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REVIEW ARTICLE

PLATFORM SWITCHING: A SOLUTION TO CRESTAL BONE LOSS!!!!! – A LITRATURE REVIEW

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ABSTRACT

The goal of current dental implant treatment is more than just the successful Osseo integration of the implant. It includes an aesthetic and functional restoration surrounded by stable peri-implant tissue levels that are in harmony with the existing dentition, Crestal bone remodelling starts immediately after implant placement, Platform switching is a technique which can preserve the crestal bone loss. The purpose of this article is to carry out are view of studies dealing with the platform switching concept to preserve the Crestal bone, the mechanism by which it contributes to maintenance of biological width, how the stresses are distributed and influence of micro gap on Crestal bone loss.

INTRODUCTION

Current major challenges in implant dentistry are the long term preservation of healthy peri-implant tissues which can provide both aesthetics and function over an extended period of time (**Alexender *et al.,* 2010**). Concept of platform switching for the optimal maintenance and conservation of peri-implant bone levels has gained popularity amongst commercial implant makers over the last few years (**Gardner, 2005; Luongo *et al.,* 2008**). The platform switching effect was accidentally established in the 1980s and early 1990s when different commercial dental implant manufacturers introduced implants of larger diameter before producing the corresponding abutments of the same measures. 14 years later, evaluation of those treatments in which abutments of lesser diameter were used revealed better preservation of the hard and soft tissues than treatment that use abutments with diameters matched to the implant (**Gardner, 2005; Luongo *et al.,* 2008**).

Platform switching concept

The platform switching concept was developed to control bone loss after implant placement; it refers to the use of an abutment of smaller diameter connected to an implant neck of larger diameter (Fig. 1); this connection shifts the perimeter of the implant-abutment junction inwards towards the central axis (the middle of the implant) improving the distribution of forces (**Lazzara and Porter, 2006**).

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Factors such as bacterial infiltration, micro-movements and the transmission of stress at the implant-abutment interface give rise to apical migration of the biological width (Fig 2). With platform switching, the implant-abutment interface is displaced horizontally towards the centre of the platform and separated from the marginal bone. Thus, bacterial infiltration, micro-movements and stress occur at a distance from the marginal bone, giving rise to lesser apical migration of the biological width and therefore to less marginal bone resorption (**Lazzara and Porter, 2006**).

How platform switching reduces crestal bone loss..!!!

The close relationship between the bone and the implant is the essence of Osseo integration. The bone changes occurring at the margins adjacent to the dental implants have been the subject of many clinical and experimental studies (**Cappiello *et al.,* 2008**). In turn, many hypotheses have been proposed in relation to the physiological processes that intervene in crestal bone stabilization. Although the etiological factors underlying bone loss have not been fully established (**Luongo *et al.,* 2008**), the main causal factors of crestal bone loss are occlusal overload and peri-implantitis (**Maeda *et al.,* 2008**).

1) Shifting of inflammatory cell away from adjacent crestal bone

Lazzara and Porter first theorized that shifting the IAJ inward repositioned the inflammatory cell infiltrate and confined it within a 90° area, thereby reducing marginal bone loss (**Lazzara and Porter, 2006**) (Fig. 3).

Fig. 1.

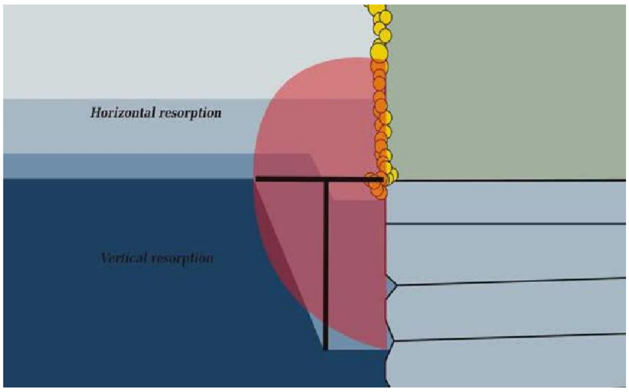

Fig. 2.

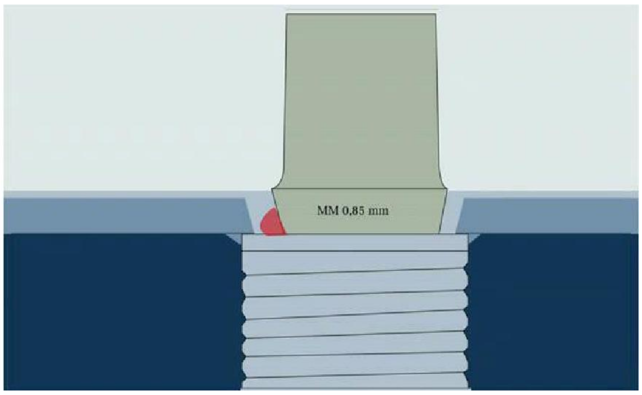

Photo courtesy: (info@fransiscobarbosaimplantology.com)

Fig. 3.

Luongo *et al.* studied biopsy specimen to find out the biologic process occurring around the platform-switched implant. They found that an inflammatory connective tissue infiltrate was localized over the entire surface of the implant platform and approximately 0.35 mm coronal to the IAJ but did not reach the crestal bone, which may be the reason for crestal bone preservation by platform switching (**Luongo *et al.,* 2008**). **Ericsson *et al.*** found histological evidence that an inflammatory cell infiltrate is located 1 to 1.5 mm adjacent to the IAJ. Considering the fact that bone is always encircled by approximately 1 mm of healthy connective tissue, it can be assumed that crestal bone remodeling may take place to establish space between the bone and the microbial contaminated tissue of the IAJ to create a biologic seal (**Ericsson *et al.,* 1995**).

2) By maintaining biological width improve the biological seal around implant

According to Lazzara and Porter, the deliberate creation of a space for the mentioned physiological barrier minimizes the space for repositioning of the fibers. By displacing the junction with the abutment to a more medial position with respect to the axis, an increased surface area of the implant is freed – thus favoring controlled repositioning of the biological space.[4] The space is created in the horizontal plane one millimeter from the implant-abutment junction, supported over the external margin of the platform. In addition, this procedure keeps the inflammatory infiltrate away from the crestal bone margin, with a 50% reduction in occupation surface (**Lazzara and Porter, 2006**). **Canullo *et al.*** Bone remodeling after dental implant placement, the most widely studied has been the formation of a new biological space. The creation of this mechanical barrier serves as a defense mechanism, preventing the penetration of bacteria from the oral environment (**Canullo *et al.,* 2010**).

Degidietal, Physiological sealing shows morphological differences according to whether it is formed in relation to a tooth or a dental implant. The biological space adjacent to an implant is greater than the space adjacent to a natural tooth, with histological differences in terms of the organization and distribution of the fibers (**Degidi *et al.,* 2008**). **Trammell *et al.*** in a case-control study measured the biological space with reduced and conventional platform abutments in the same individual. Although the mean biological width was similar in both groups (1.57 ± 0.72) mm with the expanded platform and 1.53 ± 0.78 mm with conventional abutments), bone loss was significantly smaller with the expanded platform (**Trammell *et al.,* 2009**). **Vela-Nebot *et al.*** conclude that platform switching improves aesthetic results and that when invasion of the biologic width is reduced; bone loss is reduced ($p< 0.0005$). However, they say that further microbiological, pathological and clinical studies are necessary to confirm both these results as well as the study's working hypothesis (**Vela-Nebot *et al.,* 2005**).

3) Influence on micro-gap, reduces crestal bone loss

Gaston N. King *et al.* alveolar crestal bone resorption occurs as a result of the micro gap that is present between the implant–abutment interface in dental implants. 2-piece non-welded implants showed significantly greater crestal bone loss compared with 1-piece welded implants after 1 and 2 months suggesting that the stability of the implant/abutment interface may have an important early role to play in determining crestal bone levels (**Gaston *et al.,* 2002**). **Cappiello *et al.*** confirmed the important role of the micro-gap between the implant and abutment in the remodeling of the peri-implant crestal bone. Platform-switching seemed to reduce peri-implant crestal bone resorption and increase the long-term predictability of implant therapy (**Cappiello *et al.,* 2008**). **Hermann *et al.*** significant crestal bone loss occurs in 2-piece implant configurations even with the smallest-sized micro gaps (<10 μm) in combination with possible movements between implant components (**Hermann *et al.*, 2007**).

4) Decrease the stress on Peri-implant bone

Many studies have shown that stress values and concentration areas decreased for cortical bone when implant diameter increased than abutment. Load transfer mechanisms and possible failure of osseointegrated implants are affected by implant shape, geometrical and mechanical properties of the site of placement. Maximum stress areas were numerically located at the implant neck, and possible overloading could occur in compression in compact bone (due to lateral components of the occlusal load) and in tension at the interface between cortical and trabecular bone due to vertical intrusive loading components (**Luigi Baggi *et al.*, 2008**).

The stress distributions at the implant/abutment connection and in the peri-implant region are dominated by the structural characteristics of the connection interface (**Luigi Baggi *et al.*, 2008**). **Maeda *et al.*** used 3D finite element model to examine the biomechanical advantages of platform switching. They noticed that this procedure shifts the stress concentration away from the bone-implant interface, but these forces are then increased in the abutment or the abutment screw (**Maeda *et al.*, 2008**). **Hsu *et al.*** analyzed the behavior of reduced platform restorations in the context of a finite elements study in three dimensions. Their results showed a 10% decrease in all the prosthetic loading forces transmitted to the bone-implant interface (**Hsu *et al.*, 2009**). **Canay *et al.*** designed eight different implant–abutment connections. Implant–abutment micro-gap at bone level was hypothetically set-off inward toward the central axis of implant to create "diameter shifting" or "platform switching" concept. They concluded in their study that stresses are confined to the cortical bone region around the implant neck. For the designs with greater horizontal offset, intensity of stresses are higher at the abutment part resting above the bone level. Thus platform switching may risk the mechanical properties of abutments if horizontal set-off is increased. Though decrease in abutment diameter decreases the stresses generated around the implant, the differences are very slight. They remarked that platform switching may not be related to changes in load transfer (**Canay *et al.*, 2009**).

Jason Schrotenboer *et al.* fabricated a two-dimensional model to analyze the bone–implant interactions under masticators forces. Two abutment diameters, 4.5 mm representing platform switching and 5 mm representing a standard platform, were used in conjunction with a 5-mm diameter fixture. A 100 N force was applied vertically and obliquely to the abutments. Results showed that reduction of abutment diameter resulted in measurable but minimal effect on Von Mises stresses in the crestal region of cortical bone. However, it was concluded that further clinical trials are warranted before any firm conclusion could be drawn (**Schrotenboer *et al.*, 2009**).

Conclusion

"Platform switching", can be explained by the increase in the distance separating the crestal bone from the abutment/implant interface which displaces the area of inflammatory connective tissue to a more coronal and medial level. For long-term success of an implant, Platform switching helps to preserve crestal bone around the implants and provide best aesthetic results.

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