

Perception of Dental Under-Graduates and Graduates Regarding Radiation Hazards and Protection In Dental Institutes, Karachi; KAP Analysis

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ABSTRACT:

Background: Dental radiography examinations provide valuable diagnostic information that helps dental professionals solve clinical difficulties. Dental practitioners must exercise extreme caution when recommending x-rays. To reduce patient and practitioner exposure to un-needed radiations, the International Commission on Radiological Protection issued recommendations that included the ALARA Principle "As Low as Reasonably Possible"

Objectives: To assess the perception regarding radiation hazards and protection among dental undergraduates, and dental professionals (house officer, graduates, and dental practitioners) in Karachi, Pakistan.

Methods: This is a descriptive cross-sectional study which took around 6 months of duration. The study is conducted using the convenience sampling technique and involves four different dental Institutes in Karachi. The study was performed on 299 participants. The sample size was estimated using open epi sample size calculator version 3.01, by inserting 73.6% prevalence, that high-speed films reduce the radiographic exposure with 5% margin error and 95% confidence interval. Non-probability, convenience sampling technique was used. The collection of data was done using a questionnaire which was disseminated to the

participants in the form of a hard copy. It was a self-designed questionnaire which was pre-tested and validated on thirty subjects to check the reliability of the study. Content and construct validity showed no significant changes. The questionnaire showed high degree (0.89) of agreement during test-retest of the questionnaire. Data was stored and analyzed using SPSS (version 22.0).

Results: A survey was conducted in which 299 participants were selected, working at different government and private dental institutes. Out of these, 53.2% were male and 47.7% were female participants. Response rate was 11% from third-year, 16.7% from fourth-year, 51.7% from house officers and 20.3% from GDPs. Awareness regarding the ALARA principle among third-year students is 6.2%, and 16.4 % in fourth-year students. Whereas 54.1% of house officers and 23.3% of GDPs know about the ALARA principle

Conclusion: The study entailed 6 months of assessment in four dental institutions of Karachi, on 299 subjects using a questionnaire. A high proportion (0.89) of agreement was marked. Awareness of ALARA Principle rose through 3rd and 4th years, and was the highest in House Officers (54.1%) with a further decline in GDP's (23.3%). In light of adverse impact of dental x-rays, the percentage of subjects that concurred with its dangerous qualities fell, with the highest in third-years and the lowest in GDP's.

Index Terms: Dental radiology, Radiation, hazards, perception, protection, protocols, ALARA principle, Dental graduates

I. INTRODUCTION

Clinical dentistry requires the use of dental imaging. Radiographs are hence frequently referred to as a clinician's primary diagnostic tool. However, it poses a risk, thus exposure to dental radiation should be reduced if possible [1] Dental radiographic examinations provide valuable diagnostic information that helps dental professionals (such as dentists and dental students) to address clinical problems. X-ray images are used increasingly around the world. The routine use of dental radiographs exposes practitioners and patients to unnecessary biological hazards. [2] Dentists use radiographs to evaluate their patients. They are trained to perform dental radiographic exposures during their undergraduate and postgraduate training, particularly during clinical rotations. [3] The radiographs may harm a living cell's DNA directly or indirectly by producing free radicals, which are erratic, reactive, and uncharged molecules. [4] Annually, approximately 480 million dental radiographs are performed, accounting for approximately 15% of all diagnostic X-ray examinations. As a result, there is growing concern about frequent low-level ionizing radiation exposure. [5] Radiation-related biohazards are classified as stochastic or non-stochastic. [6] Stochastic effects are those that occur when a person is exposed to a high dose of radiation. With increasing doses, the likelihood of these effects increases. Whereas Non-stochastic effects are those in which the incidence and severity vary with dose but for which there is a threshold dose. Both are harmful and may cause major consequences[7].The health hazards of x-rays to human beings which include genetic mutations, blood cancers and oncogenesis are very common due to the

unawareness of these effects from radiation[8].Therefore, understanding potential hazards and ways of properly implementing safeguards and preventive measures are crucial. Wherever possible, dental radiation exposure should be reduced. To decrease radiation dose, the ALARA (As Low as Reasonably Achievable) principle was implemented. In general, the ALARA concept considers the rationale for the radiological study and uses the least amount of radiation necessary to create radiographs with a reasonable level of diagnostic quality. Since a safer approach is not yet available, radiographs should only be taken at the lowest dosage with a reasonable information yield. [9]Such radiological exposures should be beneficial and outweigh any risks. Dental professionals in countries like India, Saudi Arabia, Nepal, Egypt, and Nigeria invested extensively in the field of radiation and are still working at an expeditious pace. A questionnaire based cross-sectional survey conducted among Egyptian dental health professionals included 152 participants. Among the participants, there were thirty-three undergraduates, forty-four internships & seventy-five postgraduate dentists. Overall, the correct response ranged from 18.2%- 97% for the undergraduate dental students, 13.6% - 88.6 % for the internships & from 21.6 % - 90.7% of post graduate dentists. [10] Another study was conducted among Saudi dental students. Among the fifty-seven samples enrolled in the study, forty-two were in preclinical and fifteen were in clinical dental years. Overall, correct response ranged from 22%-76% in the preclinical group & from 33.3% -72.7% in the clinical group[11]. Furthermore, the KAP study conducted in January 2017 in Bihar, India revealed a low to average result among undergraduates and graduates regarding radiation biology and protection[6]. In addition, a cross-sectional study was conducted among 110 radiology, radiotherapy, and dentistry staff selected by universal sampling technique in Northern Nigeria. Although majority, 85 (77.3%) participants were aware that exposure to

ionizing radiations could cause harm to the body or result in sickness, only 65 (59.1%) had good knowledge of radiation hazards[7]. Hence, we hypothesize that the perception and knowledge of dental undergraduates and graduates regarding radiation risks and their effects may be insufficient. In this study, we include the clinical year dental students of third and fourth-year BDS (Bachelor of Dental Surgery) and general dental practitioners (GDPs), including house officers, to assess the knowledge and attitude of dental health professionals regarding radiation hazards

II. MATERIALS AND METHODS

This is a descriptive cross-sectional study that was approved by institutional review board of Liaquat College of Medicine and Dentistry (Ref.No.IRB/D/000019/21). The study setting included two public sector colleges, Jinnah Postgraduate Medical Centre & DIKIOHS, and two private sector colleges LCMD & Altamash. The study was conducted within a period of 6 months.

The study was performed on 299 participants. The sample size was estimated using open epi sample size calculator version 3.01, by inserting 73.6% prevalence, that high-speed films reduce the radiographic exposure with 5% margin error and 95% confidence interval. Non-probability convenience sampling technique was used. It was a questionnaire-based study, the hard copy of which was distributed among third-year and final year students of BDS, house officers, and the general dental practitioners who had exposure to radiation in their clinical practice. It was a self-designed questionnaire which was pre-tested and validated on thirty subjects to check the reliability of the study. Content and

construct validity showed no significant changes. The questionnaire showed a high degree (0.89) of agreement during test-retest of the questionnaire. The individuals who participated in the pilot study were not considered for the main study to prevent bias. The questionnaire consisted of independent variables and questions related to knowledge regarding radiation hazards among dental undergraduate and graduates. Data was stored and analyzed using SPSS (version 22.0). Descriptive statistics of socio-demographic variables were presented as mean \pm standard deviation or frequency percentages. Outcome variables were assessed in proportion according to knowledge and attitudes. Factor variables were compared using Chi-square test for categorical variables, independent t-test for quantitative variables. Level of statistical significance was set at $P \leq 0.05$. **Inclusion criteria:** third- and fourth-year dental undergraduates, house officers, and general dental practitioners with clinical exposure were included in the study.

III. RESULTS :

Present survey was conducted from three hundred participants working at different government and private dental institutes. Out of these, 53.2% were male and 47.7% were female participants. Response rate was 11% from third-year, 16.7% from fourth-year, 51.7% from house officers and 20.3% from GDPs participation from government sector was 58.3% (175) whereas private sector participation was 41.7% (125).

Table 1 shows the perception regarding radiation hazards among undergraduates (third-year and fourth-year) and graduates (house officer and GDPs)

| | | Designation | | | |
|---|--------------|---------------------|---------------------|----------------|------------|
| | | 3 RD BDS | 4 TH BDS | House Officers | GDPs |
| | | Count (%) | Count % | Count % | Count % |
| How do you consider yourself regarding radiation knowledge? | Excellent | 1 4.3 | 8 16.3 | 7 4.5 | 3 5.3 |
| | Good | 5 21.7 | 11 22.4 | 31 20.0 | 17 29.8 |
| | Average | 12 52.2 | 28 57.1 | 89 57.4 | 27 47.4 |
| | Insufficient | 5 21.7 | 2 4.1 | 28 18.1 | 10 17.5 |
| Is dental x ray harmful? | Yes | 20 87.0 | 34 69.4 | 84 54.2 | 29 50.0 |
| | No | 2 8.7 | 11 22.4 | 63 40.6 | 26 44.8 |
| | Do not know | 1 4.3 | 4 8.2 | 8 5.2 | 3 5.2 |
| Are x rays reflected from the walls? | Yes | 16 69.6 | 27 55.1 | 45 29.0 | 23 41.1 |
| | No | 5 21.7 | 13 26.5 | 67 43.2 | 22 39.3 |
| | Do not know | 2 8.7 | 9 18.4 | 43 27.7 | 11 19.6 |
| Are you aware of radiation symbol? | Yes | 21 91.3 | 35 71.4 | 130 83.9 | 53 91.4 |
| | No | 2 8.7 | 10 20.4 | 18 11.6 | 5 8.6 |
| | Do not know | 0 0.0 | 4 8.2 | 7 4.5 | 0 0.0 |

| | | | | | |
|---|-------------|------------|------------|-------------|------------|
| Are collimators and filters useful? | Yes | 7 30.4 | 21 42.9 | 44 28.6 | 22 37.9 |
| | No | 14 60.9 | 16 32.7 | 89 57.8 | 32 55.2 |
| | Do not know | 2 8.7 | 12 24.5 | 21 13.6 | 4 6.9 |
| Are you aware of deterministic effects? | Yes | 3 13.0 | 23 46.9 | 29 18.8 | 17 29.3 |
| | No | 17 73.9 | 17 34.7 | 100 64.9 | 36 62.1 |
| | Do not know | 3 13.0 | 9 18.4 | 25 16.2 | 5 8.6 |
| Are you aware of the ALARA principle? | Yes | 9 39.1 | 24 49.0 | 79 51.0 | 34 58.6 |
| | No | 13 56.5 | 15 30.6 | 65 41.9 | 21 36.2 |
| | Do not know | 1 4.3 | 10 20.4 | 11 7.1 | 3 5.2 |
| Are you aware of NCRP/ICRP? | Yes | 4 17.4 | 12 24.5 | 21 13.5 | 17 29.8 |
| | No | 18 78.3 | 27 55.1 | 108 69.7 | 35 61.4 |
| | Do not know | 1 4.3 | 10 20.4 | 26 16.8 | 5 8.8 |
| Does high speed film require reduce exposure? | Yes | 10 43.5 | 18 36.7 | 41 26.5 | 24 41.4 |
| | No | 8 34.8 | 10 20.4 | 18 11.6 | 5 8.6 |
| | Do not know | 5 21.7 | 21 42.9 | 96 61.9 | 29 50.0 |
| Are you aware of the ideal | Yes | 16 69.6 | 26 53.1 | 103 66.5 | 41 70.7 |

| | | | | | |
|--------------------------------------|-------------|------------|------------|------------|------------|
| distance between operator and x ray? | No | 5 21.7 | 14 28.6 | 24 15.5 | 6 10.3 |
| | Do not know | 2 8.7 | 9 18.4 | 28 18.1 | 11 19.0 |
| Contraindication in pregnant ladies? | Yes | 5 21.7 | 17 34.7 | 64 41.3 | 13 22.8 |
| | No | 17 73.9 | 22 44.9 | 87 56.1 | 43 75.4 |
| | Do not know | 1 4.3 | 10 20.4 | 4 2.6 | 1 1.8 |

Table 1: Knowledge of Radiation Hazards among Dental Undergraduates and Graduates shows the level of awareness regarding the ALARA principal among third-year students that is 6.2%, and 16.4 % in fourth-year students. Whereas 54.1% of house officers and 23.3% of GDPs knows about the ALARA principle. Around 29.6% of the undergraduates and 70.4% graduates show that they have an understanding regarding NRCP and ICRP as shown in Figure 2.

Figure 1: Knowledge of ALARA Principle in Dental Fraternity

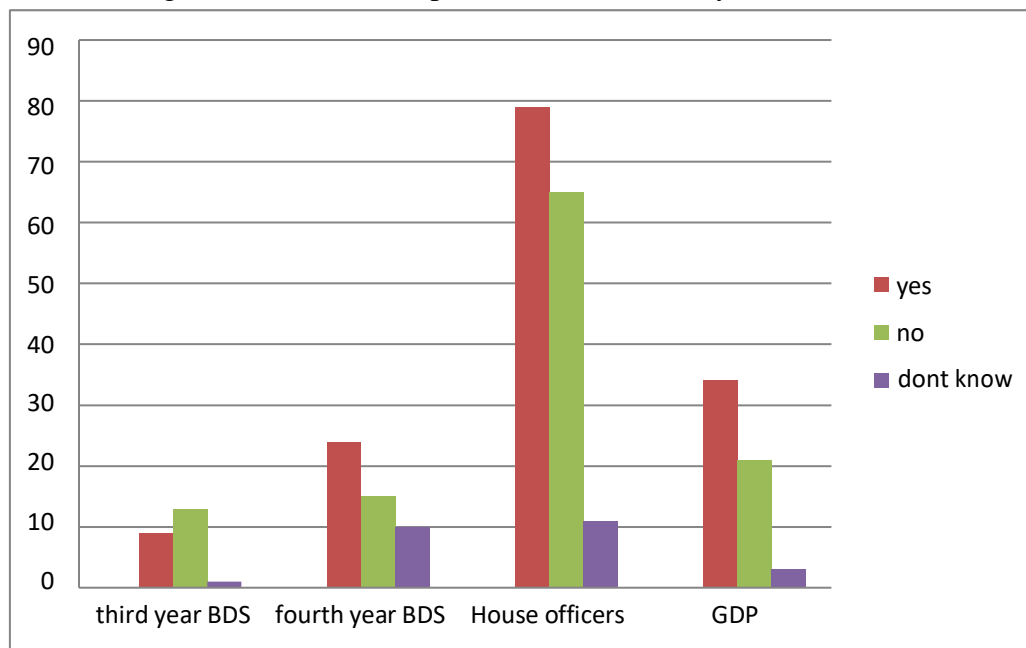


Figure2: Knowledge of NRCP/ICRPP Principle in Dental Fraternity

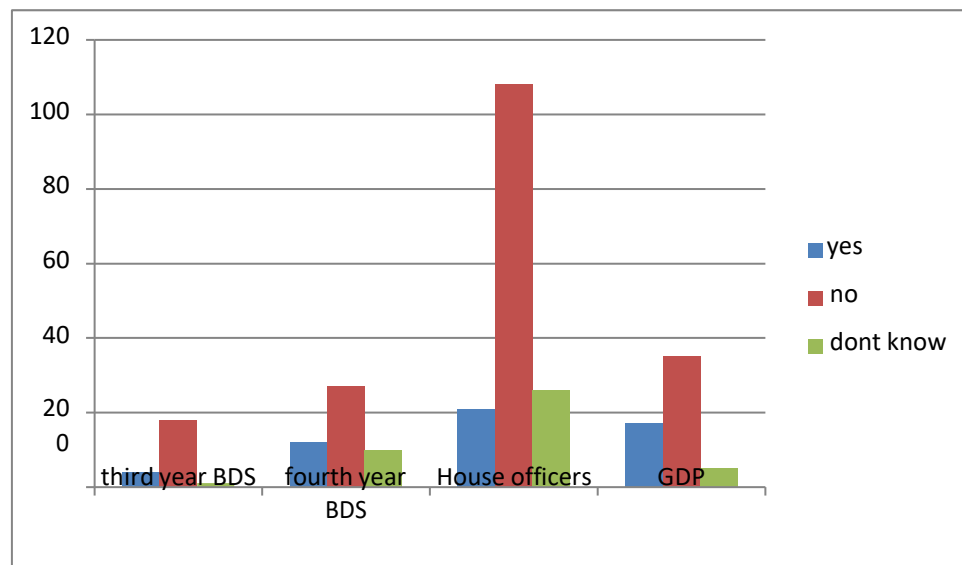


Table 2 shows the association of knowledge regarding radiation hazards among different educational sectors. Awareness of radiation symbol and contraindication during pregnancy show that there is statistically significant relation in both private and government sectors.

| Characteristics | Pearson Chi-square | P-value |
|--|--------------------|---------|
| How do you consider yourself regarding radiation knowledge | 9.74 | 0.021 |
| Dental x ray harmful? | 0.132 | 0.93 |
| X ray reflected from the walls? | 1.89 | 0.38 |
| You are aware of radiation symbol? | 7.56 | 0.02* |
| Usefulness of collimators and filters? | 2.26 | 0.32 |
| Awareness of deterministic effects? | 1.38 | 0.50 |
| High speed film requires reduce exposure? | 2.96 | 0.22 |
| Awareness regarding ideal distance between operator and x ray? | 0.038 | 0.98 |
| Contraindication in pregnant ladies? | 11.5 | 0.00* |
| *Statistically significant at 0.05 | | |

Table 2: Association of Knowledge Regarding Radiation Hazards among Different Educational Sectors.

IV. DISCUSSION:

Every human being on the planet is exposed to ionizing radiation, with human-made sources accounting for around 18% of that exposure. Numerous studies aimed at measuring radiation exposure have indicated an increased prevalence of birth abnormalities, cataracts, cancer, and a shorter life span. Although the preceding statement is inconclusive and may not apply to diagnostic dental radiography, it is admissible because no proof of zero-risk can be provided.

The ALARA Principle recognizes that however small the administered dose is, some stochastic consequence may occur [13]. Three factors should be considered to reduce the occupational dose, which is defined by the ICRP as "the exposure incurred at work and principally as a result of work". In routine dental practice, effective dose should never exceed 1 mSv per year, which is the annual dose limit for the public [14]. The shielding of walls, the position of the X-ray beam that should be directed towards a shielded area, and the distance of the operator when exposed to dental radiation, which should be 6 feet (2 meters) away from the patient at an angle of 90°–135° from the tube head (Position Distance Rule). In addition, rectangular collimation and the use of digital sensors or F-speed film (the fastest among the other varieties) could be explored to reduce radiation exposure. The use of receptor holders to optimize and eliminate repeated exposure is another measure to reduce radiation exposure [4]. As far as shielding is concerned, a study suggests that use of lead apron, even in pregnant patients, or gonadal shielding are not recommended, due to negligible radiation dose reduction [15]. In this study, it is found that dental students, including undergraduates and graduates, considered themselves to have average knowledge regarding dental radiation. Regarding harmfulness of dental x-rays 87% of third-year students, 69.4% fourth-year students, 54.2 % of house officers, and 50% of GDPs appraise that dental radiation may cause

deleterious effects in human body.

Both undergraduates and graduates have significant knowledge (p value=0.02) regarding radiation symbol, equivalent results in the study conducted in Karachi shows approximately 54.5% undergraduates, and 67.3% graduates recognizes radiation symbols. Another study conducted in India shows similar results [6]. Only fourth-year students have significant knowledge at 42.9%, regarding usefulness of collimators and filters, whereas 28.6 % house officers and 37.9% GDPs demonstrated awareness about collimators. A study conducted in Egypt shows that 30.3% of undergraduates and 36% of postgraduates shows the equivalent results [10]. This study shows insignificant knowledge of participants regarding radiation deterministic effects among undergraduate and graduates in contrast to a study conducted in Egypt which shows prominent level of perception among their graduates.

ALARA (as low as reasonably achievable) is a foundational term in radiation protection [16]. Interestingly our study shows that knowledge regarding the ALARA Principle is sufficient among fourth-year students, house officers, and GDPs. While in a study conducted in Saudi Arabia reported that the GDPs has insufficient knowledge regarding the guidelines that is around 41.67% whereas the interns and postgraduates shows a high percentage 40% and 55% in awareness of this concept [17]. The study shows a lack of awareness in participants regarding NCRP /ICRP among undergraduates and graduates. A study that was conducted in Saudi Arabia also showed that 53% of the participants had no knowledge about ICRP despite of attending formal lectures and courses regarding the radiation protection [18]. Except for the third-year students, none of the study groups have adequate knowledge regarding high-speed film exposure. Our result shows that there is an ample knowledge related to ideal distance between operator and x-ray source among undergraduates and graduates. In contrast to study conducted in Karachi that shows the

insignificant knowledge among participants [6]. This study shows that 34.7% of fourth-year student and 41.3% house officers considered that dental radiographs are contraindicated during pregnancy. On the other hand, majority of the participants maintained that it is not contraindicated to take radiographs. A study conducted in Egypt shows that 77.3% postgraduate dentists are also in favor of taking radiographs during pregnancy [10]. On contrary, another study conducted in Faisalabad shows that 58.6% students from third-year, 38% from fourth-year, and 21% house officers think that dental x-rays are completely contraindicated in pregnant women [19]. It is important to provide further knowledge to boost up the confidence regarding radiation knowledge and attitudes, and raising awareness in patients about the hazards related to radiation exposure [20].

Limitations:

The limitation of this study is the selection criteria of participants, the third year and final

year student may lack the knowledge and awareness about x-ray radiations as their clinical exposure is minimal which may lead to a biased result.

Conclusion:

There is a steep decline in the knowledge of ALARA principal from House Officers (54.1%) to GDP's (23.3%) followed by final year and third year students with 16.4% and 6.2% respectively.

In light of adverse impact of dental x-rays, the percentage of subjects that concurred with its dangerous qualities fell, with the highest in third-years and the lowest in GDP's.

In the end, we would like to suggest that third year and final year students should have some lectures and mentorship dedicated towards x-rays, radiation and their harmful effects which will help them to protect themselves as well as the patients from radiation hazards. We would also suggest the GDP's to keep in touch with the latest articles and books so they can retain a firm grip over basic dental SOP's.

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