THE JOURNAL OF PROSTHETIC DENTISTRY

TIPS FROM OUR READERS

# A straightforward technique for removing titanium bases from screw-retained monolithic implant-supported prostheses

Guilherme C. Silva, DDS, MS, PhD

Monolithic screw-retained computer-aided design and computer-aided manufacturer (CAD-CAM) ceramics are widely used for implant-supported prostheses because of their efficiency in terms of manufacturing time, cost, and predictability.[1,2] In this prosthetic design, a complete-contour prosthesis is typically milled in translucent zirconia or lithium disilicate and adhesively cemented under optimal conditions extraorally onto a titanium base, resulting in a screw-retained prosthesis.[3,4] This method has the advantage of using prefabricated machined titanium bases that will not be processed in a furnace as in conventional techniques for metal-ceramic restorations, ensuring their structural integrity, absence of oxidation, and optimum fit.[5,6] There is also the benefit of using high-strength materials that have a lower risk of fracture or chipping than ceramic veneered prostheses,[7] and because of the extraoral cementation, cement remnants around the implant-abutment interface are avoided.[3,4]

In the autho's practice, intraoral adjustments for these prostheses may be performed by cementing the crowns with an interim luting agent onto the bases, which facilitates removal in case ceramic modifications for color or proximal or occlusal contacts are needed. However, in some clinical situations, the crowns may become loose or displace from the base, so it may be preferable to perform intraoral adjustments with the prosthesis already definitively cemented to the base.[8] Moreover, because airborne-particle abrasion with aluminum oxide (particle size 50 μm, 0.25 MPa pressure, for 10 seconds, and at 10 mm)[9] on the titanium base[4,9] or in the intaglio of translucent zirconia[10,11] (particle size 50 μm, 0.2 MPa pressure, for 15 seconds, and at 10 mm)[11] is an essential step for adequate retention, some dentists may request that their prostheses are definitively cemented by the dental laboratory technician, as chairside airborne-particle abrasion devices may not be as effective as laboratory ones.[12] Additionally, pressure higher than 0.3 MPa may negatively affect the flexural strength of translucent zirconia.[11]

To perform corrective firing cycles on the ceramic, the prosthesis must be removed from the base[8]; the only nondestructive way to achieve this is to soften the cement, whereas the bond strength between the titanium base and crown is high.[4,13] This softening can be performed with an Er,Cr:YSGG laser[14] or in a conventional ceramic furnace, but an improper temperature may oxidize the base or even expand the metal to the point of fracturing the ceramic. Therefore, the reported technique provides a straightforward, safe, and rapid way of removing the titanium base from the crown while preserving both.

Figure 1. Monolithic zirconia screw-retained implant-supported crown adhesively cemented onto titanium base placed in pin in ceramic furnace.

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.
Adjunct Professor, Department of Restorative Dentistry, School of Dentistry, Federal University of Minas Gerais (UFMG), Belo Horizonte, Brazil.

**Figure 2.** After firing cycle, screwdriver firmly pushed against screw. Note displacement of titanium base from crown.


**Figure 3.** After airborne-particle abrasion with aluminum oxide (particle size 50 μm, 0.25 MPa pressure, for 10 seconds, at 10 mm) base clean and ready for adhesive recementation. Note nonoxidized connection of base. Intaglio surface of translucent zirconia also airborne-particle abraded with aluminum oxide (particle size 50 μm, 0.2 MPa pressure, for 15 seconds, at 10 mm).

## TECHNIQUE

1. Set the holding temperature of the furnace (Programat C2; Ivoclar AG) to 200 °C, closing time to 1 minute, temperature increase rate to 30 °C per minute until a maximum temperature of 400 °C, and a holding time of 1 minute are reached. Vacuum or slow cooling are not required.
2. Place the crown without the screw on a support pin or mantle and start the furnace firing cycle, which will last about 7 minutes (Fig. 1). In the presented setting, a slow and gradual rise in temperature prevented an abrupt linear thermal expansion of the metal that could crack or fracture the ceramic. The final temperature is sufficiently high to soften the cement without oxidizing the metal base or damaging the ceramic.
3. At the end of the cycle, allow the crown to cool at room temperature. Place the screw into the crown and firmly push in the screw with a screwdriver (SCS; Institut Straumann AG). The base will displace easily (Fig. 2).
4. Remove the cement residue from the base with a hand instrument and then use airborne-particle abrasion (Basic Eco; Renfert) with aluminum oxide (particle size 50 μm, 0.25 MPa pressure, for 10 seconds at 10 mm) (Fig. 3). Correct the crown with the necessary firing cycles and then adhesively recement the base to the crown.

## REFERENCES


1. Mühlemann S, Kraus RD, Hämmerle CHF, Thoma DS. Is the use of digital technologies for the fabrication of implant-supported reconstructions more efficient and/or more effective than conventional techniques: A systematic review. Clin Oral Implants Res 2018;29(Suppl 18):184-95.
2. Shen XT, Li JY, Luo X, Feng Y, Gai LT, He FM. Peri-implant marginal bone changes with implant-supported metal-ceramic or monolithic zirconia single crowns: A retrospective clinical study of 1 to 5 years. J Prosthet Dent 2022;128:368-74.
3. Lopes ACO, Machado CM, Bonjardim LR, Bergamo ETP, Ramalho IS, Witek L, et al. The effect of CAD/CAM crown material and cement type on retention to implant abutments. J Prosthodont 2019;28:e552-6.
4. Zahoui A, Bergamo ET, Marun MM, Silva KP, Coelho PG, Bonfante EA. Cementation protocol for bonding zirconia crowns to titanium base CAD/CAM abutments. Int J Prosthodont 2020;33:527-35.
5. Kano SC, Binon PP, Bonfante G, Curtis DA. The effect of casting procedures on rotational misfit in castable abutments. Int J Oral Maxillofac Implants 2007;22:575-9.
6. Braian M, De Bruyn H, Fransson H, Christersson C, Wennerberg A. Tolerance measurements on internal- and external-hexagon implants. Int J Oral Maxillofac Implants 2014;29:846-52.
7. Mühlemann S, Lakha T, Jung RE, Hämmerle CHF, Benic GI. Prosthetic outcomes and clinical performance of CAD-CAM monolithic zirconia versus porcelain-fused-to-metal implant crowns in the molar region: 1-year results of a RCT. Clin Oral Implants Res 2020;31:856-64.
8. Zhang Y, Tian J, Wei D, Di P, Lin Y. Quantitative clinical adjustment analysis of posterior single implant crown in a chairside digital workflow: A randomized controlled trial. Clin Oral Implants Res 2019;30:1059-66.
9. Pitta J, Burkhardt F, Mekki M, Fehmer V, Mojon P, Sailer I. Effect of airborne-particle abrasion of a titanium base abutment on the stability of the bonded interface and retention forces of crowns after artificial aging. J Prosthet Dent 2021;126:214-21.
10. Thammajaruk P, Inokoshi M, Chong S, Guazzato M. Bonding of composite cements to zirconia: A systematic review and meta-analysis of in vitro studies. J Mech Behav Biomed Mater 2018;80:258-68.
11. Zhang X, Liang W, Jiang F, Wang Z, Zhao J, Zhou C, et al. Effects of air-abrasion pressure on mechanical and bonding properties of translucent zirconia. Clin Oral Investig 2021;25:1979-88.
12. Fonseca RG, Martins SB, de Oliveira Abi-Rached F, Dos Santos Cruz CA. Effect of different airborne-particle abrasion/bonding agent combinations on the bond strength of a resin cement to a base metal alloy. J Prosthet Dent 2012;108:316-23.
13. Linkevicius T, Caplikas A, Dumbryte I, Linkeviciene L, Svediene O. Retention of zirconia copings over smooth and airborne-particle-abraded titanium bases with different resin cements. J Prosthet Dent 2019;121:949-54.
14. Walinski CJ, Ou KL. Resin cement removal from titanium dental implant surface using a novel side-firing laser fiber and Er,Cr:YSGG irradiation. Am J Dent 2020;33:178-82.



**Corresponding author:**
Dr Guilherme C. Silva
Department of Restorative Dentistry
School of Dentistry, UFMG
Av Antônio Carlos 6627
Belo Horizonte, MG, 31270-901
BRAZIL
Email: gccs@ufmg.br



https://doi.org/10.1016/j.prosdent.2021.05.004