Platform-switching and super-short implants: an effective technique to manage residual jaws bone volume

Dear Editor,

The therapeutic planning of a study destined to an implant-prosthetic rehabilitation is often influenced by the absence of an adequate quantity of vertical bone. In posterior-lower quadrants the vertical limit is represented by the inferior alveolar canal while in posterior-upper quadrants the limit is the maxillary sinus. Considering that the sinus lift is a difficult surgery, operator-dependent and often with not predictable results, the possibility to insert a limited length implant may be an effective alternative.

The presence on the implant-market of some fixtures which could reach the length of 5-6 mm represents a valid and efficacious instrument for the surgeon, especially when a regenerating surgery is technically impossible. We have to consider the fact that the patient is often not available for long, several and expensive surgeries with reserved prognosis.

If the implants with a length inferior to 8mm are considered short, the ones with inferior dimension to 6 mm are defined super-short. Though the surgical techniques which aimed at a horizontal or vertical increment are numerous, the placement of short implants seems the best alternative, because they appear to be more effective and cause less complications than conventional implants placed in reabsorbed jaws.1

With regard to posterior sectors, the placement of super-short implants, in the presence of residual bone with length included between 4 and 6 mm, seems to be a good alternative to sinus lift’s procedures.2

We should also consider that presently the number of available trials is limited, with short follow-ups and high risk of bias for results.

Several studies confirm that, in the presence of limited residual bone in the posterior area, the use of short implants is a better choice because it results to be faster, easier in the execution and associated with less morbidity than other kind of vertical augmentation surgeries.3-7

In particular the Osseotite® surface, applied to short implants, shows excellent results during follow-ups.8 The outliving and the results obtained with super-short implants seem to be equivalent to the ones, already effective, obtained with short implants.9-13 If the reduction of the prosthetic surface or platform switching is associated to a short implant there are more possibilities to maintain over time a good level of hard tissue and soft peri-implant tissue.14, 15

It is believed that the saving of marginal bone should be attributed to the repositioning of the mucous neck in the modified implant-abutment junction and to the consequent limitation of the inflammatory infiltrate in the surface exposed and subjected to the switching.

As the infiltrate produces a peri-implant bone absorption, the containment of the same over the platform of the implant preserves the bone crest from the absorption. The grade of absorption of the marginal bone is inversely proportional to the difference between screw’s diameter and abutment’s diameter.16-18 The difference between diameters has to exceed the limit of 0,8mm to have a significant statistically effect. The platform switching can reduce by 1/3 the loss of peri-implant bone.19

A series of preliminary histologic results obtained with dogs support the hypothesis that platform switching can induce a circular orientation of collagen fibers on the level of implant platform and not on the level of bone-crest, near the first implant’s coil.20 The platform switching seems to reduce the loss of crestal bone working as a mechanical retention for the orientation

Figure 1.—A) Initial orthopantomogram performed in Jun 2010; B) initial CBCT performed in February 2011 (tangential section of the surgical area); C) initial CBCT (cross-section of the surgical area).
of periodontal fibers. Ultimately, the platform switching seems to reduce the absorption of the peri-implant crestal bone increasing the long-term predictability of implant therapy.21

This paper will focus on a series of interesting therapeutic technique because the prosthetic rehabilitation interested all four quadrants. Moreover, during the rehabilitation different length implants and both sintered and lithium-disilicate crowns were used. One of these lithium-disilicate crowns was placed on an abutment screw-retained on a super-short implant, to which the platform switching was applied. However, this prosthetic solution has to be considered at present as an unconventional solution.

In June 2010, a 31-year-old male patient with a swelling in the area 4.7 causing spontaneous pain presented himself to our observation. The patient was otherwise healthy, and both remote and near pathological anamnesis did not show significant issues.

The orthopantomography (Figure 1A) displayed the presence of a diffused radiolucency in the area 4.7 associated to the fracture of the apical third of the mesial root of the same tooth. Clinically, beyond the swelling of the area, there was a significant mobility of the prosthesis over the same tooth.

We proceeded with the elaboration of a therapeutic program which included initially the extraction of 4.7 and 3.8 and the root canal therapy of 1.6, 1.5, 2.6, 3.6, 3.7, 4.5. After several unsuccessful attempts on endodontic recovery of 2.6, also because of the discovery of some perforations and a micro-fracture at the expense of the mesiobuccal root, we decided for the avulsion of the same, executed in February 2012. Meanwhile, some re-
After an accurate analysis of TC cone-beam of both jaws executed in February 2012, we proceeded with the positioning of a super-short fixture in the area 2.6, sized 6×6 mm (BIOMET 3i™ NXFOS660); it was a forced choice because of available limited bone diameters (Figures 1B, C). According to the examination of TC cone-beam the osseous density, verified during the surgery, deposed for a bone kind D2.

Considering the transverse (Figure 2A) and the vertical contraction (Figures 2B, C), it was decided to create a full-thickness flap starting from a clearly palatal incision to overturn in buccal direction the whole mucoperiosteal low-cut tissue, without making released incisions, in order to increase the vestibular aspect of the area.

After drilling the bone with a calibrated drill, the implant was manually screwed at a set torque of 50 Ncm. With the mounting in situ, the patient was invited to close in habitual closing position in order to check the correct sagittal positioning of the implant (the control was effectuated several times during the drilling and during the insertion of the fixture) and compared to the opponent teeth (Figure 3A).

After the instrumental control of the good primary retention of the fixture and after the disassembly of the mounting we proceeded with a visual control of the area (Figure 3B) and with the simultaneous placement of a healing screw, which was 5 mm in diameter and 4 mm in height (Figure 3C). In this phase, we prepared the ground for the achievement of platform switching.

Three vertical mattress sutures of non-absorbable material were made (Figure 3D) in order to support the stabilization of the flap and one periapical radiograph was made (Figure 3E).

The patient was then subjected to a rigid protocol of home and professional hygienic support which included dressings with antiseptics (hydrogen peroxide and chlorhexidine-digluconate).

Six months after the positioning of the fixture (Figure 4A) and after verifying the good clinic conditions of the area, we proceeded with a polyether impression which, after having being checked in laboratory, allowed the start of all procedures aimed to the realization of prosthesis.

The expectation of 6 month was not determined by clinical reasons but because of the lacking availability of the patient.

The laboratory executed, as we usually ask for abutments, a jig made of self-cure resin aimed to facilitate constructions of composite resin with quartz fiber pins were made on 1.6, 3.6, 3.7, 4.5, destined to a temporary prosthesis with provisional restorations.
the repeatable placement of abutments in the oral cavity permitting the regulated intervention of the torque wrench.

Following a strict hygienic and clinical uncompromising protocol it was possible to reach the delivery of the abutment with soft tissues in ideal trophism and health condition (Figure 4B).

With the help of the jig it was possible to connect accurately the abutment to the fixture through a gold screw (BIOMET 3i™ UNIHG) tightened to 35 Ncm using a torque wrench and whose characteristics allow to determinate a preload on the implant and to contrast effectively unscrewing (Figure 5A).

A lithium-disilicate crown, obtained using the technique of pressing and whose thicknesses were carefully defined in laboratory with the help of a silicone half-mask, was cemented on the abutment.

After a careful control of contacts executed also with the help of shim-stock foil (Figure 5B), an intraoral radiograph was made.

Already at the delivery of the restoration it was possible to appreciate how was determinant for the improvement of mucous depths (Figure 5C) a simple and careful execution of the flap without the help, at least in this study, of autologous grafts or xenografts.

Concurrently with the positioning of the implant in the area 2.6, other two Osseotite® implants were placed in area 4.7 (BIOMET 3i™ OSS510) and in area 4.6 (BIOMET 3i™ OSS410).

Once verified the primary stability two healing screws was positioned with the diameter of 5 mm and 4 mm in areas 4.7 and 4.6, respectively.

Over these fixtures a gold-ceramics prosthesis of two crowns was placed. This prosthesis presented a special design which prevents food impaction and allows a correct self-cleansing and oral hygiene at home. Immediately one orthopantomography was made (Figure 6A).

The patient was included in a professional hygienic maintenance recall program which provided biannual checkups and hygiene sessions.

Periapical radiographs were performed to evaluate the level crestal bone around the fixture. This was done: at the step of surgery, at the step of delivery prosthetic, at the step of 12 and 48 months of prosthetic functionalization.

In this study, the radiographs have been used with the superimposable technique. This technique involves the use of an acrylic resin bite-block modified to allow a repetitive housing of the radiograph and equal distances to the x-ray tube.

Levels bone values were performed using a computer with a design software (AutoCAD®) computing the initial margin bone level (I-MBL) and the final margin bone level (F-MBL) as on the mesial protrusion than on the distal protrusion of the fixtures as well.

The patient which was administered on a six-month protocol of dental professional hygiene, and after four years (in December 2015) a X-ray examination was performed using the same acrylic resin bite-blocks.

In this study, the difference between I-MBL and F-MBL values (Figure 6B, C) obtained in T0 (time during the moment of prosthetic load) and T1 (time in four years later from prosthetic load) was computed.

At four years later from prosthetic load, the fixture was osseointegrated and marginal bone absorption was limited. Neighboring soft tissue was in health condition and trophism (Figure 6D).

At T0, the I-MBL values were about 5.97 mm and 5.78 mm in the mesial and distal position of the placed fixture (6 mm length), respectively; at T1, the values...
were about 5.84 mm and 5.66 mm with a minimal absorption of bone levels on mesial and distal positions. In this clinical study, the values obtained from radiographic analysis showed that on the tried fixture (BIOMET 3i™ OSSEOTITE® 6 mm in diameter, 6 mm in length) the bone peri-implant absorption after four years from prosthetic load was about 0.12 mm on distal protrusion and 0.13 mm on mesial protrusion.

The obtained results according with good performance in the middle time of super-short implant and platform-switching protocol applied on the same one. In this clinical study the mesial absorption in T1 is basically the same to distal one.

These measurements, which were performed by the same operator several times with superimposed results, were very accurate, and thus highly reliable. The reduced availability of vertical bone may be exceeded by the positioning of short implants or ultra-short implants whose performances are comparable to the performances of longer ones.

Considering that super-short implants are available also with large diameters, we know that we have at our disposal very extended surfaces of bone-implant contact. If we consider that in addition there is the possibility of using the technique of platform switching, we are also able to save in a secure and predictable way the peri-implant bone-crest from quick and significant process of resorption. Without compromising about esthetic results.

The execution of a flap in a precise and clear way, if there are the conditions, determine a low post-surgical morbidity with reduced problems for the patient. This allows to gain, in favorable conditions, significant mucous depths without the need of executing autologous grafts and xenografts.

The use of a prosthetic solution on the super-short implants shows the application of single crown made of lithium disilicate on gold or titanium abutment, though actually considered a no-conventional technique, allows the osteointegration.

The use of this implant-prosthetic solution in atrophic jaws by choosing super-short implants and platform switching protocol with lithium disilicate crowns seems to represent a valid alternative to maxillary sinus augmentation and bone grafting. However, these interesting clinic results obtained in this and in other similar studies require a medium or long-term follow-up. We will keep record of the data regarding the endurance and the resistance over time of lithium-disilicate crowns in posterior sectors, the radiological response to the platform switching, and the survival of super-short implants.

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