

Biological Space from an Implant and Aesthetic Perspective

The Concept of “Platform-switching”

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In the anterior sector, the lack of postoperative bone resorption around the implant collar constitutes a vital factor in stabilizing the papillae and obtaining a harmonious dental neck line in relation to the neighboring teeth.

During the first year of use, stabilization of the crestal bone at the level of the first thread of a screw-retained Brånemark type implant has always been observed and considered normal. While many biomechanical theories have been advanced without really being convincing, better knowledge of biology offers new keys to better understand this phenomenon. In fact, it has been observed that resorption around the collar begins when the implant is exposed, and as long as the latter remains submerged, the crestal bone is stabilized at the level of the collar.

Following loading, or surgical stage 2, bone stabilization beneath the collar seems to depend on several factors, such as, respecting a biological space, the location of an area of inflammatory connective tissue (ICT), and the state of the implant surface.

In 1997, Abrahamsson *et al.* showed that multiple screwing and unscrewing movements of the healing screw result in apical migration of the epithelial attachment around the implant collar. The authors stress that this epithelial migration results, in turn, in an apical relocation of the bone level, so that a biological space compatible with the health of the peri-implant tissues is restored. The presence of a bacterial infiltration has also been revealed at the abutment/implant interface. This infiltration results in the permanent presence of an area of inflammatory connective tissue (ICT) which continues to contribute to apicalization of the first contact point between the implant and the bone. Finally, the condition of the surface, unlike the parameters mentioned, plays a positive role with regard to the resorption phenomenon. When the implant surface is rough, the bone's capacity to adhere to the titanium is increased when significant stresses are applied, particularly during immediate loading.

CONCEPT OF “PLATFORM-SWITCHING”

This concept consists of using prosthetic components that are undersized in relation to the diameter of the implant collar in order to limit peri-implant bone

resorption. This strategy arose from observation and analysis, as early as 1991, of situations in which bone resorption didn't occur or occurred minimally around wide 5 mm implants (3i®, Implant Innovations). The crestal bone level remained stable for the entire length of the implant, up to the collar, and this was the case regardless of the loading period. In all cases, undersized prosthetic abutments, 4 mm in diameter, had been used.

The reproducibility of the results leads us to believe that the position of the abutment/implant interface constitutes an essential element in the location and the degree of crestal resorption, and leads us, furthermore, to design the mechanisms governing the biological peri-implant space differently.

In fact, the biological space around implants was defined as the distance (2 to 3 mm) which separates the peri-implant bone from the connection between the implant and the abutment. This distance results from the presence of the ICT when the implant abutment is the same diameter as the implant, i.e. when one part is a continuation of the other.

By using a component that is narrower than the implant collar, the prosthetic connection is displaced towards the center of the implant, and this increases the

distance separating the peripheral bone from the base of the abutment. With regard to the abutment/implant interface, the ICT is located at a more coronal level, at the level of the collar, and no longer migrates apically towards the first thread of the implant. Consequently, resorption is avoided and the crestal bone is stabilized at the level of the implant collar.

CLINICAL APPLICATIONS

“Platform-switching” is particularly indicated in all cases where an optimal aesthetic result is desired. In 2000, Small and Tarnow showed that in 80% of cases, a 1 mm vestibular recession occurred during the first year of loading. This soft tissue recession, which is indicative of an underlying bone loss, represents a major risk in the anterior sector. By applying the concept of “Platform-switching”, using simple means, it is possible to obtain greater stability of the peri-implant tissues, using undersized components for the implant in question. It can easily be applied to 3i® implants. In fact, the 4, 5, and 6 mm implants carry the same external hexagon or, in case of the Certain® line, have the same internal connection. This characteristic shared by the most frequently used implants makes the system more flexible to use. “Platform-switching” can be

applied simply by screwing an abutment with a 4 mm diameter onto an implant with a 5 mm diameter without using a specific component. The same procedure can be repeated by providing an implant 6 mm in diameter with an abutment 5 mm in diameter.

This procedure can take place when an implant is loaded upon placement, using the single-stage surgical protocol, in single cases of immediate placement of a temporary prosthesis in sub-occlusion, and finally, in cases of immediate loading for completely edentulous patients. During all phases of the implant treatment, it is important to respect the undersizing of the components, up until the final implant-supported prosthesis is made.

Finally, the state of the titanium surface also constitutes an important parameter in maintaining the bone at the level of the collar. Testori *et al.* observed in 2001 and 2002 that for rough surface implants (Osseotite®, 3i-Implant Innovations), loaded immediately and placed using trephines used for histological examinations, bone stabilization had occurred at the 3rd thread, i.e. at the interface between the machined section and the rough section of the implants. According to Davies *et al.*, a rough surface simplifies migration of the osteogenic cells towards the surface of the implant through the

fibrin network. On the basis of these observations, the Osseotite® implants with a hybrid surface, developed since 1996, are now available in the FS (Full Surface) version that is rough from top to bottom and not just after the 3rd thread, in order to promote the stability of the bone up to the collar of the implant.

CONCLUSION

In the anterior sector, the stability of the bone at the level of the implant collar represents one of the keys to success in oral implantology. The use of prosthetic abutments with a reduced diameter in relation to the implant diameter limits the crestal resorption usually observed during the year following loading. The results obtained by applying this concept, called “Platform-switching”, can be explained by the increase in the distance separating the bony rim from the abutment/implant interface which displaces the area of inflammatory connective tissue to a more coronal and medial level. Finally, even though this lack of resorption was observed in the presence of implants with a machined collar, the use of completely rough implants should further increase the potential for tissue stability at the crestal level.

IN THE ANTERIOR SECTOR,
THE STABILITY OF THE BONE
AT THE LEVEL OF THE IMPLANT COLLAR
REPRESENTS ONE OF THE KEYS
TO SUCCESS IN ORAL IMPLANTOLOGY

CLINICAL CASE No. 1 **Fig. 1** – Orthodontic treatment made it possible to restore the ideal mesiodistal space prior to placement of an implant (Orthodontic work - Dr. E. Serfaty).

Fig. 2 – The presence of the lingual arch simplifies placement of the surgical guide in the vestibular position. The latter makes it possible to position the implant in the 3 spatial planes, in accordance with the prosthetic project.

CLINICAL CASE No. 1 (continued)

Fig. 3 – A small diameter implant (MicroMiniplant NT, 3i® - Implant Innovations) was placed in order to maintain a minimum mesiodistal space of 1.5 mm between the implant collar and the adjacent tooth. This space is necessary for the development and the preservation of the gingival papillae.

Fig. 4 – All of the prosthetic components used (healing screw, impression coping, and abutment) have the same diameter as the implant. “Platform-switching” cannot be applied to small diameter implants because the dimensions of the abutments are too small and this would result in a risk of fractures. As a reminder, the average diameter of narrow implants, regardless of the implant system, is between 3.3 and 3.5 mm at the level of the collar.

Fig. 5 – Postoperative result at 1 year: A PFM crown was bonded to a titanium abutment. The quality of the aesthetic result is due to the presence of papillae which testify to the presence of bony septa on both sides of the implant. (Prosthetic work - Dr. P. Miara).

Fig. 6 – X-ray taken 4 years postoperatively: bone healing has stabilized at the first thread of the 4 mm implant (15) and at the 2nd thread of the 5 mm implant (16). The prosthetic components have the same diameter as the implant collars. The “Platform-switching” technique was applied to the wide implant (5 mm diameter) in position 17, using a 4 mm undersized abutment. Note the lack of resorption at the level of the first threads of the implant, and the stabilization of the bone at the level of the collar.

CLINICAL CASE No. 2 **Fig. 7 and 8** – Tooth 11 is ankylosed and reveals terminal internal resorption. This situation is the result of a traumatic expulsion of the tooth 15 years earlier. The tooth was reimplanted immediately after endodontic treatment.

Fig. 9 – Flapless surgery is performed in order to limit the tissue resorption inherent in any bone exposure.

Fig. 10 – Precise vertical positioning of the implant (NT Certain®, 3i®) is ensured by visualizing the depth marks on the “3 in 1” connector.

Fig. 11 – A GingiHue® titanium abutment is used as a temporary abutment. The retention provided by the internal connection eliminates the need to use the prosthetic screw to stabilize the abutment during all fitting phases.

CLINICAL CASE No. 2 (continued)

Fig. 12 – A 5 mm implant was placed immediately after 11 was extracted. A non-functional, temporary crown, adjusted in sub-occlusion, was placed during the same intervention. Clinical view at 2 months post-operatively.

Fig. 13 – The control X-ray reveals the presence of an undersized abutment (4 mm in diameter), compared with the implant diameter (5 mm), in order to stabilize the bone at the level of the implant collar in accordance with the “Platform-switching” concept.

Fig. 14 – Clinical result at 1 year post-operatively: the dental neck line and preservation of all of the papillae testify to the low bone resorption linked to this immediate surgical strategy in association with “Platform-switching”. Following a 2 to 4 month healing period, a permanent PFM crown is adjusted in occlusion. (Prosthetic work - Dr. C. Sabban).

CLINICAL CASE No. 3 Fig. 15 and 16 – The presence of a discordant dental neck line at 11 and 21 is a counter-indication for immediate implant placement following extraction, as there is a risk of accentuating this discrepancy with regard to the dental neck line of the adjacent natural teeth.

Fig. 17 – A vestibular orthodontic device was placed in order to displace the incisors and thereby produce coronal displacement of the entire osteomucous complex. Clinical result after 12 months. (Orthodontic treatment - Professor R. Garcia).

Fig. 18 – Both implants are placed immediately after 11 and 21 are extracted. The ideal position of the implants simplifies the placement of the temporary crowns as no correction is required at the level of the implant abutments.

Fig. 19 – The temporary crowns are rebased, then bonded with temporary cement. They will remain connected for the osseointegration period to increase the rigidity of the implant/abutment/prosthesis system.

Fig. 20 – The control X-ray at 3 months postoperatively makes it possible to visualize the gap between each prosthetic abutment (4 mm in diameter) and the diameter of the wide conical implants (5 mm) (NT Certain®). The peri-implant bone covers all of the threads as well as the collar of the implants.

CLINICAL CASE No. 4

Fig. 21 and 22 – Clinical and X-ray views of terminal internal resorption due to reimplantation. Immediate implantation following extraction was indicated. A temporary crown will be placed in sub-occlusion during the same procedure.

Fig. 23 – After 6 weeks of osseointegration, an impression was made in order to obtain a master cast. A “UCLA Gold” type abutment was used to establish an ideal emergence profile. Its precious metal base made it possible to attach a pressed ceramic band, in order to avoid the presence of metal in the event of gingival recession.

Fig. 24 – A PFM crown with a ceramic-tooth interface was made using the same master cast (Prosthetic laboratory - Marc A. Leriche).

Fig. 25 – The internal connection of the implant can be used to tighten the abutment screw with a torque of 20 Ncm using a torque wrench. The definitive crown is also bonded with temporary cement. The papillae around the implant have been completely preserved, from the point of view of their volume, texture, and color. The dental neck line has remained harmonious. (Prosthetic work - Dr. M. Bartala).

Fig. 26 – A conical implant, 5 mm in diameter, that is rough over its entire surface, was used (3i® NT Certain, FS for Full Surface). The control X-ray highlights the reduced diameter of the UCLA Gold abutment, associated with a crestal bone level situated at the collar of the implant.

SPECIAL ISSUE AESTHETICS