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RESEARCH ARTICLE

PLATFORM SWITCHING- A PARADIGM SHIFT IN IMPLANT DENTISTRY

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Abstract

In an attempt to improve long-term bone maintenance around implants, a new implant-to abutment connection referred to as "platform switching" has been proposed. It refers to the use of an abutment of smaller diameter connected to an implant neck of larger diameter. Bone platform switching involves an inward bone ring in the coronal part of the implant that is in continuity with the alveolar bone crest. Bone platform switching is obtained by using a dental fixture with a reverse conical neck. It is used as a method of reducing crestal bone loss and maintaining the gingival papillae. Platform switching appears to limit crestal resorption and seems to preserve peri-implant bone levels.

INTRODUCTION

The goal of modern implant therapy entails more than just the successful osseointegration of the implant. A successful result must also include an esthetic and functional restoration surrounded by stable peri-implant tissue levels that are in harmony with the existing dentition.[1,2] The development of osseointegrated implants represents one of the most important breakthrough in contemporary dental practice in the oral rehabilitation of partially or fully edentulous patients. Based on the pioneering work of Branemark (University of Gothenburg, Sweden) and Schroeder (University of Berne, Switzerland) who first proposed the concept of osseointegration or functional ankyloses, respectively, implant dentistry has subsequently seen some major advances, particularly in the past two decades.[3]

One aspect of implant therapy that can be extremely challenging is the placement and subsequent restoration of implants in the esthetic zone. In order to predictable realise patient's esthetic expectations, the crestal bone changes that commonly occur around endosseous implants and the subsequent soft tissue reaction to the osseous changes must eb understood. The soft tissue must then be managed to ensure its long term stability.[4]

Crestal bone loss has been documented as one of the important factors that affect the long term prognosis of an implant. The initial breakdown of the implant-tissue interface generally begins at the crestal region in successfully osseointegrated implants.[5]

After second stage surgery, bone resorption of 1.5 to 2mm may occur at the implant-abutment junction. One criterion of successful implant osseointegration is that vertical bone loss should not exceed 2mm in the first year of function and should remain less than 0.2mm annually thereafter.[6]

The remodelling process involves marginal bone resorption that is affected by one or more of the following factors: 1) a traumatic surgical technique; 2) excessive loading conditions; 3) the location, shape, and size of the implant abutment microgap and its microbial contamination; 4) the biologic width and soft tissue considerations; 5)

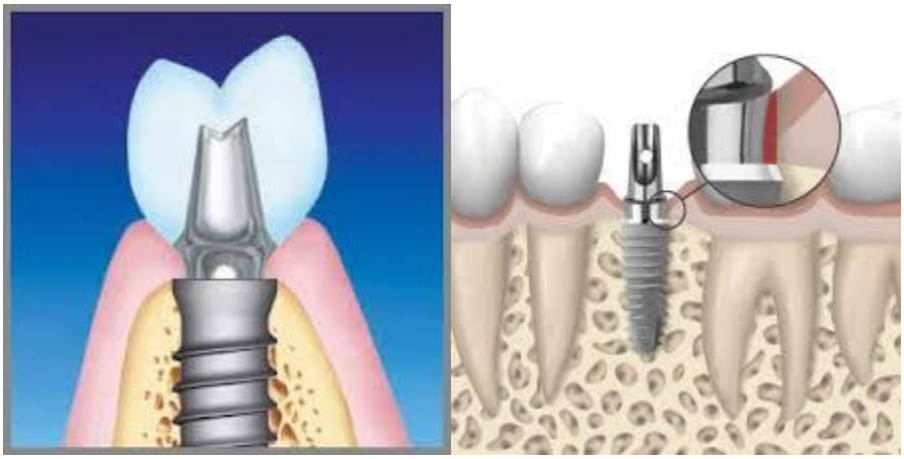
a peri-implant inflammatory infiltrate; 6) micromovements of the implant and prosthetic components; 7) repeated screwing and unscrewing; 8) the implant-neck geometry; and 9) the infectious process.[7,8]

WHAT IS THE PLATFORM SWITCHING CONCEPT?

In 1991, Implant Innovations, Inc. (3i, Palm Beach Gardens, FL) introduced 5 mm and 6 mm diameter implants. They were intended to increase the bone to implant contact, when placing shorter implants in areas of limited bone height. At that time, prosthetic components of similar dimension were not easily available; hence clinicians restored them with standard 4.1 mm diameter components, which created a 0.45-0.95 mm circumferential horizontal difference in dimension between the implant seating surface and the attached component. After a 5-year period, the typical pattern of crestal bone resorption was not observed in platform switched implants. Thus, the discovery of the concept was a coincidence.[9]

However, the concept of platform switching was not fully understood, and several theories were suggested to explain this phenomenon. The biomechanical theory proposed that connecting the implant to a smaller-diameter abutment may limit bone resorption by shifting the stress-concentration zone away from the crestal bone–implant interface and directing the forces of occlusal loading along the axis of the implant.[10] One theory assumed that shifting the implant-abutment connection may medialize the location of the biologic width and minimize the marginal bone resorption. This theory was based on previous studies that showed that placing the implant-abutment junction (IAJ) at or below the crestal bone level may cause vertical bone resorption to re-establish the biologic width.[11]

Another theory concerned the role of the inflammatory cell infiltrate at the IAJ. Ericsson et al.[12] showed that the bone resorption at the IAJ was caused by an inflammatory cell infiltrate that formed a 1.5-mm semispherical zone around the IAJ. Regardless of the nature of the peri-implant inflammatory infiltrate, the physical repositioning of the IAJ away from the external outer edge of the implant and neighboring bone may limit bone resorption by containing the inflammatory cell infiltrate within the angle formed at the interface away from the adjacent crestal bone.



STUDIES

Canullo et al.[13] performed an RCT to measure the amount of marginal bone loss and periodontal indices at 22 implants placed in maxillary fresh-extraction sites and restored with either platform-switched or matched prostheses. A significant radiographic difference in marginal bone levels was observed between the test and control groups after a mean follow-up period of 25 months. On the other hand, periodontal parameters (i.e., bleeding on probing, probing depth, and the modified plaque index) did not show any statistically significant difference between the two groups.

Canullo et al.[14] assessed the marginal bone level around 80 implants. The implants were randomly assigned into four groups (three test and one control) based on the discrepancy between the diameters of the abutment and the implant platform. The findings suggested that the extent of the inward shifting was inversely proportional to the amount of marginal bone loss.

Cappiello et al.[15] evaluated the marginal bone level alterations of 73 implants with an extended platform of 4.8 mm and 55 implants with a matched platform of 4.0 mm. After 1 year of function, the radiographic examination

showed that the marginal bone loss around the platform-switched implants ranged between 0.6 and 1.2 mm (mean: 0.95 – 0.32 mm), whereas the marginal bone loss around the control implants ranged between 1.3 and 2.1mm (mean: 1.67 – 0.37mm) which was statistically significant.

Crespi et al.[16] placed 30 platform-switched implants and 34 platform-matched implants. Provisional crowns were immediately placed after surgery, and implants were followed up for a period of 2 years. A radiographic marginal bone resorption of 0.73 – 0.52 mm and 0.78 – 0.49 mm were reported in the platform switched and platform-matched groups, respectively. No statistically significant difference was shown between the two groups.

Enkling et al.[17] performed a split-mouth trial of 50 platform-switched and matched implants placed in the posterior mandible and followed up for 12 months. The authors suggested that the extent of microbial colonization had a greater impact on the amount of peri-implant bone loss than the platform design.

Hu¨rzeler et al.[18] evaluated the marginal bone-level changes of 22 wide-diameter implants, which were randomly connected to either platform-switched or non–platform-switched abutments. The mean bone loss for the platform switched implants was significantly less than those placed with traditional abutments ($P \leq 0.013$).

Kielbassa et al.[19] reported on the marginal bone loss around immediately restored implants using an implant with a built-in platform-switch and a standard control one. No significant difference in crestal bone levels was observed between the two implant designs ($P = 0.729$). Additionally, all implants showed a favourable soft tissue response with a significantly higher papilla score after the first year of function.

Trammell et al.[20] conducted an RCT in which 25 dental implants were placed in the mandible to evaluate the marginal bone loss around platform-switched and platform-matched implants. The platform-switched implants showed significantly less crestal bone loss compared to conventional implants (0.99 – 0.53 mm versus 1.19 – 0.58 mm).

Prosper et al.[21] reported a multicentre RCT of 360 platform-switched and control implants that were placed using three different placement methods: submerged, non-submerged, and submerged with reduced abutment. Patients were followed up for 24 months. A statistically significant difference in the crestal bone changes were found between the two groups. In addition, there was no significant difference in the modified sulcus bleeding index, plaque index, and implant-stability quotient between platform switched and matched implants during the period of the study.

Vigolo and Givani[22] evaluated 182 single wide-diameter implants placed in posterior sites. Of these, 97 implants were restored with prosthetic components that were 0.8 mm narrower in diameter than the implant platform, and 85 implants were restored with prosthetic components of the same diameter. The implants were evaluated for 5 years. There was a statistically significant difference in the marginal bone loss between the test and control groups at 1 year. However, the marginal bone levels did not show any significant changes at 2, 3, 4, and 5 years of function.

CONCLUSION

Within the limitation of the available data, the results reveal that the inward shift of Implant Abutment Junction platform switching can be considered a desirable morphologic feature that may prevent the horizontal saucerization and preserve the vertical crestal bone levels. An additional improvement in the marginal bone levels around dental implants may also be obtained with a greater degree of shifting. Platform switching also provides the clinician with additional surgical and prosthetic treatment options for use with wide-diameter implants. According to the different papers, this expanded platform obtains excellent aesthetic outcomes. Moreover, the implant design modifications involved in platform switching offer multiple advantages and potential applications, for example in the anterior zone where preservation of the crestal bone can lead to improved aesthetics.

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