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Research Article

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Evaluate Dental Students' Knowledge, Attitudes, and Practices of Oral Radiology within the Department of Conservative Dentistry and Endodontics

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ABSTRACT

Introduction: Dentists have come to rely on X-ray imaging techniques for diagnosis, treatment and follow-up phases. This requires dentists to have sufficient knowledge and experience of radiographic safety standards.

Objectives: The aim of this study is to evaluate the level of knowledge and practice within dental students with regards practicing of safety standards for oral radiology and technique of imaging.

Methods: The survey was completed through a descriptive study, conducted on 111 students studying dentistry, divided into two groups according to academic level. The questionnaire was made up of multiple choice questions and was divided into three areas: principle knowledge, radiobiology/radioprotection, and technique/interpretation. The data was analyzed, the Pearson chi-square test was performed to assess the database, which yielded a significance level at P-value ≤ 0.05, and the outcomes were presented in percentages.

Results: The overall percentages of correct responses for the 35 questions showed that those who studied in the last academic year had better responses comparing to responses of the first academic year students, that revealed between 63.62% correct response from final year, while 21.77% from 1st years. It is significant to highlight that the result raises questions as for the level as well as, quality of academic knowledge that are being transferred to students before graduation.

Conclusion: The survey's findings concluded that the majority of the participating dental students needed more knowledge and practice to make the most appropriate choices concerning technology, radioprotection, or best practices for limiting radiation exposure for patients during oral radiography.

Key Words: Dental Students, Oral Radiology, Technique, Interpretation, Radioprotection, X-ray, Libya

INTRODUCTION

In the field of dentistry, oral radiology plays a crucial role in dentistry in diagnosing of oral diseases and treating various dental conditions. In addition, assisting dentists in determining the best course of action of the conservative and endodontics treatment. Without these imaging techniques, dentists would have to rely solely on visual inspection, which could lead to missed diagnoses and ineffective treatments. In conservative dentistry and endodontics, the use of advanced treatment modalities in combination with the use of radiograph images are essential throughout the course of treatment, as they determine the type of intervention, the success rate, and the prognosis of the case.[1] Using advanced imaging techniques such as bite-wing radiographs, occlusal radiographs, and panoramic radiographs, dentists can obtain detailed images of teeth, and surrounding tissues, allowing them to identify problems that might not be visible to the naked eye.[2,3]

Oral radiography is vital in identifying diseases such as hidden dental decay, bone loss from periodontal disease, or abscesses, as well as other pathologies, including cysts, tumors, and bone changes associated with systemic disease. Also identifying minor lesions, like minor caries. By catching these lesions early, dentists can take preventive measures or perform minimally invasive treatments. Unfortunately, studies have shown that dentists often have incomplete knowledge of radiological

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guidelines and limited ability to use equipment in oral radiology.[4,5]

Therefore, it is of utmost importance that dentist students have a comprehensive understanding of safety standards in oral radiology. The assessment of dentist students' knowledge and practice of safety standards for oral radiology is essential to ensure that they are equipped with the necessary skills and awareness to protect themselves, their patients, and the general public from potential radiation hazards.[6]

Radiation exposure is a serious concern in the dental field, as dentists and their staff are regularly exposed to ionizing radiation from oral radiology and other diagnostic tools. While these tools are essential for diagnosing and treating dental problems, they can also pose significant health risks if proper precautions are not taken. The risks associated with radiation exposure include an increased risk of cancer, genetic mutations, and other harmful effects on the body.[7] To minimize these risks, it is important for dentists and their staff to take radio protective measures such as wearing lead aprons, using thyroid collars, and limiting the amount of time spent near the source of radiation. By taking these steps, dental professionals can ensure that they are providing quality care while also protecting their own health and safety.[8,9]

It's imperative that dentistry students have a robust grounding in oral radiology to offer precise and effective patient care.[10] Several studies have been conducted to assess the knowledge, attitudes, and practice of oral radiology among dentist students. These studies have revealed some interesting findings. For instance, some studies have shown that the level of knowledge and attitudes towards oral radiology are strongly associated with the number of years in practice and attendance of courses.[11,12]

Objectives

This study's main objectives are evaluating the level of oral radiology practice among dental students for patient care, and assessment of student dentists' knowledge of oral radiology that they adopt for taking radiation safety.

Methodology

Study Design: In the present study, we questioned a sample of dental students using the descriptive study approach. From December 2022 to May 2023, the study was conducted at the Department of Dental Conservative, Endodontic, and Pathology.

Instrument: The survey questions were prepared and designed based on an analysis of previous researches, among which were journal publications that discussed oral radiograph and safety procedures.[11,13,14,15,16]

Participation and study groups: The research targeted a group of students who are studying in their first –year dental student (Group-1), and final- year group dental student (Group-2) of students who are studying in their graduation year in the Faculty of Dentistry at Zawia University. Thirty-two (32) out of seventy-five (75) dental students participated in the survey.

Data collection: We distributed the questionnaire in-person to dentist's students to make it easier for students to complete it. The participants were asked about the following:

I. Demographic data such as age, gender, academic level, etc.
II. The multiple-choice questions were designed in the form of affirmative sentences with answers "Yes", "No" and "Do not know". Dental students were reassured about the data collected through the anonymous processing of the questionnaire.

Data analysis: The survey collected data on knowledge, attitude, radioprotection, practice, technique, and interpretation of dental students about oral radiology, which was subsequently processed, entered into an electronic database and analyzed using SPSS version 21.

The statistical method used was descriptive. With regards to the assessment of the statistical significance of differential statistics, the Pearson chi-square test was applied. It was used to analyze individual and multiresponse data. P-values of less than 0.05 were considered evidence of statistical significance. Each correct response received a "1" score, while every incorrect response received a "0" score and incorrect response (including the "Do not know"). There were no negative recorded. The correct response was graded into low (1%–50%), average (51%–75%), and good (>75%).

RESULTS

The final sample of the survey composed of 111 students, first year-students (49.5%) and final year students (50.5%). The demographic information table 1 shows that students are aged between 20 and 24 years old with higher dominance of female (72.1%) and the majority were al Zawia city resident (85.8%). The overall correct answers within the first year was (22.29%), while final year student's answers were (69.59%). (Table 2, Figure 1)

DISCUSSION

Oral radiographs are crucial for accurate and early detection, of dental hard tissue disease and defects as well as during the endodontic treatment. The results of this study demonstrated that the correct answer percentage for the first year was 22.29%, and the final year was 69.59%, which were in accordance with previous studies where they found that dentist students do not have enough knowledge about radiation.[12,17]

Essential knowledge regarding the oral radiograph

Concerning the essential level of knowledge of dental radiograph[18], the result of the survey showed that the knowledge of dental students about oral radiography varied depending on the academic year, where the difference emerged as significant between students of first year comparing to students of final year (P-value=0.000), where only 386 (38.46%) answered correctly against 613 (61.36%) of incorrect answers (Table 3).

The response of dental students indicated a low level of knowledge and awareness regarding oral radiology among all students that dictate the improvement of curriculum taught at the collage.[19,20] The students' highest percentage of correct responses was, (89.2%)to the statement of 'X-rays are electromagnetic radiation. In addition, (73.0%) of students have also appropriately replied to the statement (It is not possible to generate x-rays without power supply). (Figure 2)

Radioprotection awareness

The result shows significant difference regarding the radioprotection (P-value= 0.000), the percentage of correct answers within first year was (28.41%) while (81.03%) was the percentage of correct answers of final year. (Table 4)

The all correct answers were 488 (54.95%), while400 (45.055) as incorrect answers that serves as evidence of the successful transmission of knowledge within their curriculum, reflecting the emphasis placed on ensuring the effective operation and maintenance of these crucial machines in dental practice.[21,22,23] The understanding and recognition of the significance of x-ray machine maintenance among students (66.7%) is an indication of the effectiveness of their education and training. The significant percentage mentioned above serves as evidence of the successful transmission of knowledge within their curriculum, reflecting the emphasis placed on ensuring the effective operation and maintenance of these ultimate machines in dental practice. (Figure 3)

In addition, (82.1%) agreed that is importance of holding the film when taking radiographs to children by parents as they cooperate better that shrink the need to replication the procedure. The majority of students (66.7%) thought that radiographic pictures must be performed on pregnant women only in the second trimester of pregnancy in order to reduce the chance of deleterious effects. Which coordinated the previous studiesrevealed that dental radiographs are generally considered safe for pregnant patients when abdominal and thyroid shielding is used.[24] In addition to the preventive, diagnostic, and restorative dental treatment is safe throughout pregnancy.[25,26]

Attitude and practice experience

During endodontic treatment the operator has to use radiograph along the procedure at least 5 times.[27,28] It was found that dental students (69.6%) did not prefer to hold the film during exposure, which indicates their awareness of the potential risks of radiation exposure.[10,29] On the other hand, there are other studies in contrast where dental students prefer to hold the film during exposure. [30]

Final year students expose high level of knowledge regarding attitude and practice with (14.18%) within first year students, and (84.29%) among final year students. Table 5 shows significant difference prominent between the responses among the students of first and final year (P-value=0.000). The general Percentages of correct responses as 275(49.55%) while 280(50.45%) counted as incorrect responses. Dental students' response to items (18,22) revealed that (55.0%) of students reported that they use a plastic barrier to cover the sensor before use and follow a disinfection protocol after each patient, which is necessary to prevent transmission of infection between patients. Which indicated the high level of education among students about cross infection control measurement which is mandatory to protect patient and dental staff. [31]

Another aspect of the findings of attitudes and practice revealed that (44.1%) of students agreed with the statement that they use a thyroid collar for radiation protection. As revealed by previous studies, using a thyroid collar can reduce the radiation exposure to the thyroid gland, which is one of the most radiosensitive organs in the body, and it is recommended to use for all intraoral examinations, extra oral examinations, as well as endodontic treatment when it does not interfere with the area under examination and image quality.[10,21, 32, 33] (Figure 4)

Technique of oral radiography in Conservative dentistry and Endodontics

Radiographic techniques such as Bite-wing and Occlusal techniques, as well as Panoramic radiographs, in the context of endodontics.[34,35] Students demonstrate the difference in knowledge regarding radiographic Techniques with (14.09%) of first year student, and (81.25%) among final year students (Table 6). In addition, the overall correct answers were 213(47.97%) in contrast with 231(52.03%) of incorrect answer.

Approximately, 59.5% of students agreed to the statement of Bite-wing radiographs are indicated to investigate dental decay which is in line with the previous studies that stated the use of this technique affords better diagnostic method to recognize the interproximal caries. 54.1% of respondents disagree to the statement Panoramic radiographs are indicated to investigate incipient caries lesions. This finding upholds previous studies which stated that Bitewing radiographs appeared superior to panoramic radiography for the detection of dental caries overall, with superior sensitivity for proximal caries and caries overall.[36,37,38,39,40] (Figure 5)

Interpretation of oral radiographs to identify disease

Identifying oral pathology through radiographic interpretation is a skill that dental students acquire to varying degrees depending on their levels of education and training throughout their school years.[4]It was found that the level of knowledge of oral radiographic interpretation was at an average level, with the rate of correct answers (69.64%) among dental students in their final year. (Table 7.Figure 6)

Study limitations

This study was subject to various restrictions due to the uncontrollable response rate. The quantity of responses also varied and was not allocated equally throughout the study groups.

CONCLUSIONS

The comparison showed that those who studied the final academic year had slightly better responses comparing to students of first academic year. It is significant to highlight that the result shows the increased level of quality and knowledge that are being transferred to students before graduation. It's fair to say that final year students have acquired more skills and better knowledge as a result of the curriculums thought in the faculty of dentistry.

Considering the constraints of the study, it can be concluded that the findings indicate that knowledge, attitude, and practicing dental students in the oral radiology are not up to standard. A new and more effective approach to undergraduate education must be developed, taking into account these requirements, which is the duty of the faculty.

It is obvious that the future of dentistry depends on dentist students' knowledge, attitudes, and practices regarding oral radiology and radio protective measures. It is impossible to disregard the dangers of radiation exposure, and adequate steps must be taken to safeguard both patients and medical staff.

Recommendation

It is recommended to do more studies are needed to evaluate the current status of oral radiography processing solutions education and practice in different cities and settings, and to identify the best methods to improve the learning outcomes and clinical performance of dental students.

Therefore, based on these findings, more regular training and continuing education programs are suggested to keep dental students up to date with the latest radiological and diagnostic techniques.

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The authors declare that they have no conflict of interests.

Authors' Contribution:

Every author has made an equal contribution.

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APPENDIX

Attachment 1: Tables and Figures

Table 1: Demographic

Demographic data		Frequency of responses	Percentage of responses
Gender	Male	31	27.9%
	Female	80	72.1%
Age (year)	<20	48	43.2%
	21	7	6.3%
	22	5	4.5%
	23	44	39.6%
	>24	7	6.3%
Educational level	First- year	55	49.5%
	Final- year	56	50.5%
City	Zawia	103	85.8%
	Tripoli	4	3.3%
	Al-ajelat	1	0.8%
	Zwara	1	0.8%
	Al_zahra	1	0.8%
	Almaya	1	0.8%

Table1 2: Correct and incorrect answers per year group in relation to items 1–35

	First- year n (%)	final- year n (%)	Total n (%)
Incorrect	1325(77.71)	528 (30.41)	1853 (53.85)
Correct	380 (22.29)	1208 (69.59)	1588 (46.15)
Total	1705	1736	3441

$\chi 2$= 774.3. P-value=0.000**

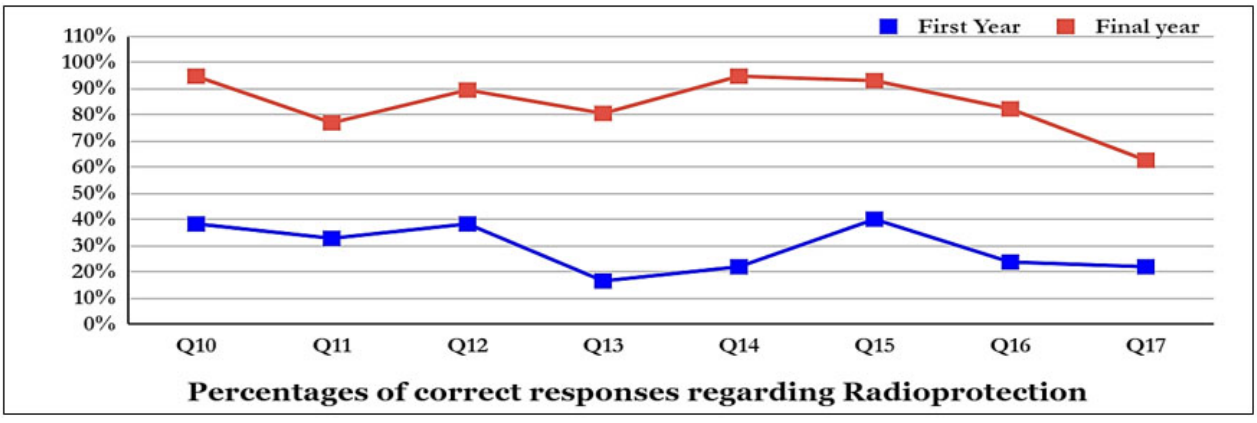

Figure 1: Percentages of correct responses regarding all question of questioner; 1st (22.4%), final (70.39%).

Table 3: Correct and incorrect answers per year group in relation to items 1–9 of Domain Essential Knowledge

Domain		First- year n (%)	Final- year n (%)	Total n (%)
Principles Knowledge	Incorrect	341 (68.89)	272 (53.97)	613 (61.36)
	Correct	154 (31.11)	232 (46.03)	386 (38.46)
	Total	495	504	999

χ2= 23.4. P-value= 0.000**

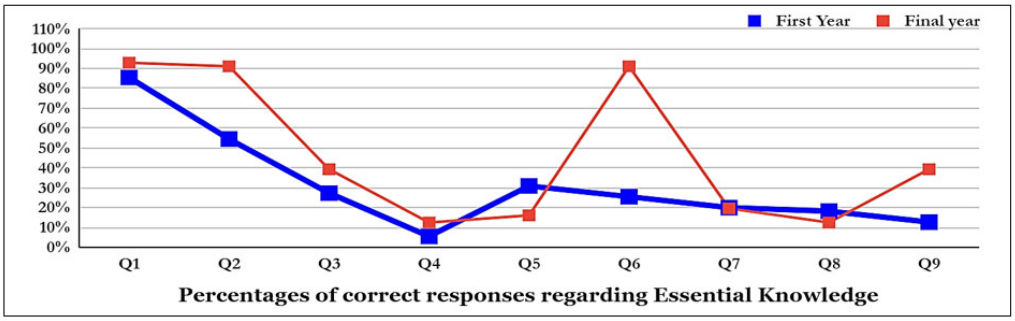

Figure 2: Percentages of correct responses regarding Essential knowledge; 1st (31.11%), final (46.00%).

Table 4: Correct and incorrect answers per year group in relation to items 10–17 of Domain Radioprotection

Domain		First- year n (%)	final- year n (%)	Total n (%)
Radioprotection	Incorrect	315(71.59)	85 (18.97)	400 (45.05)
	Correct	125 (28.41)	363 (81.03)	488 (54.95)
	Total	440	448	888

χ2=248.2. P-value=0.000**

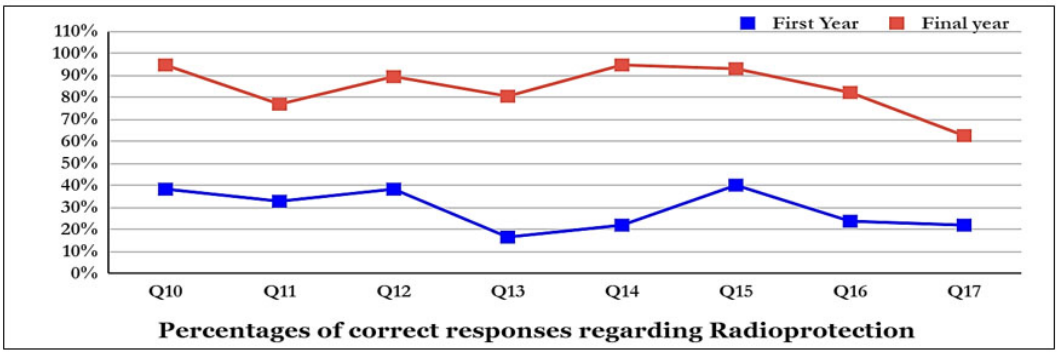

Figure 3: Percentages of correct responses regarding radioprotection; 1st (29.09%), final (84.15%).

Table 5: Correct and incorrect answers per year group in relation to items 18–22 of Domain Attitude and Practice

Domain		First- year n (%)	final- year n (%)	Total n (%)
Attitude and Practice	Incorrect	236 (85.82)	44 (15.71)	280 (50.45)
	Correct	39 (14.18)	236 (84.29)	275 (49.55)
	Total	275	280	555

χ2=272.7. P-value=0.000**

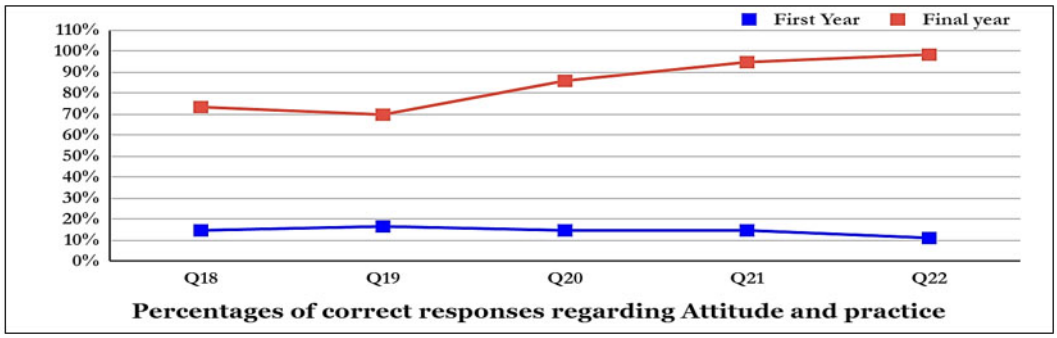

Figure 4: Percentages of correct responses regarding Attitude and practice; 1st (14.16%), final (84.26%).

Table 6: Correct and incorrect answers per year group in relation to items 23–26 of Domain Techniques of oral radiographs

Domain		First- year n (%)	final- year n (%)	Total n (%)
Techniques	Incorrect	189 (85.91)	42 (18.75)	231 (52.03)
	Correct	31 (14.09)	182 (81.25)	213 (47.97)
	Total	220	224	444

χ2=200.5 P-value=0.000**

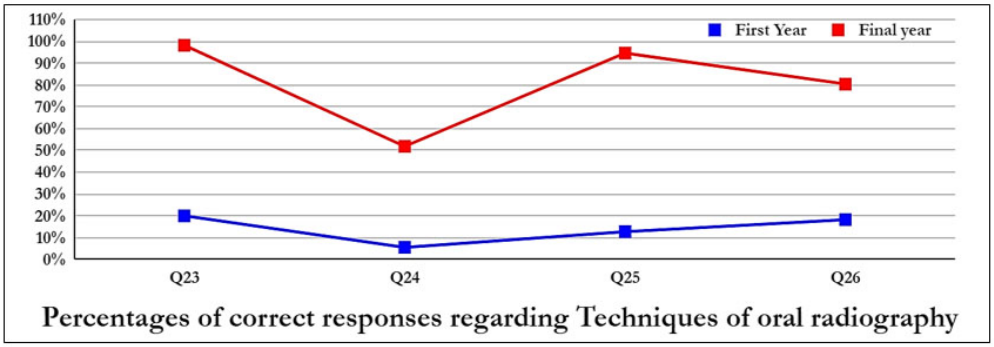

Figure 5: Percentages of correct responses regarding techniques of oral radiography in conservative dentistry and endodontics; 1st (14.10%), final (81.25%).

Table 7: Correct and incorrect answers per year group in relation to items 27- 31 of Domain Interpretation

Domain		First- year n (%)	final- year n (%)	Total n (%)
	Incorrect	244(88.73)	85 (30.36)	329 (59.28)
Interpretation	Correct	31 (11.27)	195 (69.64)	226 (40.72)
	Total	275	280	555

χ2=195.8 P-value=0.000**

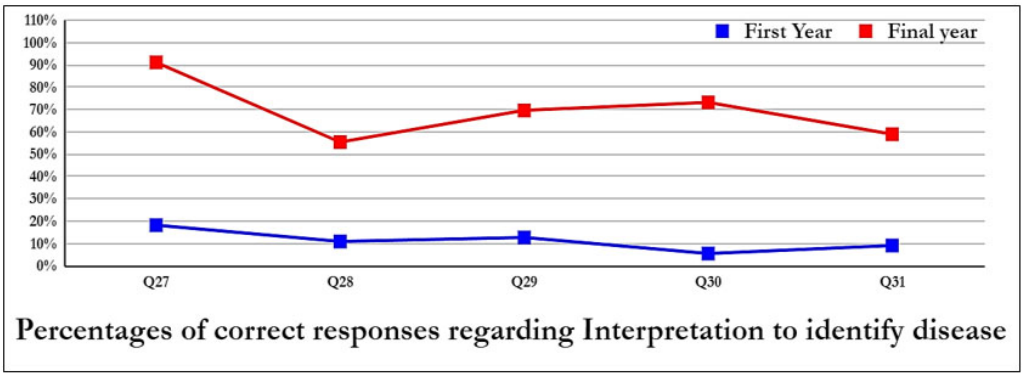

Figure 6: Percentages of correct responses regarding Interpretation to identify disease; 1st (11.28%), final (69.60%).

Attachment 2: Questionnaire Study on dentist's students

Name: .....

Gender: ☐ Male ☐ Female

Age: .....

Academic Year ☐ 1st year ☐ 2nd year ☐ 3rd year ☐ Final year

Work in the radiology department: ☐ Yes ☐ No

The city where you live: .....

I.	Principles knowledge	Yes	No	Do not know
1.	X-rays are electromagnetic radiation.	✓		
2.	It is not possible to generate x-rays without power supply.	✓		
3.	The oil in the tube head is heated when the x-ray machine is turned on, even if no exposure is performed.		✓	
4.	The room must be immediately isolated if x-ray tube is broken.		✓	
5.	A radiograph fixed within 15 seconds is adequate for diagnosis.		✓	
6.	Covering the processing solutions can extend their usage time.	✓		
7.	Rinse stops the action of the developer in the manual processing.		✓	
8.	Digital radiography has less harmful effects compared to conventional radiography		✓	
9.	Does dental radiograph absolutely contraindicated in pregnant patients?		✓	
II.	Radioprotection	Yes	No	Do not know
10.	Radiographic examination in pregnant women must be performed only in the second trimester of pregnancy in order to reduce the chance of deleterious effects.	✓		
11.	Protecting gonads from radiation is not necessary, because dental radiographs are taken in the head and neck region.	✓		
12.	All human tissues have the same radio sensitivity.		✓	
13.	Whole body low-intensity-fractionated irradiation is more dangerous than high-intensity-localized irradiation.	✓		
14.	X-ray operators have minimal chance of somatic effects if they correctly adopt the radioprotection rules.	✓		
15.	An adequate maintenance of the x-ray machine results in better productivity, and protection for both operator and patient.	✓		
16.	Parents should hold films in children's mouth if they do not cooperate during examination.	✓		
17.	Periapical radiographs are strictly indicated for children only in cases of emergency.		✓	

III. Attitude and practice	Yes	No	Do not know
18. While taking radiographs do you use thyroid collar?	✓		
19. Do you prefer to hold the films during exposure?		✓	
20. Do you adjust exposure time depends on the patient and required tooth?	✓		
21. Do you use plastic barrier to cover the sensor?	✓		
22. Do you follow disinfection protocol after each patient?	✓		
IV. Technique	Yes	No	Do not know
23. Bite-wing radiographs are indicated to investigate dental decay.	✓		
24. Occlusal radiographs are indicated to investigate bucco- lingual bone expansion.	✓		
25. Panoramic radiographs are indicated to investigate incipient caries lesions.		✓	
26. A full-mouth series (FMX) is indicated if many teeth are absent during physical examination.		✓	
V. Interpretation	Yes	No	Do not know
27. An unerupted superior left-canine had dislocated coincidently with the x-ray tube in the Clark method. Therefore, it is localized in a palatal position.	✓		
28. A diffuse radiolucency in the mandibular body, apically to lower molars, may indicate an aggressive lesion named "Stafne bone defect".		✓	
29. Since it onset, dental decay is radiographically detected.		✓	
30. Multilocular ameloblastoma has a ground-glass appearance.		✓	
31. Tooth displacement and bone expansion are typical of malignant lesions		✓	