Implant-Supported Fixed Restorations for the Partially Edentulous Arch

By Prof. Gregor-Georg Zafiropoulos & Assoc. Prof. Moosa Abuzayda, UAE

When restoring a partially edentulous arch with an implant-retained fixed restoration (fixed partial denture, FPDs), several procedural steps may influence the fit and function of the framework. These include: 1) the correct transfer of the implant position, 2) the correct transfer of vertical height and maintenance of the maxillo-mandibular relationship, 3) the determination of an optimal occlusion, and 4) the selection of implant abutments with the correct shape and angulation. The described method allows the accurate transfer of the implant position and the recording of the interocclusal relationship using transfer key and electroformed gold copings.

Figure 1. Impression system. L: titanium impression post placed on the implant, R: plastic impression copings.

Figure 2. A: Master cast with 2nd set of titanium impression posts; B: Transfer key in situ.

Case

A 62-year-old man with a partial edentulism of the left posterior mandible presented for implant placement and prosthetic restoration. Teeth #34–36 had been extracted due to root caries 5 years previously. Two screw cylinder implants (straight line, 13.5 mm length, 11.5-mm diameter, Dentsply, Duisburg, Germany) were placed manually at a torque of 35 Ncm in the areas of teeth #19 and #21, following a two-step surgical protocol.

The implants were uncovered 8 weeks after placement, system specific healing abutments were placed, and a closed-tray impression was taken using a transfer system consisting of a titanium impression post (TImP) and a plastic impression coping (pickup, Dentegris, Fig. 2). For impression, a polyether material (Impregum; 3M ESPE, St. Paul, MN, USA) was used. To ensure that the titanium impression posts remained in the exact same position, they were left on the implants until the interocclusal relationship was recorded (1 day later).

In the dental laboratory, a final master cast was fabricated using system specific implant analogs and a new set of TImPs (Fig. 2A). The cast was used to fabricate for fabrication of a transfer key, resin copings were made on top of the TImPs (pattern resin, GC America, Inc., Alsip, IL, USA) and connected to each other using a light-curing resin (tray pink temporary cement, Omnident, Rodgau, Germany; Fig. 2B). The transfer key was removed from clear poly(methyl methacrylate) (PMMA, Zenotec, Wieland, Pforzheim, Germany) and veneered with porcelain (Vintage MP; Shofu, Rat ingen, Germany; Fig. 09B). After the impressions had been taken, the abutments were left in the patient’s mouth and the temporary FPD from colored PMMA was placed on them using temporary cement (TempBond, Kerr, Orange, CA, USA; Fig. 08B).

In the dental laboratory, a final master cast was used using the mock-up and electroformed copings to transfer the position of the gold implant abutments (Fig. 09A). The metal framework was milled from a Co-Cr alloy (Zenotec NP, Wieland, Pforzheim, Germany) and veneered with porcelain (Vintage MP, Shofu, Rat ingen, Germany; Fig. 09B). Then, the gold copings were fixed into the framework (AgC Ceram, Wieland, Pforzheim, Germany). The final FPD was fixed over the implant abutments using a temporary cement.
By DTI

When it comes to materials used in implantology, titanium and tita-
nium alloys have always been the material of choice. However, recent
advancements in the functionality of ceramic implants have positioned
them as a viable, metal-free alternative with aesthetic properties
and greater aesthetic appeal. The International Academy of Ceramic
Implantology (IACI) is an association entirely dedicated to ceram-
ics and metal-free alternatives to metal-based implants. Dental Tribune
Online spoke with the President and co-founder of the IACI, Dr. Sammy
Noumbissi, about the association’s mission, as well as current trends in
the field of ceramic implantology.

**Interview:** “The future of ceramic implants is really bright for many reasons”

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**Dental Tribune Online:** How have ceramic implants pro-
gressed since their initial de-
velopment in the late 1960s?

**Dr. Sammy Noumbissi:** Ceramic implants were born out of a desire
for a material that would appear similar to natural teeth and be just as
functional. They were a response to early concerns about the long-term
stability and health effects of metal alloys being embedded in bone and
exposed to the oral environment. Early ceramic implants were mostly
made of one ceramic compound, such as alumina or zirconia. They
were all monocristalline in com-
position and were initially found to be vulnerable to functional stresses or
premature structural breakdown.

Alumina was prone to fracture and zirconia displayed low temperature
degradation and poor suitability to the high humidity in the oral envi-
ronment.

Starting in the mid-1980s, advances in manufacturing and technology
led to the development of ceramic composites. These composites were
made by combining specific and different bioerodibles that were
known to have unique physical and chemical properties. These advances
created new and more structurally stable polycrystalline bioerodibles
with greatly improved functional properties. This is how we developed
dental implants that are made of ce-
ramic composites, such as alumina-
toughened zirconia and hot isostat-
pessed yttria-stabilized zirconia.

In terms of design, the early im-
plants, for the most part, were one-
piece designs. This was because dur-
ing the initial testing of the implants, structural failures migrated to the
connection area between the im-
plants and the abutments. Around
2014, ceramic implant manufac-
turers started releasing two-piece
cemented zirconia implants. This
 signaling a new era in ceramic im-
plantology because the flexibility that was once only available with ti-
tanium implants had finally come
to ceramic implants. More recently,
two-piece, screw-retained ceramic
implants with metal and metal-free
screws have been developed, no
longer limiting them to cementable
restorative options.

What are some of the issues associated with metal
implants, and are these negated

New developments have led to the use of
highly alloyed metals, reducing their
ability to address problems related to
interocclusal and interproximal
distances, implant angulation, and
related soft tissue responses.

Although this report has described the fabrication of a three-unit FPD
supported by two dental implants, this technique can also be used for the
rehabilitation of larger partially edentulous areas with multiple-unit
FPDs retained on more than two implants (Fig. 10). The abutments were
not removed after mounting and tonguing until the final restora-
tion was fitted and placed. Thus, the position of the abutments remained
unchanged, eliminating errors that might occur during repeated attach-
ment of the abutments for various test fitings of the restoration. A proper fit of a restoration requires
the accurate transfer of the intracoronal implant position to the master
cast and a precise fit to the abutment can be achieved with AGCs.16

The use of a mock-up allows not only the evaluation of PFD fit, occlusion,
and shape but also the fabrication of an exact final master cast, because
the AGCs remain in a fixed position while impressions are taken. Fur-
thermore, any necessary change in shape or occlusion can also be made on
the mock-up and transferred to the final denture.

Although this technique requires one or two more clinical treatment
sessions than other traditional tech-
niques, this does not represent a real
disadvantage given the superiority of the final result. The disadvantages
of this method include the higher
cost and the need for a very skilled
laboratory technician.

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oral environment. Galvanism is the most important, but often ignored problem. All dentists are taught in dental school not to mix dissimilar metals in the oral cavity—nevertheless, this rule is consistently violated with implants. We have implants connected to all kinds of alloyed abutments, screws, crowns and copings even when they come from the same manufacturer. Galvanic corrosion occurs and studies have shown that in the process, metal ions get released into the surrounding soft tissue; bone, lymph nodes and even distant organs. Corrosion also come from mechanical functional stresses that induce cracks and pitting of the metal and breakdown of the implant. Zirconia ceramic implants, alternately, do not conduct electricity or heat, are non-corrosive and retain very little biofilm and plaque in comparison to metals. Furthermore, studies have also shown better vasculatization, soft-tissue health and apposition with zirconia in comparison to titanium.

What is the success rate of ceramic implants?
Ceramic implants today, in my experience, and for many fellow ceramic implantologists, have the same success rate as titanium implants. They are now as versatile as metal implants thanks to the evolution in design, surface enhancement protocols and improvements. Various treatment modalities are applicable with ceramic implants. Immediate placement, immediate temporary, full arch and full mouth rehabilitation can be performed with excellent and predictable outcomes. I, however, believe that adopting ceramic implantology should be accompanied by a minimum amount of training or shadowing from an experienced clinician, even if one has experience with titanium implants.

Given that ceramic implants are a viable alternative to titanium, why do many dental professionals still regard them with skepticism?
The early stages of ceramic implants were so difficult and controversial so much so that a stigma regarding their viability and functionality still persists. I would rather ask this question: “Why aren’t there more dentists placing ceramic implants despite evidence of their viability?” This is the case for a few reasons. Metal implants have a very strong background and the cost of manufacturing zirconia is still pretty high. All of the major implant manufacturers (with the exception of Implant Direct) do not have a ceramic implant on the market, let alone in development. Furthermore, the cost of production and pricing of titanium implants have decreased, making them more accessible to dentists and patients. I would also add that dental materials are evolving very fast and dental schools and graduate programs are lagging in educating their students on the capabilities and applications of these new materials. I often have conversations with dental academicians, professors and new graduates and unfortunately, for the most part, there is a distorted view and misunderstanding of zirconia. To many, accepting zirconia as a restorative material is an easier exercise than recognizing it as an implant and implantable material, but I have seen this changing rapidly over the last couple of years.

Where do you see the field of ceramic implantology heading?
The future of ceramic implants is really bright for many reasons. Patients increasingly ask for safer, less invasive solutions, as well as metal-free alternatives for teeth repair or replacement. Dental attitudes and understanding of zirconia and bio-occlusions are slowly, but steadily evolving, with a definitive shift toward biological and inert materials. There has also been a shift in the healthcare industry towards wellness, wellbeing and providing therapies that have little to no side effects. As I previously mentioned, some of the largest players in the implant industry are incorporating or have already adopted ceramic implants in their product line, either by development or by corporate acquisitions. A quiet, but major shift is happening in implant dentistry.

What prompted you to establish the IAOCI?
The IAOCI was created to provide a platform where ceramic implant adopters and believers can exchange ideas, experiences and engage in clinical and scholarly conversation.

The other primary objective was to reach out and help our colleagues better understand bioceramics and realize that metal-free implants are a viable and proven alternative. With the help of our supporters and through our other educational activities, we plan to establish a research fund in 2017 to support graduate dental students and residents who elect to conduct projects involving ceramic implants.

The IAOCI will be hosting its Sixth Annual World Congress in Miami, Florida. What can dental professionals expect from the event?
We are fortunate, honored and privileged to have Prof. Sami Sandhaus, a pioneer and forerunner of ceramic implantology, as our keynote speaker. The theme of our congress in February 2017 is “Evidence-Based Ceramic Implantology – Where Are We Today?” For three days, the congress will host a gathering of the world’s foremost authorities in ceramic implantology and dental bioceramics. Our speakers will share data gathered over 10, 15 and even 20 years regarding ceramic implants. They will also cover zirconia as an implant material, its behavior under function, its biocompatibility and immunocompatibility and superior hygiene properties, and the lack of galvanic activity, corrosion and ion release in ceramic implants.

We will also be offering surgical and prosthetic workshops on implant systems from the top three industry players. This is a great opportunity for current users, non-users and even skeptics to come and listen to 15 world-renowned and published experts present and share their experiences and expertise around ceramic implants.

Thank you for the interview.

Interview: “Implant failure is a failure for both the dentist and the patient”

By Marc Chalupsky, DTI

Originally from Syria, Dr. Iyad Estoiny obtained his master’s degree in dental school not to mix dissimilar metals in the oral cavity—nevertheless, this rule is consistently violated with implants. We have implants connected to all kinds of alloyed abutments, screws, crowns and copings even when they come from the same manufacturer. Galvanic corrosion occurs and studies have shown that in the process, metal ions get released into the surrounding soft tissue; bone, lymph nodes and even distant organs. Corrosion also come from mechanical functional stresses that induce cracks and pitting of the metal and breakdown of the implant. Zirconia ceramic implants, alternately, do not conduct electricity or heat, are non-corrosive and retain very little biofilm and plaque in comparison to metals. Furthermore, studies have also shown better vasculatization, soft-tissue health and apposition with zirconia in comparison to titanium.

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Thank you for the interview.
New implant releases antimicrobial drugs to fight infections

By DTI

LEUVEN, Belgium: Bacterial and fungal pathogens can form a biofilm on dental implants that is resistant to antimicrobial drugs like antibiotics. As a result, these implants pose a significant risk of infection. A multidisciplinary team of researchers at KU Leuven in Belgium has developed a dental implant that gradually releases such drugs from an integrated reservoir. The antimicrobial liquid could help prevent and fight infections.

“Our implant has a built-in reservoir underneath the crown of the tooth,” explained lead author Dr Kaut De Cremer. “A cover screw makes it easy to fill this reservoir with antimicrobial drugs. The implant is made of a porous composite material, so that the drugs gradually diffuse from the reservoir to the outside of the implant, which is in direct contact with the bone cells. As a result, the bacteria can no longer form a biofilm.”

In the laboratory, the implant was subjected to various tests for use with chlorhexidine, a universal mouthwash with a powerful antimicrobial effect. The study shows that the streptococcus mutans bacteria, a major contributor to tooth decay, is prevented from forming a biofilm on the surface of the implant when the reservoir is filled with the mouthwash. Furthermore, biofilms that were grown beforehand on the implant could be eliminated in the same way. This indicates that the implant would be effective in terms of both preventing and curing infections. This study titled “Controlled release of chlorhexidine from a mesoporous silica containing a cromporous titanium dental implant prevents microbubble formation”, was published online in January in Volume 35 of the European Cells and Materials journal.