-up, the retrieved cast dowel/core is deemed to be mildly loosely fitting within the caries-free canals (i.e., with suboptimal snug fit), it can be air-abraded, ultrasonically cleaned, and oxidized if it is made of metal base alloy or either silane coupling agent bonded to its surface using special equipment (Silicoater, Kulzer, Irvine, CA) or tin-electroplated if made of noble metal alloy[6] in preparation for adhesive resin bonding. Additionally, the radicular dentine to be conditioned before the cast dowel and core can be bonded using the appropriate etchants and adhesive resin luting cement, which provide significantly higher retentive tensile bond strength[7,8] due to the fact that adhesive cement is an active resin that chemically bonds not only to the restoration but also to the tooth structure preparation, even if designed with suboptimal or less-than-ideal retentive features.[9]

Following the cement disintegration firing cycle, contamination to the ceramic furnace can be overcome by purging it in the manner recommended by the manufacturer. Firing below the auto-glaze temperature of the porcelain minimizes any pyro thermomechanical detrimental effects on the restoration, such as vitrification.

Summary

This technique has several advantages. It enables the clinician to separate the cemented prosthesis from its respective substructure in a practical, simple, and predictable way whenever indicated. It is a chairside, time-saving procedure that can be

carried out in the dental laboratory once the restoration components' assembly is safely retrieved. As per clinical judgment, the separated components can be reused either provisionally (interim prostheses) or permanently (the abutments and custom-cast dowel and core system) without a remake. This in turn renders it a cost-effective procedure.

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