Comparison of Implant-Supported Crown Length Measured on Digitized Casts and Intraoral Radiographs

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Correct measurement of crown length is important for calculating the crown-implant ratio. The aim of this study was to compare the length of implant-supported crowns measured on digitized casts and intraoral radiographs. Crown lengths were studied in 50 patients with 86 implant-supported crowns in the posterior region. The mean length of implant-supported crowns was 9.83 ± 1.72 mm on three-dimensional models and 10.99 ± 1.91 mm on radiographs, which is a statistically significant difference *(P* < .001). It can be concluded that a new gold standard for crown measurement should be defined. *Int J Prosthodont 2012;25:357–359.*

Telleman et al[1] performed a systematic review on the impact of implant length on survival rates and showed a trend of increased failure rate for short implants; however, in another review,[2] no such trend could be found. In conventional prosthodontics, the crown-root ratio is commonly used as a prognostic factor for survival. Blanes[3] stated in a systematic review on crown-implant ratios that different methods have been used to assess crown-implant ratios: the anatomical crown-implant ratio, calculated by dividing the length of the anatomical crown (including the transmucosal abutment) by the length of the implant, and the clinical crown-implant ratio, calculated by dividing the length of the portion of crown, abutment, and implant above the alveolar bone by the length of the implant portion within the alveolar bone. In terms of function, the clinical crown-implant ratio is said to be closer to reality.[4] It is doubtful if measuring crown length on a radiograph is useful in determining the clinical crown-implant ratio. The most coronal portion of the crown may not be the point of the crown that is in function. However, it is possible to define the actual occlusal contact point with the antagonistic tooth using three-dimensional (3D) models. Therefore, the aim of this study was to compare the length of implant-supported crowns measured on digitized casts and intraoral radiographs.

Materials and Methods

Fifty patients with one or more implant-supported crowns in the posterior region of the maxilla or mandible were included in this study. All implants (Biomet 3i) were 8.5 mm in length.

Dental casts with implant analog(s) and of antagonist arches were scanned using a 3D scanner (3Shape D640, 3Shape A/S). The actual occlusal contact point of the implant-supported crown and antagonist tooth was recorded clinically. Using a software program (DentalDesigner, 3Shape A/S), a two-point measurement was carried out to determine the shortest distance from the neck of the implant analog to the occlusal contact position on the antagonist model (Fig 1).

Intraoral radiographs were taken using a standardized paralleling technique with an individualized film holder. After calibration, the radiographs were analyzed using computer software to perform linear measurements on the digital radiographs (Fig 2).

Paired *t* tests were used to compare crown length (significance level: .05). Furthermore, the agreement between crown lengths measured with both methods was explored by means of a Bland and Altman plot.[5]

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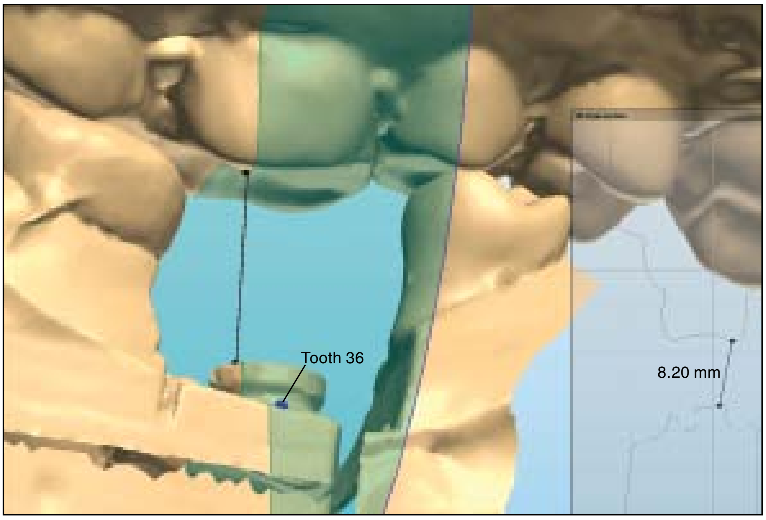

Fig 1 Digitized dental casts aligned in proper occlusion. A two-point measurement from the neck of the implant analog to the contact position on the antagonist model was taken to define the length of the implant-supported crown.

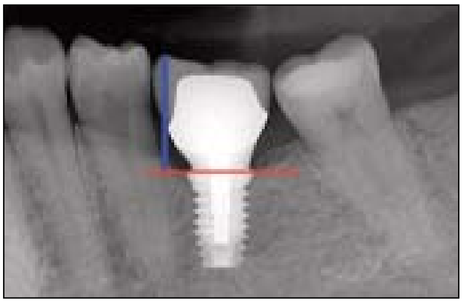

Fig 2 Calibration and two-point measurement obtained on an intraoral radiograph to define the length of the implant-supported crown.

Table 1 Mean Length (Standard Deviation) of Implant-Supported Crowns Measured on Digital Models and Intraoral Radiographs

No. of implant-supported crowns	Model (mm)	Radiograph (mm)	Significance
Total (n = 86)	9.83 (1.72)	10.99 (1.91)	3D < radiograph (*P* < .001)
Premolars (n = 37)	9.81 (1.72)	10.86 (1.78)	3D < radiograph (*P* < .001)
Molars (n = 49)	9.85 (1.73)	11.09 (2.01)	3D < radiograph (*P* < .001)
Maxilla (n = 49)	10.21 (1.84)	11.63 (1.94)	3D < radiograph (*P* < .001)
Mandible (n = 37)	9.34 (1.41)	10.16 (1.51)	3D < radiograph (*P* < .001)

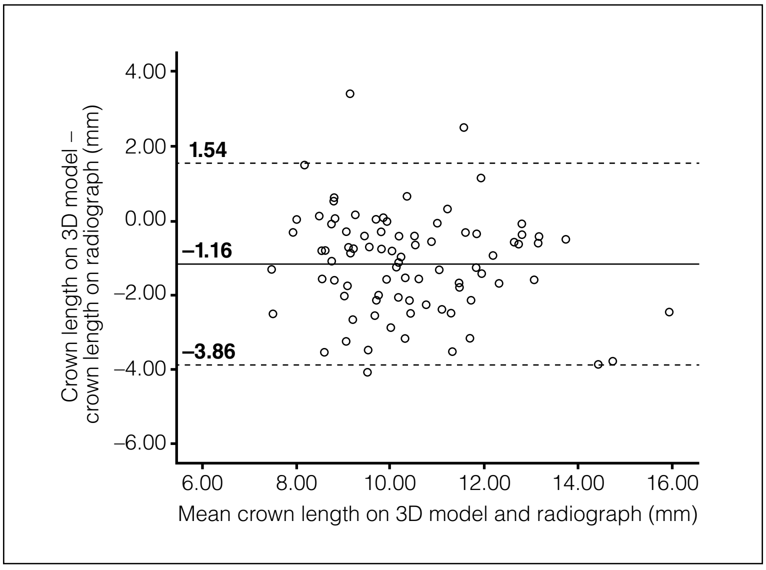

Fig 3 Bland and Altman plot of difference between lengths of implant-supported crowns on 3D models and radiographs.

Results

The total number of implant-supported crowns analyzed was 86. The mean lengths of the implant-supported crowns with both methods are listed in Table 1. The Bland and Altman plot (Fig 3) showed that there was an absolute systematic error between both methods. Separate calculations of mean lengths of implant-supported crowns in the premolar region, molar region, maxilla, and mandible showed significant differences between the two measuring methods (Table 1). The mean anatomical crown-implant ratio (with known implant length of 8.5 mm) measured on 3D models (1.16 ± 0.20) was significantly lower than that measured on radiographs (1.29 ± 0.22, *P* < .001).

Discussion

With 3D models, crown length can be measured in the most clinically relevant manner. However, it is not possible to define the actual marginal bone level around the neck of the implant on 3D models, which is needed for calculating the clinical crown-implant ratio. Aiming at the most realistic clinical scenario for scientific research, both radiographs and 3D models are necessary, and outcomes must be combined. Calculations have shown that using the incorrect crown length will result in a statistically different crown-implant ratio.

The Bland and Altman plot showed strong agreement in the difference per patient between determinations of crown length with both methods. The difference of approximately 1 mm is rather consistent throughout the study group (Fig 3). Therefore, a correction factor of diminishing the crown length measured on the radiograph by 1 mm could be used. Although it is not the actual 3D measured value of the crown length, it is more realistic than taking the value of radiographs without a correction factor.

Conclusions

The statistically different outcomes of the two methods have limited clinical relevance but may have important implications in research. A new gold standard for crown measurement should be defined.

Acknowledgments

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Literature Abstract

Tongue piercing: The effect of material on microbiological findings

Biofilms can form on oral piercings, and they may serve as a reservoir for bacteria. The anaerobic conditions in the piercing channel may further encourage growth of the bacteria associated with periodontitis. Oral piercings can be composed of various materials, and this study investigated whether there are differences in the bacteria collected from tongue piercings made of different materials. Eighty-five subjects with tongue piercings participated in the study. After a baseline dental examination, sterile piercings of four different materials (stainless steel, titanium, polytetrafluoroethylene, and polypropylene) were assigned randomly to the subjects. After 2 weeks in situ, the piercings were removed, and the microbiologic samples collected were processed by the checkerboard DNA-DNA hybridization method. The clinical data collected revealed that no subjects were affected by localized periodontitis. However, 28.8% of patients had lingual recession, with approximately half of these occurring on the mandibular incisors. Five percent of subjects reported chipping on one tooth. There was a statistically significant difference in relative microbial counts between the tongue, piercing channel, and piercing stud. The tongue had higher proportions of bacterial species compared to the piercing channel and the stud. Higher proportions of bacteria were also found on the studs made of stainless steel compared to polytetrafluoroethylene or polypropylene piercings. The low bacterial counts found in the piercing channel and stud imply that a tongue piercing may not contribute to increased risk of bacterial infection or gingival problems. However, the stud material may have an effect on the prevalence of bacteria, with stainless steel being the least favorable.

Kapferer I, Beier US, Persson RG. *J Adolesc Health* 2011;49:76–83. **References:** 35. **Reprints:** Ines Kapferer, MD, Department of Restorative and Operative Dentistry, Dental School, Innsbruck Medical University, Anichstrasse 35, 6020, Innsbruck, Austria. Email: ines.kapferer@gmx.net—*Clarisse Ng, Singapore*