



“COMPLIANCE OF DENTISTS IN AGRA AND MATHURA REGION WITH SAFETY STANDARDS OF ORAL RADIOLOGY”

Dental Science

Dr. Chander Udey Singh Pawar*	Reader, Dept Of Oral Medicine & Radiology, JCD, Dental College, Sirsa, Haryana. *Corresponding Author
Dr. C Anand Kumar	Professor, Dept Of Oral Medicine & Radiology, Maaruti Dental College, Bangalore.
Dr. Ruby Bansal	Senior Lecturer, Dept Of Oral Pathology, JCD, Dental College, Sirsa, Haryana.
Dr. Manish Gupta	Reader, Dept Of Oral Medicine & Radiology, Santosh Dental College & Hospital, Ghaziabad, Uttar Pradesh.
Dr. Rahul Pawar	MDS, Dept of Orthodontics.
Dr. Neha Vaid	Senior Lecturer, Dept Of Oral Pathology, JCD, Dental College, Sirsa, Haryana.

ABSTRACT

OBJECTIVE: This study through a questionnaire was aimed to survey the dental practices in Agra and Mathura region for gauging the knowledge, the attitude and the behaviour of the dentists with regard to the oral radiology safety standards. **MATERIALS & METHOD:** For conducting the survey a questionnaire comprising of 24 questions was delivered to 100 dentists in the region in question by hand. After certain time the answer sheets were collected and analyzed. **RESULT:** Among the 100 respondents 98% of the dentists used periapical views of a limited area in the initial visit. 88% used E-speed film whereas 12% used a digital sensor as image receptor. Bisecting angle technique was being used by 92% dentists while only 8% use paralleling cone technique. 27% used a rectangular collimator and 14% used long cone. 30% dentists selected proper exposure time. Merely 4% dentists used both lead aprons and thyroid shields to protect the patients. Disposal of the used processing solutions and the lead foils was done properly by only 5% and 8% respectively. **CONCLUSION:** Present study reveals that the knowledge of the dentists is not adequate to the desired extent and they are required to update themselves regarding radiation protection techniques and to improve their radiology practice by attending educational programs for the well being of both patients and themselves.

KEYWORDS

Radiation Protection, Dental Radiography, Safety measures.

INTRODUCTION

Radiographic examination is the commonly used technique in the medical investigations. The dental practitioners frequently use radiographs from the simple diagnosis of incipient caries up to the complex procedures like Implant planning. According to the UNSCEAR (United Nations Scientific Committee on Effects of Atomic Radiation) as reported in the year 2008, approximately 480 million of diagnostic radiographic examinations are done in dentistry per annum in the world and it forms approx 15% of the total diagnostic X-ray examinations in health care.¹

In medical diagnosis X-rays should only be administered if the same is clinically justified; the doses should expose to the lowest of radiations acceptable to the patients & the practitioners and the administration of maximum dose should be limited.² It is assumed that radiation dose levels in dental practice are relatively low and one should consider the cumulative effect of repeated exposures.³ The radiation protection measures acquire importance from the somatic changes and genetic mutations caused due to the harmful effects of radiation.⁴ There should be a determined implementation of the proper decision and selection criteria for radiography in private dental clinics for radiological quality assurance.³ Obviously, this can be done by performing radiographs accurately and by reducing the number of radiographic examinations due to unnecessary repeated radiation exposure.⁴ To achieve this goal the dental practitioners are required to keep pace with the latest developments and techniques through advanced educational courses.⁵

This study was carried out in the form of survey by using a questionnaire to gauge the knowledge, the attitude and the behaviour of the dentists with relation to oral radiology safety standards. Questionnaire based survey is widely used research method as it provides meagre cost effective and important information about the knowledge, the attitude and the practices of the dentists. The motive for carrying out this study was to make aware of the general dental practitioners that more attention should be paid to radiation protection in dentistry.

MATERIALS & METHOD

This study was conducted on 100 dentists (general and specialized) having their private clinics in Agra and Mathura. It is worth mentioning

here that the dentists lacking radiographic equipments were not made part of this study. Mainly we considered radiation safety standards, the methods applied to control patients' from unnecessary exposure during dental radiography.

The guidelines for carrying out study were derived from the American Dental Association, 2006 recommendations. Another factor under consideration was the environmental pollution being caused by dental radiography for which the Federal Resource Conservation and Recovery Act of 1976 was passed.⁶ A questionnaire consisting of 24 questions (Appendix I) was distributed by hand to the dentists. After given time the forms of questionnaire were collected from the dentists personally. After examination it was found that all the 100 dentists responded the questionnaire and hence they all were included in the study.

The statistical analysis was done through a Statistical Package for the Social Sciences (SPSS 13 for Windows). Mean for demographic variables was taken into account while percentage was calculated for the responses given by dentists. Frequency distribution and the significance of differences between two independent groups were analysed by using the Chi-square test. The level of significance was laid down at 5%.

RESULTS

The group of 100 dentists was comprised of 73 males and 27 females aged between 25–45 years. 77% categorized themselves as non-specialists and 23% as specialists. 30% were from Mathura and 70% from Agra.

This study revealed that majority of dentists nearly 98% use periapical views of a limited area and merely 2% use bitewing in the initial visit of the patients.

Regarding the key knowledge about the radiation protection for the pregnant women 88% knew that they should not take periapical radiographs. 73% dentists were unable to explain the rationale relating to radiation protection. Dentists to the extent of 28% did not know that the thyroid gland is the most important organ in dental radiography protection.

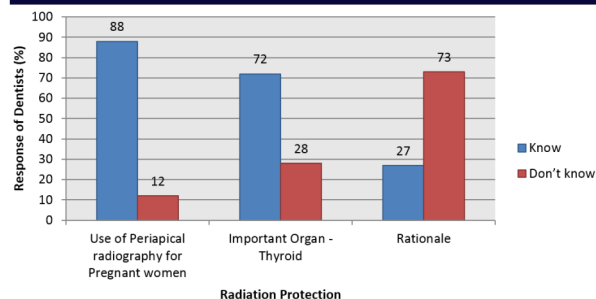


Figure No.1 Depicting the knowledge about the radiation protection.

Fig.-1. Merely 25% responded that panoramic exposure gave more radiation dose to patients and 65% answered full mouth periapical radiography while 10 kept themselves mum. Fig.-2.

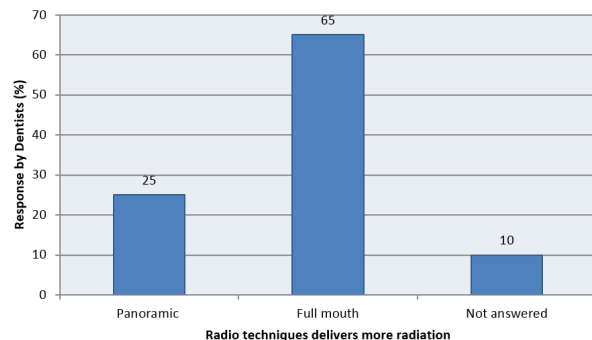


Figure No. 2 – Showing that the majority of full mouth periapical radiography delivering more radiation than panoramic.

As regards use of film holders 90% of the participants quoted that they are using film holders ($p > 0.05$). A marginal number of 8% dentists use paralleling technique while 92% use the bisecting angle technique.

Regarding the use of collimator 27% used a rectangular, 53% used round while rest 20% not answered (Fig.-3).

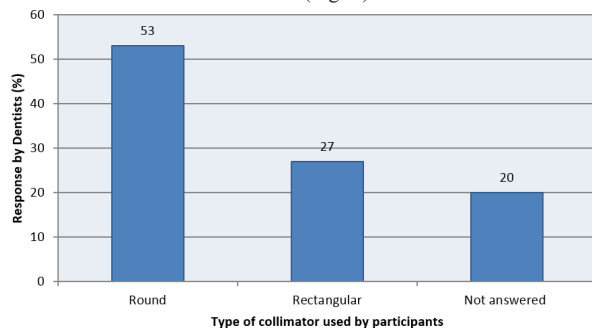


Figure No.3 – Showing that the majority uses round collimator Vs rectangular

Most of the dentists nearly 88% use film as radiographic receptor with E-speed film while 12% dentists use a digital receptor ($p < 0.05$). Study further revealed that 30% dentists apply proper exposure time whereas 35% adjusted the exposure time suitably for maxillary and mandible. 44% attuned the exposure time properly for different kind of patients according to their physique while 21% changed according to the position of tooth (Fig.-4)

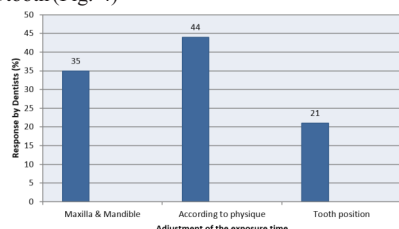


Figure No.4 – The response of dentists which adjust the proper exposure time according to location and patient.

In respect of the patient protection only 4% of dentists used both thyroid shields and lead aprons regularly in their practice while 21% used this protection occasionally. 50% never used them and 25% opted not to answer this question ($p > 0.05$) as shown in Fig.5.

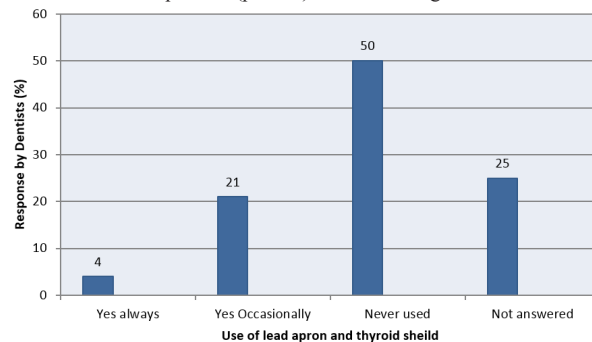


Figure No.5 – Very few dentists use the lead apron and thyroid shield regularly in their practices

For their own protection 30% of the dentists followed the position and distance rule correctly ($p > 0.05$).

On the issue of equipment maintenance the majority of the dentists nearly 85% did not have regular maintenance check-ups of their X-ray machines ($p > 0.05$).

About the knowledge of management of radiographic waste only 8% of dentists disposed the used processing solutions properly and merely 5% of dentists disposed of the film coverings and lead foils as hospital waste. (Fig.-6)

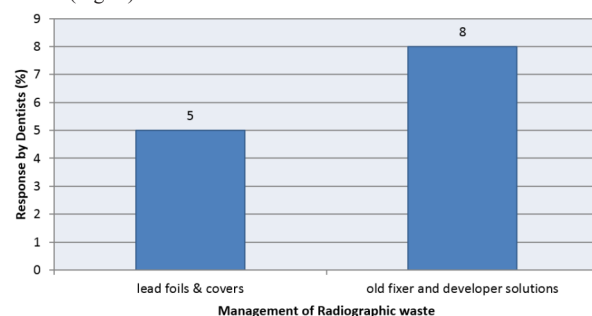


Figure No.6 - The minority of dentist's response about management of radiographic waste

DISCUSSION

Dentists in their practice have to assess the pros & cons of dental oral radiographs against its hazards⁸ and therefore the effect of ionizing radiation on living system is well known and well documented.⁹ The risk involved in dental radiography is certainly small as compared to many other risks in everyday life.¹⁰ Guidelines in dental radiology stand formulated to avoid unnecessary exposure to X-radiation and to identify specific individuals who may benefit from a radiographic examination.¹¹ However, following the principles of ALARA (As Low As Reasonably Achievable) are important to avoid needless radiographs. The results of our survey accentuate that the dentists practicing in Mathura and Agra region are having deficient knowledge on the topic of dental radiography as well as radiation protection.

All the dentists included in the study were having the facilities for radiographic investigation in their clinics. In agreement with the studies of Shahab et al⁷ and Chaudhry et al,¹ the periapical view in initial visits was found to be administered by 98% dentists. However, the most preferred technique was bisecting angle as 92% dentists used this technique and only 8% used paralleling periapical technique. Though the paralleling technique is better in performance yet it is scanty used. Perhaps this is due to the requirement of expertise in this technique and little inconvenient to the patient. Further appropriate film holders are necessary. On the other hand bisecting angle technique is simple and easy though it can results in image distortion and reproducible views are not possible.

The present study showed that 27% of the dentists used rectangular collimators which was variable with the studies done in countries

Sweden (29%)¹², Korea (14%)¹³, Belgium (6%)⁵, Turkey (5.5%)¹⁴, and Canada (8%)¹⁵. The low rate of rectangular collimation use may be attributed to the low rate of film positioning devices being used by 27% in our research as well as the concern of cone cutting. Using of the rectangular collimator restricts the X-ray beam to the receptor area and can prevent unnecessary patient exposure.⁴ It is widely accepted that the replacement of round collimator by rectangular models reduces exposure to ionising radiation by a factor of four making it possible to reduce the dose administered to the patient by up to 60%.¹⁶

The most sensitive intra-oral film generally used in dental practice is E-speed which results in a dose reduction of 40-50% when compared with D-speed film. Dentists should be encouraged to shift from D and E speed films to the faster F speed film to reduce 20% radiation dose to their patients.^{3,7} Digital imaging facilitates enhancement of image in a number of ways; however, it carries risk of multiple retakes.¹⁷ In our study 88% used E-speed films while only 12% dentists used a digital receptor which was similar with the results of Shahab et al⁷ and Math et al¹⁸ but was not in consistent with that of Lee and Ludlow¹³. From above analysis it transpired that most of the dentists of this region were not using proper method, material, and equipment for reducing unnecessary radiation exposure to patients.

Cell damage is caused by radiation ionization with the formation of ions consequently which can produce free radicals, break chemical bonds, create cross-linkage between macromolecules or damage molecules and genes.¹⁹ In our survey we found that about 88% dentists knew that pregnant women should not have any periapical radiograph. It is commonly known to the dentists that Undifferentiated rapidly proliferating cells are susceptible to radiation damage than differentiated stable cells because in M and G2 phase cells are more sensitive and resistant in the late S phase. Rapidly proliferating cells are found in foetuses as the developing foetus is sensitive to the effects of radiation especially in the 2-9 weeks after conception, the period of organogenesis.¹⁹

The present study postulates that 73% of dentists were unable to explain the rationale for radiation protection. Only 25% answered that panoramic exposure give more radiation dose to the patients than full mouth periapical radiography. Further, 28% did not know that the thyroid gland is the most important organ in dental radiography protection. The biologic interaction between ionizing radiation and living organism leads to changes in the electron level immediately within a fraction of seconds of the exposure and persist for a varied period of time.⁹

While taking radiographs an average standing distance of 2.2m from the patient should be maintained which is considered to be a safe distance.¹⁸ In our survey we found out that 30% of the dentists followed the position and distance rule correctly for their own protection. 30% adjusted proper exposure time and 35% attuned the exposure time properly for maxillary and mandible, 44% changed the exposure time properly for different kind of patients according to their physique, and 21% change properly according to the position of tooth. These results are at par with results of Shahab et al⁷ but not in agreement with the study conducted by Javali and Dantu.⁹ The results illustrate that the dentists in our study are not attuning the proper exposure time and was using the old and exhausted processing solutions. They are not updating themselves with the advancements in the technology.

As it is well known phenomenon for patient protection the lead aprons are used for the absorption of scattered radiation and to reduce the dose. In the present study we found that only 5 % of dentists use both thyroid shields and lead aprons regularly in their practice, 20% use occasionally, 50% never use them and 25% did not answer this question. Obviously, the respondents who have not answered this question are either unaware of the fact or they don't want to implement this protection. Ninety-eight percent reduction in scattered radiation and attenuate dose to 0.04 μ R can be achieved using lead aprons.²⁰ Lead aprons with the minimum thickness of 0.5 to 1mm should be used.²¹ Our study is almost in consistence with that of Aggarwal B et al²² that use of lead apron was only by 1.84% dentists and no dentist was found using thyroid collar.²²

The basic steps of quality assurance are X-ray machine maintenance, and regular check-up of the equipments. In the present study, 85% of the dental practitioners did not perform regular check-up of their X-ray machines. The X-ray equipment should be calibrated periodically to

avoid any radiation leakage from the x-ray unit.²¹ The present study is having similar results with that of Jacobs et al⁵ and Swarna et al¹⁸.

All radiographic procedures generate certain hazardous substances which cause potential challenge to the environment. The unused film should not be kept with general waste as it contains un-reacted silver that can be toxic for the environment.²³ Most radiographic waste of the dental office can be managed as non-hazardous waste, if proper disposal guidelines are followed.²⁴ The present study discloses that only 5% of dentists dispose of the used processing solutions properly and 8% of dentists dispose the film covering & lead foils as hospital waste which is in agreement with the results of Shahab et al⁷. Most of the dentists are not aware of the harmful effects of the radiographic waste and some of them ignore it considering their waste as insignificant.²⁴ It becomes the moral duty of the dentists to dispose of the waste as per the guidelines for proper disposal of waste. The law also propounds legal duty upon them in this regard to save the environment.

In conclusion, the existing survey results indicate that the dentists' awareness and practicing of radiation protection techniques are not satisfactory. Therefore, the dentists are required to update their knowledge about the latest techniques and advancements in the field of radiography by participating in the post-academic courses or by attending the training programmes.

Appendix I (Questionnaire)

1. Gender: Male -- Female --
2. Age:
3. Date of graduation:
4. City of practice:
5. Work as: General practitioner -- Specialist --
6. Which type of radiographic examination do you usually prescribe in the initial visit? Bite wing -- Selective periapical view -- Panoramic -- Full mouth periapical view --
7. Which technique do you use for periapical radiography? Paralleling technique -- Bisecting angles technique --
8. Can you take any periapical radiographs from a pregnant woman? Yes -- No --
9. What is the underlying principle of radiation protection in dental radiography?
10. The most important organ in radiation protection in dental radiography? Gonads -- Bone marrow -- Thyroid -- Skin --
11. Which technique do you use for periapical radiography? Paralleling technique -- Bisecting angles technique --
12. Do you make use of film holder while taking radiographs? Yes -- No --
13. Which of the following radiographic techniques distributes more radiation to the patient? Panoramic -- Full mouth --
14. Type of collimator do you use? Round -- Rectangular --
15. Which type of radiographic receptor do you use? Film -- Digital receptor --
16. What type of film speed do you use for periapical radiography? D -- E -- F --
17. Do you use the proper exposure time for the periapical view? Yes -- No --
18. Change exposure time from maxilla to mandible: Yes -- No --
19. Change exposure time according to the tooth position (From anterior teeth to posterior teeth): Yes -- No --
20. Adjust exposure time according to the patient physique? Yes -- No --
21. Do you have periodic check up for your X-ray equipment? Yes -- No --
22. For your own protection what distance do you follow?
23. Do you use leaded apron and thyroid shield for patient protection? Always -- Occasionally -- No --
24. How do you dispose of your radiographic waste? Film lead ---- Old developer and fixer solutions -----

REFERENCES

1. Chaudhry M, K. Jayaprakash, K.K. Shivalingesh, Agarwal V, Gupta B, Anand R, Sharma A, Kushwaha S. Oral Radiology Safety Standards Adopted by the General Dentists Practicing in National Capital Region. Journal of Clinical and Diagnostic Research. 2016 Jan;10(1): ZC42-45
2. Horner K. Review article: radiation protection in dental radiology. Br J Radiol 1994;67(803):1041-49.
3. Agarwal SR, Waingade M and Garcha V.2016, Knowledge, Awareness And Practice Regarding Radiographic Techniques And Radiation Protection Among General Dental Practitioners In Pimpri-Chinchwad City: A Questionnaire Based Cross-Sectional Survey. Int J Recent Sci Res. 7(9):13310-315
4. Constantiniuc M, Popa D, Ispas A, Burde A, Hedesiu M. Radiation protection -- An

- issue of knowledge and technique in dental offices. *Prophylaxis* 2016;6(2):98-103
5. Jacobs R, Vanderstappen M, Bogaerts R, Gijbels F, Attitude of the Belgian dentist population towards radiation Protection. *Dentomaxillofacial Radiology* 2004;33(5):334-339
 6. White SC, Pharoah MJ, Oral Radiology: Principles and Interpretation, (6th edn); St. Louis, MO: Mosby 2009
 7. Shahab S, Kavosi A, Nazarinia H, Mehrizadeh S, Mohammadpour M, Emami M. Compliance of Iranian dentists with safety standards of oral radiology. *Dentomaxillofacial Radiology* 2012;41(2):159-164
 8. Booshehri MZ, Ezoddini-Ardakani F, Nozari H. Evaluation of dentists' awareness about personnel and patients national protection in Yazd dental office, *Health* 2012;4(8):490-92.
 9. Javali R, Dantu R. Attitude and awareness about radiation protection among dental surgeons in North Karnataka: A questionnaire study. *J Indian Acad Oral Med Radiol* 2018;30:116-20.
 10. Kaur A, Mishra N, Deepak U, Kumar G.C.S, Singh P. Awareness of Radiation protection measures of Dental Imaging among Private Dental practitioners in Lucknow City- A Questionnaire Survey. *International Journal of Maxillofacial Imaging* October-December 2015;1(1):1-5
 11. Espelid I, Mejäre I, Weerheijm K. EAPD guidelines for use of radiographs in children. *European Journal Of Paediatric Dentistry*, 2003;40-48
 12. Svenson B, Soderfeldt B, Grondahl HG. Attitudes of Swedish dentists to the choice of dental X ray film and collimator for Oral radiology. *Dentomaxillofac Radiol* 1996;25(3):157-61
 13. Lee BD, Ludlow JB. Attitude of the Korean dentists towards radiation safety and selection criteria. *Imaging Sci Dent* 2013 Sep; 43(3):179-184.
 14. Ilguy D, Ilguy M, Dinçer S, Bayirli G. Survey of dental radiological practice in Turkey. *Dentomaxillofac Radiol* 2005;34:222-7.
 15. Bohay RN, Kogon SL, Stephens RG. A survey of radiographic techniques and equipment used by a sample of general Dental practitioners. *Oral Surg Oral Med Oral Pathol* 1994;78:806-10.
 16. Alcaraz M, Martinez-Beneyto Y, Jódar S, Saura-Iniesta AM, Velasco E. Development of intra-oral dental radiology after the establishment of new quality control legislation in Spain. Eleventh Congress of International Radiation Protection Association, Madrid, Spain, 23-28th May 2004.
 17. Binnal A, Rajesh G, Ahmed J, Denny C. Factors determining Radiation Protection Practices among Indian General Dental Practitioners: An Explorative Study. *World J Dent* 2017;8(1):14-20.
 18. Math SY, Murugesappa DG, Annigeri R, Kalra D. Compliance of Indian dentists with oral radiology safety measures. *J Oral Maxillofac Radiol* 2013;1:104-10
 19. Enabulele JE, Igbiniedion BO. An assessment of Dental Students' knowledge of radiation protection and practice. *J Educ Ethics Dent* 2013; 3:54-9.
 20. 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 Bioall Sci* 2016;8:S53-8
 21. Reddy SS, Devi BKY, Shwetha V, Kumar TP, Premkumar A. An Overview of Various Radiation Protection Protocols To Be Adopted While Making Intraoral Periapical Radiographs. *Journal of Dental & Oro-facial Research* 2016;12(02):8-10
 22. Aggarwal 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. *Journal of International Oral Health* 2015;7(12):51-55.
 23. Koneru J, Mahajan N, Mahalakshmi M. Management of Dental Radiographic Waste: A Review. *Odontology* 2014;4(3):206-209
 24. Koneru J, Mahajan N, Mahalakshmi M. Management of Dental Radiographic Waste. *DJAS* 2014;2(II):55-58