Awareness of Forensic Odontology in a Sample of Dental Physicians in Upper Egypt

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Abstract

Background: Forensic odontology is the proper management, analysis, and interpretation of dental evidence to present it on behalf of justice. Objectives: The goal of this study was to assess the forensic odontology knowledge, practice, and attitude of a random sample of dental physicians in Upper Egypt. Methodology: This cross-sectional study involved 450 dental physicians from different specialties. An English-language online self-administered survey was utilized for the study. Three sections comprised the questionnaire: knowledge of forensic odontology, use of forensic odontology in daily practice, and attitudes towards forensic odontology. Results: Sixty-seven percent of the participants were familiar with forensic odontology. Nearly 72% of the participants knew DNA could be found in teeth. According to 86% of the participants, forensic dentistry helps identify offenders and the deceased. Most of the dentists in the survey kept dental records. The vast majority of the studied dentists felt they did not know adequately about forensic odontology. A little over 63% of those surveyed said they would be keen on attending forensic dentistry courses. Conclusion: The current study indicated that dental physicians in Upper Egypt had insufficient knowledge, lacked forensic odontology practice, and a positive attitude toward it. There is a greater awareness of forensic dentistry among male physicians and physicians with more experience and higher educational levels. Measures should be taken to raise the awareness of forensic odontology.

Key words

Forensic science, Forensic odontology, Awareness

Introduction

The Federation Dentaire International defines the field of dentistry known as "forensic odontology" as the specialization that deals with the proper management, analysis, and interpretation of dental evidence on behalf of justice. It is a specialty of dentistry that addresses medical and legal matters (Abdul et al., 2019). Four sections comprise forensic dentistry: dental identification, bite marks, cheiloscopy, and rugoscopy (Abdul et al., 2019). Due to the integration of forensic odontology with forensic medicine, dentists assist in identifying human remains, assessing bite marks, estimating age, and looking into claims of social abuse (Jyothi et al., 2017).

Dentists have a moral and legal obligation to create and maintain dental records (Hashim et al., 2020). When fingerprints are useless due to destruction, dental data are crucial for corpse identification (Umashankar et al., 2022).

By comparing information from the person's life and post-mortem records, dental science was used to identify the deceased (Seraj et al., 2021). Dental tissues are resistant to changes in temperature and decomposition, making them a dependable and efficient source of DNA that is highly beneficial in identification (Hashim et al., 2020).

Cheiloscopy is a technique used to examine a person's lip print. The distinctive pattern of lip prints are made by the interaction of lip's external surface peaks and depressions. Lip prints on clothing, mugs, glasses, and cigarettes may be seen at the crime scene (Abdul et al., 2022).

Despite its significance in criminal justice, forensic dentistry receives little attention in many countries worldwide (Seraj et al., 2021). Since there is a constant demand for qualified forensic odontologists, dental physicians should have their expertise evaluated and, if necessary, expanded. The goal of the current study was to assess the knowledge, practice level, and attitude toward forensic odontology in a sample of dental physicians in Upper Egypt.

Subjects and Methods

Study Design: This cross-sectional study was carried out from January to April 2023. It was applied to 450 dental physicians with different dental specializations. According to a prior study that had been published, the questionnaire was modified (Abdul et al., 2019).

For this study, Microsoft Forms software was utilized to create an online, self-administered questionnaire in the English language. Information regarding the participants’ gender, number of years of clinical experience, and educational background was requested. Three sections comprised the questionnaire: knowledge of forensic odontology (questions 1-10), use of forensic odontology in daily practice (questions 11-18), and attitudes towards forensic odontology (questions 19-22). Prior to the study's commencement, the questionnaire was pretested on ten dentists to make sure they could understand every question.
Inclusion criteria: Dentists from Upper Egypt only were included in the study. The questionnaire was published on the social media groups of Dental Syndicate in Upper Egypt.

Calculation of Sample size: The sample size of the present research was estimated according to Charan and Biswas’ (2013) formula. The proportion of forensic odontology knowledge is 50% since no previous study has been done in the same population. The absolute error of precision is 5%. Accordingly, the total sample size was 385.

\[
\text{Sample size} = \frac{z^2 p (1 - p)}{d^2}
\]

\( z = \text{Standard normal variate (1.96)} \)
\( p = \text{Expected proportion based on previous studies} \)
\( d = \text{Absolute error of precision (0.05)} \)

The anticipated non-respondent rate of 10% equals 39, so the sample size should be \( 385 + 39 = 424 \) at least.

Ethical Considerations

The aim of the research was explained to the participants through a cover letter at the beginning of the questionnaire. Informed consent was acquired before fulfilling the questionnaire. Participation in the study was voluntary without providing any rewards and carried no risk for participants.

Participants were informed about their right to withdraw at any time without any consequences. The questionnaire was anonymous, and no identifying information would be shared.

This study got the approval of the Medical Research Ethics Committee of the Faculty of Medicine, Sohag University. IRB registration number: Soh-Med-23-01-37.

Data analysis

The gathered data were classified as nominal and examined using IBM SPSS Statistics, Version 20. The results were calculated on a percentage basis and analyzed using the Chi-square test. The reliability of the questions was tested (Cronbach's Alpha = 70%), and their validity was assured.

Results

Demographic data of the participants

Four hundred and fifty dentists were subjected to the questionnaire, with approximately forty-eight percent (48.5%) males and fifty-two percent (51.5%) females. Thirty-eight percent (38.2%) of the participants had clinical experience for 2-6 years, thirty-one percent (31.1%) had clinical experience for less than 2 years, and thirty-one percent (30.7%) had clinical experience beyond 6 years. Of the participants, sixty-seven percent (67.1 %) had only a bachelor's degree in dental surgery, fifteen percent (15.1%) had a master's degree, and five percent (4.9%) had a Ph.D. degree (Table 1).

Knowledge of forensic odontology (Questions 1–10)

About sixty-seven percent (66.7%) of the people surveyed were familiar with the dental specialty known as forensic odontology. Of the participants, over seventy-two percent (72.4%) were mindful that deoxyribonucleic acid (DNA) could be extracted from teeth. Most respondents (86.2%) agreed that forensic dentistry helps identify offenders and the deceased. The value of the bite mark form of the teeth was known to about 79% of the participants (Fig. 1A).

Barr bodies can be used to determine sex, according to over 43 percent of the participants. About seventy-two percent claimed that enamel/dentin is a tool for determining age (Fig. 1B).

About 86% of the participants said they can determine the dental age by looking at eruption patterns and calcification; 7% said they can do so using histological techniques; 2% said they can use biochemical techniques; and 5% said they have no idea how to do it (Fig. 2A).

When asked how to identify dead persons in large-scale catastrophic events like fires and crashes, fifty-three percent replied that they would use dental records, twenty-five percent of the participants said they would reassemble the damaged corpses, and four percent would use fingerprints (Fig. 2B).

Only twenty-four percent of respondents recognized the proper name for the forensic dental practice that examines lip prints (cheiloscopy) (Fig. 2C).

Regarding their source of knowledge, 44% of the participants stated that they got their information from the media (television, the internet), 26% from undergraduate books, 24% from scientific publications and textbooks, and 6% from workshops and seminars (Fig. 2D).

Practice of forensic odontology (Questions 11–18)

Only 10% of the participants received forensic odontology-related formal training. Forensic odontology was a component of the curriculum for about 26 percent of the participants during their college studies. Most dentists surveyed (71.1%) believed that Egypt had few resources for studying forensic science. A little more than half of the dentists (51.6%) who took part in the study knew they could be called into court as expert witness in forensic dentistry (Fig. 3).

Most surveyed dentists (73.3%) kept dental records in their clinics. Radiographs (42.8%) and patient case records (29.4%) were the most frequent dental records preserved by dentists, followed by photographs of patients (14.4%) and casts (13.4%) (Fig. 3-A).

Seventy-five percent of the participants said they could suspect child abuse by looking for physical injuries, behavioral abnormalities, and scars. 9% by observing behavioral abnormalities, 6% by looking for physical injuries, and 2% by looking for scars. However, 8% of the participants had no idea how to diagnose child abuse (Fig. 4B).

When asked what they would do if they suspected child abuse, fifty-four percent would tell the parents, thirty-three percent would notify the police, and thirteen percent would take no action (Fig. 4C).

Attitude toward forensic odontology (Questions 19–22)

Most of the population surveyed (80%) thought their comprehension of forensic odontology was insufficient. If a diploma or postgraduate course in forensic odontology were offered, almost sixty-three percent of the respondents would be interested in...
enrolling. The interest in forensic dentistry as a career was shown by over 62% of the respondents. About seventy-four percent expressed interest in attending forensic odontology workshops and seminars (Fig. 5).

The chi-square test results revealed a significant correlation between gender and forensic dentistry knowledge. Males had more knowledge than females (p-value = 0.008). Additionally, years of clinical experience were significantly correlated with knowledge of forensic dentistry (p = 0.028). The highest level of knowledge was observed in dentists having more than six years of experience. Education level and knowledge level were significantly correlated (p = 0.008). Dentists with a PhD degree in dental surgery exhibited the highest level of knowledge (Table 2, Fig. 6).

Table (1): Demographic data of the participants.

<table>
<thead>
<tr>
<th>Gender</th>
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<th>Percent (%)</th>
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<td>48.5</td>
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<tr>
<td>Female</td>
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<td>51.5</td>
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<th>Count</th>
<th>Percent (%)</th>
</tr>
</thead>
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<td>Master Degree</td>
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<td>15.1</td>
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<tr>
<td>PhD Degree</td>
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<td>4.9</td>
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<tr>
<td>Other (as diploma)</td>
<td>58</td>
<td>12.9</td>
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Table (2): Correlation between knowledge of forensic odontology, gender, years of clinical expertise, and education level by chi-square test.

<table>
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<tr>
<th></th>
<th>Are you familiar with the dental specialty known as forensic odontology?</th>
<th>X²</th>
<th>p-value</th>
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<td>Yes</td>
<td>No</td>
<td>Total</td>
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<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Male</td>
<td>164 (75.3%)</td>
<td>54 (24.7%)</td>
<td>218 (100%)</td>
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<tr>
<td>Female</td>
<td>136 (58.6%)</td>
<td>96 (41.4%)</td>
<td>232 (100%)</td>
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<tr>
<td>Years of clinical experience</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 2</td>
<td>76 (54.3%)</td>
<td>64 (45.7%)</td>
<td>140 (100%)</td>
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<tr>
<td>2 - 6</td>
<td>122 (71%)</td>
<td>50 (29%)</td>
<td>172 (100%)</td>
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<tr>
<td>&gt; 6</td>
<td>102 (74%)</td>
<td>36 (26%)</td>
<td>138 (100%)</td>
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<tr>
<td>Education level</td>
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<td></td>
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<tr>
<td>Bachelor of dental surgery</td>
<td>208 (69%)</td>
<td>94 (31%)</td>
<td>302 (100%)</td>
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<td>Master Degree</td>
<td>48 (70.5%)</td>
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<td>68 (100%)</td>
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<td>PhD Degree</td>
<td>20 (91%)</td>
<td>2 (9%)</td>
<td>22 (100%)</td>
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<tr>
<td>Other (as diploma)</td>
<td>24 (41.5%)</td>
<td>34 (58.5%)</td>
<td>58 (100%)</td>
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</table>

*Significance at p-value < 0.05. df: degree of freedom.
Figure (1): Bar charts represent the response of the participants to questions assessing their knowledge about forensic odontology (questions 1-6). 1A questions (1-4). 1B questions (5-6).
Figure (2): Pie charts represent the participants’ responses to questions assessing their knowledge about forensic odontology (questions 7-10). 2A How can you determine the dental age? 2B In large-scale catastrophes, how could you identify a deceased person? 2C What is the term used in forensic dentistry for the examination of lip prints? 2D What is your primary source of information about forensic dentistry?

Figure (3): Bar chart represents the response of the participants to questions assessing their practice of forensic odontology (questions 11-15).
Figure (4): Pie charts represent the response of the participants to questions assessing their practice of forensic odontology (questions 16-18). 4A Which of the following records do you maintain? 4B How can you suspect child abuse? 4C If you suspected child abuse, what would you do?

Figure (5): Bar chart represents the participants’ responses to questions assessing their attitude toward forensic odontology (questions 19-22).
Discussion

A crucial field of dentistry called forensic odontology aids in the identification of those impacted by disasters and the resolution of criminal cases. Since teeth remain resistant to physical and environmental changes, they are regarded as the most trustworthy and dependable identification method (Manju et al., 2021).

Despite the expanding significance of forensic dentistry worldwide, this study is the first to be carried out in Egypt to evaluate dental physicians’ understanding of the discipline of forensic dentistry.

Two-thirds of the participants were familiar with forensic odontology as a dental specialty. As compared to female participants, most male participants knew about forensic odontology. The knowledge of forensic odontology grew as clinical experience increased.

Higher levels of education were also linked to greater awareness. Nearly all participants with a Ph.D. were knowledgeable about forensic odontology, followed by participants with master's degrees and then individuals with merely bachelor's degrees in dental surgery. The lack of forensic odontology in the undergraduate curriculum, as declared by most participants, may be the blame for this.

Abdul et al. (2022) reported similar findings, noting that forensic odontology was not included in Saudi Arabia’s undergraduate curriculum. Isher et al. (2019) discovered that, in contrast to the current finding, most of the questioned dentists in Punjab, India, had a forensic odontology course during their undergraduate studies.

Only around one-quarter of participants in the current survey said they learned most of their forensic odontology knowledge from textbooks or journals. Also, 26% of the participants learned forensic odontology from undergraduate books. About half of the participants said they learned it via media. Seraj et al. (2021) discovered a similar outcome and ascribed it to the media's crucial role in raising public awareness.

Tooth tissues endure external factors while conserving part of their original structure. Because of this characteristic, teeth are a valuable source of DNA. Using the polymerase chain reaction (PCR) technique, DNA may be amplified from even small amounts of the source, and the results can then be compared to antemortem materials like blood or hair (Kumar and Aswath, 2016).

Nearly three-quarters of the participants knew the possibility of teeth serving as a DNA source. Hannah et al. (2017) obtained comparable results. Most participants also agreed that forensic odontology is crucial in helping law enforcement officials identify offenders and the deceased.

Barr bodies and Y chromosomes are used to determine a person's gender (Sharma et al., 2015). Less than half of the individuals knew that sex is determined using the Barr body analysis. Studies have been conducted to extract DNA from dentine and pulp tissue for PCR tests to determine a subject's sex (Krishan et al., 2015).

Three types of age-related tooth alterations may be distinguished: formative, degenerative, and histological. Up to 12 years old, formative changes, including crown or root completion and teeth emergence, are reliable predictors (Carvalho and Lussi, 2017).

Periodontitis, periodontosis, secondary dentin and cementum apposition (visible under a microscope), root resorption, and root transparency, as seen in ground sections, are degenerative processes. The primary histological indicators of age estimation are incremental enamel and dentin lines, neonatal lines, dentinal translucency, and degree of crown and root development (Shah et al., 2020; Carvalho and Lussi, 2017).
Most participants claimed that calcification and eruption patterns may be used to determine dental age. They also concurred that tooth enamel and dentin are tools for determining age. The tooth is an excellent indicator of age.

A bite mark examination is a vital component of forensic dentistry that necessitates prompt action from the forensic dentist. If examination is delayed, crucial evidence may be lost since the markings fade quickly in both the living and the dead (Shebah et al., 2022). Law enforcement may be able to accuse a suspect in a crime case if they can match bite marks left on human tissues to the defendant's dental structure (Isher et al., 2019). More than 70% of participants comprehended the significance of the bite mark. A similar result was reported by Abdul et al. (2019).

The dentist can help to identify the dead in major disasters. The presence of dental anomalies, carious teeth, extracted teeth, fractured teeth, prosthetic appliances, and the degree of the maxillary incisors' shoveling all are distinguishing characteristics (Krishan et al., 2015). According to more than half of the dental participants in the present study, the dental records are the most reliable method for identifying dead bodies in mass disasters. In accordance with the present result, Akram et al. (2019) said that more than three quarters of Pakistani dentists were aware of the crucial role of forensic dentistry in mass disasters.

More than half of the participants were not aware that lip print analysis is referred to as cheiloscopy, demonstrating an extremely poor level of understanding of cheiloscopy. This could be attributable to ignorance about it and the application of these approaches. Seraj et al. (2021) discovered similar outcomes with dentists in India.

Nearly three-quarters of participants said that they maintained dental records in their clinics. A similar result was reported by Agrawal et al. (2022) and Tahir et al. (2022). It has been suggested that forensic dentists help law enforcement organizations properly represent the dental evidence gathered from crime scenes. The dental evidence is compared with the antemortem data that dentists can access to identify the deceased (Krishan et al., 2015).

In comparison to patient photographs and patient casts, radiographs were found to be the most often kept documents, with about one-third of participants having been keeping them. This was explained by the significance of radiography in practice and patient follow-up.

Dentists need to understand how crucial it is to create correct dental records and how to keep these documents safe. These dental records are kept for future practice references and use in medicolegal matters. According to Sahni et al. (2016), regulations dictate that records be retained for a minimum period of 7 years and an ultimate duration of 10 years.

Almost all of the participants lacked professional formal training of forensic odontology. This was in accordance with Kashif et al. (2020), who noted that in Karachi, Pakistan, less than a quarter of dental participants had received formal training in forensic odontology.

Most dentists surveyed believed that Egypt had inadequate resources for studying forensic science. Similar findings were reported in studies conducted in Afghanistan and Saudi Arabia (Seraj et al., 2021; Abdul et al., 2019).

In most cases, forensic dentists involved in the identification of dead people and criminal investigations are compelled to give testimony in the court as expert witnesses (Preethi et al., 2011). A little over half of the dentists knew they could be requested as qualified witnesses in court. Seraj et al. (2021) observed similar findings.

When a dentist observes an oral injury, especially if it is associated with other body injuries, he should be mindful of child abuse. It was reported that 50% of child abuse cases exhibited oral or facial injuries (Costacurta et al., 2016). Three-quarters of the participants reported that they could spot child abuse through physical harm, alterations in behavior, and scars. Similar results were noted by Seraj et al. (2021).

More over half of the participants said that their response to child abuse was to alert their parents. A different finding was made by Seraj et al. (2021), who found that 60% of the surveyed dentists said they would call the police if they suspected child abuse.

According to a study by Zinzow et al. (2009), approximately one in ten children experience physical abuse at the hands of their parents; hence, dentists should disclose incidents of child abuse to the authorities rather than the parents.

Most participants admitted that they knew little about forensic odontology and were curious about attending workshops and seminars. Seraj et al. (2021) and Sahni et al. (2016) found comparable outcomes.

About 60% of the respondents were interested in forensic dentistry as a career. However, Abdul et al. (2019) reported that 83% of participants were willing to have forensic dentistry as a job.

**Conclusion**

In medicolegal matters, forensic odontologists are extremely important. According to the current study, dental physicians didn't know enough about forensic dentistry. In Egyptian universities, there were not enough seminars, workshops, or official training programs that taught forensic odontology. Also, forensic odontology is not included in the dentistry curriculum at most universities.

Dentists in Upper Egypt do not adequately practice forensic odontology. Most of the participants had a positive attitude toward forensic odontology. They want to become more knowledgeable and join forensic dentistry as a profession.

Male physicians and physicians having more experience and higher educational levels have more knowledge of forensic dentistry.

**Recommendations**

- More effective measures should be taken to fill the knowledge gap as forensic odontology becomes increasingly important. As a start, forensic
odontology has to be added to the university curricula in Egypt.

- Dental practitioners should routinely attend seminars, workshops, and formal training to improve their competence in handling medicolegal problems. Dentists with less education (a bachelor's degree) and low experience (less than 2 years) should receive special attention.
- It is necessary to raise awareness of this field among dentists and encourage their participation in teams for inquiry and identification. The development of forensic dentistry as a distinct field within the dental sciences should be supported.

References


الوعي بعلم طب الأسنان الشرعي في عينة من أطباء الأسنان في صعيد مصر

المقدمية: طب الأسنان الشرعي هو المعايير المناسبة والتحليل والتفصيل أدلة الأسنان من أجل تقديمه للعدالة. نهدف من الدراسة: قدمت هذه الدراسة التي تقييم مدى معرفة أطباء الأسنان في صعيد مصر بعلم طب الأسنان الشرعي وممارسته وموقف أطباء الأسنان منه. طبيعة البحث: حملت هذه الدراسة المفتوحة 450 طبيب أسنان من تخصصات مختلفة. تم استخدام دراسة استقصائية ذاتية الإجابة باللغة الإنجليزية على الإنترنت. تم تقسيم الاستبان إلى ثلاثة أقسام: معرفة طب الأسنان الشرعي، طب الأسنان الشرعي في الممارسة اليومية، وموقف أطباء الأسنان منه. النتائج: سبعة وستون بالمائة من المشاركين كانوا على دراية بطب الأسنان الشرعي. كان ما يقرب من 72% من المشاركين على علم بإمكانية العثور على الحمض النووي في الأسنان. وفقاً لنحو 86% من المشاركين، فإن طب الأسنان الشرعي مفيد في تحديد كل من الجناة والمنتج. يتفق معظم أطباء الأسنان في نفس السجلاس الأسنان. شهدت الغالبية العظمى من أطباء الأسنان الذين شملتهم الدراسة آلامًا لا تعوق الكثير عن طب الأسنان الشرعي. قال ما يزيد قليلاً عن 63% من مجمل الاستطلاع أنهم سيحرصون على حضور دورات طب الأسنان الشرعي. الخلاصة: أظهرت الدراسة الحالية عدم كفاية المعرفة وعدم ممارسة طب الأسنان الشرعي والموقف الإيجابي لجاهم من أطباء الأسنان في صعيد مصر. هناك وعي أكبر بطب الأسنان الشرعي بين الأطباء الذكور والأطباء ذوي الخبرة الأكبر والمستويات التعليمية الأعلى. ينبغي اتخاذ تدابير لرفع مستوى الوعي بطب الأسنان الشرعي.