

CASE STUDY

Single Appointment Posterior CAD/CAM Implant Crown for Bone-Level Implant

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Dental-implant-supported single-unit restorations have long-term and predictable clinical success. Traditional restorative protocols involve either implant-level or abutment-level impressions

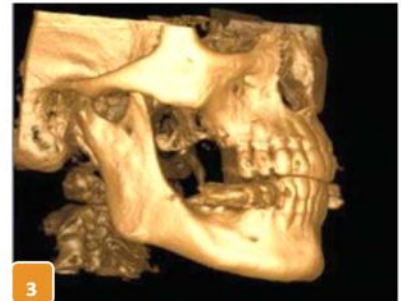
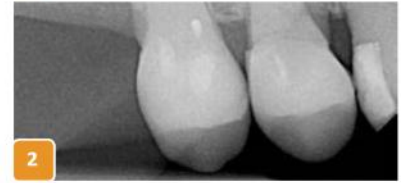
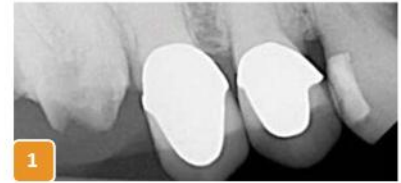
that are sent to dental laboratories for fabrication of the restorations on either manufacturer-specific standard abutments or custom-milled or cast abutments. Bone-level implants have been designed specifically for emergence profile management and gingival esthetics. However, abutment designs for one-level implants can limit restoration esthetics when post-operative healing of tissues does not yield a minimal tissue cuff of 2 mm. This case study describes a technique for circumventing this challenge by modifying a standard anatomic abutment to utilize the implant platform on a bone-level implant as the restoration margin for a chair-side CAD/CAM restoration.

CASE REPORT

A 74-year-old female patient with an unremarkable medical history and a history of complex restorative dentistry with successful dental implant restora-

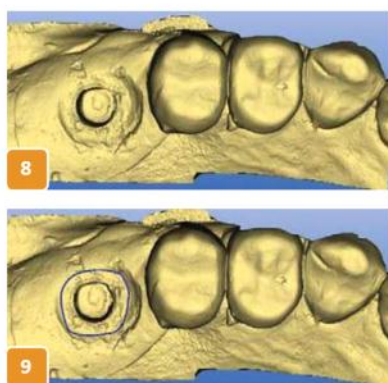
tion of the mandibular left first molar presented to the dental office with a fractured, non-restorable, maxillary right first molar with a periapical radiolucency (Figure 1). The occlusion on all remaining teeth was stable with smooth anterior crossover and posterior disclusion in eccentric movements.

The non-restorable maxillary right first molar was extracted and allowed to heal for three months (Figure 2). A CBCT scan was taken for consideration of anatomic factors and density of bone (Figure 3). The images revealed an adequate width and depth for implant placement. Bone height was 7.8 mm, a dimension short of an 8 mm implant. An internal sinus elevation to provide additional millimeters was planned simultaneously with the implant placement. A tissue punch was created to access the underlying bone crest. A series of osteotomies were performed making sure to stay 0.5-1.0 mm below the sinus floor. Gentle tapping to the



sinus floor allowed the elevation of the Schneiderian membrane while still attached to the sinus cortical plate. The site received bone particulate xenograft (Bio-Oss, Osteohealth) to help elevate and augment the sinus. A Straumann Bone Level 4.8x8 mm implant (Straumann USA) was inserted in the site. The implant primary stability was achieved and confirmed by tightening a cover screw. Healing was followed for four months until the implant reached osseointegration. After healing, the implant cover screw was completely exposed, but the implant was apparently well integrated, as determined by percussion and palpation (Figure 4).

A closed-tray polyvinyl siloxane (EXAMIX, GC America) impression was made of the implant using conventional



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- » Fig. 1: Radiograph showing non-restorable tooth #3
- » Fig. 2: Radiograph showing adequate bone healing for implant placement
- » Fig. 3: CBCT image of implant site
- » Fig. 4: Implant at healing cap removal showing healthy gingival cuff
- » Fig. 5: PVS impression with soft tissue mouldage
- » Fig. 6: Working model with soft-tissue mouldage for emergence profile contouring of restoration
- » Fig. 7: Modified abutment on the working model
- » Fig. 8: Digital model of working model with customized abutment in place
- » Fig. 9: "Overdesigned" margin design to allow for sculpting of the emergence profile on the restoration after milling

techniques, and a model was poured in die stone (WhipMix) (Figure 5). A soft-tissue mouldage with denture reline material (GC Soft Reline, GC America) was completed to allow for sculpting of the emergence profile. After the impression, GC Reline Soft was injected as soft-tissue mouldage around the impression analog. The intaglio surface of the impression material must be lightly coated with glycerin to prevent adhesion of the mouldage material (Figure 6). A digital impression of the opposing occlusal surface (antagonist) was made intraorally with a polyvinyl bite registration material (Patterson Bite, Patterson Supply).

A standard anatomic titanium abutment was seated into the analog on the model, and the screw hole filled with wax. The emergence profile was sculpted with a scalpel. The abutment was milled with a carbide bur in a high-speed dental handpiece with water spray, during which time the factory-designed chamfer was removed (Figure 7).

A digital impression of the seated abutment was made in the "preparation" window of a CEREC 3 unit (Sirona), using a light coating of reflective powder (Figure 8). A crown was designed for milling

with usual techniques, except the margin line was overdrawn to enable chairside contouring of the emergence profile (Figure 9). The proposal was adjusted to properly position occlusal contours and contacts within the parameters of the antagonist. A lithium disilicate block (e.max, Ivoclar) was milled. A transfer jig was fabricated with thermoplastic acrylic on the laboratory model. (Figures 10 and 11, page 10). The abutment was then transferred to the mouth and torqued to 35 N/cm. The adjusted green-stage crown was stained and glazed, and then fired in a vacuum oven (Ivoclar) according to manufacturer instructions.

A polyvinyl siloxane plug (EXAMIX, GC America) was used to fill the access opening (Figure 12). Then the intaglio surface of the crown was steamed, conditioned with hydrofluoric acid, cleaned with 37 percent phosphoric acid, and then silanated. A resin-modified glass ionomer cement (Rely-X Luting Cement, 3M ESPE) was used to lute the crown to place. Appropriate centric occlusion without lateral loading was verified (Figures 13 and 14).

DISCUSSION

Anatomical variations, financial

considerations, and complications with post-operative soft-tissue healing may limit the ideal position of bone-level implants, despite all efforts to place the implant optimally. Customization of standard abutments can be performed to alter the position of restoration margins, limited apically by the abutment taper. If the implant platform is entirely exposed, esthetic restoration requires elimination of the margin on the implant abutment itself. In this case, the platform of the bone-level abutment needed to serve as the restoration margin.

There are multiple approaches to the restoration of this case that could have been considered. A chair-side CAD/CAM system was used to complete the restorative procedures in a single visit for patient convenience. Lithium disilicate has a solid anecdotal history as a viable restorative material for implant restorations, although this use is off-label from the manufacturer's recommendations. Alternatively, the impression taken could have been sent to a commercial dental laboratory for fabrication of a porcelain-fused-to-metal, full cast metal, zirconium, pressed and veneered lithium disilicate, or milled and veneered lithium disilicate crown by conventional techniques. However, at least two restorative appointments would have been needed.

The abutment choices for this case included a modified standard anatomic abutment manufactured by the implant company (either zirconium or titanium), a custom-designed and milled titanium abutment, or a custom-cast abutment. The patient's desire for a single-appointment restoration limited



» Fig. 10: Transfer jig fabricated on the working model
 » Fig. 11: The implant positioned intraorally with the transfer jig
 » Fig. 12: PVS plug placed in screw access opening
 » Fig. 13: Final lithium disilicate restoration #3
 » Fig. 14: Radiograph showing complete seating of final restoration on a well-integrated bone-level implant

the abutment choice to a modified standard abutment. Strength and necessary milling adjustment required titanium over zirconium. (The minimal abutment wall thickness is 0.5 mm per Straumann Technical Support.) It was necessary for the implant collar to serve as the margin in this case because the implant collar was situated flush with the keratinized mucosa. Since the shortest collar for a bone level standard abutment is 2 mm, a large gap cervical to the restoration would have been created in vivo without substantial modification. Risks of this modification procedure are damage to the implant collar during preparation, fracture of the implant abutment, or fracture of the lithium disilicate crown. If a metal-based laboratory-fabricated crown would have been fabricated, the option of a screw-retained restoration could have been considered, as well as a single-unit abutment/crown complex restoration. However, this would have potentially increased the cost of the restoration and would have required at least two restorative visits. It is generally

accepted and well-published that cemented single-unit implant crowns are a reasonable treatment option. ❖

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