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Evaluation of the percentage of proximal caries diagnosis in Bitewing radiography technique by senior students of Sari dental school in 2018

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Abstract

Background and Purpose: dental caries is the most common chronic disease in the world and the rate of dental caries in many developing countries, it is considered as a health problem. Radiography is one of the best diagnostic tools in dentistry ending in accurate diagnostic procedures. Bitewing Radiography is considered as the gold standard for caries diagnostics nowadays. Last year students - who have completed most of their theoretical and practical courses - should have the ability to interpret radiographies. Hence, measuring the last year students' abilities can effectively help increase the level of knowledge and knowledge of future dentists.

Materials and Methods: The study was cross-sectional. In this study, 100 radiographs of molars and premolars teeth were collected. First, the professors approved their radiology department, and then the graphs were given to all students of the year. The students wrote their results on proximal lesions of each tooth according to the criteria obtained on the paper. Data were analyzed using SPSS-24.

Results: The mean percent of correct diagnosis of proximal caries in maxilla was 75.00% ± 19.43% in in mandible 71.66 ± 21.13%. There were no significant differences in the rate of caries diagnosis by the last year students.

Conclusion: the correct diagnosis of caries among students was 78.86%. Additionally, the mean of correct detection in maxilla was higher than mandible, but statistically insignificant.

Keywords: carries, bitewing, diagnosis

Introduction

Dental caries is the most common chronic disease in the world, which is considered a health problem in many developing countries. Dental costs account for a large part of the health sector's costs [1]. Thus, by timely diagnosis and proper treatment, the imposition of heavy costs to the health department can be prevented. Many methods have been proposed for the detection of caries, one of which is the use of radiography [2].

Radiography is useful in detecting caries, as the caries leads to demineralization of enamel and dentin [3]. The lesion in the diagnostic image is seen as a radiolucent region (darker), since the demineralized tooth area does not absorb x-ray photons as much as healthy regions [4].

Radiography is a valuable aid in detecting caries during a complete clinical examination of the teeth. A precise clinical examination to evaluate caries activity on the tooth surface may be possible for smooth surfaces and to a degree for occlusal surfaces [5]. However, when the level is clinically healthy (e.g. when a fracture has not ended in a cavity), even the most accurate examinations may lead to failure to detect submillimeter demineralization, including occlusal surfaces [6]. Clinical evaluation is limited to the proximal surfaces of the teeth in contact with each other. Several clinical studies have indicated that radiographic examination can show caries lesions, without which it remains hidden at both occlusal and proximal levels [7].

Bitewing radiography shows the image of the crown of the tooth and the adjacent tissues of the jaw and the edges of the alveolar bone on a film. This method is used to detect the progression of proximal surfaces of caries, expanding the pulp range, overhanging restoration, alveolar bone resorption and occlusal teeth [8].

Recent results show that caries diagnosis and treatment are completely different from what was done in the past. Nowadays, inactive and superficial lesions are not treated, and inactivity of caries is monitored by preventive methods, but it should be subject to periodic care including radiographic studies at specified intervals [11-9].

These intervals differ from patient to patient and are specified by certain risk factors like economic and social status, fluoride application, quantity and quality of saliva, and the dietary habits of a person [12].

Radiography of bitewing is seen as the gold standard for caries diagnosis [13]. The teaching of techniques and principles is among the theoretical and practical lessons of radiology in the faculties of Iran and the world and the general dentist should be familiar with the principles and application after

graduation. Students of the last years completing most of their theoretical and practical lessons need to have the ability to interpret radiographically. Thus, measuring their student abilities last year can be an effective help to raise the level of knowledge and knowledge of future dentists. The purpose was to specify the percentage of diagnostic prognostic diagnosis of proximal caries by BDI radiography by students at the end of the year, in order to determine whether the students who entered the community to provide treatment to patients were able to detect caries in bitewing radiography.

Materials and Methods

The following study is an analytical-analytic study. In this study, the students of dentistry at Sari University were the target group.

Using the results of the study, Shirani *et al.* [14] performed as follows to calculate the sample size:

$$n = \frac{z^2_{1-\frac{\alpha}{2}} p(1-p)}{d^2} = 100, p = 0.7, d = 0.09, \alpha = 0.05$$

The inclusion criteria were passing practical and theoretical radio lectures by this group of students.

In this study, 100 radiographies of molars and premolars were collected. First, the professors of the radiology department confirmed them, and each radiograph that the definitive diagnosis of the three professors about it was similar, was considered as a stereotype applicable to the study. It has to be noted that the lightmed negatoscope made of Taiwan Used for diagnosis.

The graphs were coded and the assessor was unaware of the result of the diagnosis. Then the graphs were given to all last year students. The students wrote their results on proximal lesions of each tooth according to the criteria obtained on the sheet. Each student examined 100 graphs and the students were told that the follow-up is done within a week, and the participants, if they were tired of seeing stereotypical stereotypes, could go refer the following day. These graphs were the same for all and at the end the students' sheets were corrected by the researcher and were considered for each grade sheet. Additionally, the mean scores of students were compared with faculty scores individually as a percentage of correct recognition. In this method, Kappa agreement test was used to examine and agree between observers and radiographic stereotypes.

In this study, Chi-square test was used for statistical analysis and SPSS24 was used for analysis.

Results

In the study, of 100 bitewing radiographies, there were 80 caries cases, 42 of which were detected in maxilla and 38 in mandible according to the radiologist's opinion. The total number of students enrolled in this study was 30 students from the entrance to the 2013 dental school of Sari. In Table 1, the mean percentage of the correct diagnosis of proximal caries by students is expressed in terms of jaw and in general.

Table 1: Mean percentage of correct diagnosis of proximal caries by students

	Mean	SD
Mandible	71.55%	21.13%
Maxilla	75.00%	19.43%
Total	78.76%	17.34%

In this study, the students' response was divided into three categories: the first group was the students with less than 50% correct diagnosis, the second group were students with correct diagnosis between 51-70%, and the last group was more than 71% of proximal caries. Table 2 states the number and percentage of students who have correctly diagnosed the proximal caries in the by-vignette radiographs in each jaw and in general by the resolution of the correct response.

Table 2: Number and percentage of students diagnosing proximal caries

Jaw / correct response rate	Maxilla		Mandible		Total	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Less than 50 percent	4	13.33	4	13.33	2	6.7
51-70%	7	23.33	10	33.33	7	23.33
More than 70%	19	63.34	16	53.34	21	70.00
Total	30	100	30	100	30	100

This study examined the hypothesis that the rate of diagnosis of caries by the last year students is not different from the actual value. After analysis, this hypothesis was confirmed by using the T-test of a single sample (Table 3).

Table 3: The results of a t-test univariate T test to verify the first hypothesis

One-Sample Test				
95% Confidence Interval of the Difference		Sig. (2-tailed)	df	
Upper	Lower			
-17.7443	-32.2557	0.000	29	Maxilary Per
-20.4397	-36.2270	0.000	29	Mandible Per
-14.7563	-27.7103	0.000	29	Total

Moreover, using a t-test, a pair of samples showed that the rate of diagnosis of caries by students was not related to the type of jaw patients (up and down) (Table 4).

Table 4: The result of the t-test of a coupled sample t test to examine the second hypothesis

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		
					Lower	Upper	
Pair 1	MaxilaryPer (Binned) - MandiblePer (Binned)	0.100	0.403	0.074	-0.050	0.250	0.184

Discussion

Accurate and timely diagnosis of caries can stop the further expansion. Detection of proximal caries by radiography depends on the individual clinical experience. In recent decades, several criteria have been introduced for caries diagnosis. As proximal caries are not detectable by eye and clinical examinations, bitewing radiography is the main diagnostic tool for caries lesions [15].

Bitewing radiography is a picture of the crown of maxilla and mandible teeth and alveolar crust in a stereotype. Bitewing radiography is so valuable in detecting proximal caries not clinically proven [16]. Given the horizontal angle of the beam, this radiography can depict secondary caries under infections that may not be seen in periapical radiography. This radiography is also useful for observing periodontal conditions, and this radiography has great ability to represent the caries [17].

In this study, 3 faculty members of oral and maxillofacial radiology department were selected as the golden standard. However, in this case, both professors are likely to make a mistake. Thus, in this study, Kappa agreement test was used to determine the agreement between observers and radiographic stereotypes.

The results showed that overall correct diagnosis among the students was 78.86%. In this study, the percentage of people with less than 70% proximal caries diagnosis in radiographic images was about 30%. As one of the main pillars of regenerative treatments is the diagnosis of caries and its depth by radiography, it is recommended that retraining courses be designed for these students. Moreover, it should be noted that only 2 students had an unfavorable condition (less than 50% of the correct answer), which does not seem to be a bad indication, and it shows the correct training of the faculty.

Additionally, in analyzing the second hypothesis, it was found that diagnosis of caries has nothing to with the patient's jaw. In justifying this, one can state that it may be due to the intrinsic nature of the X-ray images of X-rays and X-ray radiation. As the images of the bitewing radiographs are made with a vertical angle of 0 degrees or at least 5 degrees, there are no super-imposition anatomical structures on the tooth.

The population was the final year students of general dentistry. The reason for choosing these students is that these students have passed all practical and theoretical lessons encompassing the diagnosis and treatment of caries in the diagnostic, radiological and repair departments. Thus, it is expected to be able to detect proximal caries.

Different studies have been done to evaluate the proximal caries diagnosis. For instance, Civera *et al*. reviewed the agreement between Visual Detection, common radiographs and digital methods in the diagnosis of interproximal and occlusal caries in posterior teeth in patients with low prevalence of caries. The results showed that two radiographic techniques had a higher agreement on the diagnosis of lesions. This agreement was higher in dentin lesions compared to enamel [18].

In a cross-sectional study, Shirani *et al*. (2013) in Isfahan examined the students' diagnostic ability to diagnose proximal dental caries. They stated that the dysfunctions by dental students were high compared to the golden standard [14]. The results were different from the results of the study. The reason for this difference can be due to differences in the universities studied. Moreover, the educational curriculum in the school year studied by Shirani *et al*. was related to the old system. During the current study, changes in the educational curriculum of the students were implemented by the Ministry of Health and Medical Education, which can end in better education and ultimately students have better performance.

Neekneshan *et al*. (2011) stated that the ability of students to recognize caries lesions from healthy tissue was desirable and their reliability was not significantly different from the gold standard. Students were more likely to detect the presence of caries lesions, but not about the depth of the caries [19]. The results are similar to those of the present study.

Pourhashemi *et al*. (2009) compared the diagnosis of occlusal caries by observational method, bitewing radiography, and fluorescence laser. They stated that the sensitivity of the observational method was 43%, bitewing 27%, and the observational method 78%, bitewing 69%. Finally, although the accuracy and capability of the fluorescence laser method are higher than BW radiographic methods and observational methods, it is better to use this method using other methods to reduce diagnostic errors [20]. In analyzing the results of Pourhashemi *et al*., one can state that the use of fluorescence lasers needs special equipment and separate training, which is costly. Thus, it is thought that the fluorescence laser method can be useful in research activities. Moreover, they only evaluated occlusal caries and not the other ones. It should be noted that even if the clinical effect of fluorescence laser is useful in the diagnosis of occlusal caries, but none of the benefits of bitewing radiography, like the evaluation of alveolar bone fractures, have been examined.

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