Forensic odontology-related awareness, knowledge, and attitude among dentists and dental students in two Egyptian universities: a survey-based study

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KEYWORDS

Awareness; Dentists; Dental students; Egypt; Forensic odontology; Knowledge

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ABSTRACT

Aim and objectives: This study evaluated the awareness, knowledge, and attitude regarding forensic odontology (FO) among dental students and graduates at Beni-Suef University and Badr University in Cairo, Egypt.

Methods: This cross-sectional study included 316 dentists and dental students in their final year of undergraduate study. An online self-administered questionnaire in English was used to obtain participants' responses.

Results: Less than half of the participants (47.5%) were aware of the branch of dentistry named FO. The highest percentages of correct answers in the knowledge assessment were reported in dental age estimation questions, while the lowest percentages were in items related to the use of FO in confirming sexual abuse and using palatal rugae as a marker in forensic identification. The most common source of knowledge was the internet (52.0%). Only 11.1% of the participants received FO courses in their colleges. Studying FO as a postgraduate course was interesting to 67.4% of the participants. The knowledge score was significantly associated with the participants' gender, graduation status, and educational level.

Conclusion: This study revealed a lack of awareness of FO as a branch of dentistry among dental students and dentists in Egypt. Increasing awareness and knowledge of FO could be achieved by integrating FO into the dental curriculum at both undergraduate and postgraduate levels.

INTRODUCTION

According to the World Dental Federation (FDI), forensic odontology (FO) refers to the area of dentistry concerned with properly handling and examining dental evidence and appropriate evaluation and demonstration of dental findings in favor of justice.[1] FO processes, reviews, analyzes, and presents dental evidence to provide scientific proof and unbiased data to judicial proceedings.[2]

The identification of human remains using dental records, age and gender identification of the living and deceased, analyzing bite marks, providing evidence of abuse, and expert witness testimony in court using forensic dental evidence are just a few of the immense applications of FO.[3] Several techniques are utilized in FO, including rugoscopy, cheiloscopy, tooth impressions, bite mark analysis, radiography, photography, and

molecular procedures.[4]
Dentists are actively engaged in applying FO, so they should possess adequate expertise and knowledge of FO while dealing with dental records, studying bite marks, interpreting radiographs, conducting DNA analysis of tooth pulp, and assessing tooth morphology.[2,5] Courses, demonstrations, and lectures presented by the American Academy of Forensic Science (AAFS) represent fundamental training sources for forensic dentists. Professional certification in FO is offered by the American Board of Forensic Odontology (ABFO), a division of the AAFS.[6,7]
Despite the importance of FO to criminal justice, it is still underdeveloped in many countries.[8] Several studies conducted in Saudi Arabia revealed a lack of sufficient knowledge of FO among dental practitioners and students.[5,9,10] In the United Arab Emirates, a study conducted at Ajman University indicated inadequate knowledge of FO among dental students.[8]
In Egypt, there is a significant literature gap regarding FO, and no study has evaluated the knowledge or attitude of dentists or dental students toward FO. This study aimed to bridge this gap by assessing the awareness, knowledge, and attitude toward FO among dental students and graduates at Beni-Suef University and Badr University in Cairo, Egypt.

PARTICIPANTS AND METHODS

This cross-sectional study was conducted among dentists and dental students in their final year of undergraduate study at two Egyptian universities, Beni-Suef University and Badr University in Cairo, from March 2023 to June 2023.

Study tool:
A semi-structured questionnaire in the English language was developed after reviewing previous literature and included the following parts:
Part 1: Demographic and professional characteristics of the participants, including gender, age, years of clinical experience, level of education, and work sector (private or governmental).
Part 2: Awareness of FO and whether the participants had attended FO courses were assessed by two closed-ended questions with yes or no answers. The actual knowledge was evaluated by 15 close-ended statements sourced from published literature,5,9,10 with three answers: yes, no, or do not know.
Part 3: Attitude toward FO was assessed using six questions with answers rated on a 5-point Likert scale (strongly disagree, disagree, neutral, agree, and strongly agree).
The questionnaire underwent piloting and validation to identify any problems in the questions that could lead to biased answers. Cronbach's alpha of reliability for the knowledge and attitude sections was 0.74 and 0.76, respectively.

Study participants and sample size:
All dentists and dental students who were willing to participate in their final year at Beni-Suef University and Badr University in Cairo were included in the study. The sample size for students was calculated using Epi-Info. Based on the expected level of knowledge (30%) and a confidence interval of 95%, the sample size required was determined to be 175 students. For dentists, they were totally included.

Data collection technique:
An online self-administered questionnaire on Google Forms was utilized. The questionnaire link was sent to the official email addresses of the dentists and dental students, accompanied by a cover letter explaining the study's aim and assuring the anonymity of participants' responses.

Ethical statement and approval:
The study received approval from the research ethics committee of the Faculty of Dentistry, Beni-Suef University (approval number #REC-FDBSU/06042013-04/KF). All data-gathering processes were conducted confidentially following the Helsinki Declarations of biomedical ethics. Participants were informed about the anonymous nature of the survey, and their participation was voluntary. Only those who agreed were given access to the questionnaire.

Statistical analysis:
Data was entered and analyzed using Statistical Package for Social Sciences (SPSS) statistical software version 25 (International Business Machines IBM, SPSS Inc, NY). Descriptive statistics (frequencies and percentages) were used to demonstrate categorical sample characteristics and responses, while the arithmetic mean, and standard deviation (SD) were used to present the outcomes.

The Shapiro-Wilk test was employed to test normality, with a significance value greater than 0.05 (0.2) indicating normal data distribution.
The summated score of the 15 actual knowledge statements was obtained for each study participant (correct responses scored 1, wrong and do not know responses scored 0). The scores were then converted into percentages classified into four categories: ≤50 (poor), 50-70 (moderate), 70-90 (good), and ≥ 90 (very good).11 The attitude score was calculated on a scale from 1 (strongly disagree) to 5 (strongly agree), with the maximum score being 30, indicating a positive attitude.
Bivariate analysis was conducted using Pearson's chi-square ($\chi 2$) to identify the association between demographic factors and awareness of FO and knowledge levels. Statistical significance was set at $P < 0.05$.

RESULTS

This study included 316 dentists and dental students, with a mean age of 24.38±7.15 years. The majority of the participants (258, 81.6%) were between 18 and 28 years old, more than half of them (172, 54.43%) were females, and (144, 45.57%) were males. More than half of the participants (175, 55.4%) were undergraduates, while (72, 22.8%) graduated less than 5 years ago and (69, 21.8%) graduated 5 years or more. Regarding educational level, (175, 55.4%) were dental students, (60, 19%) had bachelor's degrees, (40, 12.6%) had master's degrees, and (41, 13%) had doctorate degrees. Membership in the governmental sector was represented by (200, 63.3%) of participants, while (116, 36.7%) were from the private sector (Table 1).

Table 1. Demographic and professional characteristics of the study participants

Variable	Frequency N=316	%
Age (years)		
18-28	258	81.6
>28-38	34	10.8
>38-48	20	6.3
>48	4	1.3
Mean ± SD	24.38±7.15	
Minimum-maximum/range	18-54/36	
Gender		
Male	144	45.57
Female	172	54.43
Graduation status		
Undergraduate	175	55.4
Graduated (<5 years)	72	22.8
Graduated (≥ 5 years)	69	21.8
Level of education		
Dental student	175	55.4
Bachelor degree	60	19.0
Master degree	40	12.6
Doctorate degree	41	13.0
Work or faculty sector		
Private	116	36.7
Government	200	63.3

SD: Standard deviation

Regarding participants' awareness of FO, (150, 47.5%) reported that they were aware of the branch of dentistry named FO, while (166, 52.5%) did not know about it (Figure 1). Figure 2 shows that (35, 11.1%) of the participants took FO courses in their colleges.

Regarding responses to knowledge items among participants who were aware of FO, the percentages of correct replies for each question varied. The highest percentages were reported in questions related to age estimation; an individual's dental age can be estimated by the eruption status (135, 90%), FO can be used to estimate age (133, 88%), and an individual's dental age can be estimated by radiography (127, 84.7%). The lowest percentages of correct answers were reported in questions regarding whether FO can confirm sexual abuse (77, 51.3%) and whether palatal rugae can be used as a marker in forensic identification (80, 53.3%).

The reported sources of knowledge in FO were the internet (78, 52.0%), followed by undergraduate and postgraduate lectures (51, 34%), books (31, 20.7%), scientific articles and journals (30, 20.0%), and seminars and workshops (19, 12.7%). The mean knowledge score was 10.7±3.1. The knowledge percentage score was categorized as "poor" for (23, 15.3%), "moderate" for (25,16.7%), "good" for (55, 36.7%), and "very good" for (47, 31.3%) of the respondents (Table 2).

Participants' attitudes toward FO, as presented in Table 3, revealed that (113, 75.3%) of those who knew FO as a branch of dentistry agreed about the importance of FO in recognizing culprits and deceased individuals, and (118, 78.7%) agreed on the importance of keeping dental records. Only (13, 8.6%) reported that their knowledge of FO is adequate, while (96, 64%) reported inadequate knowledge of FO. Studying FO as a postgraduate course was interesting for (101, 67.4%) participants, but only (50, 33.4%) wanted to specialize in FO. The mean attitude score was 22.5±3.1.

The association between participants' demographic and professional characteristics and awareness of FO as a dentistry branch revealed significant differences between various subgroups. Older participants, females, those with five years or more of experience, those with doctorate degrees, and those working in the public sector were more aware of FO than their comparable groups (p-value = 0.000) (Table 4).

Figure 1. A pie chart representing the distribution of participants (n=316) regarding awareness of forensic odontology as a branch of dentistry.

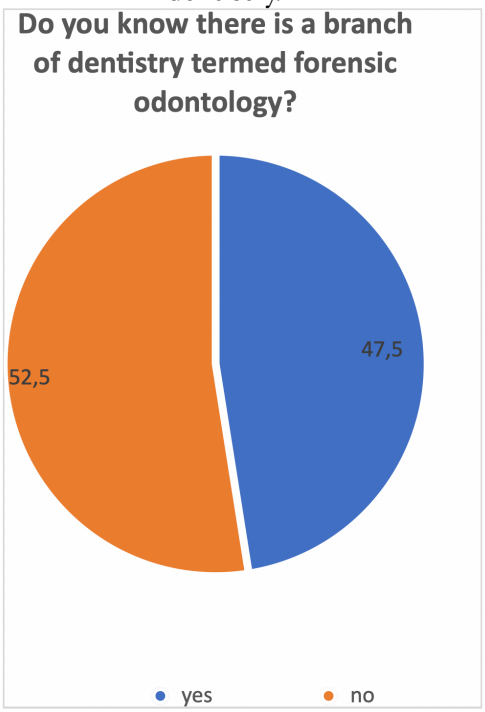

Figure 2. A pie chart representing the distribution of those who took a forensic odontology course in their colleges.

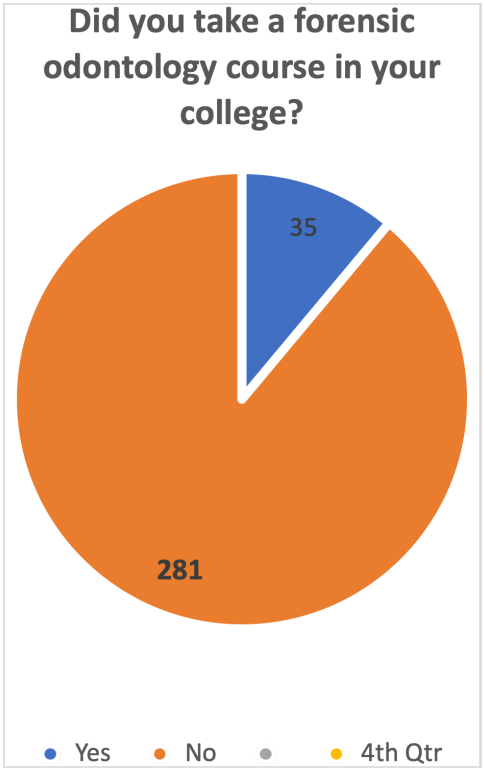

Table 2. Participants' responses to forensic odontology knowledge items

Variable	Frequency N=150	%
Forensic odontology aids in physical violence identification		
yes	115	76.7
No	8	5.3
I do not know	27	18
Forensic odontology can be used to estimate age		
yes	133	88.7
No	7	4.7
I do not know	10	6.7
Forensic odontology can be used for gender identification		
yes	111	74
no	11	7.3
I do not know	28	18.7
Forensic odontology can confirm child neglect		
yes	111	74
no	11	7.3
I do not know	28	18.7
Forensic odontology can confirm sexual abuse		
yes	77	51.3
No	21	14.0
I do not know	52	34.7
Analysis of bite-mark patterns aids in identifying criminals		
yes	118	78.7
No	5	3.3
I do not know	27	18
Dental patterns are unique identifiers		
yes	115	76.7
no	6	4.0
I do not know	29	19.3
An individual has a unique jaw structure		
yes	89	59.3
no	24	16.0
I do not know	37	24.7
An individual has a unique lip print		
yes	84	56.0
No	9	6.0
I do not know	54	36.0
DNA can be extracted from the teeth of a deceased person		

yes	118	78.7
no	7	4.7
I do not know	25	16.7
Palatal rugae can be used as a marker in forensic identification		
yes	80	53.3
no	3	2.0
I do not know	67	44.7
Practicing forensic odontology needs a permit or certification		
yes	117	78.0
no	2	1.3
I do not know	31	20.7
An individual dental age can be estimated by radiography		
Yes	127	84.7
no	6	4.0
I do not know	17	11.3
An individual dental age can be estimated by the eruption status		
yes	135	90.0
No	5	3.3
I do not know	10	6.7
The most accurate method to identify individuals		
DNA comparison	88	58.7
Fingerprints	35	23.3
Physical anthropological exam of bone and teeth	18	12.0
Visual identification	9	6.0
What was your source of information in forensic odontology? [A]		
Undergraduate or postgraduate lectures	51	34.0
Internet	78	52.0
Scientific articles and journals	30	20.0
Books	31	20.7
Seminars and workshops	19	12.7
Others	9	6.0
Total knowledge score		
Poor knowledge	23	15.3
Moderate knowledge	25	16.7
Good knowledge	55	36.7
Very good knowledge	47	31.3
Knowledge score (mean ± SD)	10.7±3.1	

A: Participants reported more than one answer.
SD: Standard deviation

Table 3. Participants' attitudes towards forensic odontology

Variable	Frequency N=150	%
Forensic odontology is helpful in recognizing culprits and dead persons		
Strongly agree	35	23.3
agree	78	52.0
Neutral	23	15.3
Disagree	6	4.0
Strongly disagree	8	5.3
It is important to keep patients' dental records		
Strongly agree	58	38.7
agree	60	40.0
Neutral	20	13.3
Disagree	5	3.3
Strongly disagree	7	4.7
My knowledge of forensic odontology is adequate		
Strongly agree	2	1.3
agree	11	7.3
Neutral	41	27.3
Disagree	68	45.3
Strongly disagree	28	18.7
I am interested in studying forensic odontology, if there is postgraduate study		
Strongly agree	37	24.7
agree	64	42.7
Neutral	34	22.7
Disagree	10	6.7
Strongly disagree	5	3.3
I want to be a specialist in forensic odontology		
Strongly agree	19	12.7
agree	31	20.7
Neutral	68	45.3
Disagree	19	12.7
Strongly disagree	13	8.7
I want to participate in workshops and seminars in forensic odontology		
Strongly agree	32	21.3
agree	54	36.0
Neutral	36	24.0
Disagree	12	8.0
Strongly disagree	16	10.7
Attitude score (mean ± SD)	22.5±3.1	

SD: standard deviation.

Table 4. Association between demographic and professional characteristics of the participants and awareness that forensic odontology is a branch of dentistry

	Knows (N=150)	Does not know (N=166)	P-value
Age (years)			
18-28 (N=258)	106 (41.1)	152 (58.9)	0.000*
>28-38 (N=34)	26 (76.5)	8 (23.5)	
>38-48 (N=20)	14 (70.0)	6(30.0)	
>48 (N=4)	4 (100)	0 (0)	
Gender			
Male (N=144)	65(45.1)	79(54.8)	0.000*
Female (N=172)	84(48.8)	88 (51.16)	
Graduation status			
Undergraduate (N=175)	67 (38.3)	108 (61.7)	0.000*
Graduated (<5 years) (N=72)	33(45.8)	39 (54.2)	
Graduated (≥ 5 years) (N=69)	49(71.0)	20(29.0)	
Level of education			
Dental student (N=175)	60(34.3)	115 (65.7)	0.000*
Bachelor degree (N= 60)	32 (53.3)	28 (46.7)	
Master degree (N=40)	29(72.5)	11 (27.5)	
Doctorate degree (N=41)	32(78.0)	9(22.0)	
Work or faculty sector			
Private (N=116)	52(44.8)	64 (55.2)	0.000*
Public (N=200)	98 (49.0)	102 (51.0)	

*P-value is statistically significant.

The association between demographic and professional characteristics of the respondents and knowledge scores revealed significant differences regarding gender, graduation status, and educational level (P-value = 0.04, 0.002, and 0.002, respectively) (Table 5).

Table 5. Association between demographic and professional characteristics of the participants and knowledge scores

	Poor	Moderate	Good	Very good	P-value
Age (years)					
18-28 (N=100)	20(20.0)	15(15.0)	32(32.0)	33(33.0)	0.09
>28-38 (N=30)	2(6.7)	6(20.0)	10(33.3)	12(40.0)	
>38-48 (N=16)	2(12.5	2(12.5)	10(62.5)	2(12.5)	
>48 (N=4)	0 (0.0)	0(0.0)	3(75.0)	1(25.0)	
Gender					
Male (N=69)	9(13.0)	6(8.7)	25(36.23%)	29(42.0%)	0.04*
Female (N=81)	13(16.0)	18(22.2)	30(37.0%)	20(24.7%)	
Graduation status					

Undergraduate (N=70)	19(27.1)	14(20.0%)	22(31.4%)	15(21.5)	0.002*
Graduated (<5 years) (N=30)	3(10)	5(16.7)	12(40.0)	10(33.3)	
Graduated (≥ 5 years) (N=50)	3(6.0)	7(14.0)	21(42.0)	19(38.0)	
Level of education					
Dental student (N=65)	18(27.7)	13(20.0)	21(32.3)	13(20.0)	0.002*
Bachelor degree (N=30)	2(6.7)	3(10.0)	12(40.0)	13(43.3)	
Master degree (N=27)	1(3.7)	5(18.5)	7(25.9)	14(51.8)	
Doctorate degree (N=28)	1(3.6)	3(10.7)	16(57.1)	8(28.6)	
Work or faculty sector					
Private (54)	3(5.5)	9(16.7)	21(38.9)	21(38.9)	0.06
Public (96)	19(19.8)	15(15.6)	34(35.4)	28(29.2)	

*P-value is statistically significant.

DISCUSSION

FO is a significant branch of dentistry that plays a crucial role in identifying the living and deceased and investigating abuse and criminal acts. Awareness and knowledge of FO are essential among dental practitioners.[5,12] Practicing FO has gained importance in many developed countries; however, it is struggling in developing countries like Egypt.

This study is the first to evaluate awareness, knowledge, and attitude toward FO among dentists and dental students in Egypt.

An important finding in this study is that 52.5% of the participants were unaware that there is a branch of dentistry termed FO, which can be explained as FO is not included in the undergraduate or postgraduate academic curricula in Egypt. Among the participants, only 11.1% reported they had FO courses in college. Similarly, several studies conducted in various countries, such as Saudi Arabia,[3,5] UAE,[8] and Pakistan,[13,14] reported inadequate knowledge and awareness of FO among dental practitioners or students. Dietrichkeit Pereira et al. [15] stated that one of the primary causes of the lack of knowledge of FO is that it is not a part of the mandatory undergraduate curriculum in dentistry. On the other hand, several studies in India, such as Sahni et al. [16] in Delhi, Rahman et al. 2017 [11] in Bhubaneswar, and Ram et al. [17] in Chennai, reported sufficient knowledge of FO among dental teaching staff, surgeons, and students, respectively. The Dental Council of India curriculum includes 30 hours of theoretical and practical FO sessions for the third and final years of the Bachelor of Dental Surgery program, which explains the adequate knowledge of the dental community in India.[18]

Regarding responses to knowledge of FO items among participants who knew that FO is a branch of dentistry, the majority correctly answered questions related to dental age estimation. This finding is consistent with Almutairi et al. [9] and Hashim et al. [8] However, Preethi et al. [19] reported that around half of their study participants did not know how age can be estimated using teeth.

The importance of FO can be related to the resistance of dental tissue to high temperatures and decomposition, making it a suitable source for DNA.[20] Fortunately, more than three-quarters of dentists and dental students who knew FO was a branch of dentistry acknowledged this fact, which is consistent with the results of Gupta et al.,[21] Hashim et al.,[8] and Tahir et al.[13]

The majority of dentists and dental students in this study agreed about the importance of FO in identifying physical abuse and child neglect; however, only half of them approved its role in sexual abuse cases. Intimate partner violence might include bite marks that require expert dental consultation.[22] Therefore, dentists must have sufficient knowledge, a trained eye, and professional skills for such consultations.

Palatal rugae are unique, and their shape remains constant throughout life, making them an alternate identification source when other approaches are challenging.[23,24] Nearly half of the participants in this study did not know that palatal rugae could be used in forensic identification, a similar result to that reported by

Almutairi et al.[9] Additionally, almost half were unaware that each individual has a unique lip print and jaw structure, possibly due to a lack of exposure to FO in Egypt.

In this study, although more than half of the dental students and dentists were unaware of FO's existence as a branch, the majority who knew this fact had a sufficient knowledge score; 31.3% were classified as very good and 36.7% as good.

Regarding participants' attitudes toward FO, most of those who knew FO was a branch of dentistry agreed about the importance of FO in recognizing culprits and deceased persons and the importance of keeping dental records. This finding is consistent with Ali et al.,[14] who reported that 87% of their study participants believed dental records are valuable in identifying the deceased and crime suspects. Additionally, Preethi et al. [19] found that most dental practitioners know the value of maintaining dental records.

A dental record is maintained for forensic purposes and may be used as a future reference for practitioners, as consumer court evidence, and for dental insurance. The increased public awareness regarding legal issues in healthcare necessitates dental practitioners being more knowledgeable about dental records.[25]

In this study, the minority (8.6%) believed that their information about FO is adequate. Similarly, Abdul et al. [3] reported that 93.2% of undergraduate dental students and 83.4% of graduates acknowledged their lack of knowledge about FO. Hashim et al. [8] found that 93.1% of participants agreed they are missing adequate knowledge in FO.

Despite studying FO as a postgraduate course being interesting for more than two-thirds of participants who knew FO as a dentistry branch, only about one-third wanted to be specialists in FO. This finding could be related to the absence of job opportunities in FO in Egypt, which discourages dentists from choosing FO as a profession. Similar results were reported by Abdul et al.,[3] Hashim et al.,[8] and Al-Abdaly et al.[5] On the contrary, Hannah et al. found that 89.6% of participants believe that FO has good scope as a profession.[26]

Regarding the association between the demographic and professional characteristics of the participants and awareness and knowledge of FO, older participants, females, those with five years or more of experience, those with doctorate degrees, and those working in the public sector were more aware that FO is a branch of dentistry than their comparable groups. Additionally, the knowledge score was significantly associated with gender, graduation status, and educational level.

This is in accordance with Almutairi et al.,[9] who found that experience above 5 years, Ph.D. education, and working in the government sector were significantly associated with higher actual knowledge. Additionally, Tahir et al. [13] reported higher awareness among consultants and specialists than undergraduates and postgraduate residents and the older age group than the younger ones. They attributed this difference to consultants' better clinical experience and access to more opportunities for ongoing medical education.

CONCLUSION AND RECCOMANDATIONS

This study revealed a lack of awareness of FO as a branch of dentistry among dental students and dentists in Egypt. However, those aware that FO is a branch of dentistry showed adequate knowledge of various FO items. The knowledge score was significantly associated with the gender, graduation status, and educational level of the participants. This study highlights the importance of integrating FO into the dental curriculum at the undergraduate and postgraduate levels. Dental institutions should offer FO training through workshops, seminars, regular education programs, and in-field training in forensic centers to enhance the knowledge and skills of graduates. Moreover, offering more job opportunities in FO will increase interest in attending and participating in various education and training programs.

Strengths and limitations

This study was the first to evaluate FO awareness, knowledge, and attitude among dentists and dental students in Egypt. Egypt has 68 dentistry faculties, including state-funded, national, and private institutions. However, this study was conducted in only two educational institutions, so the sample does not represent all dentists and dental students in Egypt. The study can serve as a benchmark for future studies advocating the importance of FO.

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