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Review Article

Immunologically Neutral Dental Implants Ceramic (Zirconia) Implants

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Abstract

Since their introduction in the 1960s, titanium implants have dominated the field of dental implants. As a result, titanium implant systems are primarily the foundation for the goods and solutions, scientific and clinical research, as well as the development and effectiveness of this treatment. The subject of when and why to substitute titanium implants with ceramics is evident for practitioners thinking about adding ceramic implants to their portfolios. Of course, every situation and patient is different, but there are a few things to take into account if ceramic and Titanium implants are an option based on the signs. The patient's resistance to having metallic medical devices inside their body, which might manifest as mucosal recession and the visibility of gray Titanium is one of the problems with titanium implants. In addition, the emotional feel of a more 'natural' alternative may be of preference. From a clinical perspective, recent developments in zirconia solutions now mean that the restorative flexibility of a two-piece, cemented, and/or screw-retained options are available, along with proven osseointegration and soft tissue adhesion, [1] generally lower plaque accumulation, [2] and less bacterial adhesion than titanium implants [3]. Titanium implants are often narrower at the implant-abutment transition. With design improvements such as the SDS implant, a wider tulip stabilizes the connection from the implant to the crown allowing gingiva attachment. To preserve soft tissue and pink esthetics and to eliminate the micro-gap, ceramic implants have often been designed at tissue-level with a customizable tulip or abutment. This will prevent the disturbance of the valuable bond between the implant and the tissue, which is unique to zirconia-tissue interactions. In various cases, Ceramic implants are used as a substitute for titanium implants as they are given a white esthetic appearance and are 100% metal-free.

Keywords: Dental implants; Titanium implants; SDS; Zirconia implants; Ceramic implant.

Titanium dental implants associated allergies

Hypersensitivity or Allergic reactions associated with titanium implants are rare; however, there is an increasing concern for

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sensitivity which may be a drawback for Titanium [4]. A study has showed that only 0.6% of patients, displayed allergic reactions to Titanium implants [5]. In patients with titanium implant failure or its associated allergy, Zirconia implants are used as an alternative. However, apart from allergy, rejection of implant may be due to hygiene or, smoking history of patient [6,7].

What are zirconia implants?

Zirconia dental implants are one-piece fixtures surgically positioned near the gum line. As a result, they are frequently simpler to manage and are the preferred choice for implant by surgeons followed by the crown treatment because of their one-piece nature. This prevents the use of metal during the treatment and can benefit people who have previously experienced problems with metal implantation. Zirconium oxide in the form of high-quality Zirconia is used to create ceramic dental implants, otherwise known as Zirconia. The addition of oxide to zirconium changes its composition, nomenclature, and behavior. The final zirconia dental implant is more cosmetically pleasing than the titanium option due to its white color.

The story on ceramic implants

Researchers and clinicians are constantly exploring methods to enhance current therapy modalities. As a result, dentistry is continuously changing and developing, whether for improved longevity, greater levels of predictability, more cost-effective treatments, or more esthetic outcomes. The all-ceramic one-piece implant for areas of high aesthetic concern or in situations of titanium allergy is an intriguing and occasionally contentious development. Zirconia implants have been created by several manufacturers, who report success. In areas of thin tissue where implant "show-through" may be an issue, zirconia implants are a more aesthetically pleasing option. Zirconia implants, however, have been made for many years by numerous manufacturers. They seem to be gaining popularity in standard implant care. There are encouraging studies demonstrating that zirconia implants integrate very well same as the titanium implants, with comparable torque values. Clinical trials suggest that zirconia implants may even improve soft-tissue responsiveness.

Is zirconia really metal-free?

Clinicians and patients are frequently unclear about the distinction between zirconium and zirconium dioxide (Zirconia). If a zirconia implant is made of zirconium, can it truly be described as "metal-free"? Yes. Zirconium dioxide is used to create the ceramic substance known as "Zirconia." Electrons transfer from the zirconium to the oxygen molecules during the irreversible chemical reaction known as zirconium oxidation. As a result, ceramic Zirconia differs significantly from metal zirconia in terms of its conductivity, toughness, and wear resistance. Therefore, zirconia implants are accounted as 'metal-free' [8-10].

What is biological dentistry?

According to the International Academy of Biological Dentistry and Medicine (IABDM), the impact of all dental products, treatments, and operations on the entire body is the focus of biological dentistry; it is fluoride-free, mercury-free, mercury-safe, and metal-free. Dental material biocompatibility testing on an individual basis is essential. It demands that every clinical procedure be built with elements that not only enhance the patient's quality

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of life but also sustains it. Life is what "biological" alludes to. Oral and systemic health are inextricably linked in the context of the entire person due to their complex, dynamic interactions. The best clinical techniques and technological advancements in dental care in the West are combined with a wide range of techniques from other fields in biological dentistry. General dentists, oral surgeons, orthodontists, pedodontists and periodontists are some examples of biological dentists. Additionally, they have received in-depth instruction in dental toxicology and healing modalities, such as homeopathy, iridology, herbology, Ayurveda, Traditional Chinese Medicine (TCM), and energy medicine. Conservative dentistry is the biological dentistry, and the biological dentists hold a strong and unwavering belief in the Hippocratic maxim to "first, do no harm.". Their main aim is to be minimally invasive yet appropriately active.

Why metal-free zirconia dental implants?

Allergies & sensitivities

In contrast to metal implants, zirconia implants are hypoallergenic. Unexpectedly, many cases of titanium implant sensitivity manifest themselves years after surgery when itching and irritation appear near implant sites. It's the ideal environment for implant failure and bone loss. The insertion of metal devices should be carefully examined beforehand to avoid skin sensitivities and allergies. This is especially important because removing a titanium implant from the jawbone is difficult.

Biocompatibility & optimal osseointegration

Zirconia is the primary component of ceramic (Zirconia) implants. It is biocompatible in nature that promotes complete assimilation into the jawbone. In a recent microscopic examination, zirconia implants showed excellent osseointegration, with no evidence of inflammation or foreign body rejection. As a result, Zirconia is an ideal material for dental implants, according to several scientists [11,12].

Esthetics

The color is possibly the most obvious yet basic distinction between Titanium and ceramic implants. With titanium implants, a cosmetic issue frequently surfaces as an inherent concern. Some patients worry that the Titanium or their gray gums will eventually appear around the edge of the crown. Zirconia is far more aesthetically pleasing than Titanium since it is white and non-metallic. It's the ideal base shade, closely resembling what nature originally produced [12].

Corrosion resistant

Zirconia do not conduct heat or electricity and is resistant to chemical corrosion. It is a bioinert material that will not travel to other locations in the body or cause any chemical reactions that will obstruct the ideal dental health. Titanium is another matter. Scientific research has established that a titanium implant will corrode in the mouth's moist environment, particularly if there are other metals (such as gold on lays/inlays, bridges, alloy metal crowns or amalgam fillings) nearby that can cause reactions. Pure titanium or titanium alloys are metals that are often used in direct contact with host tissues [12,13]. These highly reactive metallic biomaterials quickly develop a layer of titanium dioxide

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(TiO_2) upon exposure to fluid media or air. This layer of dioxide forms a boundary at the interface between the biological medium and the metal structure, determining the degree of biocompatibility and the biological response of the implant. Corrosion is the deterioration a metal undergoes as a result of the surrounding medium (electrochemical attack), which causes the release of ions into the microenvironment. No metal or alloy is entirely inert in vivo. Corrosion phenomena at the interlace are particularly important in the evolution of both dental and orthopedic implants and are one of the possible causes of implant failure after initial success. Fluoride, present in various water supplies, toothpaste, and mouthwashes, makes metal corrosion even more active [14]. As a result, the titanium implants' surface is attacked literally and according to various scientific articles, Titanium can also travel to the surrounding tissues or lymph nodes from the implant site.

Zirconia non-conductivity

Zirconia's inability to conduct electrical charges has many advantages. Due to the non-conductivity of Zirconia encourages healthier gums and a healthy oral environment that prevents adherence of bacterial growth on its surface.

Holistic-friendly

Zirconia implants are also bioinert, making them the ideal tooth replacement option for people who follow holistic health concepts. In addition, Zirconia implants do not interfere with how energy travels via the body's meridians.

One-piece design

The two metal components of conventional titanium implant systems-the implant inserted into the jaw, and the abutment positioned above the gum line-are fastened together by a fixation screw. Under the intense pressure of chewing, micro-movement may happen where these pieces meet, resulting in warm, wet areas that provide an ideal environment for anaerobic bacteria to proliferate. The conditions are suitable for a destructive chain of events: the bacteria release toxins that cause inflammation, which may result in bone loss and implant failure. Due to its strength and cosmetic advantages, which have been clinically demonstrated, ceramic components have become more widely used in dentistry during the past few decades. As a result, all-ceramic crowns and implant abutments are becoming more popular, and implants are now available in one-piece and two-piece designs constructed of biocompatible Zirconia [15].

One-stage surgery

Ceramic implants are often designed to be put in place right away following tooth extractions. With this one-stage procedure, insertion time is cut in half while patient comfort is increased, and optimal preservation of the tissue and bone is often observed.

Comfort

Due to biocompatibility and Zirconia's robustness, patients who receive zirconia implants typically undergo a quicker implant process overall, with a considerable improvement in comfort and function.

No micro-gaps

Micro-gaps might be visible with conventional titanium implants after the surgical insertion of metal below the gum line. However, Zirconia has virtually no micro gaps if a tissue level or one-piece

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implant is utilized (such as SDS or Ceraroot).

If a bone level piece is utilized (Nobel), the micro gap is still a concern; however, Zirconia properties tend to harbor less biofilm and bacteria, reducing the risk of a micro-gap associated with peri-implantitis.

Better bond with bone

Ceramic implants have been reported to have overall osseointegration with the bone that is either comparable to or superior to titanium implants [13,14]. Therefore, this is the best option for people with unsuccessful implants. In addition, Titanium always has inflammatory Cytokines involved, unlike Zirconia, which has no inflammatory process in the integration.

Soft-tissue-friendly

Several studies have shown that ceramic implants have properties similar to titanium implants, like low or weak inflammatory responses, soft tissue attachment, and osseointegration. Other studies show there is attachment to Zirconia, but not so with Titanium [16].

Less plaque accumulation

Ceramic implants inhibit the adhesion of bacteria and plaque due to their smooth finish leading to a healthier smile and mouth. In addition, ceramic implants demonstrate less affinity for retaining and attracting plaque than Titanium [14,15], preventing implant failure.

High endurance

Ceramics are metals with a higher endurance rate. As a result, these implants can endure up to 150 pounds of force before fracturing and cracking, which is highly beneficial to people of all ages and sizes.

Non-polar

Zirconia implants are non-polar in nature and thus prevent bacterial adherence as compared to Titanium, thus creating a healthier implant option.

Preserves bone

Bone Loss has been observed in various titanium implants; however ceramic implants do not cause any bone loss. Let's keep in mind that if Titanium implant threads are exposed, they will harbor biofilm and bacteria - this will usually end poorly [16]. On the other hand, Zirconia can be exposed, and often the tissue will just attach, even with a recession-preventing additional recession over the years.

Cleaner

SDS Ceramic implant margins are placed at the gum line, whereas Titanium is placed underneath the gum line. This above-gum level option helps the patient to keep the implant cleaner and preserves healthy surrounding gum tissue as a result of better oral hygiene [17].

This is true with SDS Ceramic Implants, but not with other Ceramic implant systems that are just mimicking Titanium designs, such as Zeramax, Nobel, and more coming onto the market.

No metallic taste

Zirconia is clean and fully oxidized, making it a metal-free material that prevents metallic taste after implantation as in Titanium implants that results in metallic taste due to corrosion and oxidation, resulting in a metallic taste in your patients' mouth.

A growing market

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Ceramic implants are undoubtedly a niche market-estimated at around 1%-but it is growing. 16 In terms of market share, it is expected to grow by up to 50% year-on-year over the next five years.

Practices that want to stay ahead of the game and diversify their offerings may consider adding ceramic implants to their portfolio. For dental offices that emphasize esthetic solutions as a critical differentiator of their services, offering the white color of ceramic implants could make them stand out from other local practices.

Benefits of adding ceramic implants to your practice

Dental implants have been used successfully for many years and are specifically made to replace missing teeth. As many dental surgeons know, Titanium has long been the material of choice for most dental surgeries. However, Titanium isn't always the ideal material; for some patients with high implant failure rates, Zirconia may be a preferable alternative. In addition, many seek a more practical alternative because they are worried about putting extra metal in their bodies [15].

Switching from titanium to zirconia for implant procedures

According to one study, 97.6 percent success rate over the course of five years regarding 831 ceramic implants. It was also noted in the same study that the patients' mouths were healthy and free of implant-related complications. The choice is quite clear when it concerns the difference between ceramic vs. metal implants.

For this reason, many surgeons are switching from old titanium implants to newer, cleaner, and hygienic Zirconia. Ceramic implants have been used for a few decades now and are gaining popularity because of their smooth and seamless finish [18]. By offering a metal-free alternative to your patients, they will be happier and healthier as a result.

Zirconia-the implant material of choice

Non-ductile zirconia

Zirconia ceramic is less flexible as compared to the titanium and therefore cannot warp inside the bone as titanium implants do when chewing forces act on them. As a result, zirconia implants can be positioned in areas where the bone thinly tapers. New treatment protocols have been developed with A-PRF™, so that bone augmentation is no longer required in many cases. Also, a pointed alveolar ridge should never be leveled before implant placement because that amount will lower the gingiva or papilla.

Zirconia-epithelial connection

Soft tissue attaches to Zirconia-Dr. Rudelt from Hamburg proved this by means of histological examinations of human material 30 years ago. Cur- rent histological examinations by Professor Oliva and Kniha family further confirm this. Concepts such as "One Abutment – One Time" are based on this characteristic. For the first time, we have at our disposal an implant material that both grows into/osseointegrates with bone and enables soft tissue to attach. As a result, a defined implant-abutment transition is no longer necessary. The quadruple micro thread with the same pitch as the coarse thread (7°) is only 0.04 mm deep and can come into contact with bone as well as be exposed because the gingiva will also attach to this surface [19,20].

Swiss dental solutions (SDS)-a new design concept in ceramic implants

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The SDS implant has a unique shape. Unlike many other implant systems, it has been developed during practical use in the operating theater. Dr. Volz not only developed the first generations of the Z-System ceramic implant but also gave the SDS implant its current unique shape based on his experiences of more than 20,000 personally placed ceramic implants. According to Dr. Volz, it is definitively wrong to copy a proven titanium implant shape and produce this in Zirconia, as this material has completely different physical, biological, and immunological properties. In addition, Dr. Volz believes that a cylindrical shape is unsuitable for a ceramic implant.

This belief is based on the fact that one of the few disadvantages of ceramic as an implant material is that it is unable to dissipate the frictional heat generated at the surface to the core. The risk of bone overheating with subsequent bone degradation is disproportionately higher with a cylindrical ceramic implant, which may still be placed congruently in a cavity prepared with a tap or even undersized.

For this reason, SDS SWISS DENTAL SOLUTIONS developed a so-called BIOLOGICAL DRILLING PROTOCOL creating the first implant system ever with ceramic drills adapted to the different bone classes [21]. "No craftsman would think of working in concrete, steel, mahogany, or balsa wood with the same drills and try to securely anchor the same screws in these very different materials".

The SDS implant

In summary, the SDS implant can be divided into two areas that perform completely different tasks from a biological and mechanical standpoint and thus must also look completely different.

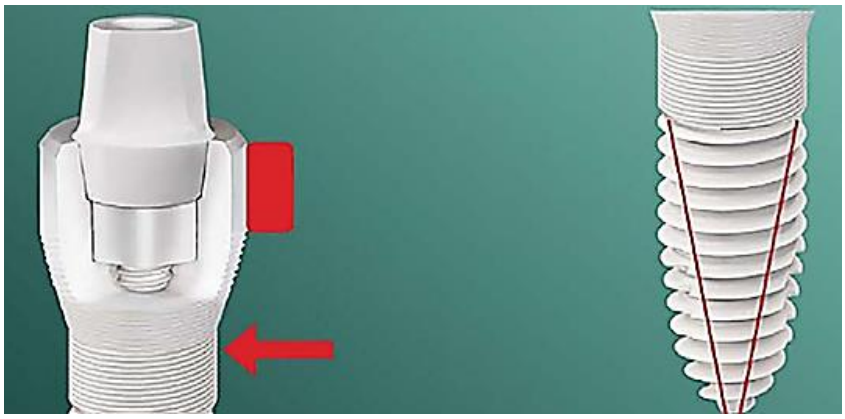

Figure 1: SDS Implants

- The upper coronal part of the implant does not exert any pressure on the poorly perfused cortical bone.
- The machined surface of the top 3mm connects superbly with the gingiva and osseointegrates when in contact with bone.
- The quadruple micro thread with the same gradient as the coarse thread (7°) is just 0.04mm deep and can be used both in contact with bone and on an exposed basis, as the gingiva also connects with this surface.
- The connecting screw is only 1.3mm long, meaning that the load-bearing

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portion (see red arrow) is not only solid but, even in the case of a two-piece implant, has a significantly higher core diameter than one-piece implants of the same diameter due to its small thread depth of 0.04mm. The two-piece implant with a diameter of 3.8mm thus has a core diameter of 3.72mm in this area, which corresponds to the core diameter of a one-piece implant with a diameter of >4.3mm.

- The lower apical portion is furnished with the unique DYNAMIC THREAD design, which comprises a conical core (see red line) and the parabolic envelope of the outer thread contour. In soft type III and type IV bone, the bone is condensed in a single operation, and a very high primary stability is achieved. In harder type II and I bone, the overextended preparation promotes the formation of "DE NOVO BONE."
- The relatively thin tip means that the implant is excellently suited for secure placement even on slanted surfaces without the danger of slipping and without the slightest risk of spinning, i.e., "eternal thread."

The one-piece and two-piece SDS ceramic implants

The one-piece and two-piece implants are identical in shape up to the prosthetic plateau, meaning that the surgeon can decide right up to the last second which implant should be used. As the lengths of the implants are graduated in 3.0mm steps and the vertical machined portion is also 3mm high, the surgeon can either apply the nominal length (from the apical tip to the end of the fine thread) at bone level or aim at the prosthetic plateau with the next marking (nominal length +3.0mm), i.e., at the highest point of the interdental papilla or the enamel cement interface of the adjacent tooth [22]. The graphic shows how much abutment mass is still retained even if it is prepared with applied angles of 30° and 40°.

Unlike some other implant systems, the SDS implant is comprised of high-purity (tetragonal zirconia polycrystals) TZP zirconia, which has been approved by the EU and FDA authorities for grinding by SDS users. Some implant systems are produced using so-called ATZ (alumina toughened Zirconia), which contains around 20% alumina. Other implants are, in turn, given a tooth color or a pink appearance by admixing additional components (including further metal oxides), meaning that these producers are no longer allowed to release the implants for grinding.

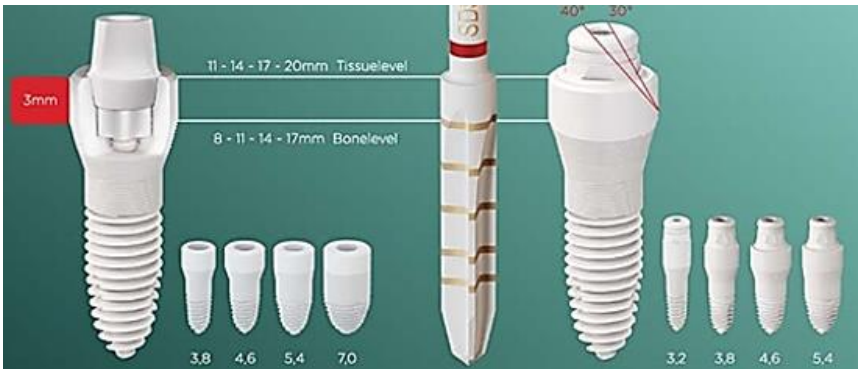

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Figure 2: The one-piece and two-piece SDS ceramic implants.

However, it is precisely this possibility to grind the implant that, in addition to its unique esthetics, ensures optimal tissue compatibility. This is because, in contrast to almost all other systems, SDS implants have only a single gap at the tissue level for both their one-piece and two-piece implant systems. Namely, the one at the gingiva level, where the crown is not cemented on the abutment but rather on the implant. Without a doubt, the safest and healthiest variant, which already made the Straumann Bonefit tissue-level implant® so successful 40 years ago. SDS SWISS DENTAL SOLUTIONS holds a German patent for this design [21,23]. Each time an abutment is unscrewed, there is always a very strong odor, which inevitably means that there are bacteria in the gap. This gap is much bigger in Zirconia than is the case in Titanium, where the relatively soft titanium components cause a kind of cold welding, which is, of course, not possible with ceramic materials. The cementing of the abutment in the implant (in the same way as the solid abutment in the Bonefit implant) also means that a loosening of the abutment can be ruled out-eradicating a further source of potential complications! This is quite apart from the fact that no tools and parts are required for the prosthetic restoration of the one-piece implant, and only the screw and a screwdriver are needed for the two-piece implant. The prosthetic restoration of the SDS implant is even simpler than the restoration of a natural tooth, as there is neither the need for anesthesia nor the application of a build-up filling. In addition, SDS implants "can be Grinded or Prepared," not so with other tissue level implants like Strauman. This is key to an excellent prosthetic situation allowing tissue-level customization of the gingiva.

Figure 3: SDS Implants

Figure 4: SDS Implants

Every day, clinicians resolve conceivable situations with the unique portfolio of SDS implants, ranging from single-tooth implants in the front teeth right through to

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comprehensive reconstructions in the sense of "GREAT ON EIGHT" with immediate implants and immediate restoration. Thanks to the BIOLOGICAL DRILLING PROTOCOL and the unique DYNAMIC THREAD, the SDS implant is safe and simple to place and can be inserted into almost any immediate implant socket. Among other things, this is due to the surface of the Zirconia, which as an "inert" material, has no free surface electrons and is thus also unable to trigger an immunological response, such as the release of the cytokines TNF-α and IL1-β, that cause activation of osteoclasts leading to peri-implant bone resorption (peri-implantitis) [24]. This extraordinary biocompatibility and immunological neutrality mean that Zirconia is the only known material that bonds firmly to the gingiva.

All-in-one concept clinical case

SDS zirconia immediate implants and bioesthetic restoration

A 46year-old female patient presented after multiple opinions recommending very different treatment plans. Plans range from re-treating the root canals to full extractions and removable prosthetics. The patient was uncertain about the best way forward in restoring the failing prosthetic dental work composed of PFM porcelain-fused to metal crowns and bridges and multiple failing root canal treated teeth.

The primary motivation was to (Figure 5) change the course on patients declining overall health and avoid removable partials. The doctor was also concerned about the many root canal-treated teeth and the metal implants with visible inflammation that may be connected to a declining liver, gall bladder, disrupted hormone levels, and overall increased systemic inflammation. Practitioner utilized the Avatar (electroacupuncture, according to Voll) to indicate disruptions in these meridians. There was also a concern for potential metal allergy. The patient presented with frequent migraine headaches, clenching, and chronic fatigue.

Figure 5: Patient for SDS zirconia immediate implants and bioesthetic restoration.

All the natural teeth were root canal treated or removed except for #18,20,21,25,26, and 31. PFM crowns #2,3,4,5,8,9,10,11,12,13,14,15, 18,19,20,22,23,24,27,28,29,30,31. Titanium Implants #8, #30. Multiple failing root canal treated teeth indicate a chronic apical abscess CAP with peri-apical radiolucencies. The patient had slight mobile lower incisors, mild recession, and generalized arrhythmia around all metal-based crowns. After a complete examination and presentation of our findings, the patient expressed interest in the unique All-In-One concept of the Swiss Biohealth method to remove all inflammatory sources and to utilize immediate implantation using SDS

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ceramic implants and long-term fixed temporaries followed by a Bioesthetic permanent bite rejuvenation. In November 2018, the patient was referred by Dr. Corbin Popp, Denver, Colorado, to the Swiss Biohealth Clinic SBH.

Pre-operative measurements

After a year of raising funds for treatment, the patient started the supplementation provided by the Swiss Biohealth Clinic to bolster the patient's regenerative capacity in the months prior to traveling to Switzerland to begin treatment at the end of October 2019. The clinical examination revealed in the CBCT scan taken on-site that ischemic osteonecrosis could be diagnosed in the sense of FDOJ. Due to the SAC Assessment classification tool, a guideline to graduate the difficulty of a surgical implant case, we faced a complex situation in terms of aesthetic, surgical, and restorative evaluations.

An essential part of our SWISS BIOHEALTH CONCEPT is strengthening and optimally preparing our patient's immune system to achieve the best possible bone healing. Therefore, four weeks before the surgery, our patients start to supplement the BASIC IMMUNE mixture, formulated by Dr. Klinghardt and Dr. Volz, that not only contains every necessary micro-nutrient for optimal support of the body's own regeneration but also works as a pre-biotic due to the cellulose sponges it contains. Then, it is taken for another four weeks after the surgery. This intervention can lift the vitamin-D level to 70ng/ml or higher to reach optimal bone growth. On the day before the surgery, the patient received an infusion consisting of Vitamin C (15g), Vitamin B12, Natrium bicarbonate, magnesium sulfate, procaine, and ringers' solution. The surgery was performed the following day after the All-In-One-concept in one day. During the whole treatment, the patient receives the so-called BTPII-infusion, which contains vitamin B12, sodium carbonate, procaine, Mg-sulfate and 15g of vitamin C. A pain-relief infusion is used instead of the high-dosage vitamin C to bear the treatment. It is of great importance to prevent the activation of the sympathetic nervous system to preserve healing mechanisms and the immune system.

Following the above-mentioned protocol to optimize the patient for the upcoming restorative and surgical procedures, the patient spent the initial days in the SBH clinic removing all restorative metal materials following a protection protocol in line with the SMART protocols of the IAOMT (International Academy of Oral Medicine and Toxicology). The few restorable teeth received placement of composite core build-ups with (Luxatemp) provisional crowns.

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Figure 6: Pre-Operative measures.

Figure 7: Pre-Operative measures.

Figure 8: Pre-Operative measures.

Figure 9: PANO before.

Surgical Intervention

In all four wisdom tooth regions, both the ischemic and degenerative bone material was removed with piezo surgery, and autologous bone chips were obtained after a minimally invasive approach.

The lower arch was treated; first, teeth #19,20,22,23,24,27,28,29, and 30 were extracted under local anesthesia with a minimal and gentle procedure aiming to save as much bone as possible. The inflamed tissue was carefully cleaned and removed. It is inevitable to thoroughly clean the alveolus and disinfect it, as ceramic implants only osseointegrate in healthy bone. For additional cleaning, the ozone DTA 60 was used for 60 seconds on level 6 for site disinfection. The Upper arch was then treated by removing #

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2,3,4,5,9,10,11,12,13,14, and 15. In regions #2,3,14, and 15, vertical sinus (summers lift) in the maxillary anterior region was performed with osteotomes for additional implant stability. All surgical extraction sites were treated with ozone DTA and closed after inserting PRF (Platelet Rich Fibrin) matrices.

Figure 10: Post-operative long-term prosthetics.

Figure 11: Post-operative long-term prosthetics.

Figure 12: Post-operative long-term prosthetics.

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Figure 13: Post-operative long-term prosthetics.

Figure 14: Post-operative long-term prosthetics.

Figure 15: Post-operative long-term prosthetics.

Figure 16: Post-operative long-term prosthetics.

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Figure 17: Post-operative long-term prosthetics.

Implantation and bone augmentation

It is imperative to follow a drilling protocol that considers the biology of the bone. The drills for the implantation are made of ATZ ceramic. The implants gained excellent primary stability by merging different protocols that vary based on appropriately adapted form drills and bone class. In the compacta region, the blood flow preservation was achieved through oversized drilling and, therefore, zero compression on the bone. The implant's stability was gained on the tip through an aggressive "Macro-Thread" that works simultaneously as a bone condenser on the spongiosa. Ceramic implants were placed in regions # 2,3,4,5,6,8,9,11,12,13,14. Due to the pronounced resorption in region #15 no implant was placed on this site.

A-PRF and i-PRF were centrifuged (Mectron) for 8 minutes at 1200 revolutions per minute. A-PRF membranes were utilized in the closure of the mucoperiosteal flap, which had previously been opened by a marginal incision, and was sutured again after gentle brushing (Brushing System, Dr. Choukroun) with deep apical mattress sutures and papillary sutures. The implants were immediately provided with a long-term provisional restoration (Luxatemp, Durelon TM). The healing phase at the SWISS BIOHEALTH CLINIC is supported by the MY BIOHEALTH WEEK, in which the patients are looked after by our medical team and get treatments that keep them in parasympathetic mode. The patient experienced minor swelling on the surgical sites and reported feeling great days after surgery. After a few days, the patient was able to fly home to the United States. In only one minimally invasive and biological intervention, chronic inflammation and the inflammatory teeth were removed.

Post-operative measurements

The patient returned to Denver, Colorado, and was seen by Dr. Corbin Popp and Dr. Arturo Zarzar two weeks post-surgery. The patient reported mild swelling and no pain, 0/10. At this time, the patient seldom would need to take the recommended 400mg ibuprofen every 8hrs to manage patient pain. The tissue exhibited slight recession but was healing well without redness or drainage and only with mild swelling. The patient was reassured about healing normally though temperature sensitivity on #31 temporary crown, likely due to marginal leaking, was a major concern. We infiltrated near the surgical sites 2ccs procaine 2% w/o epinephrine, then 1cc Vit B12, 2cc Trameel, and 1cc Lymphomyosot, followed by 11gamma ozone injections five minutes following the procaine anesthetic. Patient healing was unremarkable over the next several weeks. At six weeks post-operative, the patient presented with a fractured upper interim prosthetic. All sites were healing well; however, patient mentioned migraine headaches had been periodically returning and was concerned that it may be from clenching.

The interim has heavy wear on site #14. In addition, the patient had sore muscles and evidence of a mandible-to-cranial base discrepancy. We discussed the Foundation for Bioesthetic Dentistry (OBI) method utilizing a bioesthetic Maxillary Anterior Guidance Orthotic, bMAGO to achieve the most stable condyle position and to simulate an increase in the occlusion's vertical dimension to expand our restorative rebuilding options. With the fractured

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provisional removed, the implants were PerioM tested, indicating good osseointegration except for implant #14, where the apparent occlusion was heavy.

A bonus with the SDS implant system is the ability to prepare the implant tulip to customize them to the level of the gingiva. The anterior implants were, therefore, gently modified with a red stripe diamond bur, and new chairside provisionals were fabricated (Luxatemp cemented with Duralon); new alginate impressions (Dentsply) were taken to the lab to fabricate a new set of PMMA interim provisionals at an arbitrary VDO of 18mm using bilateral manipulation. A maxillary orthotic MAGO (maxillary anterior guided orthotic) was also lab fabricated at a VDO of 21mm.

The new lab PMMA provisionals were delivered 6 weeks later (3mo Post operative-cemented with RelyX (3M) for better long-term bonding)) and the MAGO was seated over the provisional. Following multiple adjustment visits to balance the MAGO orthotic as the condyles settle to the most stable condylar position SCP in preparation for the Final Prosthetics. Again, the patient had significant improvement with fewer headaches and clenching over the following weeks. Five months later, the patient was feeling very good, and the bite appeared very stable with minimal adjustment to balance the MAGO over the provisional. The patient remained in provisionals for another 9 months before completing the final prosthetics. Minimal adjustments were completed over this span, and the patient was feeling much better systemically, and the doctor was feeling much better about the patient's stable hormone levels, lack of migraines, and improved energy levels.

The restorative solution for the tissue level SDS implant is straightforward and is perfect for the restorative dentist. With a preparable (grindable) tulip of the implant, the implant preparations are similar to conventional bridge and crown preparations. Two-piece implants placed at the posterior have cemented (Ketac) post (or abutment) with a PEEK screw cemented for additional retention. One-piece implants require no additional parts or pieces customary to titanium implant systems.

Figure 18: Post-operative measurements.

15-Months post-operative, the condyles were very stable with a reproducible consistent bite without the need for any manipulation. The provisionals were removed, and the implants were prepared and customized down to the level of the gingiva using red stripe diamond football bur (Brasseler). Final records were taken

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with full arch VPS (3M light/heavy) impressions after all preparations were refined as well as a Face Bow, and the bite was preserved by removing the interims in sections with (Blue Bite VPS) registrations. New upper final crowns were fabricated by Andre's Dental Studio in Dana Point, CA. Posterior upper crowns were cemented with SDS protocols. (Cemented with Ketac).

The Anterior crowns were sent back to the lab for minor refinements. Weeks later, the Anterior upper crowns were cemented with SDS protocols. (Ketac) At this visit, the lower provisionals were removed and refined with new records to fabricate the opposing lower final crowns. A month later, the Lower crowns were delivered as well as the fabrication of a new protective MAGO splint.

Figure 19: Patient after Post-operative measurements.

Figure 20: Patient after Post-operative measurements.

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Figure 21: Post-operative measurements.

Figure 22: Post-operative measurements.

Figure 23: Post-operative measurements.

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Figure 24: Post-operative measurements.

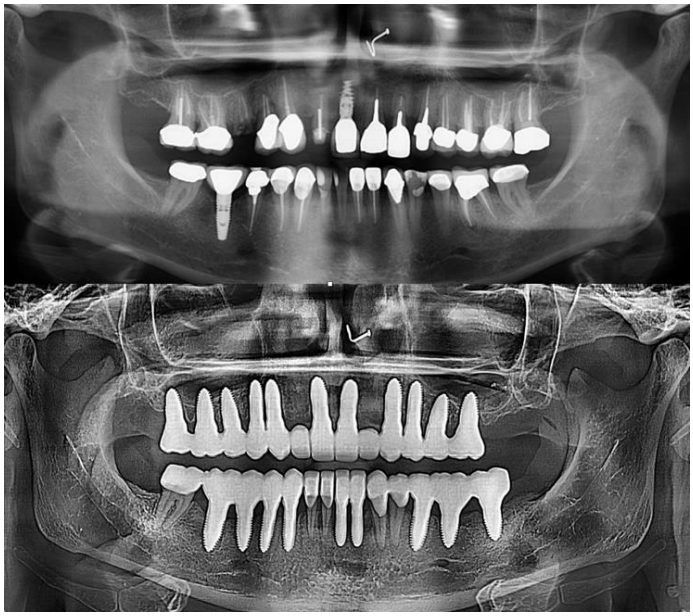

Figure 25: Post-operative measurements.

Figure 26: Post-operative measurements.

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Challenges with ceramic implants

Non-heat conductive

Due to the non-conduction of heat in Zirconia implants, the risk of overheating the bone is greater, and the need for over-preparation is indeed important, especially in the cortical layer near the collar of the implant. In addition, torque values are generally lower for insertion.

One-piece cement-retained systems

Ceramic implants have very different material characteristics and have different designs and drilling protocols. Until recently, Zirconia has been mainly used as a one-piece, cement-retained system, which presents several drawbacks in terms of the rigidity and stability of a cemented restoration [17]. One-piece implants are less flexible, and the limited flexibility can create challenges during the design of the restoration and implant placement [18]. Training for Ceramic implants is indeed recommended.

One-Piece Zirconia implants usually cannot be left to heal under the gums

The process by which dental implants fixate to the bone is called osseointegration. This process usually takes about 6 months to complete. When dental implants are surgically placed, they must have a certain torque value or primary stability. Implants that do not have good primary stability need to be left to heal under the gums for 3-6 months following placement. Unfortunately, zirconia dental implants cannot heal under the gums because of their "one-piece" design, meaning that they often do not have a removable abutment but one that is fixed to the implant. This is not applicable for some two-piece Zirconia implant systems. Zirconia implants with a small diameter are prone to fracture.

Conventional zirconia Implants may be more prone to cracking than titanium dental implants. As it was mentioned above, Zirconia is very strong in compressive forces but somewhat brittle in elastic forces. This is why small diameter zirconia implants are, in some cases, contraindicated. Often times in implant dentistry, the dentist must utilize a small diameter implant in the range of 3.0mm-3.75mm due to thin bone or small spaces between the teeth.

Conclusions

This case offers a great example of the Swiss Biohealth Concept of removing all failing dentistry and potential inflammatory sites and placement of immediate Zirconia SDS implants; and the final rehabilitation utilizing multiple sets of Interim prostheses combining the biological protocols of the Swiss Biohealth Concept (removing all interference fields in one sitting), and OBI Method for bite rejuvenation (Oragnathic Bioesthetic International). The Swiss Biohealth Concept/OBI duo is a fantastic option for patients seeking a non-metal biocompatible solution for partial or complete edentulism. The final product is beautiful, biocompatible, and harmonious in function. Most important the health of the patient was greatly improved, and practitioner was also very impressed as patient's symptoms and markers of inflammation as well as meridians were back to normal.

Recent developments in zirconia solutions shows the restorative flexibility of a screw-retained, two-piece or cemented options including and soft tissue adhesion, lower plaque accumulation less bacterial adhesion

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and osseointegration clinically [1]. Titanium implants are narrower at the implant-abutment transition; however, ceramic implants should be wider, and which is what SDS has done since the wide tulip stabilizes the gingiva allowing it to attach. To preserve soft tissue and pink esthetics, Ceramic implants should be placed tissue-level. This will also prevent the disturbance of the valuable bond between implant and the tissue. This way, soft tissue, and pink esthetics are preserved to a maximum. In addition, the white color and soft tissue properties of ceramics make implants' deep (bone-level) placement unnecessary. During the prosthetic restoration, it is essential not to destroy the zirconia-epithelial connection with electrosurgical devices or retraction cords. In various range of cases, Ceramic implants are used as the excellent substitute of the titanium implants as they are given esthetic white appearance and are 100% metal-free.

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