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Giuseppe Vercellotti, co-owner and chief operating officer of Piezosurgery Incorporated.

What sets Piezosurgery devices apart from others?

Interview: Piezosurgery's Giuseppe Vercellotti

By Sierra Rendon, Managing Editor

Implant Tribune recently had the honor of interviewing Giuseppe Vercellotti, MSc, co-owner and chief operating officer of Piezosurgery Incorporated. Vercellotti's father, Tomaso Vercellotti, is the inventor of the revolutionary technology.

What is Piezosurgery® and where does it originate from?

Piezosurgery is a patented ultrasonic technology specifically engineered for bone surgery. Piezosurgery was developed in the late 1990s by Tomaso Vercellotti, MD, DDS, and Mectron Medical Technology to overcome the limits in precision and safety of traditional bone-cutting instruments.

This technology employs the vibration of piezoelectric ceramics to cut bone but not soft tissues. Despite the fact that they are based on similar physical phenomena, Piezosurgery is so technologically advanced that it has no elements in common with normal ultrasonic ablation devices. The operation of this ultrasonic surgical device is driven by sophisticated software, which controls and optimizes the ultrasonic vibration necessary for bone cutting. The vibration is generated in the handpiece and exerts its cutting action through insert tips specifically designed

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Precautions for using zirconia implant abutments

By Moustafa N. Aboushelib, DDS, MSc, PhD, and Rien van Paridon, DDS, PhD

The introduction of zirconia to the dental field opened the design and application limits of all-ceramic restorations.

Thanks to its high strength and fracture toughness, long-span posterior restorations are now possible with high accuracy and success rate. Additionally, its white color allows better reproduction of the required color especially in the anterior zone.

These properties make zirconia an interesting material for the construction of implant abutments and superstructures.[1]

The fabrication of zirconia implant abutments utilizes state-of-the-art CAD/CAM technology, which uses patients' models for the production of an individual customized abutment.[2]

Moreover, the CAD phase allows accurate positioning and angulation of the zirconia abutment ensuring obtaining the best esthetics.

The fabrication of zirconia implant abutments is complicated by the problem of providing adequate fixation to the implant body.

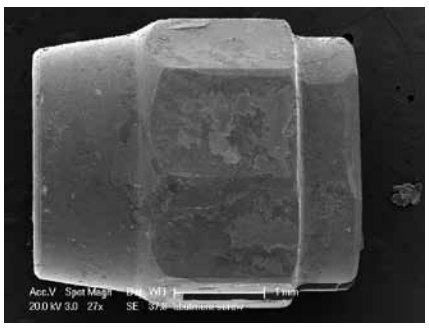

Fig. 1: SEM image, 27x. Internal metallic nut, which depends on friction fit inside the zirconia implant abutment. (Photos/Provided by Dr. Moustafa Aboushelib)

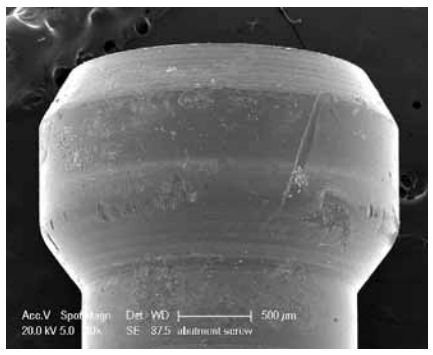

Fig. 2: SEM image, 10x. The metallic fixation screw used to press on the metallic nut for providing adequate retention with the implant body.

For titanium abutments, the fixation screw exerts direct pressure on the abutment, which in turn is provided with external or internal hex to provide connection with the implant body.

On the other hand, zirconia is a brittle material and friction between the fixation screw and the internal surface of the ceramic abutment could produce high internal stresses that could lead to unexpected fracture.[3]

This problem is solved by insertion of a friction fit internal metallic nut (Procera zirconia abutment for Straumann implants), which is equipped with an external hex for establishment of proper contact with the implant body (Fig. 1).

Additionally, the fixation screw interlocks with the metallic nut during tightening procedure (Fig. 2). This

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AAIP to host 28th annual meeting

The American Academy of Implant Prosthodontics will hold its 28th annual meeting on Nov. 6 at the Marriott at McDowell Mountains, Scottsdale, Ariz., in association with the Dental Implant Clinical Research Group and Midwestern University College of Dental Medicine.

The theme of the meeting will be "Implant Update — 2010," and feature outstanding dental clinicians and a well-known financial analyst.

Featured speakers at the meeting are Drs. Robert J. Braun, Clement Guarlotti, Leonard I. Linkow, Harold F. Morris, Peter A. Neff and Azfar Siddiqui, and G. Kent Mangelson.

Linkow, considered by many of his colleagues as the "Father of Oral Implantology," will speak on "Five Decades of Dental Implants."

In 1992, New York University College of Dentistry created the first and only endowed chair in implantology in perpetuity with Linkow as the recipient.

Neff, formerly professor and chairperson of the Department of Occlusion at Georgetown University School of Dentistry and author of the popular textbook "TMJ Occlusion and Function," will speak on "Occlusal Considerations in Implant Prosthodontics."

Morris, co-director of the Dental Implant Clinical Research Group and clinical professor of restorative dentistry at Temple University School of Dentistry in Philadelphia will speak on "Recent Advances in Implant Research."

Braun, professor of oral and maxillofacial pathology, medicine and surgery at Temple University School of Dentistry in Philadelphia, will speak on "Systemic Implications of Oral Disease and its Relation to Oral Implantology."

Siddiqui, associate professor of dentistry at Midwestern University College of Dental Medicine, will speak on "Lateral Bone Condensing and Expansion for Dental Implant Placement."

Guarlotti, past president of the American Academy of Implant Prosthodontics, will discuss "New Implants for Old Fixed Prostheses."

Mangelson, CFP, an expert in the area of lawsuit protection and prevention, will speak on "Advanced Lawsuit Protection and Tax Reduction Strategies for Dentists." Man-

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for drilling, cutting and remodeling mineralized tissues. The cutting action produced by the unique modulated ultrasonic vibration of Piezosurgery is micrometric (extreme precision) and selective (no trauma to soft tissue); additionally, combined with irrigation, the vibration produces a "cavitation effect" that helps to keep the surgical site sterile and bloodless.

Over the years, as the result of Mectron's continuous technological innovation, more than 50 insert tips have been designed and engineered to provide surgeons with the best cutting tools for each anatomical situation. Indeed, Piezosurgery allows one to perform bone surgeries with high precision, greater respect for soft tissues, greater visibility and enhanced healing.

What are the advantages of Piezosurgery in implant and bone surgery?
The surgical advantages of Piezosurgery are many and truly remarkable.[1] First, Piezosurgery delivers high precision. The ultrasonic wave employed by the device is a "microvibration," which compared to the macrovibrations of traditional bone-cutting instruments makes this technology incredibly more precise and safe. Indeed, the cutting action does not require as much pressure and can be interrupted at any time to check the progress of the surgery. The cutting action is then resumed and refined as needed, with precision and safety for both the surgeon and the patient. Second, Piezosurgery's cutting action is harmless to soft tissues. Thanks to the specific resonance range, the device is extremely effective on mineralized tissues but totally harmless to soft tissue, allowing for a safety level never experienced before.

This feature is obviously of crucial importance when operating in proximity of delicate soft-tissue structures, such as blood vessels, nerves, mucosa, etc. Third, thanks to its dual-wave technology, Piezosurgery delivers maximum intraoperatory visibility.

When the "hammering effect" produced by the wave modulation on the insert tip hits the irrigation solution, the latter is converted in a fine spray. The sprayed molecules of the irrigation fluid hit the cutting site, cool it down and produce a temporary hemostatic effect, allowing for maximum visibility during surgery. Once terminated, the surgery bleeding resumes, hence starting all biological processes leading to proper healing. Lastly, one of the greatest advantages of Piezosurgery is the fact it is gentler to the tissues and, in fact, induces faster healing. Histological and biomolecular studies have shown that compared to traditional techniques, the use of Piezosurgery is not only characterized by minimal postoperative bone loss but actually promotes faster healing.[2,3] In my opinion, this incredible feature makes Piezosurgery the preferable instrumentation for most bone surgical applications.

How did your father, Dr. Tomaso Vercellotti, get involved with Piezosurgery?
Prompted by the limitation in precision and safety of traditional bone-cutting instruments, my father pioneered the use of piezoelectric ultrasonic frequencies for bone surgery. Upon realizing that the effectiveness of conventional ultrasonic instruments in cutting bone was extremely limited, he set off, in conjunction with Mectron Medical Technology, to develop a new technology that would allow overcoming such limitations. Their joined efforts resulted in the creation of Piezosurgery, a technology that has truly revolutionized the way we approach bone surgery.

My father's clinical and scientific efforts were truly indispensable to make Piezosurgery into a surgical revolution. First, he wanted to ensure that this new technology would truly benefit surgeons and patients alike, improving surgical predictability and reducing morbidity and complications.

To this goal, my father engaged in several research collaborations with clinicians and institutions across the world. In addition to studies on cutting efficacy of the technology and bone healing response in animal models, fervid clinical research activity has arisen immediately since the initial distribution of the Piezosurgery technology.

To date, Piezosurgery is the only piezoelectric surgical technology that has been demonstrated to be effective and successful by the clinical community through peer-reviewed publications. The number of publications on Piezosurgery increases every day, testimony of the clinicians' understanding of the truly revolutionary nature of this technology.

The results of this research, published in more than 70 scientific articles, prove the advantages of Piezosurgery and make a compelling, evidence-based argument for its adoption in a variety of bone surgical applications.

Why did he get so passionate about this procedure?
My father realized immediately the technology he had developed had remarkable characteristics and understood he had an opportunity to simplify and improve a variety of surgical procedures. Along with several international colleagues, for several years he has been developing new surgical protocols and procedures. As a result, an entirely

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IT Corrections

Implant Tribune strives to maintain the utmost accuracy in its news and clinical reports. If you find a factual error or content that requires clarification, please report the details to Managing Editor Sierra Rendon at *s.rendon@dental-tribune.com*.

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design is associated with the problem of generation of internal stresses, which could lead to unexpected fracture of the zirconia implant abutment.

This article will evaluate the fracture causes of several broken zirconia implant abutments. Fractographic analysis of the broken segments will allow recognition of the location and site of the critical fracture.

Case presentations: Case 1

A broken zirconia implant abutment was sent by the treating dentist for fracture analysis. Patient's records indicated that the patient complained of loosening of the implant-supported zirconia-veneered crown (#21).

The treating dentist also complained that the internal metallic nut lost friction contact with the zirconia abutment and that he had to re-assemble the components before screw fixation. The abutment was fractured after two incidents of screw loosening.

The same problem led to fracture of the second abutment, after which the dentist decided to insert a titanium abutment.

Fig. 2a: A broken maxillary premolar was extracted and implant was immediately inserted.

Fig. 2b: Procera zirconia abutment.

Fig. 2c: Procera zirconia veneered crown inserted over the zirconia abutment.

Scanning electron microscopic examination indicated that the abutment was fractured due to pressure from the metallic screw nut.

The solution

Once the metallic nut has lost friction fit with the zirconia abutment, it cannot be correctly reinserted inside the abutment, and areas of friction contact between the improperly assembled components could lead to generation of high internal stresses causing fracture of the zirconia implant abutment as was reported for the two examined abutments. A new abutment should be used in such case.

Case 2

This next case featured a broken zirconia implant abutment. SEM analysis revealed that it was an angled abutment, which corrected the tilt of an implant replacing a maxillary lateral incisor. The entire buccal wall was fractured beneath the temporarily cemented zirconia-veneered crown.

The solution

Zirconia is a brittle ceramic material that must be used in adequate thickness to gain full potential of its high strength. A minimal wall thickness (0.5-0.7 mm) is required in the entire structure of the zirconia implant abutment.

This thickness must be increased in areas of high stresses to avoid unexpected fracture. Tilt correction resulted in over-reduction of the buccal wall (0.3 mm thickness), which resulted in fracture of the weakened segment.

To reduce possibility of fracture, it is recommended to use a metallic abutment for correction of angle of insertion.

Case 3

The final case featured a broken veneer porcelain from a Procera zirconia superstructure. This new design combines both the implant abutment and the framework of the restoration in one single structure, thus reducing the number of components the dentist uses during the prosthetic phase.

This single component zirconia structure does not utilize an internal metallic nut for achieving contact with the implant body.

On the contrary, this single component super structure utilizes the fixation screw to obtain direct fixation to the implant body.

The solution

Using single component superstructures has several advantages as they simplify the handling procedure, do not require anti-rotation feature and reduce the number of structural interfaces of the entire restoration. On the other hand, they require careful design to provide adequate support for the veneer ceramic.

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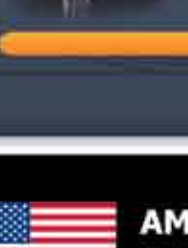

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Fig. 2d: The first and the second Procera zirconia abutments were fractured after a short period of service intra-orally.

Fig. 2e: A new zirconia veneered crown was inserted over a titanium abutment. Observe the grayish color at the cervical margin.

Fig. 3: Digital image demonstrating a fractured zirconia abutment due to over-reduction of the buccal wall.

Fig. 4a: Digital image of a broken veneer porcelain from a four-unit, implant-supported fixed partial denture.

Fig. 4b: Digital image demonstrating the contact surface with the implant body. Antirotation is not required for this fixed partial denture as the whole framework and the implant abutment are joined into a single superstructure.

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Discussion

Analysis of the broken zirconia implant abutment gave insight about the cause of fracture.

For Procera abutments with the metallic nut, the friction fit system lost adequate retention after a short service time in the mouth leading to loosening of the inserted restorations.

According to complaints of the treating dentists, it is not recommended to reassemble the metallic nut and tighten the fixation screw as this will not result in reliable retention of the restoration. In such case, it is recommended to insert a new abutment from the manufacturer using patient's records.

Moreover, over-tightening the fixation screw beyond the recommended torque could lead to generation of wedging forces inside the zirconia abutment.

The screw head could exert pressure on the metallic nut leading to spreading of its vertical walls.

Using a confirmatory X-ray before tightening the fixation screw and keeping to the recommended torque could prevent such problem. For cases with marked angle correction, it is recommended to use a metallic abutment in order to avoid over-reduction of the axial walls.

On the other hand, using single component zirconia implant superstructure, which is composed of zirconia abutment and the framework as one component, could facilitate easier handling and simplify the insertion procedure due to reduction of the components used.

Moreover, careful design consideration of the requirements of both the abutment and the zirconia framework is mandatory to ensure good function of each element. Lack of adequate support beneath the veneer ceramic or over-reduction of the axial walls of the zirconia abutment could lead to unexpected fracture. IT

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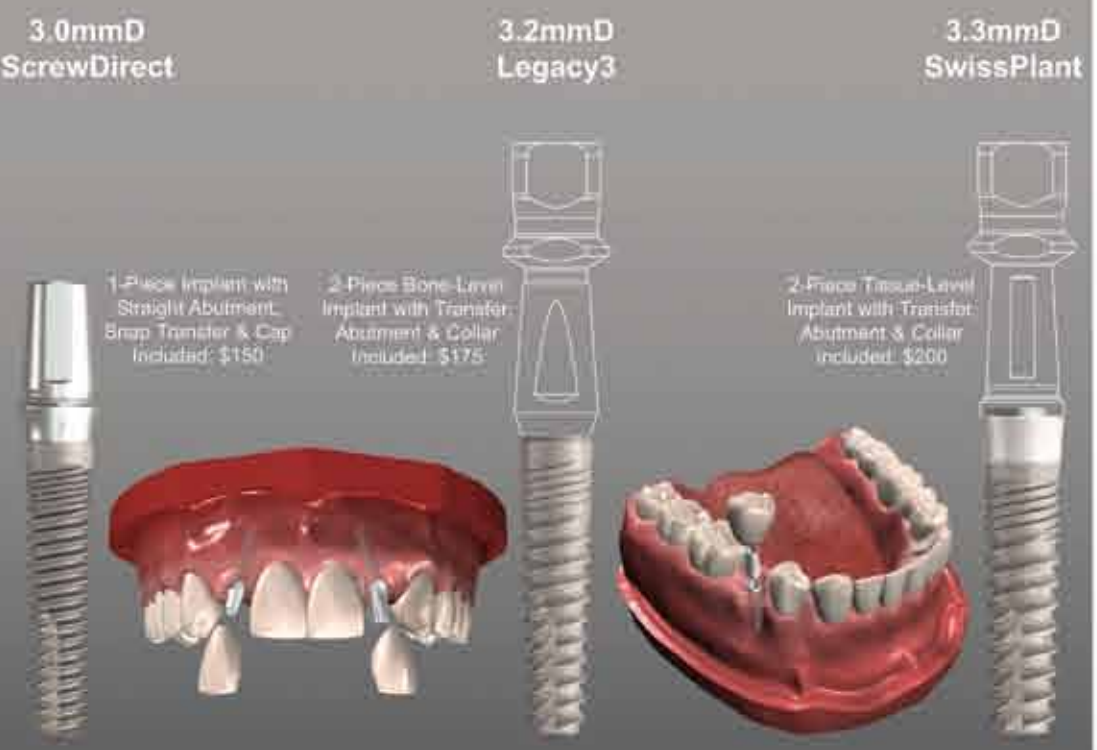

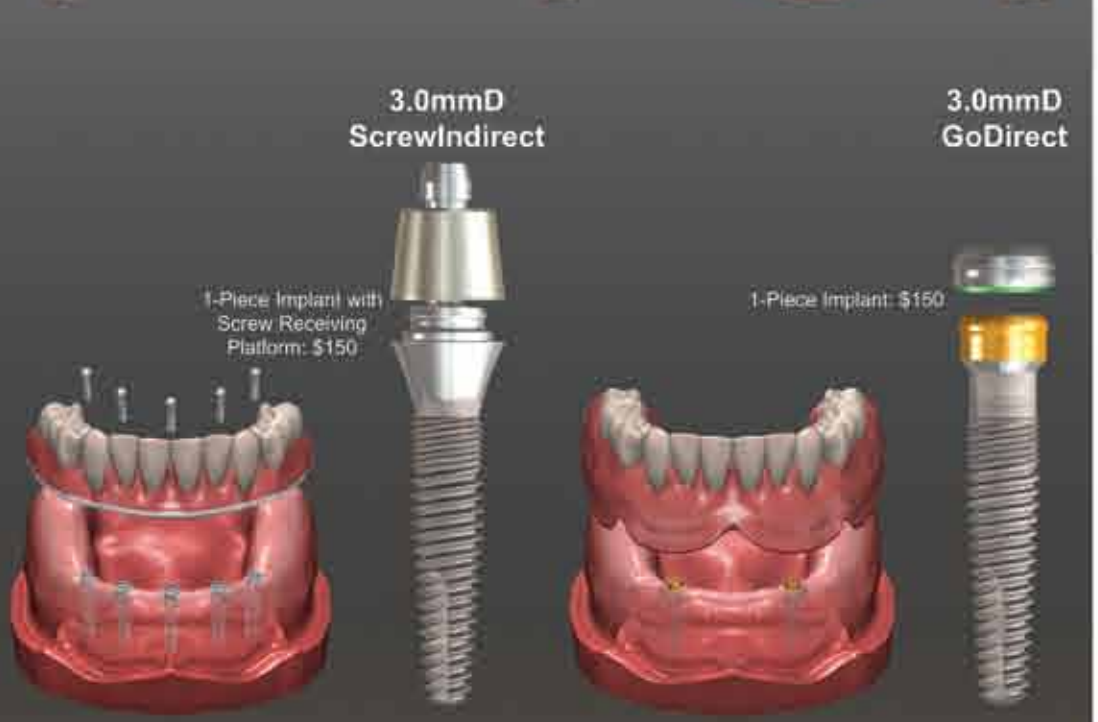

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ReActive USA price = $200
**NobelActive USA price = $694

Free Implants for Nobel Biocare Customers

3 Surgically Compatible, RePlant® Implants with Titanium Transfer/Temporary Abutments plus 2 Contoured Abutments

US List Price for 3 Implants, Abutments and Prosthetic Components:

RePlant = $620

Nobel BioCare* = $1922

FREE Introductory Offers at www.implantdirect.com

Terms and Conditions Apply

* Stig Hansson. The implant Neck: Smooth or Provided with Retention Elements. A Biomechanical Approach. Clin Oral Impl Res 1999;10:394-405