

Marginal Bone Loss Around Short Implants Supporting Single Screw-Retained Crowns: A Comparison of Two Abutment Types

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ABSTRACT

Objective: To evaluate marginal bone loss (MBL) around short dental implants supporting single screw-retained crowns and to compare the clinical performance of two abutment types in a retrospective cohort.

Materials and Methods: This retrospective study included patients restored with short 8mm bone level implants supporting single screw-retained crowns. Two abutment types were compared: Type A: a casted type one piece abutment, Type B: a multiunit abutment. Standardized periapical radiographs were analyzed to measure MBL at the mesial and distal aspects using a calibrated digital method. Crown-to-implant ratio, implant diameter, implant position, and follow-up interval were recorded. Statistical analysis was performed to compare MBL between abutment groups and assess correlations with implant-related variables.

Results: Short implants restored with single screw-retained crowns demonstrated stable peri-implant bone levels during the follow-up period. Preliminary analysis showed a measurable difference in mean MBL between the two abutment groups. Crown-to-implant ratio did not show a statistically significant association with MBL. Implant diameter and position displayed variable correlation with bone changes.

Conclusion: Short implants supporting single screw-retained crowns yield predictable outcomes with minimal marginal bone loss. Abutment type may influence MBL patterns, highlighting the importance of prosthetic selection in short-implant rehabilitation.

Keywords

Marginal bone loss (MBL), Short dental implants, Screw-retained crowns, Abutment type, Peri-implant bone stability.

Introduction

Dental implant therapy has become a highly predictable treatment modality for the replacement of missing teeth. In clinical situations involving limited vertical bone height, the use of short implants, has gained popularity as they offer a less invasive alternative to vertical augmentation procedures and reduce treatment time, cost, and patient morbidity [1-3]. Although short implants demonstrate survival rates comparable to those of standard-length implants,

their reduced length may influence biomechanical behavior, potentially increasing stress concentration around the crestal bone [4,5]. Therefore, identifying factors that contribute to marginal bone loss (MBL) in short implants is essential for ensuring long-term stability.

Among the variables that may influence peri-implant bone remodeling, the type of abutment plays a pivotal role. Abutments are responsible for transferring functional loads from the prosthesis to the underlying implant and surrounding bone [6]. Casted abutments and multi-unit abutments differ in their manufacturing techniques, precision of fit, mechanical properties, and overall

accuracy at the implant–abutment interface [7]. Variations in these characteristics may affect the size of the microgap, bacterial infiltration, mechanical stability, and load distribution—all recognized contributors to crestal bone changes [8]. Despite the clinical importance of abutment selection, studies directly comparing the influence of different abutment types on MBL in short implants remain limited.

Implant diameter is another factor that may influence stress distribution and bone response. Differences in platform width may interact with abutment design to affect the biomechanical environment of the peri-implant tissues [9]. Understanding how these variables collectively influence MBL is particularly relevant when working with short implants, where the available surface area for osseointegration is inherently reduced.

Given these considerations, further research is warranted to evaluate how abutment design affects bone remodeling around short implants in functional conditions. The aim of the present study was to evaluate marginal bone loss around 8-mm implants and to compare the effect of casted versus multi-unit abutments on crestal bone changes.

Materials and Methods

Study Design and Ethical Considerations

This retrospective clinical study evaluated marginal bone loss (MBL) around short dental implants supporting single screw-retained crowns. Patient records and radiographs were reviewed from routinely treated cases in a private clinical setting. All data were anonymized, and the study followed the principles of the Declaration of Helsinki.

Patient and Implant Selection

Table 1: Baseline characteristics of the study sample (n = 37 implants).

Variable	Value
Number of patients	30
Number of implants	37
Females, n (%)	21 (56.8%)
Males, n (%)	16 (43.2%)
Age (years), mean ± SD	53.0 ± 11.0
Follow-up (months), mean ± SD	32.3 ± 9.7
Marginal bone loss (mm), mean ± SD	0.70 ± 0.42
Marginal bone loss (mm), range	0.30 – 1.70
Implants with casted abutment	19
Implants with multi-unit abutment	18
Patients with ≥2 implants, n	6

Thirty patients who received a total of 37 short implants were included. Eligibility criteria required: 1) implant length of 8 mm; 2) diameters consistent with the manufacturer’s narrow and regular platforms (Straumann®, Basal, Switzerland); 3) restorations delivered as single screw-retained crowns; and 4) available baseline and follow-up radiographs of sufficient quality. Implants were restored using two types of screw-retained abutments: casted abutments and multi-unit abutments. Implants with peri-implant pathology, missing radiographs, or splinted restorations were

excluded. Table 1 shows the patient characteristics.

Surgical and Prosthetic Protocol

All implants were placed using a flapped approach following standard osteotomy preparation recommended by the manufacturer. Healing periods followed a delayed loading protocol, after which definitive single screw-retained crowns were delivered. Prosthetic procedures were performed according to conventional restorative guidelines.

Radiographic Assessment and MBL Measurement

Standardized periapical radiographs were used to assess marginal bone levels. Baseline bone level was defined as the first bone-to-implant contact recorded at the time of crown delivery. Follow-up radiographs were taken during subsequent recall appointments, and MBL was calculated as the difference between follow-up bone level and the baseline measurement. Measurements were obtained at both mesial and distal aspects. To ensure measurement accuracy, all radiographs were digitally calibrated using the known implant length. MBL values are reported in millimeters.

Outcome Measure

The primary outcome was the changes in marginal bone level around short implants restored with either casted or multi-unit screw-retained abutments.

Results

A total of 37 short implants (8-mm length) in 30 patients were included in the final analysis. The mean age at surgery was 53.0 ± 11.0 years (range 29–73 years), and 21 patients were female (56.8%) and 16 were male (43.2%). The mean radiographic follow-up was 32.3 ± 9.7 months (range 13–51 months).

Nineteen implants (51.4%) were restored with casted abutments (C group) and 18 (48.6%) with multi-unit abutments (M group). The majority of implants were placed on a regular platform (RC: n = 27; 73.0%) and the remainder on a narrow platform (NC: n = 10; 27.0%).

Marginal bone loss

The overall mean marginal bone loss (MBL) from baseline to the latest follow-up for all implants was 0.70 ± 0.42 mm (median 0.55 mm; range 0.30–1.70 mm). (Table 2).

Table 2: Marginal bone loss according to abutment type.

Abutment type	Number of implants	Mean MBL (mm)	SD (mm)	Median MBL
Casted (C)	19	0.78	0.45	0.60
Multi-unit (M)	18	0.63	0.38	0.50

Normality testing using the Shapiro–Wilk test indicated that MBL values were not normally distributed (p < 0.001), so non-parametric tests were used for group comparisons.

Effect of abutment type on marginal bone loss

Implants restored with casted abutments showed a mean MBL of

0.78 ± 0.45 mm (median 0.60 mm; range 0.30–1.50 mm), while those restored with multi-unit abutments showed a mean MBL of 0.63 ± 0.38 mm (median 0.50 mm; range 0.30–1.70 mm).

The Mann–Whitney U-test revealed no statistically significant difference in MBL between the two abutment types (U = 200.5, p = 0.376). (Figure 1).

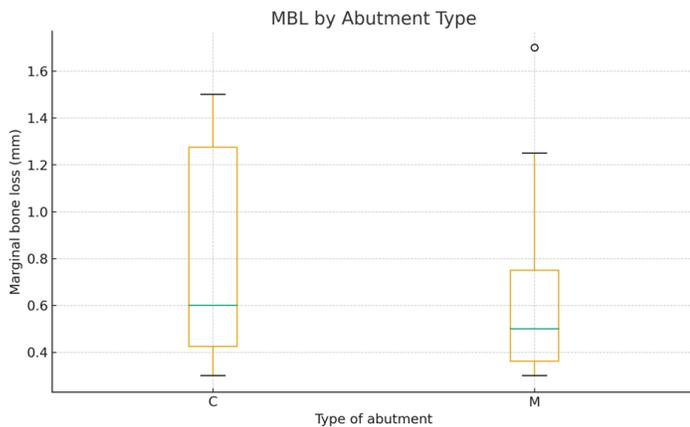


Figure 1: Marginal bone loss by abutment type.

Figure 1 Boxplot showing marginal bone loss (MBL) around implants restored with casted versus multi-unit abutments. Each point represents a single implant. No statistically significant difference was observed between groups (Mann–Whitney U test, p = 0.38).

To account for clustering of multiple implants within the same patient, a secondary analysis was performed using the median MBL per patient (30 patients; 16 in the C group and 14 in the M group). The mean patient-level median MBL was 0.76 ± 0.43 mm in the C group and 0.64 ± 0.38 mm in the M group, with no significant difference between groups (Mann–Whitney U = 124.5, p = 0.617).

Effect of implant platform (NC vs RC)

When implants were grouped according to platform diameter, the mean MBL was 0.75 ± 0.43 mm (median 0.58 mm) for NC implants (n = 10) and 0.69 ± 0.42 mm (median 0.50 mm) for RC implants (n = 27).

The difference in MBL between NC and RC implants was not statistically significant (Mann–Whitney U = 152.0, p = 0.571).

Crown-to-implant ratio and marginal bone loss

The mean crown-to-implant (C/I) ratio for all restorations was 1.27 ± 0.22 (range 0.84–2.06).

Correlation analysis using Spearman’s rank correlation coefficient demonstrated no significant association between C/I ratio and MBL ($\rho = 0.065$, p = 0.700) (Figure 2).

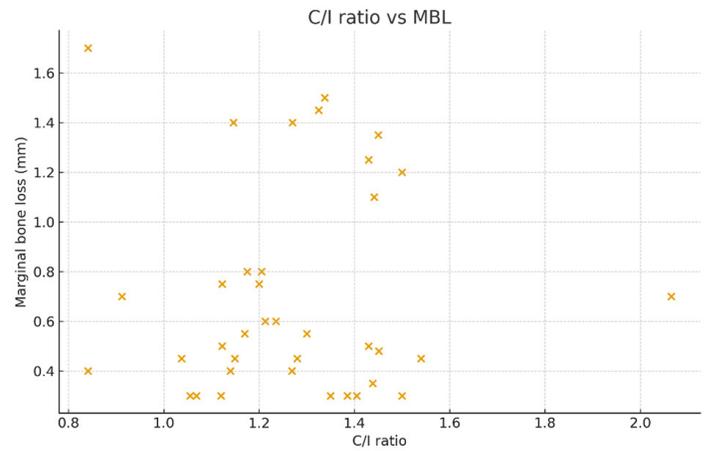


Figure 2: Relationship between C/I ratio and marginal bone loss.

Figure 2 Scatter plot of crown-to-implant (C/I) ratio versus marginal bone loss (MBL) for all implants. A weak, non-significant correlation was found between C/I ratio and MBL in this sample ($r \approx 0.01$).

Implant survival

All 37 implants were in function at the last follow-up, with no implant failures recorded during the observation period, resulting in an implant survival rate of 100% in this cohort.

Discussion

This retrospective study evaluated marginal bone loss (MBL) around short 8-mm implants restored with either casted abutments or multi-unit abutments. The findings demonstrated no statistically significant difference in MBL between the two abutment types at a mean follow-up of over 32 months. Both groups exhibited MBL values well within the accepted range for successful implant therapy, suggesting that abutment type may not play a major role in crestal bone remodeling around short implants restored with single screw-retained crowns.

The overall MBL in this cohort (mean 0.70 mm) aligns with previous literature reporting low bone remodeling around short implants placed under favorable conditions. Several studies have shown that short implants (≤ 8 mm) can achieve survival and bone stability comparable to longer implants when appropriate restorative and surgical protocols are followed [10]. The present findings support these conclusions and demonstrate that abutment selection—casted versus prefabricated multi-unit—does not appear to jeopardize the performance of short implants.

Although casted abutments have traditionally raised concerns related to microgap discrepancy, misfit, and potential inflammatory response, the comparable bone levels [11] in this study suggest that prosthetic accuracy achieved by the laboratory and the use of screw-retained restorations may have mitigated these risks. Likewise, the multi-unit abutment system did not demonstrate superior bone preservation despite its standardized manufacturing and platform

stability. This highlights that both abutment designs may be clinically acceptable when proper prosthetic protocols are followed.

The crown-to-implant (C/I) ratio, often cited as a potential biomechanical risk factor for short implants [12-14], did not correlate with MBL in this study. This finding is consistent with multiple recent reports showing that C/I ratio alone is not a reliable predictor of bone loss. Occlusal load distribution, implant position, bone density, and prosthetic design may play more significant roles than simple geometric ratios. The absence of correlation in the present study reinforces the concept that short implants can tolerate relatively high C/I ratios without compromising peri-implant bone stability.

Similarly, implant platform diameter (NC vs RC) had no significant effect on MBL. Although wider platforms are often recommended to enhance load distribution, this study suggests that both narrow and regular platforms can maintain stable bone levels in single-unit restorations when clinical conditions are appropriate.

An additional strength of the analysis was the consideration of patient-level clustering, acknowledging that some patients received multiple implants. Even when evaluating median MBL per patient, no significant abutment-related difference was observed, further supporting the robustness of the results.

This study has several limitations. Its retrospective design may introduce selection bias, and radiographic measurements were limited to available follow-up intervals rather than standardized time points. Additionally, the sample size—particularly within subgroups—may limit the ability to detect small differences. Nevertheless, the study reflects real-world clinical outcomes and provides practical evidence relevant to daily implant practice.

Overall, the findings suggest that both casted and multi-unit abutments are suitable options for restoring short implants with screw-retained single crowns, with no significant differences in marginal bone stability at medium-term follow-up.

Conclusion

Short implants restored with either casted or multi-unit abutments demonstrated comparable marginal bone stability and a 100% survival rate over an average follow-up of 32 months. Abutment type, crown-to-implant ratio, and implant platform diameter did not significantly influence MBL. Both abutment systems appear to be reliable restorative options for single crowns supported by short implants.

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