Platform switching: A step away from the gap

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ABSTRACT

To maintain long-term stability of dental implants, it is important to minimize bone loss around an implant. Several clinical studies have shown a mean crestal bone loss of 1.5-2 mm around dental implants, in the first year after prosthetic restoration, as clinically acceptable. To limit this crestal bone resorption, several modifications are being tried in the implant systems. Platform Switching is one such concept, which uses prosthetic abutments with reduced diameter in relation to the implant platform diameter. This moves the implant abutment junction and supposedly the inflammatory reaction medially, away from the crestal bone, and may thus, minimize the crestal bone loss. Although, it was a serendipitous finding, an increasing number of implant systems have incorporated Platform Switching into their designs, as an innovative feature for preserving the peri-implant bone. A Medline search was carried out using the Pubmed search engine, with keywords Platform Switching in Dental Implants. Twenty-one studies (12 random-controlled trials, four prospective-controlled clinical studies, and five clinical case series) were selected for review after screening of a total of 123 articles on the basis of the inclusion and exclusion criteria. A detailed review of these articles gave a clear tendency toward the positive impact of Platform Switching on crestal bone preservation, but further long-term, randomized-controlled trials, with uniform criteria, are required to confirm these results.

KEYWORDS: Implant abutment junction, marginal bone loss (MBL), microgap, platform switching

Introduction

Rehabilitation of missing teeth using endosseous root-form implants has been proven to be a predictable and highly successful treatment modality. Implant dentistry has continuously evolved from the original Branemark protocol to include varied techniques and wider applications. The maintenance of the peri-implant bone is a major factor in the prognosis of prosthetic rehabilitation, supported by implants.1-4 Also it is an important prerequisite for preserving the integrity of gingival margins and interdental papillae.5,6

Marginal bone loss (MBL) seems to be unavoidable after implant placement, especially after the abutments are connected. According to Albrektsson, a successful implant might lose an average of 1.5 mm of crestal bone during the first year in function, followed by a marginal bone loss of <0.2 mm during each succeeding year.5 A combination of mechanical and biological factors contributes to crestal bone loss, including a traumatic surgical technique,7 stress concentration at the crestal margin due to occlusal loading,8 location of the Implant Abutment Junction (IAJ), the microgap in relation to the crestal bone and its bacterial colonization,9,10 establishment of a biological width (2-3 mm) around the dental implants,9,11 peri-implant inflammatory infiltrate,12 micromovements of the implant and prosthetic components,9,13 and repeated screwing and unscrewing.14

The ability to further reduce this crestal bone loss may have several advantages, such as, improved esthetics, higher bone-to-implant contact, and primary stability.15,16 In recent times, several techniques have been developed to minimize MBL such as the non-submerged technique, scalloped implant, rough surface implant neck with microthreads, progressive loading, immediate implant placement, and so on. Platform Switching (PS) is also one such concept, which uses prosthetic abutments with reduced diameter in relation to the implant platform diameter, so as to move the implant abutment junction and supposedly the inflammatory reaction...
medially, away from the crestal bone, and thus, prevent crestal bone loss.

Since the accidental discovery of PS as an implant design modification for crestal bone preservation, various finite element analyses, in vivo studies, animal studies, and clinical studies have been conducted in the last decade, to substantiate evidence in favor of this concept. Minimal histological and radiological bone loss has been shown in animal studies where implants have been restored with abutments of mismatched diameter.\[17,18\] Maeda et al. in their 3D Finite Element model noted that PS shifts the area where stress is concentrated away from the cervical bone implant interface, while stress increases in the abutment or abutment screw.\[19\] In other finite element studies, Hsu et al. showed only a 10% decrease in all prosthetic loading forces transmitted to the bone-implant interface, whereas, Tabata et al. reported a decrease of 80%.\[20,21\] Over the last decade clinical trials have been conducted to investigate the influence of PS on MBL around the dental implants, as compared to the platform-matched (PM) implants [Figure 1]. However, the results have been controversial and not definitive. This article aims to investigate if there is an evidence-based rationale for the use of PS as a design feature to limit peri-implant bone loss.

**Method of literature search**

Search of the electronic database using the Pubmed search engine, with the key words ‘Platform Switching in Dental Implants’ revealed 123 publications, out of which 97 involved platform-switched implants.

**Inclusion criteria**
- Human studies, both male and female, published in Pubmed indexed journals in the last 10 years
- Studies involving platform-switched implants with at least one year follow up and considering MBL as one of the outcomes of study.

**Exclusion criteria**
- Biomechanical studies, animal studies, case reports, narrative reviews, and expert opinions
- Human histological studies
- Publications in languages other than English.

After screening the studies on the basis of inclusion and exclusion criteria, by two independent reviewers, 24 studies were identified for detailed evaluation out of which three were eliminated because they were preliminary reports of long-term prospective studies included in the final review [Figure 2-Flow chart]. All the 21 selected studies expressed radiographically detected peri-implant MBL as quantitative data. Twelve of the selected studies were random-controlled trials (RCT), four were prospective clinical-controlled studies (PCCS) without random allocation of the test and control groups, and the remaining five were clinical trials without control groups. Owing to the great heterogeneity in these studies in their own case-control groups, quantitative analysis could not be performed, but a narrative detail on the PS concept and analyses of the results of the studies have been attempted.

**Concept of platform switching**

It refers to the use of a smaller diameter abutment on a larger diameter implant collar so as to minimize circumferential bone loss. This concept was accidentally discovered in 1991, when 3i Implant Innovations (Palm Beach Gardens, FL) introduced implants of larger diameter before producing the corresponding abutments of the same measure. Fourteen years later, evaluation of those treatments in which abutments of lesser diameter were used, revealed better preservation of hard and soft tissues than those where matched abutments were used.\[22,23\] Gardner, in 2005, discussed the dynamics of hard and soft tissue changes around an implant and introduced the term Platform Switching in a case study.\[16\] Lazzara and Porter, in 2006, provided a clinical rationale for this implant design. According to them, the biological process resulting in the MBL was altered when the outer edge of the implant-abutment interface was horizontally repositioned in an inward manner and away from the outer edge of the implant platform. Terms like ‘Platform Shifting’ or ‘Platform mismatch’ have also been used to refer to this concept.

**Rationale behind platform switching**

Implant abutment connections in two piece implants, especially those with clearance, fit (index/parallel sides) in their design have a microgap at the implant abutment junction. This microgap provides bacteria with an open channel to penetrate into the implant system and also allows for micromovement of the abutment within the implant.\[24\] This micromovement further creates movements and stresses on the abutment screw, which cause a loosening and micropumping effect that expels additional bacterial by products and toxins at implant-soft tissue interface and eventually at the osseous crest. On account of the concentration of toxins, the body defenses come into play increasing the inflammatory response which leads to bone and tissue resorption.
response at the crest, causing soft tissue detachment and crestal bone loss. Platform Switching is a simple and effective implant abutment connection modification to control this circumferential bone loss around the dental implants.

Various biological and mechanical theories have been proposed in support of this concept.[22,23] It was suggested that PS displaces IAJ horizontally inwards from the perimeter of the implant platform and adjacent bone, thus increasing the distance between the inflammatory response arena at the microgap and the crestal bone, thereby minimizing the effect of inflammation on the crestal bone remodeling. Also, the angle or step thus created between the abutment and implant allows the biological width to be established horizontally. This means, less vertical bone resorption is required to compensate for the biological seal. The biomechanical theory based on finite element analysis proposed that connecting the implant to a small 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.[19]

Other modifications in implant design and placement protocol for reducing crestal bone loss
• The crestal module transmits different types of forces onto the bone depending on the surface, texture, and shape. A polished collar and a straight crestal module transmit shear force, whereas, a rough surface with an angled collar transmits beneficial compressive force to the bone and facilitates crestal bone preservation[25,26]
• Use of fine microthreads in the threaded implant neck design; decrease the peak interfacial shear stress on the cortical bone, avoiding further bone loss in this region[25]
• Location of the implant-fixture interface with respect to the crestal bone determines the amount of bone loss occurring to establish the biological width around the implants[15]
• The scalloped implant platform design has been developed to follow osseous architecture and eliminate crestal bone loss[16]
• A nonsubmerged implant placement protocol is a proven way to control or eliminate marginal bone loss[27]
• Additional factors are bone loss secondary to aggression, such as, raising of the mucoperiosteal flap
at the second-stage of surgery, for exposing the screw or colonization by bacteria belonging to the oral flora at the coronal bone and implant junction. A flapless approach at the second stage can be used to remedy this

- Immediate implant placement in the fresh extraction socket.

### Switching the platform

Platform Switching can be achieved by:

- Using abutments with a diameter smaller than the implant neck or body width [Figure 3]
- Using an implant design where the neck diameter is increased with respect to the implant body width [Figure 4]
- Using inherently platform-switched implants and conical emergence abutments, with a variable height of 1.5-2 mm, freeing the extension of the implant platform between 0.5-0.75 mm [Figure 5].\(^{[28]}\) However, this mode of Platform Switching is not advisable in mandibular Implant-Mucosal support prosthesis, as reduction in abutment diameter lessens the abutment resistance in response to occlusal loading
- Using implants with a reverse conical neck [Figure 6], referred to as Bone Platform Switching.\(^{[29]}\) This involves an inward bone ring in the coronal part of the implant that is in continuity with the alveolar bone crest. However, proximity of implant abutment junction to the alveolar crest in this design does not permit significant reduction in the crestal bone loss.

An Abutment-Implant collar diameter mismatch should be more than or equal to 0.4 mm, so as to have a significant influence on crestal bone loss, as concluded by Atieh et al., in their meta-analysis of their studies on Platform Switching.\(^{[30]}\) Canuello et al., found that the amount of MBL was inversely proportional to the extent of the abutment-implant collar diameter mismatch.\(^{[31]}\)

### Advantages of platform switching

- It facilitates formation of a peri-implant soft tissue cuff. In natural dentition, the junctional epithelium
provides a seal at the base of the sulcus against bacterial penetration. The other line of defense present in natural dentition and absent in implants is the periodontal ligament. As no cementum or fibers are present on the surface of an implant, the infection has the potential to spread directly into the osseous structures resulting in bone loss and ultimately implant failure. Platform Switching provides a horizontal shelf for the formation of a leak-proof peri-implant soft tissue cuff, which seals the crestal bone from the oral environment and bacterial invasion.

• **Effect on soft tissue esthetics around the dental implants:** Tarnow et al., showed how the presence of the dental papilla is influenced by the distance between the implants.\(^{[32]}\) When two implants are placed close to one another (interimplant distance 3 mm or less) the inter-implant bone height can resorb below the implant-abutment connection, reducing the presence of an inter-implant papilla. This may affect the clinical result in the esthetic zone. Platform Switching reduces this physiological resorption, moving the microgap away from the inter-implant bone that supports the papilla. Maintenance of the midfacial bone height helps to maintain facial gingival tissues. This helps to avoid cosmetic deformities, phonetic problems, and lateral food impaction.\(^{[33]}\)

• Unlike Platform-Matched (PM) implants, where a high stress area around the implant’s neck and along its lateral surface is present, the Platform-Switched model has the biomechanical advantage of shifting stress concentration away from the crestal bone implant interface. Shear force exerted on the cortical bone in the PS model is lower than in the PM model.\(^{[19]}\)

• Where anatomic structures such as the sinus cavity or the alveolar nerve limit the residual bone height, the Platform-Switching approach minimizes bone resorption and increases the biomechanical support available to the implant.\(^{[33]}\)

• Improved Bone Support for Short Implants: Bone remodeling around a platform-switched implant is minimized, therefore, there is potentially a greater bone/implant contact for short implants, thus opening the possibility of treating more patients with less extensive therapy.

• The amount of restorative volume available for an optimally contoured, physiological implant restoration is a critical factor for the success of an implant. The crestal bone being preserved, both horizontally and vertically, with the use of platform-switched implants, support is retained for the interdental papillae. Maintenance of the midfacial bone height helps to maintain the facial gingival tissues.

• Platform expansion in the immediate extraction situations makes it possible to minimize the gap between the recently extracted tooth bed and the implant, and acts as a physical barrier against the penetration of bacteria into the zone of contact between the bone and implant. Also, an increase in the diameter favors improved primary stability and formation of a new biological space.

**Limitations of platform switching**

- For Platform Switching to be effective, undersizing of the components must be carried out during all phases of the implant treatment, that is, from placement of the implant through to the final restoration.\(^{[22]}\)
- Sufficient prosthetic space is needed to develop a proper emergence profile.\(^{[16]}\)
- It increases the stress in abutment or the abutment screw.\(^{[19]}\)
- Platform Switching may have a positive effect on bone preservation in the first year, but after five years, the marginal bone change is insignificant, as compared to that at one year, around both PS and PM implants (Vigolo and Givani).\(^{[34]}\)

**Discussion**

The selected studies for review were published in the last 10 years and their observation period ranged from 12 months to more than 10 years. Twelve studies were randomized and four were PCCS. The remaining five were clinical case series without control [Table 1]. Most of the RCTs contrasting PS and PM implants have given encouraging results, describing PS to be of key importance for crestal bone stability, whereas, two studies have not found significant differences in bone level changes in PS compared to PM. Vanderweghe et al. concluded that PS decreases bone loss by 30% and that PS is only effective when mucosal thickness allows establishment of biological width.\(^{[35]}\) The strong point of this study was that their test and control group implants were in the same patient. There were only two more studies with PS and PM implants placed in the same patient. Enkling et al. in their split mouth trial did not find statistically significant reduction in peri-implant crestal bone loss in relation to PS implants.\(^{[36]}\) Trammell et al. could also demonstrate a difference of only 0.2 mm in crestal bone loss in PS versus PM implants placed in the same patient.\(^{[37]}\) However, inherent measurement variability in periapical radiographs has to be considered while interpreting the significance of such data.

Penarrocha-Diago et al. concluded in their study that difference in bone loss after a 12-month follow up was statistically significant in PS (0.12 ± 0.17) compared to PM implants (0.38 ± 0.51 mm).\(^{[38]}\) They had used implants with a treated surface, microthreads at the neck, and internal connection in the PS group, as opposed to the machined surface, without microthreads and external connection in the PM group in 18 totally edentulous patients. Studies by Young KS, Bratu EA, and Lee SY, have shown that a rough surface with microthreads at the implant neck help to preserve the peri-implant crestal bone.\(^{[39-41]}\) Therefore, the presence of
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Table 1: Study design and observations of the reviewed studies

<table>
<thead>
<tr>
<th>Author</th>
<th>Study design</th>
<th>No. of subjects</th>
<th>No of Implants</th>
<th>Observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enkling et al. (2013)</td>
<td>RCT</td>
<td>25 subjects</td>
<td>50 implants</td>
<td>After one year, PS = 0.56±0.44, PM = 0.61±0.57</td>
</tr>
<tr>
<td>Vanderwege et al. (2012)</td>
<td>RCT</td>
<td>15 subjects</td>
<td>30 implants</td>
<td>After three months, PS = 0.69±0.43, PM = 0.74±0.57</td>
</tr>
<tr>
<td>Penarrocha-Diago et al. (2012)</td>
<td>RCT</td>
<td>18 subjects</td>
<td>120 implants</td>
<td>After six months, PS = 0.28, PM = 0.5</td>
</tr>
<tr>
<td>Canullo et al. (2012)</td>
<td>RCT</td>
<td>40 subjects</td>
<td>80 implants</td>
<td>After 12 months, PS = 0.66, PM = 0.94</td>
</tr>
<tr>
<td>Telleman (2012)</td>
<td>RCT</td>
<td>80 subjects</td>
<td>106 implants</td>
<td>After 12 months, PS = 0.51±0.51, PM = 0.73±0.48</td>
</tr>
<tr>
<td>Fernandez-Formosa (2012)</td>
<td>RCT</td>
<td>54 subjects</td>
<td>114 implants</td>
<td>After 12 months, PS = 0.68±0.88, PM = 2.23±0.22</td>
</tr>
<tr>
<td>Canullo et al. (2010)</td>
<td>RCT</td>
<td>31 subjects</td>
<td>80 implants</td>
<td>After 33 months, PM = 1.48±0.42</td>
</tr>
<tr>
<td>Tramell et al. (2009)</td>
<td>RCT</td>
<td>10 subjects</td>
<td>25 implants</td>
<td>After 24 months, PS = 0.99±0.53, PM = 1.19±0.58</td>
</tr>
<tr>
<td>Crespi et al. (2009)</td>
<td>RCT</td>
<td>45 subjects</td>
<td>64 implants</td>
<td>After 24 months, PS = 0.73±0.52, PM = 0.78±0.49</td>
</tr>
<tr>
<td>Canullo et al. (2009)</td>
<td>RCT</td>
<td>22 subjects</td>
<td>22 implants</td>
<td>After 24 months, PS = 0.30±0.16, PM = 1.19±0.35</td>
</tr>
<tr>
<td>Prosper et al. (2009)</td>
<td>RCT</td>
<td>60 subjects</td>
<td>360 implants</td>
<td>After 24 months, PS = 0.05±0.23, PM = 0.19±0.47</td>
</tr>
<tr>
<td>Huzeler et al. (2007)</td>
<td>RCT</td>
<td>15 subjects</td>
<td>22 implants</td>
<td>After 12 months, PS = 0.22±0.53, PM = 2.02±0.49</td>
</tr>
<tr>
<td>de Almeida et al. (2011)</td>
<td>PCCS</td>
<td>26 subjects</td>
<td>42 implants</td>
<td>After 33 months, PS = 0.27, PM = 2.30</td>
</tr>
<tr>
<td>Fickle et al. (2010)</td>
<td>PCCS</td>
<td>36 subjects</td>
<td>89 implants</td>
<td>After 12 months, PS = 0.39±0.07, PM = 1.0±0.22</td>
</tr>
<tr>
<td>Linkevicius et al. (2012)</td>
<td>PCCS</td>
<td>19 subjects</td>
<td>46 implants</td>
<td>A (thin mucosa) PS, M = 1.61±0.24, D = 1.28±0.67, PM, M = 1.8±0.44, D = 1.87±0.16</td>
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<td></td>
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<td></td>
<td>B (thick mucosa) PS, M = 0.26±0.08, D = 0.09±0.05, PM, M = 1.8±0.64, D = 1.87±0.16</td>
</tr>
<tr>
<td>Cappiello et al. (2008)</td>
<td>PCCS</td>
<td>45 subjects</td>
<td>46 implants</td>
<td>After 12 months, PS = 0.95±0.32, PM = 1.6±0.37</td>
</tr>
<tr>
<td>Calvo-Guirado et al. (2014)</td>
<td>Clinical case series</td>
<td>64 subjects</td>
<td>86 implants</td>
<td>After 10 years 1.01±0.22 mm (no control gp)</td>
</tr>
<tr>
<td>Yun et al. (2011)</td>
<td>Clinical case series</td>
<td>27 subjects</td>
<td>79 implants</td>
<td>After 7.4 months, 0.16±0.8 (no control gp)</td>
</tr>
<tr>
<td>Wagenberg et al. (2010)</td>
<td>Clinical case series</td>
<td>78 subjects</td>
<td>94 implants</td>
<td>&lt;2 mm after follow up of 11-14 years (no control gp)</td>
</tr>
<tr>
<td>Cocchetto et al. (2010)</td>
<td>Clinical case series</td>
<td>10 subjects</td>
<td>15 implants</td>
<td>After 18 months, 0.30 (no control gp)</td>
</tr>
<tr>
<td>Bilhan et al. (2010)</td>
<td>Clinical case series</td>
<td>51 subjects</td>
<td>126 implants</td>
<td>After 36 months, 0.91 (no control gp)</td>
</tr>
</tbody>
</table>

MBL = Marginal bone loss, RCT = Random-controlled trials, PCCS = Prospective clinical-controlled studies, PS = Platform-switched, PM = Platform-matched

Microthreads only in the PS group might have had an additive effect on the crestal bone preservation. Canullo et al. observed significantly greater bone loss and decreased soft tissue height in the PM group as compared to the PS implants. Although the surgical protocol used was the same for both groups, the external hex connection was used in the PM and inward inclined platform implants in the PS group, which could have been a confounding factor. Crespi et al. in their RCT, concluded that there were no differences in bone level changes between the PS and PM implants after a two-year follow up. They also used different implant designs for the test and control groups, and the implants were placed in fresh extraction sockets and loaded immediately. Huzeler et al. also gave results in favor of PS, but their sample size was small (22 implants). Fernandez-Formosa et al. after a follow up of 12 months reported an MBL of 0.42 mm at the PM implants and 0.01 mm at the PS implants, but they had used different healing modes (submerged/nonsubmerged).

Telleman et al. suggested that PS reduced crestal bone resorption and better maintained the interproximal bone levels. They had used a nonsubmerged healing protocol and short (8.5 mm) internal hex implants. Canullo et al. suggested that the extent of inward shifting was inversely proportional to the amount of marginal bone loss.
surgeries had to be performed for many of them. Prosper et al. in their multicenter RCT, involving 360 implants, reported that the use of PS with an enlarged platform implant, as compared to the PM implant, significantly reduced MBL when placed with both the two-stage and one-stage techniques. The findings over a period of 24 months indicated that the positive effect of PS was stronger when implemented on implants with an enlarged platform.

Out of the selected four PCCS, Linkevicius concluded that the initial gingival tissue thickness at the crest could be considered as a significant influence on the marginal bone stability around implants. If the tissue thickness is 2 mm or less, crestal bone loss up to 1.45 mm may occur, despite a supracrestal placement of the implant-abutment interface. Fickl et al. observed significantly less bone loss in the PS group, but their results should be interpreted by taking into account that they had placed the PS implants crestally and the PM implants subcrestally. Hammerle, Hartmann et al., and Pontes et al. had concluded that the deeper the implants were placed, the greater was the bone loss. A histomorphometric analysis by Broggini et al. showed that subcrestal IAJ promoted a greater density of neutrophils and the resulting inflammation less to greater bone loss. Therefore, a variation in implant placement depth can be a confounding factor. de Almeida et al. in their controlled clinical trial showed noticeable bone remodeling in the control group (MBL = 2.30 mm) and stable levels in the test group (MBL = 0.27 mm), but a statistical analysis to calculate the level of significance was not performed. Also they had used variable placement depth of the implant shoulder in relation to the crestal bone. Cappiello et al. showed significant difference in bone loss with PS implants (MBL = 0.95 ± 0.32 mm) as compared to PM implants (1.67 ± 0.37 mm). They had used the nonsubmerged healing mode and crestal level of implant placement.

Five clinical trials without any control group were also reviewed. Calvo-Guirado et al., after a follow up of 10 years reported stable PS implants, with a survival rate of 97.1% and an MBL of 1.01 ± 0.22 mm. Wagenberg and From reported the longest follow up (11-14 years) to a prospective investigation of PS implants and confirmed the concept for crestal bone preservation.

Yun et al. reported an MBL of 0.16 ± 0.08 mm (lower than previously reported values) around the PS implants, but had used implants with microthreads in the neck design, which itself was a factor for crestal bone preservation. Cocchetto et al. reported an MBL of 0.30 mm with PS implants and Bilhan after a 36-month follow up reported an MBL of 0.91 mm.

Baumgarten et al. described the platform-switching technique and its usefulness in situations where shorter implants had to be used, where implants were placed in esthetic zones, and where a larger implant was desirable, but the prosthetic space was limited. Gardner described PS as an effective method to control circumferential bone loss. At the same time he noted several potential disadvantages of this procedure, such as, the need for components that had similar designs and the need for enough space to develop a proper emergence profile. López-Mari et al., in their review on platform-switched implants, concluded that PS was capable of reducing crestal bone loss to a mean of 1.56 ± 0.7 mm; it also contributed to maintaining the width and height of the crestal bone and the crestal peak between the adjacent implants. Atieh et al. summarized the controversial evidence on PS and concluded that the inward shift of IAJ platform switching could be considered a desirable morphological feature for crestal bone preservation, but additional, properly designed, long-term RCTs were needed, to establish long-term predictability of the concept. A recent meta-analyses on PS by Strietzel et al. revealed a significantly less mean in the MBL of PS implants, but the studies included herein showed an unclear as well as high risk of bias and a relatively short follow-up period.

Successful results in favor of PS, in the discussed studies, may be partially attributed to the various confounding factors. Most of the studies used conventional/digital radiographs to assess MBL and had the limitation of not being able to assess the buccal and lingual bone loss, as also the horizontal bone loss at the mesial/distal margins. Owing to the great heterogeneity in these studies, in their own case–control groups, in terms of implant neck geometry (smooth neck vs. rough neck with microthreads), implant abutment connection (external/internal hex/morse taper), the implant systems used (same/different manufacturers and designs), surgical protocols (submerged/nonsubmerged), placement level in relation to the crestal bone, loading protocols (immediate/delayed), and the degree of platform mismatch used, a quantitative analyses could not be performed.

Although most of the studies express a clear tendency favoring PS as an implant design modification for crestal bone preservation, long-term clinical studies with a larger sample size are still awaited.

**Conclusion**

Most of the authors agree that the use of implants with a modified platform (Platform Switching) improves bone crest preservation, leads to controlled biological space reposition, and holds the key to physiological prosthetic contours, with optimum esthetics. Moreover, the implant design modifications involved in Platform Switching offer multiple advantages and potential applications, for example, the anterior zone where preservation of the crestal bone can lead to improved esthetics. Due to heterogeneity in the studies available in literature, evidence in favor of PS is not definitive. Longitudinal RCTs with a larger sample size, uniform study design, implant geometry, surgical protocols, and assessment methods are needed to substantiate the predictability of
Platform Switching in preserving horizontal and vertical marginal bone levels and in improving the esthetic outcome.

References


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