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Knowledge and Attitudes of the Public in Saudi Arabia about Forensic Odontology during COVID-19

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ABSTRACT

Background: Forensic odontology is the handling and examination of dental evidence and the accurate interpretation and preservation of dental findings in the interests of justice. The aim of this study was to assess the level of knowledge and attitudes of the public in Saudi Arabia about forensic odontology during COVID-19.

Methods: A total of 784 adult participants from 17 cities answered a self-reported questionnaire in this cross-sectional study. The questionnaire was composed of 55 questions about their knowledge of and attitudes about forensic odontology and their willingness to register with a national dental registry. The questionnaire was validated and had a Cronbach's alpha of 0.78 and 0.75.

Results: The total knowledge score was 9.35 (out of 21), and standard deviation (SD) of 4.68. Adults and employed participants had significantly higher forensic odontology knowledge levels than older and retired participants ($p<0.05$). There was a moderate attitude toward the usefulness of forensic odontology during the COVID-19 pandemic, ranging from 36.61% to 61.48%. A total of 74.62% were willing to register with a national dental registry if one is established.

Conclusion: The public in Saudi Arabia have relatively low levels of knowledge about forensic dentistry. They had a good attitude about participating in a national dental registry. Most of them agreed on the importance of using forensic odontology in global public health disasters such as the COVID-19 pandemic. However, forensic odontology still needs to be introduced to the public, with more efforts exerted toward educational and health promotion activities.

Key words: Knowledge, Forensic odontology, Forensic dentistry, COVID-19, Saudi Arabia

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INTRODUCTION

Forensic odontology, also known as forensic dentistry, is a challenging branch of forensic science that the World Dental Federation (FDI) defined as a specialized field of dentistry dealing with the proper handling and examination of dental evidence and with the accurate interpretation and preservation of dental findings in the interests of justice [1]. It involves the application of dental sciences in the identification of unknown deceased individuals through the comparison of ante- and post-mortem records [2]. In particular, forensic odontology deals with the recognition of injuries to soft and hard oral tissue as a result of crime, rape, murder, or child abuse. But the primary applications for forensic odontology in bringing criminals to justice [3] are the identification of human remains through dental records and bite mark identification. This field of science provides the ability to determine the age, gender, and race of a victim, which can be used as evidence in resolving criminal cases [4]. Furthermore, dental tissue provides an important source of DNA material, which is now becoming the gold standard in the field of forensic identification [5].

It is common for dental professionals to face malpractice cases in their practice. And in Saudi Arabia, during 2007–2008, over 600 cases of medical error litigations were recorded. Out of these, 6% occurred in dentistry [6]. Thus, an individual's dental records, including radiographs, models, photographs, and clinical correspondence, are essential legal documents that serve as sources of information for dentists and patients, and which may be utilized as forensic evidence [7]. Therefore, these records should be securely retained by general practitioners for

the purposes of justice [8], but dental records have not received the same attention as fingerprints and facial photographic records by governmental registries [9]. However, the development of a national dental registry would provide researchers with a large amount of data regarding the prevalence and correlations of different dental disorders. In addition, these data could be used by legal authorities as evidence if the need for a forensic dental investigation arises [10].

Despite the significance and numerous applications from this field to facilitate post-mortem confirmation of a victim's identity, the literature indicates that forensic odontology is underdeveloped in many countries around the world, and action is needed to improve the utilization of this science [11]. For example, A systematic review of recent cross-sectional studies regarding the levels of knowledge and practical application of forensic odontology among dentists in India revealed inadequacy and considerable variation in the practice of forensic odontology among dentists [12]. In Saudi Arabia, studies have been conducted over the last few decades aimed at defining the level of knowledge and awareness about forensic odontology among dental professionals. This research included one study on a national scale [13], and other local studies in Riyadh [14–17] and the eastern region of Saudi Arabia [18]. These studies indicated that dental professionals had low awareness and poor knowledge and attitude about forensic dental sciences, in addition to lack of practice of forensic odontology among dental professionals.

Despite all of these studies, there are limited data regarding public awareness about forensic odontology in Saudi Arabia on a national level. The only study was conducted in Riyadh city [10] and assessed the willingness of the public to register in a national dental registry. The results indicated that two-thirds of the respondents were willing to register. In fact, there has been an urgent press to investigate this aspect, especially during the COVID-19 pandemic, which has highlighted the beneficial aspects of forensic odontology today. One study highlighted the handling of dental tissues for forensic evidence during COVID-19 [19]. However, in this regard in comparison to other publications in forensic medicine related to COVID-19 [20,21], there is a scarcity of articles focusing on the dental area, and researchers concluded that the importance of forensics has been underestimated during the COVID-19 pandemic. Consequently, the aim of this study was to assess the general public's levels of knowledge and attitudes about forensic odontology during COVID-19 in Saudi Arabia.

MATERIALS AND METHODS

This was a cross-sectional study design that was conducted between October and November 2020. A questionnaire measured the extent of knowledge and awareness among the public about forensic odontology during the COVID-19 pandemic in Saudi Arabia as part of a large research project on forensic dentistry. Inclusion criteria included male and female participants older than 18 years who lived in Saudi Arabia. Dental students, interns, and dentists were excluded. Using a convenience sampling methodology, a precision level of 5%, estimated prevalence of 50%, and confidence level of 95% yielding 385 participants were needed for this research. To overcome the non-response rate, a total of 1,000 participants were invited. Due to the current circumstances due to the COVID-19 pandemic, data collection was performed by sharing a Google link to a self-administered Arabic-language online questionnaire via social media platforms (WhatsApp, Twitter, Facebook, Instagram, and Snapchat) to a large segment of society in Saudi Arabia.

Questions were adopted from previous a questionnaire [10], and the questionnaire was tested and validated by the authors, with Cronbach's alpha measured at 0.78 and 0.75. The questionnaire was validated through expertise research and by interviewing 10 participants in a pilot application to test the syntax, grammar, language, comprehension, flow, and organization, and then the questions were modified accordingly. The questionnaire can be answered in five to ten minutes.

Seven research assistants were responsible for distributing the questionnaire. In order to participate in this study, all participants were asked to indicate their approval of the informed consent by clicking on a button labeled "next" before being able to move on to completing the questionnaire. The questionnaire took about 10 minutes to complete. All data were treated anonymously, and any information about participants was eliminated. Participants who did not agree to the consent for this study were excluded. The questionnaire contained four parts and had a total of 55 questions. Part one consisted of 13 demographic items gathering the participant's age, gender, nationality, occupation, level of education, marital status, dental information, the frequency of use of dental services, and whether they had been infected with COVID-19. Part two comprised 21 statements measuring the person's level of knowledge about forensic dentistry. The questions were answered with "yes," "no," or "I do not know." Each correct answer was given one point, and the answers were totaled for a maximum total score of 21 correct answers and a minimum of zero. Part three contained four questions to assess the participant's attitudes about forensic odontology and its relationship to COVID-19. Part four had 16 questions aimed at assessing attitudes about forensic dentistry. The final question was about the participant's willingness to enroll in a national dental registry. Ethical approval for this study was received from the research ethical committee for the Faculty of Dentistry, Umm Al Qura University, with the number 193-20.

Data analysis was conducted using Excel software and SPSS v.15 (IBM Inc., Armonk, NY, USA). Also calculated were descriptive statistics (count /percentages for categorical variables; mean/standard deviations or medians/inter-quartile ranges for continuous variables). Statistical significance was assessed via linear regression, chi-square, ANOVA, and t-test. The statistical significance level was set at a p-value of 0.05.

RESULTS

This study involved data from 784 participants, with a response rate of 78.4% from Saudi Arabia. Demographic data, including gender, age, nationality, city, region, marital status, education level, working status, existence of oral problems, usual treatment provider, frequency of dental visits, and history of infection with COVID-19 are shown in Table 1.

Table 1: Participants' demographic data.

Type of Variable	Variable	n	%
Gender	Male	117	14.92
	Female	667	85.08
Age	Less than 30 years	173	22.07
	31–40 years	144	18.37
	41–50 years	196	25
	More than 50 years	271	34.57
Nationality	Saudi	743	94.77
	Non-Saudi	41	5.23
City	Jeddah	503	64.16
	Medina	127	16.2
	Riyadh	74	9.44
	Albaha	18	2.3
	Qassim	10	1.28
	Yanbu	9	1.15
	Taif	9	1.15
	Umluj	9	1.15
	Onaizah	8	1.02
	Najran	5	0.64
	Dammam	3	0.38
	Alhassa	2	0.26
	Khobar	2	0.26
	Dharan	2	0.26
	Abha	1	0.13
	Tabuk	1	0.13
	Qunfutha	1	0.13
Region	Western	657	83.8
	Eastern	9	1.15
	Central	92	11.73
	Northern	1	0.13
	Southern	25	3.19
Marital status	Married	597	76.15
	Not married	187	23.85
Education level	High school or not educated	128	16.33
	University and higher	656	83.67
Work status	Employed	518	66.07
	Student	53	6.76
	Retired	213	27.17

Oral problem	Yes	323	41.2
	No	461	58.8
Usual care provider	Government	106	13.52
	Private	678	86.48
Frequency of visits to the dental clinic	Never	14	1.79
	Only when there is pain/problem	678	86.48
	Regularly	92	11.73
History of COVID19 infection	Yes	29	3.7
	No	755	96.3

Participants were asked 21 questions related to forensic odontology to assess their levels of knowledge, and the total knowledge score was 9.35 and standard deviation (SD) of 4.68. The items and participants' answers are shown in Table 2.

Table 2: Forensic odontology knowledge items.

Statement	Answer	N	%
Forensic odontology aids in investigating bite attacks	Yes*	581	74.11
	No	32	4.08
	I do not know	171	21.81
Forensic odontology aids in estimating the age of an individual	Yes*	607	77.42
	No	37	4.72
	I do not know	140	17.86
Forensic odontology can determine the dental disease history of an individual	Yes*	535	68.24
	No	55	7.02
	I do not know	194	24.74
All individuals have the same jaw structures	Yes	101	12.88
	No*	491	62.63
	I do not know	192	24.49
Forensic odontology aids in determining some social health-related lifestyle factors	Yes*	456	58.16
	No	82	10.46
	I do not know	246	31.38
Forensic odontology aids in investigating physical abuse (domestic violence)	Yes*	440	56.12
	No	66	8.42
	I do not know	278	35.46
Forensic odontology aids in investigating the victims of fatal accidents	Yes*	420	53.57
	No	58	7.4
	I do not know	306	39.03
Everyone has a unique teeth imprint	Yes*	408	52.04
	No	64	8.16
	I do not know	312	39.8
Forensic odontology helps in medicolegal cases	Yes*	370	47.19
	No	110	14.03
	I do not know	304	38.78

DNA can be extracted from the teeth of live individuals	Yes*	370	47.19
	No	49	6.25
	I do not know	365	46.56
Forensic odontology can identify the sex of an individual	Yes*	357	45.54
	No	93	11.86
	I do not know	334	42.6
Each individual has a unique palatal rugae	Yes*	331	42.22
	No	78	9.95
	I do not know	375	47.83
Forensic odontology aids in investigating sexual abuse	Yes*	301	38.39
	No	116	14.8
	I do not know	367	46.81
Forensic odontology aids in determining race	Yes*	285	36.35
	No	91	11.61
	I do not know	408	52.04
Forensic odontology doesn't aid with parental neglect of children's teeth	Yes	255	32.53
	No*	258	32.91
	I do not know	271	34.57
DNA cannot be extracted from dead bodies	Yes	112	14.29
	No*	252	32.14
	I do not know	420	53.57
Forensic odontology aids in determining the socioeconomic status of an individual	Yes*	246	31.38
	No	253	32.27
	I do not know	285	36.35
In forensic odontology, it is not necessary to take infection control measures when dealing with dead bodies	Yes	177	22.58
	No*	222	28.32
	I do not know	385	49.11
Forensic odontology doesn't apply to live survivors of accidents	Yes	126	16.07
	No*	190	24.23
	I do not know	468	59.69
Forensic odontology aids in determining the nature of someone's occupation	Yes*	143	18.24
	No	248	31.63
	I do not know	393	50.13
Each individual has the same lip prints or lines	Yes	400	51.02
	No*	69	8.8
	I do not know	315	40.18

* The correct answer.

When participants were asked in one question to rate their perception of their general level of knowledge about forensic odontology on a scale of 10 points (where 10 was the highest level of knowledge), participants had a median score of 4.64 (SD=2.81). Simple linear regression showed that there was a significant relationship between participants' perception of knowledge and actual total knowledge score ($p < 0.001$, r-squared=0.429).

Using t-test and ANOVA, the total score of knowledge was assessed in relation to gender, age, nationality, marital status, working status, and history of oral problems, usual care provider, and history of COVID-19. The results

showed relationships with the total knowledge score only for the age group and work status, as shown in Table 3.

Table 3: The relationships between forensic odontology knowledge scores and demographic variables.

Variable	Category	Forensic odontology knowledge scores		p-value
		Mean	SD	
Gender	Male	9.73	4.99	0.376
	Female	9.29	4.63	
Age	Less than 30 years	9.43	4.76	0.014*
	31–40 years	10.09	5.02	
	41–50 years	9.69	4.27	
	More than 50 years	8.66	4.68	
Nationality	Saudi	9.34	4.71	0.641
	Non-Saudi	9.66	4.26	
Marital status	Married	9.35	4.75	0.983
	Not married	9.36	4.49	
Education level	High school or not educated	9.02	4.73	0.379
	University and higher	9.42	4.68	
Work status	Employed	9.66	4.64	0.026**
	Student	9.28	4.77	
	Retired	8.63	4.72	
History of oral problems	Yes	9.5	4.58	0.461
	No	9.25	4.76	
Usual care provider	Government	9.54	4.04	0.661
	Private	9.32	4.78	
History of COVID-19	Yes	9.03	5.1	0.71
	No	9.36	4.67	

* Only participants 31–40 years old had significantly higher scores than those who were older than 50 years.

** Only employed participants scored significantly higher than retired participants.

Participants' answers to the attitude questions are displayed in Table 4. The attitudes toward the establishment of a national dental registry are shown in Table 5. A total of 585 (74.62%) were willing to register in a national dental record if one were to be established.

Table 4:Participant attitudes about forensic odontology during the COVID-19 pandemic.

Statement	Agree N (%)	Neutral N (%)	Disagree N (%)
During the COVID-19 pandemic, the practice of forensic odontology requires extra infection control precautions.	482 (61.48)	199 (25.38)	103 (13.14)
Forensic odontology is important during pandemics that result in high mortality rates, such as the COVID-19 pandemic.	324 (41.33)	298 (38.01)	162 (20.66)
Forensic odontology can help in determining the identity of a corpse during the COVID-19 pandemic.	304 (38.78)	322 (41.07)	158 (20.15)
There is need for forensic odontology to deal with the COVID-19 pandemic.	287 (36.61)	324 (41.33)	173 (22.07)

Table 5: Participant attitudes about statements related to establishing a national dental registry for use in forensic dentistry.

Statement	Agree N (%)	Neutral N (%)	Disagree N (%)
I believe dental records should be linked to my medical and personal profile.	629 (80.23)	116 (14.8)	39 (4.97)
I believe Saudi dentists are able to maintain my privacy and confidentiality in a national dental registry.	619 (78.95)	135 (17.22)	30 (3.83)
A dental registry should be maintained and controlled by the government.	521 (66.45)	184 (23.47)	79 (10.08)
I believe Saudi dentists have the knowledge to assess my dental profile.	515 (65.69)	208 (26.53)	61 (7.78)
I believe that Saudi dentists would be competent at creating a record of my dental profile in a national dental registry.	513 (65.43)	218 (27.81)	53 (6.76)
I believe that the results of forensic odontology are scientifically reliable.	524 (66.84)	214 (27.3)	46 (5.87)
I believe that forensic odontology is an accurate and sensitive method for the identification of victims.	494 (63.01)	210 (26.79)	80 (10.2)
I am willing to provide my dental profile in case I am involved in a legal case.	493 (62.88)	210 (26.79)	81 (10.33)
I believe that forensic odontology is an accurate and sensitive method for the identification of unknown victims.	454 (57.91)	250 (31.89)	80 (10.2)
I believe that a national dental registry can assist with law enforcement.	444 (56.63)	259 (33.04)	81 (10.33)
I believe that forensic odontology is an accurate and sensitive method of identifying criminals.	438 (55.87)	250 (31.89)	96 (12.24)
National dental records can be of tremendous help with facing pandemics such as COVID-19.	340 (43.37)	324 (41.33)	120 (15.31)
I should have the right to refuse to register in a national dental registry.	329 (41.96)	297 (37.88)	158 (20.15)
If I enroll in a national dental registry, I should have the right to withdraw my dental record from it in the future.	325 (41.45)	309 (39.41)	150 (19.13)
I think my dental records file in the national dental records is liable to be hacked and my personal information would be released.	253 (32.27)	325 (41.45)	206 (26.28)

DISCUSSION

Forensic odontology is an important branch of dentistry that can assist with solving cases of abuse and death [22], making greater knowledge and awareness of forensic odontology among the public important. The aim of this study was to assess the public's perspectives on dental registries and to identify their level of knowledge regarding forensic dentistry. The results of the present study showed that the overall total knowledge was lower than the midpoint, indicating a low level of knowledge in this population. This result is aligned with previously reported studies in Riyadh, Saudi Arabia [10] that found the knowledge score's percentage mean and standard was 39.8 ± 22.5%. This study also aligned somewhat with a previous study among dental professionals in Saudi Arabia that indicated low levels of knowledge about forensic odontology (mean, 12.19 out of 21; SD, 4.52) [13]. This can lead us to understand that the current efforts to expand public knowledge with forensic odontology are not enough, and the public needs more education efforts aimed at boosting this domain.

In our study, almost half of the participants agreed that individuals have unique teeth imprints, which is one of the main factors to depend on when testing bite marks of different individuals. Conversely [10], reported that most of that study's participants in Riyadh city had leading misconceptions regarding teeth imprints. Also in our study, 42% of the participants correctly identified the palatal rogue's area as other anatomic features of the oral cavity that is unique in each individual. However, the proportion of correct responses to this question was lower in a prior study conducted in Riyadh [10]. Although

dental stains arrangement can determine an individual's occupation [23], half of our participants were unaware of this. In addition, it was reported that dental restorations can play a major role in determining the socioeconomic status of an individual. For example, an expensive type of dental restoration can indicate a person's economic status, and the wear and stain patterns can suggest work or personal habits like smoking [23]. However, in our study, 36.35% of our participants were uninformed about this, and 32.27% believed the opposite.

Most of those who participated in our study showed good attitudes toward the efficiency and reliability of forensic odontology. This also aligned with a previous study among dental professionals in Saudi Arabia [13]. Our study showed that most of the participants agreed that Saudi dentists are able to maintain the privacy and confidentiality in a national dental registry, which is critically important because the patient–doctor relationship depends on trust, communication, and respect [24].

The proportion of our study participants willing to enroll in a future national dental registry was 74.62%, which is higher than the previous study in Riyadh, Saudi Arabia [10], and similar to a study conducted among a Midwestern US population, where around 62% of the participants were willing to participate in the National Dental Records Registry [25]. The same study that was conducted in Riyadh city showed that more than 50% agreed that individuals should have the right to withdraw or refuse to register in the dental registry [10], while our study showed a lower rate of 41%, which indicates an increase in community awareness and recognition of the importance of the role of registration in a dental registry.

This study identified participant attitudes about forensic odontology during the COVID-19 pandemic, which has had a major impact on the lives of individuals and on collective society as a whole [26]. A recent study conducted in Turkey showed that the Turkish people take compliance with preventive measures seriously, as they were heeding warnings about hand washing, social distancing, hygiene, and staying at home [27]. Similar to our study, over 60% of participants reported that forensic odontology required additional infection control precautions during an epidemic.

In our study, 41% of the participants agreed that forensic odontology is important during pandemics that result in high mortality rates, such as the current COVID-19 pandemic. In fact, this proportion was relatively similar to a previous study asking the same question of dental professionals 48.47%) [13]. This information is important because it shows that part of the public can see the benefits of forensic odontology during times of crisis, but also shows that this proportion of the public and dental professionals is not that high, which might then be reflected in underestimations of forensic odontology's contribution, especially during COVID-19. This might be one of the few studies that investigated this aspect among the public.

This study was conducted on a national level, and participants were from different locations across Saudi Arabia. It also investigated the importance of COVID-19 on public perceptions of forensic odontology. However, this study's limitations include the use of a self-administered questionnaire and the use of the convenience sampling method.

CONCLUSION

This study revealed that the public in Saudi Arabia have relatively little knowledge about forensic dentistry but have good attitudes about participating in a national dental registry. There was a considerable proportion of participants who agreed on the importance of forensic odontology's use in global public health disasters such as the COVID-19 pandemic. Nevertheless, forensic odontology still needs to be introduced to the public via more efforts aimed at educational and health promotional activities.

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LIST OF ABBREVIATIONS

- Coronavirus disease 2019 (COVID-19).
- World Dental Federation (FDI).
- Standard deviation (SD).

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