Ability of dental students in detection of proximal caries

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Abstract

Objective: Tooth decay is one of the most common chronic diseases in the world. After pit and fissures, enamel of proximal surface is the second region prone to rot (1). In recent decades, changes in the prevalence of dental caries and the pattern of distribution of the decay has been seen in people (2). In the past, progress of caries was fast and with visible cavitations and these lesions were easily diagnosed by clinical examination. But today progress of caries is slow and these lesions extend to dentin but without any evidence of clinical changes. This means that today, dentists mostly face patients with hidden carious lesions. Knowledge of these hidden caries has attracted dentist’s attention to value of radiographic examinations (3).

Caries detection methods include visual examination, palpation with an explorer and radiographic evaluations (4). Using x-ray images to examine the teeth and other oral tissues, is

Methods: In this descriptive cross-sectional study 208 inter proximal surfaces among the 13 dental bitewing radiographs were selected randomly. The radiographs were evaluated by two experienced dental specialists (a radiologist and a restorative specialist) to detect inter proximal decay between teeth. These diagnoses were considered as the gold standard. The radiographs were further assessed by fourteen final-year dental students. Finally, the collected data were analyzed by SPSS-17 software using Kappa coefficient of agreement and ICC. The sensitivity and specificity values were also determined.

Results: The value of Kappa correlation coefficient to assess the similarity between students' responses and gold standards was obtained as 0.28 ($p<0.001$). The Kappa correlation coefficient for evaluation of the precision of the data was 0.71. The sensitivity in the whole population was 0.43, while the specificity was 0.84.

Conclusion: According to the results obtained in this study, the performance of final year dental students to identify the presence and depth of proximal caries from bitewing radiographs was not satisfactory. Moreover, the ability to detect normal surfaces was unacceptable.

Key words: Bitewing, Dental students, Depth, Detection, Diagnoses, Proximal caries, Radiography.

Please cite this article as:

Received: 07.02.2015 Final Revision: 23.05.2015 Accepted: 01.06.2015

Introduction:

Tooth decay is one of the most common chronic diseases in the world. After pit and fissures, enamel of proximal surface is the second region prone to rot (1). In recent decades, changes in the prevalence of dental caries and the pattern of distribution of the decay has been seen in people (2). In the past, progress of caries was fast and with visible cavitations and these lesions were easily diagnosed by clinical examination. But
still the most important diagnostic technique (5). Bitewing radiography is the image of the maxillary and mandibular teeth crowns and alveolar crest in radiography. The use of the bitewing radiograph in the diagnosis of caries has been reported (6). However, there are still, differences between practitioners in the diagnosis and treatment of carious lesions (7, 8). Hellwig et al. (2010) reported that bitewing radiography was the most reliable tool available to detect the decay depth and the need for repair (9).

Given the importance of early diagnosis of caries, it is necessary that dental students during their education reach to a decent level of competence in the detection of caries, prevention and their treatment (10, 11). This study aimed to evaluate the skill of final-year dental students in detecting the presence and diagnosing the depth of proximal caries on a bitewing radiographs.

Methods:

This work is a descriptive cross-sectional study. 208 inter proximal surfaces among the 13 dental bitewing radiographs were studied which were randomly selected from Radiographs’ archive of patients. Entry criteria include the lack of visual and geometric error, processing errors, contact overlapping and no dental majority error during the exposure. All radiographs were taken using a cardboard film holding device and were evaluated by a radiologist and a restorative Specialist in order to detect decay between the teeth queries. The diagnoses of these specialists were used as gold standards. The exclusion criteria were based on the consensus of both specialists. Then the 208 proximal surfaces of bitewing radiographs were investigated separately by fourteen final-year dental students using the magnification on Negatoscope in subdued-light of the dark room. The radiographs were divided into the following categories by the specialists: No radiolucency = 0; Radiolucency observed in the enamel = 1; Radiolucency limited to the outer third of dentin = 2; Radiolucency extending to the middle third of the dentin = 3; Radiolucency extending to the inner third of the dentin = 4.

In order to determine the inter-observer reliability after two weeks, 6 students among the study subjects were randomly selected to re-evaluate the same radiographs and report the results. Finally, the collected data were analyzed using SPSS software (version-17). Kappa coefficient of agreement as well as sensitivity and specificity values were determined.

Results:

The number of students participating in this study was 14 out of 21 final-year students; 8 women and 6 men. Thus, the response rate was 66.6%. Mean percentage of correct reports of enamel caries and dentinal caries are 47.2 and 55.9 subsequently. Also, Mean percentage of excess reports of caries is 16.2%.

According to intra-class correlation coefficient (ICC) test which evaluates the inter-observer agreement, a reliability coefficient was calculated for all students in the top 50 ($\alpha = 0.96$). This suggests that students have similar performance and no one was excluded. The mean percentage of correct responses is shown in Graph 1. The comparison between the mean percentages of responses between two genders are brought in Graph 2. The value of Kappa correlation coefficient to assess the similarity between students' responses and the gold standard was 0.28 ($p<0.001$), and the resulting Kappa correlation coefficient to verify the precision of the answers was 0.71. The sensitivity and specificity values for the whole population were 0.43 and 0.84, respectively. The correlation coefficient for the overall similarity with the gold standard data, sensitivity and specificity for the whole population and for each gender are summarized in Table 1.
Student’s ability in detection of proximal caries

Graph 1- The average proportion of accuracy of responses compared to correct answers

Graph 2- Comparison of the accuracy of responses between the sexes (percent)

Table 1- The correlation coefficient of the overall similarity diagnosis, the sensitivity and specificity for the whole population and for each sex

<table>
<thead>
<tr>
<th></th>
<th>General Correlation Of Student-Reported Points (Kappa)</th>
<th>Sensitivity</th>
<th>Specificity</th>
<th>Positive Predictive Value</th>
<th>Negative Predictive Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Women</strong></td>
<td>0.29</td>
<td>0.45</td>
<td>0.82</td>
<td>0.52</td>
<td>0.78</td>
</tr>
<tr>
<td><strong>Men</strong></td>
<td>0.28</td>
<td>0.40</td>
<td>0.85</td>
<td>0.53</td>
<td>0.77</td>
</tr>
<tr>
<td><strong>Total population</strong></td>
<td>0.28</td>
<td>0.43</td>
<td>0.83</td>
<td>0.52</td>
<td>0.78</td>
</tr>
</tbody>
</table>
The Kappa correlation coefficient in classification for caries depth was not good. ($p<0.001$)

**Discussion:**

Based on the findings of this study, the students were able to identify only a few correct cases of inter proximal caries. Also, little similarities were found between the students' diagnosis and the gold standard. Maupomé and Sheiham (1997), in a study on 143 students in England, compared the assessments of students with the gold standard which was based on the diagnosis of two clinicians. They found that the students' overall assessment of lesions did not differ between the restored and unrestored surfaces. However, when compared with the gold standard, their decision-making was found to be better on the surfaces which had not been restored previously as opposed to those already restored (12).

Ritter et al. study in 2013 showed that dental students have ability to differentiate carious and non-carious cases within normal limits and no significant differences were noted for their reliability with gold standard (13).

Possible reasons for the lack of significant difference can be related to answer’s option that was close to each other and conservative actions of students in the definitive diagnosis that cause the results subsequently impaired. Moreover, the choice of a large number of carries surfaces, and closure of the responses to each other that are in separable could be effective in achievement of these results.

In this study, we did not find a significant relationship between gender and the number of correct responses. These findings are in agreement with the results obtained by Matalon et al. (2003) (14).

The low quality of education, large number of students in the department, failure to observe the correct ratio of students to professors and compressed and periodic education are possible causes that make the students' assessment incompatible with the gold standard.

Kimmes et al. (2006) suggested an extra one year training to increase the diagnostic ability of students in caries detection and treatment (15). Present study shows the low level of experience of students effective in decrease of the responses similarity. This is compatible with the results reported by Matalon et al. (2003) and Diniz, et al. (2010) (14, 16).

**Conclusion:**

According to this study, the final-year students did not have the ability of diagnosing restorative-needed teeth. Moreover, the ability to detect normal surfaces was unacceptable.

**Acknowledgments:**

This study was supported by a grant of Research Vice Chancellor of Shahid Sadoughi University of Medical Sciences (Grant No: 2578). There is no conflict of interest in this research. Funding: This research was funded by

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**Table 2- The correlation coefficient of the caries depth classification in students**

<table>
<thead>
<tr>
<th>Grade</th>
<th>General Correlation Of Student-Reported Points (Kappa)</th>
<th>p- value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>0.08</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Grade 2</td>
<td>0.1</td>
<td>0.018</td>
</tr>
<tr>
<td>Grade 3</td>
<td>0.35</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Grade 4</td>
<td>0.68</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>
Shahid Sadoughi University of Medical Sciences, Yazd, Iran. The authors express their gratitude to Dr. Amiri and Dr. Iranpour for helping in laboratory procedures.

Conflict of Interest: “None Declared”

References: