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Crestal Bone Loss Changes in Platform Switching around Dental Implant: A Systematic Review & Meta-Analysis.

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Abstract

Introduction: The exact mechanism by which platform switching reduces bone loss is still unkown, and there are only few reports on the extent of bone loss prevention by this technique. Hence in our study we assess the effects of platform switching in patients restored with implant supported fixed restorations on implant failure and patient satisfaction.

Materials and methods: We searched the online data bases with the search words platform switching. Implant failure, crestal bone loss. We searched for various types of studies and trials. Also the number of the sample was not restricted. Two independently reviewers evaluated trials for accurateness. The results were stated as risk ratio or mean differences, with their 95% confidence intervals. The primary outcome was patient satisfaction and implant failure.

Results: Out of the 500 studies only 12 were included. No difference between platform switching and matching in three years in implant failures was noted or patient satisfaction. Marginal bone loss, due to the disparities in the study was not meta-analyzed in our study.

Conclusions: From our analysis we can conclude that with respect to the implant success and patient satisfaction, by the platform switching, there is no sufficient data to support.

Keywords: Implant success, Meta-analysis, Platform matching, Implant-abutment model.

Introduction

In one year after placement of the dental implants, peri-implant Crestal bone usually endures remodeling and resorption, seen as minor bone loss to several millimeters leading to implant failure. Hence bone level after functional loading of implant is taken as a factor in implant success. ~2 mm loss is deliberated normal.[4] In other studies the factors, like the micro-gap between the implant and the abutment, the implant crest module, occlusal overload, and the

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biologic width around the dental implant were linked to bone loss. To overcome this the platform switching concept was proposed that uses wide diameter implants to smaller diameter abutments.[7] The exact mechanism by which platform switching reduces bone loss is still unclear, and there are only inadequate reports on the extent of bone loss deterrence by this technique. Lozzoro et al [8] stated that the inward positioning of the implant/abutment junction distances the junction away from the adjacent Crestal bone and rises the surface area to which the soft tissue can attach and establish biological width. This could lower bone loss. There is no agreement on whether the design of implant abutment connection improves implant survival on long term. A systematic review is therefore needed to determine if platform switching affects implant failure and patient satisfaction, and to identify the ideal implant abutment junction design to be used when restoring implants with fixed prosthesis. Due to disparities in the studies we intend to evaluate the effects of platform switching for the patient satisfaction in patients restored with implant supported fixed restorations on implant failure.

Material and methods

We investigated from the Cochrane trial register. The selection process was done by 2 blinded reviewers. The inclusion criteria were: 1. Randomized controlled clinical trials ≥6 months. 2. Single tooth implant/fixed partial dentures 3. Platform matched implant-abutment vs implants restored with platform switched. The primary outcomes variable was implant failure and patient satisfaction assessed using VAS. The secondary outcomes variable marginal bone loss. The follow up considered were 1-3, 3-5 and 5-10 years.

Data abstraction

The eligible studies were noted thoroughly. Quality check was done by two reviewers for evaluating the bias based on the standard guidelines.[13] No bias was seen in the included studies after a thorough assessment based on the handbook Higgin.[13] 22 measures of treatment effect the statistical analysis was done by the review manager software Revman.[12] For dichotomous data, the results were obtainable as summary risk ratio with 95% CI., for continuous data, the mean difference with 95% CI was used. Patient and 'implant failure' are the variables. In trials that compared more than two intervention groups, we combined all the groups with mismatch between the implant and the abutment into one single "platform switched" group. For all outcomes, we carried out analyses, as far as possible, on an intention-to-treat basis, i.e. we included all participants randomized to each group in the analyses, and all participants analyzed in the group to which they were allocated, regardless of whether or not they received the allocated intervention. The denominator for each outcome in each trial was calculated as the number randomized minus any participants whose outcomes are known to be missing. Assessment of heterogeneity we have assessed statistical heterogeneity in each meta-analysis using the T^2, I^2 and Chi^2 statistics. We regarded heterogeneity as substantial if I^2 was greater than 30% and either T^2 was greater than zero, or there was a low p value (less than 0.10) in the Chi^2 test for heterogeneity.

Data production

We have used fixed-effect meta-analysis for combining data where it is reasonable to assume that studies were appraising the same underlying treatment effect: i.e. where trials were examining the same intervention, and we arbitrated the trials' populations and methods sufficiently alike. If there was clinical heterogeneity sufficient to expect that the underlying treatment effects differed between trials, or if we detected substantial statistical heterogeneity, we explored this by sensitivity analysis followed by random-effects if

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essential. We did not conduct the planned subgroup analyses by the type of loading, location of prosthesis, arch, and type of fixed prosthesis due to insufficiency of the data. In future updates of this review, if there are 10 or more studies in the meta-analysis we will investigate reporting biases (such as publication bias) using funnel plots. We will assess funnel plot asymmetry visually. If asymmetry is advised by a visual assessment, we will implement exploratory analyses to examine it.

Results

We recognized 19 potentially eligible studies (25 reports). [14-32] The detailed search results are depicted in PRISMA flow diagram (Figure 1)Included studies represented in table 1, 12studies (19 reports) met the inclusion criteria for this review. Risk of bias in involved studies we have given detailed descriptions of the risk of bias in the included studies see figure 2 and figure 3 for a summary of 'risk of bias' assessments. In two studies [19,25] no information was given regarding generating the random sequence, while in the rest of the included trials adequate methods of randomization were defined.[14-18, ,20-24] Concerning allocation concealment, it was unclear in two studies how the random sequence was concealed[18,19], while all the remaining trials given adequate description of their concealment method.[14-17,20,-25] In all the included studies neither the participants nor the caregivers were blinded. Due to the nature of the intervention, blinding is not feasible and we deliberated the risk of performance bias to be low.[23] Bearing in mind detection bias, we evaluated blinding separately for different classes of outcomes. We judged the risk of detection bias to be low in objective outcomes, and high in patient reported outcomes since lack of blinding can potentially introduce bias for this class of outcomes through multiple pathways Higgins.[13]In seven studies, all the participants randomized were available for all follow-up duration with no drop outs or exclusions. [15,16,18,19,20,21,25] In four studies, the risk of attrition bias was high. [14,17,22,24] Two of them performed per-protocol analysis and had drop-outs higher than 10% [17,22] while in the other two discrepancy exited between the reports of the same study regarding the number of patients randomized, and no reply was expected from the authors when contacted by email to clarify this issue. [14,24] In Rocha, [23] the risk of attrition bias was unclear since the trial had 4% drop outs and performed per-protocol analysis. We assessed five trials to be at high risk of reporting bias due to failure to report key outcomes that are expected to be reported for such studies,[14,17,18,22,25] while in all the remaining studies, the risk of bias was low. [15,16,19,20,21,23,24] Primary outcomes implant failure seven trials reported implant failure.[15,16,18,19,21,23,25] There was no difference between platform switching and platform matching in implant failure after 1-3 years of follow up (RR 0.32, 95% CI 0.01 to 7.70; participants = 475; studies = 7; I2 = 0%) (Fig 4). With a total of 475 implants inserted, only one implant failed, in the platform matched group. Patient satisfaction three trials assessed patient satisfaction,[15,19,24] but only Hsu[19] gave usable data. After one year of follow up, there was no evidence of a difference between the two groups (MD 0.13, 95% CI -0.29 to 0.55; participants = 24; studies = 1; i2 = 0%) (Fig 4) Secondary outcomes marginal bone loss six trials gave data on marginal bone loss. [16,17,21-23,25] However, upon pooling down their data together, we recognized substantial heterogeneity (i2 = 81%) with inconsistency in the direction of effect, which was unexplained by clinical or methodological differences between the studies, and accordingly we did not perform meta-analysis since this could produce misleading results.

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Figure 1: Flowchart of retrieved studies.

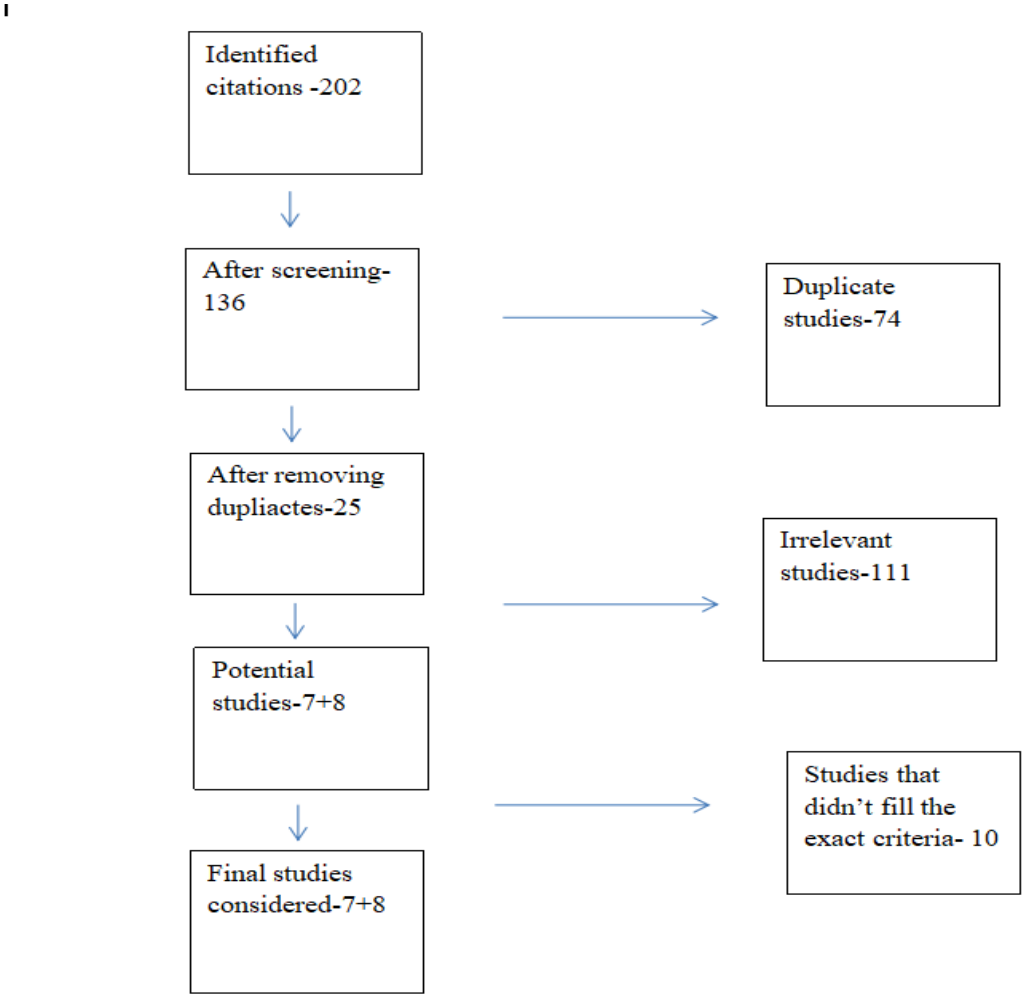

Table 1: Features of the included studies

Author	Study design	No. of patients	Age	No. of Implants (PS/PM)	Implant placement parameters	Implant site	Restoration protocol	MarginaT bone loss (meanż SD)	Significance
Canullo et al '"	RCT	31	ranged from 36 to	80	Crestal		splinted crowns	Test groupy	

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	Multicenter		78 years (mean age: 52.1 years).			In the posterior maxilla.		0.99mm, SD:0.42mm Test group2 0.87mm, SD:0.43mm Test group3 0.64mm,SD: 0.32mm PM 1.48mm,SD: 0.42mm	PRO.005 Ps0.00S Ps0.00S Ps0.005
De Angelis et al	RCT Multicenter	53	58 years range(SS.S ' 61.2) years	79 48/31	Crestal	11 of PS in anterior maxilla 68 in posterior sites	32 single tooth 47 short span	At the 1-year follow-up PS 0.26mm+0.40Smm PM 0.31mm-Ł0.432mm	 NS NS
Enkling et al	RCT Parallel group	25	51 -I 10.5 years old	50 25/25	Crestal	In the posterior mandible	Single screw-retained crowns	T6: 38 mo PS —0.35 z 0.50	
Fiernśndez-Fio‹Moso et al	RCT Parallel group	54	2S pateints Average in PM 34.7 (range 30-68 years)	104 58/56	Crestal	Edentulous areas in maxillary and	Cemented not-splinted prothesis	PM —0.46 0.37 PS 0.68 mm (SD 0.88) PM 2.23 mm (SD 0.22)	P < 0.001

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			26 patients Average in PS 42.9 (range 26-69 years)			mandibular premolar and molar regions.			
Gutmacher et al	RCT Parallel group	27	age ranged from 39 to 75 years (mean age 55.7 1 12.2 years).	41 21/20	Crestal	19 were in the molar region, 18 in the premolar region, and 4 in the anterior region	Single screw-retained crowns	At baseline PS 0.98 + 0.37 PM 0.69 + 0.20 AI 1 year PS 0.14 * 0.12 PM 0.94 * 0.36	.3379 **0025**
Hsu et al	RCT Parallel group	26	Mean age of 57.73 * 12.64 years (range, 31 to 90 years)	26 13/13	Crestal	In test group Anterior (3) Premolar (10) In control group anterior (6) Premolar (7)	Single crown	TP—T2 PS 0.23 * 0.36 PM 0.57 * 0.27 **Tt-T3** PS 0.24 0.S7 PM 0.76 * 0.40 TP—T4 PS 0.20 T 0.50	P < .05 P < .05 P .05 P .05

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		PM 0.39	0.76 * P < .01
		TP—TP PS 0.56	P < .01 0.21
		PM 0.47	0.74 *

Figure 2: Risk of bias summary: review authors' judgments about each risk of bias item for each included study.

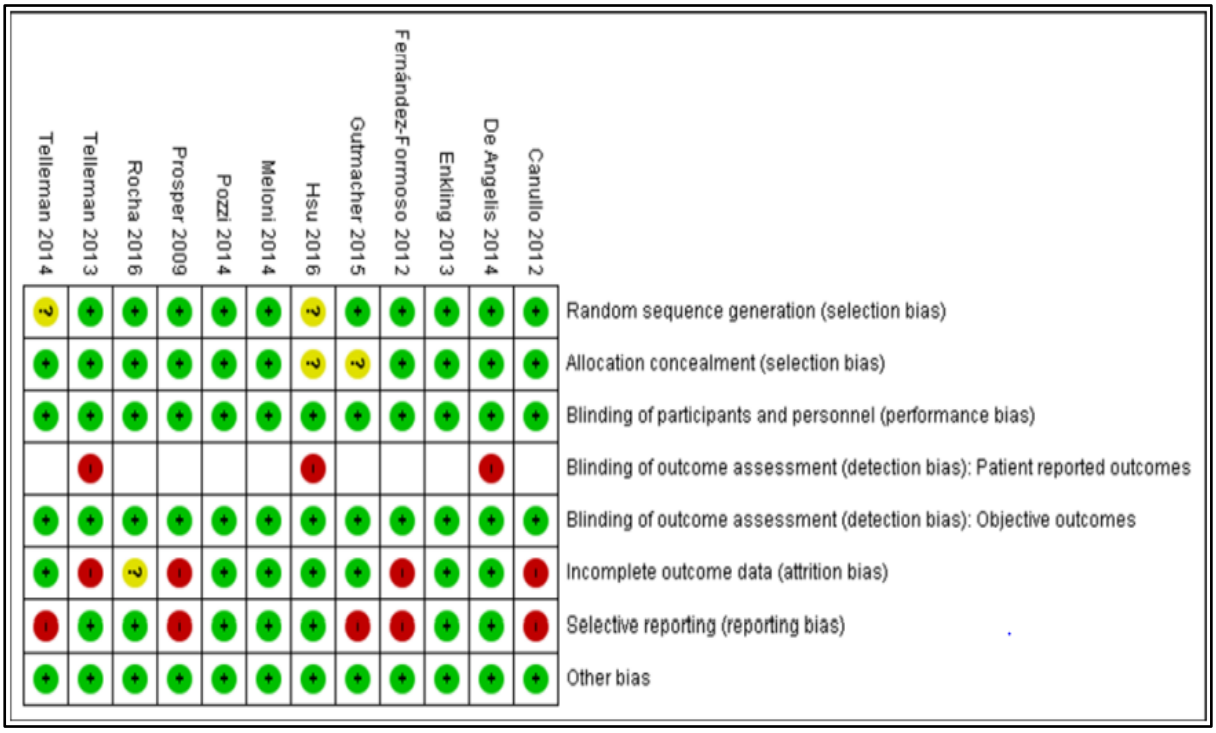

Figure 3: Risk of bias graph: review authors' judgments about each risk of bias item presented as percentages across all included studies.

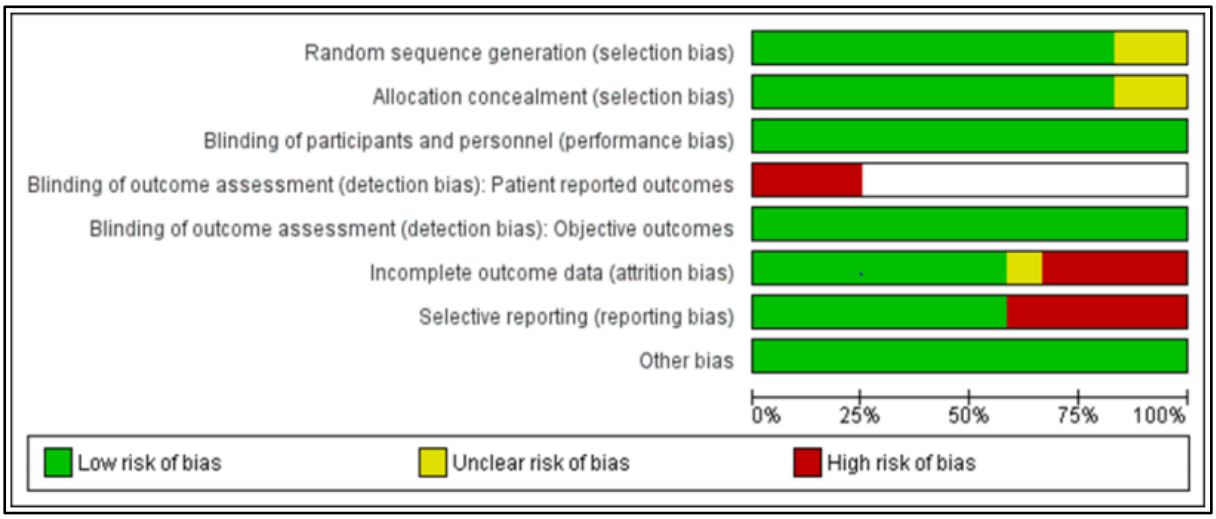

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Figure 4: Implant failure analysis.

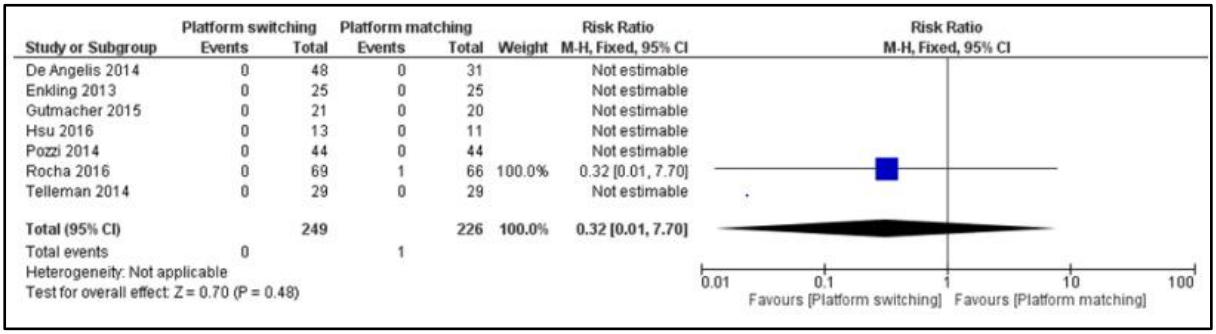
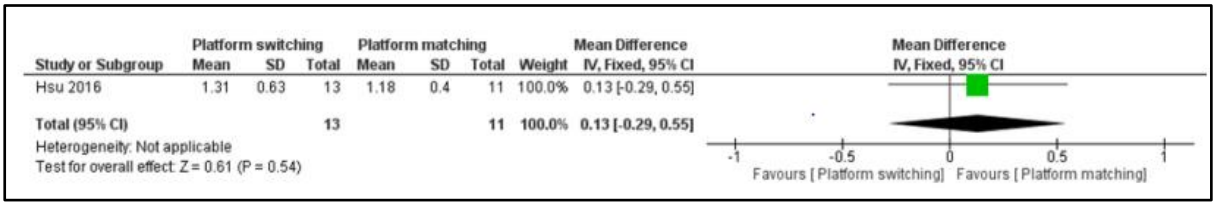


Figure 5: Patient satisfaction at 5 years.



Discussion

12 RCTS (513 participants) reported the effectiveness of platform switching in patients restored with implant supported fixed restorations on implant failure and patient satisfaction. There was no difference in implant failure and patient satisfaction, and there is insufficient evidence concerning which implant-abutment connection design is more satisfactory to marginal bone levels. The studies identified were not adequate to address the objectives of the review. Although the participants and interventions were relevant to the review question, the outcomes examined were poorly reported and most of the trials unsuccessful to assess the outcomes of interest in the review. In addition, the number of patients in the individual primary studies was relatively small, which rises the risk of random error. There is no agreement presently on the favorable design of the implant abutment connection to be used when fabricating implant supported fixed restorations. The evidence recognized do not allow a robust inference regarding the effects of platform switching in patients restored with implant supported fixed restorations on implant failure and patient satisfaction. Most of the comprised trials failed to report the outcomes in a usable form hindering their inclusion in the analysis, and since the studies were of small sample sizes, and there were few events with the ci with appreciable benefit and harm in implant failure and patient satisfaction, we would rate down quality of evidence by two levels for inaccuracy. We were able to recognize all relevant studies and obtain all relevant data. We did not apply date or language restrictions on our search. Two review authors measured eligibility for inclusion, carried out data extraction and assessed risk of bias. Therefore, we are not worried that the methods used in the review could have presented bias. The effectiveness of platform switching has been previously systematically reviewed by 3 articles.[33-35] These reviews established that there is significantly less marginal bone loss with the implants restored with platform-switching design. They also stated that there is bone gain after longer follow up times and with increased mismatch between the implant platform and the abutment. However, the methods of conducting these reviews had the potential of introducing bias, since they included RCTS and observational studies, did not comprise clinically meaningful outcomes, and combined studies with implants placed at different bone levels. In our review, there was inadequate evidence on the effect of the design on marginal bone loss, and there

was no variance between both designs in implant failure or patient satisfaction.

Conclusion

In patients restored with implant supported fixed restorations, there is inadequate evidence to support platform switching or platform matching implant-abutment connection design to increase implant survival and patient satisfaction. More well-designed randomized controlled trials (RCTS) with appropriate a-priori calculated sample sizes and long follow up durations are required. The trials should focus on clinically relevant outcomes such as the survival of the different prosthetic components and the patient satisfaction with the treatment.

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