

Evaluation of the Effect of Horizontal Crown to Implant Diameter Relationship
on Peri-implantitis: A Retrospective Study

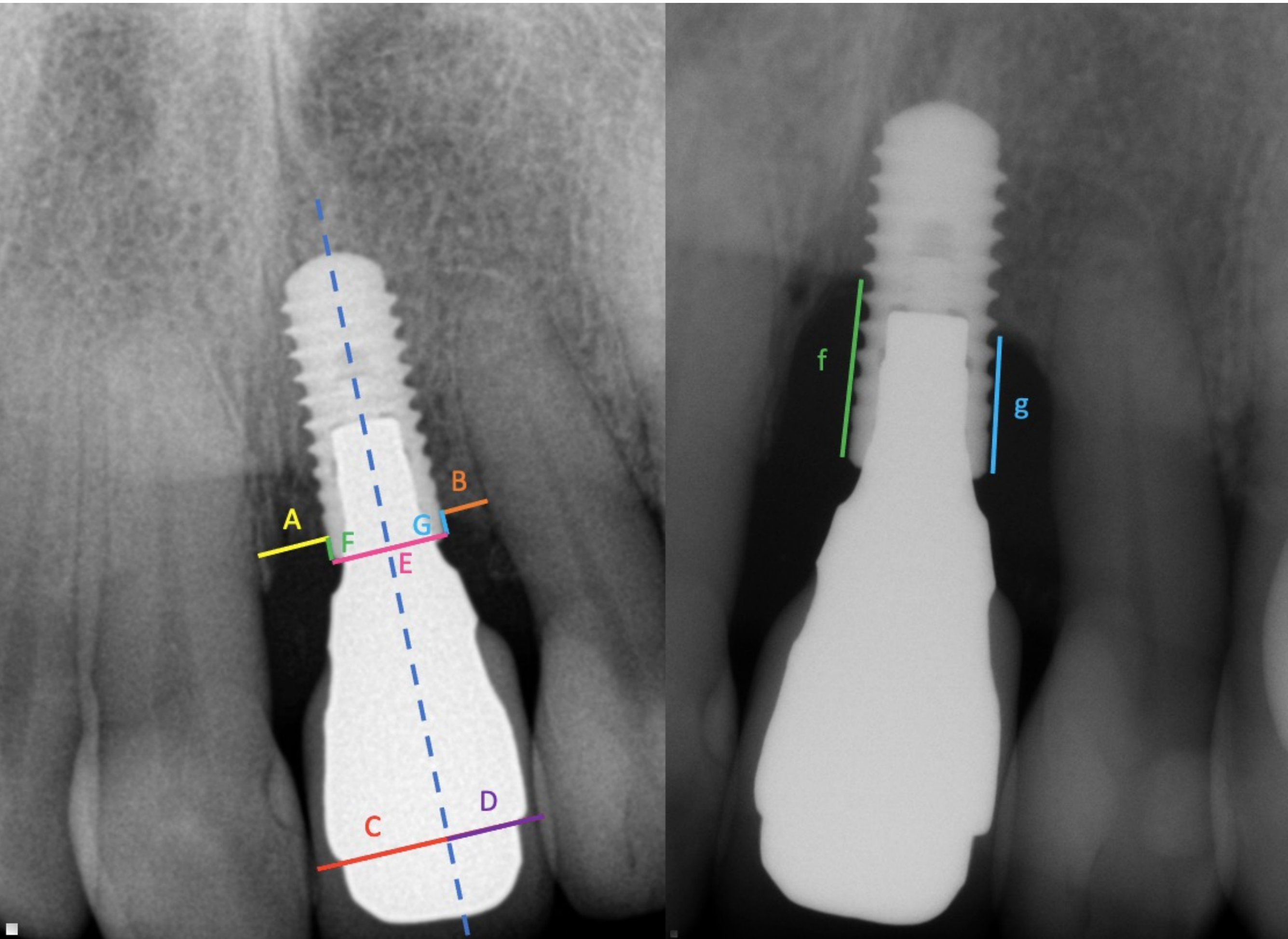
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Background

Crestal peri-implant bone loss may involve multiple factors, including inflammatory response due to biofilm and mechanical consequences related to restoration. Discrepancies between horizontal crown width and implant diameter can create large subgingival spaces which may accumulate bacteria and pose a cleansing challenge, resulting in an inflammatory lesion which can progress into peri-implantitis. Wider crowns present a greater occlusal table upon which to receive non-axial loading forces, causing more mechanical stress to peri-implant bone. The aim of this study is to evaluate the effect of horizontal crown width to implant diameter ratio on peri-implantitis which may elucidate a new perspective on peri-implantitis risk factors.

Methods

This retrospective radiographic study was approved by the Harvard Medical School IRB (IRB21- 0365). Implants restored as single crowns with adjacent natural teeth on both sides and radiographs at prosthetic loading (T1) and at least two years post-loading (T2) were included. Radiographic measurements were made for implant dimensions, crown dimensions, root proximity, and bone levels at both time points. Measurements were analyzed to evaluate whether there is an association between implant diameter, mesio-distal crown width, mesial and distal dimension of crown, and root proximity and peri-implant bone loss from T1 to T2. Statistical analysis was performed using the Pearson correlation test at $p < 0.05$ level.



Left: Baseline radiograph (T1)

Right: Follow-up radiograph (T2)

Dotted blue line: Line drawn through midline of implant parallel to the long axis of the implant.

- A) Mesial implant to root proximity
- B) Distal implant to root proximity
- C) Mesial width of crown from midline of implant
- D) Distal width of crown from midline of implant
- E) Implant diameter
- F) Initial implant platform to mesial bone level
- f) Follow-up implant platform to mesial bone level
- G) Initial implant platform to distal bone level
- g) Follow-up implant platform to distal bone level

The above measurements are utilized to perform the following calculations.

$C + D =$ Mesio-distal crown width

$C - (E/2) =$ Mesial dimension of crown

$D - (E/2) =$ Distal dimension of crown

$f - F =$ Mesial marginal bone loss

$g - G =$ Distal marginal bone loss

Results

A total of 23 implants meeting inclusion and exclusion criteria were included in this preliminary evaluation. There was no significant correlation between implant diameter ($r=0.152$, $p=0.489$), mesio-distal crown width ($r=0.240$, $p=0.271$), or crown width to implant diameter ratio ($r=0.219$, $p=0.314$) and marginal bone loss. No significant correlation was found between mesial dimension of crown ($r=0.240$, $p=0.271$) and mesial root proximity ($r=-0.030$, $p=0.893$) and mesial marginal bone loss or distal dimension of crown ($r=0.307$, $p=0.154$) and distal root proximity ($r=0.003$, $p=0.988$) and distal marginal bone loss.

Correlation with overall marginal bone loss	r	p-value
Implant length	-0.070	0.751
Implant diameter	0.152	0.489
Mesio-distal crown width	0.240	0.271
Crown width to implant diameter ratio	0.219	0.314

Correlation with mesial marginal bone loss	r	p-value
Mesial dimension of crown	0.240	0.271
Mesial root proximity	-0.030	0.893

Correlation with distal marginal bone loss	r	p-value
Distal dimension of crown	0.003	0.988
Distal root proximity	0.307	0.154

Conclusion

In this preliminary study, there was no evidence to support the hypothesis that horizontal crown to implant diameter ratio or root proximity is associated with peri-implantitis. This study is ongoing, and a larger sample size is currently being recorded and will be analyzed to elucidate potential effects of the implant and restoration relationship on peri-implantitis.

References

Schwarz F, Derks J, Monje A, Wang HL. Peri-implantitis. J Periodontol. 2018 Jun;89 Suppl 1:S267-S290.

Sanz M, Solonko M, Luengo F. Key Factors in Prevention of Peri-implant Diseases. Compend Contin Educ Dent. 2017;38(8 Suppl):6–13.

Naveau A, Shinmyouzu K, Moore C, Avivi-Arber L, Jokerst J, Koka S. Etiology and Measurement of Peri-Implant Crestal Bone Loss (CBL). J Clin Med. 2019;8(2):166.

Lang NP, Brägger U, Walther D, Beamer B, Kornman KS. Ligature-induced peri- implant infection in cynomolgus monkeys. I. Clinical and radiographic findings. Clin Oral Implants Res. 1993 Mar;4(1):2–11.

Lindhe J, Berglundh T, Ericsson I, Liljenberg B, Marinello C. Experimental breakdown of peri-implant and periodontal tissues. A study in the beagle dog. Clin Oral Implants Res. 1992 Mar;3(1):9–16.

Mombelli A, Müller N, Cionca N. The epidemiology of peri-implantitis. Clin Oral Implants Res. 2012 Oct;23 Suppl 6:67-76.

Bidez MW, Misch CE. Clinical biomechanics in implant dentistry. In: Misch CE (ed).Contemporary Implant Dentistry, ed 3. St. Louis: Mosby, 2008:543–555.

Blanes RJ, Bernard JP, Blanes ZM, Belser UC. A 10-year prospective study of ITI dental implants placed in the posterior region. II: influence of the crown-to-implant ratio and different prosthetic treatment modalities on crestal bone loss. Clin Oral Implants Res 2007;18:707-14.

Lee DW, Lee DW, Park KH, Moon IS. The effects of off-axial loading on periimplant marginal bone loss in a single implant. J Prosthet Dent. 2014 Sep;112(3):501-7.