

INTRODUCTION

Different factors have been claimed to play a role in marginal bone loss (MBL) such as apico/coronal placement, platform switching connection and soft tissue thickness. Animal studies reported that a minimum mucosa thickness is required to reduce bone remodeling. However, findings of recent trials and reviews are controversial and there is no consensus if thin tissues could be a risk factor for higher bone loss. Therefore, the aim of this review was to systematically evaluate the literature comparing MBL around implants placed in areas with thick versus thin mucosa at 1 year after implant loading. Additionally, we aimed to investigate how other variables can influence MBL in case of thin or thick mucosa.

MATERIALS & METHODS

This review was registered at the National Institute for Health Research PROSPERO with the number CRD42018084598. A **PICO question** was defined and manual as well as electronic screenings on MEDLINE/PubMed and Cochrane Oral Health Group databases was performed. Implant failure and MBL were defined as primary outcomes; aesthetic/biological complications and prosthesis failure were defined as secondary outcomes.

Inclusion Criteria:

- (1) Randomized and non-randomized comparative studies that included implants' clinical and radiological outcomes describing groups with different thickness of the mucosa;
- (2) follow-up of 12 months at least;
- (3) implants placed in healed sites; and
- (4) at least 10 implants evaluated.

Exclusion Criteria:

- (1) All articles not satisfying inclusion criteria;
- (2) repeated reports of the same study;
- (3) trials evaluating immediate implants;
- (4) or machined/smooth surfaces;
- (5) soft tissue thickness not evaluated from the occlusal portion of the crest or
- (6) indirectly without elevation of a flap.

Statistical Analysis:

Cochran's Q and I² statistics were performed and the P-value was calculated. Level of statistical significance was set at $\alpha = 0.05$. Meta-analyses were performed including subgroup analysis.

RESULTS

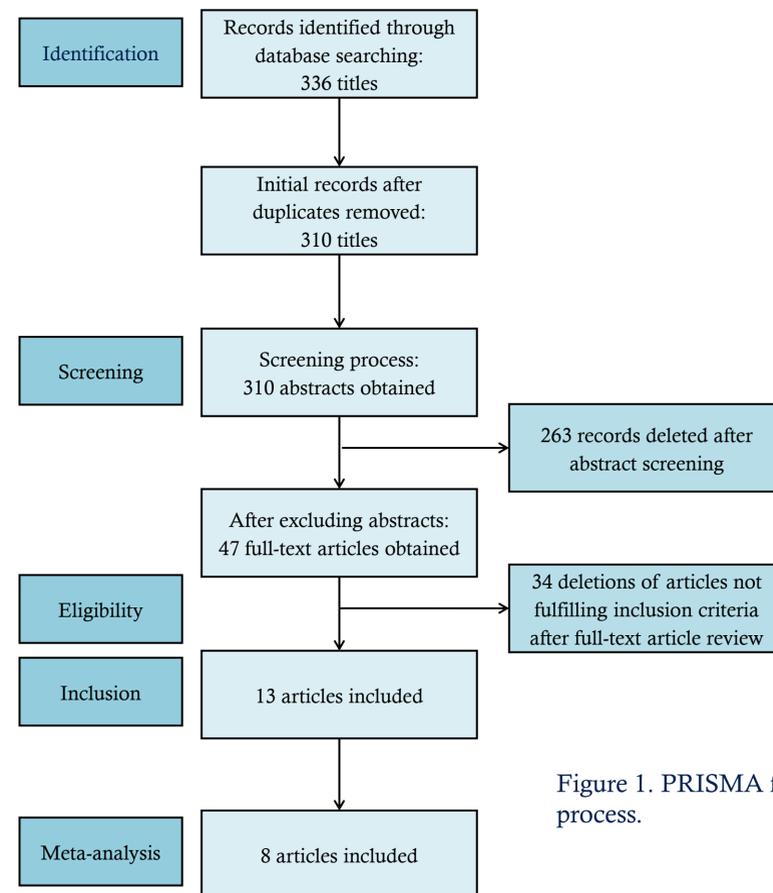


Figure 1. PRISMA flow diagram of the study selection process.

Following the PRISMA guidelines, the selection process of publications yielded 13 and 8 articles in the qualitative and quantitative analysis respectively.

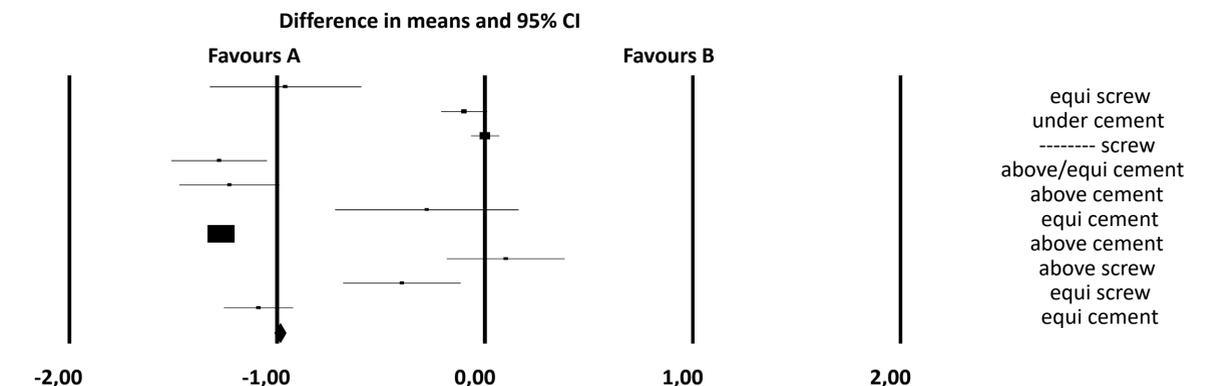
The study report stated that MBL at 12 months of follow-up found A significant less MBL was found in sites with thick mucosa [mean difference of -0.567 mm (95% CI, -0.725 to -0.409 mm, with P < 0.0001)] when compared to thin mucosa sites.

A subgroups analysis showed a significant effect in favor of the site with thick mucosa for both equi- and supra-crestal placement (means difference -0.860 mm, -1.252 mm, respectively).

When examined the effect of platform matching (PM) in our subgroups analysis, the significant bone preservation of the thick mucosa group was maintained for platform matching (PM) connections (means difference -1.241 mm, 95% CI, -1.274 to -1.208 mm, with P-value < 0.0001), while this was not observed in PS ones (means difference -0.055 mm, 95% CI, -0.118 to -0.007 mm, with P-value = 0.082). In thin mucosa group, PS groups had a less MBL than platform matching groups.

Figure 2. Forest plot of comparison of implants in patients with thin and thick mucosa. Outcome: marginal bone loss (MBL)

Study name	Statistics for each study						
	Difference in means	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Linkevicius cid	-0,960	0,190	0,036	-1,332	-0,588	-5,060	0,000
Canullo jomi 2017	-0,100	0,060	0,004	-0,217	0,017	-1,669	0,095
Jeong tripleo 2011	0,000	0,038	0,001	-0,075	0,075	0,000	1,000
Linkevicius jomi 2009	-1,280	0,121	0,015	-1,518	-1,042	-10,549	0,000
Linkevicius Stomatologija 2009	-1,230	0,126	0,016	-1,477	-0,983	-9,743	0,000
Linkevicius Stomatologija 2009	-0,280	0,229	0,052	-0,728	0,168	-1,224	0,221
Linkevicius cid 2015	-1,270	0,017	0,000	-1,303	-1,237	-74,805	0,000
van Eekeren clr 2016	0,100	0,148	0,022	-0,191	0,391	0,675	0,500
van Eekeren clr 2016	-0,400	0,148	0,022	-0,690	-0,110	-2,704	0,007
Bhat jisp 2015	-1,090	0,089	0,008	-1,264	-0,916	-12,299	0,000
	-0,992	0,014	0,000	-1,020	-0,964	-68,886	0,000



DISCUSSION

1. Results of our findings showed that thick tissue prevents peri-implant MBL at the level of statistical significance (P-value < 0.0001).
2. Subgroup analysis on apico/coronal placement contradicts the assumption that supracrestal positioning can preserve bone, suggesting that mucosa thickness plays a bigger role than vertical placement of implant shoulder (P < 0.0001).
3. Subgroup analysis showed significant bone preservation of the thick mucosa only for platform switching connections (P < 0.0001), while the beneficial effect of thick mucosa was lost for PS ones (P=0.082).
4. Studies using allogenic membranes to augment tissue thickness of thin sites showed significant less MBL in thickened sites if compared with thin sites and no significant differences when compared with naturally thick mucosa.

CONCLUSION

Within the limits of the present study, it can be concluded that implants placed in ridges with thick soft tissue have significantly less marginal bone loss regardless the supra- or equi-crestal positioning of the implant shoulder. The beneficial effect of thick vertical mucosa was lost for platform switching implants, suggesting the effectiveness of platform switching as horizontal component of biologic width. Thickening thin soft tissues seems to be a reliable procedure to reduce early bone loss. Registration of mucosa thickness prior to implant placement could be extremely beneficial to predict early marginal bone resorption.