Success With Screw-Retained Zirconia Bridges, Part Two:
Surgical and Prosthetic Steps

Authored by Michael Tischler, DDS; Scott D. Ganz, DMD; and Claudia Patch, DMD

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ABOUT THE AUTHORS

Dr. Tischler is a general dentist in private practice in Woodstock, NY. He is a Diplomate of the American Board of Oral Implantology/Implant Dentistry, a Diplomate and Fellow of the International Congress of Oral Implantologists, a Fellow of the American Academy of Implant Dentistry, and a Fellow and graduate of the Misch International Institute. He is on the continuing education editorial board for Dentistry Today and on the editorial advisory board for the Journal of Implant and Advanced Clinical Dentistry. He has published many articles in various dental journals and lectures internationally on the principles of implant dentistry and bone grafting. He is the director of the dental implant department for Tischler Dental Laboratory and is also on the BioHorizons educational speakers’ panel. He offers in-office courses at his teaching facility in Woodstock many times during the year and has a popular instructional DVD available that covers the principles of implant dentistry and bone grafting. He can be reached at (845) 679-3706 or at tischlerdental.com.

Disclosure: Dr. Tischler is the owner of Tischler Dental Laboratory, which produces the Prettau Implant Bridge. He is also on the Biohorizons Implant System Educational panel.

Dr. Ganz graduated from the University of Medicine and Dentistry of New Jersey (UMDNJ) Dental School and then completed a 3-year specialty program in maxillofacial prosthetics at MD Anderson Cancer Center in Houston, Tex. He is a Fellow of the Academy of Osseointegration, Diplomate and member of the Board of Directors of the International Congress of Oral Implantologists, on staff at Hackensack University Medical Center, and is on faculty at UMDNJ Dental School. He maintains a private practice for prosthodontics, maxillofacial prosthetics, and implant dentistry in Fort Lee, NJ. He currently serves as associate editor for the peer-reviewed journal Implant Dentistry and is on the editorial staff of many other publications. He has more than 70 publications in various professional journals and has contributed to numerous scientific textbook chapters. His book, An Illustrated Guide to Understanding Dental Implants, has been a classic for patient education for more than 19 years. He regularly presents internationally on the prosthetic and surgical phases of implant dentistry and is considered one of the world’s leading experts in the field of computer utilization for 3-D diagnostics and treatment planning applications. He can be reached at (201) 592-8888, at sdgimplant@aol.com, or at drganz.com.

Disclosure: Dr. Ganz has a financial interest in the Prettau Implant Bridge.

Dr. Patch is a general dental practitioner in Woodstock, NY. In 2009, she received her DMD degree from the University of Connecticut School of Dental Medicine where she received various awards, including the American Academy of Esthetic Dentistry Merit Award. Together with Dr. Tischler, Dr. Patch is part of the Prettau Implant Bridge team, performing the restorative aspects of the process. Additionally, Dr. Patch is a continuing education lecturer on the restorative components of the Prettau Implant Bridge. In 2012, she was selected as one of Dental Products Report's Top 25 Women in Dentistry. She can be reached at claudia@tischlerdental.com.

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INTRODUCTION

A zirconia, implant-supported, screw-retained bridge offers many advantages for full-arch tooth replacement. The advantages over the alternative fixed options are less susceptibility to chipping, better implant stabilization, and...
ideal aesthetics. In part one of this 2-part series, the aspects of treatment planning for a full-arch, zirconia, screw-retained bridge were covered. Part one reviewed the necessary treatment planning steps in detail, and important techniques for presenting the plan to the patient. Part 2 of this series outlines the surgical and prosthetic steps for patients who present with the need for fabrication of a full-arch reconstruction, and specifically, a zirconia, implant-supported, screw-retained Prettau restoration.

The surgical steps necessary to deliver an ideal zirconia option include: presurgical prosthetic planning, extraction, soft-tissue reflection, alveoloplasty, osteotomy preparation, implant placement, grafting, and implant uncovering. Once the surgical phase has been completed, the prosthetic phase will then include initial presurgical and post-surgical impressions, delivery of the first interim prosthesis, final impressions, verification indexing, try-in of a screw-retained wax setup, the delivery of a second screw-retained interim prosthesis milled from a disk of polymethylmethacrylate (PMMA) (if required), delivery of the definitive Prettau restoration, and an occlusal nightguard.

Each of the surgical and prosthetic steps will now be outlined and explained through clinical illustration in an attempt to aid the clinician in providing full-arch, implant-supported, screw-retained, zirconia restorations.

**OVERVIEW OF THE SURGICAL STEPS**

The surgical steps needed to create success for full-arch, zirconia, implant-supported, screw-retained restorations are based upon a proper diagnosis and treatment planning contingent utilizing CBCT imaging (Figures 1 and 2). Once the plan has been accepted, the proper sequence begins with extractions (when teeth are present), careful soft-tissue reflection, alveoloplasty (as required), implant placement, bone grafting, management of healing, and surgical uncovering of the implants. Although each patient’s clinical presentation may be unique and different, the surgical steps should occur in the recommended sequence to provide for successful treatment outcomes. Having a standard sequence to inform patients allows for improved efficiency and better treatment for the patient. The authors agree that expeditious surgical treatment through efficiency and planning is an important principle that minimizes blood loss, reduces the chance of infection, patient morbidity, and results in an improved treatment experience for the patient (Figure 3).

**Extractions**

Patients who are dentate require tooth extractions. Good diagnostic and surgical skills set the tone for the entire case, starting with careful tooth removal. It is important that site preservation techniques be employed to maintain as much bone as possible. When residual bone is available post-extraction, it provides for increased implant stability, better containment for bone grafting, and improved visualization of implant positions and angulations during implant placement if a surgical guide is not utilized (Figure 4). Although alveoloplasty may be required to level bone around an
extraction site, any available bone that can be maintained can be an advantage and should be visualized on the CBCT scan. Recommended techniques for atraumatic extraction are: utilizing rotation when possible, sectioning molars, utilizing leverage forceps, the careful use of elevators, and allowing enough time for the bone to expand to help elevate a root. To improve efficiency and expedite treatment, the authors recommend that clinicians organize a separate and dedicated surgical kit with all the instruments required.

Soft-tissue reflection for full-arch implant placement is the next surgical step in the sequence. A mid-crestal incision with full-thickness, muco-periosteal reflection is advocated when alveoloplasty is necessary (as defined by the CBCT based diagnosis and treatment plan). A periosteal elevator is used to reflect tissue, while keeping the instrument on the bone, whenever possible. For the maxillary arch, it is important to reflect far enough distally so that the sinus walls can be visualized to aid in determining the location of the most distal implant position. However, caution is advised since there are vital adjacent structures to avoid, including the infraorbital foramina and the palatal arteries located on the palate. The structures are usually superior enough from the reflection areas that they are not commonly a concern. A CBCT scan can aid in locating the position of the mandibular bilateral mental foramina. The mandibular arch often requires enough reflection for visualization of the mental foramina to provide an adequate zone of safety from the mental nerves. A lingual bilateral tieback with sutures helps to reposition the reflected soft-tissue flap from the surgical field of view (Figure 5).

Alveoloplasty
When planning for a screw-retained, full-arch restoration fabricated from monolithic zirconia, it is extremely important to have an appropriate vertical height, measured from the implant platform to the occlusal table, for adequate material thickness. The recommended minimal “prosthetic space” is 12.0 mm; this can be determined by measuring the pre-existing vertical dimension of occlusion (VDO). If there is inadequate VDO, it can be re-established (or opened) by changing the occlusal height or the opposing arch to achieve the required prosthetic space, or through alveoloplasty. Alveoloplasty, or vertical reduction of the crestal bone, is the most predictable way to ensure adequate prosthetic space. In addition to the required vertical height necessary for the material thickness, the amount of alveoloplasty will be dictated by a patient’s smile line in the maxillary arch. To achieve ideal aesthetics, it is necessary to keep the junction between the zirconia and the gingival crest hidden when a patient smiles (Figure 6). This is not an aesthetic concern on the mandible. A CBCT scan will indicate the adjacent anatomical markers to gauge the amount of bone to be removed. Often, an extraction site can be used to visually gauge the amount of bone to be reduced, using the implant receptor sites as a reference. A general rule is to place 10.0- to 12.0-mm length implants as apically as possible, and then to remove the vertical bone height (as needed) to obtain that position. For this type of restorative option, the surgical mindset is to reduce bone to achieve prosthetic success. While many clinicians are initially reluctant to remove bone, once the benefits are realized, that reluctance is negated.
Alveoloplasty can be performed with either a round surgical bur on an electric handpiece, or an impact air handpiece. Both techniques require copious irrigation to avoid overheating of the bone, as well as good evacuation (Figure 7). Pre-prosthetic surgical planning with CBCT and interactive treatment planning can also provide clinicians with a “guided” method to achieve the desired amount of alveoloplasty through the fabrication and utilization of a bone reduction template.4

**Implant Placement**

The desired position for implant placement as performed by the authors follows a standard sequence in both the maxilla and mandible. A CBCT scan is acquired after any extractions and prior to implant placement to assist in planning. In the maxilla, the goal is to place a minimum of 6 implants between the sinuses, unless there is adequate bone posteriorly to place implants of appropriate width and length. If there is inadequate posterior bone, the distal-most maxillary implants should be placed so that the angulation mimics the anterior wall of the sinus, or mesial to it (Figure 8). This precise placement can be achieved by taking an intraoperative radiograph, with a radiographic marker used as a guide. These distally inclined implants allow for an increased anterior-posterior spread with the prosthetic goal to have a one-tooth cantilever. The next implants can be placed sequentially in the maxilla anteriorly on either side of the incisal foramen, as close to the foramen as possible. Ideally, the implants should be angled according to the prosthetic plan trying to direct the screw-access holes toward the cingulum areas of the proposed restoration. The next sequence involves the placement of the middle implants between the distal implants, and the implants adjacent to the incisal foramen, positioned with the screw-access holes directed toward the lingual or palatal.

For the mandibular arch, it is recommended to place 5 implants between the mental foramina, with the prosthetic goal to have a one-tooth distal cantilever (Figures 9 and 10).5 The distal implants should be placed 3.0 mm anterior to the foramen with a 30° distal angulation. In order to avoid the anterior loop of the mental nerve as identified on the CBCT scan, the mental foramen needs to be visualized with adequate reflection during the surgical intervention. Following the recommended sequence, the next implant is placed anteriorly in the middle of the mandible with a lingual inclination for correct emergence of the screw-access hole. The next implants should bisect the distal and middle implant (angulated toward the cingulum) to avoid facial emergence of the screw-access hole. If an immediate loading protocol was planned, the implant insertion torque should be at least 35 Ncm or have an ISQ value exceeding 67 to provide adequate stability of the implants to support a screw-retained provisional prosthesis.

**Grafting**

When tooth extractions are required, the residual tooth sockets will leave voids in the alveolus. The authors have found that bone grafting is often required to fill these voids, and to help to provide support for the soft tissues. The authors use demineralized freeze-dried bone allograft
(DFDBA) bone putties exclusively for this purpose. The crestal contour of the soft tissue plays an important role in long-term hygienic maintenance. Therefore, it is desirable for the ridge to heal with a flat profile, resulting in a more hygienic prosthesis. The DFDBA putties do not migrate when placed, and are hemostatic and osteoinductive, making them ideal for this purpose (Figure 11).6 Careful soft-tissue management, proper closure, and suturing techniques all aid in the healing process when the implants are buried in a conventional 2-stage protocol.

Surgical Uncovering of the Implants

After an adequate healing phase, a 2-stage protocol requires the exposure of the implants, and careful management of the soft tissue cannot be underestimated. The surgical procedure to uncover the implants represents an opportunity to reposition the right amount of keratinized tissue toward the facial of the implants. To facilitate the prosthetic phase, it is also important to ensure that the coronal aspect of the implants is not buried too deep under the tissue (Figure 12). Keratinized tissue surrounding the implant allows for reduced peri-implant issues and improved implant health.7 Though adequate keratinized tissue is critical, too much tissue is problematic. The implant platform should not be more than 3.0 mm below the free gingival tissue to avoid path of insertion issues and/or potential pain due to compression of the tissue during try-in stages. If the implants are too deep in the tissue intermediate, multiunit abutments might be required, adding to the components required for the restoration as well as the cost of the restorative phase. Through the manipulation and/or reduction of abundant tissue at the surgical uncovering appointment, the desired tissue height can be obtained. When an immediate load protocol is utilized, the soft-tissue cuff height can be manipulated when repositioning and suturing the tissue at the time of surgical implant placement.

PROSTHETIC STEPS

Pre-Prosthetic Planning and Initial Impressions

The treatment plan must consider how a patient is to be provisionaled, during implant healing and after implants have been uncovered. Once the method for provision-

alization has been established, a complete evaluation of aesthetic parameters (with an emphasis on the patient's VDO, incisal edge position, gingival display, and lip mobility) is performed. In a team approach, it is critical that the prosthetic doctor work closely with the surgeon to ensure that a sufficient alveoloplasty is done to create the minimal prosthetic space of 12 mm. In the maxillary arch, the alveoloplasty will also serve to hide the juncture of the pink prosthetic gingival area underneath the patient's lip when the patient is smiling maximally (Figure 13).

If only one arch is being treated, evaluation and adjustment of the opposing arch may be required to straighten or manage the occlusal plane. Initial full-face photographs of the patient at rest and at full smile, as well as close-up photos of the patient in occlusion, are taken for reference. Upper and lower alginate impressions that fully capture the vestibule areas, a centric bite relation, and facebow records are taken. The shade and tooth mould is selected with patient input. If a patient is edentulous at first
presentation, a conventional denture technique using a wax rim followed by a wax try-in is used to determine tooth position prior to surgery. A denture and duplicate wax-up are requested from the dental laboratory team.

**Delivery of the First Interim Prosthesis**

Immediately following extraction and implant placement, the first provisional restoration is delivered. Options for provisionalization include temporization with a denture, or an immediately loaded, screw-retained provisional. Transitioning a patient by retaining teeth to support a cement-retained provisional is contraindicated, as it will interfere with an effective alveoloplasty procedure. If a complete denture is to be utilized for the provisional restoration, the authors recommend relining the denture with COE-SOFT (GC America). This material is ideal because more material can be easily added as bone remodeling and tissue changes occur during the initial healing phase. When a conventional 2-stage procedure is utilized, the reline process can capture the healing collars following the uncovering of the implants.

**Final Impression and Indexing**

The authors advocate a splinted, open-tray impression technique due to increased accuracy than alternative techniques. A polyether impression material (Impregum [3M ESPE]), used with MiraTray (Hager Worldwide) impression trays, is highly recommended (Figure 14). The authors recommend using nonrotating, implant-engaging impression copings in the anterior region, and nonengaging impression copings for the distal-most areas. Nonengaging impression components in the posterior areas (where implants are divergent) will prevent the splinted, open-tray impression from getting locked on at the time of the open-tray splinted impression. Engaging, or “indexed” impression copings are used to ensure that multiunit abutments can be properly positioned, should they be deemed necessary in the anterior region; or when the implants will obviously require re-angulation. The authors recommend that the laboratory team determine the need for multiunit abutments after the soft-tissue models are fabricated and the diagnostic wax-up can be evaluated. When the relationship between the desired tooth position and implant position has been reviewed, the need for multiunit abutments can be determined by the laboratory technician. The lab team can then order the most appropriate abutments, negating the need for clinicians to stock components. In the posterior areas, where access hole placement is less aesthetically important, the authors will usually attach the prosthesis directly to the implant without the use of an intermediate abutment.

Ideally, indexing of the dental implant position is performed by relating the implant position to an approved wax setup (Figure 15). When the provisional is a denture, the duplicate wax setup, initially requested from the lab team, can be tried in and modified during healing time until patient and provider approval is achieved. If the provisional is an immediately loaded, screw-retained prosthesis, the duplicate wax-up can often provide a better starting point than would be achieved by indexing to a wax rim. Indexing can be performed either on healing caps or directly to the implant screw-access hole. Accurate indexing requires the use of a very rigid material such as classic set Blu-Mousse (Parkell). A centric bite registration is also required for proper mounting of the final impression. A verification jig and screw-retained wax-up setup should then be requested from the laboratory team.

**Verification Jig and Screw-Retained Wax-Up Try-In**

Confirmation that the final impression is accurate is particularly critical for screw-retained prosthetics, or
biological and prosthetic complications can result.\textsuperscript{11} Therefore, proper use of a verification jig to confirm the accuracy of the final impression is required (Figure 16). The verification jig should be placed in the mouth, secured to the implants, and the clinical passivity of fit confirmed by completing Sheffield testing, and then reconfirmed of complete seating of the jig radiographically. The screw-retained wax setup is then tried in and evaluated with respect to aesthetics, phonetics, VDO, and occlusion. If significant modifications to the setup are required, try-in of a new screw-retained wax setup will be necessary. Photographs should be taken to facilitate communication with the laboratory team. If the wax setup is approved, the lab team should be asked to return a screw-retained, CAD/CAM-milled, PMMA, provisional restoration.

**PMMA Delivery**

If multiunit abutments are required, they can be placed when the screw-retained PMMA is delivered (if they were not placed previously). If the final impression was not an abutment level impression, a new tissue impression will be required following delivery of the multiunit abutments so the laboratory can properly orient the multiunit analogs on the master working cast. The authors advocate using a soft body vinyl polysiloxane (VPS) impression material expressed around the existing verification jig that has been broadened to act concurrently as a custom tray.

The screw-retained, PMMA provisional should be inserted and evaluated in terms of occlusion, aesthetics, phonetics, and hygienic access. Achieving mutually protected occlusion or group function occlusion with shallow anterior guidance is ideal when opposing natural dentition or with another full-arch fixed-implant restoration.\textsuperscript{12} Aesthetic modifications can be achieved with disks and burs to fully customize the final aesthetic result (Figure 17). When evaluating phonetics, it is imperative on the maxillary arch that there is intimate contact between the intaglio surface of the prosthesis and the tissue surface, or phonetic complications or “air bubbling” will result. If contact is inadequate, cold cure acrylic or tray adhesive and composite can be added to the intaglio surface to achieve enhanced tissue contact. If this is required, it should alert the restorative doctor that the soft tissue may have changed since the final impression was taken, and a new soft-tissue impression should be taken so that the final restoration will have the proper soft-tissue contours. This impression can also be taken by expressing soft-body VPS impression around the broadened verification jig. The ability to cleanse the restorations should be evaluated at the PMMA stage, and any modifications to improve hygiene access should be made at that time. Hygiene access will be affected by prosthetic design contingent upon proper surgical protocol, which results in a flat healed ridge with sufficient bone reduction to allow for a hidden prosthetic gingival to natural gingival margin without over-flanging. The PMMA restoration is digitally scanned in the dental laboratory with a desktop optical scanner prior to being sent to the restorative clinician for delivery. If any modifications to the PMMA restoration are required, the restoration must be screwed onto the master cast, and a high-quality VPS impression should be taken to record the differences. The resultant cast will then be digitally superimposed or...
“married” to the pre-scanned digital PMMA to ensure that the final restoration will be a replica of the modified PMMA.

**Final Prettau Bridge and Occlusal Guard Delivery**

Delivery of the final zirconia Prettau Bridge is similar to delivery of the screw-retained PMMA. Upon insertion, passivity of the final prosthesis should be evaluated and complete seat of the prosthesis confirmed radiographically. The occlusion should be checked and adjusted. Although the occlusion has been previously ascertained at the PMMA stage, small modifications to the occlusion will still be necessary at final delivery (Figures 18 to 20). Phonetics, aesthetics, and cleansability are confirmed. The use of an occlusal guard may reduce overload from nocturnal parafunction.13

Regardless of documentation of bruxism, the authors advocate utilization of an occlusal guard whenever the Prettau Bridge (Tischler Dental) is opposing natural teeth or other fixed implant-supported restorations.

**IN SUMMARY**

Part 2 of this 2-part series reviewed both the surgical and prosthetic steps required to achieve successful full-arch, screw-retained, zirconia restorations. The methodical sequencing demonstrated predictable surgical steps of extraction, tissue reflection, alveoloplasty, osteotomy preparation, implant placement, grafting, and implant uncovering. The importance of adequate bone reduction in order to provide sufficient prosthetic space cannot be underestimated. Proper prosthetic steps included: preliminary impressions, delivery of interim prosthesis, final impressions, indexing, verification jig try-in, screw-retained wax-up try-in, delivery of the transitional PMMA restoration, followed by delivery of the final zirconia bridge. If the recommended steps as outlined herein are properly followed, success with the final prosthesis can be predictably achieved.

**REFERENCES**


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1. The surgical steps needed to create success for full-arch, zirconia, implant-supported, screw-retained restorations are based upon a proper diagnosis and treatment planning contingent utilizing CBCT imaging.
   a. True  
   b. False

2. Having a standard sequence allows for improved efficiency and better treatment for the patient.
   a. True  
   b. False

3. The authors state that there is no reason to organize a separate and dedicated surgical kit.
   a. True  
   b. False

4. A mid-crestal incision with full-thickness muco-periosteal reflection is advocated when alveoloplasty is necessary.
   a. True  
   b. False

5. The mandibular arch often requires enough reflection for visualization of the mental foramina to provide an adequate zone of safety from the mental nerves.
   a. True  
   b. False

6. Related to achieving ideal aesthetics, it is not necessary to keep the junction between the zirconia and the gingival crest hidden when a patient smiles.
   a. True  
   b. False

7. For the mandibular arch, it is recommended to place 4 implants between the mental foramina, with the prosthetic goal to have a one tooth distal cantilever.
   a. True  
   b. False

8. The authors have found that bone grafting is often required to fill these voids, and to help to provide support for the soft tissues.
   a. True  
   b. False

9. Keratinized tissue surrounding the implant allows for reduced peri-implant issues and improved implant health.
   a. True  
   b. False

10. In a team approach, it is critical that the prosthetic doctor work closely with the surgeon to ensure that a sufficient alveoloplasty is done to create the minimal prosthetic space of 8.0 mm.
    a. True  
    b. False

11. The authors advocate a splinted open-tray impression technique due to increased accuracy than alternative techniques.
    a. True  
    b. False

12. Achieving mutually protected occlusion or group function occlusion with shallow anterior guidance is ideal when opposing natural dentition or with another full-arch, fixed-implant restoration.
    a. True  
    b. False
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ANSWER FORM: VOLUME 33 NO. 10 PAGE 106

Please check the correct box for each question below.

1. ☐ a. True  ☐ b. False
2. ☐ a. True  ☐ b. False
3. ☐ a. True  ☐ b. False
4. ☐ a. True  ☐ b. False
5. ☐ a. True  ☐ b. False
6. ☐ a. True  ☐ b. False
7. ☐ a. True  ☐ b. False
8. ☐ a. True  ☐ b. False
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