

# Awareness and knowledge regarding dental radiology: a cross-sectional study of dentists and dental students

Zainab Akbar, Sabeen Saeed, Sana Waris, Syed Muhammad Junaid, Sanya Javed

**Submitted**

April 10, 2023

**Accepted**

August 03, 2023

**Author Information**

*Dr. Zainab Akbar*

Assistant Professor & Head  
Oral Medicine, Diagnosis, &  
Radiology,  
Rehman College of Dentistry,  
Peshawar, Khyber  
Pakhtunkhwa, Pakistan

*Dr Sabeen Saeed*

Demonstrator  
Oral Medicine, Rehman  
College of Dentistry,  
Peshawar, Khyber  
Pakhtunkhwa, Pakistan  
(Corresponding Author)  
Email:  
sabeenhammad116@gmail.com

*Dr. Sana Waris*

House Surgeon  
Oral Medicine, Rehman  
College of Dentistry,  
Peshawar, Khyber  
Pakhtunkhwa, Pakistan

*Dr. Syed Muhammad Junaid*

Assistant Professor  
Sardar Begum Dental  
College, Peshawar, Khyber  
Pakhtunkhwa, Pakistan

*Dr. Sanya Javed*

Demonstrator  
Oral Medicine, Rehman  
College of Dentistry,  
Peshawar, Khyber  
Pakhtunkhwa, Pakistan

**Citation:** Akbar Z, Saeed S, Waris S, Junaid SM, Javed S. Awareness and knowledge regarding dental radiology: a cross-sectional study of dentists and dental students. J Rehman Med Inst. 2023 Oct-Dec;9(4):8-12.

**ABSTRACT**

**Introduction:** Dental radiographs are an important tool for the diagnostic workup of the patient. Both basic and specialized radiographs are used in dentistry and knowledge regarding its indications and techniques is required both for undergraduate and postgraduate students, general dentists, and consultants.

**Objective:** To explore the knowledge and awareness of dental radiographs among dentists and dental students of a private tertiary care dental institute.

**Materials & Methods:** The cross-sectional descriptive study was conducted at Rehman College of Dentistry, Peshawar, KP, Pakistan from October 2022 to March 2023. The questionnaire was prepared after a literature review, validation by experts, and pilot testing. Reliability was observed to be more than 0.9 and the questionnaire was disseminated through online Google forms using convenience sampling. SPSS Version 22.0 was used for descriptive data analysis.

**Results:** A total of 154 participants were included in the study; 58% were females and 42% were males. Generally, regarding most of the questions, specialists had the highest knowledge, while postgraduate and general dentists had a neutral ratio, and undergraduates were the least aware.

**Conclusion:** Despite the utmost significance of dental radiology in the diagnosis and treatment planning of patients, it is not given its due importance. Generally, the dental fraternity lags in knowledge and awareness about the field, especially at the undergraduate level.

**Keywords:** Radiology; Radiography, Dental; Dentists; Dentistry; Education, Dental; X-Rays.

*The authors declared no conflict of interest. All authors contributed substantially to the planning of research, data collection, data analysis, and write-up of the article, and agreed to be accountable for all aspects of the work.*

**INTRODUCTION**

A large number of diagnostic tests and investigations are available in the field of dentistry. Imaging remains one of the most important investigations to reach the proper diagnosis. Dental radiographs, commonly called X-rays, are used to diagnose hidden dental problems or diseases.<sup>1</sup> These include malignant and benign lesions, bone loss, bony deformities, cavities, skeletal anomalies, impactions, etc. It is a great diagnostic tool that helps the dentist see any damage or disease that is not visible to the naked eye.<sup>2,3</sup>

Both basic and specialized radiographs are available. In today's world, all dentists must have basic knowledge about the use and interpretation of dental radiographs, but unfortunately, this is not the case, which leads to a great lapse in proper diagnosis and treatment planning. The literature review reveals that not only do dental students and dentists lack knowledge regarding radiation protection and proper techniques of radiograph taking but they are not aware of advising proper radiographs for different conditions.<sup>4,5</sup> Studies regarding radiation hazards are widely available but no study assessing basic radiographic knowledge and indications of different radiographs has been conducted so far nationally. So, the general knowledge about dental radiology is questionable and our study aimed to assess general awareness about the said subject as this field needs a lot of improvement to provide quality services in a clinical or hospital setup.

**MATERIALS & METHODS**

This cross-sectional descriptive study was conducted at Rehman College of Dentistry, Peshawar, Khyber Pakhtunkhwa, Pakistan, for six months (October 2022 to March 2023). Ethical approval was taken from the institutional ethical approval committee (RCD-22-06-010, June 2022). Informed consent was taken from all the participants, and they were assured that their identity and responses would be kept confidential (as a part of a Google form). Not only the students and faculty of both private and government dental colleges of Peshawar were included, but general dentists from different areas of Peshawar were included as well through convenience sampling without any age or gender discrimination.

A questionnaire with 18 items was made after thorough literature review; it was validated by four experts and was pilot tested. Reliability was observed to be 0.90. Google Forms were used to collect data; participants were given access to the forms for three weeks. SPSS 22 was used for descriptive data analysis.

**RESULTS**

The response rate was 77% (154 participants out of 200); of these, 90(58.4%) participants were female while 64(41.6%) were male.

In general, specialists had the highest knowledge, postgraduates and general dentists had a neutral ratio, and undergraduates were the least aware.

Table 1 provides the responses of subjects regarding radiation hazards. Though most respondents said they were aware of radiation hazards, details of competent practice about hazards were not supported by the remaining responses.

**Table 1: Response of participants to questions regarding radiation hazards (n=154).**

Questions	Designation			
	Undergraduates	Postgraduates	General Dentists	Specialists
<b>Q 1. Are you aware of radiation hazards in dentistry?</b>				
No	9.3%	10.7%	15.2%	0.0%
Yes	<b>86%</b>	<b>85%</b>	<b>84%</b>	<b>100%</b>
Do not know	4%	3.6%	0%	0%
<b>Q 2. Does digital imaging require less exposure than conventional radiographs?</b>				
No	8%	21.4%	24.2%	21%
Yes	<b>49%</b>	<b>71.4%</b>	<b>63.6%</b>	<b>68.4%</b>
Do not know	42.7%	7.1%	12.1%	10%
<b>Q 3. In your opinion, are dental radiographs contraindicated for pregnant patients?</b>				
No	25%	35%	<b>54%</b>	<b>64%</b>
Yes	<b>61%</b>	<b>63%</b>	42%	36.8
Do not know	13.3%	0%	3%	0%
<b>Q 4. Are you aware of ALARA Principle regarding radiation?</b>				
No	<b>69%</b>	<b>50%</b>	<b>60%</b>	15%
Yes	30.7%	50%	39%	<b>84%</b>
<b>Q 5. Do you use a lead apron &amp; thyroid shield for patient protection against radiation?</b>				
No	<b>58%</b>	46%	42%	49%
Yes	41%	<b>53%</b>	<b>57%</b>	<b>73%</b>

Table 2 provides responses to questions related to knowledge and practice of 2D radiographs. A fair amount of similarity was

observed in responses across the different designations of subjects.

**Table 2: Response of participants to questions regarding indication of 2D radiographs (n=154).**

Questions	Designation			
	Undergraduates	Postgraduates	General Dentists	Specialists
<b>Q 6. Which one is the most prescribed basic radiograph in dentistry?</b>				
Bitewing	4%	3.6%	3.0%	0%
Periapical	<b>74%</b>	<b>85%</b>	<b>87%</b>	<b>84%</b>
Orthopantomogram (OPG)	14%	7.1%	9.1%	15.8%
Postero Anterior	6%	3.6%	0%	0% 0%
<b>Q 7. Which basic radiograph is preferred for assessing impacted teeth in the maxillary arch?</b>				
Upper occlusal	<b>40%</b>	<b>46%</b>	<b>57%</b>	<b>63.2%</b>
Lower occlusal	2.7%	3.6%	2.1%	0%
Periapical	34.7%	32.1%	24.2%	36.8%
Bitewing	22.7%	17.9%	6.1%	0%
<b>Q 8. Which basic radiograph is used for the assessment of mixed dentition?</b>				
Periapical	1.3%	0%	9.1%	0%
Orthopantomogram (OPG)	<b>93.3%</b>	<b>82%</b>	<b>87%</b>	<b>94%</b>
Cephalic	2.7%	14.3%	3.0%	5.3%
CT	2.7%	3.6%	0%	0%
<b>Q 9. Which basic radiograph is preferred for the evaluation of full mouth dental problems?</b>				
Periapical	2.7%	0%	9.1%	5.3%
Orthopantomogram (OPG)	<b>84%</b>	<b>85%</b>	<b>78%</b>	<b>84.2%</b>
Cephalic	2.7%	7.1%	9.1%	5.3%
CT	10.7%	7.1%	3.0%	5.3%
<b>Q 10. Which radiograph is used to assess sialolithiasis in submandibular glands?</b>				
Upper occlusal	6.7%	7.1%	3.0%	5.3%
Lower occlusal	<b>58.7%</b>	<b>71.4%</b>	<b>87.9%</b>	<b>84.2%</b>
Bitewing	21.3%	10.7%	9.1%	10.5%
Periapical	13.3%	10.7%	0%	0%

Table 3 provides the responses of subjects regarding 3D radiographs. The responses show slightly greater variation as compared to the responses for the 2D radiographs, with specialists scoring the highest percentages and other categories

varying in the grades of responses. The undergraduates responded fairly well with most scores in line with the other professional categories.

**Table 3: Response of participants to questions regarding indication of 3D radiographs (n=154).**

Questions	Designation			
	Undergraduates	Postgraduates	General Dentists	Specialists
<b>Q 11. Which radiograph is suggested for the assessment of sinus pathologies?</b>				
Postero Anterior (PA)	12.0%	0%	12.0%	0%
Paranasal Sinus (PNS)	<b>58%</b>	<b>67%</b>	<b>42%</b>	<b>78.9%</b>
Submento Vertex (SMV)	13%	17.9%	33%	15.8%
Antero Posterior (AP)	16%	14.3%	12.1%	5.3%
<b>Q 12. Which radiograph is used to assess skeletal anomalies?</b>				
Postero Anterior (PA)	24.0%	7.1%	12.1%	0%
Cephalograph	<b>58.72%</b>	<b>67.9%</b>	<b>69.7%</b>	<b>73.7%</b>
Lateral	14.7%	21.4%	15.2%	15.8%
Submento Vertex (SMV)	2.7%	3.6%	3.0%	10.5%
<b>Q 13. Which radiograph is used to assess fractured zygomatic arches?</b>				
Postero Anterior (PA)	22.7%	17.9%	21.2%	15.8%
Paranasal Sinus (PNS)	16.0%	17.9%	18.2%	5.3%
Submento Vertex (SMV)	28.0%	<b>50%</b>	<b>42.4%</b>	<b>73.7%</b>
Lateral	<b>33.3%</b>	14.3%	18.2%	5.3%
<b>Q 14. Which specialized radiograph is used as the gold standard for the diagnosis of squamous cell carcinoma (SCC)?</b>				
CT	<b>46.7%</b>	<b>39.3%</b>	<b>33.3%</b>	<b>68.4%</b>
MRI	34.7%	35.7%	33.3%	26.3%
CBCT	14.7%	25.0%	30.3%	5.3%
Ultrasound	4.0%	0%	0%	0%
<b>Q 15. What will be the preferred radiograph for the diagnosis of a fractured mandible?</b>				
Postero Anterior (PA)	<b>37.3%</b>	28.6%	27.3%	<b>52.6%</b>
Antero Posterior (AP)	37%	21.4%	<b>45.5%</b>	26.3%
Submento Vertex (SMV)	17.3%	<b>39.3%</b>	18.2%	15.8%
Paranasal Sinus (PNS)	9.0%	10.7%	9.1%	5.3%
<b>Q 16. Do you think you have sound knowledge about the indication of Cone Beam Computerized Tomography (CBCT)?</b>				
No	<b>61%</b>	<b>46.4%</b>	36.4%	31%
Yes	24.0%	39.3%	<b>54%</b>	<b>47%</b>
Do not know	14.7%	14.3%	9.1%	21.1%
<b>Q 17. Do you think CBCT will ultimately surpass all other dental radiographs?</b>				
No	21.3%	17.9%	33.3%	21.1%
Yes	<b>44.0%</b>	<b>53.6%</b>	<b>63.6%</b>	<b>63.2%</b>
Do not know	34.7%	28.6%	3.0%	13.8%
<b>Q 18. Which is the preferred radiograph for 3D imaging of the head and neck region?</b>				
CT	28.0%	14.3%	12.1%	26.3%
MRI	14.7%	21.4%	12.1%	5.3%
CBCT	<b>56%</b>	<b>64.3%</b>	<b>75.8%</b>	<b>68.4%</b>
Ultrasound	1.3%	0%	0%	0%

## DISCUSSION

Many facts were unveiled during our study regarding basic radiographic knowledge among dentists. Study results revealed that most dentists were aware of radiation hazards and protection.<sup>1,2</sup> Our results are comparable to studies conducted previously like a study done in 2020 by Khamtuikrua C, et al.,<sup>3</sup> and Mahasneh AM, et al.,<sup>4</sup> in the year 2022. Dental radiography is considered safe during pregnancy if protective measures have

been provided such as thyroid collar, Lead apron, and use of high-speed E films. No fetal abnormalities have been reported to x-ray radiation values 5-10 cGy and a complete set of full mouth radiographs results in only  $8 \times 10^{-4}$  cGy.<sup>6</sup> Most of the dentists in our study believed that dental radiographs are contraindicated in pregnancy. Similar results were found in a Jordanian study where 25.4% of the participants said dental radiographs can be taken in the first trimester only and in another study, approximately half

of the participants said Cone Beam Computerized Tomography (CBCT) and panoramic radiographs must not be taken during pregnancy.<sup>6-8</sup> Even in one study, 4% of general women believed radiographs to be safe during pregnancy.<sup>9</sup> In our study, most of the dentists said that they are not aware of the ALARA principle which is opposite to the study done by Almohaimede AA et al., in 2020.<sup>10-12</sup> But like our results, the majority of studies reported a lack of awareness about the ALARA principle as well. A study conducted in Nepal regarding radiation hazards and safety showed that 88% of the participants were aware about it.<sup>13</sup>

In our study, most of the dentists thought that Periapical was the most prescribed basic radiograph in dentistry which is contrary to a study done in 2020 in Europe where several clinical-based recommendations about dental radiographs were agreed upon.<sup>14</sup> Our study shows that the majority of participants were fully aware that Orthopantomogram (OPG) is used for the diagnosis of full-mouth dental problems and pathologies of mixed dentition. This follows a previous study conducted by Almalki YE at el.,<sup>15</sup> and Jadhav P<sup>16</sup>. The question regarding radiograph used for diagnosing sinus pathologies was rightly answered by most of the participants as Paranasal Sinus view (PNS). This is suggested by previous studies conducted in India as well.<sup>17</sup> In a question regarding radiographs used for the detection of skeletal facial anomalies, the majority indicated the utility of cephalography which is also supported by a previous study,<sup>18</sup> and was also shown in a study done on an ethnic Chinese population in 2022.<sup>19</sup> While some of the previous studies have used OPG and CBCT for the same purpose as well.<sup>20,21</sup> Our results showed that the lower occlusal view is the gold standard for diagnosing submandibular radiographs while sialolithiasis can be diagnosed through Multi-imaging modalities like panoramic, occlusal, cervical, CT Scan, USG, and sialography according to previous research.<sup>22</sup> For the fractured zygomatic arch, the Submento Vertex (SMV) view was considered the most commonly used radiograph while previous research supports ultrasound as equally effective as conventional radiographs like PNS and SMV.<sup>23</sup> For mandibular fractures, the PA view was selected as the correct option by the majority but OPG is used most widely.<sup>24</sup> The majority of the participants answered CT Scan is the gold standard for diagnosis of SCC which is similar to a study done in 2020.<sup>25</sup> Answering questions regarding CBCT, the majority of the participants believed CBCT to be the most preferred radiograph and they were well aware of its significance as well but unfortunately, the majority were not fully aware of its indications. The emphasis of CBCT was also emphasized in a study done by Xie J and Peng Y in 2021.<sup>26</sup> Previous literature suggests that people are generally not aware of the indications, contraindications, and proper use of CBCT.<sup>27</sup>

In our study, we found out that general specialists and general dentists have more knowledge about dental radiography than the dental students. This students lag and this subject requires a lot of attention at the undergraduate level. When prompted about dental radiographs being contraindicated in pregnancy,

specialists disagreed at the highest percentage while undergraduates (UGs) agreed. Likewise, When inquired about radiation hazards awareness, General Dentists (GDs), Postgraduates (PGs), and undergraduates did not know while specialists had sound knowledge of the ALARA principle. Similarly, when asked about basic radiographs used for assessing impacted maxillary teeth, for evaluation of full mouth dental problems, for assessment of mixed dentition, for fractured zygomatic arches, and for assessing skeletal anomalies, specialists had the highest knowledge and undergraduates had the lowest. Results are justifiable as specialists are subject experts and their knowledge and practice surpasses that of students and general dentists. Astonishingly, when inquired about indications of CBCT and the most preferred radiograph for the head and neck region, GDs had more knowledge while specialists were second. This discrepancy may be because general dentists are actively involved in dental practices with the latest modalities like CBCT, etc. Again, when inquired about the prescribed radiograph for assessment of sinus pathologies, gold standard radiograph for diagnosing squamous cell carcinoma and fractured mandible, specialists had the highest percentage.

The greatest strength of our study is that it is the first study of its kind nationally and globally. The previous study encompasses topics like radiation hazards and techniques while a holistic view regarding general radiographic knowledge and awareness is lacking.

## CONCLUSION

Despite the utmost significance of dental radiology in the diagnosis and treatment planning of the patient, it is not given its due importance. Generally, the dental fraternity lags in knowledge and awareness about the field, especially at the undergraduate level.

## LIMITATION

The limitation of our study is that the data was collected from the dental community of Khyber Pakhtunkhwa only. So, the generalizability of data cannot be ensured.

## RECOMMENDATIONS

The concerned authorities of dental colleges should take necessary measures and conduct different courses and workshops to create more awareness about dental radiology as it seems like a forgotten topic. A good and prompt diagnosis is greatly dependent on dental radiographs and the ability of dentists to read them. Therefore it should be included in the curriculum at the undergraduate and postgraduate levels and taught well to the students.

Future studies can be conducted to probe the knowledge of dental surgery assistants about taking good-quality radiographs as well. Comparison can be made between knowledge amongst consultants of different specialties as well.

## REFERENCES

- Abuelhia E, Alghamdi A, Tajaldeen A, Mabrouk O, Bakheet A, Alsalem H, et al. Dental undergraduates, and interns' awareness, attitudes, and perception of radiological protection. *Int J Dent*. 2022 May 9;2022.
- Mupparapu M, Kulkarni R. Assessment of radiology baseline knowledge of freshman North American dental students before any formal instruction. *Eur J Dent Educ*. 2022 Aug;26(3):563-8.
- Khamtuikrua C, Suksompong S. Awareness about radiation hazards and knowledge about radiation protection among healthcare personnel: a quaternary care academic-center-based study. *SAGE Open Med*. 2020 Jan;8:2050312120901733.
- Mahasneh AM, Al-Mousa DS, Khabour OF, Al-Sa'di AG, Alakhras M. Attitudes and knowledge of dental radiography amongst students of dentistry and related fields. *Eur J Dent Educ*. 2022 Nov;26(4):801-11.
- Basheer B, Albawardi KW, Alsanie SA, Alotaibi BM, Alanazi MM, Alfaifi HA, et al. Knowledge, attitudes, and perception toward radiation hazards and protection among dental professionals in Riyadh, Kingdom of Saudi Arabia. *Int J Med. Health Res*. 2019;8(9):75-81.
- Oglat AA, Hasan H. Jordanian women's (studying or working in medical fields) awareness in terms of the use of dental imaging during pregnancy. *BMC Oral Health*. 2022 Sep 24;22(1):427.
- Flagler CK, Troici CM, Rathore SA. A historical review of the effects of dental radiography on pregnant patients. *J Am Dent Assoc*. 2022 Oct;153(10):989-95.
- Abbott P. Are dental radiographs safe? *Aust Dent J*. 2000 Sep;45(3):208-13.
- Bahanan L, Tehsin A, Mousa R, Albadi M, Barayan M, Khan E, et al. Women's awareness regarding the use of dental imaging during pregnancy. *BMC Oral Health*. 2021 Dec;21(1):357.
- Almohaimede AA, Bendahmash MW, Dhafir FM, Awwad AF, Al-Madi EM. Knowledge, attitude, and practice (KAP) of radiographic protection by dental undergraduate and endodontic postgraduate students, general practitioners, and endodontists. *Int J Dent*. 2020 Apr 27;2020:2728949.
- Vilborn P, Uys A, Yakoob Z, Cronje T. Evaluation of radiation awareness among oral health care providers in South Africa. *S Afr Dent J*. 2021 Apr;76(3):122-8.
- Joseph BB, George S. The road to radiation safety and ALARA: A review. *IP Int J Maxillofac Imaging*. 2021 Jan 15;6(4):89-92.
- Joshi U, Poudyal S, Gurung D, Chaulagain R. Knowledge and awareness of dentists working at tertiary care hospital towards radiation protection and safety. *JKAHS*. 2020;3(3).
- Kühnisch J, Anttonen V, Duggal MS, Spyridonos ML, Rajasekharan S, Sobczak M, et al. Best clinical practice guidelines for prescribing dental radiographs in children and adolescents: an EAPD policy document. *Eur Arch Paediatr Dent*. 2020 Aug;21(4):375-86.
- Almalki YE, Din AI, Ramzan M, Irfan M, Aamir KM, Almalki A, et al. Deep learning models for classification of dental diseases using orthopantomography X-ray OPG images. *Sensors (Basel)*. 2022 Sep 28;22(19):7370.
- Jadhav P. Evaluation of dental radiographic imaging among insured population reporting for dental treatment—a retrospective study. *Sch J Dent Sci*. 2021 Sep;8:258-63.
- Mehta AK, Ravikumar R. Utility of paranasal sinus radiography. *Med J Armed Forces India*. 2002 Jan;58(1):98.
- Helal NM, Basri OA, Baeshen HA. Significance of cephalometric radiograph in orthodontic treatment plan decision. *J Dent Pract Contemp*. 2019 Jul 1;20(7):789-93.
- Chan GX, Tan EL, Chew MT, Wong HC, Foong KW, Yow M. Prevalence of class I, II and III skeletal relationships and its association with dental anomalies in an ethnic Chinese orthodontic population. *Proc Singap Healthc*. 2022 Dec;31:20101058211000779.
- Pallikaraki G, Sifakakis I, Gizani S, Makou M, Mitsea A. Developmental dental anomalies assessed by panoramic radiographs in a Greek orthodontic population sample. *Eur Arch Paediatr Dent*. 2020 Apr;21:223-8.
- Abdelkarim A. Cone-beam computed tomography in orthodontics. *Dent J (Basel)*. 2019 Sep 2;7(3):89
- Sarifah N, Rahman FU, Nurrachman AS, Azhari A, Epsilawati L. Considerations of multi-imaging modalities for diagnosing of sialolithiasis in the submandibular gland: a case report. *Dentino Jurnal Kedokteran Gigi*.;7(2):118-23.
- Nath P, Menon S, Suresh A, Archana S. Comparison of ultrasonography with conventional radiography in the diagnosis of zygomatic complex fractures. *J Oral Maxillofac Surg*. 2020 Jun;19:307-13.
- Nardi C, Vignoli C, Pietragalla M, Tonelli P, Calistri L, Franchi L, et al. Imaging of mandibular fractures: a pictorial review. *Insights Imaging*. 2020 Feb 19;11(1):30.
- Stratigos AJ, Garbe C, Dessinioti C, Lebbe C, Bataille V, Bastholt L, et al. European interdisciplinary guideline on invasive squamous cell carcinoma of the skin. *Eur J Cancer*. 2020 Mar 1;128:60-82.
- Xie J, Peng Y. The Head and Neck Tumor Segmentation Based on 3D U-Net. In: Andrearczyk V, Oreiller V, Hatt M, Depeursinge A. (editors). *Head and Neck Tumor Segmentation and Outcome Prediction - Second Challenge, HECKTOR 2021, Held in Conjunction with MICCAI 2021, Strasbourg, France, September 27, 2021, Proceedings. Volume 13209 of Lecture Notes in Computer Science*, pages 92-98. Springer, 2021.
- Stokes K, Thieme R, Jennings E, Sholapurkar A. Cone beam computed tomography in dentistry: practitioner awareness and attitudes. A scoping review. *Aust Dent J*. 2021 Sep;66(3):234-45.