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A comparative assessment of alveolar bone loss using bitewing, periapical, and panoramic radiography

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ABSTRACT

Background: Radiology in dentistry has a pivotal role in obtaining information for diagnostic. There is some radiographic examination often used to measure alveolar bone loss such as bitewing, periapical and panoramic. This study aims to determine the accuracy of bitewing, periapical, and panoramic radiography on the assessment of alveolar bone loss.

Method: A cross-sectional analytic method was carried out to 11 samples using bitewing, periapical, and panoramic radiography respectively. Data were analyzed by T-independent sample test.

Results: The average mean value of alveolar bone loss measurement clinically in the skull was 2 mm, but 2.2 ± 0,36 mm, 2.3 ± 0.41 mm, and 2.6 ± 0.66 mm in the bitewing, periapical, and panoramic radiography respectively. The accuracy of bitewing radiographs had the highest percentage comparing with periapical and panoramic radiography (90%: 85%: 70% respectively). In addition, the study found there was no statistically different in among groups ($P > 0.05$).

Conclusion: Bitewing, periapical, and panoramic radiographic as a comparative assessment found no statistically different in the measurement of Alveolar Bone Loss.

Keywords: Alveolar Bone Loss, Bitewing, Periapical, Panoramic.

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INTRODUCTION

Radiography has an important role in dentistry as additional information for diagnosis, case management, from diagnosis, treatment planning, and prognosis. In the abnormalities or changes of the jaw as manifestations of systemic disease, the expansion of the tumor, or a through periodontal disease, extraoral radiographic techniques such as panoramic radiography is the most technique selected. As for dental examination, the abnormalities in periodontal tissues often used intraoral periapical or bitewing radiography assessment.[1]

Each of these radiographic technique has advantages and disadvantages in the interpretation of the results. When considering the radiation dose received by the individual, the individual comfort and costs, the panoramic radiography technique is the broadest technique chosen for alveolar bone loss due to the periodontal disease. The problems efficiency of bitewing radiographs compared with periapical radiographs still unsolved in giving a picture in periodontal disease or at the height of the alveolar bone. Several recent studies indicate different levels of accuracy in periodontal assessment using extraoral radiography compared with radiography intraoral.[2]

A study conducted by Moradi J et al. which measures the alveolar bone crest to the cementoenamel junction using periapical radiographs obtains less than 10% of the actual measurements while using bitewing radiographs obtain 6% smaller than the real assessment.[3] Wilton et al. assessed 70 mandibular molars found the accuracy of periapical radiographs using Rinn XCP film holder was higher than panoramic radiographs. Besides, the accuracy of periapical radiographs using film holder han shin was smaller when compared to radiographic panoramic.[4]

In addition, a study conducted by Geidek et al. using bitewing, periapical, and panoramic radiographs had the highest level of accuracy.[5] While the periapical radiographs had the lowest accuracy rate when compared with clinical examination.[5] This study aims to determine the accuracy of bitewing radiographs, periapical and panoramic on the assessment of alveolar bone loss.

MATERIAL AND METHODS

A cross-sectional analytic study was conducted at Dental Radiology Department, Dental and Oral Hospital, University of North Sumatera and Pramita Clinic Laboratory. There were 11 pieces of

Table 1 The measurement result of the alveolar bone loss

Radiography	n	Total (mm)	Mean ± SD (mm)	Accuracy (%)	P-value
Skull	5	10	2	-	-
Bitewing	11	24	2.2 ± 0,36	90	0.76
Periapical	11	25	2.3 ± 0,41	85	0.57
Panoramic	11	29	2.6 ± 0,66	70	0.36

skull radiographs using bitewing, periapical, and panoramic radiography collected

The study protocol included: 1) Alveolar bone loss measurement was carried out to the two right mandibular molars in the skull by using a second term with a sharp tip. Place one end of the compass at the cementoenamel junction and another one in the alveolar bone crest. Press either end of the compass in the paper, and then measure the two points on the paper using a ruler. Repeat it five times, recording and calculating the average value; 2) Take bitewing, periapical and panoramic radiographs as much as 11 times respectively. Do processing and periapical bitewing films conventionally, while results from panoramic radiographs printed. Bitewing radiographs, periapical and panoramic was viewed using a viewer box; and 3) Take the alveolar bone loss measurement on each radiograph using the second compass with a sharp tip. Place one end of the compass at the cementoenamel junction and another end in the alveolar bone crest. Then press the end of the compass on the paper and measuring the two points. Records the results and calculate the average value. The accuracy formula used in this study was: (mean-2) / 2 × 100%.

Data analysis were performed by T-Independent test to get the value of the accuracy of each radiographic technique using SPSS 18.

RESULTS

The results of measurements of alveolar bone loss on the skull, bitewing radiographs, periapical and panoramic can be seen in Table 1. The mean values among radiography measurement were 2,2 ± 0,36 mm in the bitewing, 2,3 ± 0,41 mm in the periapical, and 2,6 ± 0,66 mm in the panoramic radiograph.

According to the T-independent sample test, the findings suggest no statistically significant differences among radiographs measurements ($P > 0.05$) such as 0.76, 0.57, and 0.36 in bitewing, periapical, and panoramic radiography respectively (Table 1).

Based on the formula for the accuracy measurement, the results found that the highest accuracy was bitewing radiographs (90%), followed by periapical radiographs (85%), and panoramic radiographs (70%) (Table 1).

DISCUSSION

In this study, the alveolar bone loss distoproximal of the second molar in the right lower jaw was 2 mm according to skull radiographs. The average values of bitewing radiographs were 2.2 ± 0,36 mm while using periapical radiographs obtained an average value of 2.3 ± 0,41 mm. Based on these results, measurements using bitewing radiographs get a better value closer to the actual size of the skull. This result is consistent with a study conducted by Hachem et al. which assess the alveolar bone loss where the bitewing radiographs have accuracy values closer to actual measurements rather than using periapical radiographs with a yield of 0.3 mm smaller than using radiography periapical.[6]

The results of bitewing radiographs are more accurate to assess the alveolar bone loss due to the projection angle straight through the interproximal area. This assessment is also effective for detecting the presence of calculus in the interproximal area. The long axis of the receptor bitewing usually placed horizontally, but can also be placed vertical.[7]

The similar findings conducted by Corbet et al. where the vertical bitewing radiography techniques are placed 900 perpendiculars to the tooth long axis angle could be beneficial to see how the state of alveolar bone and alveolar bone loss. As for the technique of periapical radiographs should use a full mouth survey with long cone projection techniques paralleling to become a significant standard in determining the diagnosis of periodontal disease and treatment plan.[8]

This study using panoramic radiographs obtained an average value of 2.6 ± 0,66 mm which indicates that the panoramic radiography has a value less than bitewing radiographs. The result is consistent with a previous study conducted by Semenoff that found significant differences in the measurement values between panoramic and bitewing radiographs.[7] In the category of 0-2 mm (absence of bone loss) for the measurement values obtained bitewing radiographs have an average value of 1.90 mm, while the panoramic radiography has an average value of 2.50 mm.[7]

The average value of periapical radiographs is 2.3 mm; this result indicates that the periapical radiographs have accuracy values better than

panoramic radiography. A study conducted by Rand et al. showed similar results which measure the marginal bone level by using the technique of periapical and panoramic radiographs, the five-time measurements showed that the measurement periapical have a more stable measurement value compared with measurements panoramic.[9] According to a study conducted by Semenoff et al. that categorize measurements by degree of severity, the result of periapical radiography technique was more accurate than the panoramic radiographic method.[10]

The results of panoramic radiographs are less reliable for measuring alveolar bone loss compared with intraoral radiographic technique such as bitewing and periapical due to the distance from object to the film greater than periapical radiographs. In addition, X-ray beam on panoramic radiographs is directed obliquely through films so that the image generated is not detailed.[11] Although the panoramic radiographs were unable to determine the accuracy of alveolar bone loss, Pepelassi et al. stated that panoramic radiographs could see the alveolar bone loss greater than the intra-oral radiographs only partially region. So that, the panoramic radiographs can be used to see the amount of damage that occurs on the alveolar bone in the oral cavity.[12]

CONCLUSION

There is no statistically significant difference in the measurement of alveolar bone loss among bitewing, periapical, and panoramic radiography. The accuracy of bitewing radiographs had the highest scores, followed by periapical and panoramic radiography.

SUGGESTION

Further study in the future should be carried out by using three-dimensional digital radiography to get more accurate results.

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