# Effect of Misfit of Cement-Retained Implant Single Crowns on Crestal Bone Changes

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The purpose of this clinical study was to compare peri-implant crestal bone levels between misfitting (overhanging/open margin) cement-retained implant single crowns (SCs) vs accurately fitted implant SCs. Seventeen subjects were divided into two groups: test group (misfitting crowns, n = 10) and control group (accurately fitted crowns, n = 7). Crestal bone level changes were assessed using digital software. The average differences in mean bone loss within and between the two groups were statistically significant. Cement-retained implant SCs with marginal misfit resulted in more crestal bone loss than accurately fitted crowns after a mean of 3 years in function. *Int J Prosthodont 2013;26:135–137. doi: 10.11607/ijp.3137*

The effect of misfit of implant prostheses has been scarcely investigated,[1] and an association with crestal bone loss has been proposed.[2,3] With tooth-supported dental prostheses, the most common complication due to marginal misfit is recurrent caries. However, caries is not applicable to implants; thus, the limited evidence on the effect of iatrogenic misfit on peri-implant bone loss warrants further investigation.

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The purpose of this retrospective analysis was to compare peri-implant crestal bone changes between cement-retained implant single crowns (SCs) with radiographically detected misfit versus accurately fitted implant SCs.

## Materials and Methods

### *Study Population*

This study was approved by the Institutional Review Board committee of the Harvard Medical School (CHS no. M17453-101). Patients who received an implant SC at the predoctoral clinic of Harvard School of Dental Medicine between 2001 and 2006 were enrolled in this study. Standardized digital radiographs were taken at the time of crown delivery (baseline) and at follow-up visits (at least 1 year in function). Radiographs were assessed by two examiners for prosthesis marginal fit and crestal bone level changes.

According to the results, subjects were divided into two groups: crowns with marginal misfit, either with open margin (Fig 1) or overhang (test), and accurately fitted crowns (control).

Crestal bone levels were calculated by linear measurements from the implant shoulder to the first bone-to-implant contact mesially and distally using digital software (ImageJ, NIH) (Fig 2). The difference in bone levels between baseline and follow-up was calculated.

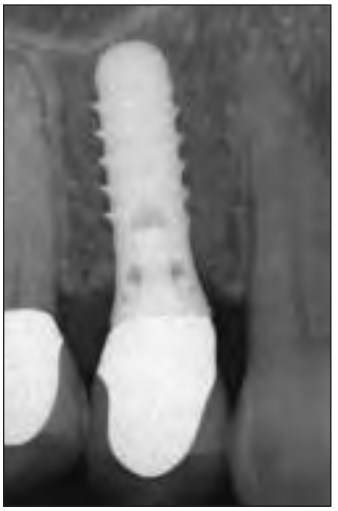

**Fig 1** Misfit: open margin.

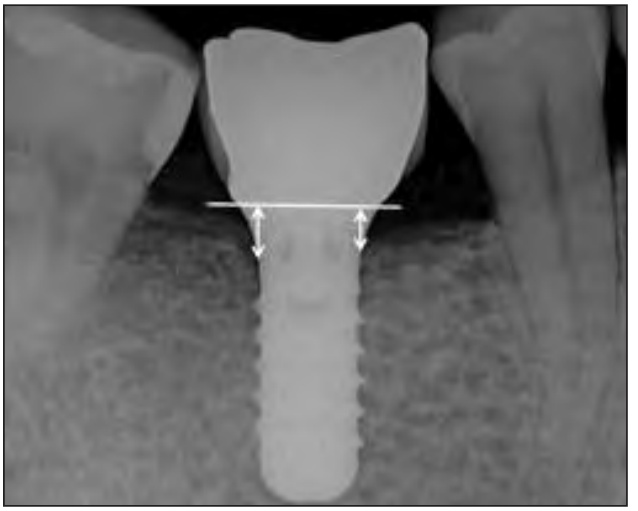

**Fig 2** Linear measurements from the implant shoulder to the first bone-to-implant contact were measured mesially and distally at baseline and the follow-up visit.

**Table 1** Patient Population and Distribution of the Crowns and Implants

| | Test group (n = 10) | Control group (n = 7) | Total (n = 17) |
|---|---|---|---|
| **Sex** | | | |
| Male | 4 | 3 | 7 |
| Female | 6 | 4 | 10 |
| **Implant type** | | | |
| Straumann | 8 | 4 | 12 |
| Replace | 1 | 2 | 3 |
| 3i | 1 | 1 | 2 |
| **Location** | | | |
| Maxilla | 1 | 2 | 3 |
| Mandible | 9 | 5 | 14 |
| **Mean age ± SD (y)** | 54.1 ± 8.7 | 55.7 ± 13.9 | 54.8 ± 10.8 |
| **Follow-up ± SD (mo)** | 33.5 ± 18.3 | 36.3 ± 13.4 | 34.7 ± 16.0 |

SD = standard deviation.

**Table 2** Comparison of Crestal Bone Levels (mm) Between Groups

| Location | Test group (n = 10) | Control group (n = 7) | *P** |
|---|---|---|---|
| **Baseline** | | | |
| Mesial | 2.36 ± 0.91 | 1.78 ± 1.09 | |
| Distal | 2.54 ± 0.77 | 1.96 ± 0.93 | |
| Mean | 2.45 ± 0.83 | 1.87 ± 0.98 | .013 |
| **Follow-up** | | | |
| Mesial | 2.58 ± 1.10 | 1.73 ± 1.07 | |
| Distal | 2.86 ± 0.81 | 2.03 ± 0.83 | |
| Mean | 2.72 ± 0.94 | 1.88 ± 0.89 | .010 |
| **Difference†** | | | |
| Mesial | −0.22 ± 0.43 | 0.04 ± 0.48 | |
| Distal | −0.32 ± 0.22 | −0.07 ± 0.29 | |
| Mean | −0.27 ± 0.28 | −0.01 ± 0.36 | .037 |

*Mann-Whitney *U* test, $P < .05$.
†A negative value indicates bone loss.

### *Statistical Analysis*

Descriptive statistics (mean values ± standard deviations) and the Mann-Whitney *U* test were used to assess crestal bone changes between groups with statistical significance set at $P < .05$.

## Results

Seventeen subjects (10 women and 7 men) with a mean age of 54.8 years (range, 40 to 83 years) were included in this retrospective analysis. Twelve tissue-level implants (Straumann), three Replace Select system implants (Nobel Biocare), and two 3i external system implants (Biomet 3i) were included for radiographic analysis. All patients were followed up from 12 to 60 months with a mean of 34.7 months (Table 1).

There was a significant difference in the bone levels at baseline between these two groups ($P = .013$). The mean bone level at baseline for the test (misfit) group was 2.45 ± 0.83 mm and for the control group was 1.87 ± 0.98 mm. At the follow-up visit, there was

a statistically significant difference between the two groups ($P$ = .010). The mean bone levels at follow-up for the test and control groups were 2.72 ± 0.94 mm and 1.88 ± 0.89 mm, respectively. When comparing the mean difference in bone level between the two groups, the mean bone loss in the test group was 0.27 ± 0.28 mm and for the control group was 0.01 ± 0.36 mm. This difference was also statistically significant ($P$ = .037) (Table 2).

## Discussion

Data are scarce on crestal bone remodeling associated with ill-fitting implant crowns. The present findings showed that marginal discrepancies have a significant effect on crestal bone remodeling.

The marginal bone loss in this study was 0.27 ± 0.28 mm for the test group and 0.01 ± 0.36 mm for the control group and may have been affected by other factors.[4] However, this represents an important parameter to take into account when delivering the definitive implant prosthesis. Since a limitation of the present study is the small sample size, further randomized controlled clinical trials are necessary to clearly corroborate the results.

Several clinical implications can be drawn from the present study. First, the results support the importance of taking a radiograph before the final cementation of an implant-supported SC so any potential overhang or open margin can be identified and corrected prior to cementation. Second, the location of the crown margin and/or abutment finishing line in relation to the peri-implant soft tissue level must be handled very carefully. Especially in the esthetic area, the abutment finishing line is commonly located subgingivally and any excess cement would be difficult to remove.[5]

## Conclusion

Under the limitations of the present study, cement-retained implant SCs with marginal misfit cause more marginal bone loss compared to accurately fitted crowns after an average of 3 years in function.

## Acknowledgments

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*Literature Abstract*

**A randomized clinical trial of biodegradable and titanium fixation systems in maxillofacial surgery**

This prospective multicenter randomized controlled trial aimed to investigate the safety and effectiveness of biodegradable screws and plates compared with traditional metallic ones. Biodegradable screws and plates have the advantage of eliminating the need for removal compared with metallic alternatives. From December 2006 to July 2009, patients who underwent mandibular and/or Le Fort I osteotomies and patients with mandibular, maxillary, or zygomatic fractures were identified. The patients were divided into two groups: a titanium control group (KLS Martin) and a biodegradable test group (Inion CPS). Bone healing 8 weeks postoperatively was the primary outcome. There was a significant difference ($P$ < .001) in the intention-to-treat (ITT) analysis of the control and test groups because, in 25 patients (21%) who were randomized to the test group, the surgeon made the decision to switch to titanium during the operation. The authors concluded that, in terms of bone healing after 8 weeks, the Inion CPS biodegradable system is inferior compared with that of the titanium system. However, it was concluded that biodegradable plates and screws could be safely used in selected cases and that the benefits of using biodegradable systems (fewer plate removal operations) should be reassessed during a follow-up of at least 5 years.

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