




# Intraoral Radiographic Processing Skills among Dentists in Saudi Arabia

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## Abstract

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**AIM:** The present study was designed to investigate use of intraoral radiographic techniques (conventional and digital) among general dental practitioners (GDP) in Saudi Arabia with focus on its availability in workplace, ease of the technique, and the recommended technique to be taught during undergraduate based on individual experience.

**METHODS:** A questioner in form of a Google sheet was designed concerning demographic data, country, district, university, year of graduation, availability of radiographic technique available in workplace, which technique learned during undergraduate study, and which technique should teach during undergraduate study based on individual experience. A GDP list was developed from different dental groups on social media. The questioner was sent to the GDP list and to improve the response rate, telephone calls were made in advance to all expected participants.

**RESULTS:** About 62.2% of participants were graduated within past 5 years, the most common dental X-ray processing technique learned during undergraduate study was the digital and conventional (both theoretical and practical) in 47.6% of participants followed by conventional (theoretical and practical) technique in 21% participants. Based on their work experience, 74.8% of participants preferred both digital and conventional techniques should be taught in dental Saudi Universities/Colleges while, the digital method was preferred by 21%.

**CONCLUSION:** However, intraoral digital radiographic technique is widely available in most regions in Saudi Arabia; it is recommended to teach both intraoral digital and conventional radiographic techniques during undergraduate study.

## Introduction

Intraoral radiography is the most widely used imaging technique in dentistry, and since the debut of digital radiography in dentistry in the late 1980s [1], intraoral digital radiography has become more popular and has mostly supplanted analog film technology [2], [3], [4], [5], [6], [7], [8].

For intraoral digital radiography, there are two types of digital imaging technologies: The indirect technique, which uses a storage phosphor plate, and the direct technique, which uses a charged coupled device and complementary metal oxide semiconductor [2], [7].

According to the recent study, 45% of dentists who are using film-based systems were opposed to switching to a digital system. The major reasons were "expense" (67%), "system complexity" (50%), and "no benefit to change" (25%) [7].

Other studies [4], [7], [8], [9] found that the utilization of intraoral digital techniques differed. A variety of benefits of digital intraoral radiography have been described, with the claim that switching from film to

digital would result in significant improvements [10], [11]. Although some of the anticipated benefits do not appear to have realized, it is reasonable to conclude that time was saved, work was simplified, and communication was streamlined [12]. There are certain limitations, according to a couple of studies, because getting good X-ray images with a solid-state detector were more challenging than conventional film [10], [13]. When compared to working with film, more images were exposed and more retakes were necessary [14]. Retakes were more common with a solid-state detector than with film [15], contravening the as low as reasonably achievable principle [16], and solid-state users noted that detector alignment was challenging, resulting in more retakes [7].

Knowledge about the use of digital intraoral radiography among general dental practitioners (GDP) in Saudi Arabia is rare. The present study was designed to investigate the use of intraoral radiographic techniques (conventional and digital) among GDP in Saudi Arabia with a focus on its availability in workplace, ease of the technique, and recommended technique to be taught during undergraduate based on individual experience.

## Methods

The present study was performed from January 2021 to April 2021; ethical approval was obtained from institutional ethical committee and performed according to the principles described in the Declaration of Helsinki. All participants signed informed consent about the study at the beginning of the questioner.

The questionnaire was designed concerning demographic data, country, district, university, year of graduation, availability of radiographic technique available in workplace, which technique learned during undergraduate study, and which technique should teach during undergraduate study based on individual experience.

### Dentist selection

GDP list was developed from different dental groups on social media. A questioner in the form of Google sheet was sent to that list and to improve the response rate, telephone calls were made in advance to all expected participants. In total, 750 questionnaires were sent out through different social media.

According to the graduation year, the participants were divided into recent (2017–2021), intermediate (2012–2016), old graduate (2000–2011), and elderly graduated (before 2000). According to the location, the participants divided into western, eastern, middle, and north areas.

Regarding the radiographic technique learned during the undergraduate study, the participants choose one of the following; digital (theory only), digital (theory and practical), conventional (theory and practical), digital (theory and practical) and conventional (theory and practical), conventional (theory only), and digital (theory only) and conventional (theory and practical).

Regarding advantages and disadvantages of radiographic technique, participants choose from associated list that includes (cost, complexity, technique difficulty, reduction of time between exposure and image display, image enhancement, and magnification and need of retake).

Finally, the participants were asked to recommend the radiographic technique that should taught during undergraduate study based on individual experience, availability of the technique, and technical problems associated with each one.

### Statistical analysis

Statistical analysis was carried out using SPSS computer package (IBM SPSS Statistics for Windows, Version 25.0. Armonk, and NY: IBM Corp., USA). Regarding to descriptive statistics, frequency and percentage were used for qualitative variables.

Chi-square test was used to assess the differences in frequencies of qualitative variables. The statistical methods were verified, assuming a significant level of  $p < 0.05$  and a highly significant level of  $p < 0.001$ .

## Results

The study included 500 participants fulfilling the inclusion criteria with 386 (77.2%) obtained their dental bachelor's degree from different governmental ( $n = 198$ ) and private ( $n = 188$ ) Universities/Colleges inside KSA. More than half of participants were graduated from Universities/Colleges in the Western Region while no participation received from the Eastern Region. About 62.2% were graduated within the past 5 years and in 47.6% digital and conventional (both theoretical and practical) dental X-ray processing was the technique learned in undergraduate training followed by the conventional (theoretical and practical) technique in 21% (Table 1).

**Table 1: General characteristics related to bachelor's degree of dental surgery**

Variables	Frequency n = 500	Percent
The degree is obtained from		
KSA	386	77.2
Outside KSA	114	22.8
Type of University/College inside KSA (n = 386)		
Governmental	198	51.3
Private	188	48.7
The University/College of graduation inside KSA (n = 386)		
Al-Baha University	16	4.15
Vision College (Jeddah)	70	18.13
Vision College (Riyadh)	47	12.18
Al-Jouf University	15	3.89
Batterjee College	22	5.7
Ibn Sina College	33	8.55
Jazan University	7	1.81
King Abdulaziz University	33	8.55
King Khalid University	8	2.07
King Saud Bin Abdulaziz University for Health Sciences	4	1.04
King Saud University	38	9.84
Najran University	8	2.07
Prince Sattam Bin Abdulaziz University	5	1.3
Princess Nourah Bint Abdulrahman University	8	2.07
Qassim University	9	2.33
Riyadh Elm University	16	4.15
Taibah University	12	3.11
Taif University	5	1.3
Umm Al-Qura University	30	7.77
University/College region inside KSA (n = 386)		
Western region	205	53.1
Northern region	15	3.9
Middle region	127	32.9
Southern region	39	10.1
Graduation year		
Within 5 years	311	62.2
Within 6–10 years	56	11.2
Within 11–20 years	98	19.6
More than 20 years	35	7.0
Dental X-ray processing technique learned in undergraduate training		
Digital (T only)	49	9.8
Digital (T and P)	27	5.4
Conventional (T and P)	105	21.0
Digital (T and P), Conventional (T and P)	238	47.6
Digital (T and P), Conventional (T only)	10	2.0
Digital (T only), Digital (T and P), Conventional (T only),	37	7.4
Conventional (T and P)		
Conventional (T only), Conventional (T & P)	18	3.6
Digital (T only), Conventional (T & P)	16	3.2

T: Theory, P: Practical.

Among participants, 58% were practicing dentistry in the Western Region while only 7% in the middle region with similar percent practicing for more

than 20 years. About 65.4% were practicing in private facilities and in 40.2%, the digital technique for dental X-ray processing was available while the conventional technique was available in 24.2% (Table 2).

Based on their work experience, when they asked about the processing method/s that should be taught in dental Saudi Universities/Colleges, the majority (74.8%) preferred both digital and conventional techniques while the digital method only was preferred by 21%.

The opinion of participants about the processing method/s that should be taught in dental Saudi Universities/Colleges was stratified according to different study variables (Table 3). In most variables, from 60.4% to 100% of participants preferred both processing methods.

This study demonstrated that advantages of digital technique included reduction of time between exposure and image display (81%), image enhancement, and magnification (93.3%), while disadvantages associated with the digital technique included technique difficulty (74.8%) and need to retake (64.6%). Regarding advantages of conventional technique included lower cost (60%) and less complicated technique (30%).

**Table 2: General characteristics related to dentistry practice**

Variables	Frequency n = 500	Percent
Region of practicing		
Western region	290	58.0
Northern region	112	22.4
Eastern region	63	12.6
Middle region	35	7.0
Duration of practicing		
5 years or less	311	62.2
6–10 years	56	11.2
11–20 years	98	19.6
20 years or more	35	7.0
Place of practicing		
Government	120	24.0
Private	327	65.4
Both	53	10.6
Type of dental X-ray processing available		
Digital only	201	40.2
Conventional (developer and fixer)	121	24.2
Both	178	35.6

## Discussion

Institutions play important role in modern society by giving knowledge to students and have become centers of revolution. Similarly, these institutions are responsible for developing highly competent, trained, and efficient students to meet society's needs. Any system that does not change according to technological environments will become fossilized. To avoid this, institutions must assess and modify their system's performance on a regular basis. Educational programs in dental institutions are responsible to provide dental students with knowledge and application skills [17].

Radiographs have become integral aspects of dentistry's diagnosis and therapy. Hence, GDP should know how to take and process radiographs [18], [19].

In this study, the response rate was 71.42% with most participants receiving a preparatory telephone call. The personal approach may have a positive effect on the response rate.

Digital and conventional radiological techniques (theoretical and practical) were taught to 47.2% of participants while, 21% of participants were taught conventional technique (theoretical and practical). Digital radiography techniques were available in 75.8% of workplaces in Saudi Arabia, while conventional radiographic technique was found in 59.8% in Saudi Arabia. Those findings explain comparable rates for using both radiological techniques in Saudi Arabia.

Advantages of digital technique include reduction of time between exposure and image display, image enhancement, and magnification which are in agreement with Berkhout *et al.* [10], and study of Parks and Williamson [11] while disadvantages associated with the digital technique include technique difficulty (74.8%) and need to retake (64.6%). This result is in accordance study of Bahrami *et al.* [13], and Berkhout *et al.* [10]. Regarding advantages of conventional technique included lower cost (60 %) and less complicated technique (30%) which comparable to study of Anissi [7], Geibel [2].

In this study, 74.8% of participants recommended to learn both digital and conventional radiographic technique, while 21% of participants recommended to learn the conventional radiographic technique. The higher percent for recommendation to teach both techniques can be attributed to most participants had learned both techniques during their study and the availability of the digital technique in most workplaces. This was beside the advantages associated with digital radiographic technique. While, still percent of participants recommend to use the conventional radiographic technique due to lack of availability of digital radiograph in certain areas, presence of required skill for a practitioner in presence of any technical problem related to digital technique, beside the advantages of conventional radiographic technique.

## Conclusion

However, intraoral digital radiographic technique is widely available in most regions in Saudi Arabia; it is recommended to teach both intraoral digital and conventional radiographic techniques during undergraduate study.

**Table 3: Relation between their opinion about the processing method/s that should be taught and different study variables**

Variables	Processing method that should be taught			p-value
	Digital n = 105 (%)	Conventional n = 21 (%)	Both n = 374 (%)	
The degree is obtained from				0.001*
KSA	93 (24.1)	19 (4.9)	274 (71.0)	
Outside KSA	12 (10.5)	2 (1.8)	100 (87.7)	
Graduation year				<0.001*
Within 5 years	77 (24.8)	7 (2.3)	227 (73.0)	
Within 6–10 years	0 (0.0)	14 (25.0)	42 (75.0)	
Within 11–20 years	21 (21.4)	0 (0.0)	77 (78.6)	
More than 20 years	7 (20.0)	0 (0.0)	28 (80.0)	
Dental X-ray processing technique learned in undergraduate training				
Digital (T only)	14 (28.6)	0 (0.0)	35 (71.4)	0.146
Digital (T & P)	0 (0.0)	9 (33.3)	18 (66.7)	<0.001*
Conventional (T & P)	26 (24.8)	12 (11.4)	67 (63.8)	<0.001*
Digital (T & P), Conventional (T & P)	56 (23.5)	0 (0.0)	182 (76.5)	<0.001*
Digital (T & P), Conventional (T only)	3 (30.0)	0 (0.0)	7 (70.0)	0.653
Digital (T only), Digital (T & P),	0 (0.0)	0 (0.0)	37 (100.0)	0.001*
Conventional (T only), Conventional (T & P)				
Conventional (T only), Conventional (T & P)	4 (22.2)	0 (0.0)	14 (77.8)	0.664
Digital (T only), Conventional (T & P)	2 (12.5)	0 (0.0)	14 (87.5)	0.445
Region of practicing				<0.001*
West region	70 (24.1)	7 (2.4)	213 (73.4)	
North region	7 (6.3)	14 (12.5)	91 (81.3)	
East region	21 (33.3)	0 (0.0)	42 (66.7)	
Middle region	7 (20.0)	0 (0.0)	28 (80.0)	
Duration of practicing				<0.001*
5 years or less	77 (24.8)	7 (2.3)	227 (73.0)	
6–10 years	0 (0.0)	14 (25.0)	42 (75.0)	
11–20 years	21 (21.4)	0 (0.0)	77 (78.6)	
20 years or more	7 (20.0)	0 (0.0)	28 (80.0)	
Place of practicing				<0.001*
Government	30 (25.0)	0 (0.0)	90 (75.0)	
Private	54 (16.5)	21 (6.4)	252 (77.1)	
Both	21 (39.6)	0 (0.0)	32 (60.4)	
Type of dental X-ray processing available				<0.001*
Digital only	44 (21.9)	0 (0.0)	157 (78.1)	
Conventional (developer and fixer)	36 (29.8)	0 (0.0)	85 (70.2)	
Both	25 (14.0)	21 (11.8)	132 (74.2)	

T: Theory, P: Practical, \*: Significant.

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