BruxZir® Solid Zirconia:

The Next Step in the Evolution of Full-Arch Implant Restorations

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Patients have become very sophisticated in their awareness of treatment options, especially when it comes to implant dentistry. For some time, fully edentulous patients have had the option of receiving a minimum of four dental implants in the maxilla or two to four implants in the mandible in order to retain a removable prosthesis. Whether a bar was used to connect the implants and the attachments positioned within the bar, or singular retaining abutments were threaded into place, the prosthesis was a conventional denture adapted to the retentive devices. These appliances significantly improved upon the form and function of the conventional denture. For maxillary restorations, implant retention has also allowed the dentist to eliminate the palate, which enhances the eating experience by eliminating the acrylic that once covered the taste buds in the roof of the mouth. Stable, retentive, and far less prone to moving around in the patient's mouth, the implant-retained overdenture has enhanced the quality of life for edentulous patients. However, implant-retained removable appliances are still just that: removable.

As patients have become more aware of advances in implant dentistry, particularly with regard to the permanently fixed hybrid appliance, their desire to have non-removable restorations has increased. Hybrid prostheses have become increasingly popular in cases where the anatomy is acceptable and an adequate amount of space exists for the prosthetic design. These hybrid appliances take the cue from removable implant-retained overdentures, but connect to strategically placed implants through a CAD/CAM-designed titanium framework that holds high-quality denture teeth in place via an acrylic base, establishing form, function and esthetics quite similar to natural teeth. This is even more remarkable for the patient, as the appliance offers a maximum amount of stability and function by permanently attaching to the implants. Further, because they are not removed by the patient on a daily basis, they elicit a more positive psychological response.

These acrylic-based hybrids have been an excellent solution for many edentulous patients. However, some problems have arisen. Acrylic can crack or fracture, and denture teeth, regardless of the quality, are subject to wear, dislodging and deformation over time. The repair, reinforcement or outright replacement that can be required has dampened what has otherwise been a life-changing form of treatment.

Amid advancements in materials science and CAD/CAM technology that allow for the precise milling of a

prosthetic appliance from 100 percent solid zirconia, the next step in the evolution of edentulous solutions is the BruxZir® Full-Arch Implant Prosthesis. This fixed restorative option offers patients the function and esthetics of the traditional hybrid denture, while eliminating the issues with long-term durability inherent to acrylic prostheses. Because monolithic zirconia comprises the body, gingival areas and teeth of the prosthesis, it provides maximum resistance to wear and fracture. Despite its strength, BruxZir Solid Zirconia is wear-compatible with the enamel of opposing teeth.[1] By virtue of advanced staining techniques and the translucency of monolithic zirconia, this resilience is coupled with esthetics that compare favorably with those offered by acrylic dentures.

This full-arch restoration attaches to the edentulous ridge by way of either custom abutments, which allow the prosthesis to be cemented into place, or titanium copings, through which screws connect the prosthesis to the implants. The concepts and steps involved in restoring an edentulous arch with the BruxZir Full-Arch Implant Prosthesis are virtually the same as those required for an acrylic hybrid denture, so the learning curve is slight for clinicians who are experienced with traditional hybrids. For doctors new to fixed full-arch implant restorations, the protocol is straightforward, incorporating several layers of quality control that ensure a well-fitting final prosthesis. In the following case presentation, the clinical procedure for restoring an edentulous arch with the BruxZir Full-Arch Implant Prosthesis is depicted in detail, with care taken to document the clinical steps, as well as the tools and materials provided by the dental lab, that help ensure an accurate prosthetic outcome.

Case Report

A 79-year-old male patient presented with advanced and recurrent tooth decay that had rendered a majority of his maxillary dentition mobile and unesthetic *(Fig. 1)*. The patient was edentulous in the areas of teeth #12–15, and the crowns of his remaining upper posterior teeth had worn down substantially due to long-term bruxing. Radiography confirmed the poor prognosis for his natural maxillary teeth *(Fig. 2)*. In addition to the pain and discomfort caused by the state of his teeth, the patient was self-conscious with regard to the poor smile esthetics they caused him *(Fig. 3)*. With the entirety of his maxillary dentition deemed non-restorable, a full-arch implant restoration was proposed that would provide stability, function, and prevention of the devastating bone loss that occurs in the absence of teeth.[2] The patient strongly preferred a fixed appliance to a removable solution, and was thus evaluated for a BruxZir Full-Arch Implant Prosthesis, which would provide much-needed durability along with the wear-friendly properties that would suit the patient well in the presence of chronic bruxism.

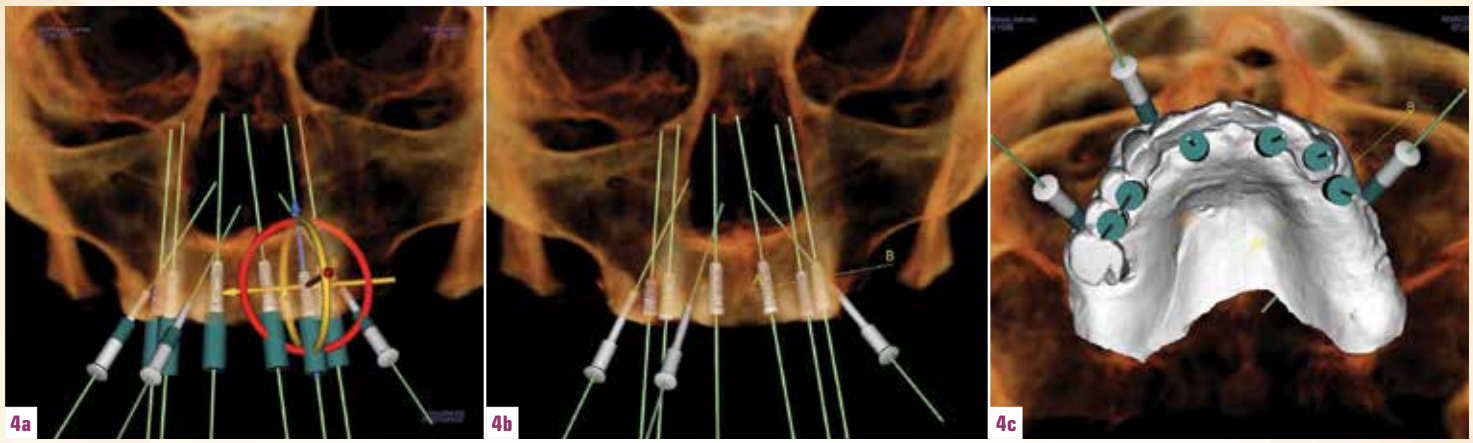
The patient's bone volume, vital anatomical structures, and vertical dimension were assessed to determine the feasibility of an implant-supported restoration. A series of CBCT scans was taken to help determine the ideal number, location and angulation of implants within the patient's maxilla. The literature clearly demonstrates that the placement of four properly spaced implants has an excellent prognosis for fixed implant-supported prostheses.[3] However, placing six dental implants in the edentulous maxilla or mandible can provide added confidence that many clinicians may desire for fixed full-arch restorations. The patient's maxilla exhibited adequate quality and quantity of bone for the placement of six implants, and the patient's available restorative space allowed for the fabrication of a prosthesis milled from monolithic zirconia.

A treatment plan was developed that called for extraction of the patient's

Figure 1: *Preoperative view of the patient's dentition exhibits mobile and severely decayed maxillary teeth and crowns.*

Figure 2: *Panoramic radiograph exhibits advanced wear and deterioration of the patient's maxillary dentition.*

Figure 3: *Besides making it difficult to function, the state of the patient's teeth significantly compromised the esthetics of his smile.*



Figures 4a–4c: *CBCT scanning and digital treatment planning software were used to plan implant placement in a 3-D environment and generate a surgical guide.*

maxillary teeth followed by the guided surgical placement of implants using the All-on-6 technique. The implants would serve as the foundation for the BruxZir Full-Arch Implant Prosthesis, providing the patient with a durable, long-term solution along with substantially improved oral esthetics. Invivo5 software (Anatomage Inc.; San Jose, Calif.) was used to develop a digital treatment plan that would place the implants in optimal position to support a fixed implant restoration *(Figs. 4a–4c)*. This diagnostic tool also served as an aid in determining the appropriate width and length of the implants, and confirmed that the screws that would hold the proposed restoration in place would extend through the occlusal surfaces of the prosthesis. A surgical guide was fabricated to help create osteotomies that would position the implants in their preplanned locations *(Fig. 5)*.

With the treatment plan finalized, the patient was called in for surgical placement of the implants. A sequence of drills was used to create the osteotomies through keys inserted in the sleeves of the surgical guide. Then, six Legacy™ 3 implants (Implant Direct; Las Vegas, Nev.) were placed in the precise position called for by the treatment plan *(Fig. 6)*. With surgical placement complete, the implant sites were sutured closed *(Fig. 7)*. Healing abutments were seated and a conventional denture was fabricated for the patient to wear during the healing phase, as immediate seating of a fixed appliance was contraindicated due to insufficient primary stability.

After four months of healing and implant integration, the patient returned so a preliminary impression could be taken. Removal of the healing abutments revealed healthy tissue surrounding the implant sites *(Fig. 8)*. A clean impression was made using vinyl polysiloxane (VPS) materials *(Fig. 9)*. The lab fabricated a master cast and soft-tissue model from the preliminary impression *(Fig. 10)*. A wax rim was provided by the lab, and the jaw relationship was recorded using standard denture techniques *(Fig. 11)*. For the next appointment, a conventional wax setup was fabricated, including denture teeth to help the lab technician establish proper horizontal and vertical positioning *(Figs. 12a–12c)*. The wax setup was mounted on an articulator along with the opposing model to verify the accuracy of the prosthetic design *(Fig. 13)*. To ensure that final milling would position the screw access holes of the definitive prosthesis in the precise location needed to accommodate the location of the implants, the dental lab fabricated an implant verification jig *(Figs. 14a–14c)*. A custom impression tray

Figure 5: *A surgical guide was fabricated to help properly position the dental implants following extraction of the patient's non-restorable maxillary teeth.*

Figure 6: *Six implants were placed in their predetermined positions. Note that the implant sites are shown with the transfer posts included with the Legacy 3 system still attached to the implants.*

Figure 7: *The implant sites were sutured and allowed to heal for four months.*

Figure 8: *After four months of healing, the soft tissue surrounding the implant sites exhibited excellent health.*

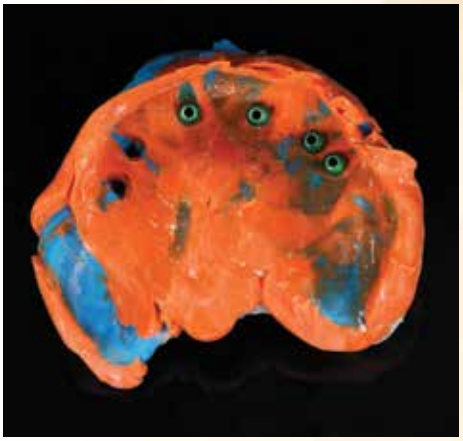


Figure 9: *A preliminary VPS impression was taken to serve as the basis for a master cast.*

was also produced by the lab and was designed to seat over the individual sections of the verification jig *(Fig. 15)*.

The wax setup, implant verification jig, and custom tray were sent to the office for the next appointment. The patient was called in for the wax setup try-in and the final impression. After seating the wax setup in the patient's mouth and tightening the prosthetic screws though the temporary cylinders, the vertical dimension of occlusion, centric jaw relationship, esthetics, bite, phonetics, and positioning of the prosthetic teeth were evaluated *(Figs. 16a, 16b)*.

Figure 10: *A master cast was fabricated, upon which the initial prosthetic design would be determined.*

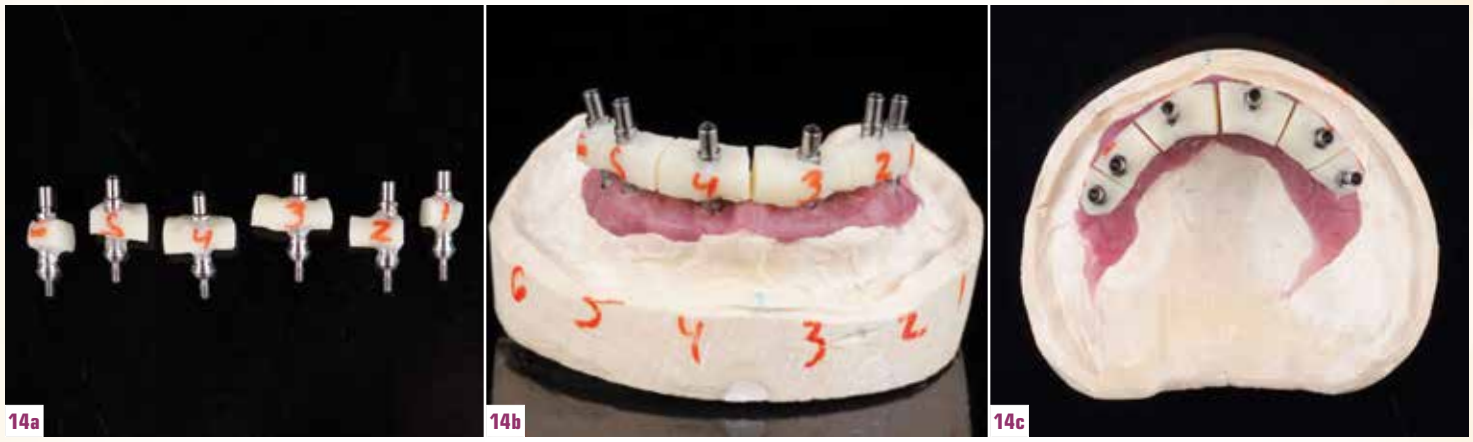
Figure 11: *The master cast was used to fabricate a wax rim so the jaw relation records could be taken.*

Figures 12a–12c: *The lab produced a wax setup for try-in. Note the ideal position of the screw access holes and temporary cylinders through which screws would attach to the implants in order to stabilize the setup during evaluation.*

Some minor adjustments were made, and the prosthetic design was approved by the patient. After removing the wax setup, each section of the verification jig was transferred to the appropriate implant and tightened into place *(Figs. 17a, 17b)*. After luting the individual sections together with acrylic resin, the final impression was taken with the custom tray, picking up the verification jig *(Fig. 18)*. The definitive master cast would be fabricated from this extremely accurate final impression, with the implant verification jig ensuring a passive fit for the final prosthesis.

Next, the dental lab scanned the final wax setup and definitive master cast,

Figure 13: *The master and opposing models were articulated to verify the prosthetic design, including the centric relationship and vertical dimension of occlusion, prior to patient try-in.*



Figures 14a–14c: *An implant verification jig was fabricated by the lab in order to capture the exact position of the implants in the final impression.*

Figure 15: *A custom tray was provided that would pick up the implant verification jig in the final impression.*

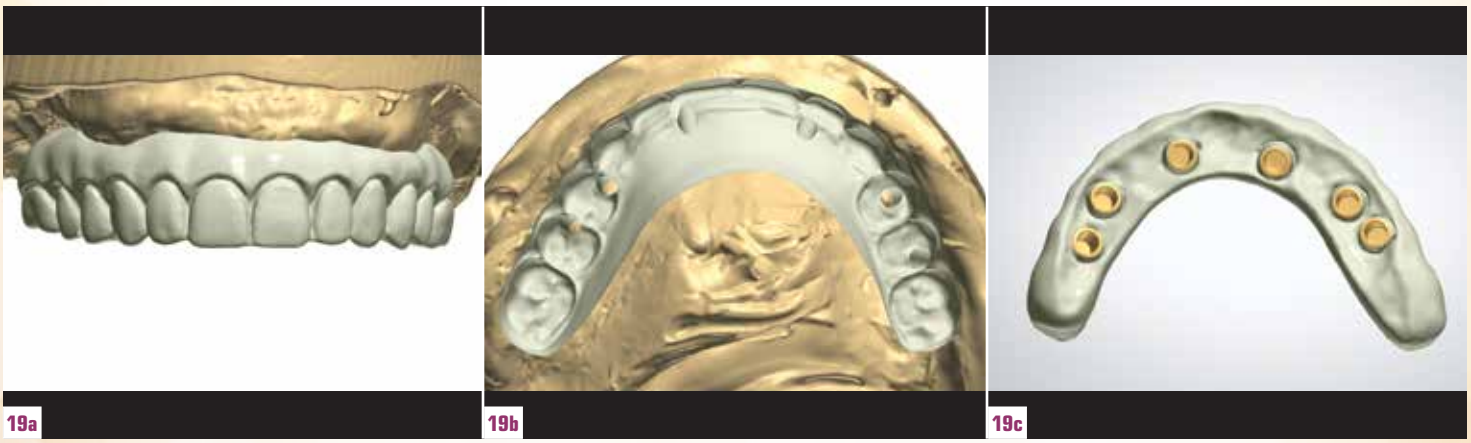
Figures 16a, 16b: *The wax setup was tried in for evaluation of the definitive prosthetic design, including esthetics, function and occlusion.*

precisely capturing the doctor-approved setup and the exact positioning of the implants for CAD/CAM processing. CAD software was used to finalize the prosthetic design, ensuring a configuration that accommodated the positioning of the implants *(Figs. 19a–19c)*. The occlusion, jaw relationship and teeth positioning were digitally verified *(Figs. 20a–20c)*. Next, the provisional implant prosthesis was milled, replicating the form of the approved setup *(Fig. 21)*. This temporary restoration is produced from poly(methyl methacrylate) (PMMA), which is easily modified, yet durable. In addition to providing the patient with a functional prosthesis while the final restoration is fabricated, the provisional adds one last layer of quality control, giving the patient and doctor an opportunity to verify the definitive design before the final prosthesis is milled from BruxZir Solid Zirconia. Although alterations at this point are uncommon, any changes are incorporated into the digital design prior to production of the final restoration.

The provisional appliance was seated at the next appointment and the occlusion, function and esthetics were verified *(Figs. 22a, 22b)*. The screw access holes were covered so the provisional could be left in place to serve as an

Figures 17a, 17b: *The individual sections of the implant verification jig were threaded into each implant intraorally.*

Figure 18: *A clean final impression was made, picking up the implant verification jig and thus ensuring passive implant positioning during fabrication of the definitive master cast.*



Figures 19a–19c: *The prosthetic design was digitally fine-tuned based on the definitive master cast and the final-approved setup.*

interim prosthesis while the final restoration was fabricated by the lab.

The final BruxZir Full-Arch Implant Prosthesis was milled from the same CAD/CAM design used to produce the provisional *(Fig. 23)*. Six titanium copings were permanently bonded in the precise positions needed to connect to the implants with a passive fit *(Figs. 24)*. The final prosthesis was seated in the patient's mouth, and the prosthetic screws were tightened to the appropriate torque per the implant manufacturer's instructions. The access holes were then sealed with composite. The final restoration fit perfectly upon delivery and met the expectations of the patient and doctor alike *(Figs. 25a, 25b)*. The patient was extremely pleased with the esthetics of the final restoration, which should enjoy the same long-term prognosis as the osseointegrated implants *(Figs. 26a, 26b)*.

WATCH THE VIDEO

Dr. Kosinski explains the case at
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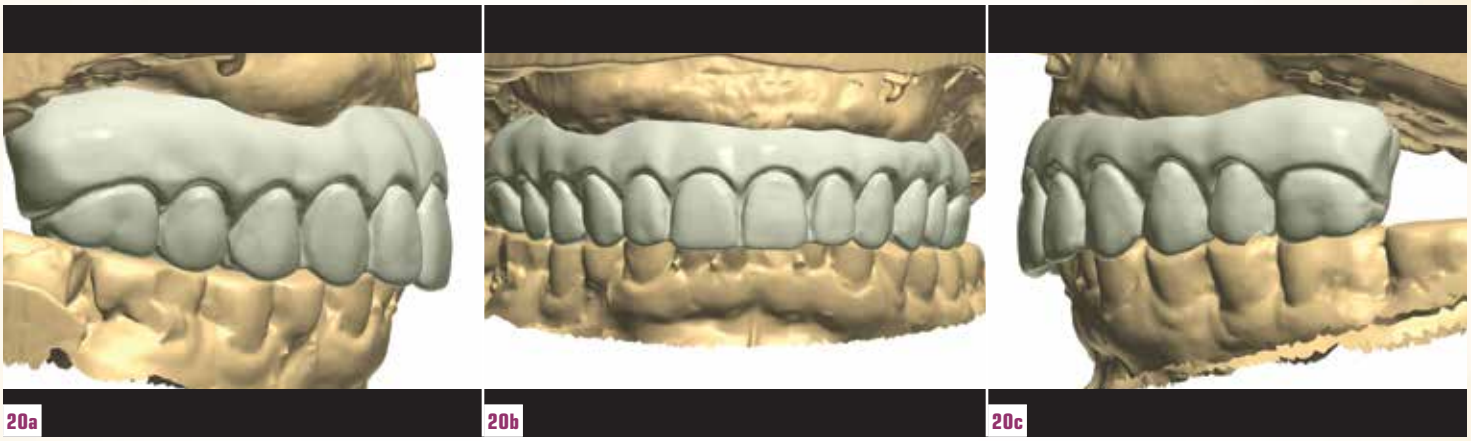


Figures 20a–20c: *CAD/CAM software allows for confirmation of esthetics, interocclusal relationship, and other design parameters prior to fabrication of the full-arch prosthesis.*

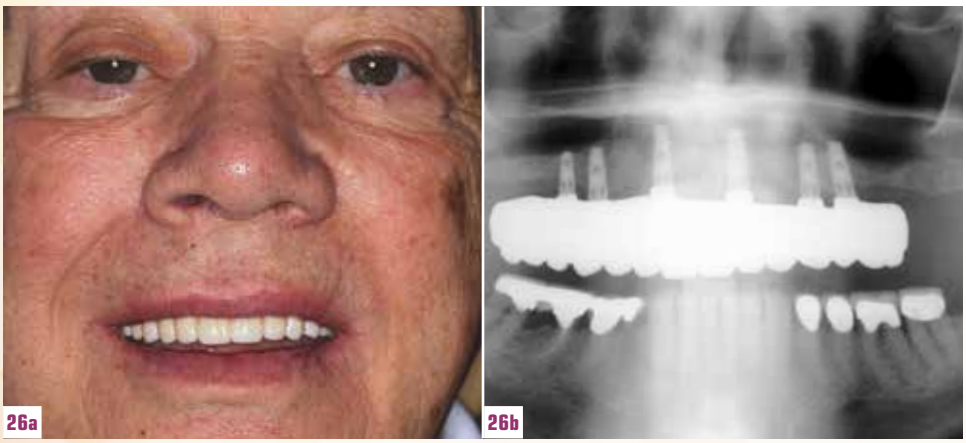
Figure 21: *The CAD/CAM-produced provisional was milled and sent to the doctor for verification of the final restorative design.*

Figures 22a, 22b: *The esthetics of the provisional implant prosthesis were ideal, and the patient was satisfied with the definitive prosthetic design.*

Figure 23: *Because no adjustments were required, the final monolithic zirconia prosthesis was milled from the same design used to produce the provisional.*

Figure 24: *The final monolithic zirconia prosthesis was milled with openings for the titanium copings, which were permanently bonded into place.*

Figures 25a, 25b: *As a duplicate of the provisional implant prosthesis, the final restoration offered the exact esthetics and function approved by the patient.*



Figures 26a, 26b: *The final BruxZir Full-Arch Implant Prosthesis provided the patient with a permanent restoration that leverages the resilience of osseointegrated implants with the durability of monolithic zirconia.*

Conclusion

For many years, the best implant option for the fully edentulous has been the fixed acrylic hybrid denture. Although these appliances have served patients well and have been nothing short of life-changing, they have also been subject to wear, chipping, breakage, and debonding of the denture teeth. Recent technological innovations have brought about the BruxZir Full-Arch Implant Prosthesis, which pairs the optimal function of the traditional hybrid with the superior strength of monolithic zirconia. As patients respond to the newest and best implant dentistry has to offer, the ability to create restorations that are at once esthetic and durable is both rewarding to the dental professional and sought after by the public. **IM**

REFERENCES

1. *Clinicians Report. Jun 2014;7(6).*
2. *Covani U, Cornelini R, Calvo JL, Tonelli P, Barone A. Bone remodeling around implants placed in fresh extraction sockets. Int J Periodontics Restorative Dent. 2010 Dec;30(6):601-7.*
3. *Maló P, de Araújo Nobre M, Lopes A, Ferro A, Gravito I. All-on-4® Treatment Concept for the Rehabilitation of the Completely Edentulous Mandible: A 7-Year Clinical and 5-Year Radiographic Retrospective Case Series with Risk Assessment for Implant Failure and Marginal Bone Level. Clin Implant Dent Relat Res. 2014 Dec 23.*