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ASSESSMENT OF KNOWLEDGE AND AWARENESS ABOUT RADIATION SAFETY PROTOCOL AMONG DENTAL PRACTITIONERS IN CHENNAI

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ABSTRACT

Background: Radiographs are commonly taken during dental diagnosis and treatment. Patients, and dental practitioners potentially receive exposure. Though it is considered that only a negligible radiation dose occurs during dental radiography, frequent and long-term exposure to this negligible radiation dose should not be ignored.

Aim: To assess the knowledge and awareness about radiation techniques, biological impacts, and safety procedures.

Materials and method: A Cross sectional survey with 20 closed ended questions was conducted on 200 Dental practitioners in Chennai.

Results: Out of 200 participants, 45.5% had very poor awareness of radiation safety protocols, 23% had moderate awareness and 31.5% had very good awareness.

Conclusion: Our study results conclude that most of the respondents have fair fundamental knowledge and awareness of radiation and protection, but with varying degrees. This reveals the need for more lectures and seminar programs for dental practitioners and during college years. This will result in a significant improvement in understanding for observing dental radiography's fundamental principles.

Keywords: Dental practitioners, ALARA concept, Ionizing radiation, Radiographs, Radiation safety protocol

INTRODUCTION:

A correct diagnosis is a key to proper treatment which can be arrived at after precise clinical, laboratory and radiological evaluations. Recently, the field of dentistry has witnessed a meticulous evolution in both diagnosis and treatment due to technological advances. (Erdelyi et al, 2020)

Intraoral Radiography and OPG (orthopantomogram) are commonly utilized radiographic procedures on a daily basis in dental scenarios. Apart from diagnosis, X-rays have been utilized in guiding the dental treatment as in root canal procedures, orthodontic procedures, etc. Also, there has been an increasing trend with the application of CBCT in almost all fields of dentistry. (Jain et al. 2019; Venkatesh and Elluru. 2017)

It is proven that the radiation produced during a diagnostic dental procedure is negligible. However, the concern of being exposed to X-ray radiation, especially if considered the overall exposure to dental diagnostic X-rays in one's lifetime, has raised a question regarding its health risk (Crane and Abbott. 2016).[4]

In this regard, the x-ray being an ionizing radiation is harmful for living tissue. It has been well established that dental X-rays can potentially increase cancer risks. (Hwang et al. 2018) Few studies have found a link between exposure to dental X-ray and increased risks of brain cancer (Preston-Martin et al. 1989), tumors of the parotid gland (Preston-Martin et al. 1985) and breast cancer (Ma et al. 2008) and thyroid cancer (Memon et al. 2010).

In this respect, every measure to decrease the radiation exposure dose to both dental personnel and the patient must be done. Hence, as advised, ALARA principle (as low as reasonably possible) is advised to be followed by placing restrictions on exposures in the workplace and the general population. (Lurie 2019)

Therefore, it is important to analyze the present status of knowledge regarding radiation safety and plan to incorporate sufficient programs to teach the application of this double-edged sword wisely for obtaining a better outcome in the future for ourselves and the patients.

The current study's objective was to evaluate knowledge, attitudes, and practices among dental practitioners regarding radiation techniques, biological impacts, and safety procedures.

MATERIALS AND METHOD

This survey was conducted on a total of 200 dental practitioners during the time period of march to may 2023. After obtaining Institutional ethical committee approval from the Ethics Committee of BIHER University, Tamil Nadu, India, the study was performed. A questionnaire with 20 questions was provided to the dental practitioners and the study's objectives were explained to the participating dentists. Informed consent was obtained.

Selection Criteria:

Inclusion criteria: Dental practitioners across Chennai

Exclusion criteria**:** Dental practitioners across Chennai who are not willing to participate after the informed consent.

Questionnaire:

A questionnaire comprising 20 closed ended questions designed and validated from comparable research was utilized. (Ghimire et al. 2017; Ihle et al. 2019; Rajeshwari and Raghunath. 2018; Srivastava et al. 2017).Other demographic details such as age, years of experience and affliction to any institution were also asked to fill in by the participants.

Statistical Analysis

The SPSS statistical analysis programme was used to analyze the collected data. The Chi-square analysis was used to determine the relationship between participant awareness and radiation protection practice, and the statistical significance level was $P \leq 0.05$.

RESULTS:

In the current study, responses from 200 dentists were obtained. Among them, the majority (64.5%) were in the age of 20-30 years, and least (4.5%) were in the 51-60 age group.

Table-1 summarizes the participant's responses regarding the questions related to the awareness of radiation dangers and recommended precautions.

Table 1; Responses Of The Participants To The Questionnaire

S.NO	QUESTIONS	RESPONSES	DENTAL PRACTITIONERS	CHI-SQUARE TEST VALUE	P-VALUE
1.	**Are dental x-rays dangerous?**	Yes	53.5	25.739[a]	**0.002***
		No	17.0		
		Not sure	25		
		May be	4.5		
2		Before dental examination.	62.5	18.604[a]	0.029*

	When is the prescription of X-ray- IOPA and OPG appropriate?	After dental examination.	12.5		
		If there exists an actual diagnostic suspect	18.5		
		Not sure	6.5		
3	**Do you think radiation protection is necessary for the dental personnel?**	Yes	23.5	30.541[a]	**0.000***
		No	14.0		
		Not sure	20.0		
		May be	42.5		
4	**Do you follow radiation protection protocols?**	Yes	49.0	23.266[a]	**0.006***
		No	24.5		
		Not sure	15.0		
		May be	11.5		
5	**Is lead apron sufficient for radiation protection?**	Yes	24.5	17.814[a]	0.037*
		No	55.5		
		Not sure	15.5		
		May be	4.5		
6	**What thickness at lead in lead apron is sufficient for radiation protection?**	0.5 mm	24.5	17.814[a]	0.037*
		0.7 mm	55.5		
		1 cm	15.5		
		1.5 cm	4.5		
7	**Do you always wear a radiation dosimeter?**	A. Yes	76.5	10.271[a]	.016
		B. No	23.5		
8	**Which gases increase radiosensitivity of the cells?**	CO2	53.0	21.600[a]	.010
		CO	19.5		
		N2	23.5		
		O2	4.0		
9	**Which wall must be reinforced by leaded protective barriers? The wall next to:**	Waiting lobby	57.5	24.347[a]	.004
		Patient	25.0		
		Reception	12.5		
		Staff room	5.0		
20	**Do you know AERB?**	Yes	26.5	50.270[a]	.000
		No	15.0		
		Not sure	17.0		
11	**Which dosimetry device is applied routinely?"**	Geiger-Muller counter	15.0	16.802[a]	.052

		Film badge	58.5		
		Thermo-luminescence dosimeter	21.5		
		Pen dosimeter	5.0		
12	**Do you wear lead goggles for radiation safety?**	Yes	15.0	24.192[a]	.004
		No	18.0		
		Not sure	57.5		
		May be	9.5		
13	**Which among the following can reduce radiation exposure in patients to X-rays?**	Use of high-speed films	56.5	18.190[a]	.006
		Increasing Kvp	26.0		
		By reducing the exposure time	17.5		
14	**Are you aware of the Recommend occupational radiation dose annually is 20 mSv**	Yes	51.0	22.095[a]	.009
		No	23.0		
		Not sure	18.0		
		May be	8.0		
15	**Purposes of collimator and filtration**	Yes	56.5	20.308[a]	.016
		No	18.5		
		Not sure	17.5		
		May be	7.5		
16	**Who is most radiosensitive; child or adult ?**	Child	59.0	15.295[a]	.018
		Adult	32.0		
		Not sure	9.0		
17	**While taking X-rays the operator should stand at ?**	6 ft	63.0	21.908[a]	.009
		8 ft	15.5		
		10 ft	14.5		
		2 meters	7.0		
18	**Radiation exposure in an IOPA is ?**	200 micro sieverts	22.5	40.927[a]	.000
		26 micro sieverts	18.0		
		5000 micro sieverts	19.5		
		5 micro sieverts	40.0		
19	**ALARA principle stands for ? Do you know it?**	Yes	63.0	19.622[a]	.020
		No	13.5		
		Not sure	13.5		

		May be	10.0		
20	**What is the normal range of kVp in intraoral X-Ray machine?**	60-70 kVp	56.5	26.633[a]	.002
		10-20 kVp	22.0		
		30-40 kVp	13.5		
		90-100kVp	8.0		

Overall, the scores of each participant were added up and the results were summarized based on a grading system. (Table 2)

Table 2; Grading system and interpretation of the results

Grades	Responses	Interpretation
Grade -1	15-20 correct responses	Very good awareness
Grade-2	10-15 correct responses	Moderate awareness
Grade-3	0-10 correct responses	Very poor awareness

From the age group between 20-30 years, 129 people participated. Among them 31.5% participants had very good awareness, 23% participants had moderate awareness and 45.5% had very poor awareness. Similarly the awareness of the participants from the age group between 31-60 years listed in the table-3.

Table 3; Awareness of the participants based on the age of the participants

			Score		
			Moderate awareness	Very good awareness	Very poor awareness
Age Groups	20-30	Count	34	35	60
		% of Total	17.0%	17.5%	30.0%
	31-40	Count	9	7	27
		% of Total	4.5%	3.5%	13.5%
	41-50	Count	3	12	4
		% of Total	1.5%	6.0%	2.0%
	51-60	Count	0	9	0
		% of Total	0.0%	4.5%	0.0%
Total		Count	46	63	91
		% of Total	23.0%	31.5%	45.5%

The overall awareness among the Dental practitioners from our study is listed in table-4. 45.5% of the participants had very poor awareness regarding radiation safety and only 31.5% had good awareness.

Table 4; Overall awareness scores

			Total
Score	Moderate awareness	Count	46
		% of Total	23.0%
	Very good awareness	Count	63
		% of Total	31.5%
	Very poor awareness	Count	91
		% of Total	45.5%
Total		Count	200
		% of Total	100.0%

DISCUSSION:

Radiographs are commonly taken during dental diagnosis and treatment. Patients, and dental practitioners receive exposure. Though it is considered that only a negligible radiation dose occurs during dental radiography, frequent and long-term exposure to this negligible radiation dose should not be ignored.

A recent study reported that female dentists and dental hygienists had a 13.1-fold increased risk of thyroid cancer (95% CI 2.1–389). (Wingren et al. 1997) Furthermore, a systematic review by Hwang et al reported a significant association between full oral radiographs and salivary gland cancer, but no no correlation was noted between parotid cancer. (Hwang et al. 2018) Therefore, dentists should be aware of long-term exposure to low-dose radiation from dental X-rays.

In the present survey, for the question regarding the “ALARA " principle, 63% of the participants answered correctly. With more years of experience, the participants had better knowledge about ALARA principles than those with less working experience. Other studies have reported varying responses for the same question. Srivastava et al. (2017), Rathi Rela (2019), Almohaimede et al. (2020) and Sultan et al. (2018) in their study reported that 37.4%, 63%, 68.1%, and 61.8% of their study participants respectively had an idea about the ALARA principle. Our results are also in accordance with Hussein et al. (2016).

Our present study shows 56.5% of participants are aware of the peak kilovoltage (kVp) used for IOPA imaging. Our findings demonstrate that 43.5% of the respondents were not aware of kVp of the equipment. Thus there may be associated risks. In contrast, previous studies by Srivastava et al. (2017), Almohaimede et al. (2020), and Sultan et al. (2018) reported that majority of their participants had adequate knowledge about this.

A varying response was obtained in the 20 questions from the participants. By calculating the overall scores, 45.5% of the participants had very poor awareness regarding radiation safety and only 31.5% had good awareness. Hence, it was noted from the present study that the participants had fundamental knowledge about radiation yet were not distributed equally among them.

Also, it can be noted that from table-3, the participants of age group 51-60 have very good awareness, whereas the participants from the age group 20-30 have very poor knowledge. Thus, the degree of attitude and knowledge of radiation exposure and hazard management in the participants was mainly based on their theoretical background, and clinical experience.

Our study outlines the need to spread more awareness regarding the knowledge of radiation, it's related applications and safety. We suggest the need for more lectures and seminar programs for dental practitioners and during college years. This will result in a significant improvement in understanding for observing dental radiography's fundamental principles.

CONCLUSION:

Our study results conclude that most of the respondents have fair fundamental knowledge and awareness of radiation and protection, but with varying degrees. There are differences in participants' comprehension of radiation among the different categories. Conduction of Continuing Education programs to update them regularly about fundamentals of radiography, the x-ray machine and related instruments, quality control procedures, the rules that govern dental radiography, their justification, and the proper application of the ALARA concept might be of great help to the practitioners in providing meticulous reduction of radiation exposure to the patient.

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