

An Esthetic Solution to the Screw-Retained Implant Restoration: Introduction to the Implant Crown Adhesive Plug: Clinical Report

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ABSTRACT

Screw-retained implant crowns may be clinically demanding, especially managing the esthetic and occlusal challenges of screw access channel closure. Many clinicians have moved away from using screw retention as a means of fixing a crown to an implant in favor of cementation to an underlying abutment. A link has been established between peri-implant disease and excess cement extrusion in cement-retained implant restorations. This article describes a novel technique of bonding a pressed porcelain plug into the screw access channel of an implant restoration that allows for control of occlusion, matches the esthetics of a cement-retained crown, and eliminates the issues of excess cement.

CLINICAL SIGNIFICANCE

Overcoming the restorative challenges (esthetic, occlusal) of the screw access channel in a screw-retained implant restoration is difficult. By fabricating a pressed ceramic over metal crown and esthetic plug these challenges can be dealt with in a predictable manner.

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INTRODUCTION

From the 1980s to early 1990s implant prostheses were primarily screw-retained. This preference changed with the introduction of components that allowed for cement retention of implant restorations.¹ Factors that have contributed to the rise in popularity of the cementation procedures include: esthetics, control of occlusion, less demanding implant placement, cost (component and laboratory), improved passive fit for multiple connected units, and similarity to conventional tooth-supported fixed prosthodontics.²

Cement-retained restorations, however, are not without their issues. It has been reported that when comparing

screw-retained implant restorations with cemented implant restorations, a measurable difference in health (modified plaque index, bleeding index) was noted, with the cement-retained crowns worsening over time.³ Sinus tracts, inflammation, and continued bone loss have been documented as being related to cement residue remaining in the peri-implant soft tissues.⁴ A recent study reported on the positive relationship between excess cement and peri-implant disease (peri-mucositis and peri-implantitis). These conditions are classified as inflammatory lesions that may affect the peri-implant tissues, with the potential loss of supporting bone. Although it is possible to treat peri-implant disease, prevention is the goal of supportive therapy.⁵ Techniques have been developed^{6–8}

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to minimize the extrusion of luting cement into the peri-implant soft tissues, but it is likely that these issues cannot be predictably eliminated. The inability to completely remove cement from the implant abutment⁹ surfaces as well as the difficulties in radiographic detection of some commonly used luting cements have been reported.¹⁰

It would seem better to avoid these problems entirely by using a screw-retained restoration, however, this requires closure of the screw access channel, which most commonly is achieved with a direct restoration that may compromise esthetics. It has been reported that the screw hole can occupy up to 50% of the occlusal table and when the screw hole is located directly over the implant, vertical loading is difficult, which may compromise biomechanics.³

Screw access closure is frequently considered a provisional procedure due to screw loosening, with little attention given to the restorative material. However, recent systemic reviews suggest that abutment screw loosening is a rare event in single-implant restorations. This is regardless of the geometry of implant-abutment connection and provided that the proper anti-rotational features and torque are used.¹¹

A clinical report documented the use of a screw-retained custom metal ceramic abutment combined with an adhesively bonded porcelain restoration¹² as a permanent solution to an implant inclination issue combined with a short clinical crown. Traditional porcelain stacking processes produced equigingival and supragingival margins on an abutment to which a porcelain suprastructure was adhesively bonded to a type III veneer. Although this technique is innovative, it is time consuming and requires the dental laboratory technician be highly skilled. Use of a pressed porcelain system that requires only moderate laboratory time and less demanding technical skills is described. The implant crown adhesive plug (ICAP) consists of a pressed metal ceramic screw-retained crown with the access channel closed by a custom pressed porcelain plug that is shaped and shade matched to the crown. The pressed ceramic plug is etched, silanated, and adhesively bonded with composite lute into the

crown—similar to an inlay. This type of restoration eliminates some of the disadvantages associated with screw-retained crowns, such as the unesthetic appearance of the screw channel and disruption of the occlusal contact area. It also eliminates cement contact with the susceptible peri-implant tissues.

CLINICAL REPORT

Case 1

A 60-year-old female patient required restoration of both premolar and molar dental implants (Replace Select, Nobel Biocare USA, Yorba Linda, CA, USA). The implants were optimally placed using a surgical guide designed and fabricated according to the patient's restorative needs. After fixing the appropriate impression copings to the implants an open tray implant level impression was made in vinyl polysiloxane (Aquasil Ultra, Dentsply, York, PA, USA). In the laboratory, analogs (Nobel Biocare) were attached to the impression copings (Nobel Biocare) and an implant cast fabricated that incorporated a soft tissue gingival mask (Gingitech, Ivoclar Vivadent, Schaan, Liechtenstein) with a type IV stone (Fuji rock, GC, Leuven, Belgium).

Cast-to laboratory abutments (Nobel Biocare) were fixed to the implant analogs and waxed to full contour from which a putty matrix (Sil-Tech, Ivoclar Vivadent, Schaan, Liechtenstein) was made. The matrix provided a cutback guide for the metal framework dimensions needed to support porcelain. The wax pattern incorporating the cast-to abutment was sprued, invested (Microstar HS Investment, Microstar Dental, Lawrenceville, GA, USA) and cast in porcelain bonding alloy (JP1, Jensen Industries, North Haven, CT, USA) according to the manufacturer's instructions. The casting, once divested and cleaned, was opaqued (Pulse Opaque, Ceramoy, Stuttgart, Germany) with the required shade and sintered.

The putty index was used to make a full contour waxing over the opaqued framework. A cast custom metal key was warmed and inserted into the screw

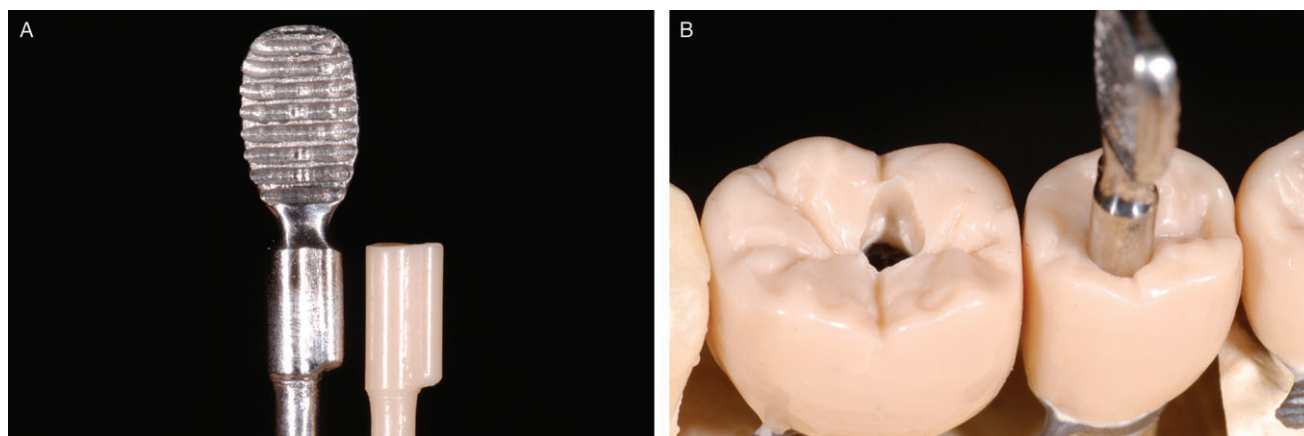


FIGURE 1. A, Custom occlusal metal key forms occlusal screw access channel with wax replica of screw channel pattern. B, Custom metal key placed in the premolar waxing, forming occlusal screw access channel pattern seen in molar.

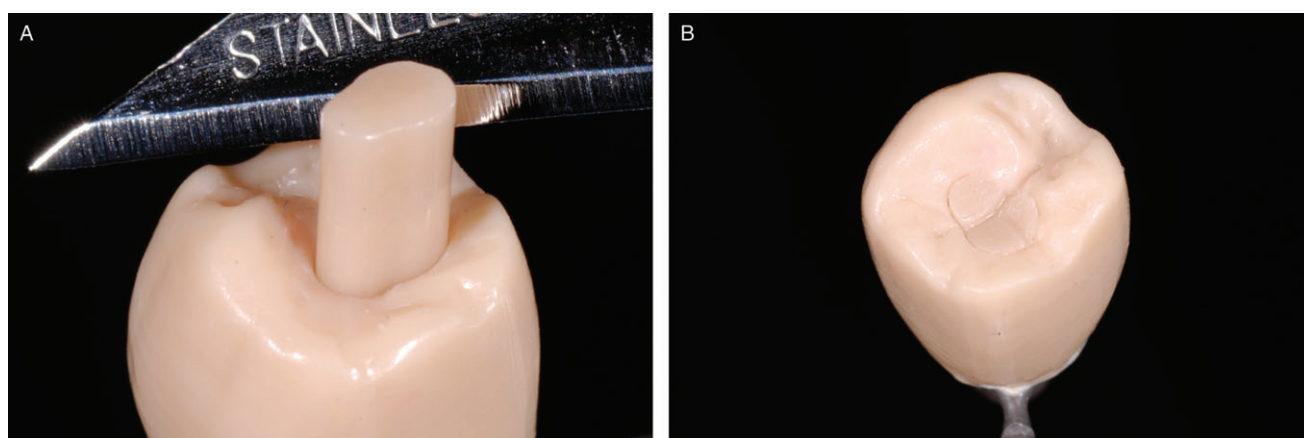


FIGURE 2. A, Wax replica key pattern placed in the premolar screw access channel. B, Wax key pattern shaped to conform to the occlusal morphology of the premolar.

access channel through the wax up (Figure 1A). Wax replicas of the key (Geo, Renfert, Hilzingen, Germany) were produced by placing the shank of the key in a putty matrix for a mold then injecting with molten wax. The wax key replica was inserted and contoured (Figures 2A and B) to form the wax plug.

The contoured wax plug and crown were attached to the same sprue (Figure 3A) and invested in porcelain pressing investment (Microstar HS Investment). The appropriate shade of ingot was selected (Pulse-Press-to-metal ingot, Jensen Industries) and the pressing was made following the manufacturer's recommendations in the pressing furnace (Vario Press 300, Zubler, Ulm, Germany). The pressed ceramic was

recovered using airborne particle abrasion with the engaging surfaces of the implant crown protected with a layer of wax (Figure 3B). The porcelain plug was opaqued on the internal aspect to prevent gray show through of the metal screw channel. The porcelain of the crown and plug were customized with stains and glazed.

The fitting surfaces of the porcelain were prepared for adhesive bonding¹² by etching with 9% hydrofluoric acid (Porcelain Etch, Ultradent Products Inc., South Jordan, UT, USA) for 90 seconds, then rinsed for 20 seconds. Finally, cleaning was completed by separate immersion of the crown and plug in distilled water in an ultra-sonic bath for 5 minutes. The bonding surfaces

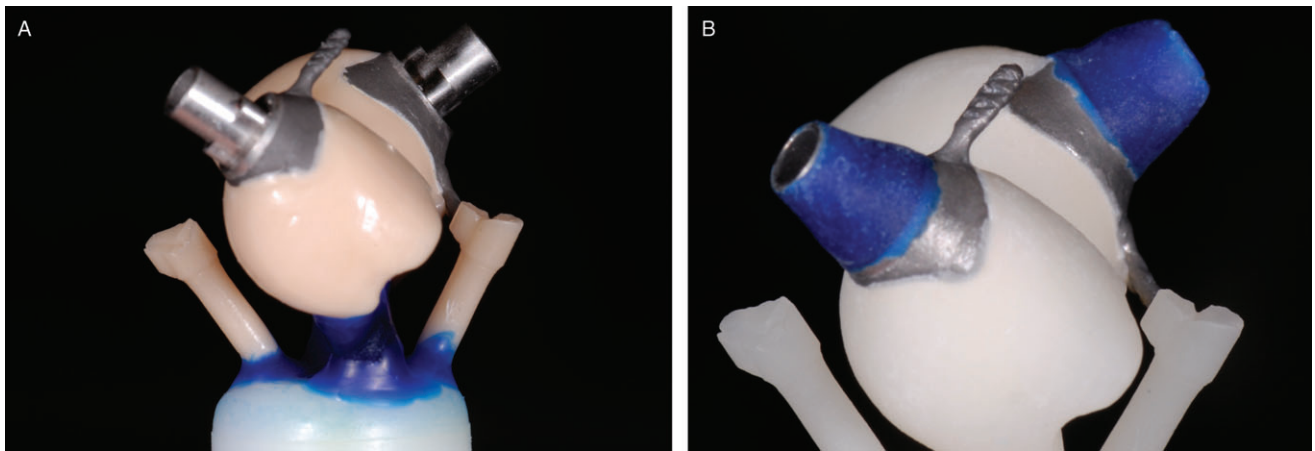


FIGURE 3. A, Wax crown and plug, simultaneously sprued and ready to invest for pressing in porcelain. B, Pressed crown and plug-in porcelain (a layer of blue wax protects the implant abutment interfacing surfaces during airborne particle abrasion).

were silanated (Silane, Ultradent Products Inc.) following thorough oil-free air drying and dried at 100°C for 5 minutes in the oven.

To avoid saliva contamination of the fitting surfaces of the abutment crown rubber dam isolation was used. After radiographic confirmation of complete seating the screw was tightened to the appropriate torque (35 Ncm). Further cleaning with 35% phosphoric acid (Ultra-Etch, Ultradent Products Inc.) for 30 seconds, and a 20-second rinse followed. A small pellet of sterilized polytetrafluoroethylene (PTFE) tape (Oatey Co., Cleveland, OH, USA) was placed over the screw head¹³ and the previously etched and silanated porcelain surfaces were then coated with adhesive resin (Prime and Bond, Dentsply) followed by the application of resin luting agent (Ultra-Bond Plus, DenMat, Santa Maria, CA, USA). The plug was seated and held in place for light polymerization. The final ICAP was cleaned of excess resin, occlusion evaluated, adjusted and the crown polished with porcelain polishing points (Dialite, Brasseler USA, Savannah, GA, USA) (Figure 4).

Case 2

A 64-year-old female presented with an osseointegrated implant in the lower left first premolar region. The implant (Endopore, Sybron, Orange, CA, USA) was previously restored with a cement retained single PFM crown that was causing some soft tissue irritation as a



FIGURE 4. Clinical view implant crown adhesive plug, after seating and bonding in the pressed porcelain plug.

result of excess cement extrusion into the peri-implant tissues (Figure 5A). Due to the lingual inclination of the implant traditional filling of the screw access channel would result in an unsightly and difficult restoration. The ICAP was used to overcome these issues. The crown's metal substructure was cast and opaque applied. A full-contour waxing was made (Figure 5B) and in this instance due to the complexity of the case the pressed ceramic porcelain fused to metal crown was fabricated prior to the ceramic plug. Once fabricated, the internal aspect of the ceramic plug was opaqued (Figures 6A and B) and the bonding surfaces were etched and silanated to allow for adhesive resin bonding as described earlier (Figures 7A and B). The crown was

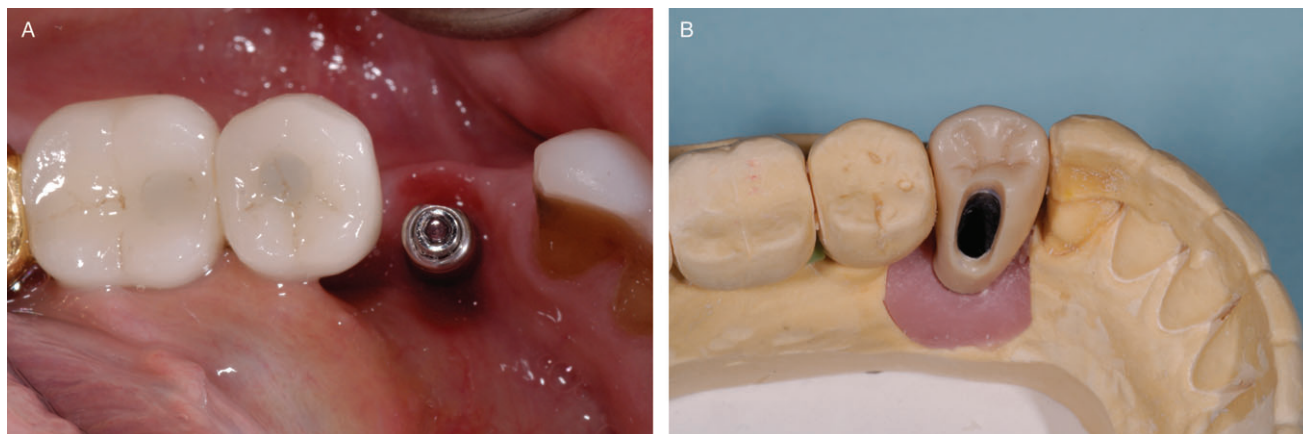


FIGURE 5. A, Implant position. Note lingual inclination. B, Full contour waxing prior to pressing in porcelain (metal frame work within and screw access shown).

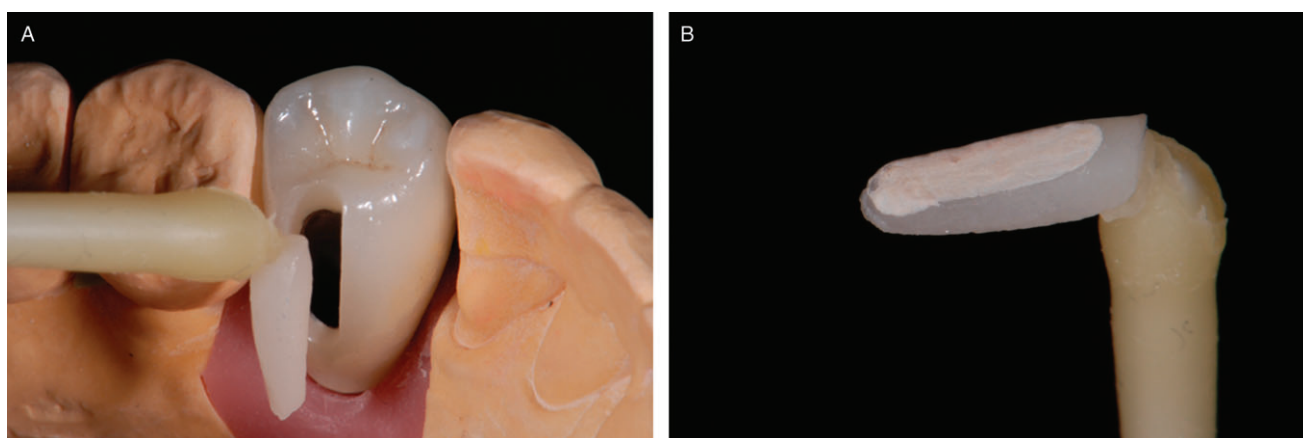


FIGURE 6. A, Pressed ceramic crown with pressed porcelain screw access channel plug. B, Porcelain pressed porcelain plug, note opaque on intaglio surface of plug to prevent metal show through.

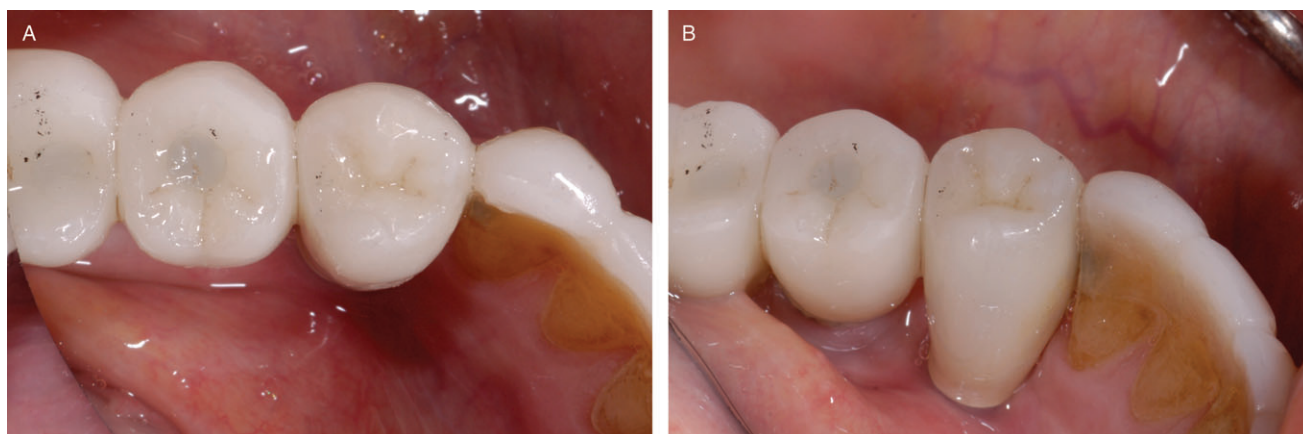


FIGURE 7. A and B, Clinical views of the implant crown adhesive plug—occlusal and lingual of lower left first premolar with lingual plug.

delivered and screwed to the appropriate torque, rubber dam placed for isolation and the porcelain plug cemented.

CONCLUSION

The ICAP is a restoration that has three major advantages, which include improved esthetics, controlled occlusion, and the elimination of potential cement induced peri-implant disease. It is a durable, esthetic restoration that can be economically made with moderate skills in the dental laboratory.

DISCLOSURE AND ACKNOWLEDGEMENTS

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