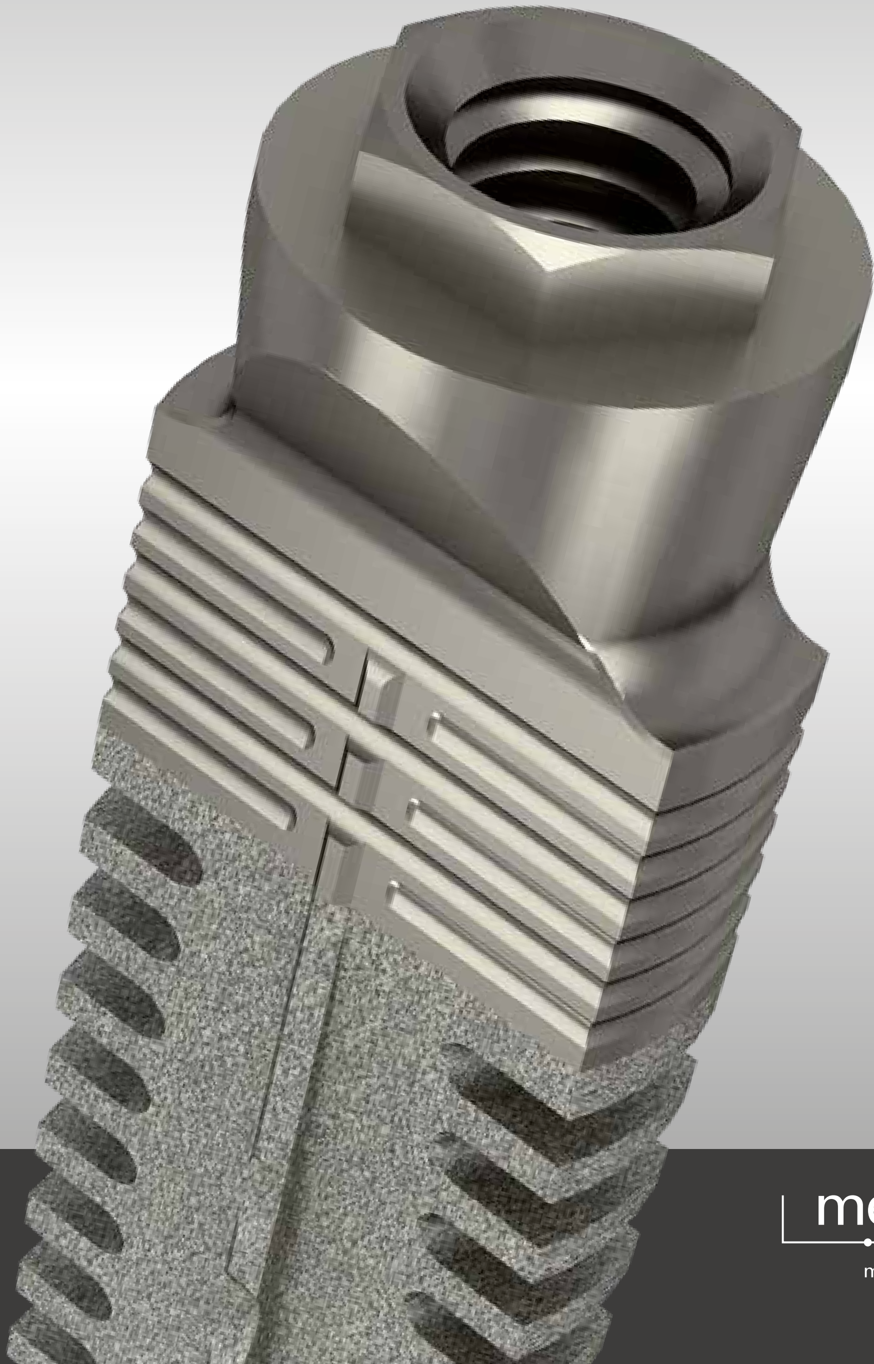
Rex Implants®
minimally invasive technology

YEAR 2020
ISSUE 1

1-2020

IMPLANT POST

REX PIEZOIMPLANT: A NEW PARADIGM IN IMPLANT DENTISTRY



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medical technology

Product editorial

IMPLANT-SUPPORTED REHABILITATION OF THE NARROW ATROPHIC ALVEOLAR RIDGE

Alveolar ridge resorption begins immediately after the loss of one or more teeth. Its course varies from patient to patient, but always leads to a vertical—and above all, horizontal—reduction of the alveolar ridge. Resorption is a continuous process that is particularly pronounced in the first three months after extraction. It can lead to a 30–50% reduction in alveolar ridge size in the first year and up to 40–60% in the second year (Figs. 1 and 2).

Spontaneous resorption of the alveolar ridge is initiated in the coronal part of the socket, starting with the loss of the bundle bone, which is a thin layer of vestibular alveolar bone. Especially in patients with a thin bone phenotype, a horizontal defect may then develop rapidly.

Observations have shown that this resorption progresses faster and more aggressively if the vestibular cortical lamella on the tooth is less than 1 mm thick or if the bone has been affected by trauma (fracture or overheating). According to one of the most common hypotheses, a thin vestibular bone lamella (less than 1 mm) cannot ensure a sufficient blood supply to the bone cells via the haversian canals. This results in atrophic bone resorption (with a stronger lamella, the resorption will be less pronounced).

In addition, in a significant proportion of patients, rigid mobile dentures can accelerate the resorption of the ridge; it is also enhanced by anatomical, metabolic, and mechanical factors.

As a result, a patient's alveolar ridge will soon become too narrow to insert a standard implant (as early as three to six months after tooth loss).

As described in the literature, the successful insertion of an implant requires a sufficient amount of available bone. For best results, it is therefore essential to ensure that no less than 1.5 mm of bone width is available both buccally and lingually, but in any case not less than the critical width of 1 mm.

As a general rule, the width of the alveolar ridge should be at least 6 mm when inserting a 4-mm implant to avoid compromising the integrity of the vestibular cortical bone. This requires a thickness of at least 1 mm (Fig. 3).

With a 6-mm-wide ridge and a 4-mm implant, this requirement can only be met if the implant is exactly centered, such that the remaining thickness is distributed evenly between the two bone lamellae. However, rotary instruments with sharp cutting edges tend to remove more of the thin vestibular cortical bone than of the more resistant lingual cortical bone, shifting the effective implant axis to the vestibular. This can create considerable problems, especially in the esthetic zone.

Therefore, if the bone width is not sufficient, the insertion of a standard-diameter conventional implant is not advisable, except in connection with prior or simultaneous bone augmentation.

Figs. 1 and 2: Alveolar ridge resorption following tooth extraction in the upper and lower jaw (Cawood JI, Howell RA. A classification of the edentulous jaws. Int J Oral Maxillofac Surg. 1988; 17(4): 232–236).

FIG. 1

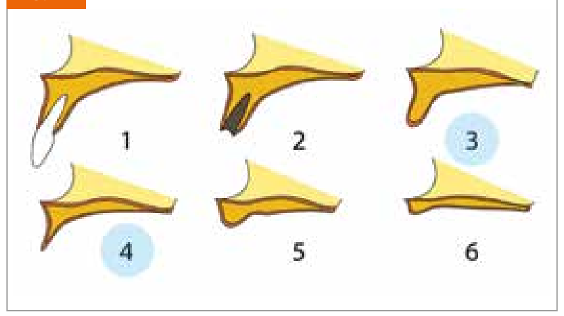

FIG. 2

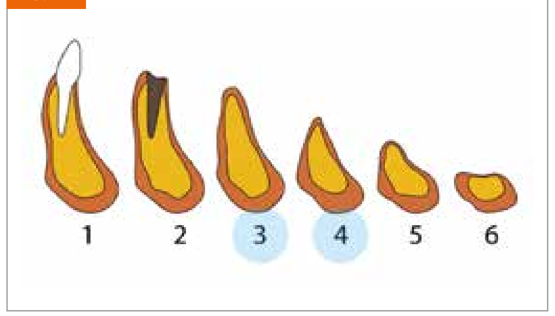

FIG. 3

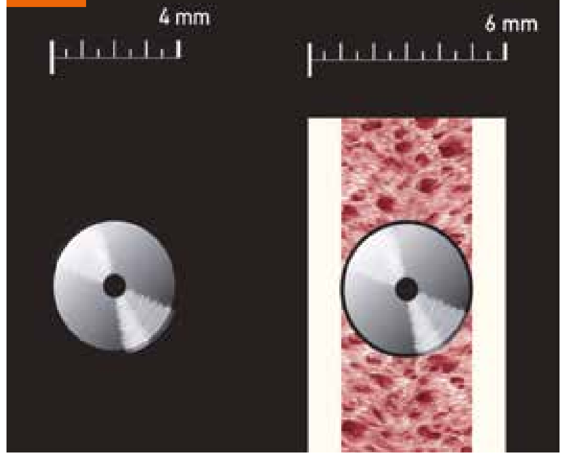

Fig. 3: 4-mm implant inserted in a 6 mm wide alveolar ridge.

Fig. 4: Preparation of the implant bed for a PiezoImplant compared to a preparation for a conventional implant.

In fact, placing an implant in a narrow alveolar ridge can increase the risk of dehiscence and bone/gingival recession. This may result in the implant shoulder and coating being exposed, allowing bacterial plaque and concrements to accumulate and trigger peri-implant mucositis or peri-implantitis, which in turn can result in the loss of the implant.

Current approaches

Blade implants have been used in the past to ensure an adequate buccal and lingual bone volume in the narrow alveolar ridge. However, the osseointegration and reliability of these implants have been shown to be insufficient. The reason for the lack of success could be the overheating of the bone during preparation with high-speed drills, or the design of the implants themselves that makes it difficult to achieve the required primary stability, renders the implants susceptible to fractures (comparable to thin screw implants), or does not offer the surface treatment necessary for a given case.

Anatomical observations have shown that when a blade implant is inserted, the bone walls are widened by the implant's wedge-like action, causing the implant to lose much of its primary stability, as the elastic regeneration of the bone stabilizes the implant predominantly at its tip, leaving a gap at the shoulder level. This gap facilitates lateral micromovements and prevents the osseointegration of the implant in favor of connective-tissue integration, even though the material itself—a titanium alloy, as used for screw implants—is perfectly capable of osseointegration.

In the 1990s, the lack of reliability of blade implants led to the introduction of regenerative techniques aimed at allowing the insertion of standard screw implants into the narrow ridge. The most common of these are autologous, homogeneous, or heterogeneous bone grafts, bone spreading, bone splitting, or guided bone regeneration (GBR).

It is generally believed that in the absence of sufficient bone, these regenerative techniques should continue to be employed, but they require much experience on the part of the practitioner and also more treatment sessions. These procedures are associated with greater risks and sometimes uncertain outcomes and expose patients to lengthy, painful, and expensive reconstructive treatment; patients therefore do not always accept them.

A new paradigm

Regardless of the size of the implant to be inserted, the anatomical shape of the narrow alveolar ridge suggests the choice of an implant whose shape corresponds to that of the alveolar ridge (Fig. 4).
This consideration, together with the possibility of sculpting the implant bed to any desired shape by means of piezosurgery, marked the beginning of almost ten years of development work for Professor Tomaso Vercellotti and Dr. Alberto Rebaudi. The result was a new implant shape, which was then realized by Rex Implants LLC in Columbus, Ohio, USA.

REX PiezoImplants are immediately recognizable by their exclusive wedge shape and rectangular cross-section. Implants with this special macrogeometry correspond to the shape of the residual alveolar ridge—unlike conventional im-

FIG. 4

plants with their round cross-section (Figs. 5 and 6).

These implants are usually cylindrical or conical and often too large in diameter to be inserted into a narrow alveolar ridge without damaging the vestibular cortical bone.

In this situation, a REX TL 1.8 PiezoImplant can be inserted and stabilized between the lingual and vestibular lamellae without damaging it. This allows the practitioner to preserve and use the small amount of available bone in a minimally invasive way, which drastically reduces the risk of vestibular dehiscences and peri-implantitis.

FIG. 5

Fig. 5: Narrow alveolar ridge. Comparison between implant sites and graphic representation the dehiscence risk with conventional preparation.

FIG. 6

Fig. 6: Implant insertion in the narrow alveolar ridge: REX PiezoImplants vs. screw implants.

Another advantage of the REX PiezoImplants is that they exert a moderate but constant lateral pressure on the cortical bone, which—according to Wolff's law on the behavior of bone under compressive load—strengthens the cortical portion of the bone. In addition, the wedge shape of the REX PiezoImplants allows the jaw ridge to be expanded by bone spreading/ridge splitting (Fig. 7).

The REX TL 1.8 PiezoImplant is versatile and can be inserted either at gingival level or lower, depending on aesthetic preferences and available prosthetic clearance.

FIG. 7

Fig. 7: Longitudinal section of two implant sites in a narrow alveolar ridge. Left: REX PiezoImplant. Right: Standard screw implant.

Despite being very delicate—only 1.8 mm at shoulder height—this implant was shown to be just as mechanically strong after 5 million test cycles as a conventional screw implant with a diameter of 3.5 or 4.0 mm (Fig. 8).

The implant bed is prepared using a small number of PIEZOSURGERY® inserts, possibly in combination with special, magnetically driven osteotomes (also wedge-shaped).

Some biological and histological studies of osteotomies performed with PIEZOSURGERY® (see the PIEZOSURGERY® Abstract Book) actually show better healing than sites prepared with drills, since piezoelectric cutting causes only very little tissue damage (Fig. 9).

A clinical protocol has been developed for the correct preparation of the implant bed, alternating between cutting and control tools. The wedge-shaped profile of the REX PiezoImplants therefore fits the prepared implant bed perfectly and offers excellent primary stability.

The implant is inserted by calibrated pressure waves of the REX IPD (Implant Placement Device) electromagnetic surgical mallet (press fit). The implants themselves cause microscopic bone expansion, which increases tissue strength and offers multiple aesthetic and functional advantages.

The macro- and microgeometry of the REX PiezoImplants together with the subcortical RBM-textured surface significantly increase the surface area of the implant, ensuring better bone contact than conventional implants of the same length (Fig. 10).

FIG. 8

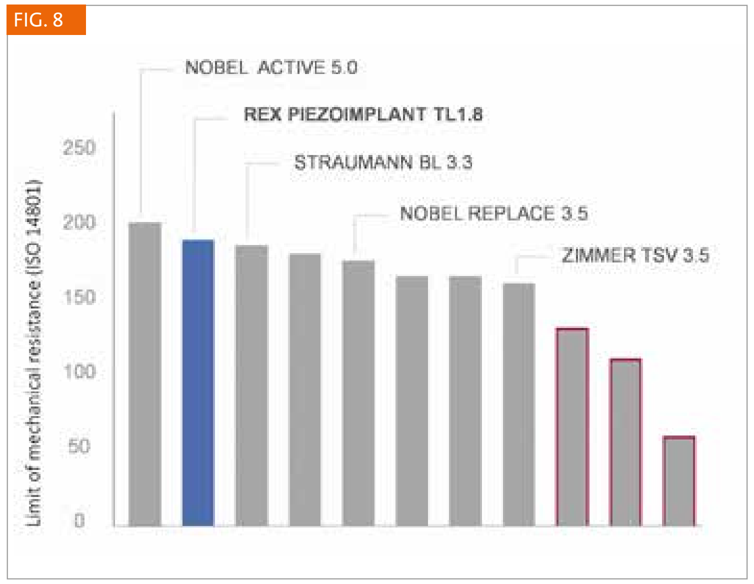

Fig. 8: Analysis of the mechanical strength of various implants compared to the REX TL 1.8.

FIG. 9

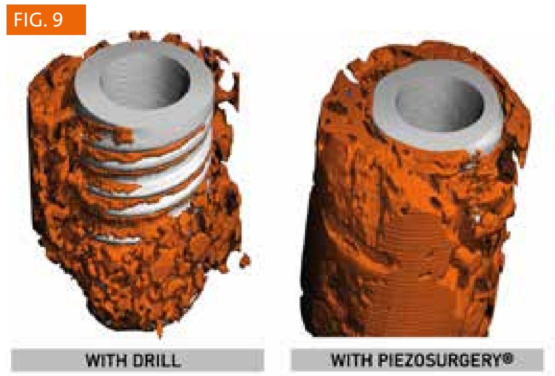

Fig. 9: Different tissue reactions to preparation with a drill and with the use of PIEZOSURGERY®.

Fig. 10: Detail of the RBM (Resorbable Blast Media) surface treatment of the REX PiezoImplant.

Fig. 11: Detail of the standard prosthetic connection of the REX PiezoImplant (4.1-mm external hex).

The REX TL 1.8 PiezoImplant combines an innovative intraosseous design with a standard prosthetic connection (4.1-mm external hex) for subsequent restoration by conventional prosthetic means (Fig 11).

The implant body features macrogrooves that promote the formation of cancellous bone and ensure that the prosthetic load is distributed across several horizontal support planes, while the smooth surface on their coronal aspect allows the easy removal of bacterial biofilm.

REX PiezoImplants consist of a grade 23 titanium alloy (Ti6Al4V), a biocompatible alloy of high purity and mechanical strength. They are available in four lengths (9, 11, 13, and 15 mm).

Their innovative shape together with the novel techniques for preparing the implant bed and inserting the implant requires thorough familiarity with the relevant surgical protocol.

Mectron offers a comprehensive range of theoretical and practical courses in which the participants can familiarize themselves with the techniques. This also includes support by tutors who assist in the implementation of the surgical protocol on animal models.

FIG. 10

FIG. 11

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Dr. Francesco Oreglia

INSERTING THREE REX TL 1.8 PIEZOIMPLANTS (2 × H = 9 MM AND 1 × H = 11 MM)

A 71-year-old woman presented for treatment of an abscess on tooth 44, which served as an abutment tooth for a bridge (44 to 47).

The endodontically treated tooth 44 exhibited a periapical endodontic lesion and had been restored with a cast post-and-core. Its prognosis was unfavorable. The patient suffered from mild hypertension, but since it was controlled by medication, there was nothing to preclude dental treatment.

A cone-beam computed tomography (CBCT) of the bone was taken in the area to be rehabilitated. The radiological examination showed a residual bone height sufficient for an implant, but the ridge was too narrow and would have required bone augmentation or excessive lowering of the bone profile to accommodate a standard implant.

Following the principles of minimally invasive treatment, it was decided to extract the non-salvageable tooth 44 and to insert three wedge-shaped REX TL 1.8 PiezoImplants at sites 44, 45, and 46 after a healing period of four months (Fig. 1).

The CBCT showed a ridge with a horizontal width of 3.5 to 4.5 mm, which is not sufficient to maintain a peri-implant bone lamella 1.0 mm in thickness when using conventional implants and therefore would not guarantee the long-term stability of the peri-implant bone tissue. The status of the bone supply suggested the use of the new REX PiezoImplants with a shoulder width of 1.8 mm, which are able to preserve sufficient bone over the long term (Fig. 2).

A crestal incision was made and a full-thickness flap elevated using the PIEZOSURGERY® Insert PR1.

Once the alveolar ridge had been exposed and accessible, the implant osteotomy was performed according to the specific REX PiezoImplant/PIEZOSURGERY® protocol, using special PIEZOSURGERY® inserts as described in the relevant surgical manual.

FIG. 1

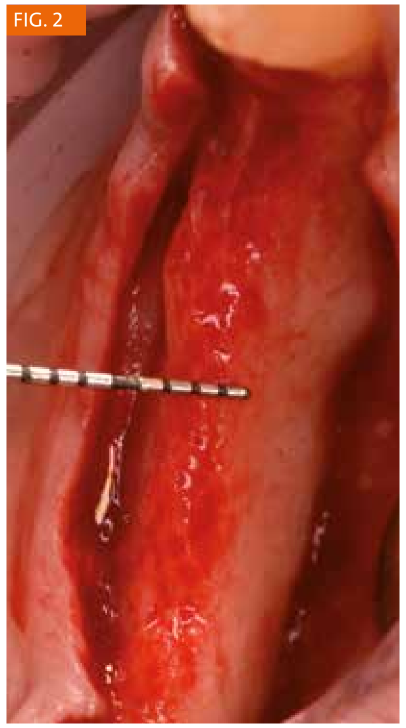

FIG. 2


Fig. 1: Extensive edentulous space.

Fig. 2: Exposed edentulous alveolar ridge and a probe for size comparison.

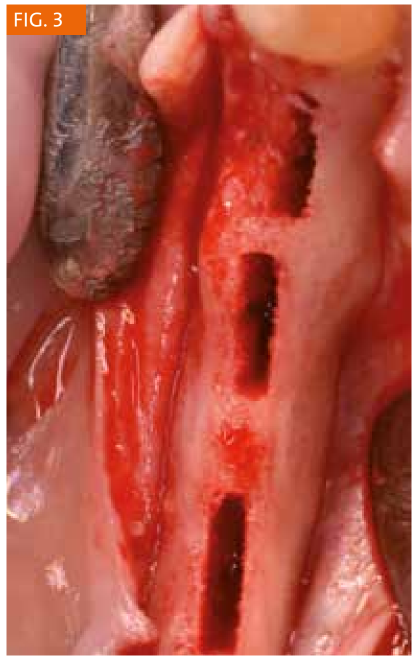
FIG. 3


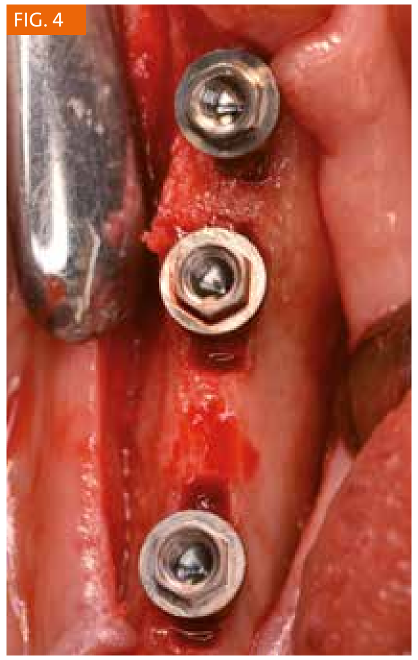
FIG. 4


Fig. 3: Prepared implant bed after using Insert W2.

Fig. 4: The implants in place in the jaw.

The preparation of the implant site started with the PIEZOSURGERY® Insert W1 under copious irrigation with saline solution. Insert W1 has a maximum diameter of 1.5 mm and produces an directional initial cylindrical-conical pilot osteotomy, which is very precise even in a narrow jaw ridge.

The mesiodistal dimension of the REX PiezoImplant is 5 mm; thus, with a target distance of 1.5 mm, the osteotomy started 4 mm from the cervix of the adjacent tooth.

Once the center of the preparation had been determined, a reference pilot osteotomy was performed mesially and distally with Insert W1, 2.7/2.8 mm from the center of the preparation to delineate the incisions with the subsequent piezosurgical inserts. This distance can easily be determined with the appropriate gauge. The REX PiezoImplant has a larger mesiodistal dimension than the standard screw implant.

Next, Insert W1 was used to insert the alignment pin along the insertion axis provided in the treatment plan to ensure the parallelism with the adjacent teeth and the correct position relative to the opposing jaw, possibly using a custom verification template. In addition, a radiograph was taken to check the preparation axis.

As the position proved to be correct, the procedure was continued with Insert W2 (microsaw), which has a width of 2.20 mm and is moved gently to the appropriate depth (corresponding to the length of the implant to be inserted) in a mesiodistal direction. Insert W2 must be inserted at least 1 mm deeper than the selected implant length.

This incision must follow the axis of inclination (determined by the W1), and its mesial and distal boundaries must be within the limits marked on the alveolar ridge.

Insert W3 (microfile) has a diamond-coated surface, a width of 2.5 mm and a thickness of 0.85 mm. Its task is to define the vertical walls, floor, and line angles of the osteotomy. This instrument is also moved carefully and under copious irrigation.

Once this had been achieved, the desired preparation depth was reached. The correct execution is checked by inserting Fit Gauge W2/W3 (implant analog) and thus confirming the depth achieved.

The remaining step was the buccolingual extension of the osteotomy for the insertion of REX PiezoImplants, which unlike conventional blade

FIG. 5

Fig. 5: Implants with healing abutment.

Fig. 6: The completed bridge in situ.

implants have a wedge-shaped profile that significantly increases their potential primary stability.

Insert W4 is used for widening near the implant shoulder (or Insert W4H if there is a strong layer of residual cortical bone). Bone widening serves to allow perfect stabilization of the implant and to achieve minimal compression at the level of the cortical bone.

During preparation with Inserts W4 or W4H, it is important to continuously check the dimension of the osteotomy with Fit Gauge W4/W4H to avoid excessive enlargement.

The Implant was positioned passively up to half the length of the REX PiezoImplant. The implant was inserted and stabilized by calibrated vertical tapping with the REX IPD (Implant Placement Device), a special atraumatic electromagnetic surgical mallet. Experience has shown that insertion by tapping is well accepted by patients and can also be calibrated surprisingly well.

It is recommended to place the implant 0.5 mm subcrestally, with possible adjustments depending on the individual situation.

The patient received the following PiezoImplants: REX TL 1.8 (H = 11 mm) at site 44 and 2 × REX TL 1.8 (H = 9 mm) at sites 45 and 46 (Fig. 4).

The implants were monitored by resonance frequency analysis and prosthetic restoration was performed five months after placement (Fig. 5).

Conclusions

REX PiezoImplants were developed for optimal anatomical adaptation. They have many advantages: Their rectangular cross-section allows insertion into a narrow alveolar ridge. Their wedge shape ensures good primary stability. No bone augmentation surgery is required The implant bed can be prepared with the PIEZOSURGERY® technique, which promotes healing and supports osseointegration. The surgical protocol is uncomplicated, and the connection of the prosthesis is simple thanks to a standard connection being used (4.1 mm external hex).

The REX PiezoImplant is the first implant in the world that can only be inserted after piezoelectric preparation (UISP, ultrasonic implant-site preparation). This preparation technique favors faster osseointegration and increases peri-implant bone density, as described in the literature.

Ten years of observation and a preliminary multicenter study have shown that this procedure is safe and predictable, offering survival rates comparable to conventional oral implantology and allowing a high level of clinical and urgical standardization. In addition, bone augmentation—which is not always predictable and not always accepted by patients—is not required (Fig. 6).

FIG. 6

Dr. Crescenzo Russo

INSERTING TWO REX TL 1.8 PIEZOIMPLANTS (H = 11 MM) IN AN EDENTULOUS PATIENT

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Degree in dentistry from the University of Torino in 1993. Working with implant prosthodontics since 1995. Cooperation with Dr. Tomaso Vercellotti since 2000. Founding member and Secretary of the International Piezosurgery Academy on 2009 (member of its Board from 2009 to 2013).

An adult woman with a narrow alveolar ridge and a thin periodontal phenotype presented for a dental exam.

As a result of jaw atrophy following tooth loss, there was not enough bone volume available for the insertion of standard implants.

The patient did not want to undergo bone regeneration or augmentation because she feared the consequences of an invasive procedure and because of the risk of complications. Therefore, a less invasive therapy with narrow wedge implants was suggested.

The implant was a REX TL 1.8 PiezoImplant (Fig. 1), a new type of implant specially designed for the narrow ridge, 1.8 mm in width at shoulder level and 11 mm in length. This is a tissue-level implant with a 4.1-mm external hex connection.

The computed tomography (CT) showed a very narrow alveolar process about 4.6 mm in width (Fig. 2).

Superimposing a radiographic template of the implant on the CT gives an indication of whether the bone supply is sufficient for this type of implant (Fig. 3).

The implant site was prepared piezoelectrically according to the surgical manual, and the implant was inserted using the REX IPD electromagnetic surgical mallet.

FIG. 1

FIG. 2

FIG. 3

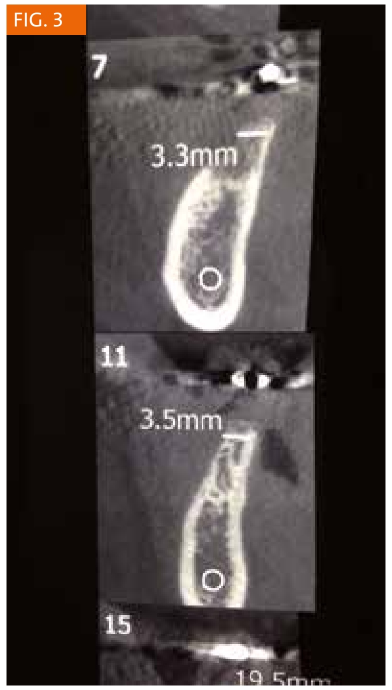


Fig. 1: REX TL 1.8 PiezoImplant (H = 11 mm).

Fig. 2: The CT shows a very narrow jaw ridge of about 4.6 mm.

Fig. 3: Checking the bone supply by superimposing a radiographic template of the implant on the CT.

Figs. 4a and 4b:
Initial situation: Narrow bone crest.

Figs. 5a and 5b:
Two inserted REX TL 1.8 PiezoImplants (H = 11 mm).

Figs. 6a and 6b:
Initial follow-up at nineteen days. Excellent adaptation of the soft and hard tissues.

FIG. 4A


FIG. 4B

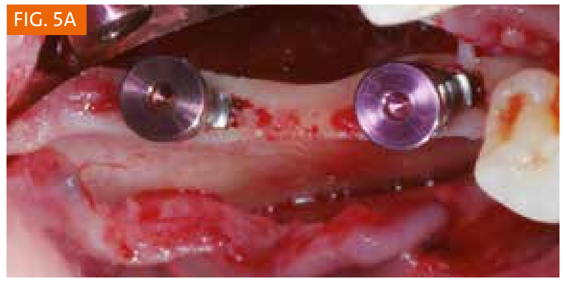

FIG. 5A


FIG. 5B


In the narrow edentulous ridge, not only the bone tissue but also the gingival tissue were very thin (Figs. 4a and 4b). Nevertheless, the implants were inserted without any particular difficulties, following the piezoelectric preparation and insertion protocol recommended by the manufacturer.

FIG. 6A


FIG. 6B


After insertion, the soft tissue was adapted and sutured around the transmucosal healing abutments according to the tissue-level procedure (Figs. 5a and 5b).

The first clinical and radiological follow-up at nineteen days showed excellent adaptation of the soft (Fig. 6a) and hard tissues (Fig. 6b).

The follow-up at four months also indicated regular healing (Figs. 7a and 7b) and clinically verifiable osseointegration.

To ensure proper osseointegration, a six-month waiting period was observed, at the end of which an impression was taken with the multi-unit abutments (MUA) supplied with the implant (Figs. 8a and 8b).

Two weeks later, the framework try-in of the screw-retained gold/ceramic design (Figs. 9a and 9b) and the subsequent delivery of the restoration proceeded without any problems.

Subsequent control radiographs showed optimal function and excellent bone stability.

FIG. 7A


FIG. 7B


FIG. 8A


FIG. 8B


FIG. 9B


FIG. 9A


Conclusions

This clinical case illustrates the application of the principles of minimally invasive implant surgery using wedge-shaped implants with a rectangular cross-section.

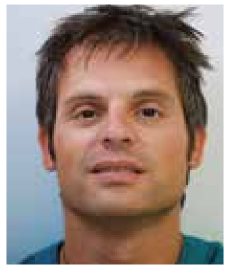
These implants require an implant site prepared with PIEZOSURGERY®. The wedge-shaped implants were calibrated with the REX IPD and stabilized in the implant bed in a controlled press-fit procedure.

The geometry of the implant with its horizontal macrogrooves helps distribute the load on the bone correctly. Minimally invasive osseointegrated wedge-shaped implants are a useful alternative to screw implants in narrow ridges that would require much more lengthy, complex, and invasive regenerative procedures.

Figs. 7a and 7b:
Implants at the four-month follow-up.

Figs. 8a and 8b:
Control CT of the implants and impression at six months.

Figs. 9a and 9b:
Control CT and clinical situation with framework try-in after six months.



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Co-developer of the REX PiezoImplant.

Dr. Andrea Alberghini Maltoni, Dr. Alberto Rebaudi

SOFTWARE-SUPPORTED PLANNING AND GUIDED SURGERY USING REX PIEZOIMPLANTS

The REX PiezoImplant was developed for easy insertion in the narrow alveolar ridge where standard implants with a circular cross-section cannot be placed due to space limitations.

Computer-assisted implantology facilitates rehabilitation and correct implant positioning in areas that offer limited bone volume. The planned surgical procedure using a surgical template guides directs the surgeon in placing implants and makes optimal use of the available bone through a minimally invasive surgical procedure.

The present article describes a method for treatment planning and for creating a surgical template, developed especially for the placement of the new REX PiezoImplants following piezoelectric preparation of the implant site.

In order to be able to use piezoelectric instruments, a new type of surgical template for implant beds with a rectangular cross-section has been developed, adapted to the shape of the instruments for the REX procedure.

The implant position and the surgical template can be planned using appropriate 3D software tools that can create files readable by 3D printers. Implant planning requires working with virtual implants. For the present case, the Implant 3D v.9 software (Medialab) was used. Its library contains the shapes of the REX PiezoImplants and the corresponding prosthetic components.

In order to obtain a virtual model that includes all the information needed for correct treatment planning, an occlusal scan of the dental arch is combined with a cone-beam computed tomography (CBCT) scan. Parameters taken into account include bone supply (width, height), bone quality, gingival thickness, prosthetic space, and occlusion.

In this way, the restoration can be aligned with the implant axes and a suitable surgical template can be designed that accommodates the available space. In the present case, the template was stabilized, with high precision, on the adjacent teeth and with anchor pins, whose position was determined using the same software as before.

Once this step was complete, the surgical guide template was exported to an STL file, and printed on a 3D printer.

Introduction

Titanium dental implants have been shown to be consistently successful in submerged as well as non-submerged healing situations with screw-type as well as press-fit implants. To improve the osseointegration of the implant, biological factors must be considered to limit the trauma that the preparation will cause to the bone and to prevent micromovements of the implant in its bed.

Adequate time for healing must be allowed before loading the implant. The clinician should not underestimate the importance of favorable anatomical and site-related conditions or of the projected loading protocol and type of prosthetic rehabilitation within the patient selection process. Furthermore, the thickness of the available soft tissue must be assessed, and the esthetic integration of the future restoration must be considered.

Looking at the sheer number of individual factors to be considered, it becomes evident that the planning and design phase requires meticulous attention.

Sophisticated 3D software is now available that captures all the information needed for the design phase and accurately combines radiographic images with scans of the dental arch and occlusal relationships. This software can also add the profiles of implants and prosthetic components into the resulting visualization, creating a projection that takes into account both surgical and prosthetic requirements.

Especially in the narrow ridge, implants require a sufficiently strong bone lamella on the vestibular and lingual sides to preserve stable bone and soft-tissue conditions and to avoid dehiscences and recession.

In addition, the position and angulation of the implant are particularly important in order to facilitate a prosthetic solution exhibiting a correct functional anatomy along with attractive esthetics.

Computer-aided planning and the use of surgical templates to correctly position the implant or implants allows us not only to precisely tailor the implant position to the available bone supply but also to identify the best prosthetic solution while at the same time significantly reducing the risk of error.

The present case report illustrates the implant-prosthetic rehabilitation of a narrow alveolar ridge where all important surgical and prosthetic requirements were met. After appropriate planning, a surgical template was designed to guide piezoelectric inserts instruments during placement of one of the new REX PiezoImplants with their wedge-shaped profile.

Case report

A 67-year-old man presented with teeth 24, 25, and 26 missing due to periodontal involvement. The patient exhibited a distinctly atrophic ridge with a considerably reduced bone supply after only a few years (Fig. 1). He had been wearing a removable clasp-retained partial denture (abutments 23 and 27) for several years; he did not consent to the bone augmentation required for implant therapy. After tooth 27 had begun to show hypermobility, the patient returned to inquire whether a fixed restoration was possible after all.

FIG. 1

FIG. 2

FIG. 3

Fig. 1: Clinical baseline situation.

Fig. 2: Panoramic CBCT view of the initial situation.

Fig. 3: Measuring the thickness of the bone with the same 3D implant-planning software that was used to plan the placement of the REX TL 1.8.

He had initially refused implant therapy because this treatment mode would have required bone surgery for ridge augmentation. However, he did accept a minimally invasive rehabilitation in which a novel REX TL 1.8 PiezoImplant was to be inserted along with an additional screw implant that did not require bone augmentation.

Following a careful overall diagnosis, a CBCT scan of the second quadrant (ProMax 3D Mid, Planmeca) was used to measure the extent of bone loss. At site 24, the alveolar ridge had a width of 2.9 mm (Fig. 2) and exhibited a considerable vestibular concavity, which made treatment planning difficult (Fig. 3).

In order to get a complete overview of the case, the second quadrant and the opposing jaw were scanned in occlusion with an intraoral scanner (Emerald, Planmeca) for a digital impression.

FIG. 4

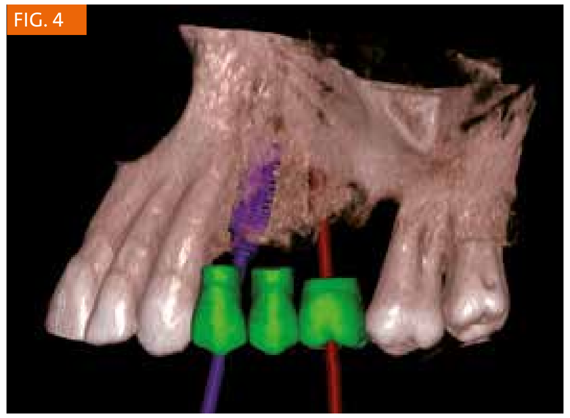


FIG. 5

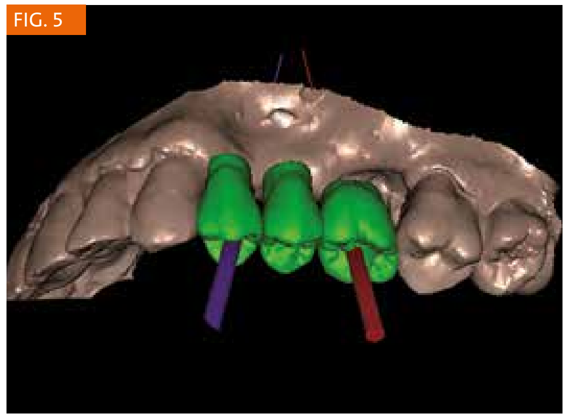


Fig. 4: Implant-prosthetic planning by CAD software. Radiological scan and diagnostic wax-up produced by the dental technician. The implant axis coincides with the axis of the crown.

Fig. 5: Implant-prosthetic planning by CAD software. Optical scan and diagnostic wax-up.

By superimposing the radiological image with the optical image, it was possible to simulate the implant-prosthetic restoration in the 3D implant software by way of a digital diagnostic wax-up to determine the shape of the prosthetic elements. This turned out to be an important tool in defining an implant position that corresponds to the prosthetic situation.

Using the implant profiles in the Implant 3D software library, the REX implant at site 24 and a screw implant at site 26 were virtually positioned, taking into account the available bone supply and other prosthetic requirements (Figs. 4 and 5).

The decision to combine a wedge-shaped implant and a screw implant as abutments for a single in one restoration was made after analyzing the available bone supply. The width of the ridge was approximately 3 mm at sites 24 and 25, so a REX TL 1.8 PiezoImplant (H = 11 mm) was chosen.

Site 26, by contrast, was to receive a cylindrical-conical implant with a circular cross-section (evo slim fit, 3.5 × 10 mm, Ghimas). Since both the REX PiezoImplants and the screw implants osseointegrate, they can both be used as abutments for the same bridge.

In a guided surgical procedure, the implants should be inserted in a position that is compatible with the bone supply and with the requirements of a screw-retained restoration.

The software made it possible to optimally align the implant axis according to the virtual diagnostic wax-up, according to the respective prosthetic element, using the extended implant axis as reference to be optimally centered within the projected crown (Figs. 4 and 5).

Since prosthetic information is often unavailable, the implant positions dictated by the anatomy of the bone frequently do not represent the prosthetically ideal positions.

Once the planning stage was completed, the GuideDesign CAD software was used to design the surgical template for the wedge-shaped implant and the screw implant (Fig. 6).

The surgical template was additively manufactured from biocompatible resin by 3D printing (Creo 3D, Planmeca) and sterilized.

A flap was raised in local anesthesia (Fig. 7) so that the width of the alveolar ridge could be measured directly and the surgical template inserted, at the same time checking its stability of fit on the adjacent teeth (Fig. 8). With the bone now exposed, the bone surface was smoothed with the PIEZOSURGERY® SLC osteoplasty tool before preparing the implant site.

The difference between the rectangular guide for the REX implant and the round guide for the screw implant is interesting to see (Fig. 8).

The implant site was then prepared as guided by the surgical template, using the appropriate sequence of calibrated drills for the screw implant and PIEZOSURGERY® Insert W2 for the REX TL 1.8 (Fig. 9). After removing the template, the result of the preparation was inspected, showing a surgical field with sharp demarcations and clear lines (Fig. 10).

FIG. 6

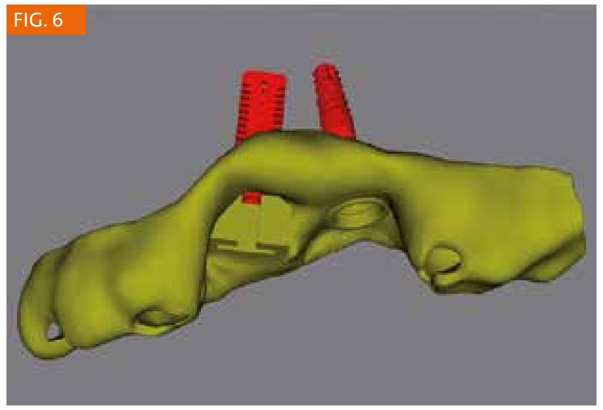


FIG. 7

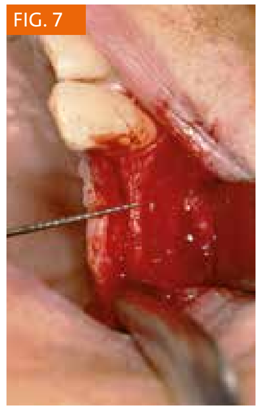


FIG. 8

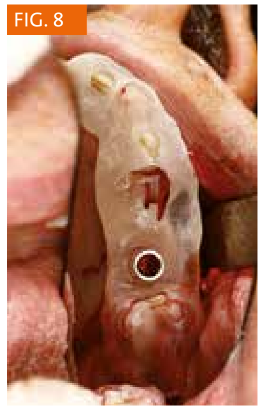


FIG. 9

FIG. 10

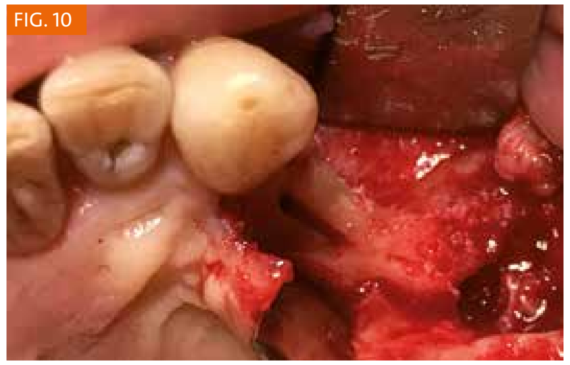


FIG. 11

FIG. 12

Fig. 6: Design of a surgical template for a wedge-shaped REX TL 1.8 PiezoImplant and a cylindrical screw-type implant (3D printing based on SDL data).

Fig. 7; Raising a flap and measuring the ridge thickness.

Fig. 8: Placing the surgical template.

Fig. 9: Preparing the implant site for the REX TL **18** using PIEZOSURGERY® inserts as guided by the surgical template

Fig. 10: Implant bed for the wedge-shaped REX implant prepared by a guided procedure.

Fig. 11: Placing the REX TL 1.8 with the driver of the REX IPD electromagnetic surgical mallet.

Fig. 12: Inserting the conventional implant.

Remarkably, the implant bed for the REX TL 1.8 is not located centrally in the alveolar ridge, which would be its “normal” anatomical position, but further palatally, in line with the axial position of the future restoration.

The preparation was completed with Inserts W2 and W3; a surgical template is not needed for this, as the existing osteotomy provides the required guidance. The working depth achieved was checked with Fit Gauge W2-W3. The preparation was hen finished with Insert W4 on the cortical side—once again guided by the existing osteotomy.

After renewed checking with the appropriate Fit Gauge W4, the REX TL 1.8 (Fig. 11) and the screw implant (Fig. 12) were inserted.

The wedge-shaped Rex PiezoImplant was inserted using the press-fit technique with the REX IPD electromagnetic surgical mallet, which stabilizes the implant and provides moderate bone expansion.

Teeth 27 and 28 were extracted. For ridge preservation purposes, Fisiograft Bone Granulate bone substitute material was mixed with liquid I-PRF (platelet-rich fibrin) and placed under a

Figs. 13a to 13c: Extracting the two distal teeth, followed by guided bone regeneration (GBR) with Fisiograft Bone Granular and PRF.

Fig. 14: Control tradiograph after insertion of the two implants.

Fig. 15: CBCT at five months for the guided insertion of the distal implant. Despite the undesirable scatter, it is evident that the REX implant is correctly positioned.

FIG. 13 A

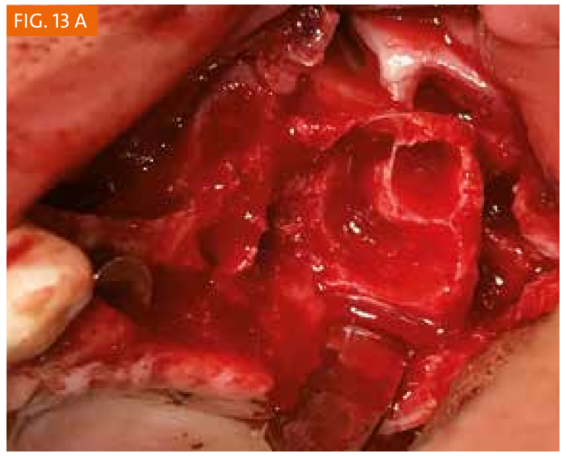


FIG. 14

FIG. 13B

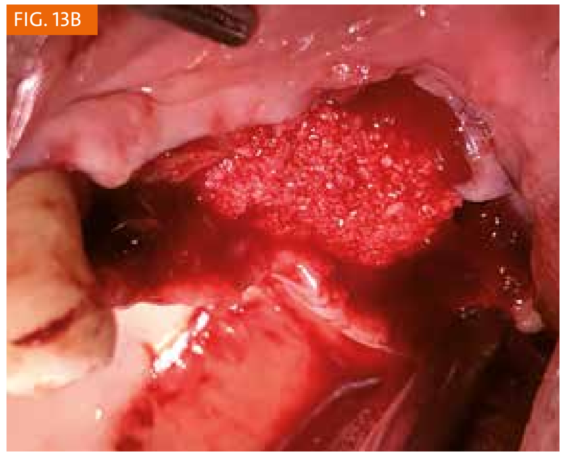
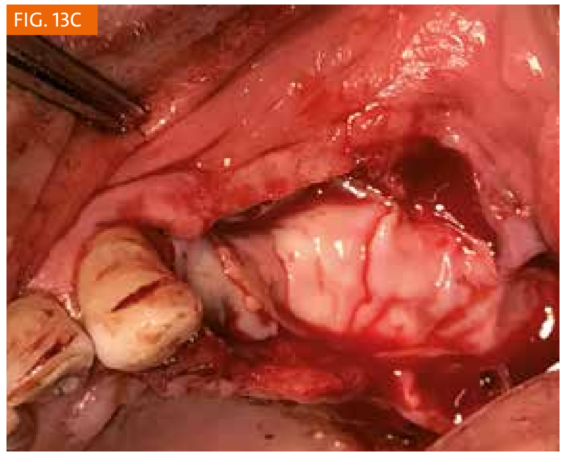


FIG. 15

FIG. 13C



PRF membrane (Fig. 13) so that another implant at site 27 could be inserted in a second surgical procedure.

To promote graft healing, the site was stimulated after the extraction to improve blood circulation and achieve vascularization. Once inserted, the two implants were checked intraorally (Fig. 14).

When the grafted material had healed, a further local CBCT scan was prepared to plan the insertion of implant 27. The CBCT showed optimal healing after five months (Fig. 15). It also demonstrated that the position of the REX TL 1.8 implant achieved by the template-guided surgery corresponded exactly to the position originally defined within the software (Fig. 4).

On completed healing, implant 26 was re-entered and a second surgical template placed for the insertion of implant 27 (Fig. 16).

Immediately following the surgical procedure, an impression of the area was taken with the intraoral scanner and special impression pins that were screwed onto the two implants (Fig. 17).

The screw-retained CAD provisional as shown in the final radiograph (which also shows the digital T-base abutment, Fig. 20), was milled from PMMA using the chairside technique (Fig. 18) and delivered immediately (Fig. 19).

It was interesting to note that the 3D planning actually enabled the correct positioning of the continuous screw access channels of the bridge (Figs. 5, 18, and 19).

FIG. 16

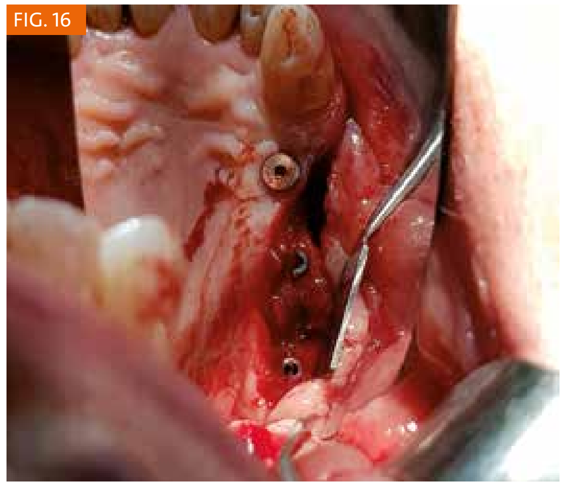


FIG. 17

Fig. 16: Re-entry of the two implant sites and guided insertion of a third distal implant.

Fig. 17: Intraoral scan of scanbodies on both implants for delivery of a screw-retained immediate temporary restoration.

FIG. 18

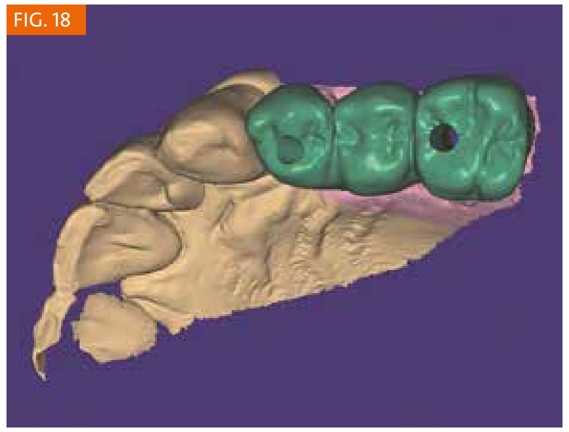


FIG. 19

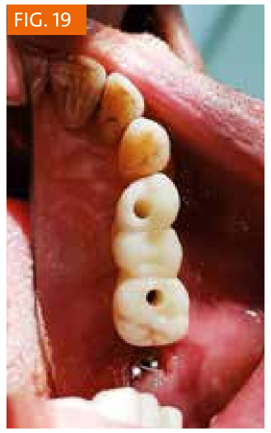


FIG. 20

Fig. 18: Designing the screw-retained immediate temporary restoration with ExoCAD.

Fig. 19: Delivery of the screw-retained provisional restoration (milled from PMMA).

Fig. 20: Control radiograph of the screw-retained immediate temporary on two implants.

Conclusions

The digital transformation in oral implantology allows careful case planning, taking into account the anatomical and prosthetic situation (Fig. 20).

To achieve the best possible rehabilitation, 3D scanning, planning, exporting, and printing technologies are used to create a surgical template for a guided implantology procedure.

Computer-assisted planning in connection with a guided intervention allows the numerous prerequisites for long-term success to be considered in the best possible way while considerably reducing the risk of errors.

Software planning and the ensuing surgical template allow the implant to be correctly positioned within the available bone, considering the patient's occlusal situation and the requirements of the soft and hard tissues, with a significant positive effect on subsequent function.

The innovative REX PiezoImplant can be used to restore a narrow ridge while taking into account all the anatomical, clinical, and prosthetic requirements and reaping the impressive benefits of guided surgery.

SCOPE OF DELIVERY
REX PIEZOIMPLANT®

SURGICAL KIT TRAY

- The Surgical Kit Tray from REX Implants contains a complete set of PIEZOSURGERY® instruments needed to prepare an implant site for a REX TL 1.8 PiezoImplant.
- It includes the implant analogs for checking the precision of the preparation, the drivers for the press-fit insertion of the implants themselves, and all other insertion tools required.

The Surgical Kit Tray comprises:
- Radel surgical cassette
- Inserts W1, W2, W3, W4, W4H
- 2 × Alignment Pins IM1S
- 2 Implant Analogs W2-W3
- 1 × Lab Analog W4-W4H
- 1 × Driver S
- 1 × Driver L
- 1 × Remover for REX TL 1.8
- 1 × Thumb Knob
- 1 × Instrument ST0
- 1 × Instrument ST20
- 1 × Instrument CR2

REX IPD (IMPLANT PLACEMENT DEVICE)

- Electromagnetic surgical mallet REX IPD for the insertion of REX PiezoImplants.
- The calibrated force pulses are atraumatic and protect the bone to the maximum extent.
- With the explantation adapter of the REX IPD, incorrectly placed implants can be easily removed.

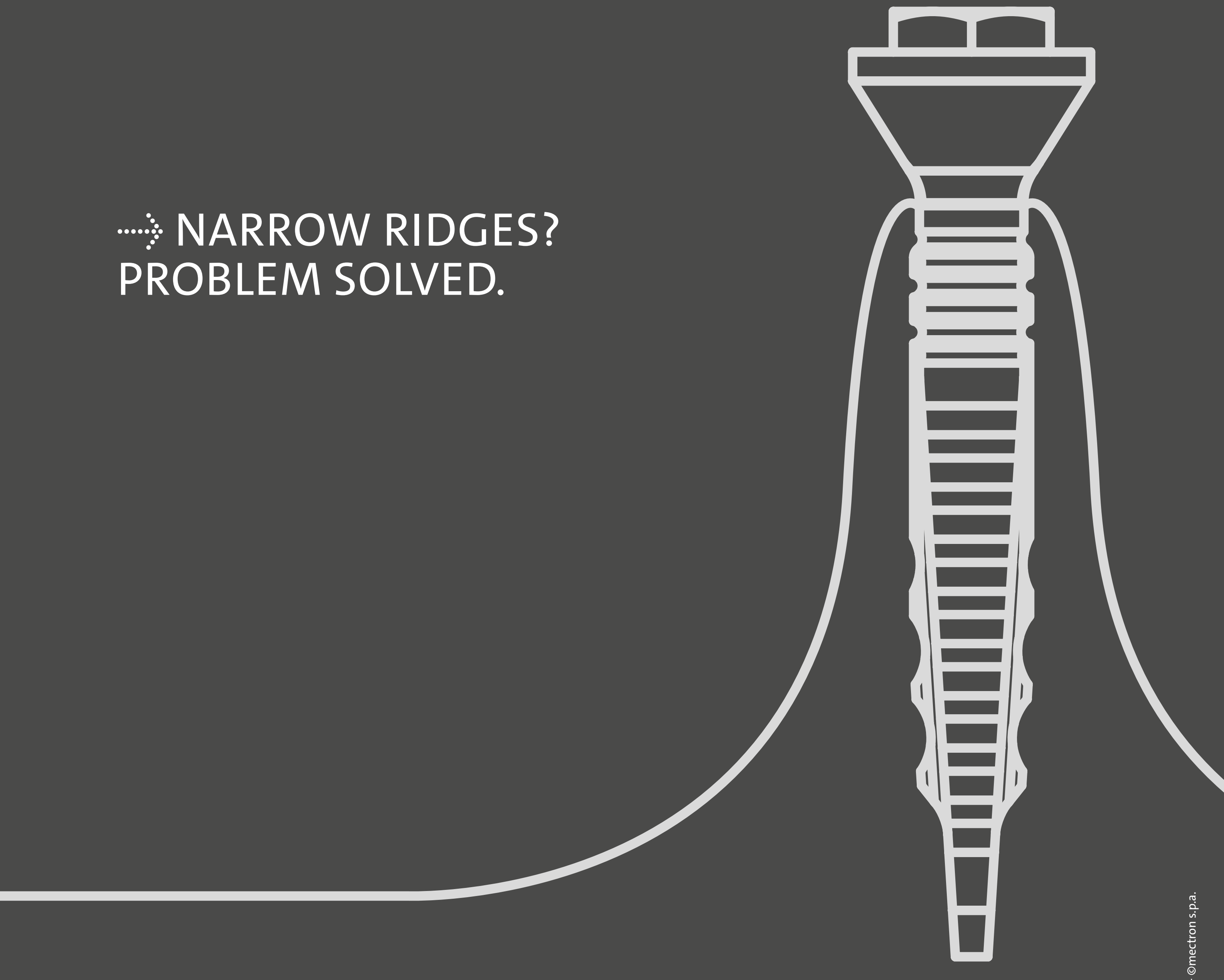
The REX IPD comprises:
- Console with control panel
- Handpiece
- Handpiece support
- Foot switch
- Adapter WR1

Rex Implants®

minimally invasive technology

The PiezoImplant System

NARROW RIDGES? PROBLEM SOLVED.



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