

Knowledge, Attitude and Perception among Egyptian Dental Undergraduates, Interns and Postgraduate Regard Biological Hazards and Radiologic Protection Techniques: A Questionnaire Based Cross-Sectional Study

Eman Arnout

Oral Medicine, Periodontology, Diagnosis and Oral Radiology, Faculty of Dentistry, Ain- Shams University, Cairo, Egypt
emanarnooo@gmail.com

Abstract: *Background:* Dental Imaging has a benefit to patients; however, it carries a potential harm from being ionizing type of radiation. As the clinical year dental students, interns and dentists will be at risk from radiation hazards during their life, they should have thorough knowledge towards the biological hazards of x-ray and different protection protocols. *Objectives:* To assess and compare knowledge, attitude and perceptions (KAP) among Egyptian dental undergraduates, postgraduate and interns towards biological hazards of dental x-ray and appropriate radiographic protection techniques. **Materials & Methods:** The study participants included 152 subjects. This study was done via an online survey questionnaire which was sent by mail. The questions of the questionnaire were divided into three parts, 1st part to classify them into undergraduate dental students, interns & post graduate dentist. The 2nd part of questions was to assess KAP of x-ray biological hazards and the 3rd part of questions was to assess KAP of radiographic protection techniques. **Results:** Among 152 participants were answered the questionnaire. They were classified to 33 Undergraduate, 44 Internships & 75 Postgraduate dentists. Over all the correct response was ranged from 18.2% - 97% for the undergraduate dental students, 13.6- 88.6 % for the internships & from 21.6 % - 90.7% of post graduate dentists. A clear consensus was noticed among interns, undergraduate and postgraduate to almost all questions. **Conclusion:** The Knowledge, attitude and perception (KAP) level regard the biological hazards effect of x-ray and different protection protocols were noted to be ranged from low to high in all groups. This outcome necessitates continual teaching to ensure maximum safety toward x-ray.

[EmanArnout. **Knowledge, Attitude and Perception among Egyptian Dental Undergraduates, Postgraduate and Interns Regard Biological Hazards and Radiologic Protection Techniques: A Questionnaire Based Cross-Sectional Study.** *Life Sci J* 2014;11(6):9-16]. (ISSN:1097-8135). <http://www.lifesciencesite.com>. 2

Key words: Knowledge, Attitude, Radiography, Protection, Hazards, Dentists

1. Introduction

Dental Imaging has a definite benefit to the patient; however, it carries a potential harm from being ionizing type of radiation. A statistical association has been reported between dental X-ray and increased occurrence of thyroid cancer, intracranial meningioma and salivary gland tumors. (1-3)

Although the radiation doses used for dental imaging seems to be low relatively to medical doses, but the cumulative doses are high due to repeated examinations over time. The unfettered habit of requesting dental radiographs could lead to unnecessary radiation exposure. (4, 5)

It is notable that ionizing radiation has either direct or indirect biological damaging effect. DNA damage including single or double strands break or cross link is one of x-ray hazards. (6)

Occurrence probabilities of Biological hazards are classified into: stochastic and Non-stochastic effect. Stochastic effect, meaning that there is no deterministic dose that could lead to biological damage. Non stochastic or deterministic effect, on which there is determined dose above which the

damaging insults start to appear. High-dose ionizing radiation has deterministic and stochastic effects. In contrary to lower doses, radiation hazards are primarily stochastic rather than deterministic. (7, 8)

Mutually dentist and patient's are at a high risk to stochastic effects as it has no dose threshold. (9)

Since 1977, the International Commission on Radiological Protection (ICRP) began to develop the risk/benefit concept. This concept is recommended that all patient exposure must be justified and kept as low as possible. So it is a mandatory issue to follow ALARA principle "As Low As Reasonably Achievable" during dentist routine work. (10, 11)

However, ALARA principles are not strictly applied in the dental field. (12, 13)

The dentists should justify the criteria of dental imaging selection in order to reduce radiation. Although the selection criteria for dental radiographs has been revised and published in agreement with guidelines and peer-reviewed research materials of USA, Europe& Korea, (14-16) little has been published on this subject in Egypt.

Many techniques and equipments have been developed to reduce biological hazards to patients as

well as operators.¹⁰ This includes appropriate collimation, proper film speed selection, use of a lead apron and thyroid collar as well as application of appropriate positioning protocol during exposure.(¹⁷⁻¹⁹)

As the clinical year dental students, interns and dentists will be at risk from radiation hazards during their life, they should have a thorough knowledge towards the biological hazards of x-ray and different protection protocols. Moreover, there has been no internationally published data about the KAP of dentists in Egypt regards biological hazards and radiographic protection techniques. The aim of the present study was to assess knowledge, attitude and perceptions of Egyptian dental students, interns and dentists towards biological hazards of dental x-ray and appropriate radiographic protection. Moreover, to compare KAP, between undergraduate, interns and post graduate.

2. Materials and methods

The present cross sectional study was performed on 152 participants. The responders were classified to 33 undergraduate dental students, 44 interns & 75 post graduate dentists. The purpose of this classification was to determine whether the clinical experience years were more informed about radiation safety.

This study was done among Egyptian dental colleges via an online survey questionnaire (<https://www.surveymonkey.com/>). It was sent by mail, it was anonymous & voluntarily to apply.

KAP assessments were gathered with questionnaire following Prabhat *et al.*, 2011 with slight modification. (19)

The questions of the questionnaire were divided into three categories of questions:

First group of questions was to classify the samples to undergraduates, interns & post graduates. Moreover, to classify the gender of the participants and to be sure that all the included samples had study oral radiology course.

Second questions group were to assess the KAP towards the biological hazards of x-ray. This part was enclosed of 5 questions (2, 3, 4, 5& 9) as shown in Table2.

The third categories of questions were to assess the KAP towards the radiographic protection techniques and equipments. This part was enclosed of 13 questions (6- 8, 10-19) as shown in Table2.

Statistical Analysis:

A non-parametric one-way ANOVA (Kruskal-Wallis) test followed by paired group comparisons using Chi-square test were used to analyses the difference between the internship students, postgraduates and undergraduates.

Statistical analysis was performed with IBM® SPSS® (SPSS Inc., IBM Corporation, NY, USA) Statistics Version 21 for Windows.

3. Results

Responders

The study participants included 152 subjects; they were classified to 33 undergraduate, 44 Internships & 75 Postgraduate dentists. The response rate was 45.5% male and 54.5% female among the undergraduate students, while 48.0% male and 52.0% female among postgraduates and no sexual predilections for interns. Table 1

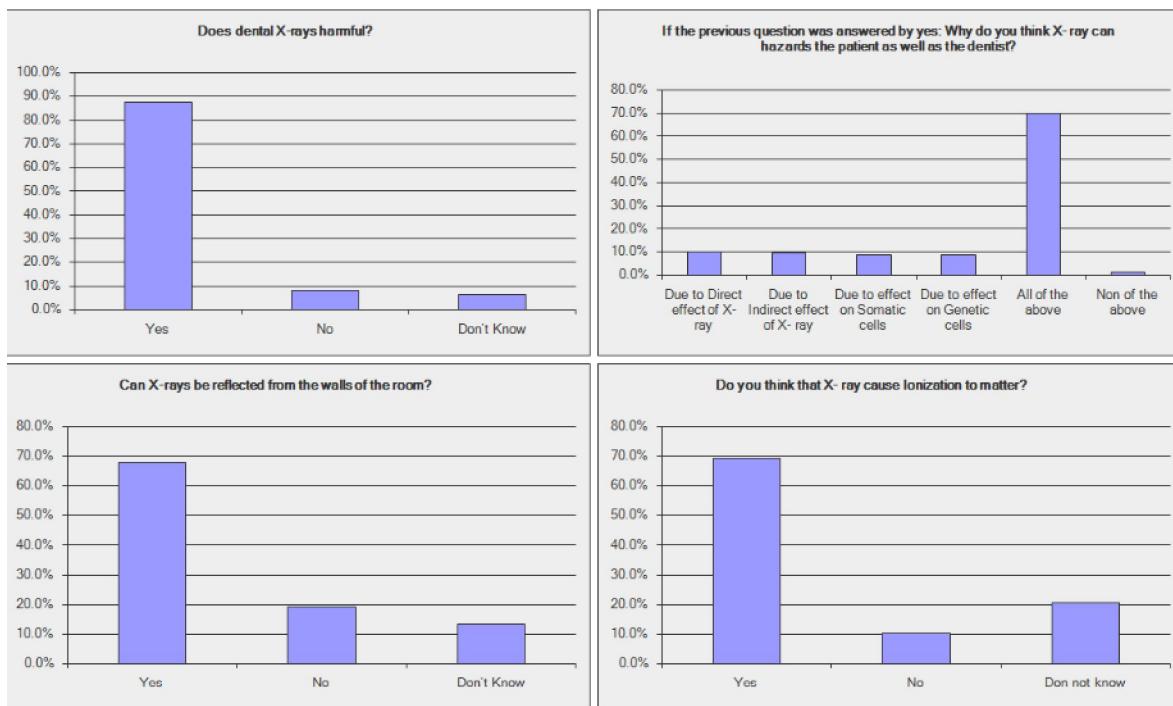
Table 1: Classification of the participants based on grouping

		Group						Total	
		Undergraduate		Internships		Postgraduate			
		Count	Column N %	Count	Column N %	Count	Column N %		
Gender	Male	15	45.5%	22	50.0%	36	48.0%	73	
	Female	18	54.5%	22	50.0%	39	52.0%	79	
Total		33			44		75	152	

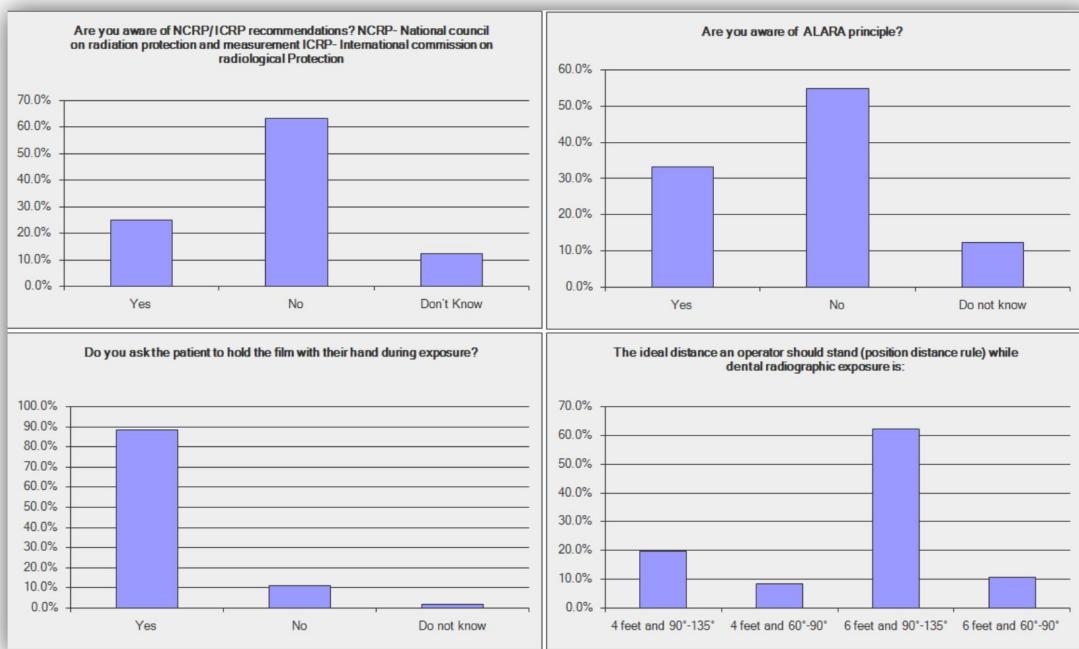
KAP results

Regards the general KAP towards biological hazards of dental imaging, the overall correct responses were ranged from 19.3% to 69.9%. While

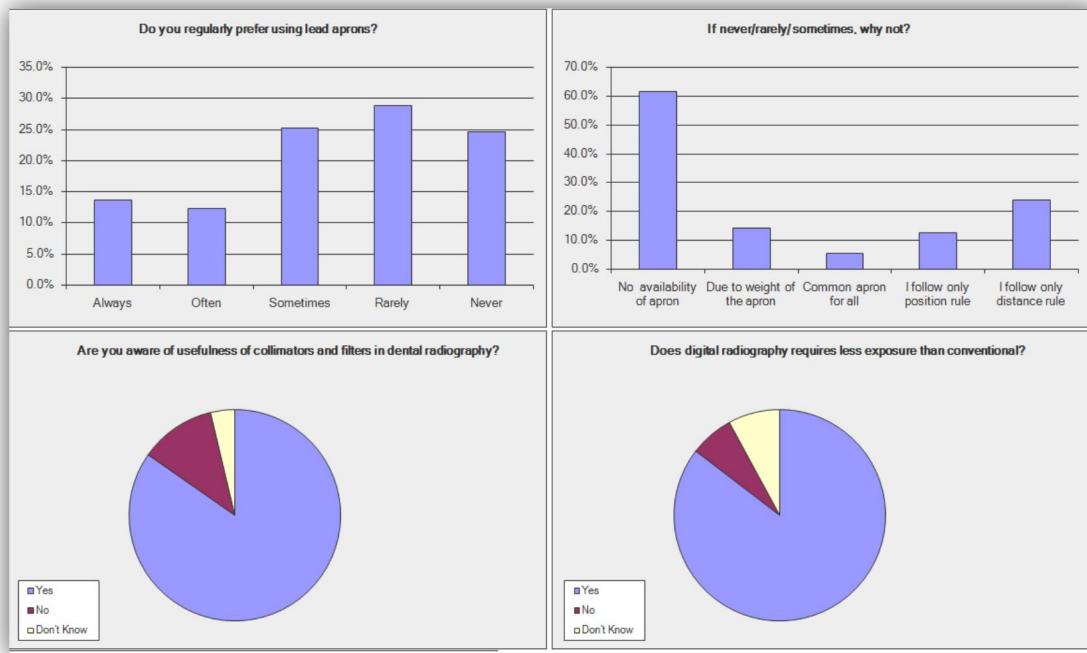
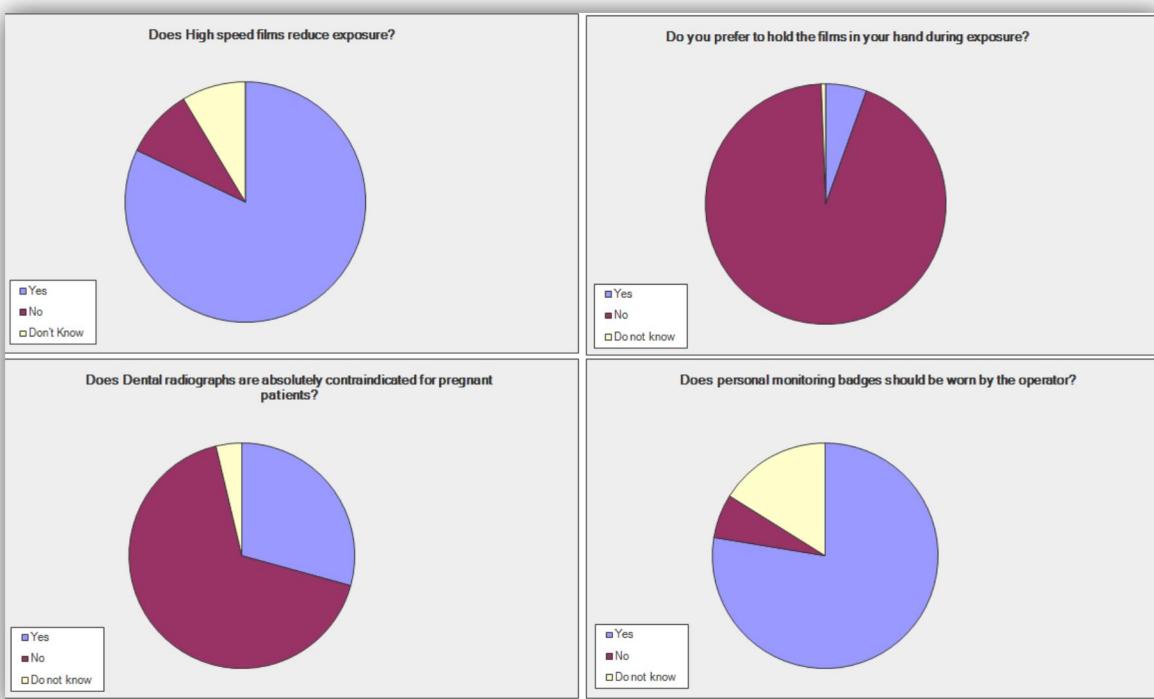
regards KAP towards radiographic protection techniques & equipments, the overall correct responses were ranged from 25% to 93.9%. Figures 1, 2, 3& 4.



Figure, 1: From the column chart 87.5% of the samples were know that dental X-rays were harmful, 19.3% knows that X-rays can not be reflected from the room walls, 69.5% knows that X-ray is ionizing type of radiation. A 69.9% of the participants understand that the hazards from x-ray because of direct & indirect effect on either somatic or genetic cells.



Figure, 2: From the column chart only 25% of the participants knows NCRP& 33.3% knows ALARAA principle. A 88.3% of the responders let the patients hold dental film by their finger. 62.1% of the responders were understand the proper positioning of the operator during dental exposur.

F
d
c
ey
S
S

Figure, 4: The pie charts showed that 65.6% of the student understand that high speed films reduce, 93.9% of the responders prefer not to hold dental film by their finger exposure, 67.1% of the responders know that dental radiographs were not absolutely contraindicated to pregnant patients & 77.6% of them realize the importance of wearing the personal monitoring badges

Comparison between KAP among undergraduates, internship and postgraduate's dental students:

A clear consensus was noticed among interns, undergraduate and postgraduate to almost all questions except to question that ask: "Do you ask the patient to hold the film with their finger during exposure?", where only 84% postgraduate as compared to 97% and 97.7% of undergraduate and

internship students respectively ($P=0.017$) answered by No. Table2.

The response of the undergraduate students, when compared with postgraduate and interns showed insignificant difference in majority of questions except "Do you regularly prefer using lead aprons?" where the Undergraduate students more likely to use the lead apron more than the internes and the postgraduate student. Table2.

Table 2: Table showing the Questions given to the participant and their responses group wise

No.	Questions	Group						p-value	
		Undergraduate		Internships		Postgraduate			
		Count	%	Count	%	Count	%		
1	Did you complete Oral Radiology course that teach x-ray physics?	Yes	33	100.0%	44	100.0%	75	100.0%	1.00 NS
		No	0	0.0%	0	0.0%	0	0.0%	
2	Are dental X-rays harmful?	Yes	27	81.8%	35	79.5%	69	92.0%	0.158 NS
		No	4	12.1%	8	18.2%	2	2.7%	
		Don't Know	2	6.1%	1	2.3%	4	5.3%	
3	If the previous question was answered by yes: Why do you think X-ray can hazard the patient as well as the dentist?	Due to Direct effect of X-ray	3	12.0%	3	8.3%	1	1.4%	0.361 NS
		Due to Indirect effect of X-ray	3	12.0%	2	5.6%	7	10.0%	
		Due to effect on Somatic cells	2	8.0%	4	11.1%	6	8.6%	
		Due to effect on Genetic cells	2	8.0%	1	2.8%	5	7.1%	
		All of the above	15	60.0%	26	72.2%	51	72.9%	
		Non of the above	0	0.0%	0	0.0%	0	0.0%	
4	Can X-rays be reflected from the walls of the room?	Yes	23	69.7%	31	70.5%	49	66.2%	0.939 NS
		No	6	18.2%	6	13.6%	16	21.6%	
		Don't Know	4	12.1%	7	15.9%	9	12.2%	
5	Do you think that X-ray cause ionization to matter?	Yes	24	72.7%	31	70.5%	55	73.3%	0.922 NS
		No	4	12.1%	4	9.1%	7	9.3%	
		Don't Know	5	15.2%	9	20.5%	13	17.3%	
6	Are you aware of NCRP/ ICRP recommendations? NCRP-National council on radiation protection and measurement ICRP- International commission on radiological Protection	Yes	11	33.3%	9	20.5%	21	28.0%	.310 NS
		No	19	57.6%	28	63.6%	47	62.7%	
		Don't Know	3	9.1%	7	15.9%	7	9.3%	
7	Are you aware of ALARA principle?	Yes	28	84.8%	39	88.6%	68	90.7%	0.641 NS
		No	3	9.1%	5	11.4%	6	8.0%	
		Don't Know	2	6.1%	0	0.0%	1	1.3%	
8	Are you aware of usefulness of collimators and filters in dental	Yes	15	45.5%	17	38.6%	37	49.3%	0.301 NS
		No	16	48.5%	19	43.2%	32	42.7%	

	radiography?	Don't Know	2	6.1%	8	18.2%	6	8.0%	
9	Are you aware of deterministic effects and stochastic effects?	Yes	10	30.3%	15	34.1%	27	36.0%	0.917 NS
		No	20	60.6%	26	59.1%	38	50.7%	
		Don't Know	3	9.1%	3	6.8%	10	13.3%	
10	Does digital radiography requires less exposure than conventional?	Yes	31	93.9%	34	77.3%	66	88.0%	0.095 NS
		No	1	3.0%	5	11.4%	4	5.3%	
		Don't Know	1	3.0%	5	11.4%	5	6.7%	
11	Do High speed films reduce exposure?	Yes	32	97.0%	34	77.3%	62	82.7%	0.07 NS
		No	0	0.0%	7	15.9%	6	8.0%	
		Don't Know	1	3.0%	3	6.8%	7	9.3%	
12	Do you prefer to hold the films in your hand during exposure?	Yes	1	3.0%	1	2.3%	5	6.7%	0.319 NS
		No	31	93.9%	43	97.7%	70	93.3%	
		Don't Know	1	3.0%	0	0.0%	0	0.0%	
13	Do you ask the patient to hold the film with their finger during exposure?	Yes	32	97.0%	43	97.7%	63	84.0%	0.017*
		No	1	3.0%	1	2.3%	11	14.7%	
		Don't Know	0	0.0%	0	0.0%	1	1.3%	
14	Does Dental radiographs are absolutely contraindicated for pregnant patients?	Yes	11	33.3%	14	31.8%	14	18.7%	0.077 NS
		No	22	66.7%	30	68.2%	58	77.3%	
		Don't Know	0	0.0%	0	0.0%	3	4.0%	
15	Do personal monitoring badges should be worn by the operator?	Yes	28	84.8%	36	81.8%	60	80.0%	0.858 NS
		No	1	3.0%	3	6.8%	5	6.7%	
		Don't Know	4	12.1%	5	11.4%	10	13.3%	
16	Will you adhere to radiation protection protocol at the time of your future private clinical practice?	Yes	28	84.8%	37	84.1%	64	85.3%	0.978 NS
		No	2	6.1%	1	2.3%	2	2.7%	
		Don't Know	3	9.1%	6	13.6%	9	12.0%	
17	What is the ideal distance an operator should stand (position distance rule) while dental radiographic exposure?	4 feet and 90°-135°	8	24.2%	7	15.9%	9	12.0%	0.091 NS
		4 feet and 60°-90°	5	15.2%	5	11.4%	2	2.7%	
		6 feet and 90°-135°	17	51.5%	29	65.9%	58	77.3%	
		6 feet and 60°-90°	3	9.1%	3	6.8%	6	8.0%	
		Always	8	24.2%	3	6.8%	7	9.3%	
18	Do you regularly prefer using lead aprons?	Often	7	21.2%	2	4.5%	9	12.0%	0.004*
		Sometimes	10	30.3%	14	31.8%	19	25.3%	
		Rarely	4	12.1%	15	34.1%	19	25.3%	
		Never	3	9.1%	10	22.7%	20	26.7%	
		Skipped	1	3.0%	0	0.0%	1	1.3%	
		No availability of apron	24	72.7%	33	75.0%	47	62.7%	
19	If never/rarely/ sometimes, why not?	Due to weight of the apron	1	3.0%	2	4.5%	11	14.7%	0.440 NS
		Common apron for all	2	6.1%	1	2.3%	1	1.3%	
		I follow only position rule	2	6.1%	3	6.8%	5	6.7%	
		I follow only distance rule	4	12.1%	5	11.4%	11	14.7%	

4. Discussion

It has been proofed that there were association between radiation exposure and increase occurrence of cancer, abortion, fetus mutagenic changes, cataracts and shortening of life span. Although the previous statement being non-definite and May not applied well for diagnostic dental radiography, it is still acceptable by applying stochastic biological hazards effect. (20)

The radiation effect could be stochastic effects which follow the probability of occurrence of biological hazards effects, independently, compared to deterministic one. That is to say, the effects pursue all or none role response i.e. the patient may either showed biological damaging effect or not affected at all, with a minimal radiation exposure. From that point, the radiation protection protocol should focus in prevention of the deterministic effects occurrence and to reduce the probability of stochastic one. That is why the dentist should be restricted to the ALARA principle concept which keeping radiation exposure "As Low As Reasonably Achievable". (11, 20, 21)

So, a thorough knowledge about the biological hazards of x-ray is a must in order to perform proper radiation protection protocols. Considering this, in the present study, Undergraduate dental students, interns and post graduate dentists were selected.

The result of the present study showed that among all groups, 87.5% of Undergraduate, 81.8% of the Internships and 92.0% of Postgraduate group were considered x-ray to be harmful. Relatively it is a high percentage especially for the postgraduate. This could be explained by strong x-ray physics course which emphasizing on biological hazards and different methods of protection.

Through your daily work, a classic question is usually asked by patients and by the technician, was presented in the questionnaire: Can X-rays be reflected from the walls of the room? , 69.7% of the undergraduate, 70.5% of the internships and 66.2% of the 2nd group answered by Yes. This result is appalling if you think that the entire participant will use dental radiographs in a regular basis.

The present study showed that 33.3% of the Undergraduate dental students and 31.8% of the Internships considering that it is absolutely contraindicated to make dental radiograph to pregnant female. To simplify this result, about 30- 50 % of the future dentist will dismiss the pregnant women from their clinic, regardless their pregnancy semester, the level of emergency & regardless the different precautions measurement that should be done for these deprived women. On the other hand 77.3% of postgraduate dentists knew that taking radiograph of pregnant female is not absolutely contraindicated. Although the percent is relatively

higher than 2 previous groups, it is still low for the clinical application.

When the participants were questioned about the importance of collimators and filtration in dental x-ray machine: Only 30.3% of the undergraduate, 34.1% of the internships and 36.0% of the postgraduate dentists were answered by yes. Moreover, when they were asked about their awareness of deterministic & stochastic effect, about 70 % of the undergraduate, 66 % of the internships and 64 % of the postgraduate dentists were unaware of the probability of occurrence of radiation biological damage.

In support to our previous results, Prabhat *et al.*, 2011, evaluated undergraduate dental students & interns in their study, their results showed over all, the correct response was 77.3% and it was noted in descending order from Interns 90.62%, followed by fourth year (83.8%) and third year students (61%). (19)

Conclusion:

From the response obtained through our study, it is obvious that the KAP level of the biological hazards effect of x-ray was low to medium in all groups. Radiation protection principle is to take certain precautions that will minimize exposure to dental professional and patient together with gaining benefits for the patients. Although the level of KAP of the different protection protocols of the both groups were found to be ranged from medium to high general knowledge, this outcome necessitates continual education to ensure maximum safety. So, it is preferable to do refresh program at regular intervals at institutional and national level for strict adherence of different radiographic protection regulation protocols.

Corresponding author

Eman Arnout; BDS, MDS, Ph.D.
Lecturer of Oral Radiology, Faculty of Dentistry,
Ain-Shams university
Email address: emanarnoo@gmail.com

References:

- Preston-Martin S, White SC. Brain and salivary gland tumors related to prior dental radiography: implications for current practice. J Am Dent Assoc 1990; 120: 151-8.
- Memon A, Godward S, Williams D, Siddique I, Al-Saleh K. Dental x-rays and the risk of thyroid cancer: a case-control study. ActaOncol 2010; 49: 447-53.
- Claus EB, Calvocoressi L, Bondy ML, Schildkraut JM, Wiemels JL, Wrensch M.

- Dental x-rays and risk of meningioma. *Cancer* 2012; 118: 4530-7.
4. Martinez Beneyto Y, AlcarazBanos M, Perez Lajarin L, Rushton VE. Clinical justification of dental radiology in adult patients: a review of the literature. *Med Oral Patol Oral Cir Bucal* 2007; 12: E244-51.
 5. Dental Association Council on Scientific Affairs. The use of cone-beam computed tomography in dentistry. An advisory statement from the American. *The Journal of the American Dental Association* (August 1, 2012) 143, 899-902,
 6. Ribeiro DA, de Oliveira G, de Castro G, Angelieri F. Cytogenetic biomonitoring in patients exposed to dental X-rays: comparison between adults and children. *Dentomaxillofac Radiol* 2008; 37: 404-407.
 7. United Nations Scientific Committee on the Effects of Atomic Radiation. UNSCEAR 2006 Report to the General Assembly with Scientific Annexes. Effects of Ionizing Radiation. Volume I Report and Annexes A and B. New York, NY: United Nations, 2008.
 8. U.S. National Academy of Sciences, National Research Council, Committee to Assess Health Risks from Exposure to Low Levels of Ionizing Radiation. Health Risks from Exposure to Low Levels of Ionizing Radiation. BEIR VII Phase 2. Washington, DC: National Academies Press, 2006.
 9. Haring JI, Lind LJ. Chapter 5: Radiation protection in Textbook of Dental Radiography Principles and Techniques. W.B. Saunders. Company 1996. P 64 – 79.
 10. ICRP. Recommendations of the ICRP. ICRP Publication 26. Ann ICRP 1977; 1: 1-53.
 11. White SC, Pharoah MJ. Chapter 2: Radiation biology in Oral Radiology Principles and Interpretation, Fifth edition. Mosby, St. Louis 2004. P 25 – 46.
 12. Kantor ML. 2006. Longitudinal trends in the use of individualized radiographic examinations at dental schools in the United States and Canada. *J Dent Educ*; 70: 160-8.
 13. Byung-Do Lee1, John B. Ludlow. 2013. Attitude of the Korean dentists towards radiation safety and selection criteria. *Imaging Science in Dentistry*; 43: 179-84
 14. Frederiksen NL. Guidelines for prescribing dental radiographs. United States Food and Drug Administration. *Tex Dent J* 1995; 112: 63-7.
 15. Tyndall DA, Price JB, Tetradiis S, Ganz SD, Hildebolt C, Scarfe WC. Position statement of the American Academy of Oral and Maxillofacial Radiology on selection criteria for the use of radiology in dental implantology with emphasis on cone beam computed tomography. *Oral Surg Oral Med Oral Pathol Oral Radiol* 2012; 113: 817-26
 16. Byung-Do Lee & John B. Ludlow. Attitude of the Korean dentists towards radiation safety and selection criteria. *Imaging Science in Dentistry* 2013; 43: 179-84
 17. Ilgüt D, Ilgüt M, Dinçer S, Bayırlı G. Survey of dental radiological practice in Turkey. *Dentomaxillofac Radiol* 2005; 34: 222-7.
 18. American Academy of Pediatric Dentistry, Ad Hoc Committee on Pedodontic Radiology. Guideline on prescribing dental radiographs for infants, children, adolescents, and persons with special health care needs. *Pediatr Dent* 2012; 34: 189-91.
 19. MPV Prabhat, S Sudhakar, B Praveen Kumar, Ramaraju. Knowledge, attitude and perception (KAP) of dental undergraduates and interns on radiographic protection- A questionnaire based cross-sectional study. *Journal of Advanced Oral Research*, Vol 2; Issue 3: September 2011
 20. Karjodkar FR. Chapter 6: Protection from radiation in Textbook of Dental and Maxillofacial Radiology, First edition. Jaypee brothers, New Delhi. P 49 – 65.
 21. World Health Organisation, Geneva. Efficacy and radiation safety in interventional radiology. Chapter 2: Radiation safety. A.I.T.B.S. Publishers & Distributors (Regd.) Delhi – 51. First edition 2002: P 26 – 55.