Zirconium Dioxide Implant Solutions
A Metal-Free Option

David DiGiallorenzo, DMD

Zirconia dioxide has a long history of use in orthopedic and dental applications. Zirconium (Zr) is a metal; however, through a chemical reaction with oxygen, zirconium is converted to zirconia or zirconium dioxide (ZR02). Currently, there are several manufacturers of zirconia dioxide dental implants.

Z-Systems, a Swiss-manufactured single-piece dental implant, was FDA approved more than four years ago for use in tooth-replacement therapy. Developed in 2001 by Dr. Ulrich Volz, in collaboration with Metoxit, a world leader in the production of ceramic material, the new implants offered a predictable way to produce strong, dimensionally stable, metal-free implants using the isostatic process.

A key element of success in the process is the quality of the raw materials and the technology of the production.

Not all zirconia is created equal. Currently, worldwide it is estimated that 3 percent of patients may be sensitive to titanium.1-7

In addition, the systemic toxicity associated with titanium nanotechnology is still unknown.8 However, it does appear there is peripheral organ accumulation of metal ions in certain clinical situations.9-10

How this affects overall health is still unknown. With increasing frequency, patients are requesting metal-free biologic implants and restorative solutions. Many holistic and esthetically oriented doctors and patients are looking for a metal-free esthetic option in tooth replacement therapy.

Zirconia biocompatibility has been successfully documented in animal studies and human studies. These studies have found zirconia to be biologically compatible with osseo-integration. Specifically, they have reported cellular responses similar to titanium, similar bone-to-implant contact, simi-
lar healing times, similar biomechanical strength and similar soft-tissue biologic width, and similar removal
torque values.11-25

Additionally, several studies have shown less inflammatory infiltrate at the implant abutment junction
and less bacterial colonization in this region, which may have clinical significance regarding short and long-
term biofilm accumulation and susceptibility.26-30

The only human clinical retrospective study to date in the literature on human success rates of
zirconia reported a 92 percent success for smooth surface zirconia and 97 percent for rough surface zirconia
over five years and 831 subjects.31

The Implant

The Z-look Evo is a single-stage threaded implant with a prep-able abutment. It is imperative to use
the 49 micron zirconia prep bur for reduction to reduce microcrack propagation. Preparation can be com-
pleted at placement. There is no risk of heating of the implant body because of the low thermal conductivity
of the material.32 The apical thread pattern is self-tapping. The current surface is sandblasted to improve
surface character- istics. However, a new dual-processed sand-blasted and laser-etched surface is now
available.

The single-stage design eliminates the effects of the microgap and micromotion on the crestal
interface of bone and soft tissue [Fig. 1]. The current diameters range from 3.3 to 5.5 mm and from 8.5 to 15
mm length [Fig 2].

Diagnosis and Treatment Planning

The author has been selectively placing zirconium Im-
plants during the last three years. The following consid-
erations should be strictly adhered to when considering diagno-
sis and placement. Consider guided surgery for optimal align-
ment from a top (crown)-down approach. The abutment can
be prepped up to 20 degrees. Any misalignment beyond 20
degrees will cause restorative complications. Snap Caps and
Analogs are available for impressions and lab processes [Figs.
3-5].

Only place the implant in healthy patients with no sys-
temic and local risk factors such as
smoking, diabetes, poor bone qual-
ity and metabolic deficiencies. Type
1-2 host bone is ideal for successful
integration.

Zirconia tends to lag four
weeks behind in cellular biologic fixa-
tion, according to
animal studies. In sites with native
bone, I will allow implants to remain
undisturbed
for four months on the lower and six
months on the upper.

Limiting any micromotion at
the bone to implant interface is crucial. An essex appliance is recommended during healing. Because grafted
sites still contain areas of devitalized bone, longer healing times are important.

The following healing times are suggested for grafted sites. Allow grafted bone in extraction sockets
on the maxillary arch to heal a minimum of six months, even when using bioactive modifiers; sinus grafts a
minimum of eight months; and lateral ridge augmenta-
tions on the upper and lower arch eight months prior
to implant placement.

Consider undersizing the osteotomy to develop optimal primary stability. Progressive long-term load-
ing in provisionals is highly recommended to begin the accommodative physiologic bone response at the
 cellular level. There is no replacement for experience, and the success of zirconia implant therapy is directly
related to the operators’ surgical and prosthetic skills and experience.

Biology

The primary means of surface modification to enhance surface microtexture on zirconia include acid
etching, laser etching and sandblasting. These processes will enhance the hosts’ cellular response and
secondary fixation. However, remember zirconia’s secondary fixation occurs about four weeks slower than
Crestal biologic bone response will always include accommodative bone resorption to the first thread. As a result of the implant design, 2 mm of bone loss will occur upon placement to provide room for biologic width [Fig. 6].

A two-piece design with a medialized offset will eventually provide the opportunity to preserve crestal bone, while providing optimal restorative interface options. Immediate loading and implants placed into extraction sockets is not recommended at this time, as there is not enough clinical information or literature to support this approach.

Soft-tissue response is remarkable with crestal creeping soft-tissue attachment over time [Fig. 7]. It has been shown fibroblasts migrate extremely well on zirconia surfaces.\(^{35-36}\) As well, biofilm development is retarding as result of the surface biodynamics.\(^{37}\)

To date, I have not reported any biomechanical failures including fracture, nor have any been reported in the literature. It appears from the literature that at the 12-week point in animal studies, the bone to implant contact and removal torque analysis for zirconium and titanium is the same [Fig 8].

Stress distribution for zirconia and titanium is the same. The esthetic benefits of zirconia prevent the grey show-through associated with many titanium implants, particularly in the thin biotypes [Fig. 9].

**Case Study**

A 55-year-old man with remarkable health had lost #8 five years prior. The area was never grafted. Zirconia success is optimal in host bone [Fig. 10]. A 4.0 by 13 Z–Look was secured under 50 ncm of torque [Fig. 11]. An essex appliance was placed for the duration of the four-month healing interval [Fig. 12]. A four-week post-op revealed dynamic soft tissue health and composition.

A provisional was placed at four months and progressively loaded over the next two months [Fig. 13].

A final all-zirconium crown was placed at six months. X-ray and cone beam at the one-year mark reveal crestal bone loss to the first
thread. However, they also show excellent tissue stability and esthetics [Figs. 14-17].

Figs. 14-15: A final all-zirconium crown was placed at six months.

Figs. 16-17: X-ray and cone beam at one-year mark reveal crestal bone loss to the first thread; however, they also show excellent tissue stability and esthetics.

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References
4. Elizabeth Valentine-Thon1, PhD; Kurt Müller2, MD; Gianpalo Guzzi3, DDS; Sybille Kreisel4, MD; Peter Ohnsorge5, MD & Martin Sandkamp1, MD Neuroendocrinology Lett 2006; 27(Suppl 1):17–24.
14. Stadlinger B, Hennig M, Eckelt U, Kuhlisch E, Mai R. Department of Oral & Maxillofacial Surgery, Faculty of Medicine, University of Technology Dresden, Germany.
Bailout Procedure for Cement Retained Implant Supported Crowns

Gerald Rudick, DDS

Over the many years that dental implants have become a reliable treatment option for replacing missing teeth, there has always been the controversial issue of whether the final crowns should be screw retained or cemented - the objective in both situations is safe, easy removal and retrievability if it becomes necessary.

A screw retained crown is very simple to retrieve as it is just a matter of uncovering the access hole to the screw, and reversing it. The advantage to screw-retained implant supported crowns, in addition to the ease of removal, is that there is never an issue of excess cement getting stuck deep under the gingival tissues.

In cementable situations the excess cement (always use temporary cement) is sometimes difficult to see visually under the margins. If the cement used was not very radiopaque, it will not show up as a foreign body, but might appear as particulate grafting material. The decision to use a cement retained crown depends largely on where the access to the screw will be in relation to the anatomy of the crown, and this of course depends on the position of the implant as it is usually determined by the available bone.

In the case of anterior teeth, if the access hole cannot be in the cingulum, then it cannot be used, and a cementable restoration is the only solution. For the posterior teeth, the screw access hole cannot be on a cusp, and is best to be in the occlusal fossa, to prevent porcelain fracture and appropriate axial loading.

Over the years, research has shown that a custom-made abutment is probably the safest option for cement retained crowns, because it follows the contour of the gingival tissues at what should be the CE junction; but this adds significant cost to the treatment. The excess cement that is released under the gingival tissues, will be close to the surface, be visible with the naked eye, and is easy to spot and remove; whereas in the case of using stock abutments, it might be more difficult to spot the excess cement, since it is at the bottom of the gingival sulcus at the bone level; the dentist may only become aware of this problem when tissue irritation is evident or there are destructive radiographic changes around the implant.

**Weak Link**

It does not matter what type abutment is used in a cementable case, stock or custom made; the weak link is always the risk of the abutment screw loosening. In multiple joined crowns, it is a simple matter to insert a crown and bridge remover under the joint and tap off the crowns. In the case of a well formed single unit, it is almost impossible to remove the cemented crown, as there is nothing for the crown and bridge remover to grip on to, or an instrument to push the crown off the abutment; and a loose abutment that is unsecured is like a tug of war with a rubber rope.
Case Study

The case presented is of two upper central incisor crowns inserted three years previously, one on an endodontically treated tooth, and one on an implant placed into a previously grafted site for a healthy 60 year old female. The patient came back to our office with the fear that her implant was failing, as the implant crown was loose.

Upon examination she had no pain, as pain would be indicative of a failing implant, and the gingival tissues appeared normal. The crown fit very well, and there was no edge or margin on which to seat a crown gripper, or a dental instrument. But a vibration could be felt when finger tapping on the crown.

Technique

Here is a simple solution to retrieve a loose cemented implant crown – no damage to the crown and no cost to the dentist! In the past, I have tried securing a copper band to the crown with compound and utilizing a paper clip to create a handle or purchase point for the crown remover. However, the back action force of the crown and bridge remover would often tear the relatively soft copper band [Figs. 5a–5e]. So, thanks to the suggestion of Frank Higgenbottom, DDS of Dallas, TX, I was able to utilize a stainless steel matrix band [Henry Schein] secured with a Tofflemire matrix band holder, to create a similar but stronger grip and purchase point [Figs. 6a-6b].
Summary
The crown was simply removed, the abutment unscrewed and the implant and abutment cleansed with Dakin’s solution (water and 5% chlorine). The stock implant abutment that was originally modified at the time of crown fabrication was securely screwed back, and temporary cement was used to secure the crown. It is most important that when removing a screwed on standard abutment, that its exact position be verified prior to placing the cement in the crown.

Fig. 7: Standard Adin hexagonal abutment cut down to allow space for cementable restoration. It was removed and placed without checking its exact position when replacing the crown; it had to be removed before the fresh cement set; this is the photo after the crown was removed – hence the splattering of cement particles.

Fig. 8: Implant crown replaced and cemented with temporary cement, with the abutment in the exact position.

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Extractions were done approximately three weeks ago. Now patient wants implants. What are my grafting options in the maxilla? Should I wait several months until sockets heal and sinuses pneumatize and then do sinus lifts, or should place particulate grafts into the defects now? Not sure there is much buccal plate remaining to contain graft material. Also, should I graft the lower left now or wait? Pt is a 55 year-old female. She says she has given up smoking for vaporizing.

William H. Pippin, DDS

What does the patient want? Other things of interests here are (1) Lip line (2) Perio status of remaining teeth - Without looking at photos it is hard to say but I feel a full upper clearance- wait 6-10 weeks then re-assess is a safer option. What are your thoughts?

Henry Mulla, NARELLAN Australia

I try to graft these sockets at the time of extractions and stage the sinus lift. But if that wasn’t discussed before and she wants implants now then I would graft the sinus in 5 weeks after getting and scan. Get some soft tissue closure.
over the sockets and initial bone growth in the mean time, which will make it easier to elevate and close the surgery. The lower...I would see the scan before making a decision. I am not sure about the vapor cigarettes, but as far as I am concerned it’s the same garbage with regard to bone grafts. If it can’t help it then it takes away from it. And patient should be aware IMHO.

**Michael Katzap DDS, MAGD**

At this stage please wait 3 months and then do a CT to see over the sockets and initial bone growth in the mean time, which will make it easier to elevate and close the surgery. The lower...I would see the scan before making a decision. I am not sure about the vapor cigarettes, but as far as I am concerned it’s the same garbage with regard to bone grafts. If it can’t help it then it takes away from it. And patient should be aware IMHO.

**Gregori M. Kurtzman, DDS, MAGD, FPFA, FACD, FADI, DICOI, DADIA**

At this point insufficient bone to support the implants if placed so would go and do sinus grafts (lateral approach) and sockets on lower wait 3 months and place the lower implants and the upper implants let heal 3 months on lower and 5 on upper before loading and restoring.

At this stage please wait 3 months and then do a CT to see how much buccal plate is left. No rush, let the bone level and remodel, and then decide what to do.

**Raul R. Mena, DMD**

I’m concerned about how sinus floor dropping down would affect final bone height if I perform lift now. Also, it appears to me that the membrane would be easier to access and elevate after the floor levels out. Perhaps my concerns are unfounded.

**Bill Pippin**

Wait until you have soft tissue continuity and then you can use a trephine to the floor of the sinus to then in-fracture that segment. After that you would then graft the space you just created when you mobilized the segment upward.

**William Schlesinger, DDS, MAGD, ABGD**

I think a lateral approach would give you more control since you have to lift the entire sinus but will also require grafting at the crest to fill the voids created when the teeth were extracted. I would wait till you get soft tissue closure then go in and do the grafting. Others may have differing opinions and would be great to hear them.

Certainly the lateral approach has a lot more history and documentation. Also I don’t have experience with this infracture technique however I think it may help the residual crest of bone be in a more ideal position as it relates to the remaining natural teeth.

**Dr. William Schlesinger**

If the crest didn’t have the large defects from the recent extractions I could agree but I think that is going to make the trephine approach harder – at time of extraction.

**Gregori M. Kurtzman**

I want to see the 3D - I am thinking we will have a different idea.

**Jeffrey C Hoos DMD, FAGD**

You removed the rotten teeth but you still have a filthy, diseased mouth with no posterior occlusion or stops! To really gain the patients confidence put out the fire before design and rebuilding.  
1. Make a couple of cheap wrought wire partial with a full palate on the upper. Will allow her experience of what full dentures will be like. Establish an occlusal plane for later, if more teeth are lost can be added easily and can be relived to protect grafted areas later.
2. Put her on an oral disease program. Period scaling, proxy brushes with Dakar’s solution and peroxide after thorough brushing all taught her by your assistant and checked weekly. When there is no bleeding and plaque, address decay. She now has a healthy mouth and confident that whatever you suggest will work and last.  
3. Now you can graft. Where needed, do sinus augmentation best as per CBCT, place implants and finally finish to an established occlusion. Not a HO, have done many like cases and they worked long term.

**Dave Dalise**

Dave’s suggestion is the only predictable way to treat this case. I would never place an implant into a
mouth where there is any bleeding at any location. Now that sounds kind of dogmatic but that is where I am at this point in implantology. When there is absolutely no bleeding anywhere in the mouth, then think about reconstruction of the posterior. That is what time and experience has taught us. There are mouths full of plaque and calculus but the key to implant success is no bleeding anywhere. That is going to be the key to this case. The reconstruction of the maxilla with a sinus lift will be easy. Once the mandible is healed, without a bunch of nonsensical bone grafting being done, it can be evaluated for implants. At the time of the extractions some plumbers tape can be glued over the sites and create a blood compartment. That works just like placing an immediate denture. For those who do not do a lot of immediate dentures, they change healing of extraction sites remarkably. I have never seen a dry socket under an immediate denture, and I do not think my experience is unique. Just placing a denture on extraction sites creates enough of a compartment for healing so that we do not see dry sockets and much better healing. Placement of a stayplate would have been equally effective in helping bone heal.

Douglas M. Martin DDS, FAAID, FICOI, MAIT, Diplomate ABOI/ID.

Retreating Anterior Implant Case for Maxillary Lateral Incisors

Here is a case I would like to get some opinions on - 29 year old female with congenitally missing lateral incisors. Implants placed 9 years ago are Nobel Replace Select 3.5mm. As you can see, the position of the implants is not ideal. What are the options to get this young woman a better smile? We did discuss removing the implants, grafting and replacing with better positioned implants as well as veneers on the Central Incisors. However, removing the implant in the left lateral position will be difficult due to its proximity to the canine.

Craig O’Donoghue, DDS, Fairbanks, Alaska

Are we looking at because of the age of the patient at time of placement? Way to young and this is what happens. Removing is going to be challenging without tremendous defect. Graft and growing tissue and getting tissue mature. I would think at least 6 months. For me would be multiple procedures - love to see the progression - How old now?

Jeffrey C Hoos, DMD FAGD

I can see why the other implant wasn’t placed. I would refer to an oral surgeon to remove and possible block graft the defect. Do you have a CT? I’ve see restorative heroics but most leave more than a little to be desired.

Richard D. Cottrell, DDS

Removing it is the only choice.

Raul R. Mena DMD
Not all cases need implants and this case may be better managed with ceramic bridges since the centrals need work to improve esthetics. Craig should remove them since it’s a female and the pre-maxilla (bone shouldn’t be real dense) what about placing a placement head into the implant and try to counter rotate it to break the integration which in theory should leave less of a defect compared to cutting it out worse case go to plan two and use piezo to remove them via the buccal (think once flapped there won’t be much thickness of buccal bone). In this case we did a gingivectomy on 1st premolars, right cuspid and both centrals to make the tooth longer gingivally. The implants were removed as they were too apical and too facial in placement. Can graft and place new implants or do three unit ceramic bridges [6-8 and 9-11] with pontics at the laterals. Centrals and cuspids will need to be made wider for better dimensions esthetically. The lateral at #7 currently is too wide in comparison to the central.

Gregori M. Kurtzman, DDS, MAGD, FPFA, FACP, FADI, DICOI, DADIA

Ideally one would redo the implant placement. Another option might be designing an abutment to look like gingival tissue and a tooth prep. Then do crowns on the lateral and veneers on the central - Thinking outside the box.

Richard G Knecht, RGK Dental Lab, Inc

Pink porcelain was used on the left lateral - which I just temporarily screwed back in. The angle and position still put the implant crown much more labially than the central incisors. I would rather bury the implants and do bridges than try and polish these turds.

Craig O’Donoghue

I know I’ll get a lot of bitching about this, since it is an implant forum and everyone is titanium happy, but do not discount eliminating the fixtures, doing some tissue recontouring to the canines and centrals, and doing fixed bridgework. Her centrals are way too narrow, and given her bone heights - unless you want to subject her to multiple bone augmentation procedures to gain vertical height, it is going to be extremely difficult to get a good aesthetic result with fixtures. It should be part of your differential treatment planning.

Gary L. Henkel DDS MAGD

Only way I can see this one Craig is removal and grafting then re-do later in ideal place as you suggested with other veneers.

Wayne Sutton, DDS,FACCE,FGAD,FDOCS,FADIA

If you’re going to restore the centrals and also veneer the cuspids anyway for better esthetics, why not forget implants at the laterals and place ceramic bridges? I agree Craig is highly capable of treating this but as I mentioned yesterday not every case has to be treated with implants. This case may be better managed with ceramic bridges then one has to decide do we take out the two implants or bury them and place osseous graft over them and place some all ceramic bridges in

Gregori M. Kurtzman

This is why I tend to shy away from replacing laterals in young patients. They should live another 80 years, lots of time for something to go wrong. I prefer a very conservative prep on the cuspids and a cantilever bridge to replace the laterals, if the occlusion allows. If the centrals need cosmetic help, I’d still go with conservative veneers on the centrals instead of a 3 unit bridge.

John Highsmith DDS, Clyde, NC

I have done a handful of cases like Craig posted using 3 unit emax veneer bridges 6-8, 9-11 from Bob Clark and Williams Lab. You need a great lab to pull that off. Standard minimal prep veneer preps on canines and centrals with some possible additional reduction on mesial of canines and distal of centrals for path of draw/connector room. eMax bonded entirely to enamel so it’s very strong and aesthetic. Proper case selection is important as you mentioned.

Arturo R. Garcia DMD

Yep, that’s a good conservative approach. Don’t know why I didn’t think of that.

Gary L. Henkel
Becoming Credentialed

The American Academy of Implant Dentistry (AAID) inducted 90 new Associate Fellows and Fellows into the Academy at its 63rd Annual Meeting. This brings the total number of current AAID credentialed members to 989. The Academy is the only organization recognized by the U.S. Federal and State Courts as having a bona fide implant dentistry credentialing program. Credentialing by the AAID means that the dentist has (1) Demonstrated qualifications, knowledge, skills and competence in implant dentistry (2) Education, training and experience in implant dentistry (3) Completed 300 or more hours of postdoctoral or continuing education related to implant dentistry (4) Trained in dental implant process, including diagnosis and surgical placement of dental implants and/or the placement of replacement teeth (5) Meets national standards of education and practice in oral implantology. For more information about the AAID and its credentialed members, please visit www.aaid.com or www.aaid-implant.org or call the AAID at 312-335-1550.