

Stability of vertical height measurements on digital panoramic radiographs using posterior mandibular implants as reference.

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INTRODUCTION

Panoramic radiographs are used as standard examination tools for implant treatment planning; they give the best radiographic survey, impart a low radiation dose, and appear sufficient to evaluate available bone height before inserting posterior mandibular implants. Image distortion in rotational panoramic radiography has been well described. This study aims to control the stability of vertical height measurement on digital panoramic radiographs using implants in the posterior segment of the mandible as radiopaque reference objects.

MATERIAL AND METHODS

This study included 11 implants inserted in the premolar region and 15 implants in the molar region of 18 partially edentulous patients (mean age 66.65 years). Panoramic radiographs were taken with a digital panoramic unit. The proprietary measurement software (Kodak 8000C, Eastman Kodak Company, Rochester, NY, USA), calibrated with a 5 mm-diameter metal ball, and a mouse-driven calliper were used for vertical linear measurements. Twenty-six 10 mm-long standard Straumann® implants (Straumann AG, Basel, Switzerland) were measured from the implant's apex to the top of the small healing cap giving a total length of 14.3 mm. Measurements were taken twice (1-2) with an interval of one week by two independent observers (A-B). The stability of the measures was analyzed and the distortion ratio (DR= radiological implant length/real implant length) was calculated.

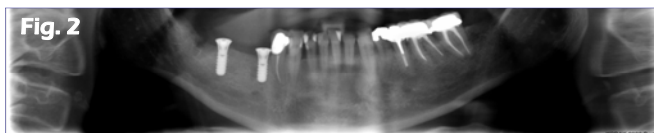
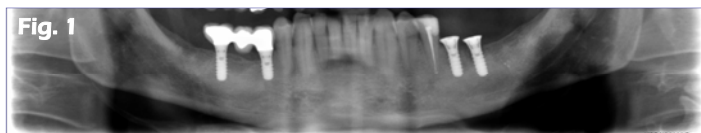


Fig. 1 and 2. Immediate postoperative panoramic radiographs taken with a digital panoramic unit (Kodak 8000C, Eastman Kodak Company, Rochester, NY, USA), showing 10 mm-long implants inserted in the posterior segments of the mandible.

RESULTS

The radiological implant length with the corresponding calculated distortion ratio for each series of measurements are shown in the Table.

DR = radiological implant length/real implant length)

	Global implant length	Premolar implant length	Molar implant length	Global DR	Premolar DR	Molar DR
A1	13.6-14.5 mm (mean: 14.08 mm)	13.8-14.5 mm (mean: 14.03 mm)	13.6-14.4 mm (mean: 14.11 mm)	0.95-1.01 (mean: 0.98)	0.96-1.01 (mean: 0.98)	0.95-1.00 (mean: 0.98)
A2	13.4-14.5 mm (mean: 14.01 mm)	13.5-14.3 mm (mean: 13.92 mm)	13.4-14.5 mm (mean: 14.08 mm)	0.93-1.01 (mean: 0.97)	0.94-1.00 (mean: 0.98)	0.93-1.01 (mean: 0.98)
B1	13.5-14.3 mm (mean: 14.01 mm)	13.8-14.2 mm (mean: 14.02 mm)	13.5-14.3 mm (mean: 14.01 mm)	0.94-1.00 (mean: 0.97)	0.95-0.99 (mean: 0.99)	0.94-1.00 (mean: 0.97)
B2	13.5-14.3 mm (mean: 14.01 mm)	13.5-14.3 mm (mean: 13.99 mm)	13.8-14.1 mm (mean: 14.01 mm)	0.94-1.00 (mean: 0.97)	0.94-1.00 (mean: 0.97)	0.94-1.00 (mean: 0.97)
	Global mean: 14.27 mm			Global mean: 0.97		

CONCLUSIONS

A good stability in vertical measurements was noted in the 2 implant groups. The mean measured total length was 14.27 mm (maximum variability: 1.1 mm) with an identical variability for molar and premolar segments. The mean vertical DR was 0.97, unrelated to the localization. The vertical measurement stability using a software-based calibrated measurement tool confirms the safe utilization of digital panoramic radiography for preoperative implant length evaluation, including in premolar and molar mandibular segments.