

A Comparison of two radiographic techniques to determine the distance between alveolar bone crest and cemento-enamel junction in patients with chronic periodontitis

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ABSTRACT

Statement of the problem: Diagnosis of periodontal diseases without any accurate radiograph is inadequate. Bitewing (BW) and periapical (PA) radiographic techniques are commonly used to assess alveolar bone crest (ABC) level which is crucial in the evaluation of periodontal disease.

Purpose: The purpose of this study was to compare the precision of BW and PA radiographs in determining the distance between the alveolar bone crest (ABC) and cemento-enamel junction (CEJ).

Materials and Methods: This study evaluated 80 interproximal surfaces in patients suffering from chronic periodontitis. BW and PA radiographs were taken from posterior teeth of each patient and the distance between CEJ to ABC was measured on them. The real distance was determined during surgery by means of a periodontal probe. Statistical analysis was done by paired t-test.

Results: According to this study the mean real distance between CEJ and ABC was found to be 4.266 ± 1.467 mm, and the mean distances on BW and PA radiographs were 4.014 ± 1.488 and 3.826 ± 1.483 mm respectively. These results showed that on average the distance measured on BW radiograph appeared to be 0.252 mm (6%) lower than the real distance ($p=0.000$) and 0.44mm (10%) less in the PA technique ($p=0.002$).

Conclusion: The bitewing technique is more accurate in the assessment of the alveolar bone crest level compared with the PA technique.

Key words: Bitewing Radiography, Periapical Radiography, Chronic Periodontitis

INTRODUCTION

Periodontitis is of great concern among oral disease due to its high prevalence and complications such as tooth mobility and tooth loss. Diagnosis of periodontitis is based on measuring either the loss of connective tissue attachment to the root surface or loss of alveolar bone crest.

The radiograph can be a valuable aid in diagnosis of Periodontitis and determining its prognosis and evaluation of its treatment outcome⁽¹⁾. Radiographies usually serve in clinical and epidemiological studies to evaluate the amount of alveolar crest bone loss⁽²⁾. They provide valuable information about the height of the alveolar bone and the outline of the bony crest⁽³⁾. To determine the height of the alveolar bone crest, the distance between a reference point like the cemento-enamel junction (CEJ) to alveolar bone crest (ABC) should be measured⁽⁴⁾. None of the radiographic techniques used nowadays have all the benefits of an ideal radiography. In the radiographic evaluation

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of the alveolar bone height, some differences in measurements can be seen. These differences vary based on the severity of the disease, the involved site (upper or lower jaw; anterior or posterior region), anatomical limitations and patient cooperation. Bitewing (BW), periapical (PA) and panoramic are three radiographic techniques used for the evaluation of the periodontium⁽³⁾. Different opinions exist about the best radiographic technique for diagnosis and evaluation of periodontal bone loss.

Palson & Reed found that results from BW and PA techniques were different in evaluating the alveolar bone crest level and comparisons showed that correlation of the two BW and PA techniques were less than 70% in 86% of the cases⁽⁵⁾. Mehdizadeh in a study showed that the amount of bone loss on PA radiographs was 0.41mm or 9.4% less than the real amount and this difference was statistically significant. In BW radiographs the amount of bone loss was 0.37mm or 8.5% less than the real amount. This was also statistically significant. They concluded that the BW technique had higher accuracy than PA technique in evaluating the amount of alveolar bone loss and its findings were closer to real amounts⁽⁶⁾. Chitsozi et al. compared the CEJ-ABC distance in PA, BW and panoramic techniques with their real amounts. According to their findings BW had a higher correlation with real amounts ($r=0.98$, $P=0.000$) than the PA radiography ($r=0.94$, $P=0.00$) and panoramic radiographs had the lowest ($r=0.72$, $P=0.000$)⁽⁷⁾.

Radiographic mistakes in the diagnosis of the height of alveolar bone loss can lead to change of treatment plan or delays in treatment. Therefore, it is necessary to determine the alveolar bone status with the most accurate techniques.

The aim of this study was to compare the accuracy of the two BW and PA techniques in evaluating the distance between CEJ-ABC by comparing these measurements on radiographies with the real amounts.

Material and methods

In this study subjects were 10 patients with chronic periodontitis referred to the Periodontology Department of Hamadan Dental Faculty during 2005 -2006. Criteria

for choosing patients were as follows: chronic periodontitis, candidate for periodontal surgery without any contraindications for radiography. The subjects were informed about the study and then they signed a consent form for the study.

After clinical examination, PA and BW radiographs were taken from each site of every subject. In total, 80 interproximal surfaces of posterior teeth were included in the study.

All the radiographs were taken with a parallel technique using Kodak Ekta speed plus, No.2 films, by an Elitys Trophy radiographic machine set at 70 Kvp and 8 mA and exposure times of 0.6s for molars and 0.5s for premolars. All the radiographs were processed in the same manner. After determining the CEJ and ABC on the radiographs the distance between them was measured using a digital caliper (sensitivity 0.01 mm). The subjects underwent periodontal surgery using a technique that provided good view and access to the alveolar crest.

The distance between the CEJ and ABC in the distal and mesial aspects of the roots was measured by means of a William's probe after flap retraction, scaling and root planning and before shaping and contouring the bone. The measured distance on the probe was then subjected to another measurement using the same digital caliper. All measurements and procedures were performed by the same clinician.

Results

The results indicated that the mean real distance between CEJ- ABC was 4.266 ± 1.467 mm; this distance was 4.014 ± 1.488 on BW radiographs and 3.826 ± 1.483 on PA radiographs.

The comparisons of mean differences of measurements between the groups of different radiographic techniques were done using paired t-test. (Table 1)

The findings showed that the distance between ABC to CEJ (the reference point) was 0.252mm (6%) less than real amounts in the BW technique and 0.44mm (%10) less in the PA technique.

Table1: Comparison of mean distances measured in each technique with real distances

Groups	No.	Mean Difference	Mean difference with 99% confidence interval	p. value*
PA radiograph-real amounts	80	0.44± 0.835	0.194 0.687	0.000
BW radiograph-real amounts	80	0.252 ± 0.715	0.041 0.463	0.002

Paired t-test*DISCUSSION**

The results showed that the distance between CEJ and ABC on BW radiographs were closer to the real amounts compared with PA radiographs, therefore, BW technique was more accurate in determining this distance. The measurements on both radiographic techniques were less than the real amounts that indicates an underestimation in the diagnosis of bone loss when using these radiographic techniques.

The amount of bone loss on PA radiography was less than the amount seen on BW radiographs. This finding is in agreement with findings of Reed and Polson's study which found that PA radiographs usually underestimate the amount of bone loss compared with BW⁽⁵⁾.

In our study, on PA radiographs the average distance between ABC to CEJ was 10% (0.44mm) less than the real amount of bone loss and on BW radiographs it was 6% (0.252mm) less than the real amount of bone loss. This is in consistence with the results of a similar study done by Medizadeh and Tavakoli in Shahid Beheshti Dental School in which the average bone loss on PA and BW radiographs was 0.41 (9.4%) and 0.37 (8.5%) less than real bone loss respectively. These results together with the results of Gedike *et al.* study support the idea that BW is more accurate in determining the alveolar bone loss compared to PA technique and the measurements are closer to the real status. Akesson *et al.*, however, found that PA radiography had a higher accuracy as well as

greater precision compared with panoramic and bitewing radiographs.^(8,9)

In the study of Chitsazi *et al.* or both BW and PA radiographs the distances of CEJ to alveolar crest were very close to real amounts (in the maxilla: BW $r=98\%$ PA $r=93\%$ and in the mandible: BW, $r=99\%$, PA $r=82\%$)⁽⁷⁾.

In the present study, like some other studies a significant difference existed between measurements in the two PA and BW techniques^(6,9). This might be due to the practical limitations related to each technique. Difficulty in paralleling the film with tooth axis in PA technique because of anatomical limitations and patient compliance can cause distortion. The least amount of distortion occurs in the posterior part of the mandible and the most occurs in the posterior part of the maxilla. Anatomical limitations can cause differences from real measurements. This is particularly true in the case of a shallow palate or floor of the mouth which does not allow ideal placement of the periapical radiograph. Usually the anatomical limitations cause shortening of the image in the PA technique.

CONCLUSION

In the diagnosis of periodontal disease, using a BW technique provides more accurate measurements of bone loss than a PA technique.

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