Dr. Kosinski: Please provide captions for the 3 images of you and your staff. Thanks!

Single Posterior Implant Crown Fabrication

Cement-On Versus Screw-Retained Crowns

Timothy Kosinski, DDS

INTRODUCTION

As clinicians, we must often make decisions on the restoration of our dental implant design. In years past, screw-retained prostheses were the norm, often with custom-prepared screws or screw-retained infrastructures. Issues with past implant designs caused some problems with this type of crown. Screws could loosen, causing stress to the practitioner. Design corrections were made with advent of the UCLA abutment,[1,2] which would engage the implant body and allow for either a screw-retained or cement-on crown. Since most implants today are internally designed with some type of internal stabilizing connection (such as a hex, trilobes, or morse tapers), loosening of abutments and screws has been dramatically reduced as long as the screws are properly torqued to the manufacturer's requirements.

As screw-retained crowns were replaced by screw-retained abutments and cement-on crowns, other issues began to arise. Most problems with cement-on crowns were the result of abutments loosening under a cemented-on implant-retained crown, resulting in the need to remove the crown to re-torque the abutment or drill an access opening through the crown to tighten the abutment screw.

Another issue becoming popular in the literature is the periodontal bone loss around implants restored with cemented-retained crowns. Depending on the type of cement used, such as silicone cements, glass ionomers, and resin cements, if the practitioner does not completely remove the excess subgingival cement, the body's natural response is to lose bone around the necks of the implants.[3] Obviously, this problem can be minimized with supragingival margins or margins placed at, or very near, the gingival crest level. The problem is serious enough that screw-retained prostheses have again become popular. So, it may be appropriate to review when screw-retained crowns and cement-on implant-retained crowns are to be used.

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Choosing Between Screw-Retained and Cement-Retained Crowns

As previously mentioned, nonresorbable cements that are not thoroughly removed subgingivally can result in peri-implantitis, which is inflammation of the soft tissue around the implant that can result in bone loss.[4] Obviously, eliminating the cement with a screw-retained crown will eliminate this potential problem. As abutments are torqued into place in a cement-on crown situation, any issues with mobility of the abutment throughout time can be stressful, depending on the type of cement used to retain the crown. Using a soft or semi-flexible temporary cement (such as Temp-Bond/Temp-Bond Clear [Kerr]; Retrieve [Parkell]; Improv [Alvelogro]; TempSpan [Pentron]; or Telio CS Link [Ivoclar Vivadent]) allows for retrievability of the crown from the abutment; however, this can also be an issue if the crown comes off during use by the patient. Any type of porcelain fracture or movement of teeth resulting in open contacts can be difficult to repair. Screw-retained crowns can be removed and corrected if problems arise.

Also, it is imperative that the clinician evaluate the circumstances prior to any surgical intervention and implant placement. What does that mean? The interocclusal distance must be evaluated. An abutment for a cemented-on crown must have a minimal height of 5.0 mm, from the prepared margin to the top of the abutment, to have adequate retention. More height is even better, but with any less than 5.0 mm, the cemented crown may not be retentive long-term and may possibly result in several re-cementations, so a screw-retained crown is indicated.

Placement of the implant must be made ideal when considering a screw-retained crown. This means palatal in the anterior maxilla, in the cingulum area, and ideally in the center of a posterior tooth, down the long axis of the crown. Angulation issues with our implants can often be corrected easier with custom prepared abutments and cement-on crowns.

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The clinician must be aware of the advantages and disadvantages of having a screw hole in the occlusal surface of posterior surface, or lingual surface in anterior teeth, of a new crown. Also, we must observe the emergence of the screw in a screw-retained crown. Of course, a screw cannot come out of the facial aspect of the crown in the aesthetic zone. The patient must be made aware that the screw access may show a bit. Our best composites do a nice job in filling the access hole, but for some patients this may not be aesthetic enough.

Finally, screw-retained implant-retained crowns can end up being slightly more expensive than preparing stock abutments and fabricating basically a normal crown over the abutment. Custom abutments, when circumstances warrant, can be more expensive to the practitioner.

Indications for cement-on implant-retained crowns over prepared abutments and those indicated for screw-retained prosthesis will be demonstrated with the following 5 clinical cases.

CASE REPORTS

Cases 1 and 2 describe the use of screw-retained implant crowns. With the use of either CT scanning and diagnosis or evaluation of conventional hard models made from conventional impression techniques, the dental laboratory team can create the implant position, interocclusal distance from the opposing arch, and interproximal distances from the adjacent natural teeth.

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Case 1

In this case, our dental laboratory team created a custom contoured healing abutment and transitional crown using digital design (Figure 1). The Glidewell tapered dental implant with internal hex design (Glidewell Laboratories) is nicely positioned in the center of the edentulous ridge in the mandibular second bicuspid area using standard surgical protocol. The implant was torqued above 35 Ncm and the custom-contoured abutment was immediately positioned into the implant (Figure 2). The concept is to create ideal tissue contours for the delivery of the final implant-retained crown. The transitional crown was cemented onto the prepared abutment with a temporary cement (Temp-Bond). The margins of the crown were placed at the soft-tissue level, allowing for easy cleanup of the excess cement, thus eliminating any potential periodontal issues from the very beginning. After approximately 3 months of integration of the implant, the cemented transitional crown was removed, showing the incredibly healthy tissue response to the digitally designed transitional abutment. Healthy tissue contours were created by using a custom-fabricated abutment that allowed for ideal emergence profile in the final implant-retained crown (Figure 3). As can be seen by the transitional abutment, the interocclusal distance was limited. Following the guideline of having a least 5.0 mm of abutment height for predictable retention, it was determined that a more effective long-term restoration would be a screw-retained monolithic zirconia crown (BruxZir [Glidewell Laboratories]) (Figure 4). The implant crown was passively seated into the implant (Figure 5), and them proximal and occlusal contacts were checked. A torque wrench was used to completely seat the retaining screw to 25 Ncm. Ideal emergence profile was established using the screw-retained implant crown (Figure 6), and a digital periapical radiograph was taken to ensure the complete seat of the prosthesis (Figure 7).

Case 2

Maxillary second molar implant replacement areas should be evaluated carefully for interocclusal distance. A short abutment and cement-on crown in this area can prove to be

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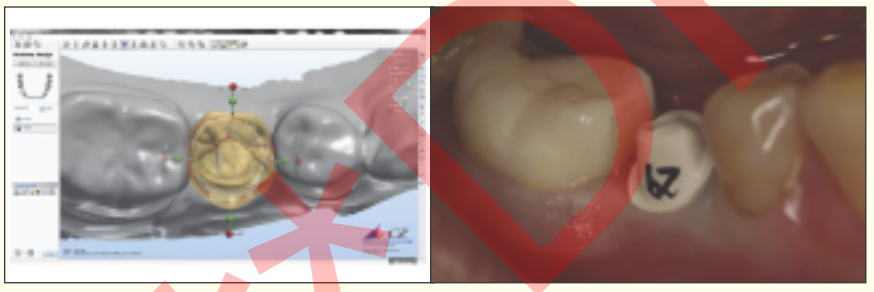
CASE 1. MANDIBULAR SECOND BICUSPID



Figures 1 and 2. The dental laboratory (Glidewell Laboratories) fabricated a digital transitional abutment and crown to be placed immediately after implant placement. The implant had been torqued to 35 Ncm, allowing the use of the custom-healing abutment.

Figure 3. After approximately 3 months of integration, the cemented-on temporary crown was removed, showing the healthy tissue response to the digitally created immediate transitional abutment.

Figure 4. Because of the limited interocclusal distance, a screw-retained monolithic zirconia (BruxZir [Glidewell Laboratories]) crown was used.

Figure 5. The implant crown was passively seated into the implant, proximal and occlusal contacts were checked, and then the retaining screw was torqued to 25 Ncm.

Figures 6. Ideal emergence profile was established using the screw-retained implant crown.

Figure 7. A digital periapical radiograph was taken to verify a complete seat.

After approximately 3 months of integration of the implant, the cemented transitional crown was removed, showing the incredibly healthy tissue....

CASE 2. MAXILLARY LEFT SECOND MOLAR SCREW-RETAINED IMPLANT CROWN

Figure 8. A soft-tissue model with the screw-retained crown was chosen due to limited interocclusal space. A short prepared abutment (less than 5.0 mm) would not have had adequate retention to retain a cemented crown in this case.

Figure 9. Stock healing abutment, 3 months after implant placement in the maxillary left second molar area. After the healing abutment was removed, we have good tissue health around the Glidewell implant.

Figure 10. The aesthetic and functional maxillary second molar has a nice emergence profile.

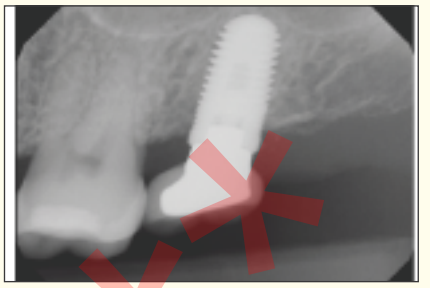


Figure 11. Final periapical radiograph of the implant crown in place.

CASE 3: CEMENT-ON IMPLANT-RETAINED MANDIBULAR FIRST MOLAR CROWN

Figure 12. Note the healthy tissue around the Glidewell implant after removal of the healing abutment.

Figure 13. A prepared titanium abutment was seated and torqued into position. The interocclusal distance allowed for a retentive prepared abutment for a cemented crown.

Figure 14. Occlusal view of the abutment ideally contoured and positioned in the ridge. The implant-retained crown was cemented to place and occlusion checked.

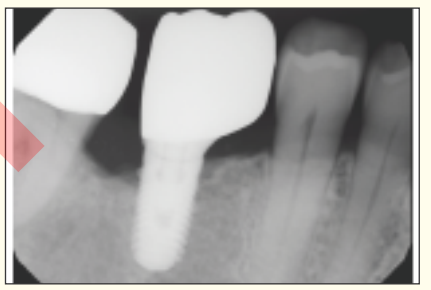


Figure 15. Final radiograph of the cemented in crown verifying that no excess cement remained subgingivally.

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disastrous due to inadequate retention with a high potential for crowns to become uncemented. Case 2 demonstrates the use of a screw-retained implant crown to replace the missing maxillary left second molar. The dental laboratory team created a soft-tissue model with a screw-retained crown due to the limited interocclusal distance. A prepared abutment would have been much too short to have successfully retained a cement-on crown. Figure 9 shows the stock healing abutment in place approximately 3 months after implant placement. After the healing abutment was removed, good tissue health around the tapered dental implant (Glidewell Laboratories) could be observed. The implant crown was then positioned and torqued intraorally (Figure 10). The aesthetic and functional maxillary second molar exhibited nice emergence profile. The final periapical radiograph (Figure 11) indicated a complete seating of the screw-retained implant crown.

Case 3

Even with the increased popularity of screw-retained implant crowns, in my practice, I tend to use more cement-on crowns over prepared stock or custom abutments. The important issues to remember are that abutment margins should be just slightly subgingival, if using a titanium material, but can be at the tissue level when using tooth-colored monolithic zirconia material. Being aware of margin design with your abutment can make the final result aesthetic and periodontally sound. Using stock abutments may hinder your ability to manage margin position, so considerations for custom abutments should be made and considered when treatment planning and determining proper fees. Figure 12 illustrates a healing abutment placed in the mandibular right first molar area. The implant and tissue were allowed to heal for about 3 months. After removal of the healing abutment, there was good tissue health around the Glidewell implant. The implant itself was approximately 2.0 mm subgingival (facial aspect). Because there is plenty of interocclusal space, a prepared titanium abutment was seated into position and torqued to 25 Ncm. The interocclusal distance allowed for a tall and retentive prepared custom abutment for a cemented crown (Figure 13). The abutment, ideally contoured and in the center of the ridge, allowed for occlusal forces to be maintained down the long axis of the implant (Figure 14). The implant-retained crown was cemented to place and the occlusion checked. I cement implant-retained crowns with a temporary cement (Temp-Bond). These cements are strong enough to hold the crown in place as long as the abutment is properly formed and yet, if any problems were to arise down the road, such as abutment loosening, they could be more easily handled. Figure 15 shows the final radiograph of the cemented crown. No excess cement was left behind because the subgingival margin, at about 1.0 mm, was not placed deeply.

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Case 4

Dental implants in certain circumstances can also be used to maintain

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CASE 4: CEMENT-ON, IMPLANT-RETAINED MAXILLARY POSTERIOR BRIDGE

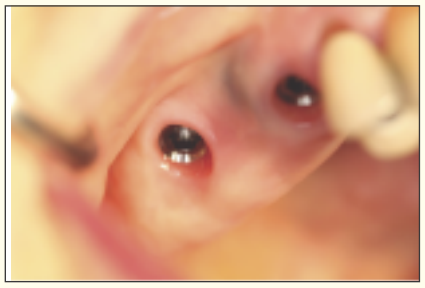
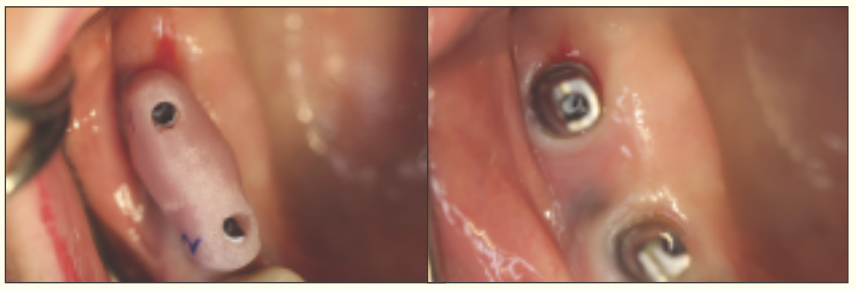
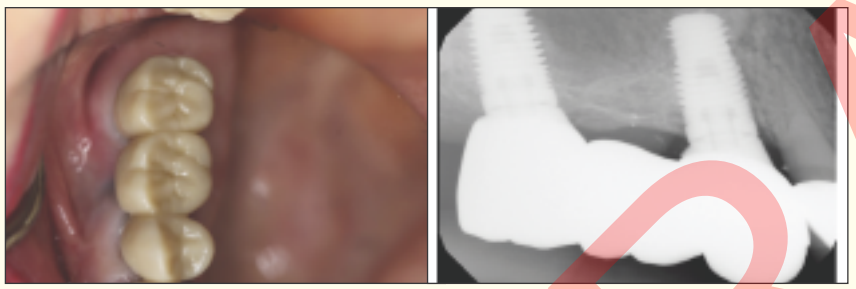


Figure 16. Healthy tissue around Glidewell dental implants after healing abutments were removed.

Figure 17. Soft-tissue models showing margins of the abutments were only slightly subgingival; allowing for emergence profile, proper aesthetics, and easy removal of cement.



Figures 18 and 19. A seating stent, provided with Glidewell implants, was used to properly position and seat the abutments. The abutments were positioned for a cement-on, 3-unit, implant-retained bridge. The laboratory (Glidewell Laboratories) was able to contour the abutments for proper draw and emergence.



Figures 20 and 21. Occlusal and radiographic view of the implant-retained, cemented, 3-unit fixed partial denture.

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bridges. This case illustrates the use of an maxillary posterior, implant-retained, cemented fixed partial denture (FPD). Once the healing abutments were removed, healthy tissue was observed around the Glidewell dental implants (Figure 16). A soft-tissue model showed that the margins of the abutments were only slightly subgingival, allowing for emergence profile, proper aesthetics, and easy maintenance of any cement (Figure 17). With the Glidewell implant system, seating stents are provided (Figure 18). The seating stent allows for proper placement of the prepared custom abutments. A torque wrench was used to properly seat the prepared abutments to 25 Ncm. The abutments were positioned for a cemented 3-unit, implant-retained FPD (Figures 19 and 20). The laboratory team was able to ideally contour the abutments for proper draw and emergence profile. A radiograph was taken to ensure complete and proper seating of the prosthesis (Figure 21).

Case 5

In this, the final case presented, the preoperative radiograph of a nonrestorable mandibular right second molar is shown (Figure 22). After approximately 4 months of healing, a Glidewell implant was surgically placed and torqued to 35 Ncm. Upon removal of the healing abutment after an additional 3 months, the tissue contours were good and the tissue was healthy (Figure 23). The interocclusal distance allowed for a long and retentive prepared custom abutment to be torqued into position to 25 Ncm (Figure 24), and the monolithic zirconia crown (BruxZir) was cemented into place (Figure 25). The final periapical radiograph was taken to verify proper seating and demonstrated no excess cement remained (Figure 26).

CLOSING COMMENTS

Preparation for the surgery of dental implants must be predicated by an understanding of the final prosthetic reconstruction. Visualizing the case finished *before*, along with any needed surgical intervention, is important if we keep in mind that dental implants are prosthetically driven. Mounted diagnostic casts are important in helping the clinician and laboratory team determine interocclusal space. Discussions about aesthetic requirements/expectations with our patients should be done prior to the placement of any implants. The benefits and risks of cement-on implant-retained crowns versus screw-retained crowns must be clearly understood.

With the advent of new polycrystalline dental materials (such as monolithic zirconia and monolithic lithium disilicate (IPS e.max [Ivoclar Vivadent]) clinicians can deliver aesthetic and strong restorations in the posterior regions, nearly eliminating the risks of fracture as experienced historically using traditional porcelains. These new high-strength, all-ceramic materials (used for abutments, crowns, and FPDs) can also improve the aesthetics around the access opening of the screw-retained crown. Ideal placement of implants so that occlusal forces are maintained down the long axis of the implant can be determined by proper planning. The newest techniques for designing the proper form and function for an implant-retained crown make decisions that much easier. CT diagnostics can allow for determining ideal

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CASE 5: CEMENT-ON MANDIBULAR SECOND MOLAR

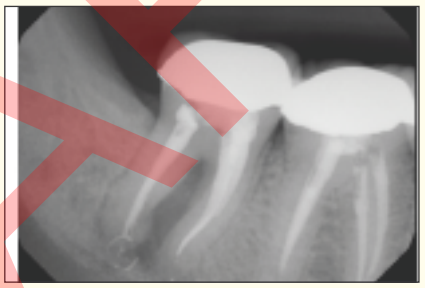

Figure 22. Preoperative radiograph of nonrestorable mandibular right second molar to be extracted. After approximately 4 months of healing, a Glidewell implant would be surgically placed and torqued to 35 Ncm.

Figure 23. Upon removal of the healing abutment, the tissue looked healthy.

Figure 24. Interocclusal space allowed for a retentive prepared abutment to be torqued to 30 Ncm. Since the interocclusal distance was greater than 5 mm, a custom abutment and cement-on implant-retained crown was used.

Figure 25. The final monolithic zirconia (BruxZir) crown was cemented into position.

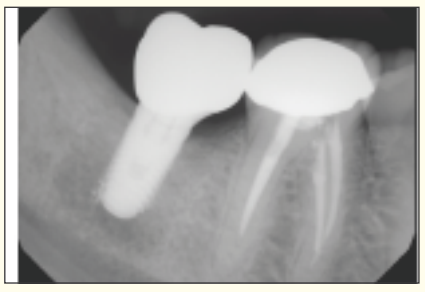

Figure 26. The final radiograph was taken to verify proper seating and no remaining excess cement.

Visualizing the case finished before, *along with any needed surgical intervention, is important if we keep in mind that implants are prosthetically driven.*

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position, type, and size of implant to be utilized prior to any surgery. The final crown can even be designed before ever bringing a surgical bur to the patient's mouth.[5]

We all want what is best of our patients. With proper clinical training and an experienced and skilled laboratory team, the modern materials and techniques that are now available allow clinicians to provide patients with the best in implant and restorative services.✦

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Disclosure: Dr. Kosinski reports no disclosures.

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