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A Perfect Fit:

Custom Abutments Produced from Digital Impressions

by ***Timothy F. Kosinski, DDS, MAGD***

Proper diagnosis and treatment planning are arguably the most important aspects of implant therapy today. Surgical intervention has proven to be less complicated than ever before, as the construction and design of implants, along with the surgical armamentarium needed to place them, have improved dramatically. Implant dentistry is best practiced with a prosthetically driven approach. Understanding how the final prosthetic outcome relates to patient anatomy, periodontal health, and the physiologic responses to surgical intervention is essential to achieving esthetic results. If the goal is to accomplish an ideal restoration using dental implants, then bone morphology needs to be accommodated, tissue health optimized, and the implant placed in optimal position for the final prosthesis. Advanced optical scanning techniques and CAD/CAM design of prosthetic components help us address these considerations with precision and efficiency, providing our patients with excellent results while controlling treatment costs.[1,2]

Being able to visualize the final restoration prior to surgical intervention is no longer an art form practiced by the experienced clinician after completing hundreds or thousands of cases. Rather, the advent of digital design and preparation allows visualization of the ideal prosthetic result to all clinicians, regardless of experience level, in a very effective and efficient manner. Technology has the capacity to rescue us from many of the pitfalls associated with improper diagnosis, surgical treatment and prosthetic fabrication. This is perhaps most evident in the fabrication of CAD/CAM-produced custom abutments, which are designed to precisely accommodate and provide support for the gingival anatomy surrounding the implant site. The delivery of custom abutments results in a natural emergence profile and esthetic contours and margins that are far superior to those produced by stock abutments.

Coupled with intraoral scanning, CAD/CAM technology can be used to produce custom abutments with an unprecedented degree of precision and efficiency.[3] Intraoral scanners produce extremely accurate digital impressions, initiating an entirely digital workflow that eliminates the time and costs associated with shipping traditional impressions and fabricating conventional models. Digital impressions offer a precise final representation of the implant site and scanning abutment, which takes the place of the conventional impression coping. The potential for material distortion associated with traditional impression techniques and the pouring of stone models is eliminated.

The intraoral scanner produces a digital file that allows for production of the restoration without a physical model, enabling a "model-less" design process. The data is used in CAD/CAM to design patient-specific abutment contours and establish the correct physiologic shape, thus creating an optimal emergence profile for the implant-retained crown. Margins can be created that are flush with the soft tissue or slightly subgingival, resulting in healthy periodontal conditions. Importantly, the CAD/CAM process provides the clinician with the opportunity to evaluate the virtual design and make any adjustments prior to fabrication of the abutment and crown. This allows the practitioner to visualize and control the unique esthetic contours of each case. Furthermore, many labs offer reduced fees for model-less implant restorations.

Oftentimes, the precise fit of custom abutments produced from digital impressions reduces the chair time needed to seat the final restoration. With the digital design of final crowns, ideal contours are created, and interproximal contacts and occlusal design are optimized. Adjustment times are reduced drastically, and thus confidence in working with high-quality crown and bridge materials such as BruxZir® Solid Zirconia is improved. In my experience, the appointments where I seat the final restoration have become much less stressful, as I expect the abutments and crowns to seat perfectly.

In the absence of the periodontal ligament, dental implants must accommodate significant occlusal forces in several directions. Because of this, it is imperative that custom abutments be designed not only to allow for an ideal emergence profile, but also to provide optimal support of the final implant-retained crown. The accuracy of intraoral scanners and the precision of CAD/CAM-designed custom abutments allow clinicians to address these concerns in a highly efficient workflow. In addition to saving time and reducing costs for custom abutments and final crowns, the model-less workflow produces esthetic outcomes that meet or even exceed patient expectations, as illustrated by the following cases.

Case 1: Maxillary Central Incisor

Figure 1: *The patient originally presented with a non-restorable maxillary left central incisor, the removal of which created significant emotional stress. A treatment plan to replace the missing tooth with an implant restoration was proposed and accepted by the patient.*

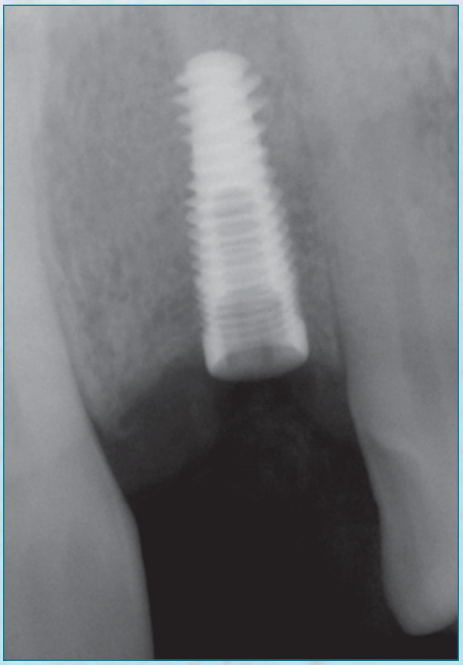
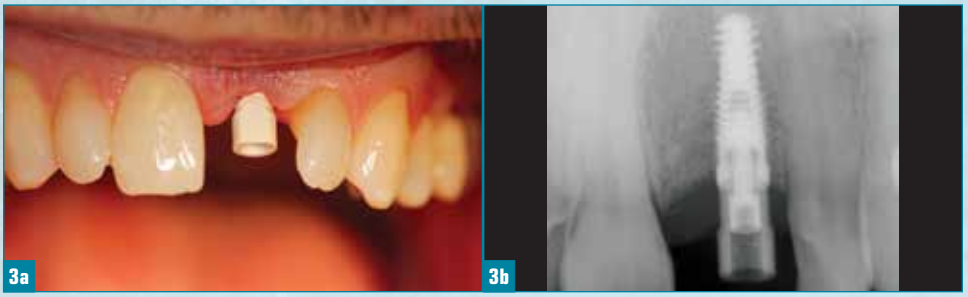
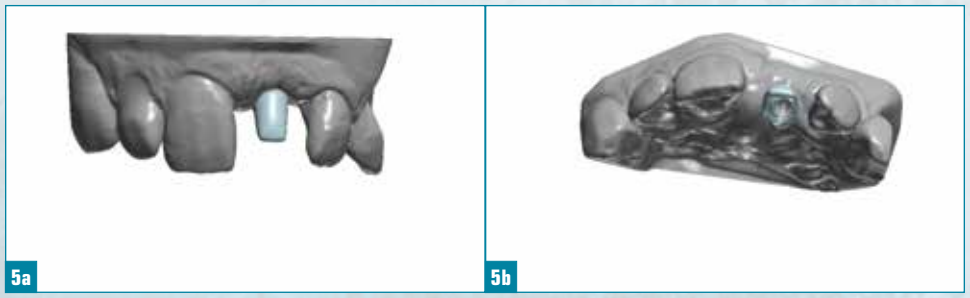


Figure 2: *Radiography confirmed that, following approximately four months of healing, the Inclusive® Tapered Implant (Glidewell Direct; Irvine, Calif.) had fully integrated with the underlying bone of the implant site.*



Figures 3a, 3b: *An Inclusive® Scanning Abutment (Glidewell Direct) was threaded into the implant, and full seating was verified radiographically.*

Figures 4a–4c: *Intraoral scans were taken, creating a digital impression that precisely captured the interdental tooth structures, soft-tissue architecture, and position of the scanning abutment from facial, lingual and occlusal perspectives. This virtual model created chairside allowed for thorough evaluation of the implant site.*



Figures 5a, 5b: *The laboratory utilized the digital impression data to create ideal custom abutments. This eliminated the need to both ship conventional impressions and casts to the lab and to use hard models for restoration design, resulting in a quicker turnaround time.*

Figure 6: *The design of the final crown was developed and finalized via precise CAD/CAM software, resulting in an incredibly accurate fit. The abutment and crown designs were evaluated by the dental practitioner prior to fabrication.*

Figure 7: *An acrylic delivery jig was included with the final zirconia abutment, allowing for precise positioning and torquing of the abutment with minimal disturbance of the implant site.*

Figure 8: *The final zirconia abutment provided for nice tissue color and ideal emergence margins for the implant-retained crown. Note that the custom abutment allows for fabrication of margins in a physiologic position, approximately 3 mm apical to the adjacent cemento-enamel junctions. Thus the final implant crown margin is level with the gingiva or just slightly subgingival, allowing for proper periodontal health and easy removal of any cement.*

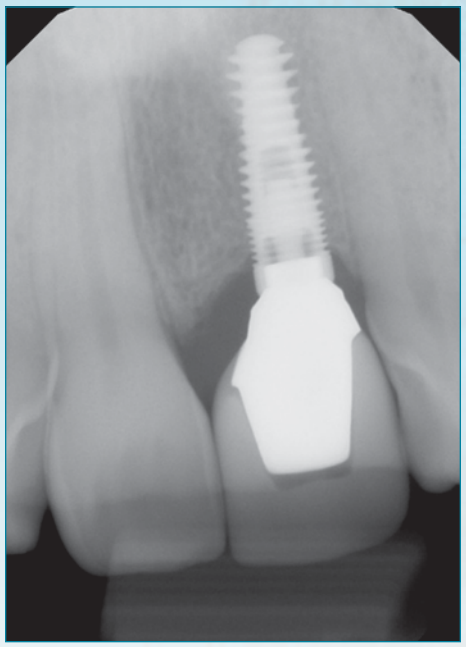


Figure 9: *Digital radiograph of custom abutment and final implant-retained crown cemented into position.*

Figure 10: *Final seating of the implant-retained crown. The patient was quite pleased with the restoration, which required no adjustments, emerged from the soft tissue nicely, and preserved the interdental papillae well.*

Case 2: Maxillary Bicuspid

Figure 1: *An Inclusive Tapered Implant was placed to restore the patient's maxillary left second bicuspid. A flapless surgical procedure was performed and a 3-mm-tall healing abutment was seated. The patient presented following healing with nice tissue health around the integrated implant and plenty of attached gingiva.*

Figure 2: *The healing abutment was removed before threading the scanning abutment into the implant.*

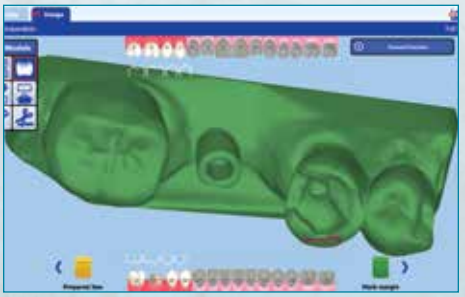


Figure 3: *Snapshot of occlusal scan. The digital impression was transmitted to the lab electronically, eliminating the need for conventional impression materials, models, bite relations and shipping.*

Figure 4: *Following completion of the model-less CAD/CAM design process and doctor approval, the custom abutment and final crown were milled.*

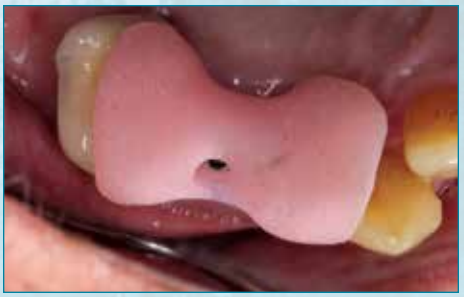
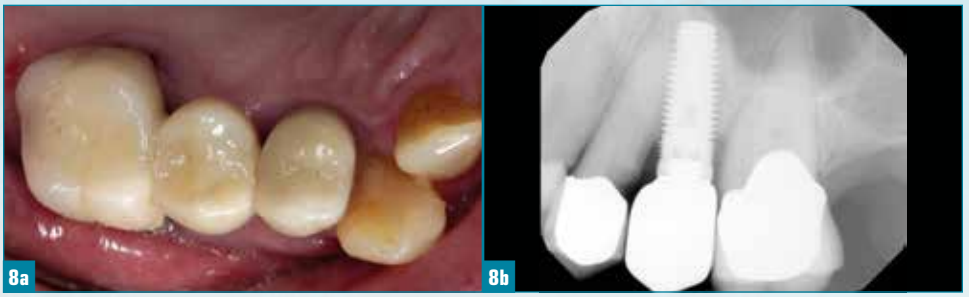


Figure 5: *The acrylic seating jig provided by the lab helped ensure proper positioning of the prepared custom abutment.*

Figure 6: *The Inclusive® Titanium Custom Abutment was torqued to 25 Ncm, exhibiting ideal margins upon delivery.*

Figure 7: *Digital radiograph of abutment in place exhibits proper margins.*



Figures 8a, 8b: *The final Bruxzir crown was cemented into place, providing a highly durable, esthetic and well-fitting restoration. The final radiograph illustrates proper positioning. Note that the decay on the first bicuspid will be treated.*

Case 3: Maxillary Lateral Incisor

Figures 1a, 1b: *The patient originally presented with a conventional crown retained by a post and core in the maxillary left lateral incisor that had fractured. The patient elected for a dental implant restoration. The tooth was extracted and an implant was placed.*

Figure 2: *After integration of the implant, the soft tissue and papillae exhibited healthy regeneration. Note the physiologic position of the implant, which was placed 3 mm palatal to the facial aspect of the adjacent crowns.*

Figures 3a, 3b: *A scanning abutment was placed and intraoral scans were taken, producing a digital impression that the lab used for CAD/CAM design of the restoration.*

Figure 4: *Following practitioner approval of the virtual restorative design, which was constructed to mirror the esthetics of the contralateral lateral incisor, the zirconia abutment with titanium base was fabricated along with the implant-retained crown.*

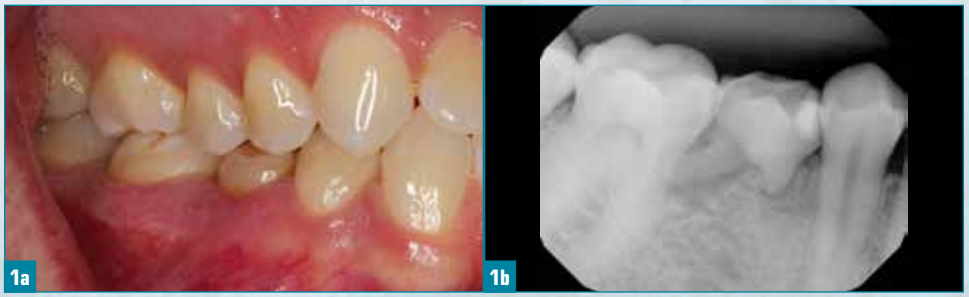
Figure 5: *The custom abutment was properly seated using the positioning jig and torqued to 25 Ncm.*

Figure 6: *The custom abutment was designed and positioned to facilitate a natural emergence profile for the final IPS e.max crown (Ivoclar Vivadent; Amherst, N.Y.).*

Figures 7a, 7b: *Fully seated implant-retained crown and final seating radiograph illustrate the slightly subgingival margins established by the custom abutment. The accuracy of the digital impression and design processes ensured proximal contacts that eliminated any dark triangles in the interdental papillae.*

Figure 8: *The patient was extremely happy with the final esthetics and smile line fostered by the implant-retained restoration.*

Case 4: Mandibular Primary Molar



Figures 1a, 1b: *The patient presented with a retained primary molar requiring extraction. A two-visit treatment plan was utilized for diagnosis, extraction, implant placement, final impression, and final seating of the custom abutment and implant-retained crown. This approach is ideal for certain cases where torque is initially achieved at a minimum of 35 Ncm and tissue healing is predictable.*

Figures 2a, 2b: *Physics® Forceps (Golden Dental Solutions Inc.; Detroit, Mich.) were used to atraumatically remove the retained primary tooth, allowing for immediate placement of an Inclusive Tapered Implant.*

Figure 3: *An osteotomy was created in the socket site.*

Figure 4: *The implant was first hand-tightened into the prepared surgical site and then torqued to 45 Ncm and ideal depth, with the implant platform at the crest of the socket.*

Figures 5a, 5b: *The Inclusive Scanning Abutment was threaded into the immediately placed dental implant, with radiography confirming full seating.*

Figure 6: *Scanning was completed efficiently and without the mess of conventional impression materials.*

Figures 7a, 7b: *The immediate final impression was submitted electronically to the lab, which was able to proceed with CAD/CAM design of the final custom abutment and BruxZir crown without pouring or scanning models.*

Figure 8: *Following completion of osseointegration, the healing abutment was removed, illustrating healthy tissue-cuff formation.*

Figure 9: *The prepared custom abutment was positioned with the seating jig and torqued to 25 Ncm.*

Figure 10: *The final implant-retained crown was cemented into place. Note the ideal emergence profile and nice tissue response.*

Figure 11: *Final digital periapical radiograph illustrates the excellent interface between the custom abutment and final crown.*

Figure 12: *The esthetic final result was achieved utilizing a simplified, highly efficient digital workflow.*

Conclusion

Custom abutments and prosthetically driven treatment planning afford clinicians the opportunity to deliver implant restorations with an emergence profile that is virtually identical to that of a natural tooth. This result can be achieved most efficiently with the digital, model-less workflow initiated by intraoral scanning, which offers highly accurate restorations, quicker turnaround times and reduced costs. The path to achieving esthetic, predictable implant outcomes has never been straighter. **IM**

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