SPECTRUM ZIRCONIA IMPLANTS

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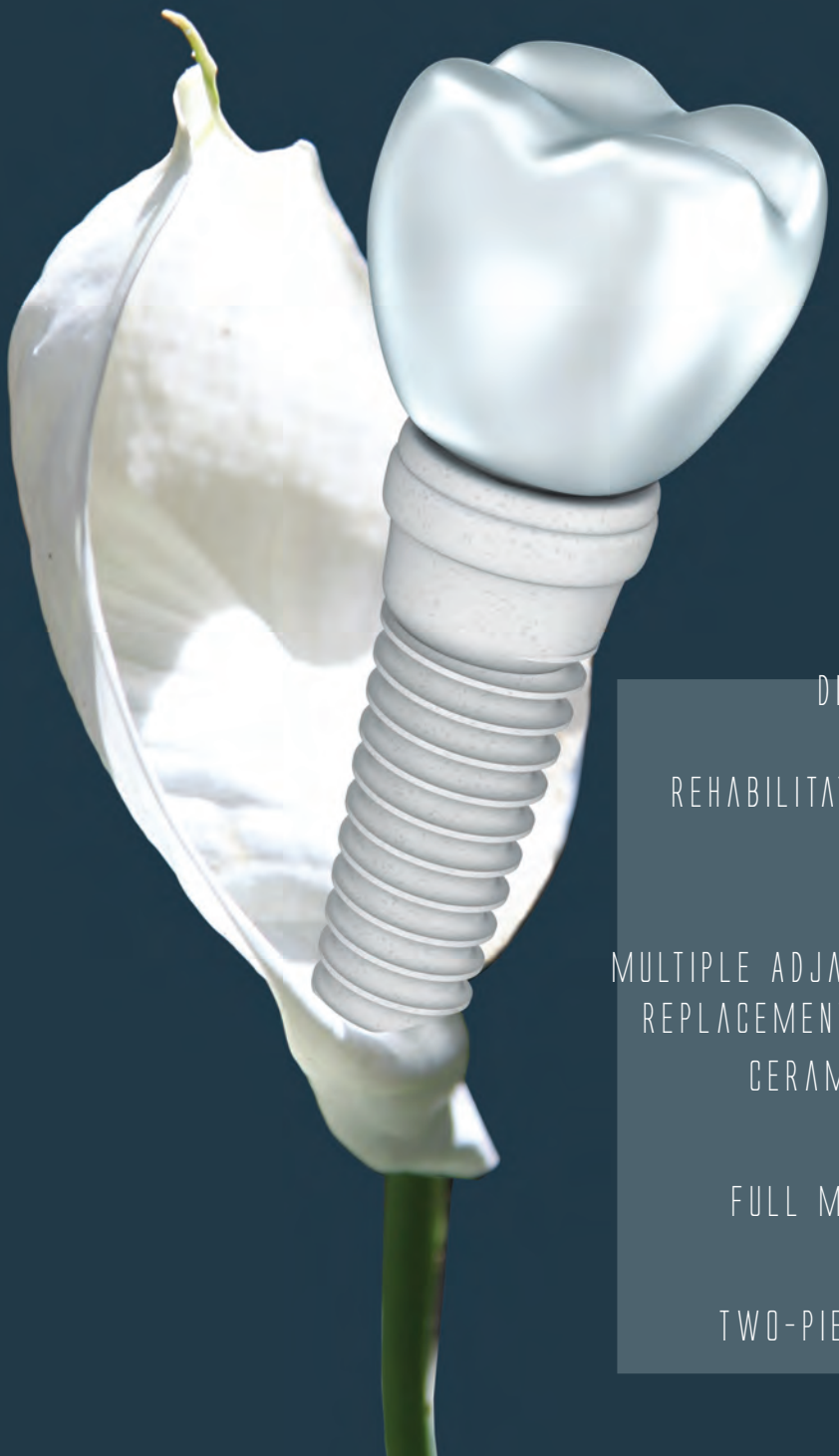

DIGITAL WORKFLOW FOR POSTERIOR MAXILLARY REHABILITATION WITH MONOBLOCK ZIRCONIA IMPLANT

MULTIPLE ADJACENT ANTERIOR TOOTH REPLACEMENT UTILIZING ONE-PIECE CERAMIC DENTAL IMPLANTS.

FULL MOUTH RECONSTRUCTION

TWO-PIECE ZIRCONIA IMPLANT

Multiple Adjacent Anterior Tooth Replacement Utilizing One-piece Ceramic Dental Implants.

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Figure 1: Retracted pre-op
Anterior 3 crowns on teeth 11,21 and 22 requiring treatment.

The number of teeth replaced by dental implants has skyrocketed in the last few decades, and implant dentistry has increasingly become a valid treatment option as a result of edentulism for a wide range of patients. The ongoing research and the advances in the field of oral rehabilitation have provided the modern dentist with an increasing array of tools and techniques that aim to replace missing or hopeless teeth in the most conservative and aesthetic way possible, in an optimistic attempt to replace what nature has gifted us with so exceptionally (biomimetics).

Introduction

The use of one piece ceramic implants for the rehabilitation of the partially edentulous patient has been used for the past 2 decades. Publications of success have varies between 85-97.6% in the literature with the most recent meta analysis showing 1-7 year success of 95%.[1] Issues in the partially edentulous mainly have to do with tissue loss, technical complications and angulation. We trust the metal free approach in rehabilitating the partially edentulous and much like the history of implantology one finds a need to stretch the applications of current dogma.

In its origins the protocols of Branemark and the early pioneers was to rehabilitate the dental cripple, the completely edentulous arch, with a hybrid fixed prosthesis retained on 5 titanium implants. The literature prior to the 1980's mainly focused and established the clinical validity of this approach. Once these techniques and protocols were accepted in North America the pioneers started to apply the same principles for tooth replacement in the partially edentulous patients and start to refine new protocols that could be applied to this aesthetically demanding tooth replacement.[6]

As one can see the evolution of ceramic implants is taking the inverse route. We started with and got comfortable with single tooth replacement in the partially edentulous[3,5] and are now applying the principles to treat multiple adjacent missing teeth in the partially edentulous patient with a metal free approach.[2,4]

This case report will highlight the use of sound prosthetic and surgical protocols in the replacement of adjacent anterior teeth utilizing one-piece ceramic implants and monolithic zirconia prosthetics via a fully digital approach.

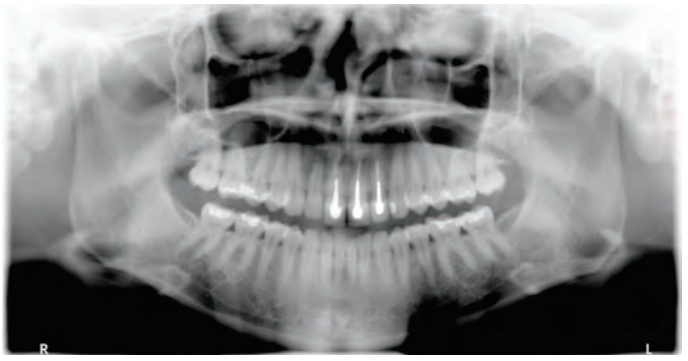

Figure 2: Pre-operative radiograph
Panoramic image showing endodontic treatment on teeth 11,21,22 with metallic posts and full coverage all ceramic crowns.

Figure 3: CeraRoot 21 insertion
CeraRoot 21 all ceramic implant being introduced into the prepared osteotomy. Notice the gingival scallop on the trans mucosal portion of the implant.

Presentation:

Diagnosis

The patient, a 28 year old female with an unremarkable medical history and in excellent general health, presented with a desire to deal with her three anterior teeth she considered very weak and unaesthetic (Figure 1). Radiographic and clinical exams revealed 3 endodontically treated teeth in the maxillary anterior region with metal posts and full coverage restoration (Figure 2). Thick biotype gingiva was very inflamed due to the very deep margins of the crowns. She was experiencing constant bleeding and the loosening and un-cementation of each of the crowns in the last 2 years. Crown on tooth 11 was mobile. Occlusion was stable and she desired the most long standing solution. Her desire was to have a fixed metal free restoration.

Treatment Plan

As the patient wanted a fixed restoration, the options discussed included an option of crown lengthening to obtain a better ferrule, changing the posts to fibre and new crowns and a second option of replacement of the three teeth with implants. After reviewing the risks of the maintenance of the teeth which included potentially retreating the root canals due to long standing coronal leakage, root fracture from removal of posts and weakness of crowns due to limited coronal structure the patient opted to extract and replace the teeth with implants. Long discussion followed dealing with long term prognosis of extracting and replacing the teeth as she was very young. She desired to be completely metal free due to her history of metal sensitivities as well as her personal preferences to have no metals used. We discussed a ceramic implant supported reconstruction. The possibility of the use of a zirconia one piece dental implant (CeraRoot, CeraRoot SL, Granollers, Spain) was discussed and the alternative titanium implant option was also discussed. We also had to address her age. As a 28 year old she would need to maintain her reconstruction for a long period of time. We do not know the long term

Figure 4: Implant position post-surgery
Final implant position at the end of surgery with the buccal margin about 1mm below the buccal tissue level.

Figure 5: Angulation of implants.
The final angulation of the implants seems extreme however in order to engage the palatal bone and emerge in the correct position the implant does lean a little forward. This position is restorable with the use of a monolithic restoration that can be made thinner on the facial surface as there is no need to blockout or mask a dark core.

Figure 6: Post-surgery Provisional
Direct provisional restorations, note the shine through of the white abutments. This will not be visible through the final monolithic zirconia but clearly demonstrated the thinness of the facial prosthesis.

operative area. An atraumatic extraction of the teeth was preformed using surgical elevators and forceps and the sockets thoroughly curetted. The osteotomies were preformed after each extraction utilizing very efficient ceramic drills at a maximum speed of 350RPM, the slow drilling helps maintain the vitality of the bone. The osteotomy was preformed after each extraction to maintain the tooth position and angulation of the implant to mimic the initial angulation of the tooth. No irrigation was used during the drilling and bone debris was collected from the drills. The final preparation of the osteotomies was done with the countersink drills. Careful attention was paid to preparing the implant site to accommodate the wide diameter of the prosthetic emergence. The shoulders of the implants were placed 1mm apical to the desired tissue level. The central incisors were replaced with CeraRoot 21 implants giving a natural gingival scallop and

Figure 7: Healed implants.
After three months of healing and soft tissue maturation we can visualize the final position of the implants and future crown margins.

outlook beyond 10-15 years of any of our approaches, she understood that whatever option she choose revisions would be necessary in the future.

To be able to rehabilitate this patient we needed to be able to place the one-piece implants in such a way that we could account for skeletal angulation (Figure 5). Because we were planning to place the implants immediately following extraction we knew the exact tooth position. Guided by a pre-operative wax up we knew exactly the emergence of each part of the prosthesis. The trans-gingival collar of the CeraRoot implant would provide us with a built-in emergence profile making the final prosthetic protocol simple and functional with very little in terms of prosthetic complications.

The final treatment would involve the extraction the three teeth, immediate placement of three CeraRoot implants on the upper arch and immediate provisionalization with a directly formed bisacryl provisional prosthesis. After a period of 3 months and the rigid fixation of the implants, full contour milled Prettau bridge would be used as final restoration.

Surgical Treatment

The patient was pre-medicated with an antibiotic (Amoxicllin 500mg) which was to be continued for 7 days post operatively. 4% Articaine 1:200,000 epinephrine (Septocaine, Septodont Inc., France) was infiltrated and used to anesthetize the

Figure 8: Healed implants radiograph
Periapical radiograph after 3 months of healing. Proper implant position and healthy spacing between implants allowing for the maintenance of crystal level of bone.

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Figure 9: Smile Designer Pro Design
Post-surgical smile design to confirm ability to deliver the final shape of the prosthetics. This was presented to the patient to confirm outcome. We utilized the Smile Designer Pro app for this visualization.

Figure 10: Occlusal view of the implants
Preparation of the tissues for intraoral scan. Laser was used to remove small amount of excess tissue, emergence of the implants is in line with the teeth.

Figure 11: STL Occlusal view
Occlusal view of the digital model.

the lateral incisor with a CeraRoot 12 implant (Figure 4). The implants were threaded into place and achieved excellent stability at over 30Ncm with the buccal restorative margin placed where desired (Figure 3). The facial of the extraction site, and the circumferential gap between the implant and the bone, was grafted with the autogenous bone chips mixed with allograft (Oragraft, Mineralized bone, LifeNet,VA, USA). The post-surgical intraoral radiograph shows the final position of all 3 implants (Figure 8). A Periotest M (Medizintechnik Gulden, Germany), a wireless device used to provide an

Figure 12: Digital Model STL
CS3600 digital STL output that was the foundation of the digital lab work. Precise digital model used to fabricate the restorations.

Figure 13: Digital Model PLY
The CS3600 outputs a full colour digital file that the laboratory can use along with the black/white STL file to more accurately design the final restoration.

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Figure 14: Day of cementation polarized view.
Final prosthesis day of cementation showing nice tissue integration and slight internal show through of the abutment.

Figure 15: Day of cementation final
Non-polarized light shows nice integration of the prosthesis and no show through from the inside. Soft tissue and papilla maturation will take place over the next 4-6 months.

objective evaluation of an implant's stability, was used to assess a baseline for stability of all 3 implants. The readings for for all implants ranged between -1.5 to +3.3. The absolute range for the Periotest M is -8.0 to +50. The more negative the reading the greater the stability/dampening effect of the measured tooth.

An immediate provisional (VISCO III Auto-cure, Anaxdent, OK, USA) was made with a direct method from a digital wax-up that was prepared previous to surgery and transferred intramurally via a essix appliance (Figure 6). The material was allowed to set on the teeth and shrink-wrap so as to splint the three implants rigidly. Once healed the material would be cut off.

Prosthetic Treatment

After 12 weeks, the soft tissue healed and the implant integrated and we were now ready for final restoration (Figure 7). Once again a Periotest M (Medizintechnik Gulden, Germany) was used to assess the stability of the implants, the readings now ranged from -4.5 to -2.8, each implant showed increase in stability. The provisional was cut off and the implants were scanned with an intraoral scanner (CS3600, Carestream, FR) after tissue retraction (Figure 10). A digital smile design utilizing a smile design software (Smile Designer Pro, TastyTech, Toronto, CA) (Figure 9) was used to communicate final tooth shape with the patient again as she wanted some changes from her post-operative provisional.

The STL and PLY files from the scan were transferred to the laboratory (Figures 11-13). Utilizing the digital files and the library of CeraRoot analogs a three unit splinted Prettau bridge was designed and milled. The lingual of the lower anteriors was made thicker to give more bulk thickness. The bridge was tried in and inserted with a Glass Ionomer cement (GC FujiCEM 2, GC America). Excess cement was carefully cleaned. Occlusion was adjusted again as to avoid any prematurities (Figure 14-15).

Discussion

When treating multiple adjacent missing teeth, the application of the one-piece ceramic implants seem to preform as well as traditional two piece titanium implants. However, the use of the one-piece ceramic implants does carry some technical protocol modifications that need to be highlighted in treating the partially edentulous patients that can avoid clinical complications that in the author's opinion have been ignored for some time. Implant angulation of the one-piece design is a primary concern. Surgical placement of the implant needs to be precise while respecting the envelope of bone support. The visualization of the final prosthetic outcome is required in order to make sure that the implant is placed in optimal position, or digital guidance may be used to accurately guide the placement. This is achievable with the one piece implant but needs to be managed by meticulous surgical planning and execution.

The complexity of creating and maintaining tissue contours and health around the implant abutment complex is an ever elusive aspect of modern implantology. With the emergence profile being designed as part of a white, tissue level implant we see less peri-implant disease and less mechanical and aesthetic soft tissue complications. The absence of a micro gap assures better bone preservation and thus better soft tissue outcomes. Periodontal health is also amplified by the absence of a connection and micro-gap, and the affinity of the gingival complex to the zirconium oxide surface.

This case presented an example of where the tooth replacement concept can be simply and cost effectively applied to rehabilitating multiple adjacent anterior teeth with great aesthetic and functional success.

As with any aspect of this emerging field we need more evidence and more work to validate the application of these techniques in the long term. ■

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The Author

Dr. Dan Hagi, received his dental training at the University of Toronto and now maintains a multidisciplinary implant and rehabilitative practice in Thornhill, Ontario. He is an associate Fellow of the American Academy of Implant Dentistry(AAID), a Fellow of the International Congress of Oral Implantology(ICOI), the Academy of General Dentistry (AGD), the Academy for Dental Facial Esthetics (ADFE) and the Misch International Implant Institute(MIII). His private practice focuses on metal free, minimally invasive implant rehabilitation and aesthetic smile design. He is a lecturer and mentor at the Dental Implantology Center of Excellence (DICE) which was founded to bring dental implant education to all, as well as a consultant on emerging metal-free materials and techniques.

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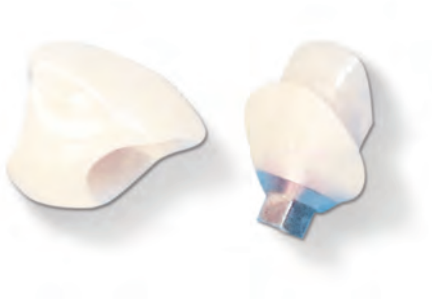

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