International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Variation among General Practitioners Libyan Dentists in Benghazi to Interpret the Dental Radiograph

Randa Farag G Salih [a], Nuha Elkadiki [b], Asiel Shembeish[c]

[a] *Lecturer, Department of Conservative and Endodontic Dentistry, Faculty of Dentistry, Benghazi University, Libya.*
[b] *Assistant Professor, Department of Conservative and Endodontic Dentistry, Faculty of Dentistry, Benghazi University, Libya.*
[c] *Tutor at Libyan International Medical University (LIMU), Benghazi, Libya.*

A B S T R A C T

To evaluate the differences presented by newly graduated general dental practitioners and how they detect different types of caries on X-rays or through visual inspection. Materials and Methods. A total of 250 newly graduated dentists and 50 extracted teeth, human permanent teeth, were selected from a pool of extracted teeth with varying conditions from sound to carious surfaces. The teeth were first visually and radiographically examined by specialized endodontics, and then the x-ray was spread among 250 new dentists to determine the caries degree. Results. The results showed that sound surfaces were detected by 89 (35.6%) of the participants, and 161 (64.4%) had sound tooth wrong interpretation. Buccal caries were detected by 85(34%), and 165(66%) had wrong interpretations for incipient caries. Of the distal caries 7.6% were mistaken as mesial caries, 56.8% of the buccal surface caries, and 14.8 of the root caries were mistaken as deep caries lesions, only 85 (34%) had buccal correct interpretation, the majority of the dentists (96%) gave root caries wrong interpretation as they have mistaken it for other caries lesions. Conclusion. Newly graduated general dentists struggle with accurately diagnosing dental caries in Benghazi, particularly in identifying different kinds of caries.

Keywords: dental caries, cavities, radiographs, interpret

1. Introduction

Dentists frequently use visual inspection and traditional radiography as diagnostic techniques to interpret dental caries. The number of caries identified increases with the use of radiography techniques, whether conventional or digital compared to a typical clinical examination. [1, 2, 3,4,6] To diagnose caries, radiographic imaging is often used in dental practice in addition to ocular assessment. [5, 7] However, studies have shown that radiography is useful for detecting lesions in the dentine. The value of radiographic testing for occlusal surfaces observed by the clinician has increased because of awareness and experience of "hidden caries," which is a caries lesion identified by radiographic testing and clinically manifests as sound or demineralized occlusal enamel [9]. Nonetheless, occlusal surface radiographs provide a three-dimensional tooth seen in two dimensions, which makes it difficult to detect mineral loss in the enamel, especially when it is hidden by healthy dental tissue or has a caries lesion layered on the dentine due to the intricate occlusal architecture. [5]

The precision of radiography determines how dental caries should be interpreted. The dentin's tendency to produce false-positive registrations impedes radiographic diagnosis of occlusal caries. The radiograph can be used to diagnose occlusal dentin caries, however, due to the wide range of interpretations, training and calibration are necessary. [5] In addition, errors in radiography that result in false-positive or false-negative results might make it more difficult to make decisions about the care and treatment of patients [2, 3]. An additional factor to consider is the examiner's proficiency—or lack thereof—in identifying occlusal caries using bitewing radiographs [5,7]. Research has shown that different doctors have different levels of experience using radiography analysis to detect occlusal or approximation caries [10]. A few studies that compare students' performance to that of faculty dentists or practitioners in the field of dentistry have been reported in the literature. They address the students' ability to recognize dental caries via bitewing radiographs [11].

2. Material and methods

2.1 Sample preparation

A total of 250 newly graduated dentists (The examiners did not receive additional training or calibration in the interpretation of radiographs) and 50 extracted teeth, human permanent teeth (Anterior, Premolars, Molars), were selected from a pool of extracted teeth with varying conditions from sound to carious surfaces. Before being used, they were kept frozen at -20°C for the duration of the tests.

All teeth were extracted from the Libyan population, The patients were told about using their teeth for research purposes before extraction, and their consent was acquired. The teeth were cleaned for 15 seconds with water and a toothbrush and 10 seconds with a water powder jet cleaner using sodium hydrogen carbonate powder after being defrosted for three hours. The calculus and debris were removed using a scaler (Cavitron). In sequence to ensure there were no powder traces in the crack, the teeth were then washed for ten seconds using a three-in-one syringe. [12]

Diagnosis	Dentists n (250)	
	Correct interpretation n (%)	wrong interpretation n (%)
Sound tooth	89 (35.6%)	161 (64.4)
Incipient caries detection (enamel caries)	171 (68.4%)	79(31.6%)
Deep caries	250 (100%)	0
Mesial caries	187 (74.8%)	63 (25.2%)
Distal caries	222 (88.8%)	28(11.2%)
Buccal caries	85 (34%)	165 (66%)
Root caries	10 (4%)	240 (96%)

2.2 Intra oral periapical radiograph

The teeth were first visually and radiographically examined by specialized endodontics, and then the x-ray was spread among 250 newly graduated dentists to determine the caries degree. The newly graduated did not get extra training or calibration in radiographic interpretation. Teeth were implanted in wax blocks, digital intra-oral radiographs were taken, and examined with an X-ray viewer (Imatec Röntgentechnik, Switzerland) and an X-ray film magnifier (magnification ×2; Svenska Dental Instrument, Sweden), examiners independently examined the films in a dark room to ascertain whether the occlusal surfaces under investigation displayed radiolucency.
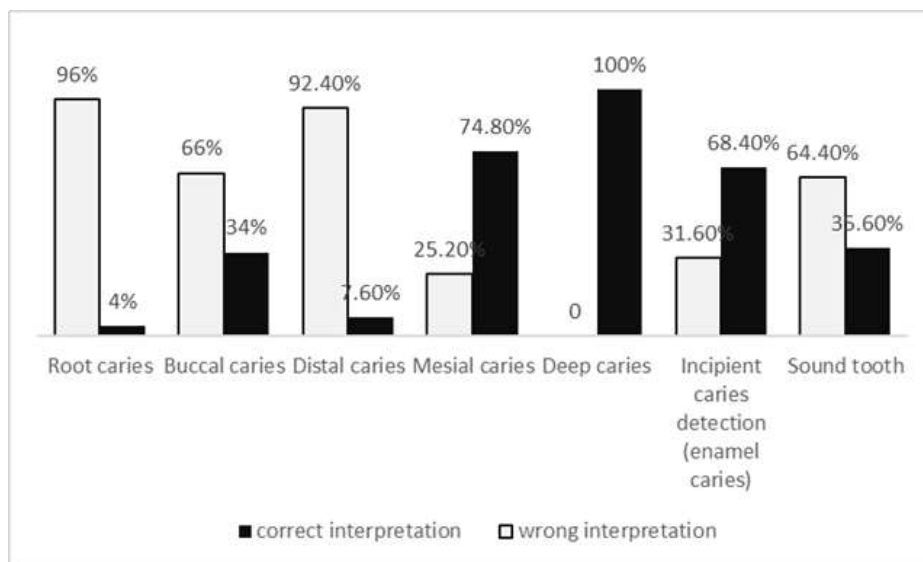
A questionnaire was distributed among newly graduated to determine the limitation of caries across each radiograph. The questionnaire consisted of seven questions, each question was for a specific X-ray and was equally distributed among all the newly graduated dentists.

3. Results

In a total of 250 newly graduated dentists and 50 extracted teeth, sound surfaces were detected by 89 (35.6%) of the participants, and 161 (64.4%) had sound tooth wrong interpretation. the incipient caries were detected by 171(68.4%), and 79 (31.6%) had wrong interpretations for incipient caries. mesial caries correct interpretation by 187(74.8%) and wrong interpretation by 63(25.2%). distal caries correct interpretation by 19(7.6%) and wrong interpretation by 231(92.4%). Buccal surface caries were detected by 85(34%), and 165(66%) had wrong interpretations for buccal caries. root caries was detected by 10(4%), and 240 had wrong interpretations of root caries.

Table 1. Correct caries detection among the respondents.

| Diagnosis	Dentists n (250)	
	Correct interpretation n (%)	wrong interpretation n (%)
Sound tooth	89 (35.6%)	161 (64.4)
Incipient caries detection (enamel caries)	171 (68.4%)	79(31.6%)
Deep caries	250 (100%)	0
Mesial caries	187 (74.8%)	63 (25.2%)
Distal caries	222 (88.8%)	28(11.2%)
Buccal caries	85 (34%)	165 (66%)
Root caries	10 (4%)	240 (96%)

**Figure 1. Correct interpretation rate for each category**

Sound teeth X-rays are mostly confused as incipient caries (59%), on another hand incipient caries are frequently confused as cavitated caries 27.6% (enamel and dentine). The carious surface times were mistaken as the opposite one such as mesial caries 24% were mistaken as distal caries. In comparison, of distal caries 7.6% were mistaken as mesial caries, 56.8% of the buccal surface caries were mistaken as root caries, and 14.8 of the root caries were mistaken as distal caries.

Table 2. Wrong interpretation for each radiographic category

Interpretation	N (%)
Sound tooth confused as	
limited to the enamel.	149 (59.6%)
limited to dentin	12 (4.8%)
Enamel caries confused as	
Dentin caries	10 (4%)
Enamel and dentin caries	69(27.6%)
Mesial caries confused as	
Distal caries	60 (24%)
root caries	3(1.2%)
Distal caries confused as	
Mesial caries	19 (7.6%)
Root caries	8 (3.2%)
Buccal caries	1 (0.4%)
Buccal caries confused as	
Mesial caries	5 (2.0%)
Distal caries	18 (7.2%)
Root caries	142 (56.8%)
root caries confused as	
Mesial caries	10 (4.0%)
Distal caries	37 (14.8%)
Buccal caries	4 (1.6%)
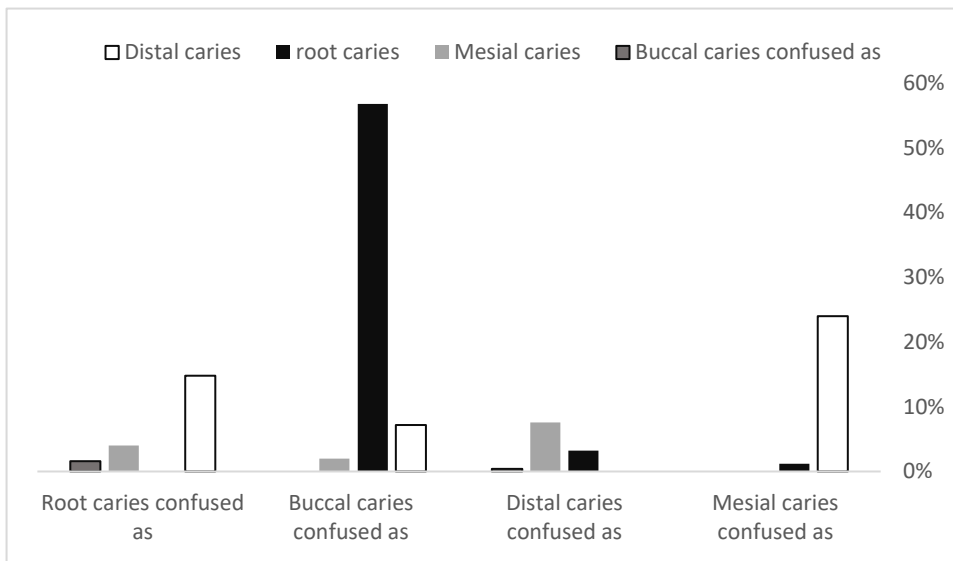
**Figure 2. Wrong interpretation of sound tooth and incipient caries**
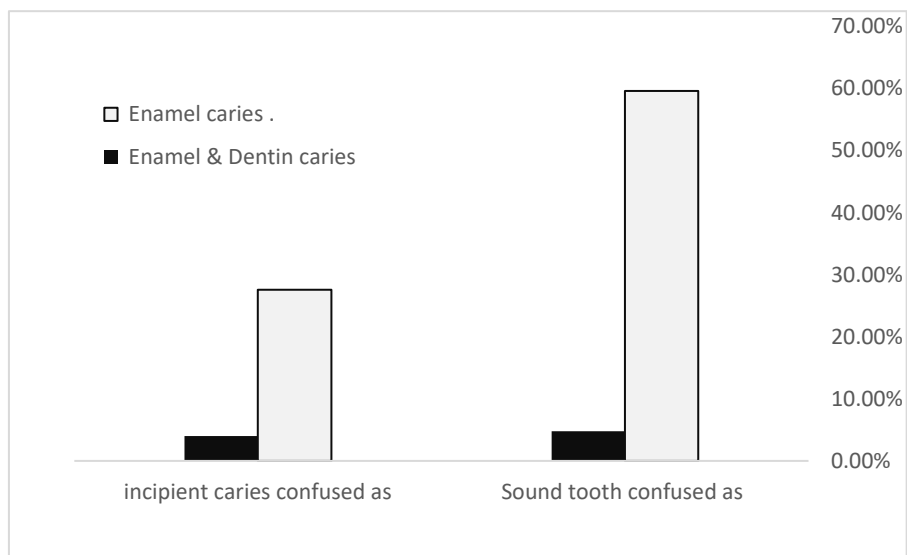
Figure 3. Wrong interpretation of different tooth surfaces caries

About the knowledge of the newly graduated dentists, 0.4% answered only one question out of a total 7 questions, 8% two questions, 23.6% three questions,33.6% four questions, 22% five questions, 12.4% six questions, and no one had the total score of 7(100%). So, there were 79 (31.6%) newly graduated dentists had failed the questionnaire score with a total score of less than 50%, and 171 (68.4%) had passed the questionnaire score with a total score of more than 50%, clarifying that question 2 (deep caries identification) is the most one answered correctly (100%), and the least one was question 6 (root caries identification) (4%).

**Table 3. Number of the correct responses for each newly graduated dentist**

Question correctly answered	N (%)
Only one question with the right answer.	1 (0.4%)
Two questions with the right answer	20(8%)
Three questions with the right answer	59 (23.6%)
Four questions with the right answer	84 (33.6%)

Five questions with the right answer	55 (22%)
Six questions with the right answer	31 (12.4%)
All the questions with the right answer	0
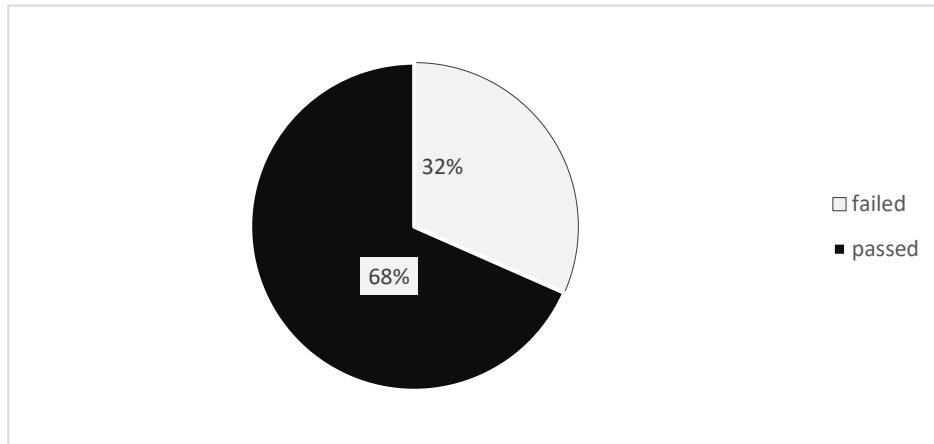
Figure 4. The rate of the newly graduated dentists who passed and failed the questionnaire total score.

The ROC curves show a questionnaire predicting the knowledge of the newly graduated dentists included in the study. Areas under curves (95% CI) were 0.995. showing that the questionnaire is an excellent predicting tool. The capability of the questionnaire to predict the knowledge of the newly graduated dentists is presented in Table 4.

Diagonal segments are produced by ties.
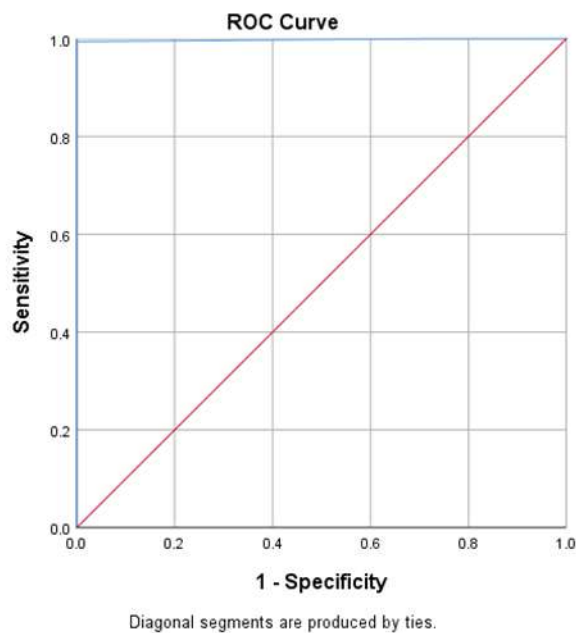
Figure 5. Receiver operating characteristic curves showing the questionnaire predict the knowledge.

Table 4. Performance of the study questionnaire in predicting the knowledge of the newly graduated dentists.

score	Sensitivity	Specificity	Positive predictions	Negative predictions
Low knowledge score <50% (less than 3 correct answers)	99.4%	25.3%	100%	0
High knowledge score >50% (more than 5 correct answers)	18.1%	100%	74.2%	25.8%

Discussion:

Dental caries accurate diagnosis can be challenging among undergraduate dentists and specialists, who need skills and performance with good eyesight and clinical practice knowledge. The material in this study was the same for all observers with 50 extracted teeth. In this study, we aimed to evaluate the differences presented by newly graduated general dental practitioners and how they detect different types of caries on the X-ray or by visual inspection. The ROC curve was a relative estimate of the accuracy of the diagnoses, which is independent of the dentist's method of choice. [13] Assuming that the lesions were of similar size, the results may show whether dentists subsequently performed better on one sort of surface than another.

According to Mejàre, the diagnostic information of carious lesions should be obtained from the patient's medical history, professional background, and, most importantly, the findings of the radiographic examination. [14] Swedish Council on Health Technology Assessment noted that radiographs are essential for determining the existence and extent of bone alterations, deep repair fractures, and cavities. [15] Although many dentists are raising questions regarding the efficacy of the radiograph in occlusal or any other caries lesion detection, assuming that it is a 2D image showing a 3D object [16], regardless of its importance in this study the newly graduated general dental practitioners were confused when it comes to incipient caries, sound teeth X-rays are mostly confused as incipient caries in almost (59%). On the other hand, incipient caries are frequently confused with cavitated caries 27.6% (enamel and dentine), as shown in (table 2). Root caries were mistaken for either mesial or distal caries on reading the radiograph, which can lead to a misleading and more aggressive treatment option. So, it is very important to enhance the dentist's ability to diagnose caries correctly to build treatment based on accurate radiographic evaluations [17], guaranteeing that the patient gets the ideal dental care and stays away from overtreatment.

When using extracted teeth to evaluate the dentist knowledge, The current results show that newly graduated general dental practitioners are less skilled in identifying dentin cavities Buccal caries surfaces than in approximate ones, as the result showed mesial caries correct interpretation by 187(74.8%), and wrong interpretation by 63(25.2%).distal caries correct interpretation by 19(7.6%) and wrong interpretation by 231(92.4%) and only 85 (34%) had buccal correct interpretation, the majority of the dentist (96%) give root caries wrong interpretation as they mistaken it for other caries lesion, only deep caries lesion was correctly interpretation by all dentist. Inspection is the first method used to diagnose caries it is inadequate or periodic since numerous discretionary criteria are involved, and the physician experience is a key factor in this process. Dentists may have different viewpoints on the same issue, which directly affects the course of therapy. Caries between teeth, hidden caries, and deep caries are still difficult to detect. [17]

Conclusions and recommendations

The study found that newly graduated general dental practitioners struggle with accurately diagnosing dental caries, particularly in identifying different types of caries on X-rays or through visual inspection. Radiographs are important for determining the extent of caries, but dentists often confuse incipient caries with sound teeth on X-rays and mistake root caries for other types of caries. Improving dentists' ability to diagnose caries correctly is crucial for providing optimal dental care and avoiding unnecessary treatments.

References

1.Duncan RC, Heaven T, Weems RA. Using computers to diagnose and plan treatment of approximal caries detected in radiographs. J Am Dent Assoc 1995; 126:873-82.1.

2.Haak R, Wicht MJ, Noack MJ. Conventional, Digital, and Contrast-Enhanced Bitewing Radiographs in the Decision to Restore Approximal Carious Lesions. Caries Res 2001; 35:193-9.

3.Duncan RC, Heaven T, Weems RA. Using computers to diagnose and plan treatment of approximal caries detected in radiographs. J Am Dent Assoc 1995; 126:873-82.

4.Rusell M, Pitts NB. Radiovisiographic Diagnosis of Dental Caries: Initial Comparison of Basic Mode Videoprints with Bitewing Radiography. Caries Res 1993; 27:65-70.

5.Espelid I, Tveit AB, Fjelltveit A. Variations among dentists in radiographic detection of occlusal caries. Caries Res. 1994;28(3):169-75. doi: 10.1159/000261640. PMID: 8033190.

6.Galcerá Civera V, Almerich Silla JM, Forner Navarro L, others. Clinical and radiographic diagnosis of approximal and occlusal dental caries in a low-risk population. Med Oral, Patol Oral y Cirug{\'\i} a Bucal. 2007;12(3):252–7.

7. Dove SB (2001) Radiographic diagnosis of dental caries. J Dent Educ 65:985–990

8. Kidd EAM, Naylor MN, Wilson RF (1992) Prevalence of clinically undetected and untreated molar occlusal dentine caries in adolescents on the Isle of Wight. Caries Res 26:397–401

9. Weerheijm KL (1997) Occlusal "hidden caries". Dent Update 24:182–184

10. Syriopoulos K, Sanderink GC, Velders XL, van der Stelt PF (2000) Radiographic detection of approximal caries: a comparison of dental films and digital imaging systems. Dentomaxillofac Radiol 29:312–318

11. Wrbas K-Th, Kielbassa AM, Schulte-Mönting J, Hellwig E (2000) Effects of additional teaching of final-year dental students on their radiographic diagnosis of caries. Eur J Dent Educ 4:138–142

12. Lussi A, Reich E (2005) The influence of tubes of toothpaste and prophylaxis pastes on fluorescence measurements for caries detection. Eur J Oral Sci 113:141–144

13 Swets JA, Pickett RM. Evaluation of diagnostic systems. Methods from signal detection theory. New York: Academic Press; 1982.

14 Mejàre IA, Axelsson S, Davidson T, et al. Diagnosis of the condition of the dental pulp: a systematic review. Int Endod J. 2012;45(7): 597-613

15 Swedish Council on Health Technology Assessment. Methods of diagnosis and treatment in endodontics: a systematic review. Available at: http://www.sbu.se/globalassets/publikationer/content0/1/methods-ofdiagnosis-and-treatment-in-endodontics_full.pdf. Accessed November 8, 2016.

16 C. Signori, T. Gimenez, F.M. Mendes, M.-C.D.N.J.M. Huysmans, N.J.M. Opdam, M.S. Cenci, Clinical relevance of studies on the visual and radiographic methods for detecting secondary caries lesions - a systematic review, J. Dent. (2018), https:// doi.org/10.1016/j.jdent.2018.05.018.

17 Bhat S, Birajdar GK, Patil MD. A comprehensive survey of deep learning algorithms and applications in dental radiograph analysis. Healthcare Analytics. 2023 Nov 14:100282