



Comparison between direct digital and conventional intraoral radiographs in detecting alveolar bone loss in Iraqi male cigarette smokers

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Abstract

The role of smoking in periodontal disease has been extensively studied for many years. Many studies build up an increasing amount of scientific data which support the concept that tobacco use is an important risk factor for increasing of periodontal diseases.

Intraoral radiographs are important for diagnosis of periodontal problems. The aim of this study is to estimate bone loss by using direct digital and conventional radiographs in smokers. One hundred eighty sites (for molar region except third molar) in cigarette smoking patients were examined by digital and conventional periapical radiograph for detection of alveolar bone loss according to sextants and severity of bone loss. All images were examined by measuring mesial and distal bone loss of molars. The study shows that the differences between the conventional and the digital images in estimation of alveolar bone loss were not the same in all mouth sextants, so more bone loss was indicated by digital image in the mandibular right and left sextants than conventional image while there was little differences in maxillary right and left sextants in both images. Also this study shows those highly significant differences in digital image than the conventional image in early bone loss but no significant differences in both moderate and severe bone loss.

Key word: Digital periapical, Conventional periapical, alveolar bone loss

Introduction

Cigarette smoking are one of the problems in Iraqi people, most of them with long term cigarette smoking suffering from periodontal problems. The role of smoking in periodontal disease has been extensively studied for many years. Clinical and epidemiological studies build up an increasing amount of scientific data which support the concept that tobacco use is an important risk factor that has a clear association with the prevalence

and progression of periodontal disease.

⁽¹⁾ Periodontal disease refers to a group of diseases that affects the tissues that invest and support teeth ⁽²⁾. Periodontal disease leads to bony changes. The bony changes can be described in terms of severity (mild, moderate and severe) with considering that early bone loss ($\leq 3\text{mm}$), moderate bone loss (4-6mm) and advanced bone loss (more than 7mm)⁽³⁾. Conventional periapical radiographs are used to detect bony loss in addition to clinical

examination over the past few years, systems that can generate radiographic digital images without the need for radiographic film have become available for use in clinical practice and are gaining in popularity among practitioners⁽⁴⁾.

Comparative studies were carried out on different radiographic procedures to evaluate the most accurate radiographic procedure for assessment of alveolar bone loss in periodontitis cases, so some authors concluded that the periapical and panoramic radiography are in great agreement for assessment of alveolar bone level in periodontal disease^(4,5).

Some authors used series digital periapical radiograph for assessment of the relations of alveolar bone which is in disagreement with others who concluded that digital radiographs are not a substitute as conventional radiographs in evaluating alveolar bone level^(6,7).

Material and Methods

Sample involved in this study was selected from patients attending Al-Mamoon center for specialist complaining from periodontal disease involving posterior teeth. All selected patients were adult between the age of 28-50 years and all of them were systemically healthy. For each patient conventional periapical radiograph using bisecting angle technique with size 2 Kodak film, kV10, mA8, were taken, and digital periapical radiographs used size 2 digital sensor and a plastic holder with a metal guiding arm supplied by the manufacturer to position the sensor for all periapical images were taken.

The total sites were examined by both digital and conventional radiographs were (102) sites in molar region only.

Two specialist examiners (one radiologist and one periodontist) examined both radiographic types to calibrate and agree on the distances between alveolar bone crest level and the position of the cemento-enamel junction on the root surface.

Both specialists determined all of the conventional periapical radiographic measurements under standardized viewing conditions. A transparent plastic ruler was used to measure the distance from the CEJ to the interproximal alveolar crest on both mesial and distal aspect of each tooth present of molar teeth only (excluding third molar).

Then they determined the digital radiographic images which were viewed on the monitor of a computer and they digitally determined the distance from the CEJ to the interproximal alveolar crest on both the mesial and distal aspects of each viewable tooth using software program.

The examiners performed their measurements independently from each other, and each examiner measured the conventional or digital radiographs twice within two weeks interval and the overall percentage agreement of measurements for the first and second reading for the conventional images was 98%, and the overall percentage agreement of measurements for the first and second reading for the digital images was 99%. The digital radiograph indicated bone loss in all the (102) sites examined while conventional radiographs indicated bone loss in about (86) sites.

The severity of bone loss (early, moderate and severe) was estimated depending on the amount of bone loss.

Finally the resultant data was arranged in tables according to sextant and severity of alveolar bone loss.

Results

This study revealed that (102) sites were radiographed by both digital and conventional periapical images. According to the examination of the two specialist, the study showed that digital images indicated bone loss in all the (102) sites in comparison to (86) sites for conventional images, so about (16) sites not appear bone loss by conventional images. According to the distribution of alveolar bone resorption in different sextants, the results in table (1) showed that in mandibular right sextants, digital images showed bone loss in about (28.4%) of the cases while conventional images indicated bone loss in about (19.6%) only. In mandibular left sextant, the digital images showed bone loss in (22.5%), while the conventional images showed about (17.6%), by contrast, in maxillary left sextant, bone loss appear in about (23.5%) in digital image in comparison to (22.5%) in conventional images, while in maxillary right sextant, digital images showed about (25.5%) and in conventional image about (24.5%). Thus, the differences between the digital and conventional images not the same in all mouth sextants, rather more bone loss was indicated by digital images only in the mandibular right and left sextants while there is little differences in maxillary right and left sextants by the two types of images, so chi-square was used for comparison between both radiographs in detection of alveolar bone loss according to sextants, the results was highly significant differences for mandibular right and left sextants ($p < 0.0001$) and non significant differences for maxillary right and left sextants.

The correlation between both images methods according to the severity of bone loss appeared in table (2) which showed that the early loss of bone (less than 3mm) in digital image

was more accurate which showed (24.5%) in comparison to only (13.7%) in conventional image, and there was little differences in both images in moderate bone loss (4-6mm) which showed (42.1%) in digital image and (39.2%) in conventional image, also little differences in severe bone loss which showed (33.3%) in digital images while in conventional images showed (31.3%). Chi-square was used for comparison between both radiograph according to severity of bone loss, the results was highly significant differences between both radiograph ($p < 0.0001$) in early loss of bone, while there was non significant differences between both images in moderate and severe bone loss.

Discussion

In this study we select patients with long term cigarette smoking (more than ten years with smoking and more than twenty cigarettes per day), to compare bone loss by digital and conventional periapical radiographs, this choice due to that smokers may have higher levels of plaque than non-smokers, which may be accounted by poorer levels of oral hygiene rather than higher rates of supragingival plaque growth, also cigarette smoking could cause a lowering of the oxidation reduction potential and this could cause an increase in anaerobic plaque bacteria. Also smoking exerts a major effect on the protective elements of the immune response resulting in an increase in the extent and severity of periodontal destruction.^(8,9)

The differences we noted between the two imaging systems in detection of alveolar bone loss may be due to the ability of the digital technique to change the contrast and increase the resolution of the image with the help of computerized analysis which made the digital images detected bone loss more

than the conventional images. The differences in mandibular right and lefts sextant between the two images system may be attributed to variations in the size and flexibility of the conventional radiograph film and the sensor used in digital radiography. Conventional radiographic film is larger than the sensor however it can flex and bend, making it easier to position in the mouth but with probability of movement, while the sensor is smaller than the conventional radiographic film, it is difficult to position comfortably in the mouth because of its rigidity, so the patient can not move his (her) ridge comfortably so the possibility of movement of the sensor in the mouth is much little than the conventional film. These differences in size and flexibility between the sensor and the conventional radiographic film may have influenced the positions and angles they were in the different region of the mouth.

In addition, both radiographic systems differed on revealing alveolar bone level in the early bone loss (less than 3mm), so digital image tended to reveal a higher number of sites as having early bone loss (24.5%) than did conventional images (13.7%) and little differences in moderate and severe bone loss, this finding may due to highly contrast and resolution of the digital image which made it easy to detect early bone loss while in advance bone loss it detected in both radiographic systems as the same, this concept due to the clearance of the bone loss which detected in both radiographic systems easily.

Conclusion

The average alveolar bone level measurements vary between

conventional and digital images in posterior regions of the mouth. In addition, the digital images tend to reveal a higher number of sites with early bone loss than in the conventional images. These findings suggest that evaluation of alveolar bone loss using intraoral digital radiographs is not comparable with that of conventional radiographic film and it is advisable to use direct digital radiography in evaluation of alveolar bone loss.

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Table (1): Number and percentage of bone loss according to sextants and chi-square between digital and conventional radiograph.

Sextants	Digital		conventional		Chi - square	p-value	sig
	No	%	No	%			
Max. right	26	25.5	25	24.5	1.601	0.172	NS
Max. left	24	23.5	23	22.5	1.965	0.160	NS
Man. right	29	28.4	20	19.6	17.45	0.000	HS
Man. left	23	22.5	18	17.6	17.25	0.000	HS

P<0.0001 High significant

P>0.05 Non significant

Table (2): The number and percentage of bone loss according to severity and chi - square between digital and conventional radiographs.

Severity of bone loss	Digital radiograph		Conventional radiograph		Chi - square	P-value	Sig
	No	%	No	%			
Early	25	24.5	14	13.7	40.05	0.000	HS
Moderate	43	42.1	40	39.2	1.677	0.194	NS
Sever	34	33.3	32	31.3	1.465	0.172	NS

P<0.0001 High significant

P>0.05 Non significant