Knowledge, attitude, and perception of dental undergraduates and interns on radiographic protection in Iraq.

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Abstract

Background: Radiation hazards are harmful and precarious, especially considering professional negligence or ignorance. **Objectives:** This study aims to assess the knowledge, attitude, and perception (KAP) of undergraduate dental students and interns toward radiation protection protocols. **Design:** This study is institutional based. **Materials and method:** The study participants comprised 255 dental undergraduate students and interns, whose curriculum includes dental radiology. Information was collected from each participant through structured questionnaires (18 questions) containing answers in the form of multiple choices. Statistical analysis, frequency distribution and percentage were determined, and chi-square test was performed to evaluate the statistical significance. **Results:** Among the 255 samples enrolled in the study, 75 were interns and 180 were undergraduates (85 and 95 from third and fourth years, respectively). The overall correct response was 79%, which in descending order was interns (92%) > fourth-year students (86%) > third-year students (60%). **Conclusion:** The KAP level with regard to radiation protection protocol was highest with interns and the least with the third-year students. This outcome necessitates incessant teaching to ensure maximum safety.

Keywords: Knowledge, attitude, dental undergraduates, radiographic

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Introduction

X-radiations are harmful to living tissues, and it is sufficiently intense to cause cancer, leukemia and genetic damage. Nevertheless, the benefits derived from the diagnostic application of X-rays in medicine and dentistry is remarkable. The effects of X-rays on humans are the result of interactions at atomic levels [1]. These biological effects can be divided into two broad categories, namely, deterministic and stochastic effects [2]. Deterministic effects are those in which the severity of the response is proportional to the dose. These effects occur in people when the dose is sufficiently large. Deterministic effects have a dose threshold below which response is not evident. By contrast, stochastic effects are those in which the probability of occurrence of the change, rather than its severity, is dose-dependent [1, 2]. Thus, stochastic effects lay the patients and the operating personnel at high risk because such effects do not have dose thresholds. On this basis, dental radiograph should be prescribed for patients only when the benefit of disease detection outweighs the risk of damage from X-radiation [3]. In 1977, the International Commission on Radiological Protection (ICRP) developed the risk/benefit concept. This concept recommends that all patient exposure must be justified and kept as low as possible. Thus, following the "As Low as Reasonably Achievable" (ALARA) principle during dentist routine work is mandatory. However, the ALARA principle is not strictly applied in the dental field [4]. Despite the biological hazards of X-ray, enormous benefits are derived from its application in medical and dental fields. Furthermore, dental imaging produces least radiation dose compared to medical imaging [5]. Dental students and dentists are at risk from radiation hazards. Thus, they should have a thorough knowledge of the biological hazards of X-ray and different protection protocols. Moreover, internationally published data about the knowledge, attitude, and perception (KAP) of students and dentists in Al Najaf, Iraq are unavailable, regards biological hazards and radiographic protection techniques, the present study aims to assess the KAP of Iraqi dental students, interns, and dentists on the biological hazards of dental X-ray and appropriate

radiographic protection. Moreover, this study aims to compare KAP among third, fourth year's dental students and interns.

Materials and methods

A cross-sectional questionnaire-based study was performed at Al Kufa University College of Dentistry in Al Najaf. The total number of participants was 290. However, 35 were excluded, either because they refused to participate or the collected questionnaire had missing information. The study sample included 255 clinical undergraduates (third and fourth years) students, and the interns were one-year residential doctors. A questionnaire related to radiation protocol in the form of multiple choices was given to each participant, and the response sheets were collected after one hour. The questionnaire used in this study was adapted from similar previous studies [4, 6]. Among the 18 questions, 16 were close-ended and 2 were leading questions. Prior to the administration of the questionnaire, institutional ethical committee approval was obtained, and the participants were informed about the importance of the study and included only on a voluntary basis. The responses from the participants were then computed into a Microsoft Excel worksheet and evaluated using Statistical Package for the Social Sciences Software version 25 (USA) for descriptive statistics, frequency distribution and percentage were determined, and chi-square test was performed to evaluate the statistical significance.

Results

Among the 255 samples, 85 students (32 males, 53 females) were in their third year, 95 students (28 males, 67 females) were in their fourth year, and 75 were interns (26 males, 49 females). Classification of the participants based on gender showed a predominance of female participants (66%), on the basis of gender distribution, the answers of the participants, no statistically significant difference was found between the answers of males and females (Table 1).

Table (1): Classification of the participants based on academic year and gender

Levels	Females		Males		Total		p-value
	N	%	N	%	N	%	0.501
Third year	53	31	32	37	85	33	
Fourth year	67	40	28	33	95	37	
interns	49	29	26	30	75	29	
Total	169	100	86	100	255	100	

A clear consensus was observed among interns and fourth-year students to almost all questions. For the question are the dental X-rays harmful, 100% of the participants gave the correct responses. The difference among the responses in all three groups was statistically significant. Approximately 89% of the participants gave the correct response for the question whether X-ray reflects from the walls. The difference among the responses in all three groups was statistically significant. With regard to the awareness of National Council on Radiation Protection and Measurements (NCRP)/ICRP recommendations, 92% of the participants provided the correct responses. The difference among the responses in all three groups was statistically significant. Moreover, 88% of the participants were aware of the radiation hazard symbol. The difference among the responses in all three groups was statistically significant. The usefulness of the collimators and filters in dental radiography were known in 89% of the participants. The difference among the responses in all three groups was statistically significant. The knowledge of the deterministic and stochastic effects and ALARA principle was known among 86% of the participants. The difference among the responses in all three groups was statistically significant. Approximately 73% of the participants provided the correct response that digital radiography requires less exposure than conventional one. The difference among the responses in all three groups was statistically significant. About 81% of the participants correctly answered that high-speed film has less exposure. The difference among the responses in all three groups was statistically significant. Approximately 96% of the participants do not prefer to hold film during exposure. The difference among the responses in all three groups was statistically significant. Approximately 60% of the participants responded correctly that they should not ask patients to hold the film directly and instead use film holders; most of the correct answers were from fourth-year students and interns. The difference among the responses in all three groups was statistically significant. Nearly 68% of the participants answered that dental radiographs are not absolutely contraindicated for pregnant patients. The difference among the responses in all three groups was statistically significant. About 78% of the participants wear personal monitoring badges under a lead apron.

The difference among the responses in all three groups was statistically significant. Out of all the participants, 71% responded that they would adhere to radiation protection protocols at the time of their future private clinical practice; whereas other participants answered that their compliance would depend on space availability, financial reasons, and having a private clinical setup. The difference among the responses in all three groups was statistically significant. During radiographic exposure, the dental X-ray tube should be focused through the open space; 59% of the participants provided the correct answer for this. The difference among the responses in all three groups was statistically significant. About 88% of the participants were aware of the ideal distance of the operator from machine and provided the correct response. The difference among the responses in all three groups was statistically insignificant. Approximately 51% of the participants prefer to use lead aprons regularly and provided correct responses, whereas the remaining participants do not prefer to use it due to unavailability or due to the weight of the apron, and others prefer to follow the position distance rule. The difference among the responses in all three groups was statistically significant (table 2)**.**

Table 2: shows the Questions given to the participant and their responses

Q	Response	III year (%)	IV year (%)	Interns (%)	p-value
1.Dental X-rays are harmful?	yes	33	37	29	0.000
	no	0	0	0	
2.X-rays can be reflected from the walls of the room	yes	2	1	1	0.000
	no	25	36	27	
	Don't know	6	0	1	
3.Are you aware of NCRP/ ICRP recommendations	yes	27	35	29	0.000
	no	6	2	0	
4.Are you aware of the radiation hazard symbol	yes	24	35	29	0.000
	no	10	2	0	
5.Are you aware of usefulness of collimators and filters in dental radiography	yes	25	36	29	0.000
	no	9	2	1	
6.Are you aware of deterministic effects, stochastic effects and ALARA principle	yes	21	36	29	0.000
	no	13	1	0	
7.Does digital radiography requires less exposure than conventional?	yes	12	35	27	0.000
	no	2	1	1	
	Don't know	20	2	1	
8.High speed films reduces exposure	yes	18	36	27	0.000
	no	2	1	1	
	Don't know	14	1	1	
9.Do you prefer to hold the films in your hand during exposure	yes	3	0	1	0.004
	no	30	37	29	
10.Will you ask the patient to hold the film with their hand during exposure	yes	30	6	4	0.000
	no	3	31	25	
11.Dental radiographs are absolutely contraindicated for pregnant patients	yes	24	3	1	0.000
	no	6	35	27	
	Don't know	4	0	1	
12.Personal monitoring badges should be worn by the operator	Above the lead apron	0	5	5	0.001
	Below the lead apron	27	27	23	
	Doesn't matter	4	3	1	
	Don't know	2	2	0	
13.Will you adhere to radiation protection protocol at the time of your future private clinical practice	yes	24	20	27	0.000
	no	6	15	2	
	Don't know	4	2	1	
14.If no/ don't know why	Depends on space availability	12	27	3	0.930
	Because of financial reasons	9	18	3	
	Private clinical setup has less radiation exposure hence it	4	4	1	

	does not require stringent protection measures				
	Others	8	9	1	
15.During radiographic exposure the dental x-ray tube should be focused through open space	yes	13	6	5	0.000
	no	5	31	23	
	Don't know	15	0	1	
16.The ideal distance an operator should stand (position distance rule) while dental radiographic exposure is	4 feet and 900-1350	1	1	1	0.137
	4 feet and 600-900	1	0	0	
	6 feet and 900-1350	27	35	27	
	6 feet and 600-900	5	2	2	
17.Do you prefer to regularly use lead Aprons	yes	14	13	24	0.000
	no	18	22	1	
	rarely	1	2	4	
18.If no/rarely why	Non-availability of apron	2	6	2	0.000
	Due to weight of the apron	28	9	0	
	Common apron for all	2	5	2	
	Will follow Position distance rule	8	30	6	

Discussion

Over the years, certain studies about the measurement of radiation exposure have indicated increased occurrence of cancer, birth defects, and cataracts and shortening of life span. Although nonconclusive, these findings may not hold well for diagnostic dental radiography because it is still acceptable given that possibility of a hazard cannot be proven [7]. This situation has produced the ALARA principle, which recognizes the possibility that no matter how small that dose is, some stochastic effects may occur [2, 8]. The radiation protection can be achieved when the operating personnel possesses thorough knowledge and apply it in clinical situations. The questionnaire given in this study was prepared as close-ended on most occasions to obtain accurate response in relevance to knowledge, whereas the evaluation of attitude and perception required leading questions. The evaluation of the results showed that all the participants were aware of the fact that X-rays used in diagnostic dental radiology are harmful and that certain levels of precautions should be taken while in use. Among all the groups evaluated, a subtle variation was noted with regard to the knowledge and understanding of the basic physics of radiation in an ascending order as follows: third-year students > fourth-year students > interns. This study showed that all the participants (100%) knew that dental X-rays are harmful, and 89% of them were aware of the reflection of X-rays from wall; this result is in agreement with that of Prabhat *et al*., who reported 100% and 88%, respectively [1]. The result of the awareness of the NCRP/ICRP recommendations in the present study is 92%, which is near the result of Prabhat *et al*. [1] and higher than Arnout [4] (27%), whereas Arnout and Jafar [6] and Shah *et al*. [9] reported 20% and 56%, respectively. Radiological protection criteria are based on ICRP and NCRP recommendations. Approximately 88% of the participants were aware of the radiation hazard symbol, which agrees with Shah *et al*. (83%) [9] and Prabhat *et al*. (89%) [1]. Usefulness of collimators and filters in dental radiography was known by 89% of the participants. Conversely, Arnout reported only 44% [4], Arnout and Jafar reported an acceptable 73% [6], Enabulele and Igbinedion reported 50% [11], whereas Prabhat *et al*. [1] and Rahal *et al*. [10] reported high results (90% and 83.3%, respectively). The knowledge of deterministic and stochastic effects and ALARA principle were evident in 86% of the participants, which is similar to Shah *et al*. (98.6%) [9] and Prabhat *et al*. (84%) [1], whereas Arnout and Arnout and Jafar reported only 33% and 40%, respectively [4, 6]. Enabulele and Igbinedion reported very low outcome of 17.9% [11]. For the question about less exposure for digital dental radiograph, the number of correct answers was 73%, which is similar to the findings of Rahal *et al*. (73%) [10] ; Arnout reported 86% [4], Shah *et al*. reported a promising 88% [9], Arnout and Jafar reported a low 40% [6], and Prabhat *et al*. reported a good 75%. High-speed films are efficient in reducing radiation doses [1]. Recent research indicates that F-speed films have a similar or higher contrast compared with Ektaspeed Plus Films and reduce patient exposure up to 20% [10]. In this context, 81% of participants were aware that high-speed film requires less exposure. Arnout reported 66% [4], Shah *et al*. reported 87% [9], Arnout and Jafar reported 47% [6], and Prabhat *et al*. reported a good 78% [1]. To achieve optimum safety, the dentist must not hold the film in place for the patient during the procedure. The response rate not to hold the films directly during exposure were 96%; Arnout reported a high 94% [4], Arnout and Jafar reported a low 46.7% [6], and Prabhat *et al*. reported a high 97% [1]. For the question about asking the patients to hold the film with their hand during exposure, 60% of the participants answered that they do not do this. Arnout and Jafar also reported a low 40% [6], whereas Prabhat *et al*. reported an average of 64% [1], and Rahul *et al*., reported 58.6% [10]. Only 68% of the participants answered that dental radiograph is not absolutely contraindicated in pregnant patients. Similarly, Arnout reported 67% [4], Shah *et al*. reported 65% [9], Prabhat *et al*. reported 59% [1], whereas Arnout and Jafar reported a poor 20% [6]. Practitioners should take all possible precautions to

minimize the risk, including use of lead apron and thyroid collar. The results obtained from the present study showed that 32% of the participants did not have sufficient knowledge regarding the diagnostic dental radiation risk and protection measures during pregnancy. Personal radiation monitoring devices or dosimeters are badges that detect various forms of radiation that workers may be exposed to. Workers are required to wear dosimeters for periods of up to three months. The accumulated dose from the various types of radiation is measured by the dosimetry service provider and reported to the employer [12]. In the present study, only 78% of the participants were aware that personal monitoring badges should be worn by operators under the lead apron. This finding agrees with the report of Arnout (78%) [4]. Approximately 71% participants were willing to adhere to radiation protection protocols in the future. Arnout reported a high 82% [4]; similarly, Shah *et al*. reported a high 89% [9], and Prabhat *et al*. reported 81% [1]. By contrast, Arnout and Jafar reported an average of 53% [6]. The remaining 29% reasoned that space availability, financial constraints, and personal interest may prevail above protocol adherence. The percentage of awareness for the distance question was 88%; the participants knew about the correct position and distance rule. This finding agrees with those of Prabhat *et al*. and Shah *et al*. who reported a high 87% [1, 9]. Lead has been found to be the best protection against diagnostic X-rays. A well-chosen lead apron can reduce the effective dose by 75%–90% [12, 14]. During radiographic exposure, the dental X-ray tube should be focused through open space, and the operator should stand at least 6 feet from the patient at the angle of 90°–135° to the central ray of the X-ray beam. In application, this rule not only takes advantage of the inverse square law of reducing X-ray exposure to the operator but also takes advantage of the fact that in this position, the patient's head absorbs most scattered radiation [15]. Approximately 51% of the participants showed awareness regarding the use of lead apron on a regular basis. The remaining of the participants have various opinions regarding the avoidance of use of lead apron on a regular basis, such as unavailability of lead apron, weight, and the apron use by all. Arnout [4], Shah *et al*. [9], and Arnout and Jafar [6] reported a low 13%, 31%, and 33%, respectively. Enabulele and Igbinedion [11] and Prabhat *et al*. [1] reported average values of 66% and 46%, respectively. In the current study design, a week after completion of the study, all the participants were recalled, and a reassurance program was conducted regarding the strict adherence of radiation protection protocol. The programs included a lecture on the basics of radiation physics, radiation biology, and protection and clinical demonstration on the usage of radiation protection barriers. A special emphasis was made on personal monitoring and operating environment as per the NCRP and ICRP guidelines.

Conclusion

On the basis of the responses obtained in this study, the KAP level of the participants with regard to radiation protection protocol was highest with the interns and lowest with the third-year students. The principle of radiation protection implies performing tasks that will minimize the exposure of patients and dental professionals while providing the benefits of diagnostic radiography to patients. The level of awareness was distributed (highest among interns, followed by fourth- and third-year students). Nevertheless, findings show that the more the participants were exposed to clinical situations, the more aware they become. Similar studies with reassurance programs at regular intervals should be performed at institutional and national levels for strict adherence of regulation protocols.

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