## Platform switching for marginal bone preservation around dental implants: a systematic review and meta-analysis.

Atieh MA, Ibrahim HM, Atieh AH.

J Periodontol. 2010 Oct;81(10):1350-66.

**Abstract**

**BACKGROUND:**

Platform switching for maintaining peri-implant bone levels has gained popularity among implant manufacturers over the last few years. However, the assumption that the inward shifting of the implant-abutment junction may preserve crestal bone was primarily based on serendipitous finding rather than scientific evidence. The objectives of the present study were to systematically review radiographic marginal bone-level changes and the survival of platform-switched implants compared to conventional platform-matched implants.

**METHODS:**

A literature search of electronic databases (MEDLINE, EMBASE, The Cochrane Oral Health Group's Trials Register, The Cochrane Central Register of Controlled Trials, the U.K. National Research Register, the Australian New Zealand Clinical Trials Registry, the Database of Abstracts of Reviews of Effectiveness, and Conference Proceedings Citation Index) was performed up to March 15, 2010. Hand searches included several dental journals, and authors were contacted for missing information. Controlled trials that compared marginal bone-level changes around platform-switched dental implants with those restored with platform-matched prostheses were selected. The review and meta-analysis were done according to the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement. Data were analyzed using two meta-analytic statistical packages. Mean differences (MDs) were calculated for analyzing continuous data, and risk ratios (RRs) were used for dichotomous data with 95% confidence intervals (CIs).

**RESULTS:**

Ten studies with 1,239 implants were included. The marginal bone loss around platform-switched implants was significantly less than around platform-matched implants (MD: -0.37; 95% CI: -0.55 to -0.20; P <0.0001). No statistically significant difference was detected for implant failures between the two groups (RR: 0.93; 95% CI: 0.34 to 2.95; P = 0.89). Subgroup analyses showed that an implant-abutment diameter difference > or= 0.4 was associated with a more favorable bone response.

**CONCLUSIONS:**

The review and meta-analysis show that platform switching may preserve interimplant bone height and soft tissue levels. The degree of marginal bone resorption is inversely related to

the extent of the implant-abutment mismatch. Further long-term, well-conducted, randomized controlled studies are needed to confirm the validity of this concept.

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## Implant neck configurations for preservation of marginal bone level: a systematic review.

Bateli M, Att W, Strub JR.

Int J Oral Maxillofac Implants. 2011 Mar-Apr;26(2):290-303.

**Abstract**

**PURPOSE:**

The aim of this article was to evaluate the effectiveness of various implant neck configurations in the preservation of marginal bone level as well as to identify the available scientific evidence.

**MATERIALS AND METHODS:**

Online and hand searches of the literature published from 1976 through 2009 were conducted to identify studies dealing with modifications in the implant neck area and marginal bone loss for at least a 5-year observation period. The search terms that were used, alone or in combination, were "implant neck," "marginal bone loss," "neck design," "bone resorption," "bone remodeling," and "implant collar." Relevant studies were selected according to predetermined inclusion and exclusion criteria.

**RESULTS:**

The initial search yielded 3,517 relevant titles and revealed eight different implant neck configurations and/or methods suggested for the preservation of marginal bone. These methods included changes in implant neck length and design, implant surface characteristics, implant diameter, and/or insertion depth; the addition of microthreads; the use of one-piece implants; and the concept of platform switching. After subsequent filtering, 20 studies were finally selected and involved the following methods: the use of microthreads (1 study); modifications in implant surface characteristics (11 studies), implant diameter (4 studies), or insertion depth (2 studies); the use of one-piece implants (3 studies); and platform switching (1 study). Because of the heterogeneity of the studies, it was not possible to analyze the data statistically. No evidence was found regarding the effectiveness of any specific modification in the implant neck area in preserving marginal bone or preventing marginal bone loss.

**CONCLUSION:**

The current literature provides insufficient evidence about the effectiveness of different implant neck configurations in the preservation of marginal bone. Long-term randomized controlled clinical trials are needed to elucidate the effects of such modifications.

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## Dimension of the periimplant mucosa. Biological width revisited.

Berglundh T, Lindhe J.

J Clin Periodontol. 1996 Oct;23(10):971-3.

**Abstract**

The objective of the present study was to determine the dimension of the mucosal-implant attachment at sites with insufficient width of the ridge mucosa. 5 beagle dogs were used. Extractions of all mandibular premolars were performed and 3 months later, 3 fixtures of the Branemark System were installed in each side. Following 3 months of healing, abutment connection was carried out. On the right or left side of the mandible, abutment connection was performed according to the Branemark System manual (control side). On the contralateral side (test side), an incision not extending through the periosteum was made at the crest of the ridge. The soft tissue was dissected and a critical amount of connective tissue on the inside of the flap was excised. The periosteum was subsequently incised, abutment connection performed, and the trimmed flaps sutured. The sutures were removed after 10 days. After a 6-month period of plaque control, the animals were sacrificed, biopsies sampled and processed for light microscopy. The length of the junctional epithelium varied within a rather narrow range; 2.1 mm (control side) and 2.0 mm (test side). The height of the suprabony connective tissue in this model varied between 1.3+/-0.3 mm (test side) and 1.8+/-0.4 mm (control side). At sites where the ridge mucosa prior to abutment connection was made thin (< or = 2 mm), wound healing consistently included bone resorption. This implies that a certain minimum width of the periimplant mucosa may be required, and that bone resorption may take place to allow a stable soft tissue attachment to form.

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## The influence of platform switching on the biomechanical aspects of the implant-abutment system. A three dimensional finite element study.

Canullo L, Pace F, Coelho P, Sciubba E, Vozza I.

Med Oral Patol Oral Cir Bucal. 2011 Sep 1;16(6):e852-6.

**Abstract**

**OBJECTIVE:**

To evaluate the biomechanical scenario of platform switching geometric implant-abutment configuration relative to standard configurations by means of finite element analysis.

**STUDY DESIGN:**

A 3D Finite Element Analysis (FEA) was performed on 3 different implant-abutment configurations: a 3.8 mm implant with a matching diameter abutment (Standard Control Design, SCD), a 5.5 mm implant with matching diameter abutment (Wider Control Design, WCD), and a 5.5mm implant with a 3.8 mm abutment (Experimental Design, ED). All the different experimental groups were discretized to over 60000 elements and 100000 nodes, and 130N vertical (axial) and 90N horizontal loads were applied on the coronal portion of the

abutment. Von Mises stresses were evaluated and maximum and minimum values were acquired for each implant-abutment configuration.

**RESULTS:**

The load-induced Von Mises stress (maximum to minumum ranges) on the implant ranged from 150 MPa to 58 Pa (SCD); 45 MPa to 55 Pa (WCD); 190 MPa to 64 Pa (ED). The Von Mises stress on the abutment ranged from 150 MPa to 52 MPa (SCD); 70 MPa to 55 MPa (WCD), and 85 MPa to 42 MPa respectively (ED). The maximum stresses transmitted from the implant-abutment system to the cortical and trabecular bone were 67 Pa and 52 MPa (SCD); 54 Pa and 27 MPa (WCD); 64 Pa and 42 MPa (ED), respectively. When the implant body was evaluated for stresses, a substantial decrease in their levels were observed at the threaded implant region due to the diametral mismatch between implant and abutment for the ED configuration. Conclusion: The platform switching configuration led to not only to a relative decrease in stress levels compared to narrow and wide standard configurations, but also to a notable stress field shift from bone towards the implant system, potentially resulting in lower crestal bone overloading.

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## The influence of individual bone patterns on peri-implant bone loss: preliminary report from a 3-year randomized clinical and histologic trial in patients treated with implants restored with matching-diameter abutments or the platform-switching concept.

Canullo L, Iannello G, Götz W.

Int J Oral Maxillofac Implants. 2011 May-Jun;26(3):618-30.

**Abstract**

**PURPOSE:**

This study sought to determine whether there was a correlation between bone resorption and individual bone patterns in patients treated with implants restored conventionally or using the platform-switching concept.

**MATERIALS AND METHODS:**

Ten patients (24 implants) were randomly assigned to receive implants with different platform diameters (3.8, 4.3, 4.8, or 5.5 mm), all of which were restored with standard 3.8-mm-diameter abutments. Biopsy specimens were obtained prior to implant placement, and histologic and immunohistochemical analyses were performed. Standardized radiographs were made at each site after implant placement and at 36 months after prosthetic loading and bone levels were determined.

**RESULTS:**

One patient dropped out, resulting in a total of 9 patients and 22 implants. Mean bone resorption was 1.358 mm for non-platform-switched implants; mean resorption was 0.832, 0.486, and 0.375 mm for implant platforms of 4.3, 4.8, and 5.5 mm, respectively. After

standardization of peri-implant bone remodeling values, a borderline direct correlation between peri-implant bone changes and levels of biglycans was found. At the same time, a borderline indirect correlation between bone changes and levels of tumor necrosis factor-a was found.

**CONCLUSIONS:**

Within the limit of this study, which was conducted in a small patient sample over a short observation period, an individual resorption trend was detected and paralleled by immunohistochemical findings. Individual local bone structure and quality seemed to be correlated to peri-implant bone resorption. Correlations between biglycan and tumor necrosis factor-a and bone resorption should be confirmed by a larger patient sample.

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## Platform-switched restorations on wide-diameter implants: a 5-year clinical prospective study.

Vigolo P, Givani A.

Int J Oral Maxillofac Implants. 2009 Jan-Feb;24(1):103-9.

**Abstract**

**PURPOSE:**

The purpose of the present investigation was to clinically assess and compare crestal bone changes, over a 5-year period, around external-hexagon wide-diameter implants restored with either matching wide-diameter prosthetic components or with platform-switched prosthetic components.

**MATERIALS AND METHODS:**

During the years 2000 to 2002 all patients who received a single 5-mm-diameter implant with an external hexagon in a private office setting were included in this study. All implants were placed in the posterior areas of the jaws. Maxillary left molars (group A1) and mandibular right molars (group A2) were restored with matching wide-diameter prosthetic components; maxillary right molars (group B1) and mandibular left molars (group B2) were restored with platform-switched prosthetic components. Marginal bone resorption was measured via intraoral radiographs each year after abutment and crown insertion. Statistical analyses were used to determine whether there was a significant difference in marginal bone levels with respect to the width of prosthetic components used.

**RESULTS:**

In all, 182 single 5-mm-diameter implants were placed in 144 patients and all implants survived. Eighty-five implants were restored with matching wide-diameter prosthetic components (group A), and 97 implants were restored with platform-switched prosthetic components (group B). A significant difference in marginal bone levels was found between group A and group B implants after 1 year. The mean marginal bone resorption was 0.9 mm (SD 0.3 mm) for group A implants and 0.6 mm (SD 0.2 mm) for group B implants. Marginal bone resorption observed at the second, third, fourth, and fifth years after abutment and crown insertion did not show any significant change.

**CONCLUSION:**

Statistically significant differences in marginal bone loss were observed between study groups. The 85 implants restored with matching wide-diameter prosthetic components showed more bone loss than the 97 implants restored with platform-switched prosthetic components.

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## Influence of the size of the microgap on crestal bone changes around titanium implants. A histometric evaluation of unloaded non-submerged implants in the canine mandible.

Hermann JS, Schoolfield JD, Schenk RK, Buser D, Cochran DL.

J Periodontol. 2001 Oct;72(10):1372-83.

**Abstract**

**BACKGROUND:**

Endosseous implants can be placed according to a non-submerged or submerged approach and in 1- or 2-piece configurations. Recently, it was shown that peri-implant crestal bone changes differ significantly under such conditions and are dependent on a rough/smooth implant border in 1-piece implants and on the location of an interface (microgap) between the implant and abutment/restoration in 2-piece configurations. Several factors may influence the resultant level of the crestal bone under these conditions, including movements between implant components and the size of the microgap (interface) between the implant and abutment. However, no data are available on the impact of possible movements between these components or the impact of the size of the microgap (interface). The purpose of this study was to histometrically evaluate crestal bone changes around unloaded, 2-piece non-submerged titanium implants with 3 different microgap (interface) dimensions and between implants with components welded together or held together by a transocclusal screw.

**METHODS:**

A total of 60 titanium implants were randomly placed in edentulous mandibular areas of 5 hounds forming 6 different implant subgroups (A through F). In general, all implants had a relatively smooth, machined suprabony portion 1 mm long, as well as a rough, sandblasted, and acid-etched (SLA) endosseous portion, all placed with their interface (microgap) 1 mm above the bone crest level and having abutments connected at the time of first-stage surgery. Implant types A, B, and C had a microgap of < 10 microns, approximately 50 microns, or approximately 100 microns between implant components as did types D, E, and F, respectively. As a major difference, however, abutments and implants of types A, B, and C were laser-welded together, not allowing for any movements between components, as opposed to types D, E, and F, where abutments and implants were held together by abutment screws. Three months after implant placement, all animals were sacrificed. Non-decalcified histology was analyzed histometrically by evaluating peri-implant crestal bone changes.

**RESULTS:**

For implants in the laser-welded group (A, B, and C), mean crestal bone levels were located at a distance from the interface (IF; microgap) to the first bone-to-implant contact (fBIC) of 1.06 +/- 0.46 mm (standard deviation) for type A, 1.28 +/- 0.47 mm for type B, and 1.17 +/- 0.51 mm for type C. All implants of the non-welded group (D, E, and F) had significantly increased amounts of crestal bone loss, with 1.72 +/- 0.49 mm for type D ($P < 0.01$ compared to type A), 1.71 +/- 0.43 mm for type E ($P < 0.02$ compared to type B), and 1.65 +/- 0.37 mm for type F ($P < 0.01$ compared to type C).

**CONCLUSIONS:**

These findings demonstrate, as evaluated by non-decalcified histology under unloaded conditions in the canine mandible, that crestal bone changes around 2-piece, non-submerged titanium implants are significantly influenced by possible movements between implants and abutments, but not by the size of the microgap (interface). Thus, significant crestal bone loss occurs in 2-piece implant configurations even with the smallest-sized microgaps (< 10 microns) in combination with possible movements between implant components.