

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. Bitewing images are one of the most important diagnostic tools for the detection of caries. Given the importance of accurate and timely detection of decay, the current study was aimed to evaluate the ability and skill of the final-year dental students to identify the presence and depth of proximal caries in dental bitewing radiography.

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:

Tavakoli E, Davari AR, Javadi ZS, Ghaffari Targh M. Ability of dental students in detection of proximal caries. *J Dent Sch* 2015; 33(3): 220-224.

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

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

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.

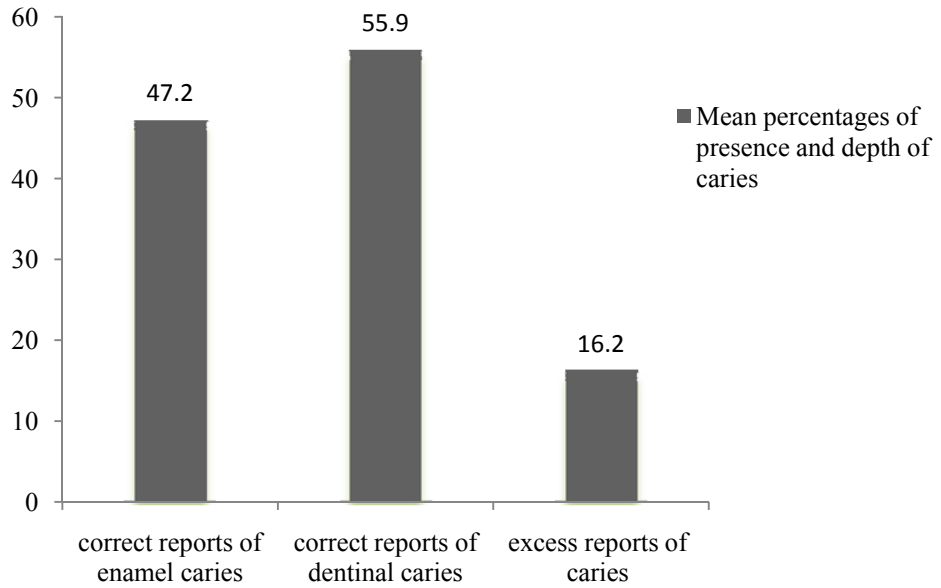
In order to determine the inter-observer reliability after two weeks, 6students among the study subjects were randomly selected to re-evaluate the same radiographs and report the results. Finally, the collected data were analyzed using SPSS software (version-17). Kappa coefficient of agreement as well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

Results:

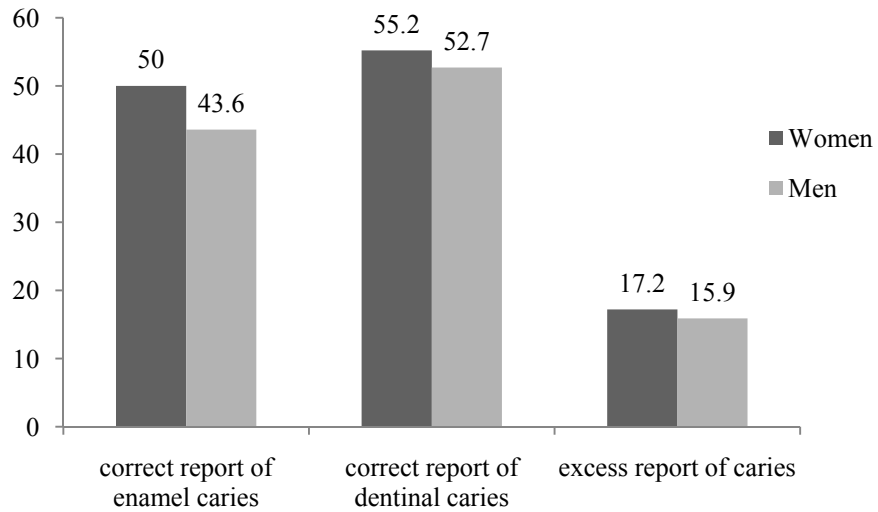
The number of students participating in this study was 14 out of 21 final-year students; 8 women and 6 men. Thus, the response rate was 66.6%. Mean percentage of correct reports of enamel caries and dentinal caries are 47.2 and 55.9 subsequently. Also, Mean percentage of excess reports of caries is 16.2%.

According to intra-class correlation coefficient (ICC) test which evaluates the inter-observer agreement, a reliability coefficient was calculated for all students in the top50 ($\alpha = 0.96$). 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.



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

	General Correlation Of Student-Reported Points (Kappa)	Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
Women	0.29	0.45	0.82	0.52	0.78
Men	0.28	0.40	0.85	0.53	0.77
Total population	0.28	0.43	0.83	0.52	0.78

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

	General Correlation Of Student- Reported Points (Kappa)	p- value
Grade 1	0.08	<0.001
Grade 2	0.1	0.018
Grade 3	0.35	<0.001
Grade 4	0.68	<0.001

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

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:

1. Bonett JB. The art and science of restorative dentistry. *Penn Dent J (Phila)* 2007; Spring 2-5.
2. Fontana M, Zero D. Bridging the gap in caries management between research and practice through education: the Indiana University experience. *J Dent Educ* 2007; 71: 579-591.
3. Weerheijm KL. Occlusal 'hidden caries'. *Dent Update* 1997; 24: 182-184.
4. Stookey GK, González-Cabezas C. Emerging methods of caries diagnosis. *J Dent Educ* 2001; 65: 1001-1006.
5. Barnes CM. Dental hygiene participation in managing incipient and hidden caries. *Dent Clin North Am* 2005; 49: 795-813, vi-vii.
6. Wenzel A. Bitewing and digital bitewing radiography for detection of caries lesions. *J Dent Res* 2004; 83 (Spec No C): C72-75.
7. Wojtowicz PA, Brooks SL, Hasson H, Kerschbaum WE, Eklund SA. Radiographic detection of approximal caries: a comparison between senior dental students and senior dental hygiene students. *J Dent Hyg* 2003; 77: 246-251.
8. Schulte AG, Wittchen A, Stachniss V, Jacquet W, Bottenberg P. Approximal caries diagnosis after data import from different digital radiography systems: interobserver agreement and comparison to histological hard-tissue sections. *Caries Res* 2008; 42: 57-61.
9. Hellwig E, Altenburger M, Attin T, Lussi A, Buchalla W. Remineralization of initial carious lesions in deciduous enamel after application of dentifrices of different fluoride concentrations. *Clin Oral Investig* 2010; 14: 265-269.
10. Pitts NB, Wefel JS. Remineralization/desensitization: what is known? What is the future? *Adv Dent Res* 2009; 21: 83-86.
11. ten Cate JM. Remineralization of caries lesions extending into dentin. *J Dent Res* 2001; 80: 1407-1411.
12. Maupomé G, Sheiham A. Decisions on diagnosis and management of approximal caries by final-year dental students. *Dentomaxillofac Radiol* 1997; 26: 107-111.
13. Ritter AV, Ramos MD, Astorga F, Shugars DA, Bader JD. Visual-tactile versus radiographic caries detection agreement in caries-active adults. *J Public Health Dent* 2013; 73: 252-260.
14. Matalon S, Feuerstein O, Kaffe I. Diagnosis of approximal caries: bite-wing radiology versus the Ultrasound Caries Detector. An in vitro study. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2003; 95: 626-631.
15. Kimmes NS, Saini TS, Carroll LR. Comparison of clinician agreement during visualization of conventional and digitized bitewing radiographs. *Gen Dent* 2006; 54: 182-185.
16. Diniz MB, Rodriguez JA, Neuhaus KW, Cordeiro RC, Lussi A. Influence of examiner's clinical experience on the reproducibility and accuracy of radiographic examination in detecting occlusal caries. *Clin Oral Investig* 2010; 14: 515-523.