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Review Article

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PLATFORM SWITCHING: LITERATURE REVIEW

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ABSTRACT

The level of bone crest surrounding the implant is of utmost significance to determine osseointegrated implant success, as preservation of marginal bone height is highly important for long-term dental implant survival. Various approaches have been described in the literature to prevent the crestal bone loss, including platform switching. "PubMed" and "Google Scholar" were used to find out any studies involving platform switching concept from 1990 up to 2009. Crestal bone preservation should be thought of starting from the design of the implant to be placed. The technique to be followed in a given case will depend upon the density of bone, force factors by the patient, bone volume and amount of soft tissues, etc. The best possible method or the combination of the methods should be used to preserve the crestal bone for the long-term success of the implants.

KEYWORDS: Crestal bone loss, crestal bone preservation, immediate implant placement, nonsubmerged implants, platform switching

INTRODUCTION

The goal of modern implant therapy is more than just the successful osseointegration of the implant. Implant perspectives have changed from just achieving good osseointegration to long term prosthetic success. The maintenance of peri-implant bone plays major role in the prognosis of prosthetic rehabilitation supported by implants. Moreover, crestal bone loss also leads to collapse of soft tissues and adversely affect the aesthetics of implant-prosthetic elements. So crestal bone levels around implant after restoration is a reference for evaluating implant success. Adell et al.were the first to qualify and report marginal bone loss. Their study indicated greater magnitude and occurrence of bone loss during the 1st year of prosthetic loading.

It was found out that radiographic marginal bone level showed a mean loss of 0.9mm at the time of abutment connection and crown placement and a further mean loss of 0.7mm at 1 year. The 1year post-restorative bone level around implant is approximately 1.5-2 mm below implant abutment junction. So, it can be said that crestal bone loss depends on implant abutment junction relative to bony crest. (Cardaropoli et al. 2006).

Among the various characteristics of implant abutment connection, the microstructure of fitting surface plays a vital role in bone remodeling around it.

Many studies suggest that at the microstructural level, there remains a gap between implant and abutment junction which leads to bacterial colonization. During mastication, the loads cause relative movements between these components. This distributes the endotoxins released from the bacterial colony, causing an infectious reaction in the tissue at the implant abutment interface level. Due to the inflammatory reaction, the crestal bone starts to resorb below the implant abutment connection until the biological width is established which acts as bacterial proof connection preventing bone resorption and stabilizes soft tissue.

In 1991, Implant Innovations, Inc. (3i, Palm Beach Gardens, FL, USA) introduced wide diameter implants with matching diameter platform. However, matching prosthetic component was not available. So, on 5 mm and 6 mm diameter implants standard 4.1 mm diameter prosthetic component was restored. On long term radiographic follow up, it was demonstrated that there was a smaller vertical change in crestal bone height with these implants as compared to the conventionally restored implants with matching diameter of prosthetic components.

This serendipity lead to the discovery of the concept of platform switching. So, platform switching is the technique in which we place the outer edge of implant-abutment interface towards the center of implant and away from the outer edge of implant-bone interface

which results in the overall decrease in the post-restorative remodeling ending in the loss of crestal bone height. (Lazzara and Potter. 2006).

After series of investigation the reason for less bone loss around the platform switched implant abutment junction was attributed to.

A minimum mucosal attachment is required to protect osseointegration once the implant is exposed to the oral environment and is in function. (Pillar et al 1991).

So, when we move implant-abutment junction away from bone margin, more space is created in horizontal and vertical direction for the soft tissue attachment. This thicker, stable and more durable connective tissue protective barrier acts against apical epithelial tissue migration, against apical migration of microbes and mechanical stimuli and thus reducing bone resorption and maintaining biological width and connective tissue above implant platform level. (Berglundh et al, 1996; Atieh et al, 2010).

A microgap is present between the implant and abutment in 2-piece implant systems. This space is colonized by bacterial flora when implants are exposed to the oral cavity during placement of abutment. This infected area leads to chronic inflammatory reaction and this area is situated immediate in contact to bone area so it leads to gradual bone loss. The advantage of platform switching is that it shifts this inflammatory zone away from the bone margin and thus protecting it from futher inflammatory reaction. (Pessoa et al, 2014; Romanos et al, 2014).

In hostile oral environment, due to the aqueous medium, the titanium and other metals present in abutment and implant undergo corrosion. Also occlusal forces causes micromotion (fretting) between implants and bone which disrupts the oxide layer protecting Ti surface and thus accelerating the corrosion process. These tribocorrosion procedures have deleterious effect on peri-implant tissues leading to bone loss. The metal ions also activate the bone resorption genes on osteoblast and increase the cytokine levels. By altering the implant- abutment connection geometry, decreases the metal ion release which in turn effect osteoblast function and bone resorbing mediators. (Alrabeah et al, 2017).

Platform switching and hard tissue changes

Cappiello et al evaluated bone loss around two-piece implant restored by platform switching. He found out that in clinically relevant situations where anatomic structures such as sinus cavity and alveolar nerve limit residual bone height, platform switching technique minimizes bone remodeling and increases biomechanical support available to the implant.

Lazzara and Porter observed radiographically that when matching diameter implant and prosthetic component is used the crestal bone remodels 1.5-2 mm apically that is approximately till the first implant thread. This remodeling is not affected when the implant is uncovered and healing abutment is placed over it. Showing that crestal bone remodeling depends only on the exposure to oral environment. It was also concluded that using smaller diameter prosthetic component over larger diameter implant or platform switched system, reduces crestal bone loss.

Canullo et al showed that over the period of 3 years implants restored by platform switching method demonstrated less marginal bone loss as compared to matched implant-abutment interface. Also, it was experienced that marginal bone level were better maintained with increasing the amount of implant – abutment mismatch.

Vigolo et al observed for 5 years and found out that platform switching shows a positive effect on preservation of bone loss at 1 year but after 5 years there was insignificant change as compared to that seen at 1 year around both platform switched implant and non-platform switched implants.

Cocchetto et al studied the effect of wide diameter implant on platform switching. He found that with wide diameter implant the bone loss is 0.19mm whereas with standard platform switched implant the bone loss on an average is 0.95mm and non-platform switched implant the bone loss is 1.5 to 2mm.

Platform switching and soft tissue changes

Linkevicius et al said that platform switching could not prevent crestal bone loss, if the mucosal tissue on the edentulous ridge before placement of implant is 2mm or less.

It is said that a minimum of 4mm of primary tissue thickness is required for peri-implant seal to form around the osseointegrated implant without hard tissue resorption. It was also suggested that anatomical condition such as mucosal tissue thickness play major role, that is more important than position of implant-abutment connection in early crestal bone loss etiology.

Ericsson et al studied the host response around the implant and distinguished the two types of inflammatory cells accumulated in the microgap between the implant and the bone. One zone is related to the gingival sulcus, just apical to mucosal edge and spreads 1.1mm around the IAJ. In this zone many types of inflammatory cells were present and it was mostly plaque induced and these lesions have no tendency to propagate further apically. Second zone is around the peri-implant mucosa and it has a more tendency to move apically. It had more collagen content and less vascular component. Apical border of abutment was always separated from the crestal bone by 0.8mm -1mm of healthy connective tissue.

Traini et al reported that crestal bone around implant has many thick blood vessels which causes high degree of metabolic activities. So, during inflammation these blood vessels do not have space to swell causing vascular resistance, necrosis and finally blocking of arterial or venous drainage. The whole process leads to craterlike bone loss around implant.

Lazzara and Porter have explained that when we horizontally reposition implant-abutment interface, firstly the surface area of exposed implant seating surface is increased, so there is no need to expose a small amount of implant surface for soft tissue to attach, reducing crestal bone loss. Secondly, by repositioning IAJ inward and distant from outer edge of implant and adjoining bone, the effect of inflammatory cell infiltrate induced due to abutment is reduced and thus reducing the rate of crestal bone loss. Moreover, this platform switching repositioning, accumulates the inflammatory infiltrate within 90 degree of exposure area rather than 180 degree of direct exposure of the surrounding hard and soft tissues which result in reduced inflammatory effect on soft tissue and crestal bone.

Cocchetto et al suggested that wide diameter platform-switched implant provides advantage of placing implant in anterior esthetically compromised maxilla. This is possible because wide platform switching maintains the soft tissue profile and also promotes primary stability by reducing the distance between the implant and the bone.

Also, the interimplant distance can be reduced with wide diameter implants so two adjacent implant can be placed in anterior maxilla which was not possible with standard non-platform switched implant.

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