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Original Study

An Intraoral Grid for Accurate Radiographic Measurements

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Abstract

Introduction: Intraoral grid is a simple way of assessing linear measurements without any magnification errors. It aids like a scale for analyzing images.

Aim: To evaluate the accuracy of the intraoral grid in assessing linear measurements.

Objective: To estimate the diagnostic accuracy of the intraoral grid with digital radiovisiography (RVG) and to measure the linear measurements on RVG with intraoral grid and to compare the linear measurements on digital RVG with grid and with the gold standard measurement.

Materials & Methods: The study sample comprised of 60subjects.Each patient was subjected to two radiographs, one radiograph with a grid and the other radiograph without a grid. Tooth length, interdental bone loss, and size of the implant were measured and the values were compared.

Results: Significant correlation was observed in the radiographs taken with and without a grid with a p-value <0.05.

Conclusion: To minimize any magnification errors, RVG with a grid can be used which aids as a scale for image analysis. It is a simple yet effective tool for obtaining accurate measurements.

Key words: *Radiovisiography, Intra oral grid, Linear Measurement*

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Introduction:

Radiovisiography is widely used in dental clinics due to its feasibility, lower cost, easy availability, and less radiation exposure. RVG is used to assess various parameters that are necessary for treatment planning such as working length determination, implant site evaluation, amount of interdental bone loss, and size of periapical lesion[1].

Though RVG software provides a horizontal and vertical grid, it does not take into account the magnification due to variations in projection geometry. So, RVG may yield differences in measurements because of magnification errors. When the grid is placed over the sensor, it will be subjected to the same magnification as the area it overlies[2].

To overcome the problems of image distortions like elongations and foreshortenings, RVG with a grid can be used which aids as a scale for image analysis[3]. It is a simple way of assessing linear measurements without any magnification errors. The intraoral grid has gridlines made up of copper, which are placed 1mm apart and show a thick line at every fifth millimeter [4].

Materials and Methods:

This study includes 60 patients and is divided into three groups; each group consists of 20 patients. In Group1: Tooth length was determined, Group 2: The length of the implant was assessed, Group 3: interdental bone loss was measured. Each patient was subjected to two radiographs. One radiograph was taken without a grid and the other radiograph with a grid.

Images were taken using a Vatech dental X-ray unit operated at 70Kvp, 8mA, and an EZ dent sensor measuring of size (39.5mmx29.2mm), images were viewed with Ez dent I viewer software. The intraoral grid which is similar to the size of the sensor is placed over the sensor using transparent adhesive tape to prevent it from sliding over the sensor. so that the chances of distortion can be minimized. The resultant image shows gridlines and measurements were taken by counting the number of gridlines in the radiograph between two specific points taken with a grid and in the radiograph taken without a grid, using RVG software straight line is drawn between the two specific points.

Radiographs were taken for all four groups; In the first group: tooth length was determined by measuring from cusp tip to radiographic root apex on radiographs with and without grid and compared with standard measurement which was recorded after extraction of the tooth using vernier calipers (Figure 1), second group: Length of the implant was assessed on radiographs taken with and without grid and compared with the standard measurement size of the implant (Figure 2). Third group: Interdental bone loss was assessed from the cementoenamel junction to the crest of the alveolar bone and compared with the values taken after the elevation of the flap using a periodontal probe (Figure 3).

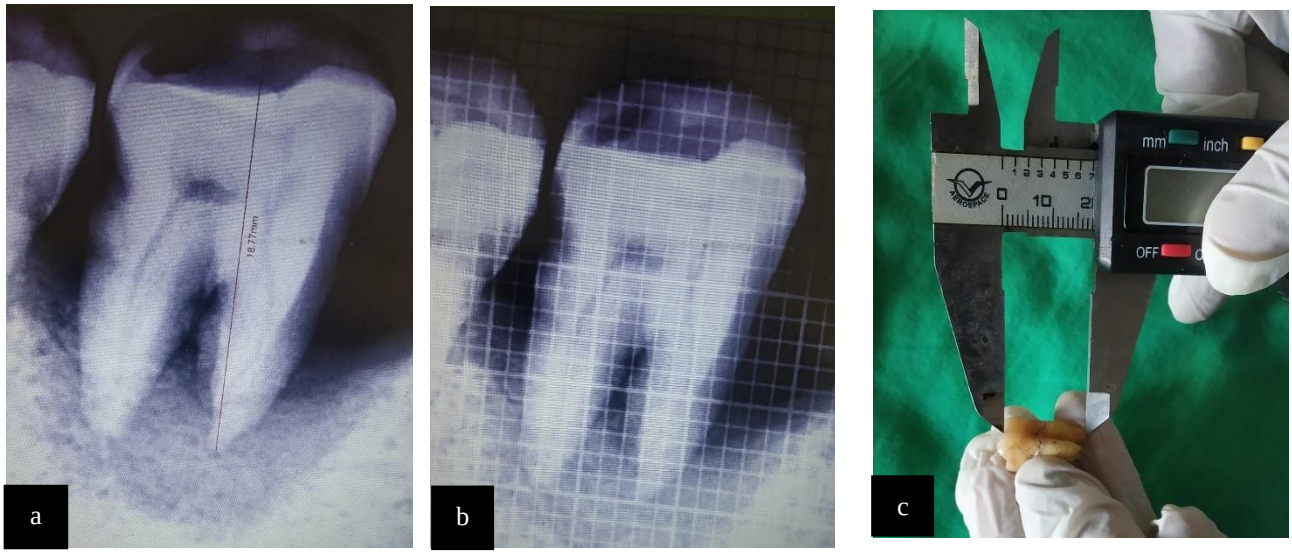

Figure 1: (a) Radiograph without grid (b) with grid (c) Measuring tooth length with Vernier calipers

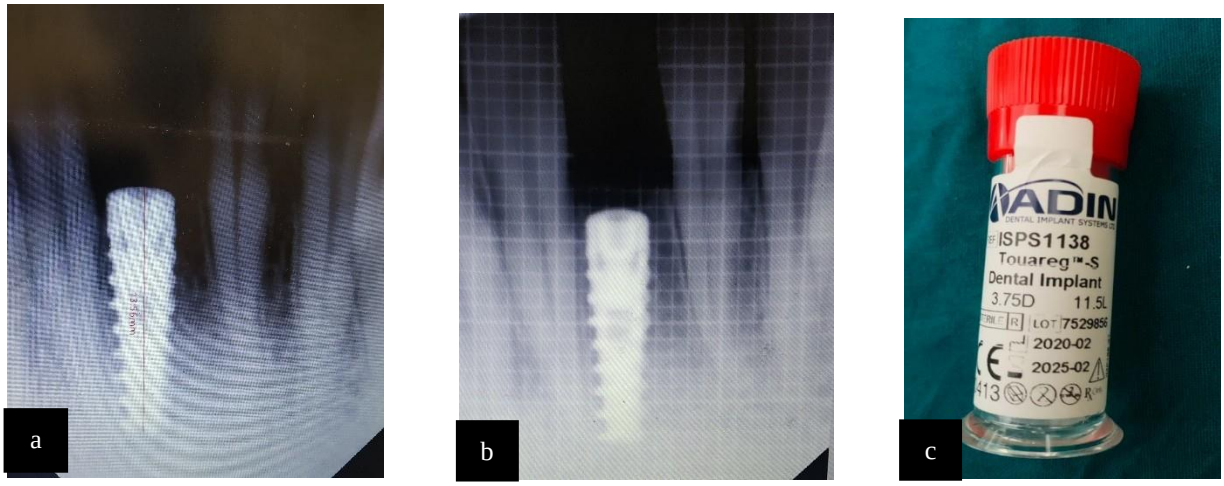

Figure 2: (a) Radiograph without grid (b) with grid (c) Standard size of the implant.

Measurements were taken by counting the number of gridlines between two specific points in the radiograph taken with a grid and the other radiograph that is taken without a grid, measurements were taken by drawing a straight line between two specific points by using RVG software.

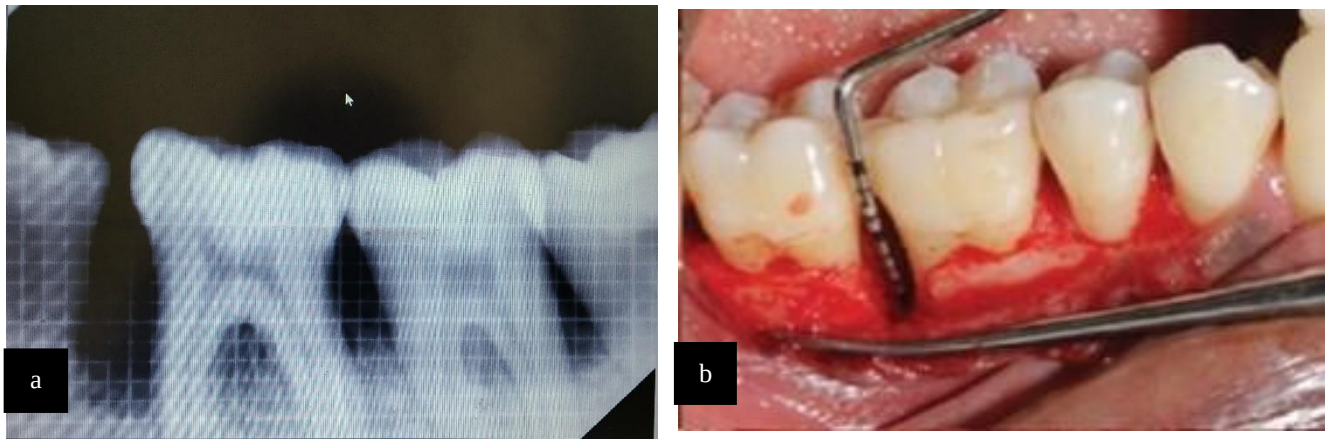

Figure 3: (a) Radiograph with grid (b) Measuring bone loss with a periodontal probe.

Results

Values were recorded on the radiographs taken with and without a grid and compared with the standard measurements. Table 1 shows mean differences of 1.55mm, 0.7mm, and 0.68mm between radiographs taken without grid and standard measurement. Table 2 shows mean differences of 0.29mm, 0.03mm, and 0.19mm between radiographs taken with grid and standard measurement. Table-3 shows pearson correlation test 'r' value of 0.940, 0.990 and 0.993 for Group 1, Group 2, Group 3 respectively with p value < 0.05 which is significant A significant correlation was observed in radiographs with and without a grid.

Groups	Without grid	Standard measurement	Mean difference
Group 1	21.83mm	20.28mm	1.55mm
Group 2	10.45mm	11.15mm	0.7mm
Group 3	4.22mm	4.9mm	0.68mm

Table 1 Measurements taken without grid and standard measurements

Groups	With grid	Standard measurement	Mean difference
Group 1	20.57mm	20.28mm	0.29mm
Group 2	11.12mm	11.15mm	0.03mm
Group 3	4.71mm	4.9mm	0.19mm

Table 2 Measurements taken with grid and standard measurements

Groups	Without grid	With grid	Pearson 'r' correlation	P value
Group 1	21.83mm	20.57mm	r =0.940	P = 0.000052
Group 2	10.45mm	11.12mm	r =0.990	P = 0.00001
Group 3	4.22mm	4.71mm	r =0.993	P = 0.00001

Table 3 Correlation of measurements taken with and without grid

Discussion

Radiograph serves as a source of investigation during various treatment procedures, diagnosis, and evaluation of prognosis. RVG allows enhancement of image contrast, density, rapid acquisition of images, storage, and retrieval of these images[6]. Due to its less cost, ease of availability and less radiation exposure, makes it a better option to use in daily clinical practice[7].

The intraoral grid is similar to the size of the sensor with grid lines made up of copper aids as a guiding tool in measuring linear dimensions[2]. To overcome the problems of image distortions, RVG with a grid can be used[8]. If the resultant image elongates, the distance between gridlines increases, but it is counted as 1mm which remains constant[6].

The present study was conducted to evaluate the accuracy of the grid in measuring linear dimensions. Comparing the values in the present study in assessing the tooth length, with and without a grid is in accordance with the study carried out by *Aayushi Kv et al*.[2] The results of the present study in assessing bone loss are in agreement with the study conducted by *Reddy KR et al*.[1] The results of the present study in assessing the length of the implant with and without a grid are similar to the study conducted by *Deshpande A et al*.[4]Results obtained in the present study showed accurate measurements in radiographs with a grid compared to the radiographs taken without a grid. Thus, the intraoral grid can serve as a simple, effective, precise armamentarium in assessing linear measurements.

Conclusion

The role of radiographs in dentistry has proven to be very vital. The usage of RVG has made the usage of this imaging tool very easier. In the future, we can suggest the incorporation of the grid on the RVG sensor. So, that diagnostic radiographs can itself be taken with a grid thus saving the patients time and inconvenience due to repeated exposures.

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Conflicts of interest - There are no conflicts of interest.

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