Knowledge and awareness of radiation hazardsand safety among dental hygienists, dental Assistants and dental assistant interns in Riyadh, Saudi Arabia

ABSTRACT

Introduction: X-ray plays a significant role in the field of dentistry and has a variety of uses in dental practice from diagnosis of tooth decay, periodontal diseases and bone defects to more sophisticated applications such as precision implant planning.The dental staff personnel use different modalities of X-rays on daily basis such as intra-oral radiography and cone beam computed tomography, although diagnostic X-rays have low quantum of ionizing radiation safety measures should be taken into consideration.All health care personnel are trained regrading radiation hazard and safety measures.

Aim: To identify the level of Knowledge and awareness about radiation hazards and safety practices among dental hygienists, dental assistants and dental assistant interns in Riyadh, Saudi Arabia.

Materials and Methods: A survey based on cross sectional study was conducted among (n=321) dental hygienists, dental assistants and dental assistant interns in Riyadh, Saudi Arabia. The survey was distributed using mixed methods as handout papers and online mediums.The questionnaire comprised of 14 questions (the total of demographic data was four (4) questions and for knowledge and awareness was ten (10) questions .

Results: From the (321) participants (75.7 %) responses had expected correct answers.

The majority of participants (86%) considered dental x-rays to be harmful to all types of patients.

Conclusion: Within limitations of this study, dental assistants, dental hygienists and dental assisting interns had adequate knowledge and awareness of radiation hazards and safety measures, however, there is a need for continual teaching of ALARA principle and radiation safety protocols during pregnancy to ensure maximum safety.

1. INTRODUCTION

From the time of its discovery, X rays have played an important role in the field of medical and dental science. Ranging from diagnostic to therapeutic applications, the use of X rays is manifold (Almaghrabi et al, 2016).

Probably, the most widespread application is in the field of dentistry from the simple diagnosis of incipient caries, miniscule fractures to aiding in more complex procedures such as precision implant planning (Bushong et al, 2017).

Radiographic investigations in medicine cause radiation exposure to both the patient and the radiographer, and care is to be taken to protect both (Fahmida et al, 2018).

In dental practice diagnostic X-rays posses low quantum of ionizing radiation and currently the policy of practice is to minimize the exposure to ionizing radiation to as low as possible. All dental care personnel should follow the guidelines to reduce the harmful effects of radiation (Hwang et al, 2018).

When diagnostic dental radiographs are taken , both patients and health care personnel are exposed to ionizing radiation, although dental radiography posses low quantum of ionizing radiation maximum caution must be taken to minimize exposure of both dental staff and patients (Hobbs et al, 2018).

Exposure to dental X-rays is associated with potential risk of cancer for instance a correlation between full-mouth X-rays and salivary gland cancer was revealed in previous studies in addition to increased risk of laryngeal cancer. Furthermore, Leukaemia and low birth weight have been reported as systemic health outcomes related to dental X-ray exposure (Motwani et al, 2019).

All health care personnel are trained regrading radiation hazard and safety measures as part of their education and must follow the guidelines to minimize radiation exposure to reduce the harmful effects of radiation (Ihle et al, 2019).

In 2014 Knowledge of biological hazards and radiation protection protocols were evaluated in Taibah University in Madinah SA. Responses were collected and compared between two groups of undergraduate dental students, (preclinical and clinical) where knowledge of biological hazards effects of X-ray was noted to be low to medium in the two groups and regrading different protection protocols knowledge levels ranged from medium to high also in the 2 groups. This outcome necessitates continual teaching to ensure maximum safety (Arnout et al, 2014).

When (Mahbob et al,2021), studied the knowledge, attitude and practice of radiation safety among dental students in the eastern province at King Faisal university, their results reflected the need to expand the curriculum to provide better exposure to radiation protection and its practice so that these students on graduation will be well-grounded with the principle governing dental radiography.

Furthermore, newly graduate dentists from Egypt and Saudi Arabia were found to be moderately competent regrading IR doses and related safety measures according to the findings of (Basha et al, 2022).

Furthermore, in 2022 Basha et al, conducted a cross-sectional study among newly graduated dentists in Egypt and Saudi Arabia assessing their knowledge about radiation

protection and they have concluded that newly graduated dentists from Egypt and KSA are moderately competent regarding IR doses and related safety measures.

Based upon evidence from indexed databases, there is a significant lack of studies from Middle Eastern countries that have investigated the knowledge of dental assistants, dental hygienists regarding IR protection.

Majority of previous studies evaluating the levels of knowledge and awareness of radiation hazards and safety measures were conducted among dental students, dental interns, and general practitioner.

Thus, the aim of this study is to evaluate the level of Knowledge and awareness about radiation hazards and safety practices among dental hygienists, dental assistants and dental assistant interns in Riyadh, Saudi Arabia.

2. MATERIAL AND METHODS

This is a cross sectional study to assess the level of radiation safety practices and awareness among (300) dental hygienists, dental assistants and dental assistant interns in Riyadh, Saudi Arabia.

The study was a questionnaire comprised of (14) questions in clinical and radiology practice.

Part one / 4 questions included the information regarding demographic data such as age, gender, job description, and years of work experience.

Part two / 10 questions which contained knowledge and awareness questions.

On receiving the approval from the institutional research and ethical committee of REU, the questionnaire was distributed among dental hygienists, dental assistants and dental assistant interns in Riyadh city and (321) responses were collected.

Inclusion criteria:

Dental hygienist practitioners, dental assistant practitioners and dental assistant interns.

Exclusion criteria

Other allied dental practitioners.

Validity of the questionnaire

The questionnaire for the present study was developed from pre validated questionnaire from “Knowledge on Radiation Protection & Practice among Dental Students’’ (Swapna et al,2017).

Data analysis

The data was collected in the excel sheets.Descriptive statistics of frequency distribution and percentages were calculated for the categorical variables. A Chi-square test was applied to compare knowledge and awareness responses across different age, gender, job description

and years of work experience. The data was analyzed using SPSS version 25 (IBM-Armonk, NY, USA). A (P-value) of $p<0.05$ was considered significant for all the statistical tests.

3. RESULTS AND DISCUSSION

According to the job description the more significant of the Dental Assisting participants (77%) than Dental Hygienist (21%) and Dental assisting Interns (2%).

Fig .1 Graphical distribution based on job description.

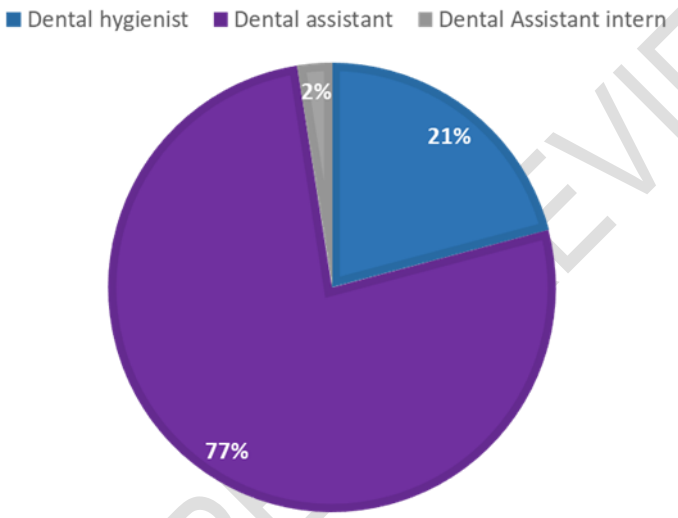
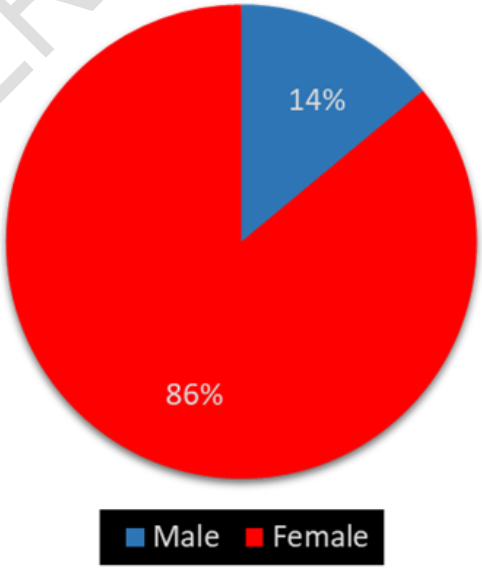
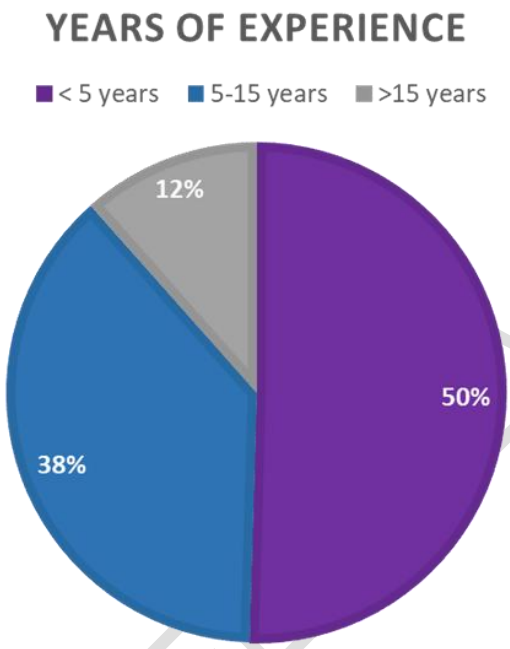


Fig .2 Graphical distribution based on gender of the participants.



According to the gender of (321) participants the majority of female more than male .

Fig 3. Graphical distribution based on years of experience



According to the years of work experience the participants less than 5 years of work experience (50%) and (38%) participants of 5-15 years and (12%) had greater than 15 years of experience .

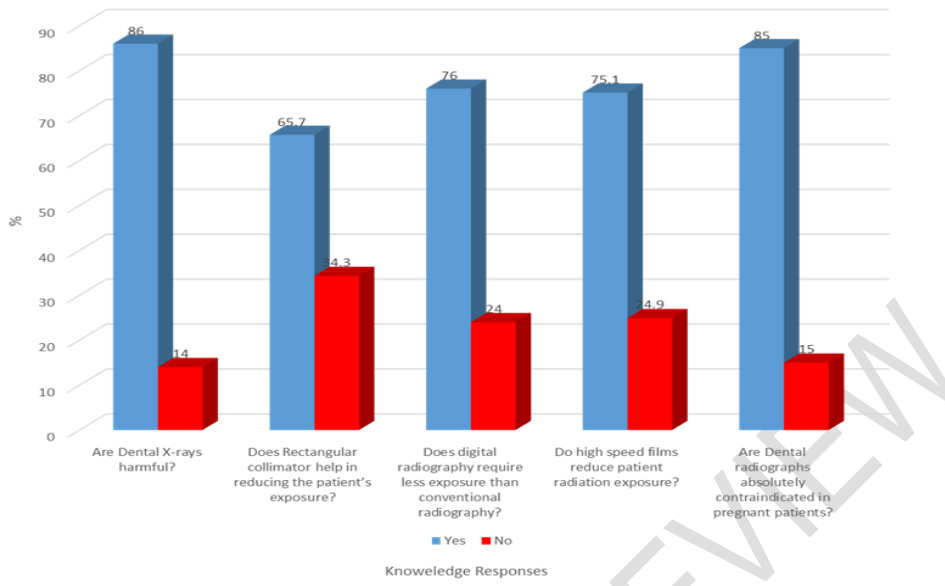


Fig .4Graphical distribution based on knowledge of the respondent.

The evaluation of the response to our questionnaire showed that majority of participants had adequate knowledge of radiation hazard and safety measures with 75.7% correct responses with majority of participants (86%) consider dental x-rays to be harmful.

85% of the participants considered dental radiographs to be absolutely contraindicated in pregnant women in contrary to the ADA radiation guidelines during pregnancy state that dental radiography is safe if performed when only necessary for the treatment and with following safety and protection guidelines and using all exposure reduction methods.

Based on our results the participants had adequate knowledge of measures used to reduce radiation exposure such as the use of rectangular collimator, digital radiography and high -speed films.

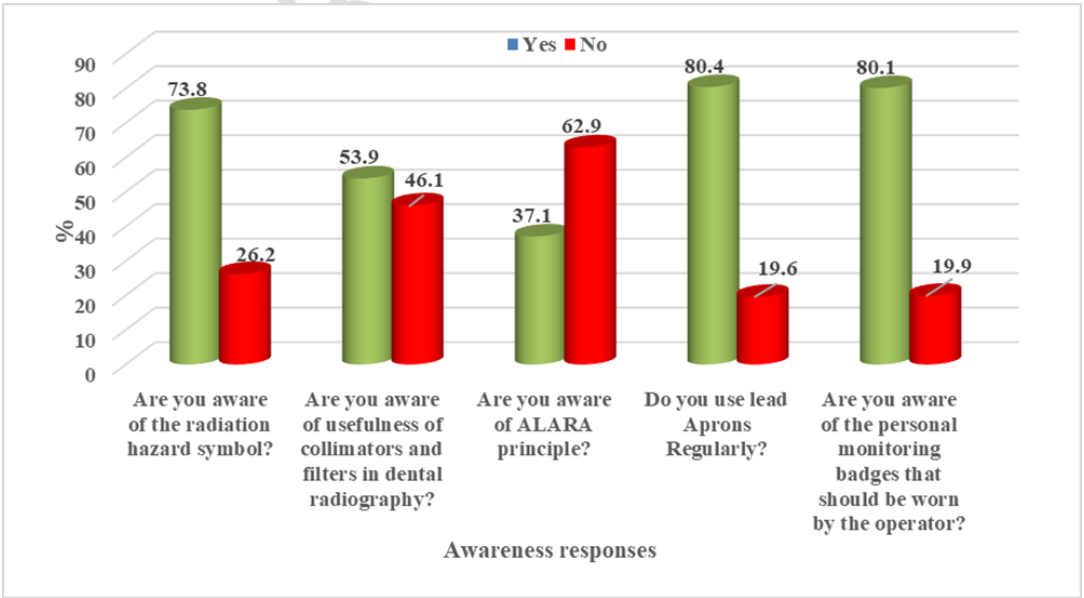


Fig .5 Graphical distribution based on awareness of the respondent.

73.8% of participants were aware of the radiation hazard symbol, however, only 53.9% of participants were aware of the usefulness of collimators and filters in dental radiography.

80.4% used lead Aprons regularly, and 80.1% of participants were aware of wearing their personal monitoring badges while operating.

However, only 37.1% of participants were aware of ALARA principle.

Table 3: knowledge and awareness of radiation hazard and safety between genders						
Variables		Male (n=45)		Female (n=276)		p
		n	%	n	%	
Are Dental X-rays harmful?	Yes	36	80.0%	240	87.0%	0.213
	No	9	20.0%	36	13.0%	
Does Rectangular collimator help in reducing the	Yes	29	64.4%	182	65.9%	0.844
patientâ€™s exposure?	No	16	35.6%	94	34.1%	
Does digital radiography require less exposure than	Yes	28	62.2%	216	78.3%	.019*
conventional radiography?	No	17	37.8%	60	21.7%	
Do high speed films reduce patient radiation	Yes	32	71.1%	209	75.7%	0.507
exposure?	No	13	28.9%	67	24.3%	
Are Dental radiographs absolutely contraindicated in	Yes	32	71.1%	241	87.3%	0.005*
pregnant patients?	No	13	28.9%	35	12.7%	
Are you aware of the radiation hazard symbol?	Yes	38	84.4%	199	72.1%	0.081
	No	7	15.6%	77	27.9%	
Are you aware of usefulness of collimators and filters	Yes	28	62.2%	145	52.5%	0.227
in dental radiography?	No	17	37.8%	131	47.5%	
Are you aware of ALARA principle?	Yes	21	46.7%	98	35.5%	0.151
	No	24	53.3%	178	64.5%	
Do you use lead Aprons Regularly?	Yes	35	77.8%	223	80.8%	0.636
	No	10	22.2%	53	19.2%	
Are you aware of the personal monitoring badges	Yes	37	82.2%	220	79.7%	0.696
that should be worn by the operator?	No	8	17.8%	56	20.3%	

There was a statistically significant difference (P =0.005) between male and female participants regarding knowledge of absolute contraindication of dental x-rays in pregnant patients.

Table 3: Knowledge and awareness of radiation hazard and safety based on job description

Variables		Dental hygienist		Dental assistant		Dental Assistant intern		p
		n	%	n	%	n	%	
Are Dental X-rays harmful?	Yes	58	86.6%	212	86.2%	6	75.0%	0.661
	No	9	13.4%	34	13.8%	2	25.0%	
Does Rectangular collimator help in reducing the patient's exposure?	Yes	49	73.1%	155	63.0%	7	87.5%	0.127
	No	18	26.9%	91	37.0%	1	12.5%	
Does digital radiography require less exposure than conventional radiography?	Yes	51	76.1%	185	75.2%	8	100.0%	0.271
	No	16	23.9%	61	24.8%	0	0.0%	
Do high speed films reduce patient radiation exposure?	Yes	51	76.1%	184	74.8%	6	75.0%	0.976
	No	16	23.9%	62	25.2%	2	25.0%	
Are Dental radiographs absolutely contraindicated in pregnant patients?	Yes	56	83.6%	212	86.2%	5	62.5%	0.169
	No	11	16.4%	34	13.8%	3	37.5%	
Are you aware of the radiation hazard symbol?	Yes	52	77.6%	179	72.8%	6	75.0%	0.724
	No	15	22.4%	67	27.2%	2	25.0%	
Are you aware of usefulness of collimators and filters in dental radiography?	Yes	39	58.2%	126	51.2%	8	100.0%	-
	No	28	41.8%	120	48.8%	0	0.0%	
Are you aware of ALARA principle?	Yes	29	43.3%	86	35.0%	4	50.0%	0.341
	No	38	56.7%	160	65.0%	4	50.0%	
Do you use lead Aprons Regularly?	Yes	58	86.6%	194	78.9%	6	75.0%	0.344
	No	9	13.4%	52	21.1%	2	25.0%	
Are you aware of the personal monitoring badges that should be worn by the operator?	Yes	60	89.6%	191	77.6%	6	75.0%	0.090
	No	7	10.4%	55	22.4%	2	25.0%	

There was no statistically significant difference when comparing Knowledge and awareness of radiation hazard and safety among job description of participants.

Table 4: Knowledge and awareness of radiation hazard and safety based on years of work experience

Variables		< 5 years		5-15 years		>15 years		p
		n	%	n	%	n	%	
Are Dental X-rays harmful?	Yes	146	90.1%	99	81.1%	31	83.8%	0.090
	No	16	9.9%	23	18.9%	6	16.2%	
Does Rectangular collimator help in reducing the patient's exposure?	Yes	111	68.5%	78	63.9%	22	59.5%	0.502
	No	51	31.5%	44	36.1%	15	40.5%	
Does digital radiography require less exposure than conventional radiography?	Yes	130	80.2%	91	74.6%	23	62.2%	0.060
	No	32	19.8%	31	25.4%	14	37.8%	
Do high speed films reduce patient radiation exposure?	Yes	140	86.4%	79	64.8%	22	59.5%	.000*
	No	22	13.6%	43	35.2%	15	40.5%	
Are Dental radiographs absolutely contraindicated in pregnant patients?	Yes	138	85.2%	104	85.2%	31	83.8%	0.974
	No	24	14.8%	18	14.8%	6	16.2%	
Are you aware of the radiation hazard symbol?	Yes	124	76.5%	86	70.5%	27	73.0%	0.513
	No	38	23.5%	36	29.5%	10	27.0%	
Are you aware of usefulness of collimators and filters in dental radiography?	Yes	101	62.3%	54	44.3%	18	48.6%	.008*
	No	61	37.7%	68	55.7%	19	51.4%	
Are you aware of ALARA principle?	Yes	82	50.6%	29	23.8%	8	21.6%	.000*
	No	80	49.4%	93	76.2%	29	78.4%	
Do you use lead Aprons Regularly?	Yes	134	82.7%	94	77.0%	30	81.1%	0.489
	No	28	17.3%	28	23.0%	7	18.9%	
Are you aware of the personal monitoring badges that should be worn by the operator?	Yes	135	83.3%	94	77.0%	28	75.7%	0.329
	No	27	16.7%	28	23.0%	9	24.3%	

When comparing Knowledge and awareness of radiation hazard and safety based on years of work experience there was a statistically significant difference (P=0.000) regarding the use of high-speed films to reduce patient's radiation exposure, furthermore, awareness of usefulness of collimators and filters in dental radiography and awareness of ALARA principles showed a statistical significance of (P=0.008) and (P=0.000 respectively).

There are limited studies to evaluate awareness of radiation hazard and safety measures among allied dental specialists such as dental hygienists and dental assistants despite their exposure to dental x-rays as members of the clinical dental team.

Although dental radiography can be relatively safe due to its minimal exposure, it still can be hazardous. Radiation protection protocol should focus mainly on reducing the exposure to the dental personnel and the patients in dental office (Swapna et al,2017) and to achieve that a thorough radiography training and understanding of safety measures are required to ensure safety of dental staff and patients.

The results showed majority of participants had the knowledge of harmful effects of dental radiation and agreed that maximum caution should be taken while handling diagnostic imaging in dental setup.

For the question "are dental radiographs absolutely contraindicated in pregnancy?" 85% of our participants considered dental radiographs to be absolutely contraindicated in pregnant women, which was significantly higher when compared with previously conducted studies on

dental students and dental interns by Swapna et al in 2017 only where 46% of students believed it was absolutely contraindicated and another study by Razi et al conducted among dentists only 42% believed so.

For the same question there was a statistically significant difference (P =0.005) between male and female participants.

ALARA stands for :As low as reasonably achievable , this principle is pivotal to lower radiation exposure to absolute minimum for protection from hazards and in the present study 62.9% of participants were unaware of it ,and similar results were found in 2022 in a cross-sectional study by Basha et al , on newly graduated dentists from Egypt and Saudi Arabia and found 58% of their participants also lacking awareness of the ALARA principle, such findings are alarming.

4. CONCLUSION

Dental hygienists, dental assistants and dental assistant interns working in Riyadh city showed adequate knowledge and awareness of dental radiation hazards and use of protective measures during their work. However, there was a significant misconception regarding dental x-ray safety protocol during pregnancy.

In addition, we have found major lack of awareness of ALARA principle and the usefulness of different devices in dental radiography such as collimators and filters.

ETHICAL APPROVAL

Ethical approval was obtained from the research ethics committee of Riyadh Elm University. An informed consent was obtained from each participant after explaining the study in full and clarifying that participation is voluntary. Data collected were securely saved and used for the research purposes only

REFERENCES

1. Agrawal B, Dosi T, Hazari A, Maheshwari C, Rajput R, Yadav N. Evaluation of Radiation protection awareness amongst general dental practitioners of Western Rajasthan in India. J Int Oral Health 2015;7:51-5.

2. Aldossari H, Ahmed Naji A, Al Shammari AK. Evaluation of awareness on radiation protection and knowledge about ionising radiation among patients awaiting radiological examinations: A cross-sectional survey. Austin J Radiol. 2019;6(3):110

3. Almaghrabi. N. A Study of Knowledge & Awareness of Radiation Exposure Risk in Makkah, Saudi Arabia. Int J Adv Res 2016;4:1852-6.

4. Amizh P, Jayanth K. To study awareness about radiation protection among dental students of Chennai A questionnaire based study. Int J Pharm Bio Sci 2017;8:542 51.12.

5. Arnout EA, Jafar A. Awareness of biological hazards and radiation protection techniques of dental imaging- A questionnaire based cross-sectional study among saudi dental students. J Dent Health Oral Disorder & Therapy. 2014;1(2):1–7.

6. Bae JM. An overview of systematic reviews of diagnostic tests accuracy. Epidemiol Health 2014;36:e2014016.

7. BahreyniToossi MT, Malekzadeh M. Radiation dose to newborns in neonatal intensive care units. Iran J Radiol2012;9:145–9. 13.

8. Briggs-Kamara MA, Okoye PC, Omubo-Pepple VB. Radiation safety awareness among patients and radiographers in three hospitals in Port Harcourt. Am J Sci Ind Res. 2013;4:83–8.

9. Bushong SC.Radiologic Science for Technologists: Physics, Biology, and Protection. 10th ed. St. Louis, USA: Mosby; 2012.

10. Bushong SC. Radiologic Science for Technologists: Physics, Biology and Protection. 11th ed. St. Louis: Elsevier; 2017. p. 483 90.

11. Crane GD, Abbott PV. Radiation shielding in dentistry: an update. AustDent J 2016;61(3):277-281.

12. Fahmida R, Deepa G, Madhu S. Knowledge, attitude and practice of radiation exposure protection for pediatric patients among undergraduate dental students. Biomed Pharmacol J 2018;11:1143 51.

13. Halboub ES, Barngkgei I, Alsabbagh O, Hamadah O. Radiation-induced thumbs carcinoma due to practicing dental X-ray. Contemp Clin Dent 2015;6(1):116-118

14. Han GS, Cheng JG, Li G, Ma XC. Shielding effect of thyroid collar for digital panoramic radiography. Dentomaxillofac Radiol 2013;42(9):20130265.

15. Hobbs JB, Goldstein N, Lind KE, Elder D, Dodd GD, Borgstede JP. Physician knowledge of radiation exposure and risk in medical imaging. J Am Coll Radiol. 2018;15:34-43.

16. Hoogeveen RC, Hazenoot B, Sanderink GC, Berkhout WE. The value of thyroid shielding in intraoral radiography. DentomaxillofacRadiol2016;45:20150407.

17. Ihle IR, Neibling E, Albrecht K, Treston H, Sholapurkar A. Investigation of radiation protection knowledge, attitudes, and practices of North Queensland dentists. J Investig Clin Dent 2019;10:e12374.

18. Joen M, Laura J. Dental Radiography Principles and Techniques. 5th ed. St. Louis: Elsevier Saunders; 2017. p. 41 52.

19. Kim YJ, Cha ES, Lee WJ. Occupational radiation procedures and doses in South Korean dentists. Community Dent Oral Epidemiol 2016;44(5):476-484.

20. Lee B-D, Ludlow JB. Attitude of the korean dentists towards radiation safety and selection criteria. Imaging Sci. Dent. 2013;43(3):179–184.

21. Lingam Amara Swapna, Pradeep Koppolu, Bassel Takarji, Sadeq Ali Al-Maweri, Nagalaxmi Velpula3, Vani Chappidi3 and Lalitha Ch. Knowledge on Radiation Protection & Practice among Dental Students, British Journal of Medicine & Medical Research, 2017,19(7),8.

22. Motwani Mukta B, Tagade Pooja P, Dhole Apeksha S, Khator Apurva D. Knowledge and attitude amongst the dental and medical students towards radiation hazards and radiation protection: A questionnaire survey. Int J Dent Res 2019;4:43 8.

23. NazargiMahabob, Mahmoud Alabdulsalam , Abdulrahman Alabduladhem , Sulaiman Alfayz , Abdullah Alzuriq , Ali Mohammed Almomin, Knowledge, Attitude and Practice about radiation safety among the undergraduates in Eastern province dental college, Journal of Pharmacy and Bioallied Sciences, 2021, 13, (7).

24. Rajeshwari J, Raghunath D. Attitude and awareness about radiation protection among dental surgeons in North Karnataka: A questionnaire study. J Indian Acad Oral Med Radiol2018;30:115 9.

25. Rela R. Knowledge, attitude and practice of radiation protection protocols amongst students of a dental college. Dentistry 2019;9:1000530.

26. Roja Reddy K, Krishnan M, Ramesh T, Sravani Krishna B, Swathi G, Sai Praveen K. Evaluation of knowledge and awareness on practice of dental radiographic safety measures in West Godavari District, India –A questionnaire based cross sectional study. Acta Sci Dent Sci 2017;1:3 9.

27. Saia DA. Lange Q & A for the Radiography Examination. 9th ed. Columbus, Ohio: McGraw-Hill; 2012.

28. Shahab S, Kavosi A, Nazarinia H, Mehralizadeh S, Mohammadpour M, Emami M. Compliance of Iranian dentists with safety standards of oral radiology. DentomaxillofacRadiol. 2012;41:159–64.

29. Soha Mohamed Ali Basha, Munerah Saleh BinShabaib ,Shatha Subhi ALHarthi, Assessment of Knowledge towards Radiation Protection Measures among Newly Graduated Dentists from Egypt and the Kingdom of Saudi Arabia: A Questionnaire-Based Cross-Sectional Study, Dentistry Journal, 2022, 10, (8).

30. Su-Yeon Hwang, Eun-Sil Choi, Young-Sun Kim, Bo-Eun Gim, Mina Ha3, Hae-Young Kim. Environmental Health and toxicology journal, 2018;33 (4).

31. Toossi MTB, Akbari F, Roodi SB. Radiation exposure to critical organs in panoramic dental examination. Acta Med Iran 2012;50(12):809-813.

32. Xu P, Luo H, Huang G-L, Yin X-H, Luo S-Y, Song J-K. Exposure to Ionizing Radiation during Dental X-Rays Is Not Associated with Risk of Developing Meningioma: A Meta-Analysis Based on Seven Case-Control Studies. PLOS one 2015;10(2):e0113210.