Original Article

Knowledge, Practice, and Attitude Evaluation of Forensic Dentistry among Iraqi Dentists: Questionnaire-Based Study

Roweda Al-Dulaimy, Harth Rashidi, Rania Alghurary, Rukaya Alsaraf, Ban Alfarag, Muhanad L. Alshami
Department of Dentistry, Dijlah University College, Baghdad, Iraq

Abstract

Background: Forensic dentistry is a branch of forensic science that deals with the examination, analysis, and interpretation of dental evidence in legal investigations. **Objective:** The aim of this study was to evaluate the knowledge, practice, and attitudes of Iraqi dentists toward forensic dentistry. **Materials and Methods:** A questionnaire was designed with four sections and distributed to dentists. The four sections were demographic, knowledge (assessed the dentists' knowledge and consisted of 14 questions), practice (evaluated the dentists' practices and consisted of six questions), and attitude (consisted of two questions to assess the dentists' attitudes). For the knowledge, practice, and attitude sections, the answers were either "yes" (correct), "no," or "I don't know" (incorrect). The correct answer frequencies were calculated, and the mean scores of responses were compared among the different variables. **Results:** A total of 414 dentists responded, including 196 male dentists and 218 female dentists. The mean age of the responders was 32.57 years, and the responders were divided according to age into: 304 (≤40 years), and 110 dentists (>40 years), according to qualifications into: 168 (postgraduate) and 246 (graduate), and according to experience years: 228 (≤10 years) and 186 (>10 years). The questions related to using teeth as indicators of age received the highest number of correct answers, whereas the use of palatal rugae and lips in forensic dentistry received the lowest scores. **Conclusion:** Iraq dentists had limited knowledge, practice, and attitude about forensic dentistry. Therefore, it is important for undergraduate and postgraduate programs, as well as official training courses, to focus more attention on forensic dentistry.

Keywords: Attitude, forensic dentistry, Iraqi dentists, knowledge, practice

Introduction

Forensic dentistry (FD) is a branch of forensic science that deals with the examination, analysis, and interpretation of dental evidence in legal investigations. This discipline involves the application of dental knowledge to matters of the law and is used in a variety of criminal and civil cases, including human identification, bite mark analysis, and investigation of dental malpractice, and abuse cases.[1] The dental evidence includes dental records, bite marks, dental impressions, dental and oral anatomy, and tooth wear patterns.[2,3]

In the field of FD, age estimation is a crucial component for determining the chronological age of both living individuals and deceased individuals, including skeletal remains.[4] Age estimation is typically based on a combination of visual and radiographic examination techniques that analyze dental development and morphological changes over time.[5] The tooth is the hardest tissue in the body and highly resistant to external influences such as extreme temperatures, explosions, and other extreme conditions, making it capable of being preserved for extended periods even after death.[6]

The sex determination considers one of the major areas in FD; it is useful when sex organs or other sexual characteristics are not present. The sex determination depends on morphological and molecular investigations.[7] Amelogenin plays a role in early dental development and can be extracted

Access this article online

Quick Response Code:

Website: https://journals.lww.com/mjby

DOI: 10.4103/MJBL.MJBL_162_23

Address for correspondence: Dr. Muhanad L. Alshami, Department of Dentistry, Dijlah University College, Al Masafi Street, Al Dora, Baghdad, Iraq.
E-mail: iraqnoafct83@gmail.com

Submission: 13-Feb-2023 **Accepted:** 08-Mar-2023 **Published:** 02-Feb-2024

How to cite this article: Al-Dulaimy R, Rashidi H, Alghurary R, Alsaraf R, Alfarag B, Alshami ML. Knowledge, practice, and attitude evaluation of forensic dentistry among Iraqi dentists: Questionnaire-based study. Med J Babylon 2023;20:709-14.

from various biological samples (tooth and saliva). Its gene is associated with both the X and Y chromosomes, and the presence of the amelogenin gene can be determined through polymerase chain reaction analysis, facilitating the differentiation between men and women. However, in some cases, a deletion in the amelogenin Y region can result in male individuals being misclassified as female individuals.[8]

Morphological analysis involves the examination of anatomic features that are distinctive for male or female individuals. One of the key characteristics studied is dentition. Several studies have shown that the size of the mandibular and maxillary canines or the inter-canine distance is proportionally larger in men compared with women. The morphology of teeth has also been investigated for sex determination. The prevalence of a distal accessory ridge on the canine has been found to be higher in males.[9] Everyone has a unique lip print and palatal rugae pattern, which can be useful in sex identification as some patterns are more prominent in one sex than the other.[10] Frontal sinus measurements have also been reported to be a useful tool in sex identification. According to a study by Uthman *et al*.,[11] the sinus size has been documented to be smaller in women compared with men.

The socioeconomic status of deceased individuals in disaster scenarios can be determined through the examination of dental markers. A high incidence of dental caries, periodontal disease, and the presence of missing or untreated teeth are indicative of inadequate oral hygiene and are correlated with low socioeconomic levels. The type of dental treatments, such as fillings, veneers, orthodontic procedures, and crowns, can serve as predictive indicators of the individual's socioeconomic status.[12]

FD is an essential component in the examination and resolution of dental malpractice incidents. Its responsibility lies in assessing the nature and standard of dental care given to patients and determining if it aligns with the guidelines established by regional and global health institutions. Furthermore, FD endeavors to evaluate injuries that occur during dental procedures and determine if they arose from inadequate treatment or a failure to diagnose and treat a dental issue. The evaluation of dental malpractice involves reviewing the patient's dental records, radiographs, and conducting a physical examination of the patient's oral and dental structures.[13] FD plays a vital role in the investigation of domestic abuse cases, which often result in oral and dental injuries from physical violence. In such cases, dentists may use molecular and bite mark analysis to link the injury to the victim or the perpetrator.[14]

In order to know the degree of readiness of the dentist to deal with cases related to FD, several studies worldwide have been carried out to assess the knowledge and attitudes of dentists regarding FD.[15,16] The objective of this study was to evaluate the knowledge, practice, and attitudes of Iraqi dentists toward FD.

Materials and Methods

Ethical approval

Ethical approval (Ref: 135) was obtained from the ethical committee at Dijlah University College on November 30, 2022, before the study was initiated.

Population, sample size, and consent

The population included the graduated and postgraduate Iraqi dentists who renewed their license with the Iraqi Dental Association in 2022 and are residing and working inside Iraq. In 2022, 9000 dentists renewed their license with the Iraqi Dental Association. Dentists who do not work in clinics (whether governmental or private) or do not permanently reside in Iraq were excluded from this study. Determining the required sample size is crucial to guarantee the quality and representativeness of the findings. Sufficient sample size plays a critical role in yielding precise and dependable results.

The study's sample size was determined using the following mathematical equations:

$$n = 0.5 / ((e\% / \mathrm{CI})^2),$$

where n represents the sample size, 0.5 is the distribution, $e\%$ is the error margin percentage (error margin = 0.05), and CI is the confidence interval which is 1.96 (for confidence level of 95%).

$$S = (n * N) / (n + N - 1),$$

Here, S represents the required sample size (396 dentists) which rounded to 400.

The response of each dentist was taken after the aim of the study was clarified and the consent was obtained.

Study design, questionnaire, and scoring

This cross-sectional questionnaire-based study depended on previous studies that used a questionnaire consisting of a group of questions to assess the knowledge, attitude, and practice of dentists toward FD.[15,17,18] The questionnaire was built using Google Forms and distributed through emails and consisted of four sections [Table 1]. The demographic section included demographic variables, such as age (40 years or less and older than 40 years), sex (male and female participants), qualification (graduate and postgraduate), and years of experience (10 years or less and more 10 years). The first section assessed the dentists' knowledge and consisted of fourteen questions (Q1–Q14). The second section evaluated the dentists' practice and consisted of six questions (Q15–Q20). Finally, the third section consisted of two questions (Q21–Q22) and assessed the dentists' attitudes. Table 1 displays the questions in the first, second, and third sections.

Answers for each question in the first, second, and third sections included yes, no, and I don't know. A score of one

Table 1: Questions to assess the knowledge, practice, and attitude regarding forensic dentistry

Q1	Have you heard of the term 'forensic odontology?
Q2	Is maintaining dental records, such as case sheets, radiographic images, and casts, essential in forensic dentistry?
Q3	Do you think forensic odontology is an important field within dentistry?
Q4	Do you consider forensic odontology to be an efficient method for identifying victims in a mass disaster?
Q5	Does forensic odontology aid in determining race?
Q6	Does forensic odontology aid in determining gender?
Q7	Does forensic odontology aid in estimating age?
Q8	Can teeth serve as a source of DNA?
Q9	Do you believe that human lip print patterns can be used to identify a population?
Q10	Do you think that bite mark patterns of humans can be used for population identification?
Q11	Does forensic odontology aid in determining the socioeconomic status of an individual?
Q12	Do you think that palatal rugae can be used for population identification?
Q13	Does forensic odontology aid in investigating domestic abuse or sexual abuse?
Q14	Is forensic dentistry involved in investigating dental malpractice?
Q15	Do you regularly maintain dental records, such as dental history, treatment details, casts, and radiographs?
Q16	Do you use a standard tooth numbering system?
Q17	Can you recognize if a patient has suffered from domestic or sexual abuse?
Q18	Will you inform the relevant authorities if your dental patient shows signs and symptoms of having been domestically or sexually abused?
Q19	Can you estimate a patient's age using their teeth?
Q20	Can you determine gender based on teeth?
Q21	Would you like the opportunity to take a training course in forensic dentistry?
Q22	Are you willing to appear in court to provide forensic dental evidence?

was given for a "yes" response (correct response), while a score of zero was given for "no" and "I don't know" answers (incorrect responses). Mean scores of the knowledge, practice, and attitude sections were compared between variables.

Statistical analysis

The statistical analysis included both descriptive and inferential statistics. The descriptive analysis involved calculating the mean and standard deviation, as well as the frequency and percentage. The inferential statistics included a Mann–Whitney *U* test to compare differences between two groups. A significance level of *P*-value set at $P < 0.05$, and all statistics were performed using statistical package for social sciences (SPSS), version 23.0 for Windows (IBM Corporation, Armonk, NY, USA).

Table 2: Distribution of the demographic variables

Sex	
Male[a]	196, 47.3%
Female[a]	218, 52.7%
Female:male	1:0.8
Age (year)	
≤40[a]	304, 26.6%
>40[a]	110, 73.4%
Mean age (year) ± SD	32.57 ± 9.19
Range (min–max)	21-64
Qualification	
Graduate[a]	246, 55.1%
Postgraduate[a]	168, 44.9%
Years of experience	
≤10[a]	228, 55.1%
>10[a]	186, 44.9%

[a] Frequency, percentage

Results

The total responders were 414 dentists, 196 men and 218 women. The mean age was 32.57 years, and the responders were divided into 304 dentists below or equal to 40 years old and 110 dentists with an age over 40. Of the responders, 168 had a postgraduate degree and the rest (246) were graduates. 55% of the responders had more than 10 years of experience. Table 2 shows the distribution of the variables in the study.

The correct answers to the questions are shown in Figure 1. The questions with the highest number of correct answers were Q19 (Can you estimate a patient's age using their teeth?), followed by Q1 (Have you heard of the term "forensic dentistry?") and Q7 (Does forensic odontology aid in estimating age?). The question with the lowest number of correct answers was Q12 (Do you think that palatal rugae can be used for population identification?).

The mean scores of the answers to questions in the knowledge, practice, and attitude sections showed no statistically significant differences between variables [Table 3].

Discussion

The results of this study indicate that the level of knowledge, attitude, and practice regarding FD among Iraqi dentists is inadequate. These outcomes agree with previous studies.[19,20] Insufficient or missing hours dedicated to the study of FD in dental schools could be the primary factor for the significant lack of knowledge about FD among dentists.[21,22] In addition, to the best of our knowledge, there are no postgraduate programs or specialized training courses in Iraq offered to dentists regarding forensics in the field of dentistry.

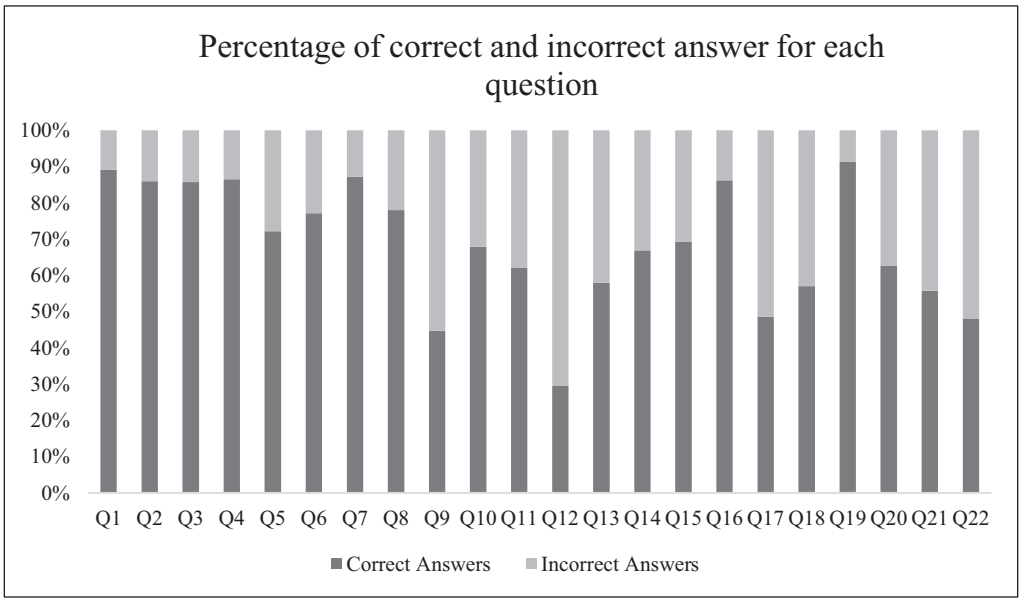

Figure 1: Percentage of the correct (black color) and incorrect (gray color) answers for each question. (Q1–Q14) represent the knowledge section, (Q15–Q20) represent the practicing section, and (Q21–Q22) represent the attitude section

Table 3: Comparison of the mean scores of the knowledge, practice, and attitude sections among the variables sex, age, qualification, and duration of experience

Variables	Knowledge		Practice		Attitude	
	Mean ± SD	*P* Value	Mean ± SD	*P* Value	Mean ± SD	*P* Value
Sex[a]						
Male (196)	10.13 ± 2.31	0.268	4.21 ± 1.160	0.540	0.98 ± 0.816	1.66
Female (218)	9.71 ± 2.73		4.10 ± 1.369		1.09 ± 0.854	
Age (year)[a]						
≤40 (304)	9.93 ± 2.68	0.594	4.17 ± 1.307	0.336	0.93 ± 0.798	0.98
>40 (110)	9.85 ± 2.13		4.08 ± 1.182		1.08 ± 0.848	
Qualification[a]						
Graduate (246)	9.84 ± 2.75	0.894	4.22 ± 1.291	0.120	1.05 ± 0.839	0.675
Postgraduate (168)	10.01 ± 2.22		4.05 ± 1.247		1.02 ± 0.837	
Experience[a]						
≤10 (228)	9.67 ± 2.79	0.06	4.13 ± 1.214	0.98	1.04 ± 0.849	0.936
>10 (186)	10.2 ± 2.19		4.17 ± 1.324		1.04 ± 8.24	
Total [a]						
414						

[a] Frequency

P Value is significant at $P < 0.05$ by Mann–Whitney *U* test

The assessment of knowledge in this study revealed that the concept of using lips and palate as indicators in FD was not understood by more than half of the dentists. Lips have been documented as an indicator for personal identification because the unique and permanent pattern of the lips. Therefore, it is advised to maintain lip prints of patients in dental records for potential use in comparison with lip prints found at crime scenes or for the identification of unknown cadavers.[23,24]

The rugae area of the palate can be used to differentiate between male and female patients.[25] The histological and anatomical aspects of the lips and palate are thoroughly discussed during undergraduate dental programs; however, the relationship between these oral cavity structures and FD is not emphasized. The knowledge and ability to determine the oral finding of the domestic abuse issue were missing in more than half of the responders. The lack of proper education and understanding has been identified as the cause for dental school curriculums falling in preparing dentists to perform this task effectively.[26]

Age estimation using dental evidence was familiar to more than two-thirds of dentists, in agreement with the findings

of Sharma and his team.[27] The timing of dentition eruption was covered as a subject in courses such as dental anatomy, oral histology, and orthodontics courses that dental students take.

The role of archiving dental records, such as case sheets, diagnostic imaging, and casts, is important in FD. The comparison of these records with obtained dental evidence is used to identify unknown cadavers or individuals (whether they be victims or suspects) at a crime scene. In addition, the records can also be used in malpractice cases.[28,29] The present study showed that most dentists agree on the importance of dental records in FD, which is consistent with the findings of previous studies.[30,31]

Lack of legal training, fear of liability, and time constraints could make dentists to be reluctant to serve as witnesses in court or calling the authorities about abuse cases.[32] This could explain the current result that less than half of the responders showed unwillingness to be a part of legal cases or take training courses in FD.

The levels of knowledge, practice, and attitude did not differ among all variables, which highlights the need to establish the subject of FD as an integral part of the dentistry curriculum and include it in continuous training for dentists.

The strength of this study was that it was the first study conducted to assess the awareness of FD among Iraqi dentists. The limitation of this study may include the possibility of bias, which may be because the email did not reach dentists who have sufficient information to correctly answer the questionnaire or vice versa. One of the reasons for this is that the email may be classified as a risky (spam) file or the dentist during the study period may not use email, or the dentist may not have the time or sufficient motivation to respond to the questionnaire.

Conclusion

The results of the study showed that dentists in Iraq had limited knowledge, practicing skill, and attitude about FD. Therefore, it is important for graduate and postgraduate programs, as well as official training courses, to focus more attention on FD.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Quarino L, Brettell TA. Current issues in forensic science higher education. Anal Bioanal Chem 2009;394:1987-93.
2. Rai B, Kaur J. Evidence-Based Forensic Dentistry. New York: Springer Science & Business Media; 2012.
3. Zakirulla M, Meer A. Modern tools in forensic dentistry. Int J Contemp Dent 2011;2:28-32.
4. Priyadarshini C, Puranik MP, Uma S. Dental Age Estimation Methods-A Review. Sunnyvale, CA: Lap Lambert Academic Publication; 2015.
5. Willems G. A review of the most commonly used dental age estimation techniques. J Forensic Odontostomatol 2001;19:9-17.
6. Baranova J, Büchner D, Götz W, Schulze M, Tobiasch E. Tooth formation: Are the hardest tissues of human body hard to regenerate? Int J Mol Sci 2020;21:40314031.
7. Albernaz Neves J, Antunes-Ferreira N, Machado V, Botelho J, Proença L, Quintas A, *et al*. An umbrella review of the evidence of sex determination procedures in forensic dentistry. J Pers Med 2022;12:787.
8. Maulani C, Auerkari EI. Molecular analysis for sex determination in forensic dentistry: A systematic review. Egypt J Forensic Sci 2020;10:1-9.
9. Bhagyashree B, Gadodia P, Nayyar AS, Patil NN, Kumar MV, Murgod V, *et al*. Sex determination using cheiloscopy and mandibular canine index as a tool in forensic dentistry. J Forensic Sci Med 2018;4:23.
10. Priyadharshini KI, Ambika M, Sekar B, Mohanbabu V, Sabarinath B, Pavithra I. Comparison of cheiloscopy, odontometric, and facial index for sex determination in forensic dentistry. J Forensic Dent Sci 2018;10:88-91.
11. Uthman AT, Al-Rawi NH, Al-Naaimi AS, Tawfeeq AS, Suhail EH. Evaluation of frontal sinus and skull measurements using spiral CT scanning: An aid in unknown person identification. Forensic Sci Int 2010;197:124. e1-e7.
12. McClanahan JGH. Forensic Dentistry: Dental Indicators for Identification. Louisiana State University and Agricultural & Mechanical College; 2003.
13. Divakar K. Forensic odontology: The new dimension in dental analysis. Int J Biomed Sci 2017;13:1.
14. Stavrianos C, Kokkas A, Eliades A, Andreopoulos E. Applications of forensic dentistry: Part II. Res J Med Sci 2010;4:187-94.
15. Nazir MA, Al-Ansari A, Al-Khalifa K, Gaffar BO. Determinants of knowledge and practice of forensic dentistry amongst dental practitioners. Eur J Dent Educ 2019;23:491-7.
16. Nagarajappa R, Mehta M, Shukla N, Tuteja J, Bhalla A. Awareness of forensic odontology among dental practitioners in Kanpur city, India: A KAP study. J Dent Res Updates 2014;1:6-12.
17. Al-Azri AR, Harford J, James H. Awareness of forensic odontology among dentists in Australia: Are they keeping forensically valuable dental records? Aust Dent J 2016;61:102-8.
18. Almuthaffer AM. Awareness and attitude on use of nanotechnology among dental and medical professionals in Iraq. Med J Babylon 2022;19:528.
19. Rahman J, Routray S, Mishra SS, Mohanty I, Mohanty N, Sukla N. Knowledge, awareness, and practice of forensic odontology among dental surgeons in Bhubaneswar, India. J Unexplored Med Data 2017;2:26-33.
20. Ali A, Sardar KP, Nasir S, Wakar SM. Knowledge, attitude and practice of forensic odontology among graduates and post graduate students at Dow University of Health Sciences (DUHS). JPDA 2016;25:111.
21. Rathod V, Desai V, Pundir S, Dixit S, Chandraker R. Role of forensic dentistry for dental practitioners: A comprehensive study. J Forensic Dent Sci 2017;9:108-9.
22. Jasim WM. Knowledge assessment of medical students' college regarding the suitability of e-learning application in medical education. Med J Babylon 2022;19:422.
23. Fonseca GM, Ortíz-Contreras J, Ramírez-Lagos C, López-Lázaro S. Lip print identification: Current perspectives. J Forensic Leg Med 2019;65:32-8.
24. Saraswathi T, Mishra G, Ranganathan K. Study of lip prints. J Forensic Dent Sci 2009;28:31.
25. Chandra S, Pandey V, Wasti A, Mangat SS, Bhagat JK, Singh R. Analysis of rugae pattern in Ranchi and Patna population. J Int Oral Health 2016;8:362.

26. Ivanoff CS, Hottel TL. Comprehensive training in suspected child abuse and neglect for dental students: A hybrid curriculum. J Dent Educ 2013;77:695-705.
27. Sharma A, Shokeen S, Arora R, Dhaginakatti S. Survey on knowledge, attitude and practice of forensic odontology among private dental practitioners in Ghaziabad city, India. J Dent Spec 2015;3:43-7.
28. Devadiga A. What's the deal with dental records for practicing dentists? Importance in general and forensic dentistry. J Forensic Dent Sci 2014;6:9-15.
29. Charangowda B. Dental records: An overview. J Forensic Dent Sci 2010;2:5.
30. Preethi S, Einstein A, Sivapathasundharam B. Awareness of forensic odontology among dental practitioners in Chennai: A knowledge, attitude, practice study. J Forensic Dent Sci 2011; 3:63-6.
31. Harchandani N, Marathe S, Hebbale M, Ul Nisa S, Hiremutt D. Awareness of forensic odontology among general dental practitioners in Pune: A cross-sectional study. J Adv Med Dent Sci Res 2014;2:10-6.
32. Wong C, Marr S. Factors influencing health-care professionals in identifying and managing elder abuse: A preliminary report. Geriatr Today 2002;5:34-47.