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## Original Article

### A Cross Sectional Study among Private Dental Practitioners Regarding Radiation Protection: Questionnaire Based Survey

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#### ABSTRACT:

**Background and Aim:** Radiation is the transmission of energy through space and matter. Even though they provide useful information and aid in diagnosis, they have the potential to cause harmful effects. This study aimed to assess the radiation protection awareness level of dentists in private clinics of Ghaziabad City, India. **Materials & Methods:** This study was solely based on a cross sectional theme which was based on a questionnaire comprised of 100 private dental practitioners of Ghaziabad City, India. We used preformed questionnaire containing questions about the radiation protection knowledge. The questionnaire was distributed among dentists in private clinics. We analyzed the data of dentists who truly responded to this questionnaire. Response was recorded and data was processed statistically to evaluate awareness level. **Results:** Statistical analysis was done using statistical software Statistical Package for the Social Sciences (SPSS). The recorded data was subjected to suitable statistical tests to obtain p values, mean, standard deviation, standard error and 95% CI.  $P \leq 0.05$  was considered as statistically significant. Only 61 dentists stood behind the lead shield when they were not using lead apron. Roughly 56 dental practitioners were not using lead apron and thyroid collars during radiographic examination and only 60 dentists send their radiography equipment for periodic annual maintenances. **Conclusion:** Within the limitations of the study authors concluded that overall level of awareness about radiation safety among general dentists of Ghaziabad, was moderate only. More importance on radiation safety, compulsory continuing professional education is recommended.

**Key words:** Awareness, Radiation Protection, Knowledge.

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#### INTRODUCTION

In literal words, radiation is the form of energy that comes from a source and travels through some material or through space. Light, heat and sound are other variants of radiation. Yet, radiation may be of two types: ionizing or non-ionizing. Ionizing radiation is radiation that carries suitable energy to remove an electron from an atom or molecule.<sup>1</sup> This is called ionization and it produces free radicals, i.e. atoms or molecules containing unpaired electrons, which tend to be especially chemically reactive. X-rays are ionizing rays which are used comprehensively in various diagnostic procedures in medical sciences.<sup>2</sup> Although they offer valuable information and aid in diagnosis, they have

the capability to cause damaging effects. Furthermore, biological hazards are usually categorized on their incidence probability into: non-stochastic and stochastic effect. Non-stochastic or deterministic, in which there is fixed dose above which the harmful effects start to appear. In dentistry, radiation is mostly used for diagnostic purposes and in a dental set-up usually the practicing dentist exposes, processes and interprets the radiograph by their own.<sup>3</sup> Albeit such exposure is very nominal, it is crucial to reduce the exposure to the dental staff and patients so as to prevent the harmful effects of radiation. International Commission for Radiation Protection (ICRP) is the regulatory body which lays down norms for radiation protection at the

international level. In India, the Atomic Energy Regulatory Board (AERB) provides the norms for radiation protection. AERB recommends norms for permissible doses of radiation from X-ray tubes, the shielding required for the walls of an X-ray tube room, the lead equivalent shielding apparel to be worn by radiation workers, and also lays down safe dose limits for radiation workers and for the general public.<sup>1,4</sup> Therefore, a questionnaire study was outlined to assess the knowledge, approach, awareness, and attitude of dentists in Ghaziabad city, India towards radiation protection. Here authors have genuinely attempted to explore the actual level of awareness among the dental practitioners.

## MATERIALS & METHODS

This cross sectional, questionnaire-based study comprised of 100 private dental practitioners of Ghaziabad city, India. The directory of private dental practitioners was obtained from the registry of Ghaziabad society of dental practitioners. There were total 280 registered in this society. Out of which, 60 were not actively practicing, rest remaining was 220. Sample size was 220 out of this 20 of them not responded to our questionnaire, final sample including in the study was total 200 clinicians. To avoid any kind of inconsistency in selection procedure, one in every two was selected through systemic random sampling. So, we have used data of 100 respondents efficiently. A close ended questionnaire containing 12 items were delivered to the dentists at their clinics. The confidentiality of the respondents and their freedom of expression were completely ensured. Informed consent was obtained from the respondents those were voluntarily ready for participation. To ensure completely hassle-free replies, the study was conducted over a period of 2 months in which dentists are asked to fill and send back the questionnaire. The worthiness of this study was revealed to all practitioners. The results were subjected to statistical analysis using chi-square test. P value less than 0.05 was considered as significant.

## STATISTICAL ANALYSIS AND RESULTS

All the observational notations were compiled and sent for statistical evaluation using statistical software Statistical Package for the Social Sciences version 21 (IBM Inc., Armonk, New York, USA). The obtained data was subjected to suitable statistical tests to calculate p values,

mean, standard deviation, standard error and 95% CI. Frequencies of responses were also recorded along with their percentage values. Table I shows that age groups 25-35 years had 23 males and 11 females ( $P < 0.05$ ), 36-45 years had 18 males and 12 females, 46-55 years had 11 males and 13 females ( $P < 0.05$ ) and  $>55$  years had 8 males and 4 females ( $P < 0.05$ ). Table II shows that 98 dentist do clinical examination and case history before prescribing dental radiographs ( $P < 0.05$ ). The mean value recorded was 1.453 with 0.557 Standard Deviation and 0.017 Standard Error. 65 dentists agreed that Patients usually ask question about radiation safety. However 35 denied it ( $P < 0.05$ ). The mean value recorded was 2.76 with 0.764 Standard Deviation and 0.022 Standard Error. Only 62 dentists were aware of collimator usage in X-ray unit while 20 were totally unaware about it. 79 dentists didn't obtain informed consent from patient regarding radiation exposure. 10 dentists were unknown to the importance of length of the cone in radiation hazard. Only 61 dentists stood behind the lead shield when they were not using lead apron. Roughly 66 dental practitioners were using lead apron and thyroid collars during radiographic examination, and only 60 dentists send their radiography equipment for periodic annual maintenances. The mean value recorded was 1.68 with 0.435 Standard Deviation and 0.071 Standard Error (Graph I & II).

## DISCUSSION

Literature has well evidenced that the average radiation dose, per annum received by general public is 2.5msv, and 15% of them are related to medical exposures. The utilization of radiation in the medical practice has evaluated since its beginning and 30% to 50% of medical decision makings are influenced by radiological interpretations.<sup>5</sup> Here, a questionnaire based survey has been conducted in 100 dental clinics in Ghaziabad city. The aim of the study was to understand and assess the level of awareness, knowledge of radiation protection among dentist population in Ghaziabad city. Clinics with X-ray facilities were selected for the survey. For reference purposes we have mentioned recommended dose limits of radiation those accepted worldwide (Table III). Our study result clearly shows that radiation protection among dentist is unsatisfactory in Ghaziabad city. Hence, awareness of radiation protection and safety measures should be followed in order to have hazard free profession.

**Table I: AGE & GENDER WISE DISTRIBUTION OF DENTISTS**

Age Group (Yrs)	Male	Female	Total	P value
25-35	23	11	34 [34 %]	0.04*
36-45	18	12	30 [30 %]	1.00
46-55	11	13	24 [24 %]	0.50
$>55$	8	4	12 [12 %]	0.10
Total	60	40	100	-

\* $p < 0.05$  significant

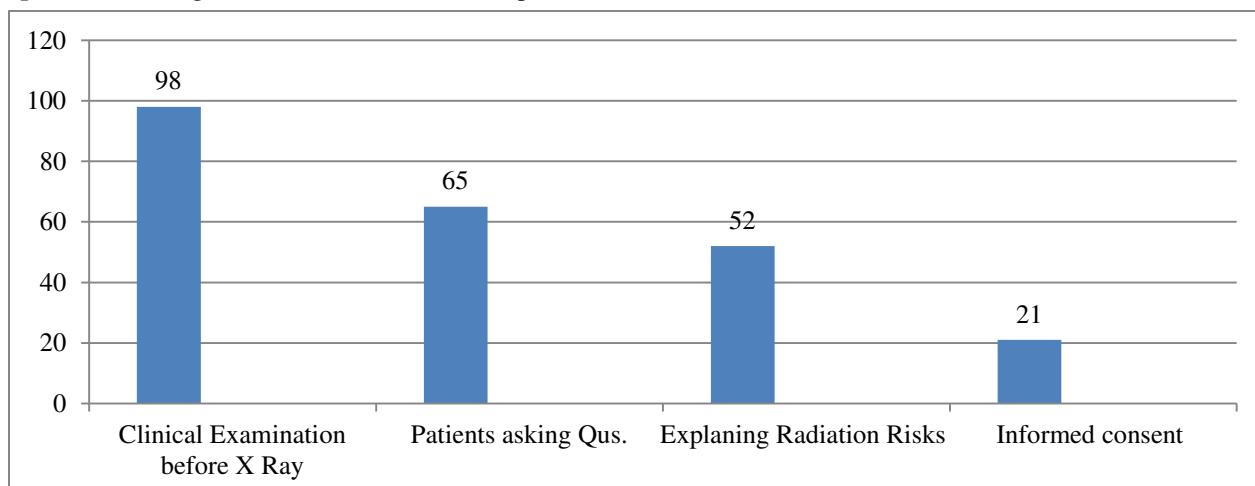
**Table II: QUESTIONNAIRE RESPONSES WITH OBSERVATIONAL STATISTICAL INFERENCE**

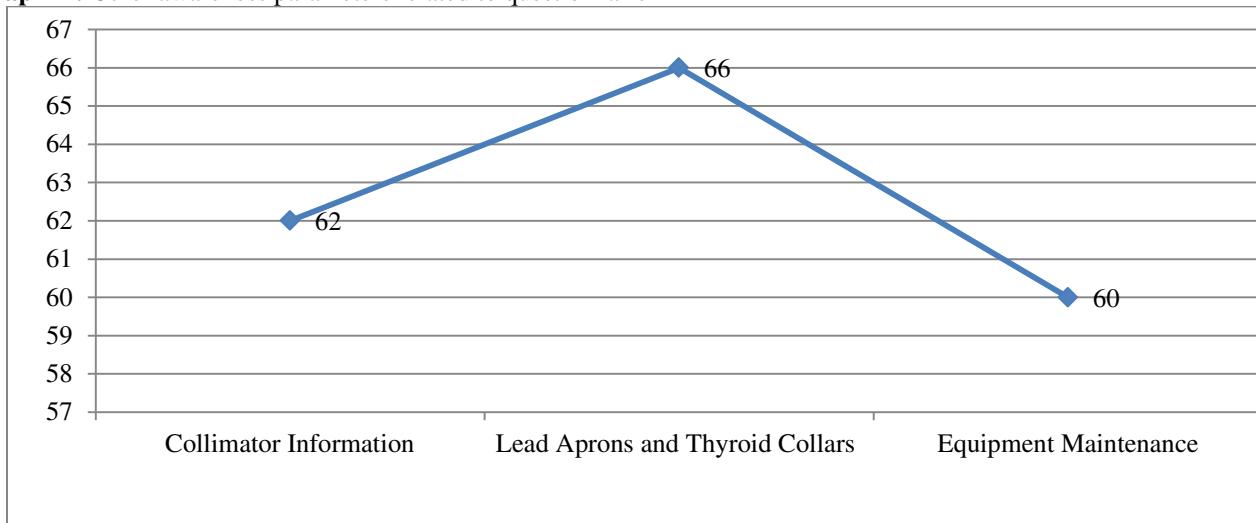
Questionnaire	Response [Value in %]	P value	Mean	Std. Deviation	Std. Error	95% CI
1. Clinical examination and patient's history taking prior to prescribing dental radiographs	Yes = 98 [98 %] No = 2 [2 %]	0.00*	1.453	0.557	0.017	1.13
2. Patients usually ask question about radiation safety	Yes = 65 [65 %] No = 35 [35 %]	0.04*	2.76	0.764	0.022	2.961
3. Explanation of radiation risks to patients before doing radiograph	Yes = 52 [52 %] No = 48 [48 %]	0.085	1.76	2.233	0.454	1.96
4. Obtaining informed consent of the patient before doing radiograph	Yes = 21 [21 %] No = 79 [79 %]	0.014*	2.39	1.432	0.500	1.96
5. Method of film holding in the patient's oral cavity during the exposure	Patient = 31 [31 %] Dentist = 19 [10 %] X Ray Film Holder = 50 [50 %]	0.064	1.84	1.667	0.558	1.96
6. Awareness about collimator those used in X-ray unit	Yes = 62 [62 %] No = 18 [18 %] Unknown = 20 [20 %]	0.022*	2.71	1.000	0.370	1.96
7. Knowledge about length of the cone used in your clinic	8 inches = 55 [55 %] 16 inches = 35 [35 %] Unknown = 10 [10 %]	0.004*	2.85	1.404	0.058	1.96
8. Usage of lead aprons and thyroid collars for patients during radiography	Yes = 66 [66 %] No = 30 [30 %] Unknown = 4 [4 %]	0.005*	2.5	1.338	0.457	1.96
9. Usage of lead aprons and thyroid collars for dentist during radiography	Yes = 44 [44 %] No = 56 [56 %]	0.004	1.96	0.295	0.443	1.96
10. Standing behind the lead shield while not using lead apron	Yes = 61 [61 %] No = 37 [37 %] Unknown = 2 [2 %]	0.024*	1.02	0.226	0.061	1.96
11. Distance from patient during the radiographic (If barriers are not used) examination	3 feet = 27 [27 %] 6 feet = 71 [71 %] Unknown = 2 [2 %]	0.005*	1.00	0.287	0.771	1.96
12. Regular maintenance of radiography equipment	Yes = 60 [60 %] No = 36 [36 %] Unknown = 4 [4 %]	0.022*	1.68	0.435	0.071	1.96

\*p&lt;0.05 significant

**Table III: RECOMMENDED DOSE LIMIT**

Recommended Dose Limit		
S. No.	Dose Quantity	Occupational Dose Limit
1.	Effective dose	20 mSv per year averaged over 5 consecutive years (100 mSv in 5 years)
2.	Equivalent dose in Lens of the eye	150 mSv in a year
3.	In Skin	500 mSv in a year/cm <sup>2</sup>
4.	In Hands and Feet	500 mSv in a year

**Graph 1:** Decreasing order of different awareness parameters

**Graph II:** Other awareness parameters related to questionnaire

Our study also revealed that only 31 % of the patients held the image receptor using their digits during the radiographic exposure accounting for additional exposure of the digits against the rule of ALARA. This was in accordance with the study results of Amanpreet et al.<sup>6</sup> The ADA suggests that the tissue area exposed to the primary X-ray beam must not exceed the minimum coverage consistent with meeting diagnostic requirements and clinical feasibility.<sup>7</sup> In our present study, 62 % of the dentists were aware that collimator was used in X-ray machine. Furthermore, ADA strongly recommends leaded thyroid collars and lead aprons. This particular preventive measure was quite unsatisfactorily used by the studied dentists in this study. Although scatter radiation to the patient's abdomen is extremely low, aprons with lead must be utilized to diminish patient's exposure to radiation. In our study, only 44 % of the dental surgeons used lead aprons and thyroid collars to protect their patients during radiographic examination. Relative radiation exposure to pregnant women may result into numerous biological effects on developing embryo such as intrauterine casualty, developmental anomalies, and mutagenic carcinogenic effects. Therefore it is advisable to avoid radiation exposure during the first trimester, i.e., during 8–15<sup>th</sup> week of pregnancy. However if it is unavoidable, it must be completed during the second and third trimester with proper protection by means of lead apron, thyroid collar.<sup>8–10</sup> To protect patients from X-ray, lead aprons and collars must be used. The main rule of a lead apron is absorption of scattered radiation and reduction of the dose received by patients. It is very imperative for dentist to update their existing awareness about new tendencies in diagnostic techniques, protective measures. This can be accomplished by ways of continuing education activities, journals, workshops, books and other print and electronic medias.<sup>11–12</sup> The

results of this survey, which highlights the levels of knowledge regarding various aspects of dental radiography and radiation protection amongst the Dental practitioners, needs to be well thought-out in the overall context of the country. In the current study design, immediately after the collection of questionnaire from the participants, the correct answers with brief explanation were given to them to assure the basic knowledge about the radiation hazards and protection protocol.

## CONCLUSION

In the studied private dental practitioners of Ghaziabad city, we concluded that most of the dentists were not strictly following the standard norms of radiation safety. The overall level of awareness about radiation safety was moderate only. There is an immediate need of implementation of radiation protection principles among dental surgeons in Ghaziabad city as majority of them were only moderately about radiation safety measures. More emphasis on radiation safety, compulsory continuing professional education is recommended. Also, practitioners must be aware of the possible hazards involved with use of X-rays and should strive hard to implement the various protective measures into practice. Moreover, our study outcomes could be treated as suggestive for predicting clinical awareness for such situations. However we expect other large scale genuine studies to be conducted that could further establish certain concrete guidelines in this field.

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