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Knowledge of radiation protection among dental students in a medical college in Nepal

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Abstract

Introduction: Radiation protection is a core component of radiographic practice and provides optimal patient safety and control of radiation hazards. In this study, we aim to determine the knowledge of radiation protection among dental students in a medical college, in Nepal.

Materials and methods: Bachelor's degree dental final year students studying at Gandaki Medical College (GMC), Pokhara, Nepal were included in this study. A questionnaire survey tool was developed by consulting with two lecturers of medical imaging technology who have more than 10 years of experience. 10 multiple-choice questions (MCQs) were handed to each participant. Each correct answer was given a "1" score and each incorrect answer was given a "0" score. There were no negative markings. The knowledge score was categorized as <60 % inadequate, 60–80 % adequate, and 80–100% excellent. Data were coded and analyzed in IBM SPSS statistics, version 28, Chicago, United States. The normality of the data was checked by using the Shapiro-Wilk test. The equality of variance was assessed by Levene's test. The p-value was set at a 5% level of significance. Two sample t-test was applied since the data followed a normal distribution.

Results: A total of 16 dental students, 5 males, and 11 females, 22.06±0.77 mean age, 20-23 age range were included in this study. Participants did not have prior training in radiation protection. The mean knowledge of radiation protection score was 52.5%, 5.25±1.52, with a maximum score of 8 and a minimum 3 of which was inadequate. There was a statistically significant difference in knowledge according to gender, p=0.01, t(14)=2.92. The mean response was 60% (adequate) for 21-year-old participants and was inadequate at other ages.

Conclusion: The knowledge of radiation protection should be improved among dental students. Adequate course materials and training should be included in their curriculum. Radiation protection national regulations should be implemented as soon as possible.

Introduction

The increasing demand for the use of X-rays and recent advancement in medical imaging technology has significantly upsurged the need for awareness of radiation protection among medical professionals [1,2]. Radiation protection is important for safe radiation-based imaging practice [3]. Ever since the inception of X-ray imaging by Wilhelm Conrad Roentgen in 1895, there have been countless radiation side effects that have plagued human beings [4]. Despite the revolutionization of medical science by X-radiation, it also offers unnecessary deleterious effects of carcinogenic and genetic health hazards and dental radiology is not an exception to that [5,6].

X-radiation is extensively used in dental imaging for diagnosing, planning and monitoring treatments and for follow-up examinations [7]. According to a recent report by the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) in July 2021, dental radiographs accounted for approximately 26% of global diagnostic radiological investigations [8]. Billions of dental radiographs are performed every year and nearly 274 million are carried out in low-income countries including Nepal [8].

With the recent advancements in dental imaging technology, there are various imaging techniques like intraoral radiography, cephalometric radiography and cone beam computed tomography (CBCT) scan [9,10]. The high radiation dose emancipated by the emerging CBCT diagnostic modality has further raised concern about radiation safety and dose accumulation in patients [9,10]. Therefore, international organizations have formulated different guidelines such as: As Low As Reasonably Achievable (ALARA) principle under the International Atomic Energy Agency (IAEA) and other organizations including the European Commission (EC), American Dental Association (ADA) and Food and Drug Association (FDA) under which the Korean government executed an act that states Korean dentist who runs clinics are legally required to arrange for an inspection of their dental radiography machinery every 3 years. Also, in the dental field International Commission on Radiation Protection (ICRP) has recently drawn attention to the “ALADA” principle which stands for As

Low As Diagnostically Achievable means the radiation dose should be limited in such a way that the diagnostic quality of the image should not be degraded which is most important in dental imaging. Hence, adequate knowledge of radiation protection is needed with special attention to the justification and optimization of dental imaging procedures [8–10].

Nepal is a peace-loving landlocked country situated in the lap of the great Himalayas [11]. Unfortunately, the healthcare system is very poor [11,12]. Again, there are no constitutional rules and regulations or any guidelines regarding radiation protection for diagnostic and therapeutic radiology in Nepal [1,2,13]. Hence, the awareness of radiation protection plays a pivotal role in the present situation. We aim to determine the knowledge of radiation protection among dental students in a medical college in Nepal.

Methods

Questionnaire

A questionnaire-based survey was carried out to elucidate knowledge of radiation protection among BDS students in Gandaki Medical College, Pokhara, Nepal. The survey consisted of demographic variables like age, sex, and 10 multiple-choice questions (MCQs) related to radiation protection. The survey was prepared by two radiographers having more than 10 years of experience in radiation protection.

Data collection

The data was collected from 1st to 31st May 2021. All the final-year BDS students participated in the study. The participants were provided with a printed copy of the questionnaire survey by the investigator and were asked to complete it in the presence of the investigator herself. The questionnaire consisted of general knowledge of X-radiation, radiation effects, radiation monitoring devices, radiation protection law, radiation protective materials, and radiation protection authority. The basic questionnaires that can capture a threshold knowledge for the dental students were determined. The questionnaire was developed by radiation protection experts with more than 10 years of experience. These questionnaires were adapted from the paper by Maharjan S et al., [14]. Each correct answer was marked as a score of “1” and the incorrect answer was marked as a score of “0”. There was no negative marking for incorrect answers.

Data analysis

The data were inserted into SPSS statistical software, version 28, Chicago, United States. A descriptive analysis and statistical tests were carried out. The knowledge of radiation protection was classified into 3 categories, <60% inadequate, 60-80% adequate, and 80-100% excellent. The normality of data was checked by using Shapiro-Wilk Test and the equality variance was inspected by Levene’s test. Two sample t-test was applied since the data followed a normal distribution. The p-value was set at a 5% level of significance.

Ethical considerations

Ethical consent of approval was obtained from the institutional review committee (IRC) of GMC, Pokhara, Nepal. Written consent for participation was taken from each participant before conducting the survey. The data were anonymized before inserting into the statistical software.

Results

A total of 16 dental students participated in this study, 5 (31%) male, and 11 (69%) female, mean age of 22.06±0.77 years old, and an age range of 20 – 23 years old. The students had not received any training regarding radiation protection. Table 1 shows the demographic features. Table 2 depicts the correct answers for each question.

The mean knowledge of radiation protection was (52.5%), 5.25±1.52 which was inadequate. The maximum score was 8, whereas the minimum score was 3. There was a statistically significant difference in knowledge according to gender, p=0.01, t(14)=2.92, as shown in Figure 1. The mean response was 60% (adequate) for the 21-year-old participants and was inadequate at other ages as depicted in Figure 2.

Table 1. Demographic characteristics

Demographic characteristics	Frequency	Percentage (%)
Gender		
Male	5	31%
Female	11	69%
Age (in years)		
20	1	6%
21	1	6%
22	10	63%
23	4	25%

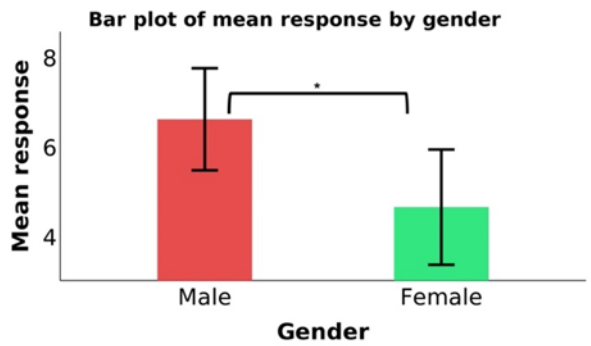

Figure 1. Bar plot showing mean response by gender (*statistically significant)

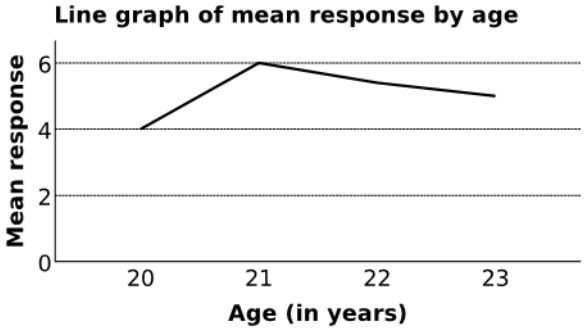

Figure 2. Line graph of mean response by age

Discussion

This study provided a snapshot of the knowledge of radiation protection among dental students in Nepal which was inadequate. This might have resulted because of the following reasons. Firstly, the dental internship in Nepal is limited to the interpretation of dental radiographs and there is no radiation protection syllabus in the dental undergraduate educational course. So, they get less opportunity to learn about the safe use of radiation in dental imaging and the inadequate knowledge of dental professionals would become more prone to risk the safety of the patient while imaging. Second, there is a lack of training and workshops on radiation safety for dental students. We strongly recommend providing training and organizing workshops and seminars on radiation safety for dental students in the present condition. There is plenty of research work conducted among radiographers, radiography professionals and physicians related to knowledge of radiation protection in Nepal [1–3,15–17], however, this study might be the first research of its kind to be conducted among dental students.

Nepal is one of the least developed countries in the world, ranked at 143rd position out of 191 nations in the Human Development Index (HDI) [12]. The dental workforce is meager and dental hygiene education is very much limited. As a matter of fact, dental education in Nepal is still in the early stages. The first dental hygiene 2-year vocational training was started in 2000 [11,12,18]. Later, in the early 2000s, 3 years academic diploma and Bachelor of Dental Surgery (BDS) courses were conducted [19]. Subsequently, in the early 2010s, a Master of Dental Surgery (MDS) course was established [19]. Furthermore, the Medical Education Commission was established in 2017 in Nepal [20]. This implies medical education including dental surgery is still in the early stage. Yet, imaging is the gold standard for diagnosis in dental science, it is high time the authorized body takes adequate actions to incorporate radiation protection in dental science with priority from the basic level.

In dental radiology, somatic stochastic effects are possible [9]. Hence, we recommend the “As Low As Reasonably Achievable” (ALARA) principle [9]. Radiation dose imparted to the patient should be justified and optimized whenever possible and the dose should be given within the standard limits [7–9]. Protective devices should be used while exposing and pregnancy situations should be considered for childbearing-aged women [9].

At present situation, Nepal lacks radiation protection regulations [1,2,13]. So, it is a crucial time for Nepal to formulate a radiation regulatory body to draft and implement radiation safety guidelines, inspect facilities and monitor radiation hazards. Again, we recommend Nepal Dental Association (NDA) formulate proper guidelines for safe imaging [21]. Nepal has been a member of the International Atomic Energy Agency (IAEA) since 2008, which has been helping continuously including the Country Programme Framework (CPF) for 2022-2027 [1,21,22]. So, we suggest NDA and IAEA strengthen dental radiation safety very soon.

Conclusion

In summary, to improve the knowledge of radiation protection among dental students, we recommend mandatory training for them. The radiation protection course should be included in the syllabus of dental education. Continuous seminars and workshops should be organized for them. Medical institutions could collaborate with international and national authorities to provide knowledge of radiation protection. Lastly, Nepal must formulate radiation protection laws for diagnostic and therapeutic imaging procedures using ionizing radiation as soon as possible.

Statements and Declarations

Competing Interest: All authors declare that there are no conflicts of interest.

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