

**Republic of Yemen**  
**University of Science and Technology**  
**Faculty of Medicine and Health Science**  
**Diagnostic Radiology Technology Department**



الجمهورية اليمنية  
جامعة العلوم والتكنولوجيا  
كلية الطب والعلوم الصحية  
قسم تكنولوجيا الأشعة التشخيصية

# **Assessment of Knowledge, Attitudes, Performance, and Challenges Regarding Radiation Protection Among Dental Students and Staff**

## **Prepared By**

Atheer Dia'a Al-deen Al-Baghdadi

Ahmed Gumaei Nasser

Bassam Mohammed Al-Marwsi

Tareq Mohameed Omar

Waleed Ahmed Hamood

## **Supervisor**

Dr. Abdullah Taher Al-hemiary

Assistant Professor of Medical  
Radiation Science

THIS RESEARCH HAS SUBMITTED IN FULFILMENT OF THE  
REQUIREMENT FOR THE BACHELOR DEGREE IN DIAGNOSTIC  
RADIOLOGY AND MEDICAL IMAGING TECHNOLOGY

**2023**

# Dedication

our study trip came to an end after fatigue and hardship, and here we are concluding our graduation research with all vigor and activity, And we are grateful to everyone who has had a favor in our career and helped us, even if only with a little bit. For respected parents, friends, and teachers... we dedicate our graduate research to you...

# **Acknowledgements**

We would like to express our gratitude to  
the supervisor

**Dr. Abdullah Taher**

for his continuous effort with us and for  
his continuous instructions. and we would  
like to thank our entire group for their  
work in this research to show it in the  
best possible way and thank all those  
who motivated us and brought us to this  
place...

## Table of Contents

Dedication.....	I
Acknowledgments.....	II
Table of Content.....	III
List of Tables.....	IV
List of Figures.....	V
List of Abbreviations.....	V
Abstract.....	VII

### Chapter 1: Introduction

1.1 Introduction .....	1
1.2 Problem Statement .....	2
1.3 Objective .....	2
1.3.1 General Objective .....	2
1.3.2 Specific Objective.....	2
1.4 Importance of The Study.....	2
1.5 Research Outline.....	3

### Chapter 2: Literature Review

2.1 Theoretical Background.....	5
2.1.1 X-rays.....	5
2.1.2 X-ray Tube.....	6
2.1.3 Dental X-rays and Radiation Exposure.....	7
2.1.4 Typical Effective Doses .....	7
2.1.5 Prescribed Dental X-rays .....	8
2.1.5.1 Bite-Wing X-rays.....	8
2.1.5.2 Periapical X-rays.....	8
2.1.5.3 Panoramic X-rays.....	8
2.1.5.4 Cone Beam CT (computed topography) Scan.....	8
2.1.6 Do Dental X-rays Deliver a High Dose of Radiation?.....	8
2.1.7 Radiation Exposure to The People.....	9
2.1.8 Radiation Effect on Health.....	9
2.1.9 Radiation you Exposed to During an X-ray.....	10
2.1.10 Types of Radiation .....	11
2.1.10.1 Alpha Particles.....	11
2.1.10.2 Beta Particles.....	11
2.1.10.3 Gamma Rays and X-rays.....	11
2.1.10.4 Neutrons.....	11
2.1.11 Radiation Shielding.....	12
2.1.11.1 Using X-ray Shielding Protects.....	12
2.1.11.2 Principle of ALARA .....	12
2.1.11.3 X-ray Shielding.....	13
2.2 Previous Study.....	16

### Chapter 3: Research Methodology

3.1 Study Design (type of study) .....	18
3.2 Study Population and Sampling.....	18
3.3 Data Collection Methods and Tools.....	18
3.4 Data Analysis.....	18
3.5 Study Period.....	18
3.6 Ethical.....	18
3.7 Study Questioner.....	19

## Chapter 4: Results and Discussion

4.1 Results.....	21
4.2 Discussion.....	31

## Chapter 5: Conclusion and Recommendations

5.1 Conclusion.....	34
5.2 Recommendations.....	35
References.....	36
Appendixes.....	37

## List of Tables

Table No.	Table titles	Page No
2.1	Radiation Measurements	10
4.1	Responses of Participants About Their Gender	21
4.2	Responses of Participants About Their Age	21
4.3	Responses of Participants About Their Jobs	21
4.4	Responses of Participants About Their Years of Experience	22
4.5	Practice Participants Responses About Films Taken a Week	22
4.6	Knowledge Participants Responses About Kilovoltage	22
4.7	Knowledge Participants Responses About Tube Current	23
4.8	Knowledge Participants Responses About Exposure Time	23
4.9	Knowledge Participants Responses About Exposure Time	23
4.10	Practice Participants Responses on Distance from The Patient	24
4.11	Practice Participants Responses on Precautions Protection	24
4.12	Practice Participants Responses on Holding Image Receptor	24
4.13	Knowledge Participants Responses About Monitoring Badges	25
4.14	Knowledge Participants Responses About Most Important Organ to Protect	25
4.15	Practice Participants Responses About Standing Place During Exposure	25
4.16	Knowledge Participants Responses About Dose Limit	26
4.17	Knowledge Participants Responses About Education	26
4.18	Knowledge Participants Responses About The Protective Material	26
4.19	Knowledge Participants Responses About The Radiation Dose in Dental	27
4.20	Practice Participants Responses About Using Lead Apron	27
4.21	Participants Responses About Radiation Protection Practice	28
4.22	Participants Responses About Radiation Protection Knowledge Attitude	29
4.23	Correlations Between Participants Knowledge, Practice, Attitudes	30

## List of Figures

Figure No.	Figure titles	Page No
2.1	Electromagnetic Radiation	5
2.2	X-ray Tube	6
2.3	The Dental Dose Compared to Other Sources	8
2.4	The Penetrating Between Each Major Types of Radiation	11
2.5	ALARA	12
2.6	Lead Shielding	13
2.7	Mobile Barriers	14
2.8	X-rays Curtains	15

## List of Abbreviations

Abbreviations	Meaning
KAP	Knowledge Attitude Performance
Gy	Gray
mGy	Milligray
$\mu$ Sv	Microgray
CBCT	Cone Beam Computed Topography
$\mu$ Sv	Microsievert
CT	Computed Topography
3D	Three Dimensional
mSv	Millisievert
ALARA	As Low As Reasonably Achievable
ICRP	International Commission on Radiological Protection
SPSS	Statistical Package for the Social Sciences
IDEC	International Dental Expo Conference
OPG	Orthopantomogram
IOPA	Intraoral Periapical
NCRP	National Council on Radiation Protection
ICRP	International Commission on Radiological Protection
GDPs	General Dental Practitioner
ALARP	As low As Reasonably Practicable

# **Abstract**

## **Background**

Since they discovered the radiation and the scientific revolution has begun to expand the concept of radiation to become comprehensive for most aspects of scientific and practical life, medical and industrial. the radiation section that contributed to the development and improvement of services provided in radiation departments. Every time a dental X-ray is done, a small radiation dose can cause Danger to the human body.

## **Aim**

To assess the knowledge and performance and attitude and challenges towards radiation protection situation among dental staff and students.

## **Method**

This study is a descriptive analytical study, based on a questionnaire that was uploaded via google form and paper the study sample 1517 participants.

## **Results**

The findings showed that Females participants have more knowledge than male, while males have more practice. Interns have more knowledge than rest of groups because their information is still fresh, the dentist group had more practice because this group had best practice in work life than rest of groups.

The results showed that there was an association between knowledge and gender, age, job and experience, age group where more than 45 years showed the best knowledge, the group with more than 15 years' experience had the best knowledge.

Moreover, there was a significant association between practice and age, job and experience while with gender there was no association, Age group where more than 45 years had the best practice, the group with 11 – 15 years' experience had the best practice.

In addition, there was an association between attitude and gender, age, job and experience, male participants had better attitude than female, age group with more than 45 years had the best attitude, dentist assistant had the best attitude, the group with 11-15 years' experience had the best attitude.

## **Conclusion**

The academic team in the dentistry department are advised to increase the lessons subject about radiation protection to improve the dentistry students' knowledge which can be reflected in their attitude and practice.

It is recommended to conduct workshops and training courses about radiation protection for the dentistry staff to help them in gaining the proper information about how to protect themselves and the patients from hazard ionizing radiation. The dentistry staff should provide radiation protection equipment in their department.

The ministry of health should establish a monitoring mechanism to ensure that health care providers have radiation protection measures.



# Chapter one

## **1.1 Introduction**

Since x-ray entered it was used in the dental pathology in 1895, it was an important diagnostic and especially in modern dentistry.

The ionization radiation ability to penetrate the soft tissues and bones on images cannot be noted by the eyes; therefore, we cannot see what is happening inside the body. Thus, the radiation devices play a big important role in the medical health care branches.

Different uses in the Eurodontia Diagnosis to the diseases that surround the face and jaws etc. as well as the ionization radiation can be hazard for the soft tissues. [1]

All the dentists and patients are in danger of effective radiation even though it is a low dose radiation exposure, it is still very important to minimize the radiation to avoid accumulated radiation dose of dentists and patients in their lives.

The radiation type used for teeth imaging is ionization radiation has different effective hazards such free radical production that affects the cells in direct and indirect ways which finally causes DNA damage including single or double DNA damage.

The X-ray is hazard to human cells and genes. It is also strong enough to turn normal cells to cancer cells and leukemia.

The radiology is the main major in medical application, medical health and dentistry. The medical imaging gives accurate diagnosis in dentistry. [2]

## **1.2 Problem Statement**

Every day, our students and doctors are at risk of exposing to radiation even if it was in a small dose due to the fact of the accumulation of the small doses is critical, so it's significant to minimize the radiation exposure, therefore this research seek to assess the knowledge and attitude and performance (KAP) to radiation protection among dental staff and students.

## **1.3 Objectives**

### **1.3.1 General Objective**

To assess the knowledge and performance and attitude and challenges towards radiation protection situation among dental staff and students.

### **1.3.2 Specific Objective**

- To assess the knowledge regarding radiation protection among dental students and staff.
- To assess the attitudes regarding radiation protection among dental students and staff.
- To assess the performance regarding radiation protection among dental students and staff.
- To assess the challenges regarding radiation protection among dental students and staff.
- To assess the effect of demographic variables and KAP of participants about radiation protection.

## **1.4 Importance of The Study**

To raise awareness to minimize or avoid the radiation exposure among dental students and dental workers as well as knowing the radiation risks.

## **1.5 Research Outlines**

Chapter one contains an introduction to this research and its general and specific objectives and the problem statement and why this study is important.

Chapter two is about a literature view to general x-rays and dental x-rays and the amount of doses used in dental equipment's and the radiation effects and how to protect from it.

Chapter three is about the research methods the population sampling and how and where it's been collected and how the data has been analyzed.

Chapter four contains the results of this study and the discussion of this study.

Chapter five contains the final conclusion of this study and the recommendation on how to solve the study problem.

# **Chapter two**

## **(Literature Review)**

## 2.1 Theoretical Background

### 2.1.1 X-rays

X-rays are a form of electromagnetic radiation, similar to visible light. Unlike light, however, x-rays have higher energy and can pass through most objects, including the body. X-rays are used to generate images of tissues and structures inside the body. If x-rays traveling through the body also pass through an x-ray detector on the other side of the patient, an image will be formed that represents the “shadows” formed by the objects inside of the body.

One type of x-ray detector is photographic film, but there are many other types of detectors that are used to produce digital images. The x-ray images that result from this process are called radiographs [3].

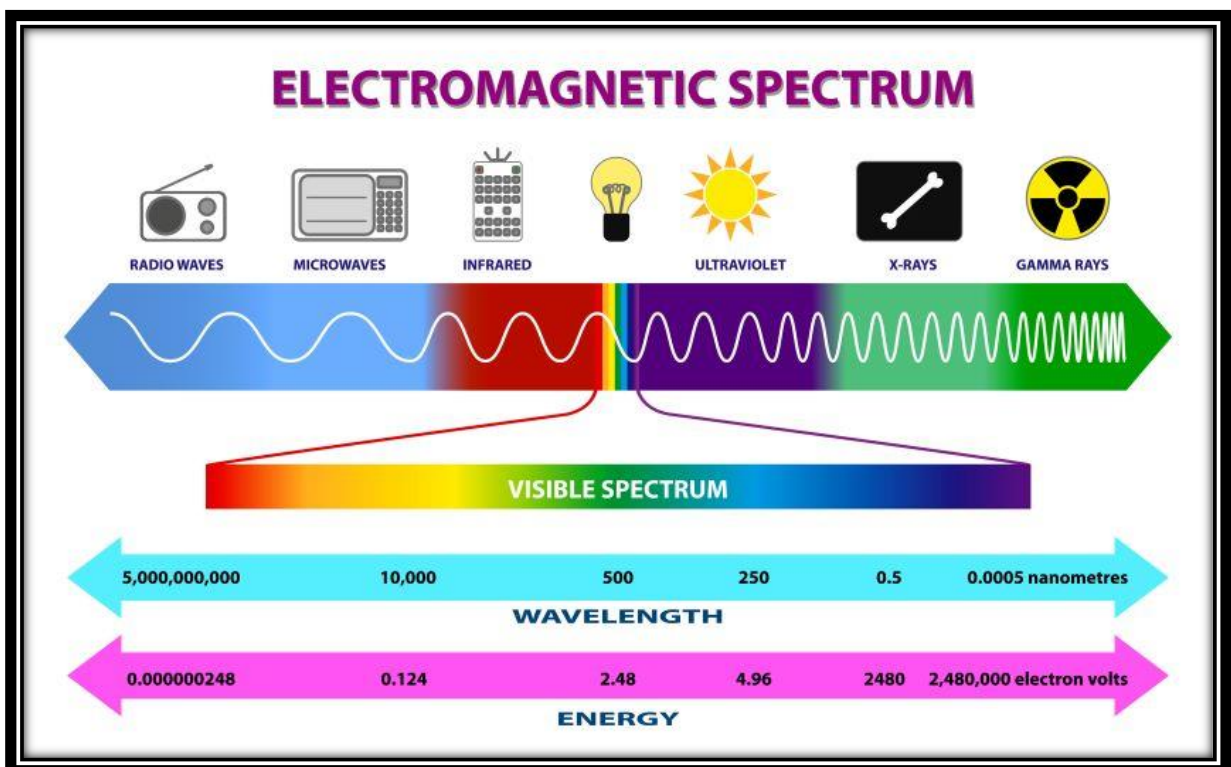


Figure 2.1: Electromagnetic Radiation [3]

## 2.1.2 X-ray Tube

It is easy to see that the X-ray emission technique initially used by Röntgen is in no way comparable to the current one. The emission systems and generators of the time were very different, and over time, they have been implemented to ensure absolute safety for both the examiner and the X-ray recipient [4].

X-rays are emitted by a process in which electrons are accelerated by means of a very high voltage and directed against a plate usually made of tungsten and molybdenum. The contact of the electrons with the plate generates the X-rays [4].

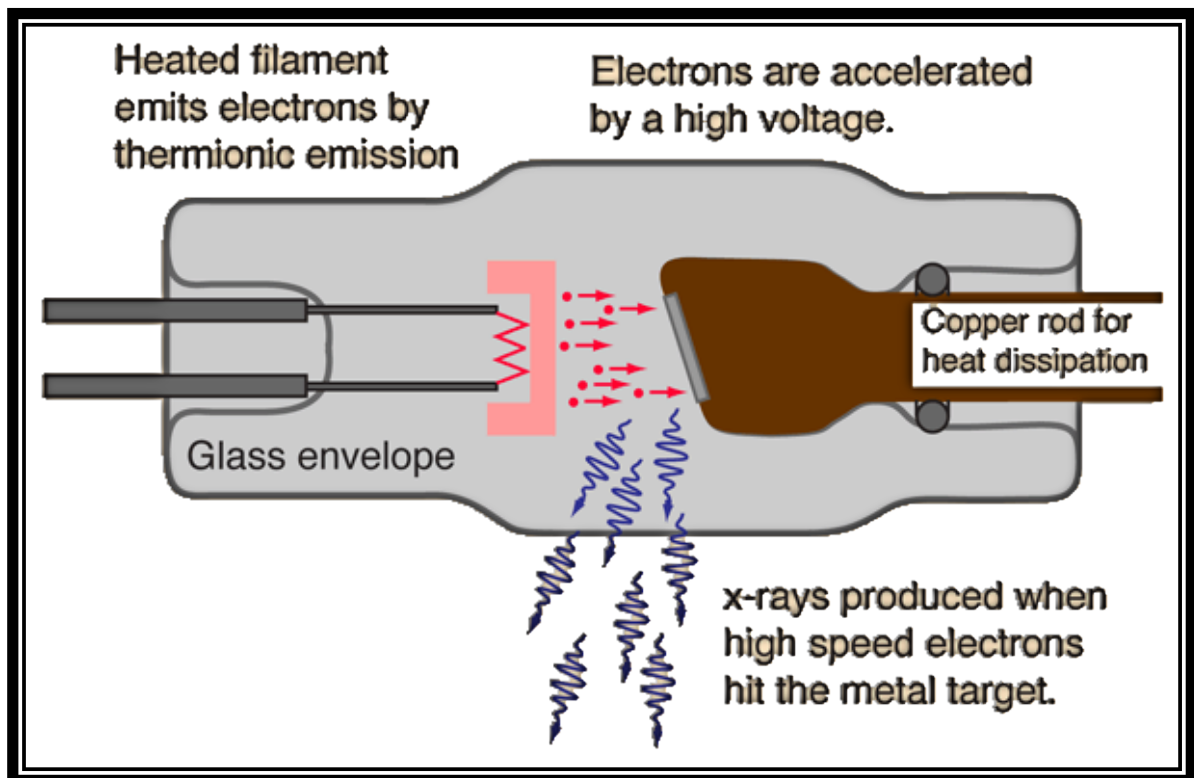


Figure 2.2: X-ray Tube [5]

### **2.1.3 Dental X-rays and Radiation Exposure**

It is generally recommended that children and adults visit their general dentist twice a year for routine check-ups and cleanings

However, the cumulative effect for patients and staff can reach dangerous levels. It is important to employ methods that can attenuate exposure and decrease radiation dosage.

X-rays are often required annually for the identification and diagnosis of dental conditions. While I believe that the benefits of x-ray outweigh the risks, the concern about the amount of radiation from dental x-rays remains one the most common questions in dentistry [6].

### **2.1.4 Typical effective doses are for**

- Intraoral dental X ray imaging procedure 1–8  $\mu\text{Sv}$ .
- Panoramic examinations 4-30  $\mu\text{Sv}$ .
- Cephalometric examinations 2-3  $\mu\text{Sv}$ .
- CBCT Procedures 50  $\mu\text{Sv}$  or below for small- or medium-sized scanning volumes, and 100  $\mu\text{Sv}$  for large volumes.



## 2.1.5 Prescribed Dental X-rays

### 2.1.5.1 Bite-Wing X-rays

Which focuses on the upper and lower back teeth and check for decay between teeth.

### 2.1.5.2 Periapical X-rays

Which shows the entire length of a tooth from crown to root and is used to look at the health of the bone that supports the teeth and to detect abscesses, cysts.

### 2.1.5.3 Panoramic X-rays

Which is a two-dimensional tomographic exam that show the entire mouth in a single image including teeth, jaws, and surrounding tissue.

### 2.1.5.4 Cone beam CT (computed topography) Scan

Which is a three-dimensional image of the teeth, soft tissues, nerve pathways and bone in a single scan. Commonly used by oral surgeons and orthodontists [6].

## 2.1.6 Do dental X-rays deliver a high dose of radiation?

Dental X-rays are at a very low dose. They would give you a similar amount of radiation as something like two hours in the sun, or an hour on a plane. And with digital X-rays, we're now able to use a radiation dose that is about a third lower than what the conventional films were [7].

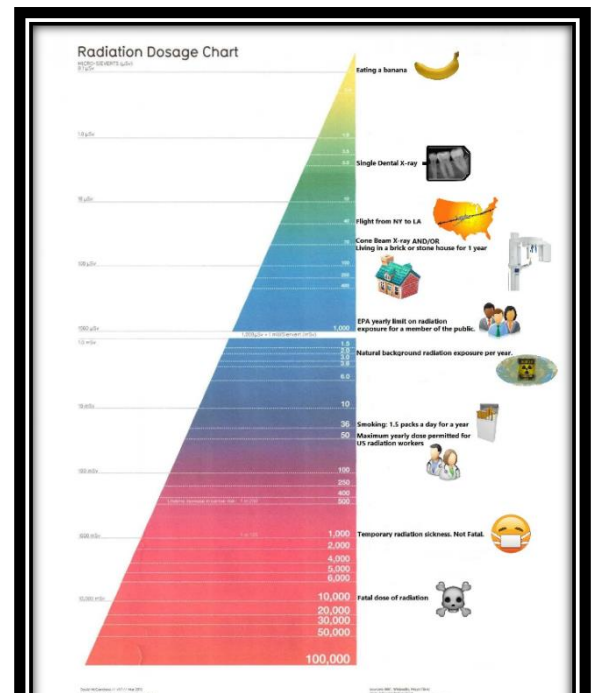


Figure 2.3: The Dental Dose Compared to Other Sources [7].

## **2.1.7 Radiation Exposure to People**

Today, the most common artificial sources of human exposure to radiation are X-ray machines and radiopharmaceuticals used for diagnostic or radiotherapy and other medical devices.

Exposure to radiation can result from natural, planned (medical, occupational) or accidental situations and it may be external, internal (inhalation, ingestion or absorption via a contaminated wound), or a combination of both.

## **2.1.8 Radiation Effects on Health**

Excessive exposure to radiation may damage living tissues and organs, depending on the amount of radiation received (i.e., the dose). The extent of the potential damage depends on several factors, including:

- The type of radiation.
- The sensitivity of the affected tissues and organs.
- The manner and length of time exposed.
- The radioactive isotopes involved.
- Characteristics of the exposed person (such as age, gender and underlying condition).

The risk of developing adverse health effects depends on the radiation dose. The higher the dose, the higher the risk of adverse effects. If the radiation dose is low or it is delivered over a long period of time, the risk is substantially lower because the damage to cells and molecules will be repaired by the body [8].

## 2.1.9 Radiation you are Exposed to during an X-ray

Radiation is measured in sieverts which indicates the health effect of low levels of ionizing radiation on the human body. Since a Sievert is a very large dose, most measurements are done in millisieverts.

**Table 2.1: Radiation Measurements**

<b>Image</b>	<b>Amount of Radiation in millisieverts (mSv)</b>
Bite-wing (2) x-ray	4.00 mSv
Periapical (2)x-ray	4.00 mSv
Panoramic x-ray	7.00 mSv
Cone Beam scan for oral surgery/ortho	9.00 mSv
CT scan of head	2.00 mSv
X-ray of an extremity	1.00 mSv
CT scan of chest	8.00 mSv
Mammogram (two dimensional)	7.00 mSv

A large amount of radiation can cause tissue damage and increase the risk of developing cancer later in life.

While x-rays, radiography, contribute to the overall radiation exposure for a patient, it is well-documented that the amount of radiation exposure for dental x-rays is very small compared to other radiography [6].

## 2.1.10 Types of Radiation

### 2.1.10.1 Alpha Particles

Alpha particles cannot penetrate most matter. A piece of paper or the outer layers of skin is sufficient to stop alpha particles.

Radioactive material that emits alpha particles (alpha emitters) can be very harmful when inhaled, swallowed, or absorbed into the blood stream through wounds.

### 2.1.10.2 Beta Particles

Beta particles can be stopped by a layer of clothing or by a few millimeters of a substance such as aluminum.

Beta particles are capable of penetrating the skin and causing radiation damage, such as skin burns.

### 2.1.10.3 Gamma Rays and X-rays

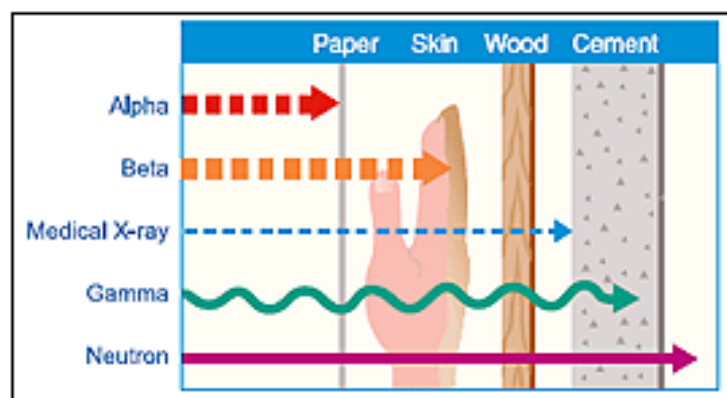
Gamma rays and X-rays are penetrating. Several feet of concrete or a few inches of lead are required to stop them.

Gamma rays and X-rays are a radiation hazard for the entire body.

While gamma rays and X-rays can easily pass completely through the human body.

### 2.1.10.4 Neutrons

Neutrons are particles and are very penetrating. -Several feet of concrete or another material rich in hydrogen (such as water) are required to stop them [9].



**Figure 2.4: The Penetrating Between Each Major Types of Radiation [9]**

## 2.1.11 Radiation Shielding

### 2.1.11.1 Using X-ray Shielding Protects

- Patients: Protect patients who are being examined and those in surrounding treatment areas or in the waiting area.
- Operating personnel: The technician or nurse positioning the x-ray and the operators.
- Other staff, visitors and the general public present in the x-ray area.
- Where the x-ray room shares a wall with another office, shielding is essential [10].

### 2.1.11.2 Principle of ALARA

As Low As Reasonably Achievable (ALARA) principle should be strictly followed along with continuous monitoring of radiation exposure with radiation badges or dosimeters [10].

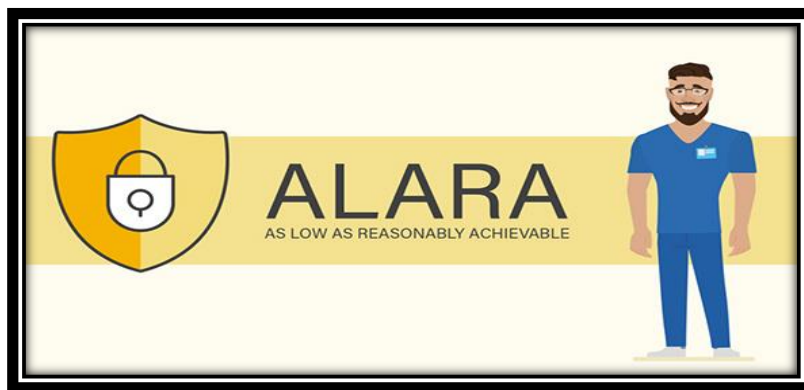


Figure 2.5: ALARA [11].

### 2.1.11.3 X-ray Shielding

With the use of proper patient protection techniques, the amount of X-ray received by the patient can be minimized. In dental radiography, clinicians must use every means to reduce unnecessary exposure to their patients, themselves and staff.

For intraoral x-rays in the dental office, a protected position behind a barrier or six-foot distance is required for the operator [10].



**Figure 2.6: Lead Shielding [12].**

Mobile radiation barriers include lead barriers with or without leaded glass viewing windows.

The advantage of a mobile barrier is that wheels on the bottom of the shield barrier allow easy movement of the shield.

Portable barriers can be moved to any area where the X-ray is to be performed, saving space in the dental office.

Leaded X-ray glass permits doctors and technicians to watch the patient safely throughout procedures, while remaining behind the barrier, enabling safe shielding against X-ray radiation.



**Figure 2.7: Mobile Barriers [10].**

X-rays curtains made from leaded rubber sheets are an effective solution for shielding healthcare workers against scattered radiation from X-ray devices while saving space. Being able to stand directly behind lead curtains will diminish the scattered radiation thus serving as a barrier between the healthcare worker and the radiation produced from the X-ray device.



**Figure 2.8: X-rays Curtains [10].**



## 2.2 Previous study

**Javali, et all (2018)**, assessed the attitude and awareness about radiation protection among dental surgeons in North Karnataka, the study sample was (n= 200) The information was collected from questionnaires using Descriptive Analytical Study 98.5% of the dentists considered clinical examination of patients before taking radiograph, but 56.5% of the dentists did not take informed consent of the patient before acquiring radiograph. Approximately 70.5% of the dentists stood behind the lead shield when they were not using lead apron. and 60% of the dentists got the radiography equipment periodically checked [14].

**Chandrasekhar, et all (2020)**. assessed awareness and determined the understanding of radiation protection devices and its role in dentistry among dental students, the study sample was (n= 100) The information was collected from questionnaires, the study was A cross-sectional observational online based study was conducted, the **Result** showed that the first set of questions; about 92% of the participants agreed that dental X-rays are harmful. Fourth question gives awareness of students on ALARA principle and was only aware of ALARA principles by 49% of the participants, the remaining them were not aware of ALARA principles by 51% According to question 5 about awareness on high-speed films, 62% of the participants claimed that high speed films reduce patient exposure [2].

**Nasir, et all (2023)** assessed the perception regarding radiation hazards and protection among dental undergraduates, and dental professionals (house officer, graduates, and dental practitioners) in Karachi, Pakistan., the study sample was (n= 299) The information was collected from questionnaires, the study was A cross-sectional observational, the **Result** showed Awareness regarding the ALARA principal 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 knows about the ALARA principle [15].

# **Chapter three**

**(Research Methodology)**

### **3.1 Study Design (type of study)**

Descriptive Analytical Study.

### **3.2 Study Sampling**

The sample of the study including 1517 participants from dental students and doctors were asked to answer the questionnaire.

### **3.3 Data Collection Methods and Tools**

We prepared a questionnaire that was uploaded on google form and was on a paper with multi-choices.

The questionnaire was distributed to postgraduate and students in dentistry and faculty members (general practitioners and dentists) at the (**International Dental Conference IDEC-Yemen 2023**) , And also the **collage of dentistry at the University of Science and Technology (UST), Sana'a University, Al-Hikma University, Al-Razi University, Al-Hadara University, Emirates International University, and Al-Ghad College**, and also given to doctors (**general physicians and dentists**) in government hospitals, including clinics, and private practice.

### **3.4 Data Analysis**

For the qualitative and quantitative description, the data were processed using computer programs including excel and SPSS.

### **3.5 Study Period**

This study was applied from 3/12/2022 To 28/02/2023.

### **3.6 Ethical**

This study was approved by the University of Science and Technology.

### **3.7 Study Questioner**

The questionnaire was divided into two sections:

First section included sociodemographic data that consisted of gender, age, working place, years of clinical experience.

The second section included items to assess KAP.

The questionnaire was in the form of multiple-choice questions related to the harmful ionizing radiation and protective measures consist of 40 questions.

Data were entered into an electronic database and analyzed using SPSS. (Statistical Package for the Social Sciences)

# **Chapter four**

**(Results and Discussion)**

## 4.1 Results

The percentage was used as a statistical method to represent the results of the questionnaire tables by using the (SPSS) program & Excel. We used the Frequency Table, T-test, Independent Samples Test, ANOVA to visualize the results of the analyzes.

### 4.1.1 Study Sample Gender

**Table 4.1: Responses of participants about their Gender**

Gender	No.	Percent
Male	780	51.4%
Female	737	48.5%
<b>Total</b>	<b>1517</b>	

**Table 4.1 showed 51.4% of participants were Males, 48.5% of participants were Females.**

### 4.1.2 Study Sample Age

**Table 4.2: Responses of participants about their Age**

Age	No.	Percent
Less than 25	983	64.8%
26 - 35 Years	441	29.0%
36 - 45 Years	84	5.5%
More than 46	9	0.5%
<b>Total</b>	<b>1517</b>	

**Table 4.2 showed that the most common age group was less than 25 983 (64.8%).**

### 4.1.3 Study Sample Job

**Table 4.3: Responses of participants about their Jobs**

jobs	No.	Percent
Dentist	684	45.0%
Dentist assistant	98	6.4%
Intern	139	9.1%
Student	596	39.2%
<b>Total</b>	<b>1517</b>	

**Table 4.3 showed that the majority of participants were dentists 684 (45.0%).**

#### 4.1.4 Study Sample experience

**Table 4.4: Responses of participants about their Years of experience**

experience	No.	Percent
Less than 5 years	1236	81.6%
5 - 10 Years	200	13.1%
11 - 15 Years	43	2.7%
More than 16	38	2.4%
<b>Total</b>	1517	

Table 4.4 showed that the most common experience group were less than 5 years with percentage 81.6%.

#### 4.1.5 Films Taken a Week by Participants

**Table 4.5: participants responses about films taken a week**

Question	Answer	No.	Percent
<b>1. Approximately how many films are taken in your practice every week?</b>	0 - 10 Films	860	56.7%
	11 - 20 Films	408	26.9%
	21 - 30 Films	146	9.6%
	More than 31	103	6.7%
	<b>Total</b>	1517	

Table 4.5 showed that participants, their x-ray imaging ranges from 0 to 10 films, with percentage 56.7%, and those who use 11-20 films with percentage 26.9%.

#### 4.1.6 Knowledge About Kilovoltage

**Table 4.6: Participants responses about kilovoltage**

Question	Answer	No.	Percent
<b>2. What is the kilovoltage of your intraoral radiographic equipment?</b>	45 - 55 kVp	943	62.1%
	56 - 64 kVp	350	23.0%
	65 - 75 kVp	191	12.5%
	More than 76 kVp	33	2.1%
	<b>Total</b>	1517	

The result in Table 4.6 showed That the majority use low kilovolts from 45 to 55 kVp with percentage 62.1%, and those who use medium kilovolts from 56 - 64 kVp with percentage 23.0%.

### 4.1.7 Knowledge About Tube Current

**Table 4.7: Participants responses about tube current**

Question	Answer	No.	Percent
3. What is the tube current of your intraoral radiographic equipment?	Less than 10 mA	1103	72.8%
	11 - 15 mA	386	25.5%
	more than 16 mA	28	1.6%
	<b>Total</b>	1517	

The result in Table 4.7 showed that the majority use less than 10 milliamperes with percentage 72.8%, and very few uses more than 16 milliamperes with percentage 1.6%.

### 4.1.8 Knowledge About Exposure Time

**Table 4.8: Participants responses about exposure time**

Question	Answer	No.	Percent
4. Does the exposure time vary?	Yes	1243	81.2%
	No	274	18.7%
	<b>Total</b>	1517	

The result in Table 4.8 showed that the percentage of participants that answered yes were larger than participants who answered no, with percentage 81.2%.

### 4.1.9 Knowledge About Exposure Time

**Table 4.9: Participants responses about exposure time**

Question	Answer	No.	Percent
4.1. If the previous question answer is Yes (Q4), it depends on what?	Film speed	272	21.8%
	Patient size	226	18.1%
	KV of equipment	745	59.9%
	<b>Total</b>	1517	

Table 4.9 showed the reason behind participants answer in Q (4) are, Film speed (21.8%), Patient size (18.1%), KV of equipment (59.9%).



#### 4.1.10 Practice About Distance from The Patient

**Table 4.10: Participants responses on distance from the patient**

Question	Answer	No.	Percent
5. At which distance from the patient are you positioned during exposure?	Less than 1 meter	239	15.7%
	1 meter	383	25.2%
	2 meters	308	20.3%
	More than 2 meters	587	38.6%
	<b>Total</b>	1517	

Table 4.10 showed that, the proportions are close to each other, and the most common answer was more than 2 meters by 38.6%.

#### 4.1.11 Practice About Precautions Protection

**Table 4.11: participants responses on precautions protection**

Question	Answer	No.	Percent
6. Do you take other precautions to protect YOURSELF from radiation during exposure?	I wear a lead apron.	393	25.9%
	I use the lowest exposure settings possible.	158	10.4%
	I keep a distance more than 2 m from the patient.	570	37.5%
	I didn't take any other precautions.	396	26.1%
	<b>Total</b>	1517	

The result in Table 4.11 showed that the majority stay more than two meters from the patient, with a percentage 37.5%.

#### 4.1.12 Practice About Holding Image Receptor

**Table 4.12: participants responses on holding image receptor**

Question	Answer	No.	Percent
7. How is the image receptor (film/sensor) held in the patient's oral cavity during the exposure?	Patient	1132	74.6%
	Film holding instrument	175	11.5%
	Operator	210	13.8%
	<b>Total</b>	1517	

The result in Table 4.12 showed that the majority make the patient hold the image receptor with a percentage of 74.6%.

### 4.1.13 Knowledge About Monitoring Badges

**Table 4.13: participants responses about monitoring badges**

Question	Answer	No.	Percent
<b>8. Where does the operator wear personal monitoring badges? (Radiation dose measuring devices)</b>	Above the lead apron	305	20.1%
	Doesn't matter	163	10.7%
	Below the lead apron	185	12.2%
	Don't know	864	56.9%
	<b>Total</b>	1517	

The result in Table 4.13 showed that the majority do not know where to place the radiation dose measuring device, with a percentage of 56.9%.

### 4.1.14 Knowledge About Most Important Organ

**Table 4.14: participants responses about most important organ to protect**

Question	Answer	No.	Percent
<b>9. What is the most important organ that must be protected during dental radiography?</b>	Skin	60	3.9%
	Thyroid	1271	83.7%
	Chest	159	10.4%
	Bones	27	1.7%
	<b>Total</b>	1517	

The result in Table 4.14 showed that the majority have knowledge in the most sensitive organ to radiation with a percentage 83.7%.

### 4.1.15 Practice About Standing During Exposure

**Table 4.15: participants responses about standing place during exposure**

Question	Answer	No.	Percent
<b>10. Where do you stand during exposure?</b>	Front of the patient	292	19.2%
	behind the patient	98	6.4%
	next to patient	243	16.0%
	away from the patient	884	58.2%
	<b>Total</b>	1517	

The result in Table 4.15 showed that the majority stand far from the patient with a percentage 58.2%.

#### 4.1.16 Knowledge About Dose Limit for Patient

**Table 4.16: participants responses about dose limit**

Question	Answer	No.	Percent
11. Approximately what is the dose limit allowed for the patient?	1 mSv	169	11.1%
	10 mSv	185	12.2%
	50 mSv	252	16.6%
	Don't Know	792	52.1%
	100 mSv	119	7.8%
	<b>Total</b>	1517	

The result in Table 4.16 showed that most people do not know the maximum dose allowed for a patient with a percentage 52.1%.

#### 4.1.17 Knowledge About Education

**Table 4.17: participants responses about education**

Question	Answer	No.	Percent
12. Have you ever had education in the form of lectures, tutorials or courses regarding ionizing radiation?	Course	61	4.0%
	Internet information	83	5.4%
	Lectures	341	22.4%
	Curriculum	781	51.4%
	None	251	16.5%
	<b>Total</b>	1517	

Table 4.17 showed that the Curriculum took the largest percentage compared to the rest of the options with a percentage 51.4%.

#### 4.1.18 Knowledge About Protective Material

**Table 4.18: participants responses about the Protective material**

Question	Answer	No.	Percent
13. What is the Protective material used for protection against radiation risk?	Aluminums	35	2.3%
	Glass	10	0.6%
	Lead	1447	95.3%
	Wood	25	1.6%
	<b>Total</b>	1517	

The result in Table 4.18 showed that the materials used for protection and a large proportion chose lead with a percentage 95.3%.

### 4.1.19 Knowledge About Radiation Dose

**Table 4.19: participants responses about the radiation dose in dental**

Question	Answer	No.	Percent
14. What is the approximate radiation dose, in mSv, of a dental panoramic?	Less than 1 mSv	234	15.4%
	50 mSv	115	7.5%
	10 mSv	138	9.1%
	20 mSv	213	14.0%
	Don't Know	817	53.8%
	<b>Total</b>		1517

The result in Table 4.19 showed that the approximate dose in millisieverts for each panorama image, and majority answered that they don't know with a percentage **53.8%**.

### 4.1.20 Practice About Using Lead Apron

**Table 4.20: participants responses about using lead apron**

Question	Answer	No.	Percent
15. why you don't use lead apron often,	No availability of apron	797	52.6%
	Common apron for all	271	17.8%
	Due to weight of the apron	208	13.6%
	Over workload	241	15.8%
	<b>Total</b>		1517

The result in Table 4.20 showed that the non-use of lead apron because there are no aprons available with a percentage **52.6%**.

**Table (4.21): participants about radiation protection practice**

Questions	Answer								Total
	Yes always		Sometimes		Rarely		No never		
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	
<b>16. Do you use lead apron during exposure?</b>	282	18.5%	327	21.5%	294	19.3%	614	40.4%	
<b>17. Do you stand behind a radiation protective barrier during exposure?</b>	758	49.9%	367	24.1%	128	8.4%	264	17.4%	
<b>18. Do you use thyroid collar during exposure?</b>	167	11.0%	266	17.5%	173	11.4%	911	60.0%	
<b>19. Do you make sure that patient wear thyroid collar during exposure?</b>	286	18.8%	267	17.6%	241	15.9%	723	47.6%	
<b>20. Do you prefer to take panoramic radiographs for every patient?</b>	319	21.0%	585	38.5%	288	18.9%	325	21.4%	
<b>21. Do you display cautioner hold a warning sign while exposed to X-ray?</b>	438	28.8%	231	15.2%	250	16.4%	598	39.3%	
<b>22. Do you provide Explanation of radiation risk/benefit for patient?</b>	343	22.6%	347	22.8%	358	23.6%	469	30.8%	
<b>23. Do you take informed consent of the patient before acquiring radiograph?</b>	810	53.3%	239	15.7%	177	11.6%	291	19.1%	

The results presented in Table 4.21 showed that most of the respondents do not use lead apron with a percentage of 40.4%, and this is dangerous for the body of the radiographer. most of the respondents were standing behind the protective barrier with a percentage of 49.9%, most of the respondents do not use a protective shield for the thyroid gland during x-rays, with a percentage of 60.0%, and this can affect the thyroid gland. the majority do not use a protective shield for thyroid gland for patients during x-rays, with a percentage of 47.6%. most of respondents ask for panoramic pictures of the teeth some time, with a percentage of 38.5%. most do not display an X-ray warning sign, with a percentage of 38.3% Most people do not explain to the patient the dangers of radiation, with a percentage of 30.8%, and this is wrong. The patient may be exposed to large doses without realizing its dangers. Most patients agree before the examination, with a percentage of 53.3%, and this is a good thing.

**Table (4.22): participants about radiation protection knowledge**

Questions	Answer								Total
	Yes		Maybe		Don't Know		No		
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	
<b>24. Is dental X-ray harmful?</b>	393	25.8%	451	29.7%	195	12.8%	478	31.5%	<b>1517</b>
<b>25. Do X-ray beams reflect from room walls?</b>	578	38.1%	349	23.0%	263	17.3%	327	21.5%	
<b>26. Should the area of X-ray collimation on the patient be reduced according to the size of the part to be imaged?</b>	1025	67.5%	226	14.9%	188	12.3%	78	5.1%	
<b>27. Are you aware of radiation shielding procedures in X-ray rooms?</b>	908	59.9%	292	19.2%	145	9.4%	172	11.3%	
<b>28. Are you familiar with ALARA principle?</b>	605	39.9%	152	9.9%	385	25.4%	375	24.7%	
<b>29. Does dental radiograph absolutely contraindicate in pregnant patients?</b>	304	20.0%	177	11.6%	68	4.4%	968	63.8%	
<b>30. Should personal monitoring badges be worn by the operator (Radiation dose measuring devices)</b>	698	46.0%	343	22.6%	266	17.5%	210	13.8%	
<b>31. Does Changing the type and speed of the film has a significant impact on the exposure required to produce an image?</b>	931	61.4%	234	15.4%	212	13.9%	140	9.1%	
<b>32. Will you adhere to radiation protection protocol at the time of your future private clinical practice?</b>	1012	66.7%	338	22.3%	99	6.5%	68	4.4%	
<b>33. Does Every radiation exposure bring the possibility of the occurrence of harmful effects?</b>	878	57.8%	421	27.7%	104	6.8%	114	7.5%	
<b>34. Are children and fetuses more vulnerable to radiation hazards?</b>	1107	72.9%	246	16.2%	80	5.2%	84	5.5%	
<b>35. Do you get the radiography equipment that you use periodically checked?</b>	590	38.9%	330	21.7%	320	21.1%	277	18.2%	

The results presented in Table 4.22 showed that the majority said yes which indicates good knowledge of the dental students and staff, the majority aware of ALARA principle with a percentage 39.9%, while in in some questions the majority said No which indicates a lack of knowledge, the majority disagree that pregnancy contraindicate in dental radiography with a percentage 63.8%, the majority sees that dental x-ray is not harmful 31.5%.

**Table (4.23): Correlations between participants knowledge, Practice, Attitudes**

	<b>Knowledge Correlation (Sig)</b>	<b>Attitudes Correlation (Sig)</b>	<b>Practice Correlation (Sig)</b>
<b>knowledge</b>	-----	0.217 (0.00)	0.168 (0.00)
<b>Attitudes</b>	0.217 (0.00)	-----	0.317 (0.00)
<b>Practice</b>	0.168 (0.00)	0.317 (0.00)	-----

The results in Table 4.23 proved that there was a significance correlation between participants Knowledge, Attitude, and Practice.

## 4.2 Discussion

This study regarding knowledge attitude performance of radiation protection.

The answers of questions regarding knowledge towards radiation protection was adequate, the majority of participants were aware about the most important organ that should be protected against radiation as it shown in (Table 4.14), the most of participants were aware about the protective material used against radiation as it shown in (Table 4.18).

While some questions indicate the lack of knowledge in radiological measurements, the majority of dental staff and students didn't know where to wear the monitoring badges as it shown in (Table 4.13), the most of the study sample didn't know the limit dose allowed for the patient as it shown in (Table 4.16), and the majority didn't know about radiation dose in dental panoramic as it shown in (Table 4.19).

For the questions regarding practice towards radiation protection, the majority never use lead apron as it shown in (Table 4.21), and the majority never use thyroid collar as it shown in (Table 4.21), and the most of the study sample stand behind a protective barrier without using lead apron these results agree with (Javali, et all, 2018),

The Results of questions regarding attitude towards radiation protection indicates good attitude among dental staff and students, the majority of the staff and students will adhere to radiation protection in the future as it shown in (Table 4.22), and the majority think that the area should be reduced according the size of the part to be imaged as it shown in (Table 4.22).

The findings showed that Female participants had more knowledge than male participants, while male participants had more practice, Interns showed more knowledge than the rest of the groups because their information is still fresh, the dentist group had more practice because this group had best practice in life than the rest of the groups.



The results showed that there was an association between knowledge and gender, age, job and experience, age group with more than 45 years showed the best knowledge, the group with more than 15 years' experience had the best knowledge.

There was a significant association between practice and age, job and experience while with gender there was no association as it shown in appendix (5), age group with more than 45 years had the best practice, the group with 11 – 15 years' experience had the best practice.

There was an association between attitude and gender, age, job and experience, male participants had better attitude than female, age group with more than 45 years had the best attitude, dentist assistant had the best attitude, the group with 11-15 years' experience had the best attitude.

# **Chapter five**

**(Conclusion and Recommendations)**

## 5.1 Conclusion

This study was conducted at the dentistry department in Sana'a's hospitals, clinics and universities. The target was staff and assistants and students in the department.

The result showed that the main problems found in all staff and students under this study included that all the samples have a little knowledge in radiation protection of themselves. Another problem was the design of their rooms and department that are not included in international system of radiation protection. Also, the knowledge for their patients who need to be protected from the ionizing radiation.

The results showed that there was an association between knowledge and gender, age, job and experience, age group with more than 45 years showed the best knowledge, the group with more than 15 years' experience had the best knowledge.

There was a significant association between practice and age, job and experience while with gender there was no association, age group with more than 45 years had the best practice, the group with 11 – 15 years' experience had the best practice.

There was an association between attitude and gender, age, job and experience, male participants had better attitude than female, age group with more than 45 years had the best attitude, dentist assistant had the best attitude, the group with 11-15 years' experience had the best attitude

## **5.2 Recommendations**

There are some recommendations that could improve radiation protection in dentistry department.

The academic team in the dentistry department are advised to increase the lessons subject radiation protection to improve the dentistry students' knowledge to reflect that in their attitude and practice.

It is recommended to conduct workshops and training courses about radiation protection for the dentistry staff to support them in gaining the proper information about how to protect themselves and the patients from hazard ionizing radiation. The dentistry staff should provide radiation protection equipment in their department.

The ministry of health should establish a monitoring mechanism to ensure that health care providers like hospitals and clinics they have radiation protection measures, and this monitoring should be periodically every six months. Also, to ensure the TLD signs to health care workers.

## References

- [1] Amal A. Almohaimede, Mohammad W. Bendahmash, Feras M. Dhafir, Abdullah F. Awwad, Ebtissam M. Al-Madi on Radiographic Protection by Dental Undergraduate and Endodontic, 26 April 2020.
- [2] HARSHINEE CHANDRASEKHAR, DHANRAJ GANAPATHY, KIRAN KUMAR PANDURANGAN, ASHOK VELAYUDHAN on Awareness on Radiation Protection Devices Among Dental students, 2020.
- [3] <https://www.nibib.nih.gov/science-education/science-topics/x-rays>
- [4] <https://www.ibisray.com/x-ray-introduction/>
- [5] <http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/xtube.html>
- [6] Dr. M. James Clark, Dr. Clark and his colleagues, <https://www.texasoralsurgery.com/780-2/>
- [7] <https://plazadental.com.au/are-dental-x-rays-safe>
- [8] world health organization (4 March 2022), <https://www.who.int/news-room/questions-and-answers/item/radiation-and-health>
- [9] <https://www.co.monmouth.nj.us/documents/118/RADIATION%20HEALTH%20BASICS.pdf>
- [10] <https://www.xraycurtains.com/blogs/news/how-to-shield-your-dental-office-during-xray-procedures>
- [11] <https://www.ramsoft.com/alara-principle/>
- [12] <https://www.suntrion.com/productinfo/4>
- [13] Charu Girotra, Siddharth Acharya, Omkar Shetty, Siddhi Savla, Mahinoor Punjani, Tannik Shah - Assessment of Knowledge, Attitude and Practice Towards Infection Control Among Dental Undergraduate Students- A Cross-Sectional Survey - Journal of Indian Association OF Public Health Dentistry - January-March 2021
- [14] Rajeshwari Javali, Raghunath Dantu - Attitude and Awareness about Radiation Protection among Dental Surgeons in North Karnataka: A Questionnaire Study - 2018 Journal of Indian Academy of Oral Medicine & Radiology | Published by Wolters Kluwer Medknow
- [15] Sobia Nasir, Duaa Ali, Maryam Omer Shamim, Aina Aqeel Sheikh, Asma Shahid, Sadaf Perception of Dental Under-Graduates and Graduates Regarding Radiation Hazards and Protection in Dental Institutes, Karachi; KAP Analysis - Journal of Xi'an Shiyou University JANUARY 2023

# Appendixes

## Appendix (1)

### Association between participants knowledge and their gender

S	Quotation	Gender	Mean	Std. Deviation	T-test	Sig. (2-tailed)
1	What is the kilovoltage of your intraoral radiographic equipment?	M	1.50	0.707	2.401	0.01
		F	1.60	0.875		
2	What is the tube current of your intraoral radiographic equipment?	M	1.33	0.503	3.065	0.00
		F	1.25	0.469		
3	Does the exposure time vary?	M	0.018	0.371	2.370	0.01
		F	0.018	0.409		
4	If the previous question answer is Yes (Q4), it depends on what?	M	2.32	0.818	2.846	0.00
		F	2.45	0.820		
5	Where does the operator wear personal monitoring badges (Radiation dose measuring devices) ?	M	2.86	1.259	6.563	0.00
		F	3.27	1.133		
6	What is the most important organ that must be protected during dental radiography?	M	2.12	0.480	1.284	0.199
		F	2.09	0.423		
7	Approximately what is the dose limit allowed for the patient?	M	3.39	3.678	0.166	0.868
		F	3.41	1.024		
8	Have you ever had education in the form of lectures, tutorials or courses regarding ionizing radiation?	M	3.68	0.945	1.269	0.205
		F	3.74	0.939		
9	What is the Protective material used for protection against radiation risk?	M	2.95	0.391	1.956	0.051
		F	2.98	0.270		

10	What is the approximate radiation dose, in mSv, of a dental panoramic?	M	3.67	1.545	4.336	0.00
		F	4.01	1.464		
11	If you don't use lead apron often, why?	M	2.84	1.166	0.909	0.363
		F	2.79	1.141		
12	Do X-ray beams reflect from room walls?	M	2.41	1.181	0.601	0.548
		F	2.2	1.157		
13	Are you aware of radiation shielding procedures in X-ray rooms?	M	1.65	1.012	2.682	0.007
		F	1.79	1.053		
14	Are you familiar with ALARA principle?	M	2.32	1.939	1.331	0.183
		F	2.43	1.224		
15	Does dental radiograph absolutely contraindicate in pregnant patients?	M	3.06	1.252	1.992	0.047
		F	3.19	1.229		
16	Does Changing the type and speed of the film has a significant impact on the exposure required to produce an image?	M	1.66	0.979	1.920	0.055
		F	1.76	1.056		
17	Does Every radiation exposure bring the possibility of the occurrence of harmful effects?	M	1.59	0.865	2.397	7.01
		F	1.70	0.942		
18	Are children and fetuses more vulnerable to radiation hazards?	M	1.45	0.811	0.601	0.548
		F	1.42	0.843		



## Appendix (2)

### Association between participants knowledge and their age

S	Question	Age	Mean	St. Deviation	F	sig
1	What is the kilovoltage of your intraoral radiographic equipment?	Less than 25 years	1.48	0.809	22.489	0.00
		26 – 35 years	1.69	0.988		
		36 – 45 years	1.57	1.093		
		more than 45 years	2.11	1.509		
2	What is the tube current of your intraoral radiographic equipment?	Less than 25 years	1.26	0.477	17.008	0.00
		26 – 35 years	1.33	0.485		
		36 – 45 years	1.33	0.471		
		more than 45 years	2.33	0.707		
3	Does the exposure time vary?	Less than 25 years	1.21	0.408	4.002	0.008
		26 – 35 years	1.14	0.348		
		36 – 45 years	1.18	0.385		
		more than 45 years	1.00	0.00		
4	If the previous question answer is Yes (Q4), it depends on what?	Less than 25 years	2.44	0.799	3.880	0.009
		26 – 35 years	2.30	.837		
		36 – 45 years	2.23	.894		
		more than 45 years	2.00	1.000		
5	Where does the operator wear personal monitoring badges (Radiation dose measuring devices)	Less 25 years	3.07	1.195	7.745	0.00
		26 – 35 years	3.14	1.222		
		36 – 45 years	2.70	1.324		
		more than 45 years	1.56	0.527		

6	What is the most important organ that must be protected during dental radiography?	Less than 25 years	2.09	0.444	5.252	0.001
		26 – 35 years	2.12	0.48		
		36 – 45 years	2.15	0.364		
		more than 45 years	1.56	0.527		
7	Approximately what is the dose limit allowed for the patient?	Less than 25 years	3.41	3.286	0.618	0.604
		26 – 35 years	3.33	1.153		
		36 – 45 years	3.68	1.008		
		more than 45 years	2.67	1.581		
8	Have you ever had education in the form of lectures, tutorials or courses regarding ionizing radiation?	Less than 25 years	3.72	0.868	0.674	0.568
		26 – 35 years	3.73	1.082		
		36 – 45 years	3.57	0.909		
		more than 45 years	3.67	1.581		
9	What is the Protective material used for protection against radiation risk:	Less than 25 years	2.95	0.373	9.918	0.00
		26 – 35 years	3.02	0.190		
		36 – 45 years	2.90	0.428		
		more than 45 years	2.56	0.527		
10	What is the approximate radiation dose, in mSv, of a dental panoramic?	Less than 25 years	3.74	1.502	5.240	0.001
		26 – 35 years	4.07	1.521		
		36 – 45 years	3.73	1.516		
		more than 45 years	3.33	1.581		
11	Do you stand behind a radiation protective barrier during exposure?	Less than 25 years	2.82	1.140	2.637	0.048
		26 – 35 years	2.80	1.199		
		36 – 45 years	2.82	1.088		
		more than 45 years	3.89	0.333		
12	Do X-ray beams reflect from room walls?	Less than 25 years	2.35	1.222	19.775	0.00
		26 – 35 years	1.88	0.988		
		36 – 45 years	2.37	1.050		
		more than 45 years	3.22	0.972		
13	Are you aware of radiation shielding procedures in X-ray rooms?	Less than 25 years	1.70	1.003	12.336	0.00
		26 – 35 years	1.74	1.063		
		36 – 45 years	1.69	1.064		
		more than 45 years	3.78	0.667		

14	Are you familiar with ALARA principle?	Less than 25 years	2.34	1.823	2.646	0.048
		26 – 35 years	2.49	1.204		
		36 – 45 years	2.08	1.153		
		more than 45 years	3.22	0.972		
15	Does dental radiograph absolutely contraindicate in pregnant patients?	Less than 25 years	3.22	1.200	7.670	0.00
		26 – 35 years	2.98	1.278		
		36 – 45 years	2.69	1.405		
		more than 45 years	3.22	0.972		
16	Does Changing the type and speed of the film has a significant impact on the exposure required to produce an image?	Less than 25 years	1.61	0.980	17.798	0.00
		26 – 35 years	1.93	1.057		
		36 – 45 years	1.52	0.950		
		more than 45 years	3.22	0.972		
17	Does Every radiation exposure bring the possibility of the occurrence of harmful effects?	Less than 25 years	1.62	0.917	17.667	0.00
		26 – 35 years	1.68	0.833		
		36 – 45 years	1.43	0.854		
		more than 45 years	3.67	1.000		
18	Are children and fetuses more vulnerable to radiation hazards?	Less than 25 years	1.43	0.784	23.145	0.00
		26 – 35 years	1.41	0.848		
		36 – 45 years	1.37	0.875		
		more than 45 years	3.67	1.000		

## Appendix (3)

### Association between participants knowledge and their job

S	Question	job	Mean	Std. Deviation	F	Sig.
1	What is the kilovoltage of your intraoral radiographic equipment?	Dentist	1.54	0.775	14.956	0.00
		Dentist assistant	1.71	0.837		
		Intern	1.91	0.913		
		Student	1.45	0.751		
2	What is the tube current of your intraoral radiographic equipment?	Dentist	1.32	0.490	3.152	0.024
		Dentist assistant	1.36	0.542		
		Intern	1.28	0.554		
		Student	1.24	0.456		
3	Does the exposure time vary?	Dentist	1.20	0.397	4.784	0.003
		Dentist assistant	1.23	0.426		
		Intern	1.07	0.259		
		Student	1.20	0.398		
4	If the previous question answer is Yes (Q4), it depends on what?	Dentist	2.38	0.817	2.172	0.090
		Dentist assistant	2.49	0.645		
		Intern	2.50	0.762		
		Student	2.33	0.861		
5	Where does the operator wear personal monitoring badges (Radiation dose measuring devices)	Dentist	3.11	1.228	3.045	0.028
		Dentist assistant	2.72	1.338		
		Intern	3.13	1.221		
		Student	3.04	1.221		

6	What is the most important organ that must be protected during dental radiography?	Dentist	2.11	0.480	22.76	0.00
		Dentist assistant	2.40	0.700		
		Intern	2.19	0.432		
		Student	2.02	0.337		
7	Approximately what is the dose limit allowed for the patient?	Dentist	3.43	3.890	1.352	0.256
		Dentist assistant	3.37	1.039		
		Intern	3.78	1.022		
		Student	3.27	1.068		
8	Have you ever had education in the form of lectures, tutorials or courses regarding ionizing radiation?	Dentist	3.70	1.071	0.579	0.629
		Dentist assistant	3.66	1.055		
		Intern	3.81	0.806		
		Student	3.71	0.782		
9	What is the Protective material used for protection against radiation risk:	Dentist	2.98	0.293	2.533	0.055
		Dentist assistant	3.00	0.249		
		Intern	2.96	0.494		
		Student	2.94	0.352		
10	What is the approximate radiation dose, in mSv, of a dental panoramic?	Dentist	3.63	1.667	7.463	0.00
		Dentist assistant	4.08	1.448		
		Intern	4.05	1.169		
		Student	3.97	1.383		
11	If you don't use lead apron often, why?	Dentist	2.13	1.224	14.87	0.00
		Dentist assistant	1.68	0.857		
		Intern	1.61	0.955		
		Student	1.81	1.072		
12	Do X-ray beams reflect from room walls?	Dentist	2.12	1.118	16.816	0.00
		Dentist assistant	2.13	1.061		
		Intern	1.79	0.974		
		Student	2.46	1.238		

13	Are you aware of radiation shielding procedures in X-ray rooms?	Dentist	1.78	1.067	5.480	0.001
		Dentist assistant	1.93	1.160		
		Intern	1.84	0.921		
		Student	1.60	0.987		
14	Are you familiar with ALARA principle?	Dentist	2.40	1.233	1.178	0.317
		Dentist assistant	2.57	1.140		
		Intern	2.48	1.230		
		Student	2.30	2.114		
15	Does dental radiograph absolutely contraindicate in pregnant patients?	Dentist	2.98	1.303	8.383	0.00
		Dentist assistant	2.99	1.280		
		Intern	3.07	1.202		
		Student	3.32	1.147		
16	Does Changing the type and speed of the film has a significant impact on the exposure required to produce an image?	Dentist	1.75	1.020	4.503	0.004
		Dentist assistant	1.95	1.049		
		Intern	1.49	0.912		
		Student	1.68	1.026		
17	Does Every radiation exposure bring the possibility of the occurrence of harmful effects?	Dentist	1.72	0.910	5.622	0.001
		Dentist assistant	1.80	0.984		
		Intern	1.57	0.702		
		Student	1.54	0.917		
18	Are children and fetuses more vulnerable to radiation hazards?	Dentist	1.55	0.935	12.145	0.00
		Dentist assistant	1.59	0.848		
		Intern	1.23	0.501		
		Student	1.32	0.722		

## Appendix (4)

### Association between participants knowledge and their experience

s	Question	Years of experience	Mean	Std. Deviation	F	Sig.
1	What is the kilovoltage of your intraoral radiographic equipment?	Less than 5 years	1.55	0.80	0.97	0.40
		5 – 10 years	1.61	0.70		
		11 – 15 years	1.40	0.70		
		More than 15 years	1.49	0.87		
2	What is the tube current of your intraoral radiographic equipment?	Less than 5 years	1.27	0.47	3.45	0.16
		5 – 10 years	1.36	0.52		
		11 – 15 years	1.38	0.66		
		More than 15 years	1.43	0.50		
3	Does the exposure time vary?	Less than 5 years	1.18	0.38	2.15	0.09
		5 – 10 years	1.21	0.40		
		11 – 15 years	1.12	0.32		
		More than 15 years	1.32	0.47		
4	If the previous question answer is Yes (Q4), it depends on what?	Less than 5 years	2.42	0.810	5.92	0.00
		5 – 10 years	2.25	0.852		
		11 – 15 years	2.24	0.925		
		More than 15 years	1.84	0.688		
5	Where does the operator wear personal monitoring badges (Radiation dose measuring devices)	Less than 5 years	3.09	1.204	6.86	0.00
		5 – 10 years	3.01	1.249		
		11 – 15 years	3.12	1.109		
		More than 15 years	2.19	1.309		

6	What is the most important organ that must be protected during dental radiography?	Less than 5 years	2.10	0.446	1.16	0.32
		5 – 10 years	2.10	0.512		
		11 – 15 years	2.00	0.000		
		More than 15 years	2.19	0.616		
7	Approximately what is the dose limit allowed for the patient?	Less than 5 years	3.42	2.975	0.48	0.69
		5 – 10 years	3.25	1.184		
		11 – 15 years	3.69	0.749		
		More than 15 years	3.14	1.417		
8	Have you ever had education in the form of lectures, tutorials or courses regarding ionizing radiation?	Less than 5 years	3.73	0.919	3.29	0.02
		5 – 10 years	3.55	1.038		
		11 – 15 years	3.76	1.100		
		More than 15 years	4.00	0.943		
9	What is the Protective material used for protection against radiation risk:	Less than 5 years	2.96	0.341	1.68	0.16
		5 – 10 years	3.01	0.355		
		11 – 15 years	2.90	0.297		
		More than 15 years	3.00	0.000		
10	What is the approximate radiation dose, in mSv, of a dental panoramic?	Less than 5 years	3.85	1.493	2.77	0.04
		5 – 10 years	3.60	1.672		
		11 – 15 years	4.00	1.361		
		More than 15 years	4.27	1.427		
11	If you don't use lead apron often, why?	Less than 5 years	1.85	1.130	19.9	0.00
		5 – 10 years	2.14	1.070		
		11 – 15 years	3.12	1.064		
		More than 15 years	1.92	1.010		
12	Do X-ray beams reflect from room walls?	Less than 5 years	2.23	1.183	15.59	0.00
		5 – 10 years	2.00	1.035		
		11 – 15 years	1.88	1.017		
		More than 15 years	3.35	0.676		



13	Are you aware of radiation shielding procedures in X-ray rooms?	Less than 5 years	1.72	1.026	4.36	0.00
		5 – 10 years	1.63	0.953		
		11 – 15 years	1.74	1.106		
		More than 15 years	2.30	1.469		
14	Are you familiar with ALARA principle?	Less than 5 years	2.36	1.712	1.23	0.29
		5 – 10 years	2.54	1.221		
		11 – 15 years	2.19	1.348		
		More than 15 years	2.11	1.048		
15	Does dental radiograph absolutely contraindicate in pregnant patients?	Less than 5 years	3.19	1.217	7.32	0.00
		5 – 10 years	2.82	1.285		
		11 – 15 years	3.00	1.343		
		More than 15 years	2.59	1.443		
16	Does Changing the type and speed of the film has a significant impact on the exposure required to produce an image?	Less than 5 years	1.68	1.019	2.07	0.10
		5 – 10 years	1.81	0.954		
		11 – 15 years	1.98	1.259		
		More than 15 years	1.81	0.995		
17	Does Every radiation exposure bring the possibility of the occurrence of harmful effects?	Less than 5 years	1.64	0.920	0.01	0.99
		5 – 10 years	1.64	0.758		
		11 – 15 years	1.64	1.008		
		More than 15 years	1.68	1.056		
18	Are children and fetuses more vulnerable to radiation hazards?	Less than 5 years	1.42	0.802	2.00	0.11
		5 – 10 years	1.43	0.849		
		11 – 15 years	1.48	0.994		
		More than 15 years	1.76	1.234		

## Appendix (5)

### Association between participants practice and their gender

S	Question	Gender	Mean	Std. Deviation	T-test	Sig. (2-tailed)
1	Approximately how many films are taken in your practice every week?	M	1.69	0.918	0.968	0.333
		F	1.64	0.892		
2	At which distance from the patient are you positioned during exposure?	M	2.84	1.127	0.595	0.552
		F	2.80	1.116		
3	Do you take other precautions to protect YOURSELF from radiation during exposure?	M	2.67	1.127	1.219	0.223
		F	2.6	1.128		
4	How is the image receptor (film/sensor) held in the patient's oral cavity during the exposure?	M	1.39	0.710	0.148	0.882
		F	1.39	0.727		
5	Where do you stand during exposure?	M	3.15	1.152	0.614	0.540
		F	3.11	1.216		
6	Do you use lead apron during exposure?	M	1.91	1.161	0.537	0.591
		F	1.94	1.112		
7	Do you stand behind a radiation protective barrier during exposure?	M	1.99	1.148	1.932	0.054
		F	1.88	1.109		

8	Do you use thyroid collar during exposure?	M	3.19	1.098	0.659	0.510
		F	3.22	1.070		
9	Do you make sure that patient wear thyroid collar during exposure?	M	2.92	1.187	0.009	0.993
		F	2.92	1.182		
10	Do you display cautioner hold a warning sign while exposed to X-ray?	M	2.62	1.258	1.383	0.167
		F	2.71	1.263		
11	Do you provide Explanation of radiation risk/benefit for patient?	M	2.63	1.174	0.24	0.811
		F	2.62	1.108		
12	Do you take informed consent of the patient before acquiring radiograph?	M	2.04	1.213	2.473	0.014
		F	1.89	1.163		
13	Do you get the radiography equipment that you use periodically checked?	M	2.12	1.120	2.3	0.022
		F	2.26	1.153		

## Appendix (6)

### Association between participants practice and their age

S	Question	Age	Mean	St. Deviation	F	sig
1	Approximately how many films are taken in your practice every week?	Less than 25 years	1.53	0.756	9.175	0.00
		26 – 35 years	1.92	0.958		
		36 – 45 years	1.76	0.733		
		more than 45 years	2.44	1.054		
2	At which distance from the patient are you positioned during exposure?	Less than 25 years	2.67	1.097	17.990	0.00
		26 – 35 years	3.11	1.070		
		36 – 45 years	2.96	1.227		
		more than 45 year	3.44	0.527		
3	Do you take other precautions to protect YOURSELF from radiation during exposure?	Less than 25 years	2.69	1.062	4.179	0.06
		26 – 35 years	2.54	1.228		
		36 – 45 years	2.62	1.289		
		more than 45 years	1.67	0.707		
4	How is the image receptor (film/sensor) held in the patient's oral cavity during the exposure?	Less than 25 years	1.38	0.707	3.363	0.018
		26 – 35 years	1.37	0.708		
		36 – 45 years	1.63	0.875		
		more than 45 years	1.44	0.527		
5	Where do you stand during exposure?	Less than 25 years	3.15	1.212	0.339	0.797
		26 – 35 years	3.10	1.162		
		36 – 45 years	3.07	0.967		
		more than 45 years	3.00	1.000		
6	If you don't use lead apron often, why?	Less than 25 years	1.87	1.132	14.263	0.00
		26 – 35 years	1.93	1.077		
		36 – 45 years	2.69	1.280		
		more than 45 years	1.56	0.527		

7	Do you use lead apron during exposure?	Less than 25 years	1.75	1.018	33.636	0.00
		26 – 35 years	2.21	1.234		
		36 – 45 years	2.44	1.216		
		more than 45 years	3.78	0.667		
8	Do you use thyroid collar during exposure?	Less than 25 years	3.19	1.111	1.732	0.159
		26 – 35 years	3.20	1.040		
		36 – 45 years	3.26	1.031		
		more than 45 years	4.00	0.00		
9	Do you make sure that patient wear thyroid collar during exposure?	Less than 25 years	2.88	1.204	3.356	0.018
		26 – 35 years	2.99	1.146		
		36 – 45 years	2.92	1.150		
		more than 45 years	4.00	0.00		
10	Do you display cautioner hold a warning sign while exposed to X-ray?	Less than 25 years	2.65	1.281	8.908	0.00
		26 – 35 years	2.56	1.220		
		36 – 45 years	3.24	1.060		
		more than 45 years	3.67	1.00		
11	Do you provide Explanation of radiation risk/benefit for patient?	Less than 25 years	2.53	1.150	12.274	0.00
		26 – 35 years	2.73	1.101		
		36 – 45 years	3.07	1.095		
		more than 45 years	4.00	0.00		
12	Do you take informed consent of the patient before acquiring radiograph?	Less than 25 years	1.88	1.30	33.909	0.00
		26 – 35 years	1.93	1.188		
		36 – 45 years	3.00	1.299		
		more than 45 years	4.00	0.00		
13	Do you get the radiography equipment that you use periodically checked?	Less than 25 years	2.14	1.118	6.426	0.00
		26 – 35 years	2.19	1.114		
		36 – 45 years	2.55	1.392		
		more than 45 years	3.33	0.707		

## Appendix (7)

### Association between participants practice and their job

S	Question	job	Mean	Std. Deviation	F	Sig.
1	Approximately how many films are taken in your practice every week?	Dentist	1.74	0.934	28.802	0.00
		Dentist assistant	1.76	1.075		
		Intern	2.17	0.968		
		Student	1.45	0.755		
2	At which distance from the patient are you positioned during exposure?	Dentist	2.93	1.109	6.374	0.00
		Dentist assistant	2.65	1.113		
		Intern	2.94	1.095		
		Student	2.69	1.106		
3	Do you take other precautions to protect YOURSELF from radiation during exposure?	Dentist	2.54	1.183	8.050	0.00
		Dentist assistant	2.32	1.163		
		Intern	2.86	1.011		
		Student	2.75	1.061		
4	How is the image receptor (film/sensor) held in the patient's oral cavity during the exposure?	Dentist	1.42	0.733	5.477	0.001
		Dentist assistant	1.61	0.795		
		Intern	1.40	0.749		
		Student	1.32	0.671		
5	Where do you stand during exposure?	Dentist	3.03	1.160	5.382	0.001
		Dentist assistant	3.03	1.296		
		Intern	3.07	1.266		
		Student	3.28	1.157		
6	Do you use lead apron during exposure?	Dentist	2.87	1.126	9.070	0.00
		Dentist assistant	2.49	1.195		
		Intern	3.19	0.99		
		Student	2.73	1.191		
7	Do you stand behind a radiation protective barrier during exposure?	Dentist	2.08	1.157	10.199	0.00
		Dentist assistant	1.93	1.142		
		Intern	2.01	1.231		
		Student	1.74	1.042		

8	Do you use thyroid collar during exposure?	Dentist	3.24	1.069	5.272	0.001
		Dentist assistant	3.14	1.201		
		Intern	3.50	0.912		
		Student	3.11	1.106		
9	Do you make sure that patient wear thyroid collar during exposure?	Dentist	2.99	1.153	4.321	0.005
		Dentist assistant	2.93	1.160		
		Intern	3.13	1.147		
		Student	2.80	1.222		
10	Do you display cautioner hold a warning sign while exposed to X-ray?	Dentist	2.75	1.249	8.961	0.00
		Dentist assistant	2.16	1.241		
		Intern	2.38	1.310		
		Student	2.71	1.241		
11	Do you provide Explanation of radiation risk/benefit for patient?	Dentist	2.71	1.157	4.811	0.002
		Dentist assistant	2.27	1.154		
		Intern	2.68	1.130		
		Student	2.58	1.115		
12	Do you take informed consent of the patient before acquiring radiograph?	Dentist	2.10	1.258	9.510	0.00
		Dentist assistant	2.09	1.167		
		Intern	1.58	0.917		
		Student	1.88	1.145		
13	Do you get the radiography equipment that you use periodically checked?	Dentist	2.23	1.163	1.542	0.202
		Dentist assistant	2.05	1.084		
		Intern	2.04	1.021		
		Student	2.19	1.142		

## Appendix (8)

### Association between participants practice and their experience

S	Question	Years of experience	Mean	Std. Deviation	F	Sig.
1	Approximately how many films are taken in your practice every week?	Less than 5 years	1.60	0.85	11.642	0.00
		5 – 10 years	1.90	1.01		
		11 – 15 years	2.07	1.17		
		More than 15 years	2.03	1.23		
2	At which distance from the patient are you positioned during exposure?	Less than 5 years	2.76	1.121	7.68	0.00
		5 – 10 years	3.11	0.966		
		11 – 15 years	2.71	1.402		
		More than 15 years	3.27	0.962		
3	Do you take other precautions to protect YOURSELF from radiation during exposure?	Less than 5 years	2.72	1.100	12.34	0.00
		5 – 10 years	2.23	1.174		
		11 – 15 years	2.55	1.329		
		More than 15 years	2.30	1.077		
4	How is the image receptor (film/sensor) held in the patient's oral cavity during the exposure?	Less than 5 years	1.38	0.712	0.74	0.52
		5 – 10 years	1.42	0.726		
		11 – 15 years	1.48	0.804		
		More than 15 years	1.51	0.804		
5	Where do you stand during exposure?	Less than 5 years	3.13	1.204	0.83	0.47
		5 – 10 years	3.14	1.115		
		11 – 15 years	2.93	1.113		
		More than 15 years	3.35	0.949		
6	Do you use lead apron during exposure?	Less than 5 years	2.87	1.146	5.836	0.00
		5 – 10 years	2.51	1.145		
		11 – 15 years	2.90	1.144		
		More than 15 years	2.62	1.255		



7	Do you stand behind a radiation protective barrier during exposure?	Less than 5 years	1.87	1.105	11.277	0.00
		5 – 10 years	2.17	1.206		
		11 – 15 years	2.71	1.088		
		More than 15 years	1.97	1.166		
8	Do you use thyroid collar during exposure?	Less than 5 years	3.23	1.081	3.51	0.01
		5 – 10 years	2.98	1.139		
		11 – 15 years	3.38	0.936		
		More than 15 years	3.35	0.949		
9	Do you make sure that patient wear thyroid collar during exposure?	Less than 5 years	2.91	1.197	3.03	0.02
		5 – 10 years	2.88	1.155		
		11 – 15 years	3.46	0.840		
		More than 15 years	2.84	1.143		
10	Do you display cautioner hold a warning sign while exposed to X-ray?	Less than 5 years	2.59	1.279	12.32	0.00
		5 – 10 years	2.80	1.127		
		11 – 15 years	3.55	0.832		
		More than 15 years	3.30	1.199		
11	Do you provide Explanation of radiation risk/benefit for patient?	Less than 5 years	2.58	1.139	9.25	0.00
		5 – 10 years	2.68	1.144		
		11 – 15 years	3.29	0.805		
		More than 15 years	3.24	1.234		
12	Do you take informed consent of the patient before acquiring radiograph?	Less than 5 years	1.87	1.139	26.85	0.00
		5 – 10 years	2.15	1.273		
		11 – 15 years	2.95	1.168		
		More than 15 years	3.14	1.294		
13	Do you get the radiography equipment that you use periodically checked?	Less than 5 years	2.13	1.118	9.267	0.00
		5 – 10 years	2.30	1.118		
		11 – 15 years	2.90	1.303		
		More than 15 years	2.65	1.317		

## Appendix (9)

### Association between participants attitude and their gender

S	Question	Gender	Mean	Std. Deviation	T-test	Sig. (2-tailed)
1	Do you prefer to take panoramic radiographs for every patient?	M	2.58	1.113	6.651	0.00
		F	2.23	0.935		
2	Is dental X-ray harmful?	M	2.41	1.186	2.989	0.003
		F	2.59	1.172		
3	Should the area of X-ray collimation on the patient be reduced according to the size of the part to be imaged?	M	1.54	0.892	0.507	0.612
		F	1.56	0.902		
4	Should personal monitoring badges be worn by the operator (Radiation dose measuring devices)	M	2	1.096	0.149	0.881
		F	1.99	1.087		
5	Will you adhere to radiation protection protocol at the time of your future private clinical practice?	M	1.59	0.861	5.136	0.00
		F	1.38	0.724		

## Appendix (10)

### Association between participants attitude and their age

S	Question	Gender	Mean	St. Deviation	F	sig
1	Is dental X-ray harmful?	Less than 25 years	2.40	1.153	10.641	0.00
		26 – 35 years	2.60	1.191		
		36 – 45 years	3.05	1.289		
		more than 45 years	3.22	0.972		
2	Should the area of X-ray collimation on the patient be reduced according to the size of the part to be imaged?	Less than 25 years	1.55	0.915	10.764	0.00
		26 – 35 years	1.54	0.823		
		36 – 45 years	1.50	0.898		
		more than 45 years	3.22	0.972		
3	Should personal monitoring badges be worn by the operator (Radiation dose measuring devices)	Less than 25 years	1.96	1.103	6.586	0.00
		26 – 35 years	1.98	1.009		
		36 – 45 years	2.31	1.251		
		more than 45 years	3.22	0.972		
4	Do you prefer to take panoramic radiographs for every patient?	Less than 25 years	2.42	1.042	8.269	0.00
		26 – 35 years	2.39	1.014		
		36 – 45 years	2.20	1.149		
		more than 45 years	4.00	0.00		
5	Will you adhere to radiation protection protocol at the time of your future private clinical practice?	Less than 25 years	1.40	0.693	52.240	0.00
		26 – 35 years	1.52	0.807		
		36 – 45 years	2.14	1.233		
		more than 45 years	3.78	0.667		

## Appendix (11)

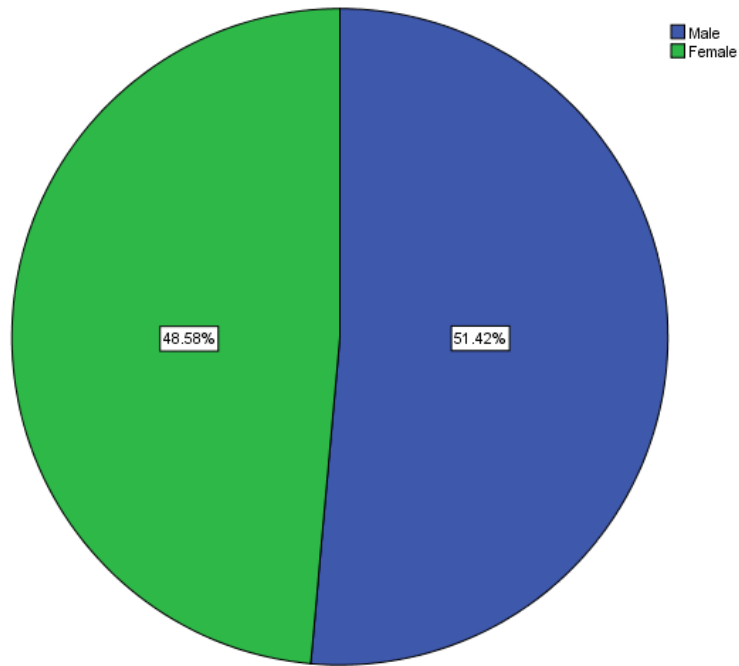
### Association between participants attitude and their job

s	Question	job	Mean	Std. Deviation	F	Sig.
1	Do you prefer to take panoramic radiographs for every patient?	Dentist	2.45	1.049	3.600	0.013
		Dentist assistant	2.53	1.168		
		Intern	2.15	0.962		
		Student	2.40	1.030		
2	Is dental X-ray harmful?	Dentist	2.69	1.191	18.971	0.00
		Dentist assistant	2.47	1.017		
		Intern	2.75	1.168		
		Student	2.23	1.148		
3	Should the area of X-ray collimation on the patient be reduced according to the size of the part to be imaged?	Dentist	1.58	0.856	2.336	0.072
		Dentist assistant	1.70	0.976		
		Intern	1.42	0.789		
		Student	1.52	0.948		
4	Should personal monitoring badges be worn by the operator (Radiation dose measuring devices)	Dentist	2.04	1.089	1.014	0.385
		Dentist assistant	2.05	1.078		
		Intern	1.91	0.952		
		Student	1.95	1.125		
5	Will you adhere to radiation protection protocol at the time of your future private clinical practice?	Dentist	1.63	0.948	16.31	0.00
		Dentist assistant	1.58	0.785		
		Intern	1.36	0.602		
		Student	1.34	0.615		

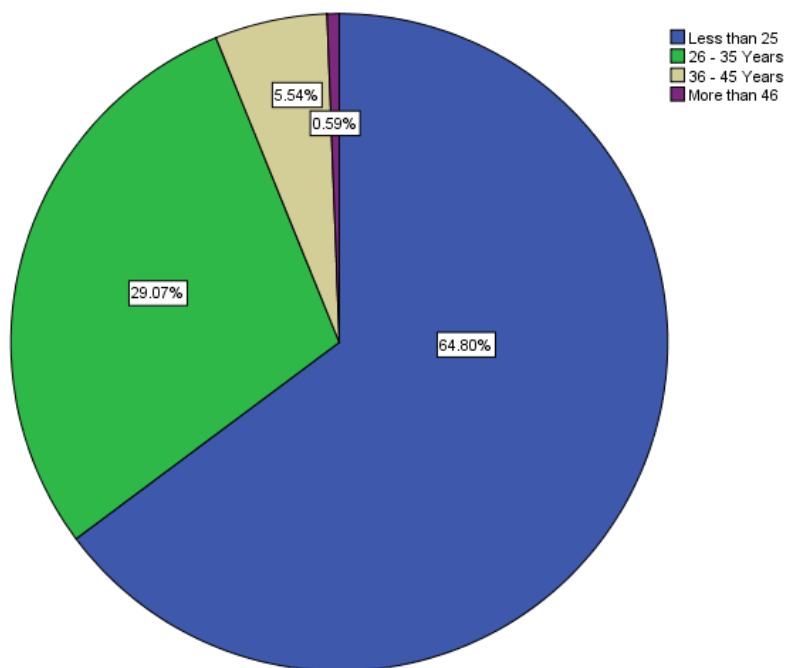
## Appendix (12)

### Association between participants attitude and their experience

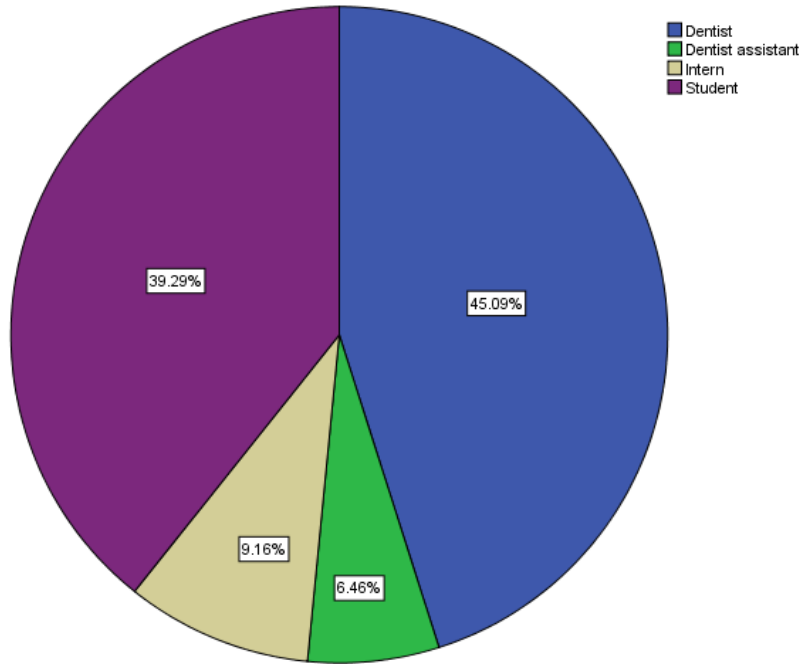
S	Question	Years of experience	Mean	Std. Deviation	F	Sig.
1	Do you prefer to take panoramic radiographs for every patient?	Less than 5 years	2.40	1.042	0.46	0.70
		5 – 10 years	2.47	1.004		
		11 – 15 years	2.31	1.137		
		More than 15 years	2.49	1.283		
2	Is dental X-ray harmful?	Less than 5 years	2.46	1.175	4.91	0.00
		5 – 10 years	2.61	1.187		
		11 – 15 years	3.12	1.173		
		More than 15 years	2.54	1.282		
3	Should the area of X-ray collimation on the patient be reduced according to the size of the part to be imaged?	Less than 5 years	1.52	0.873	4.19	0.00
		5 – 10 years	1.76	1.016		
		11 – 15 years	1.55	0.968		
		More than 15 years	1.43	0.835		
4	Should personal monitoring badges be worn by the operator (Radiation dose measuring devices)	Less than 5 years	1.99	1.092	4.56	0.00
		5 – 10 years	1.86	0.946		
		11 – 15 years	2.52	1.469		
		More than 15 years	2.16	1.143		
5	Will you adhere to radiation protection protocol at the time of your future private clinical practice?	Less than 5 years	1.41	0.695	43.23	0.00
		5 – 10 years	1.64	0.926		
		11 – 15 years	2.60	1.415		
		More than 15 years	2.08	1.211		



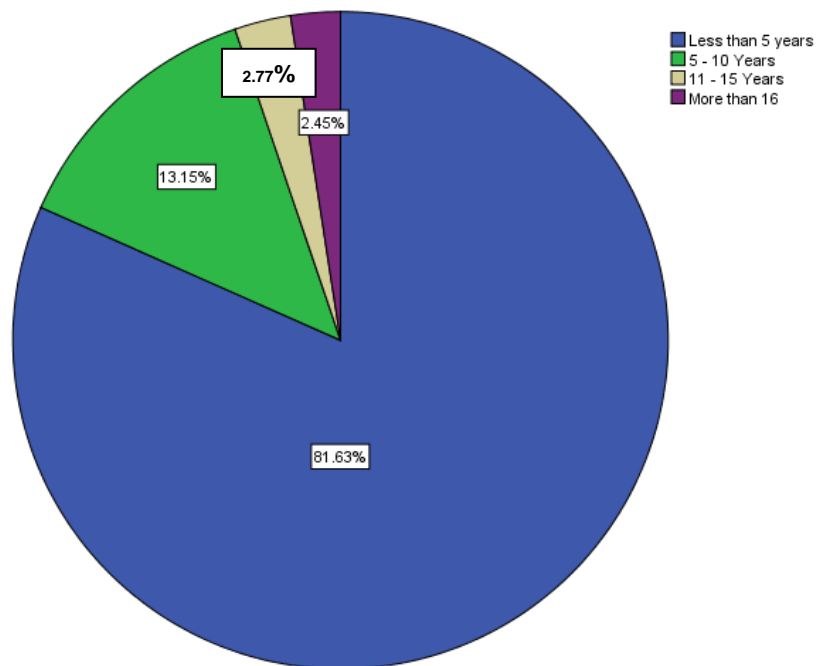
**Figure 1: Study Sample Gender**



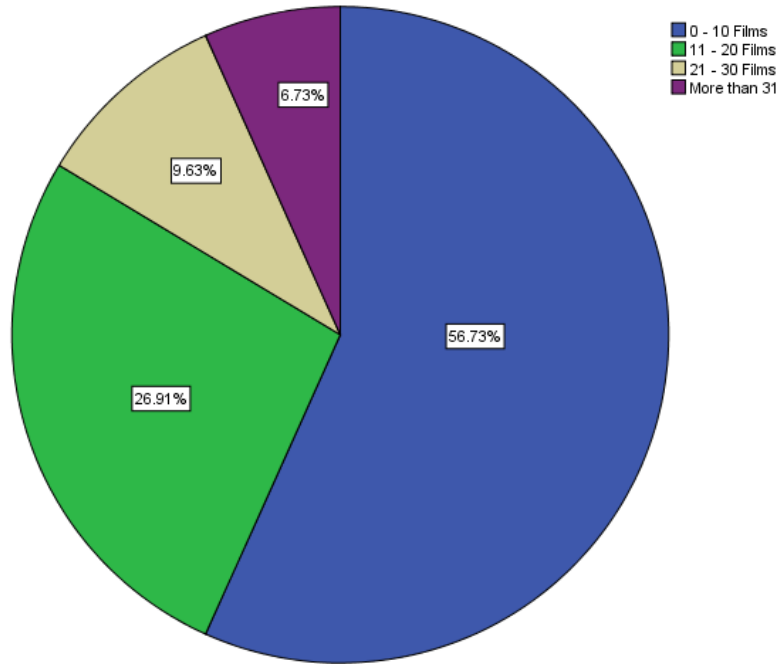
**Figure 2: Study Sample Age**



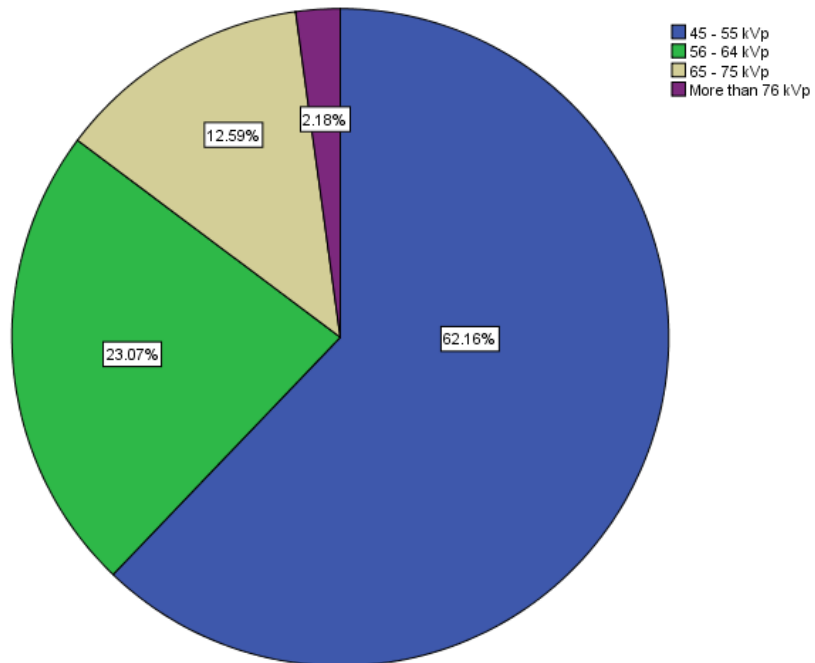
**Figure 3: Study Sample Job**



**Figure 4: Study Sample experience**

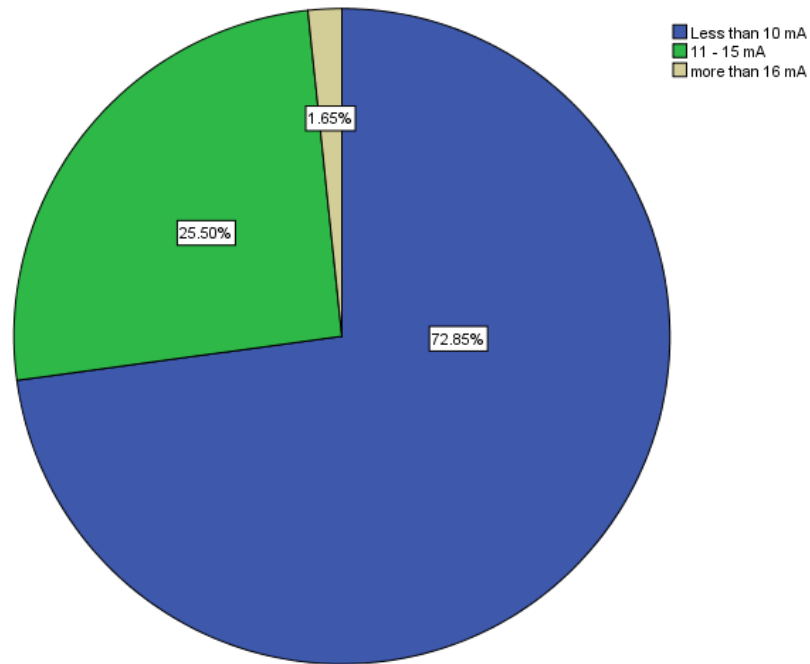


**Q1: Approximately how many films are taken in your practice every week?**

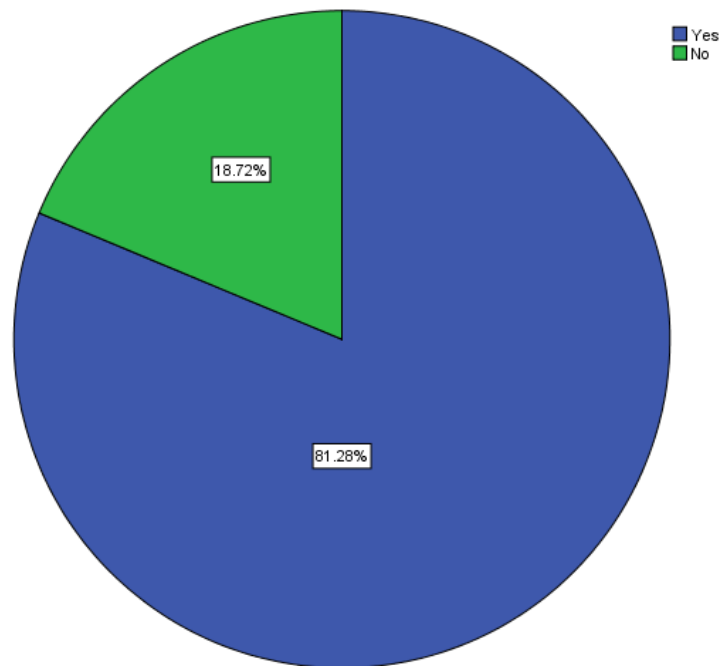


**Q2: What is the kilovoltage of your intraoral radiographic equipment?**

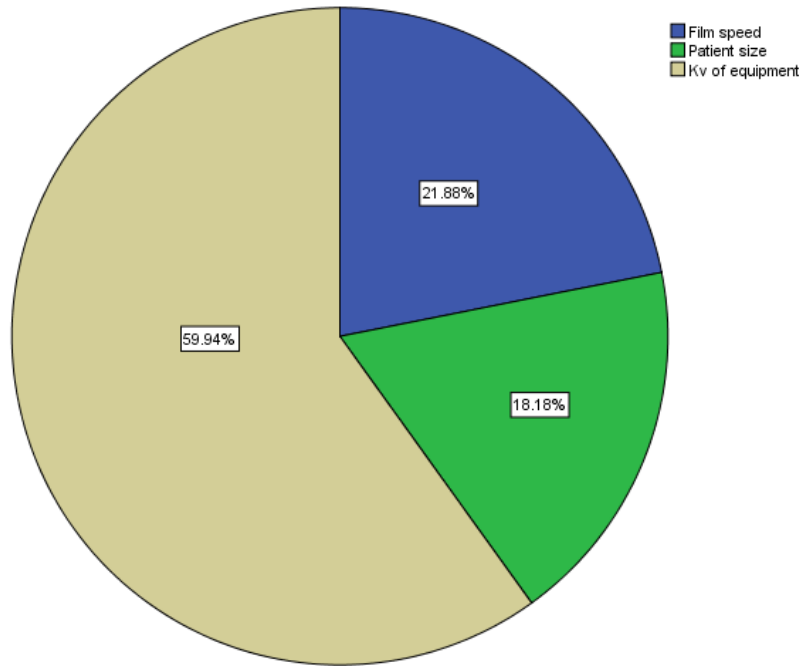




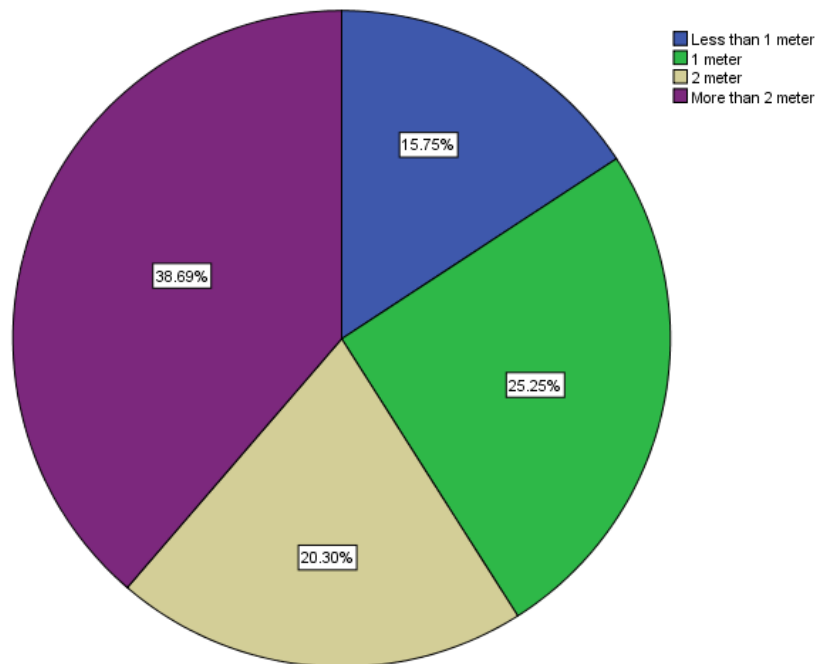
**Q3: What is the tube current of your intraoral radiographic equipment?**



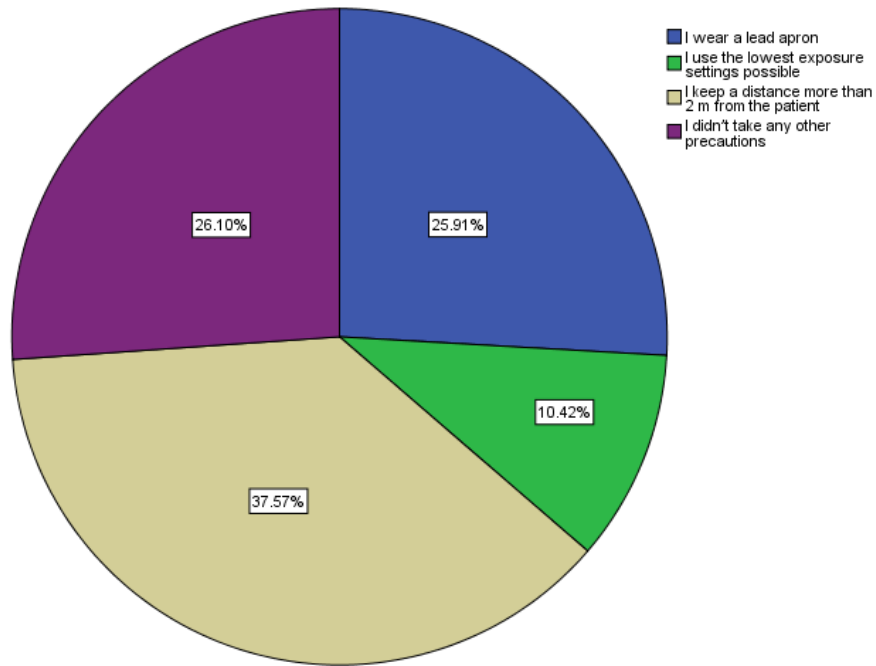
**Q4: Does the exposure time vary?**



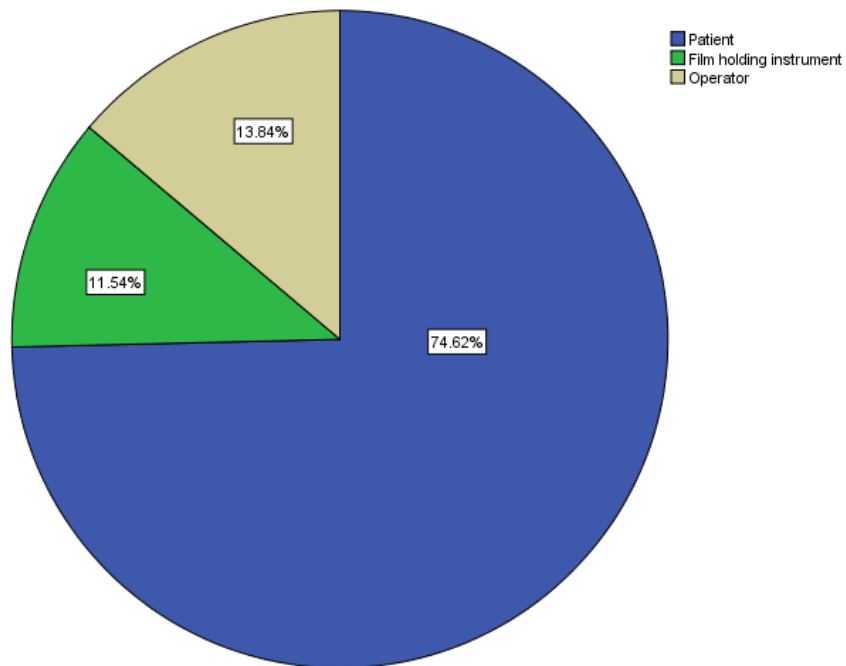
**Q5: If the previous question answer is Yes (Q4), it depends on what?**



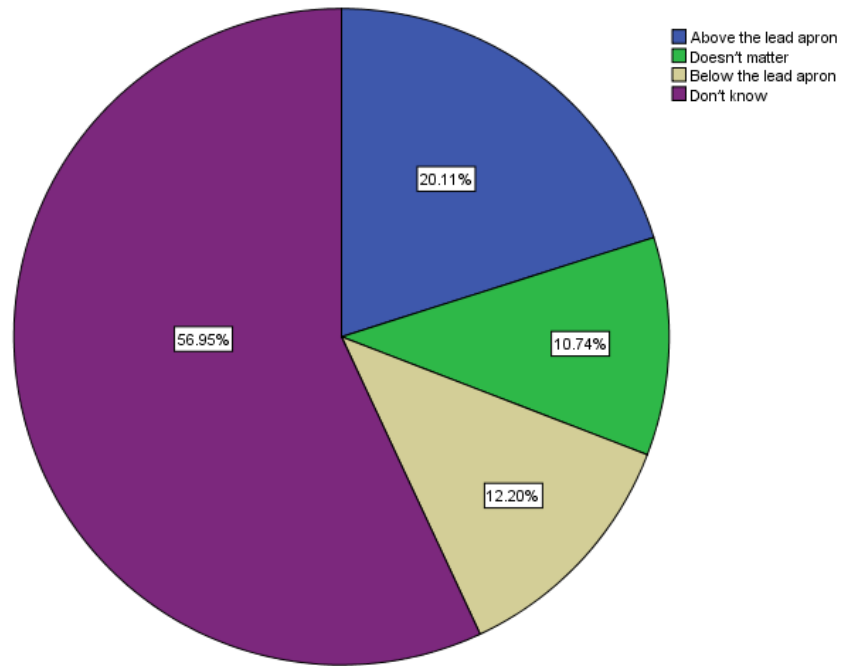
**Q6: At which distance from the patient are you positioned during exposure?**



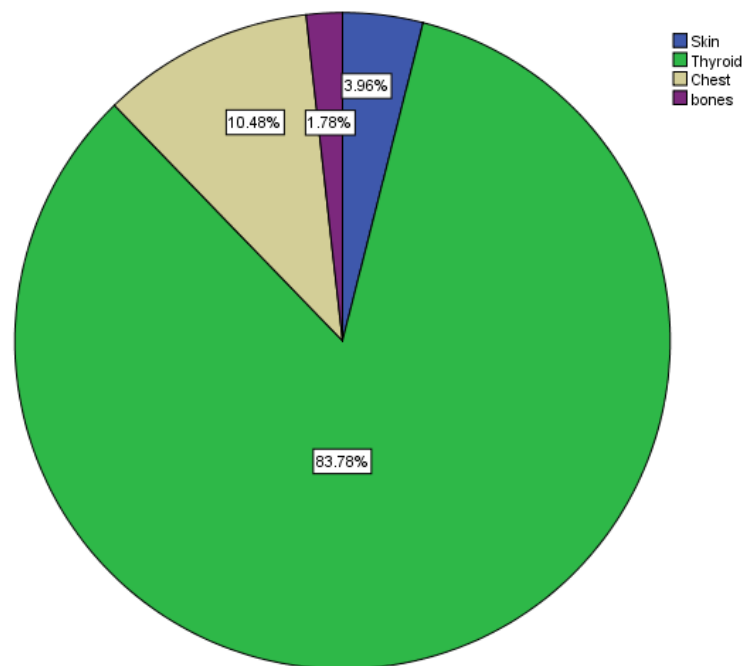
**Q7: Do you take other precautions to protect YOURSELF from radiation during exposure?**



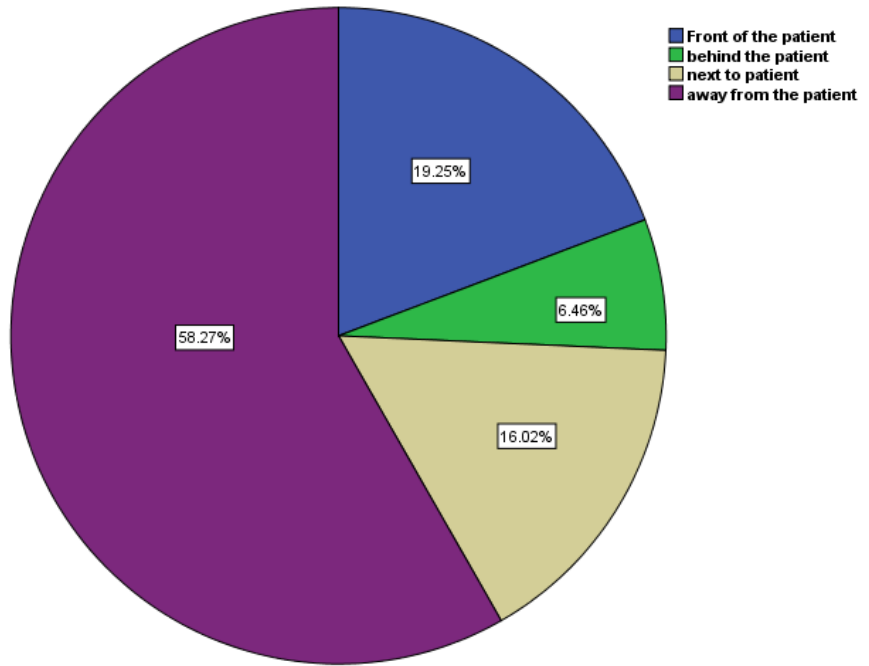
**Q8: How is the image receptor (film/sensor) held in the patient's oral cavity during the exposure?**



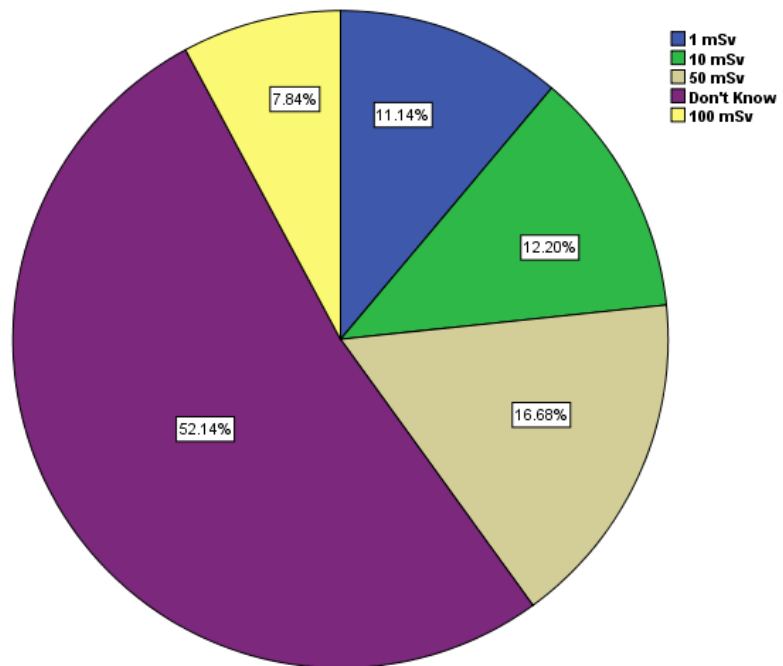
**Q9: Where does the operator wear personal monitoring badges (Radiation dose measuring devices)**



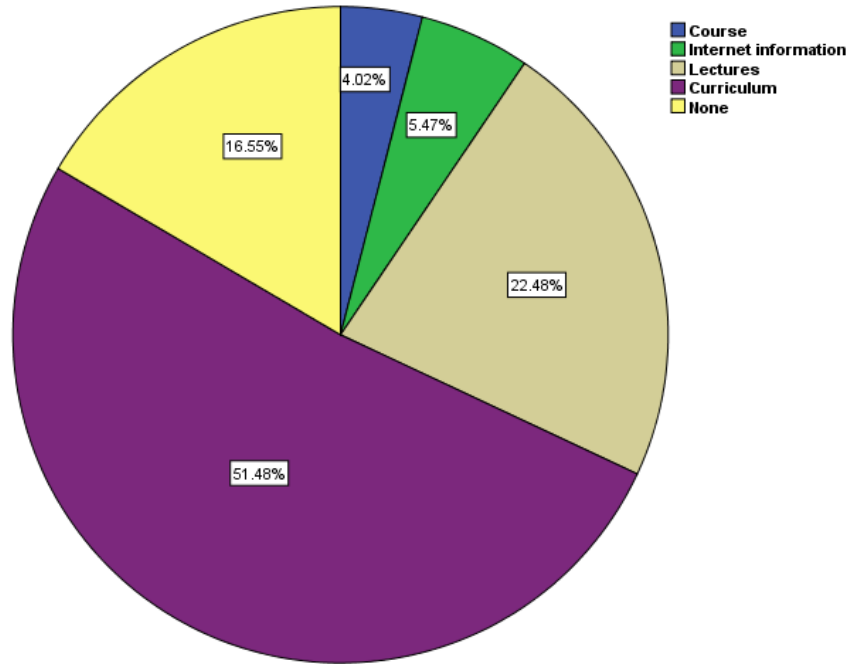
**Q10: What is the most important organ that must be protected during dental radiography?**



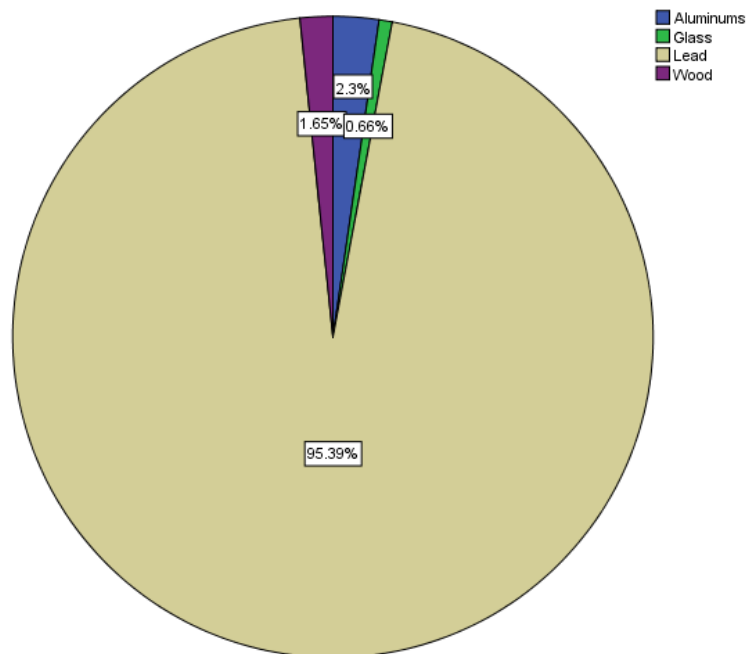
**Q11: Where do you stand during exposure?**



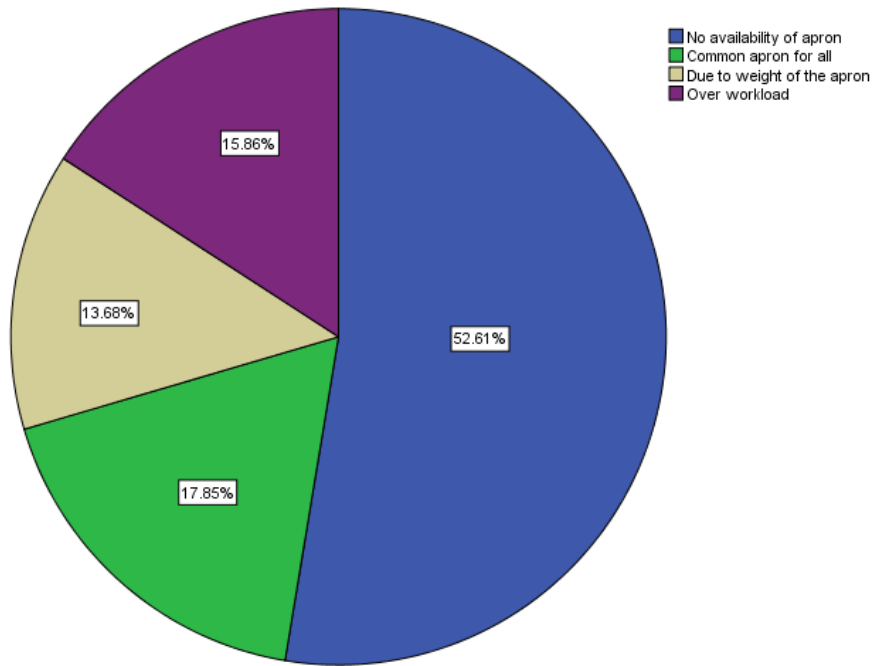
**Q12: Approximately what is the dose limit allowed for the patient?**



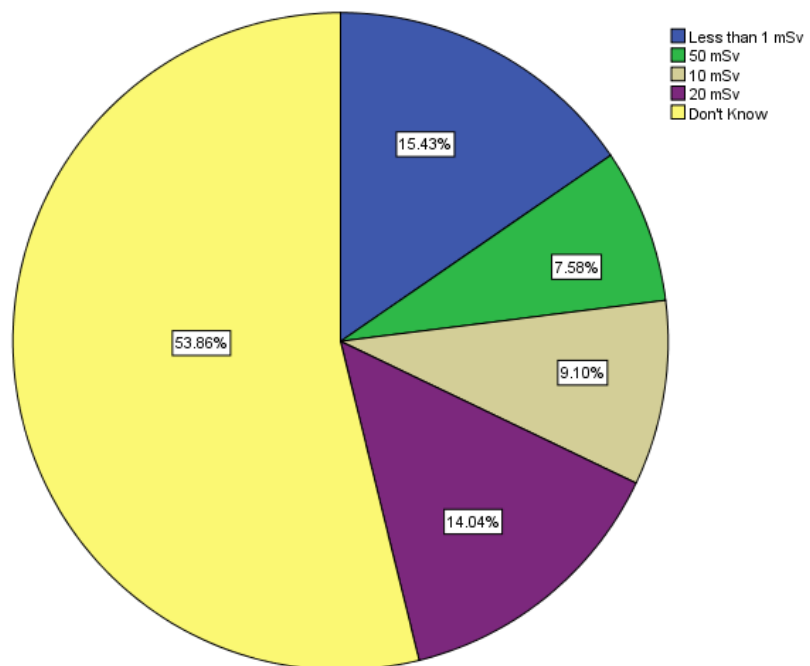
**Q13: Have you ever had education in the form of lectures, tutorials or courses regarding ionizing radiation?**



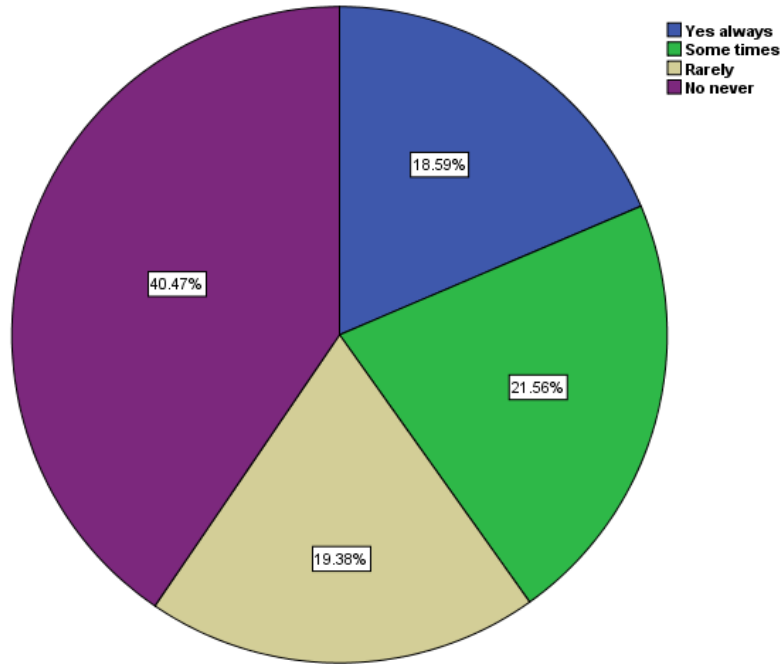
**Q14: What is the Protective material used for protection against radiation risk?**



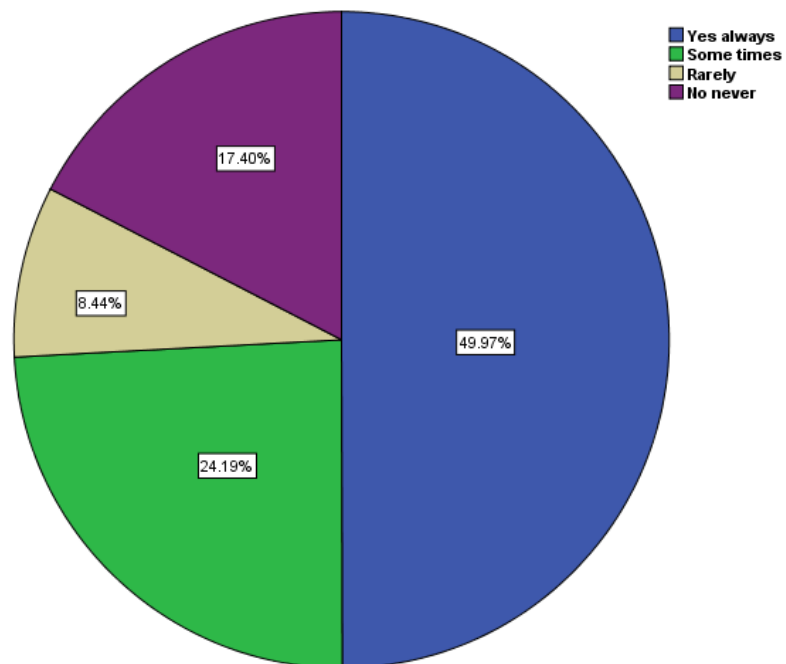
**Q15: If you don't use lead apron often, why?**



**Q16: What is the approximate radiation dose, in mSv, of a dental panoramic?**

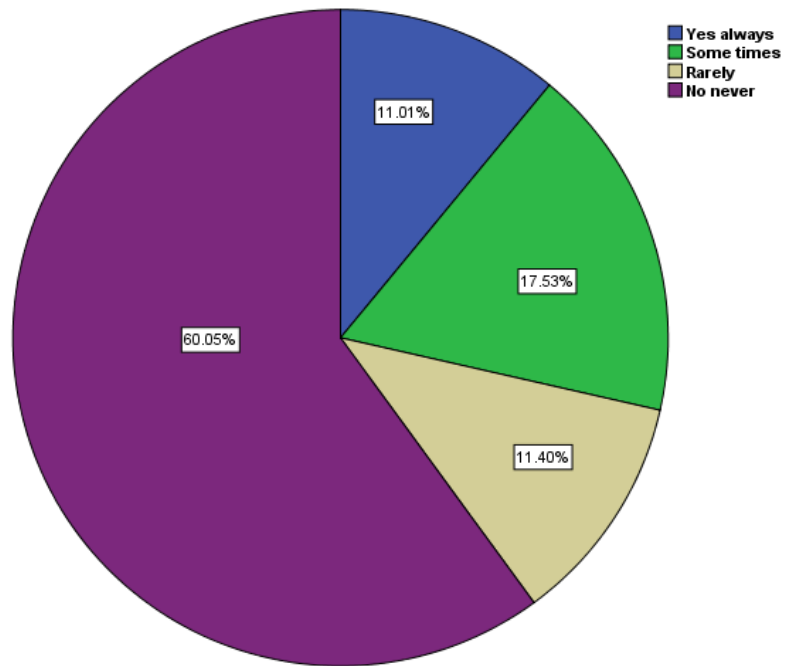


**Q17: Do you use lead apron during exposure?**

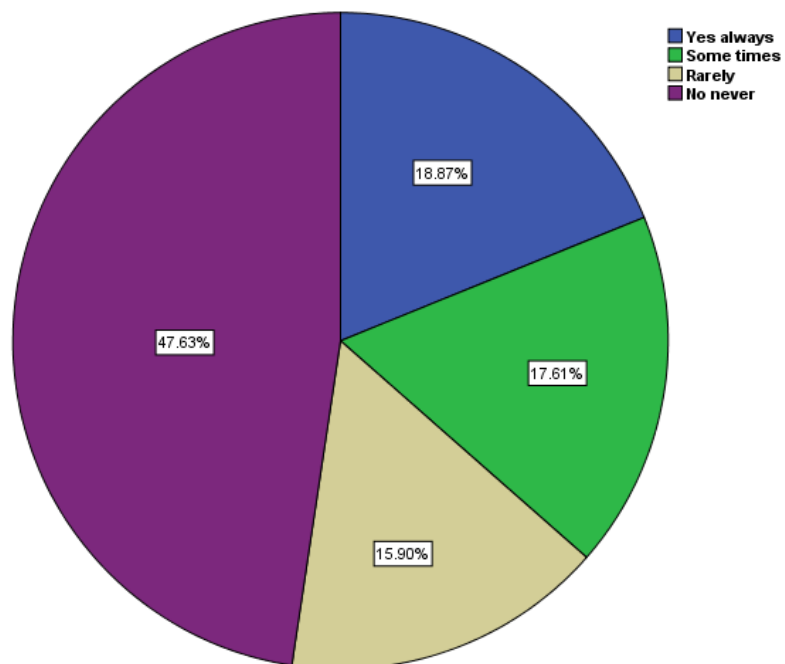


**Q18: Do you stand behind a radiation protective barrier during exposure?**

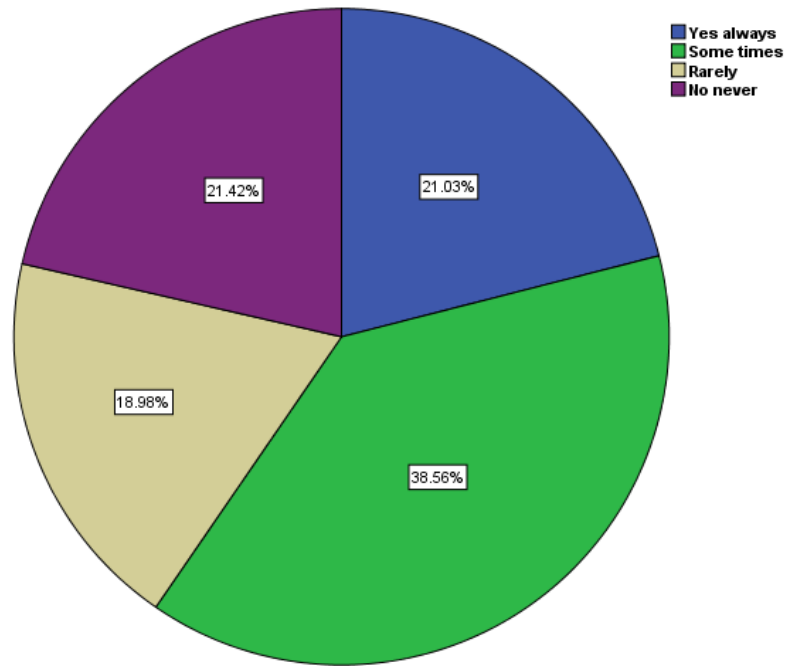




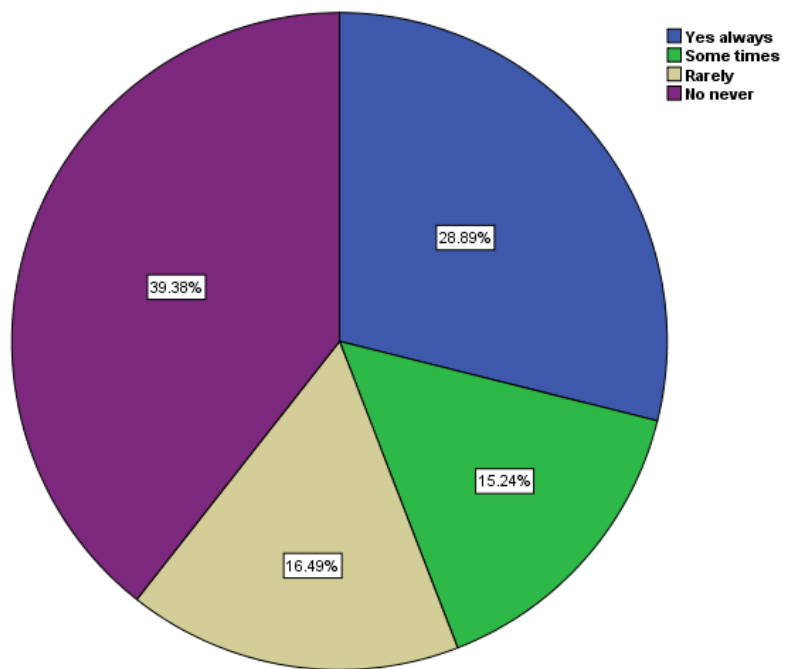
**Q19: Do you use thyroid collar during exposure?**



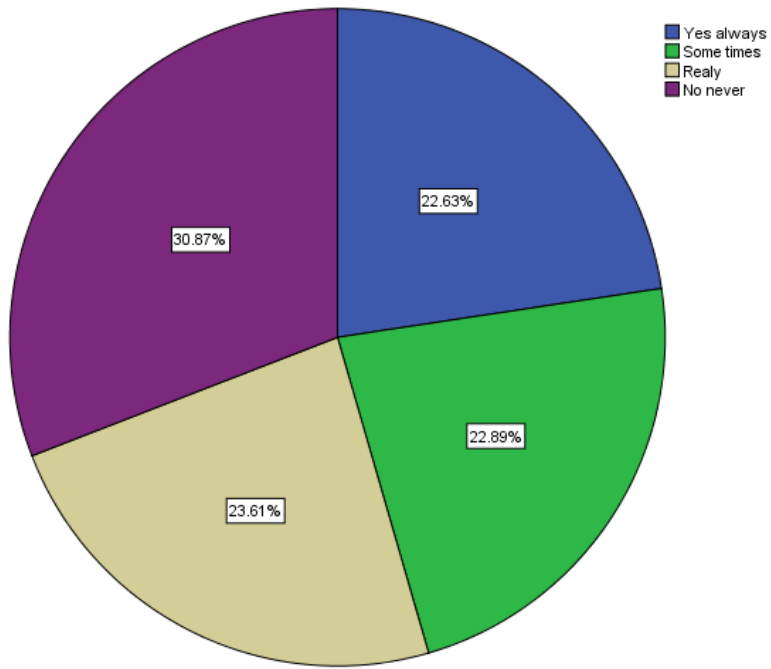
**Q20: Do you make sure that patient wear thyroid collar during exposure?**



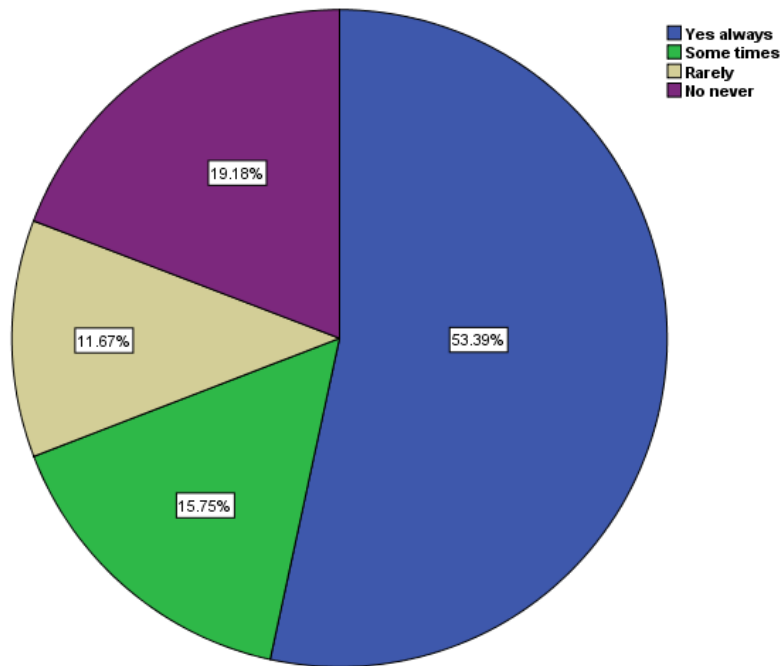
**Q21: Do you prefer to take panoramic radiographs for every patient?**



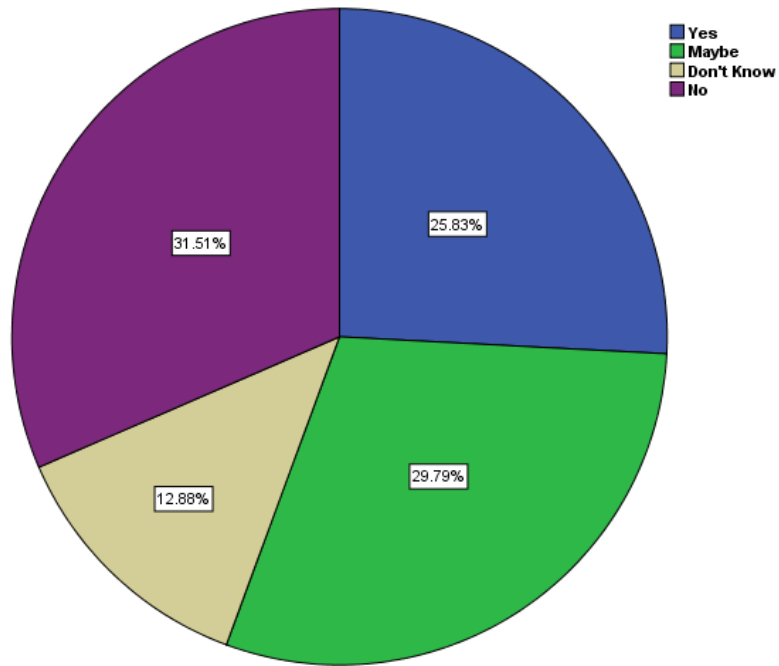
**Q22: you display cautioner hold a warning sign while exposed to X-ray?**



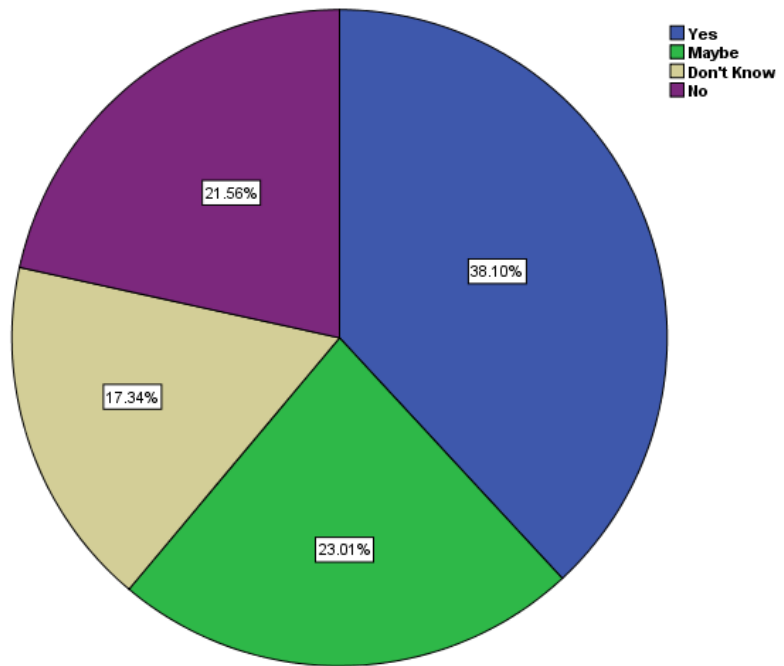
**Q23: Do you provide Explanation of radiation risk/benefit for patient?**



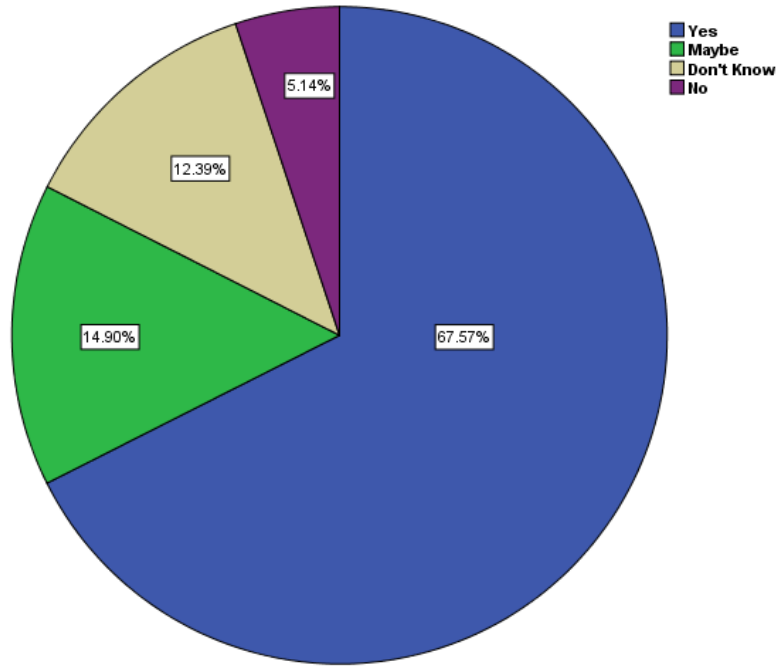
**Q24: Do you take informed consent of the patient before acquiring radiograph?**



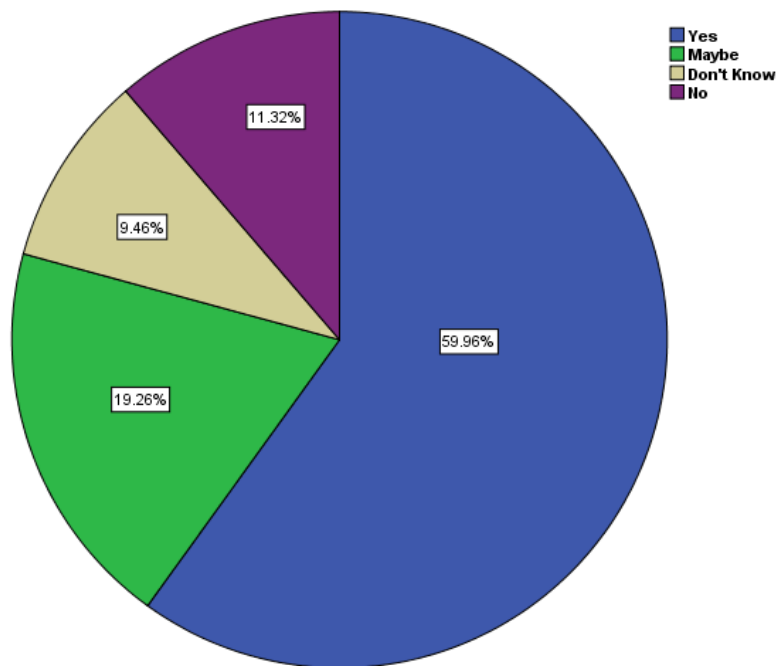
**Q25: Is dental X-ray harmful?**



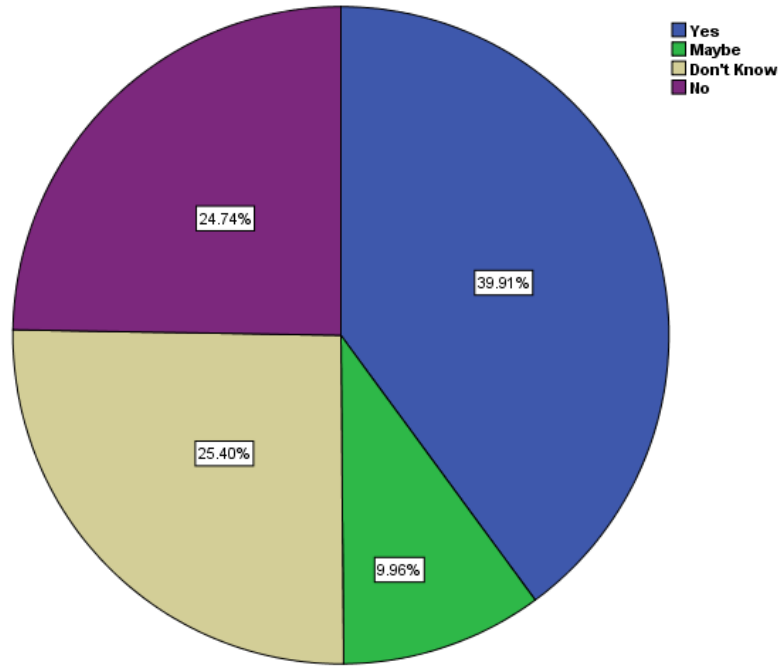
**Q26: Do X-ray beams reflect from room walls**



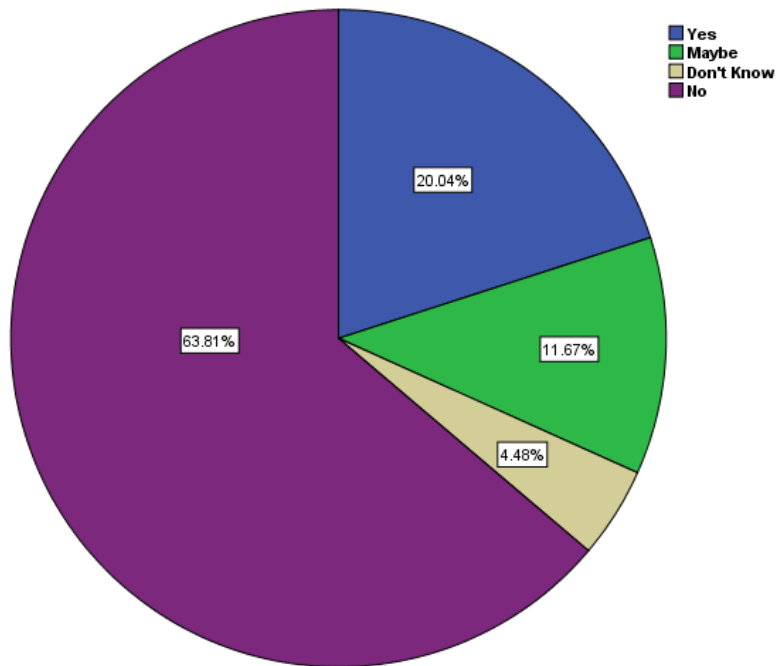
**Q27: Should the area of X-ray collimation on the patient be reduced according to the size of the part to be imaged?**



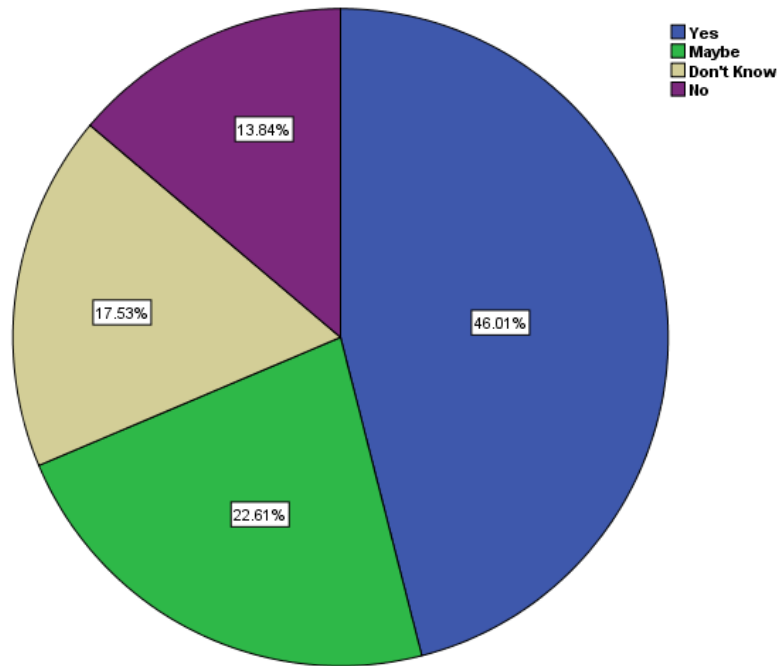
**Q28: Are you aware of radiation shielding procedures in X-ray rooms?**



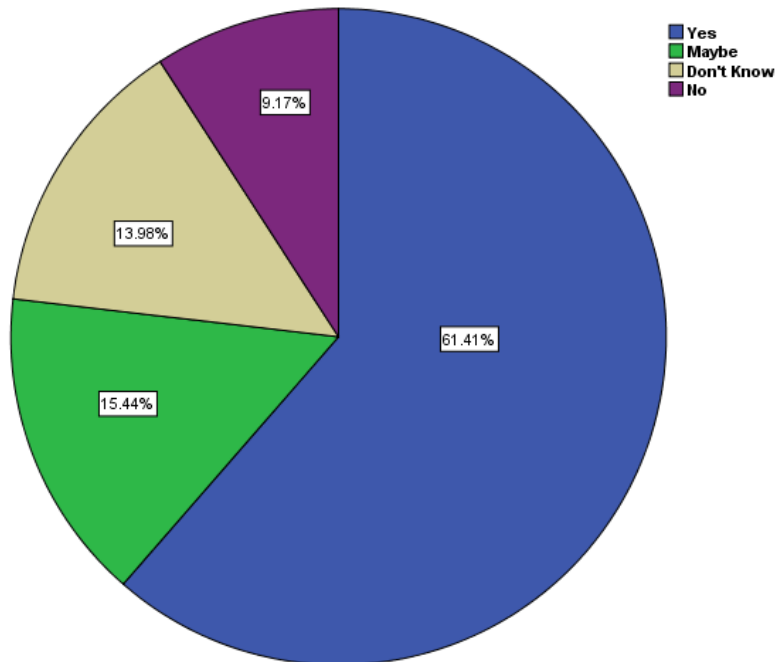
**Q29: Are you familiar with ALARA principle?**



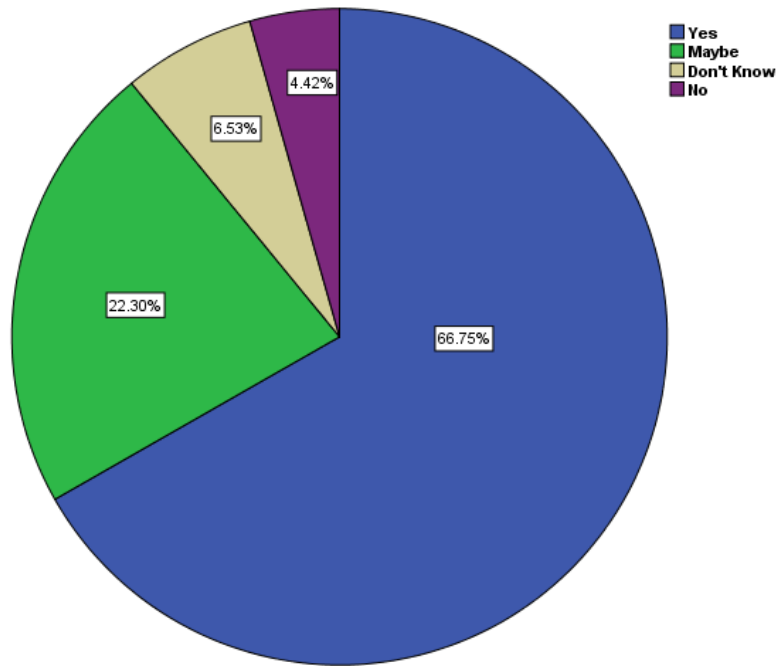
**Q30: Does dental radiograph absolutely contraindicate in pregnant patients?**



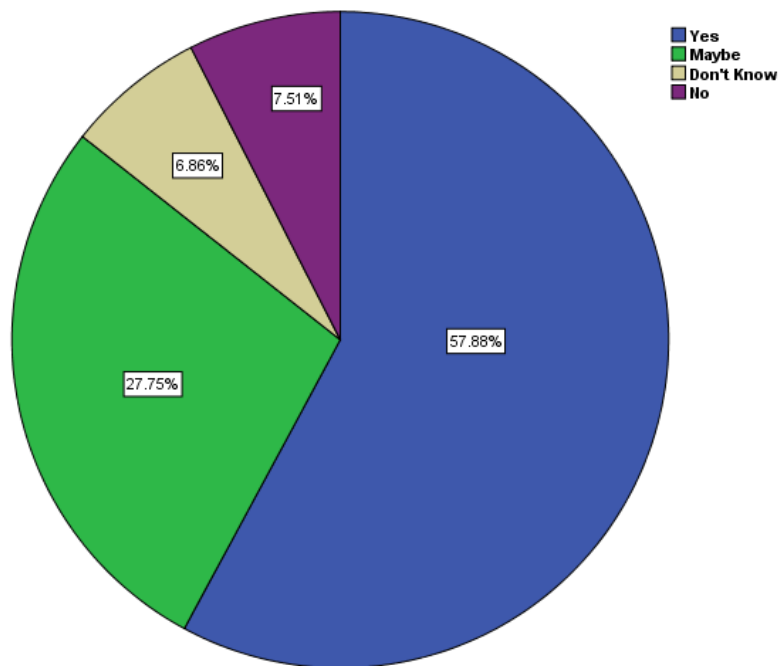
**Q31: would personal monitoring badges be worn by the operator (Radiation dose measuring devices)**



**Q32: Does Changing the type and speed of the film has a significant impact on the exposure required to produce an image?**

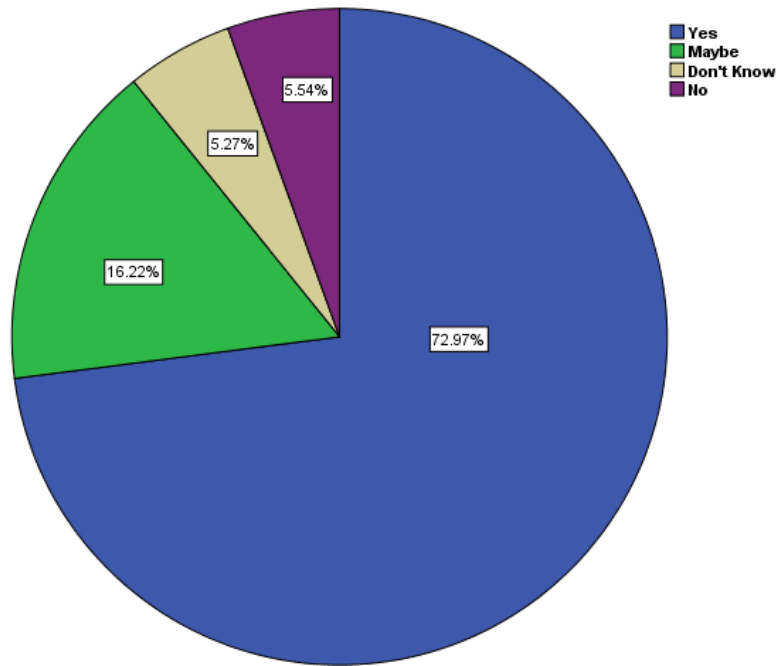


**Q33: Will you adhere to radiation protection protocol at the time of your future private clinical practice?**

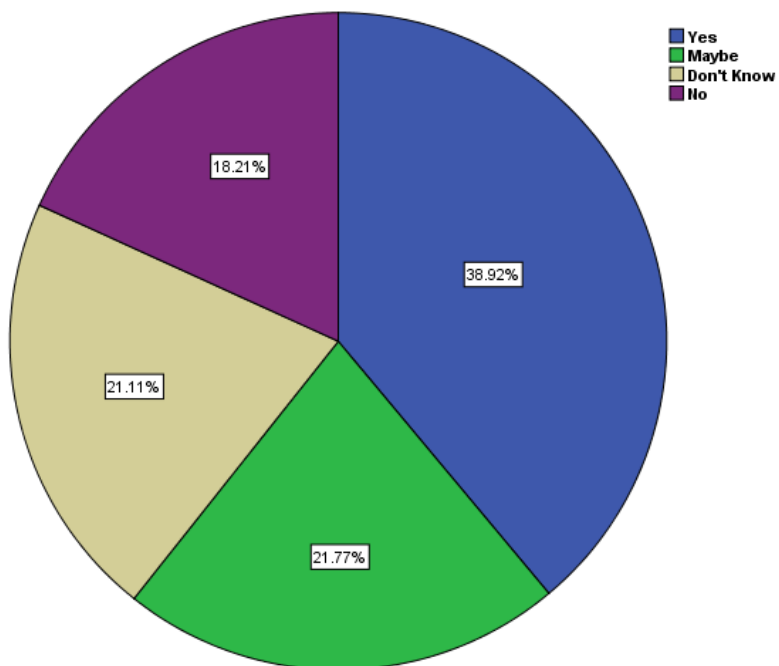


**Q34: Does Every radiation exposure bring the possibility of the occurrence of harmful effects?**





**Q35: Are children and fetuses more vulnerable to radiation hazards?**



**Q36: Do you get the radiography equipment that you use periodically checked**

بالإضافة إلى ذلك، كان هناك ارتباط بين الاتجاه نحو الوقاية من الإشعاع مع الجنس والعمر والوظيفة والخبرة، حيث كان لدى المشاركين الذكور اتجاه أفضل من الإناث، وكان للفئة العمرية التي يزيد عمرها عن 45 عامًا أفضل اتجاه، كما كان لدى مساعدي طبيب الأسنان أفضل اتجاه، وكانت المجموعة ذات الخبرة من 11- 15 عامًا لها أفضل اتجاه حول الوقاية من الإشعاع.

## الاستنتاجات والتوصيات

يُنصح الفريق الأكاديمي في قسم طب الأسنان بزيادة معارفهم حول الحماية من الإشعاع لتحسين معرفة طلاب طب الأسنان والتي يمكن أن تنعكس في سلوكهم وممارستهم.

يوصى بعقد ورش عمل ودورات تدريبية حول الحماية من الإشعاع لموظفي طب الأسنان لمساعدتهم في الحصول على المعلومات الصحيحة حول كيفية حماية أنفسهم والمرضى من خطر الإشعاع المؤين.

يجب على طاقم طب الأسنان توفير معدات الحماية من الإشعاع في أقسامهم.

يجب على وزارة الصحة إنشاء آلية مراقبة للتأكد من أن مقدمي الرعاية الصحية في قسم طب الأسنان لديهم تدابير الحماية من الأشعة.

# ملخص البحث

## خلفية البحث

منذ اكتشاف الأشعة السينية وبداية الثورة العلمية في توسيع مفهوم واستخدام الإشعاع ليصبح شاملاً لمعظم جوانب الحياة العلمية والعملية والطبية والصناعية. ساهمت الأشعة في تقديم خدمات متقدمة في أقسام الأشعة وطب الأسنان. وفي كل مرة يتم فيها إجراء تصوير بالأشعة السينية للأسنان يمكن لجرعة صغيرة من الإشعاع أن تسبب خطراً على جسم الإنسان.

## هدف البحث

التعرف على مدى وعي طلبة وأطباء الأسنان بالمعرفة حول الجرعات المستخدمة والوقاية من الإشعاع للفنيين وأخصائيين طب الأسنان والمرضى والعاملين الآخرين وكذلك تقييم اتجاهاتهم نحو الوقاية من الإشعاع والممارسات في الحياة العملية.

## منهجية البحث

هذه الدراسة وصفية تحليلية، حيث تم إعداد استبيان تم تحميله على نموذج google والذي كان عبارة عن أسئلة متعددة الاختيارات تم توزيعها على عينة شملت 1517 مشارك من الطلبة وكوادر طب الأسنان.

## النتائج

أظهرت النتائج أن الإناث المشاركات لديهن معرفة حول الوقاية من الإشعاع أكثر من الذكور، في حين أن الذكور لديهم المزيد من الأداء والممارسة العملية في الوقاية من الإشعاع. كما يتمتع طلبة الامتياز بمعرفة أكثر من باقي المجموعات لأن معلوماتهم لا تزال حديثة، وكان لدى مجموعة أطباء الأسنان مزيد من الممارسة لأن هذه المجموعة لديها أفضل الممارسات في الحياة العملية مقارنة بباقي المجموعات.

أظهرت النتائج أن هناك علاقة دالة احصائياً بين المعرفة حول الوقاية من الإشعاع والجنس والعمر والوظيفة والخبرة، حيث كانت الفئة العمرية أكثر من 45 عاماً أفضل معرفة، كما كانت المجموعة التي لديها أكثر من 15 عاماً من الخبرة لديها أفضل معرفة.

علاوة على ذلك، كان هناك ارتباط كبير بين الممارسة العملية والعمر والوظيفة والخبرة بينما لم يكن هناك ارتباط بين الممارسة في الوقاية من الإشعاع مع الجنس، كما كانت المجموعة العمرية التي لديها أكثر من 45 عاماً لديها أفضل الممارسات، وكانت المجموعة ذات الخبرة من 11 إلى 15 عاماً تتمتع بأفضل الممارسات في الحياة العملية نحو الوقاية من الإشعاع.

Republic of Yemen  
University of Science and Technology  
Faculty of Medicine and Health Science  
Diagnostic Radiology Technology Department



الجمهورية اليمنية  
جامعة العلوم والتكنولوجيا  
كلية الطب والعلوم الصحية  
قسم تكنولوجيا الأشعة التشخيصية

## تقييم المعرفة والاتجاهات والأداء والتحديات المتعلقة بالحماية الإشعاعية لدى الطلبة والعاملين في طب الأسنان

### إعداد

أثير ضياء الدين البغدادي  
بسام محمد المروسي  
احمد جماعي ناصر  
طارق محمد عمرو  
وليد احمد حمود

### إشراف الدكتور

د/ عبد الله ظاهر  
أستاذ مساعد في علوم الأشعة الطبية

هذا البحث قدم لاستكمال متطلبات الحصول على درجة البكالوريوس في تخصص تكنولوجيا الأشعة والتصوير الطبي

2023