Original Article

Comparison of marginal bone loss in SLA and RBM implants: A prospective cohort study

ABSTRACT

Context: The study aims to answer the following question: Among the patients who received a dental implant, is there any difference in marginal bone loss (MBL) between sandblasted and acid-etched (SLA) and resorbable blast media (RBM) implants?

Aims: The study aimed to evaluate marginal bone loss in SLA and RBM implants one year after loading.

Settings and Design: A Prospective Cohort Study.

Methods and Material: In this prospective cohort study with a pre-protocol population, subjects were assigned into two groups: Subjects received SLA implants in group 1 and RBM in group 2. MBL was assessed 12 months after loadings through digital parallel radiographs.

Statistical Analysis Used: An Independent *t*-test was used to compare MBL between the two groups.

Results: Sixty-six implants were studied (each group 33 implants). The mean of MBL in the RBM group was significantly higher than the SLA group (1.39 ± 0.31 mm, 0.89 ± 0.26 mm, respectively, $P < 0.001$). MBL in the mesial sides of implants in the RBM group was significantly higher than the SLA group (1.28 ± 0.29 mm, 0.8 ± 0.29 mm, respectively, $P < 0.001$). Analysis of the data demonstrated a significantly higher mean of MBL in the distal sides of implants in the RBM group than in the SLA group (1.51 ± 0.35 mm, 0.97 ± 0.27 mm, respectively, $P < 0.001$). In both groups, the mean of MBL on the distal side was significantly higher than on the mesial side ($P < 0.05$).

Conclusions: Within this study's limitation, RBM implants showed significantly more MBL than SLA implants.

Keywords: Alveolar bone loss, bone-implant interface, dental implants, osseointegration

INTRODUCTION

The surface of dental implants is essential for the differentiation and adhesion of osteoblasts in the initial phase of osseointegration and long-term bone remodeling.[1] The surface properties of the implant affect bone-implant fusion.[2] The speed and quality of osseointegration highly depend on the composition and surface roughness. Rough-surfaced implants improve biomechanical stability and bone anchoring. High roughness leads to a mechanical fusion between the implant surface.[3] It was suggested that marginal bone loss (MBL) in moderately and minimally rough surfaces is less than in rough surfaces.[4] Sandblasted and acid-etched (SLA) and resorbable blast media (RBM) are two common dental implant surfaces used in various dental implant brands.[5]

The stability of peri-implant bone is important for long-term dental implant success. The factors mostly used for measurement outcomes in implant dentistry consist of implant-related factors, the peri-implant soft tissue, and the prosthesis and the patient's systemic condition.[6] These factors are related to tissue stability,

Majid Nemati, Bahar Dadkhah, Reza Tabrizi, Shervin Shafiei, Hamidreza Moslemi

Department of Oral and Maxillofacial Surgery, Dental School, Shahid Beheshti University of Medical Sciences, Tehran, Iran

Address for correspondence: Dr. Hamidreza Moslemi, Department of Oral and Maxillofacial Surgery, Shahid Beheshti School of Dentistry, Danshjoo Blvd., Velenjak, Shahid Chamran Highway, Tehran, Iran.
E-mail: hmoslemi71@gmail.com

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which affects the progression of MBL around healthy dental implants.[6]

According to Albrektsson *et al.*,[7] marginal bone loss is 1 to 1.5 mm during the first year, and in subsequent years less than 0.2 mm. There were various reports on the survival of SLA and RBM implants.[8-10] Also, there were few studies to investigate MBL in SLA and RBM implants. The major drawback of previous studies was using different implant brands with different macro-design, which decreased the reliability of results.

The study aims to answer the following question: Among the patients who received a dental implant, is there any difference in MBL between SLA and RBM implants? We hypothesized that SLA implants are associated with a lower MBL compared to RBM implants. Therefore, this study aims to compare MBL between SLA and RBM implants.

SUBJECTS AND METHODS

The authors designed a prospective cohort study with a pre-protocol population. The sample was derived from the population of patients introduced to dental clinic between April 30, 2017, and December 31, 2018. Subjects eligible for participation in the study had an edentulous area at the posterior of the mandible with class I occlusion and needed a dental implant for restoration. Subjects were excluded from the study enrollment if they were smokers or had periodontitis, in the presence of impacted third molars, systemic diseases, and subsequent drug use, especially corticosteroids and bisphosphonates, and receiving graft in the implant site and fresh socket implantation. The patients were radiographed (immediately after loading and 12 months later) using a long-cone periapical digital radiograph (iRay D3, Dexcowin, South Korea) with 60 kV and 7 mA Dc in 0.20 sec. The radiographs' reproducibility was confirmed through the use of individual bite blocks, which were attached to the beam-guiding device (XCP, Rinn, Elgin, IL). In the mesial and distal surfaces of the implants, the bone level was measured. The shoulder of the implant was considered a reference point. The distance between the implant shoulder and the crest of the alveolar bone vertically was defined as a marginal bone level. The change of the marginal bone levels immediately after loading and 12 months later was considered the MBL. The amount of MBL at the mesial and distal of implants and the mean of MBL were reported. The images were analyzed by an oral and maxillofacial radiologist who was unaware of the groups.

All implants were Dentis brand with a similar design (Dentis Company, South Korea). However, in group 1 SLA surfaces were used and in group 2 RBM surfaces were used. All of the surgeries were performed by the same experienced oral and maxillofacial surgeon. Implants were placed equicrestally with the same drilling speed and torque (1000 rpm with 20 Ncm torque). All implants were loaded 3 months after placement with cemented crowns. Crowns were tried-in for fit, marginal adaptation, interproximal contacts, and occlusion before cementation and cemented with glass ionomer cement (Ketac-Cem; 3M ESPE America). Excess cement was carefully removed. Clinical and radiographic evaluations were done to avoid any cement excess. Patients were introduced and trained to use dental flosses and water floss for cleaning the interdental area.

MBL was considered as the primary outcome of the study. Implant failure was the secondary outcome. Age and gender distribution were analyzed as confounding factors between the two groups.

The study design and objectives were explained to all participants, and written informed consent was obtained from them. This study was performed according to the principles outlined by the World Medical Association's Declaration of Helsinki on experimentation involving human subjects, as revised in 2000. Ethical Clearance was obtained from Institutional Ethical Committee with Ref no IR.SBMU.DRC.REC.1398.003 dated 2019-02-18.

The statistical analyses were done using a statistical package for the social sciences (SPSS) version 23 (SPSS Inc., IL, USA). A Chi-square test was applied to assess the distribution of males and females in the two groups. The independent *t*-test was applied to compare MBL and age between the two groups. P values <0.05 was considered statistically significant.

RESULTS

Sixty-six subjects were studied (33 implants in each group). There were no failed implants in the two groups during the follow-up time. In total 17 males and 16 females were in group 1 (SLA group) and 9 males and 24 females were in group 2. There was no significant difference in the gender distribution between the two groups ($P = 0.08$).

The mean age in the SLA group was 55.15 ± 12.06 years, and in the RBM group was 56.82 ± 7.63 years. Statistical analysis showed no significant difference between the two groups ($P = 0.5$) After one year of loading, none of the implants were lost and had a 100% success rate.

The mean of MBL in the RBM group was significantly higher than the SLA group (1.39 ± 0.31 mm, 0.89 ± 0.26 mm,

respectively, $P < 0.001$) [Figure 1]. MBL in the mesial sides of implants in the RBM group was significantly higher than the SLA group (1.28 ± 0.29 mm, 0.8 ± 0.29mm, respectively, $P < 0.001$). Analysis of the data demonstrated significantly higher mean of MBL in the distal sides of implants in the RBM group than in the SLA group (1.51 ± 0.35 mm, 0.97 ± 0.27 mm, respectively, $P < 0.001$) [Table 1]. In both groups, the mean of MBL on the distal side was significantly higher than on the mesial side ($P < 0.05$) [Table 2].

DISCUSSION

Osteointegration is a histological achievement that cannot be measured by clinical methods; Thus, various alternative methods must be used to estimate the implant's stability. One standard method is evaluating the mesial and distal bone level with the junction of the prosthesis and the implant as a reference point. Monitoring the implant's condition with this method is an excellent indicator to ensure the stability of treatment results and allows early diagnosis and, if necessary, subsequent interventions. Failure to follow the bone level can lead to the progression of the resorption and the occurrence of luxation. According to Bergman *et al.*[11] bone resorption, more than half of the amount of bone around the implant is considered a failed treatment.

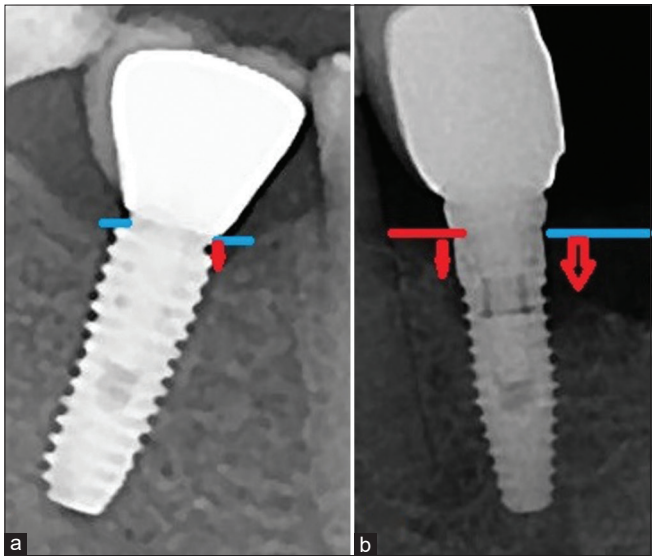

Figure 1: MBL in (a) SLA and (b) RBM implants.

Table 1: Comparing mesial, distal, and total MBL between SLA and RBM implants group

	Surface	Mean±SD††	Independent *t*-test
MMBL*	SLA	0.8±0.29	*P*<0.001
	RBM	1.28±0.29	
DMBL**	SLA	0.97±0.27	*P*<0.001
	RBM	1.51±0.35	
MBL†	SLA	0.89±0.26	*P*<0.001
	RBM	1.39±0.31	

*Mesial Marginal Bone Loss, **Distal Marginal Bone Loss, †Marginal Bone Loss, ††Standard Deviation

Table 2: The mean of mesial and distal MBL in SLA and RBM implants group

Surface	MMBL*	DMBL**	Independent *t*-test
SLA	0.8±0.29	0.97±0.27	*P*=001
RBM	1.28±0.29	1.51±0.35	*P*=0.001

*Mesial Marginal Bone Loss, **Distal Marginal Bone Loss

In this study, MBL was evaluated between SLA and RBM implants. As all implants had a similar macro-design, the bias of the study was reduced. The result of the study showed that SLA implants are associated with a lower MBL compared to RBM implants. Elkhaweldi *et al.*[8] reported that implants with SLA or RBM surface had similar survival rates in the short term. The SLA surface was advocated for use in the posterior maxilla with poor bone quality. Mohajerani *et al.*[9] concluded that the failure rate in RBM implants was higher than other surfaces.They mentioned that the higher failure rate in their study could be due to other factors such as various implant brands with RBM surfaces, and technical errors that had different manufacturing processes and designs.

The difference in MBL in the mesial and distal aspects of implants in both SLA and RBM is another finding. The higher MBL in the distal aspect of implants may be due to the vector of occlusal forces or difficult cleaning at the distal side of implants. Dereci *et al.*[12] reported that MBL was similar among different implant types. Also, they found a correlation between the distal MBL and the crown-implant ratio. In the study of Ko-Ning Ho *et al.*,[13] it was found that bone resorption in the distal part of submerged implants is higher than mesial, and the probable reason for this was occlusal forces and difficulty in cleaning the distal part, especially in the first and second molars.

Another point that should be considered is the cantilever's presence in the prosthetic components which increases the stress on the site and the bone loss adjacent to the implant. Cantilever force could lead to loosening the abutment screws; however, in implants without screw loosening, the cantilever occlusal force can result in more pressure and bone loss.[14]

It should be mentioned that using periapical digital radiographs instead of cone beam computed tomography (CBCT) was one of the limitations of this study, as CBCT could be more accurate in MBL measuring.

CONCLUSION

Within the limitations of our study, it seems RBM implants are associated with higher MBL compared to SLA implants.

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Conflicts of interest

There are no conflicts of interest.

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