

Knowledge and Practice of Radiation Protection among Dental Surgeons Practicing in Lahore

Knowledge of
Radiation
Protection
Among Dental
Surgeons

Shahlisa Hameedi¹, Sana Chaudhry², Faryal Ali Syed³, Nadia Muneer⁴, Omair Anjum⁵ and Muhammad Behzad Salahuddin¹

ABSTRACT

Objective: The aim of this study is to evaluate the knowledge of radiation protection among dental surgeons practicing in Lahore, Assess the strategies adopted in department for radiation protection and recommend remedial measures to improve the existing conditions.

Study Design: Cross-sectional study

Place and Duration of Study: This study was conducted at the Dental practitioners practicing in Lahore from September 2019 to March 2020.

Materials and Methods: A pre-designed questionnaire, containing the demographic information, questions to judge the knowledge of radiation protection and different strategies adopted in their setups for radiation protection, was distributed among 217 practicing dental surgeons of Lahore. These questionnaires were then retrieved and the data was collected and analyzed.

Results: 55.3% of the respondents were male with mean age of 41.54 ± 4.2 years. Majority only had basic knowledge regarding the harmful effects of x-rays while being unaware of the radiosensitive organs of the body, ALARA principle or position distance rule. 11.1% were aware of annual recommended dose limit for occupationally exposed workers. 46.1% used protective apparels with lead apron being most frequent. A significant number did not use any radiation monitoring device or use appropriate filtration and collimation.

Conclusion: Bulk of the dental surgeons exhibited unsatisfactory knowledge and adopted inadequate measures for radiation protection. The need of the hour is to organize periodic lectures and workshops to dispense latest teachings regarding the dangers of radiation and methods for the safety of workers as well as the patients.

Key Words: Dental Surgeons, Knowledge, Lahore, Practice, Radiation protection, x-rays

Citation of article: Hameedi S, Chaudhry S, Syed FA, Muneer N, Anjum O, Salahuddin MB. Knowledge and Practice of Radiation Protection among Dental Surgeons Practicing in Lahore. Med Forum 2021;32(2):71-75.

INTRODUCTION

The accidental discovery of x-rays by German physicist Wilhelm Roentgen gave birth to radiology. However, x-rays are ionizing electromagnetic radiations and exposure can lead to an array of health hazards¹.

1. Department of Community & Preventive Dentistry Department, Avicenna Dental College, Lahore.

2. Department of Oral Biology, Avicenna Dental College, Lahore.

3. Department of Orthodontics, De'montmorency College of Dentistry, Lahore.

4. Department of Dental Materials, Avicenna Dental College, Lahore.

5. Department of Dental Materials, Lahore Medical & Dental College, Lahore.

Correspondence: Shahlisa Hameedi, Assistant Professor, Community & Preventive Dentistry Department, Avicenna Dental College, Lahore.

Contact No: 0321-5248688

Email: dr.shahlisa@gmail.com

Received: August, 2020

Accepted: October, 2020

Printed: February, 2021

Increased radiation exposure causes cell death, whereas limited exposure leads to damage or change in the DNA of irradiated cells². These effects are categorized as either stochastic effects, which are not dose-related, such as cancer, or deterministic effects, such as necrosis or burns, which are only observed after relatively high-dose exposure³. Children are even more susceptible to the effects of ionizing radiation, with the probability of developing carcinoma being the most in childhood and becoming less with progression of age⁴.

Radiology holds fundamental importance in dentistry for diagnosis, planning and monitoring of treatment as well as follow up⁵. It plays innumerable roles from the basic diagnosis of caries, minute fractures to assisting in complicated processes like implant planning⁶. Dental surgeons employ radiographs more frequently than other medical specialties with the radiographic modalities varying from intraoral periapical radiograph to advanced techniques like cone beam computed tomography⁷. Increased use of cone beam computed tomography in orthodontics patients has been associated with the increased incidences of breast cancers in female patients, especially during age range of 10 to 30 years⁸. Various studies exhibit increased

incidence of thyroid and breast carcinomas in female dentists and more frequent development of melanomas in male dentists⁹.

The main principle of radiation protection is to curtail radiation exposure to the least while permitting use of the radiation for specific advantageous purposes¹⁰. In 1973, ALARA principle (as Low as Reasonably Achievable) was developed for optimization of radiographic doses with the aim of judicious use of radiation¹¹. Partial/segmented dental panoramic views, that limit the x-ray beam only to the area of interest, can be used successfully to reduce radiation exposure¹².

This study was carried out to evaluate the knowledge and the steps taken for radiation protection among dental surgeons practicing in Lahore. By having a general insight to this data, we can further suggest remedial measures to improve upon the existing situation. This would also allow us to pinpoint specific areas which need to be focused in this regard.

MATERIALS AND METHODS

The study was conducted among dental surgeons privately practicing Lahore, from 15 September 2019 to 14 March 2020. 217 dental surgeons, both male and female, practicing in either private clinics or in academic institutions in Lahore, were included in the study. Dental surgeons without x-ray facility in their setups were excluded from the study. Sample size was calculated using openepi sample size calculator, taking usage of radiography in dental practice as 69%¹³, confidence interval as 95%. 217 came out to be the sample size. Non-probability, purposive sampling was done. Approval of the institute's ethical committee for research was obtained before starting the research.

A structured questionnaire, consisting of multiple choice questions, was developed after research on the subject and discussion with experts. The first section consisted of basic information. The second section comprised of questions which dealt with the knowledge regarding radiation protection. The third section constituted of the various protocols adopted in the department for the purpose of radiation protection. The respondents were asked to select one option as the answer to the question.

The data collected was analyzed using SPSS version 21. Mean and standard deviation was calculated.

RESULTS

120 (55.3 %) of the respondents were male while 97(44.7 %) were females. The age range was from 25 years to 65 years while mean age was 41.54 ± 4.2 years. 131 (60.4 %) had done B.D.S (graduation) while 86 (39.6 %) were holding a post-graduate qualification. 42.4 % had been practicing for 5 to 10 years, followed by those practicing for less than 5 years (35.5 %). 63.1 % dental surgeons were practicing in private setups while 36.9 % were performing institutional duties. The demographic data is shown in table 1.

Table No.1: Demographic data of the respondents

S.No	Demographic Data	Results
1.	Gender	
	Male	55.3%
	Female	44.7%
2.	Age	
	25 - 34 years	19.4%
	35 - 44 years	31.8%
	45 - 54 years	28.6%
	55 - 64 years	16.6%
	65 years and above	3.7%
3.	Qualification	
	Graduate (BDS)	60.4%
	Post-graduate qualification (MCPS/FCPS/Masters etc)	39.6%
4.	Clinical Experience	
	Less than 5 years	35.5%
	Between 5 - 10 years	42.4%
	More than 10 years	22.2%
5.	Practicing at	
	Academic institution	36.9%
	Private clinic	63.1%

Table No.2: Response regarding section-II of the questionnaire

S.No	Knowledge About Radiation Protection	Results
1.	Are you aware of the harmful effects of x-rays on human health?	
	Yes	93.1%
	No	6.9%
2.	Do you know the most radiosensitive organs of human body?	
	Yes	52.1%
	No	47.9%
3.	Are you familiar with the ALARA principle?	
	Yes	24.9%
	No	75.1%
4.	Do you have an understanding of the Position Distance Rule?	
	Yes	29.5%
	No	70.5%
5.	Do you know the effect of filtration and collimation on radiation exposure?	
	Yes	31.8%
	No	68.2%
6.	Do you understand link between kVp and exposure time with radiation dose?	
	Yes	26.3%
	No	73.7%
7.	Are you aware of the annual permitted dose limit for occupationally exposed workers as recommended by the ICRP?	
	Yes	11.1%
	No	88.9%
8.	Have you ever attended any workshop / seminar regarding radiation protection?	
	Yes	6.5%
	No	93.5%

Table No.3: Response Regarding Section-III of the Questionnaire

S.No.	Practice of Radiation Protection	Results
1.	Are the following radiation protection apparel used in your department?	
	A) Lead apron	
	Yes	46.1%
	No	53.9%
	B) Thyroid collar	
	Yes	24.9%
	No	75.1%
	C) Gonadal shield	
	Yes	35.0%
	No	65.0%
	D) Breast shield	
	Yes	25.3%
	No	74.7%
	E) Safety Glasses	
	Yes	30.4%
	No	69.6%
2.	What mechanism is used for holding the film?	
	Staff	63.1%
	Patients attendant	27.6%
	Film holder	9.3%
3.	Do you stand behind a lead barrier when the x-ray is performed?	
	Yes	44.7%
	No	55.3%
4.	Are X-ray warning / caution signs displayed in the department?	
	Yes	75.6%
	No	24.4%
5.	What radiation monitoring devices are used in your department?	
	Film badges	66.3%
	TLDs	0%
	OSLDs	0%
	Electronic personal dosimeters	0%
	None	33.7%
6.	Is the Position Distance Rule strictly followed?	
	Yes	28.6%
	No	71.4%
7.	Can other people enter the room when x-ray is being performed?	
	Yes	61.3%
	No	38.7%
8.	Do you use appropriate collimation and filtration in your department?	
	Yes	64.9%
	No	35.1%

93.1% had basic knowledge regarding the harmful effects of x-rays on human health however, only 52.1%

were aware of the radiosensitive organs of the body. Only 24.9% understood the ALARA principle while 29.5% were familiar with the position distance rule. Only 11.1% were aware of the annual recommended dose limit for occupationally exposed workers. Bulk (93.5%) of the respondents had never attended a seminar, lecture or a workshop on radiation protection. Data regarding the answers to section II is shown in table 2.

Less than half of the respondents were wearing protective apparels in their departments while performing x-rays. In 63.1% of the departments, dental staff was holding the radiographic film while x-ray was performed. 33.7% were not using any radiation monitoring device. Radiation warning signs and cautions were not displayed in 24.4% of the departments. Answers to section III is in table 3.

DISCUSSION

Dental surgeons utilize x-rays more commonly as compared to any other medical branch¹³. Radiation exposure in dentistry has been linked with to increased incidence of tumors of the salivary and thyroid glands, meningiomas and increased frequency of low birth weight children in exposed pregnant females¹⁴. Radiation protection holds critical importance for health care professionals with the purpose of diminishing needless radiation exposure and reducing its hazards¹⁵. The three cardinal principles of radiation protection are justification (benefit of exposure should outweigh risks), optimization (exposure kept as low as possible) and dose limitation (total dose should be less than permissible dose for occupationally exposed workers)¹⁶. In our study, 55.3% participants were male, having age between 35 – 44 years.60.4% were graduates, 42.4% had clinical experience between 5 -10 years and 63.1% were working in private setups. Most of our respondents had only basic knowledge and lacked detailed awareness or critical insight on radiation protection. Similar results have been seen in other studies performed on this subject all over the world. A study concerning the knowledge of dental surgeons, x-ray technicians, dental undergraduate students and radiography students regarding radiation protection was conducted in Poland, Europe¹⁷. The study inferred that radiation awareness amongst all the four groups of respondents was unsatisfactory with the differences between them being not statistically significant.

In our study, only 29.5% of the dental surgeons were aware of the position distance rule while 70.5% were unfamiliar with it. Similarly, only 9.3% dentists, in our study, employed film holder to hold radiographic film while performing x-rays while in 63.1% cases, staff of the dental department was utilized to hold the film. A study carried out to evaluate the perception of radiation protection in dental surgeons in India, also yielded similar results¹⁸. Bulk of the dental surgeons included

in the study (54%) did not know the position distance rule while only 46% were familiar with it. Majority (59%) of the dentists did not utilize film-holding devices with only 41% employing film-holding devices. Our study showed that the various steps taken for radiation protection in the departments were insufficient and needed improvement. Less than half of the respondents used protective apparels with lead apron being most frequent (46.1%). A study conducted to ascertain the radiographic safety practices of dentists, concluded that these practices were insufficient. Majority (60.4%) employed only lead protection for performing dental x-rays, even of pregnant females whereas a large proportion of respondents (39%) themselves placed the radiographic films inside the mouth of the patient¹⁹.

Hence, the results of our study agree with the different national and international studies performed for this purpose and reinforce them. The main limitation of our study is that it is a questionnaire based research and the answers may not accurately depict the exact knowledge and practice of the respondent in actual. Secondly, as the answers were fixed, there was lesser margin for the participants to provide answers that may correctly manifest their feelings on the subject. However, it appears from the results of our study that the situation in our setup locally is even more dismal and requires substantial improvements. This calls for appropriate training of healthcare workers in the field of radiation protection to make sure that they possess sufficient knowledge and can implement consequential changes in their department. This information is crucial not only for all healthcare workers but is extremely critical for the patients visiting the hospitals as well as general public²⁰.

CONCLUSION

Bulk of the dental surgeons exhibited unsatisfactory knowledge regarding radiation protection while majority of the departments showed inadequate measures adopted for this purpose. The need of the hour is to organize periodic lectures and workshops to dispense latest teachings regarding the dangers of radiation and methods for the safety of workers as well as the patients.

Recommendations: On the basis of the research done for this study, following recommendations are made to improve the knowledge and practice of radiation protection.

1. Adoption of standard x-ray views to produce x-rays with acceptable quality and prevent repeat x-rays.
2. Daily maintenance of x-ray machine with periodic calibration to prevent leak radiation.
3. Usage of protective apparel to prevent exposure to radiosensitive organs.

4. Use of rare earth metal intensifying screen to reduce radiation exposure.
5. Use of appropriate collimation and filtration to limit the patient's exposure to low energy x-rays.
6. Employment of film holding devices when the x-ray is being performed.
7. Detailed chapter regarding radiation protection should be included in the curriculum, both at undergraduate and post-graduate levels.
8. Dental surgeons lacking proficiency in radiation protection should undergo dedicated lectures / seminars / workshops to enhance their knowledge of the field.
9. PNRA should hold periodic inspections in all institutions. Failure to meet safety standards should result in temporary cancellation of license till the situation is improved.
10. Creating awareness amongst the patients and the general public regarding the hazards of ionizing radiation and the basic radiation protection.

Author's Contribution:

Concept & Design of Study:	Shahalisa Hameedi
Drafting:	Sana Chaudhry, Omair Anjum
Data Analysis:	Faryal Ali Syed
Revisiting Critically:	Nadia Muneer, Muhammad Behzad Salahuddin
Final Approval of version:	Shahalisa Hameedi

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

1. X-ray [Internet]. En.wikipedia.org. 2020 [cited 20 October 2020]. Available from: <https://en.wikipedia.org/wiki/X-ray>
2. Singh V, Singh VK, Shankar P, Singh D, Lakhani P, Tutu S, et al. Knowledge among general public regarding adverse consequences of radiological examination. *World J Pharm Pharm Sci* 2015;4: 964-9.
3. Rajaraman P, Hauptmann M, Bouffler S, Wojcik A. Human individual radiation sensitivity and prospects for prediction. *Annals of the ICRP* 2018; 47(3-4):126-141.
4. Choi E, Ford NL. Measuring absorbed dose for i-CAT CBCT examinations in child, adolescent and adult phantoms. *Dentomaxillofac Radiol* 2015;44: 20150018.
5. Granlund C, Thilander-Klang A, Ylhan B, Lofthag-Hansen S, Ekestubbe A. Absorbed organ and effective doses from digital intra-oral and panoramic radiography applying the ICRP 103 recommendations for effective dose estimations. *Br J Radiol* 2016;89(1066):20151052.

6. Aravind BS, Joy ET, Kiran MS, Sherubin JE, Sajesh S, Manchil PR. Attitude and awareness of general dental practitioners toward radiation hazards and safety. *J Pharm Bioallied Sci* 2016;8(Suppl 1):S53-S58.
7. Sharma SR, Karjodkar FR, Sansare KP, Saalim M, Mishra ID, Johaley S, et al. Attitude and awareness of general population towards radiation hazards and safety: An institutional study. *Ind J Dent Res* 2019;30:27-30.
8. Yeh JK, Chen CH. Estimated radiation risk of cancer from dental cone-beam computed tomography imaging in orthodontics patients. *BMC Oral Health* 2018;18(1):131.
9. 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
10. Sabol J, Šesták B. Quantification of the risk-reflecting stochastic and deterministic radiation effects. *RAD Conference Proceedings* 2017;2: 104-108.
11. Berkhout WE. Het ALARA-principe. Achtergronden en toe passing in de praktijk [The ALARA-principle. Backgrounds and enforcement in dental practices]. *Ned Tijdschr Tandheelkd* 2015;122(5):263-70.
12. Pakbaznejad Esmaili E, Waltimo-Sirén J, Laatikainen T, Haukka J, Ekholm M. Application of segmented dental panoramic tomography among children: positive effect of continuing education in radiation protection. *Dentomaxillofac Radiol* 2016;45(6):20160104.
13. Shahab S, Kavosi A, Nazarinia H, Mehralizadeh S, Mohammadpour M, Emami M. Compliance of Iranian dentists with safety standards of oral radiology. *Dentomaxillofac Radiol* 2012;41: 159-64.
14. Chaudhry M, Jayaprakash K, Shivalingesh KK, Agarwal V, Gupta B, Anand R, et al. Oral Radiology Safety Standards Adopted by the General Dentists Practicing in National Capital Region (NCR). *J Clin Diagn Res* 2016;10(1): ZC42-ZC45.
15. Tsapaki V, Balter S, Cousins C, Holmberg O, Miller DL, Miranda P, et al. The International Atomic Energy Agency action plan on radiation protection of patients and staff in interventional procedures: Achieving change in practice. *Phys Med* 2018;52:56-64.
16. Do K. General Principles of Radiation Protection in Fields of Diagnostic Medical Exposure. *J Korean Med Sci* 2016;31(Suppl 1):S6.
17. Furmaniak KZ, Kołodziejska MA, Szopiński KT. Radiation awareness among dentists, radiographers and students. *Dentomaxillofac Radiol* 2016;45(8): 20160097.
18. Balaji V, Ranjith K, Buvaneswari P. Perception of Radiation Protection among Dentist in South Chennai, Tamil Nadu. *Int J Prevent Public Health Sci* 2019;5(2):14-17.
19. Hasan A, Khan JA, Ali B, Afshan Z, Shakir MN, Shah SYA. Practices of dentists about digital techniques in dental radiology and radiographic safety. *J Pak Dent Assoc* 2019;28(4):181-186.
20. Naqvi STS, Batool SW, Rizvi SAH, Farhan K. Awareness of Hazards of X-Ray Imaging and Perception Regarding Necessary Safety Measures to be Taken During X-Ray Imaging Procedures Among Patients in Public Sector Tertiary Hospitals of Karachi, Pakistan. *Cureus* 2019 May 25;11(5): e4756.