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ASSESSMENT OF KNOWLEDGE, ATTITUDES, AND PRACTICES OF FORENSIC ODONTOLOGY IN SOUTH PUNJAB, PAKISTAN: A CROSS-SECTIONAL STUDY

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Abstract

Objectives: This cross-sectional study assessed dental practitioners' knowledge, practices, and attitudes toward forensic odontology in South Punjab, Pakistan.

Methods: From January to March 2023, 192 dental surgeons in South Punjab participated in a cross-sectional study. A structured questionnaire collected demographic information, knowledge, attitudes, and practices related to forensic odontology. IBM Statistical Package for Social Sciences (SPSS) version 25.0 was used to analyse the data, and results were presented as percentages and frequencies.

Results: The study found that participants had varying knowledge about forensic odontology functionalities. While 94.2% of those who answered recognised teeth as a reliable source for DNA extraction, only 23.5% thought their current knowledge was adequate. A considerable number (88.5%) agreed that dental records can be utilised to identify dead people and suspects. Furthermore, 95.8% were interested in prescribed training to advance their forensic odontology knowledge.

Conclusions: The study concludes that while dental practitioners in South Punjab demonstrate a general awareness of the importance of dental records and teeth in forensic investigations, there is a need for targeted education and training. Findings suggest variability in practitioners' responses to child abuse recognition and reporting, emphasising the importance of more explicit guidelines. The study identifies a strong desire for further education in forensic odontology, indicating the necessity

for structured programs to enhance practitioners' expertise. This study underscores the importance of continuous education and training in forensic odontology to address existing gaps in understanding and knowledge.

Keywords: Forensic odontology; Dental record; Knowledge; Attitude; Practice; Forensic;

INTRODUCTION

Forensic odontology is a dental speciality concerned with appropriately handling and analysing dental evidence and thoroughly scrutinising dental findings in the pursuit of justice. Forensic odontology encompasses all dental specialities, and forensic dental fieldwork necessitates knowledge and understanding of all dental specialities [1]. The first formal educational programme at the Armed Forces Institute of Pathology in the United States prompted renewed curiosity in forensic dentistry in the 1960s. Because the number of reported cases has increased since then, the term "forensic odontology" has become relatable to dental practitioners, law enforcement agencies, and other forensic groups [2].

In diverse circumstances, forensic odontologists assist legal authorities by analysing dental evidence. The subject can be categorised into criminal, research, and civil [3]. The civil field involves mass calamities such as aviation accidents, natural disasters, and railroad accidents, which necessitate identifying victims in varying phases of corporeal destruction. The criminal field identifies individuals solely based on their dental remnants in suicide, homicide, or rape using bite mark evaluation, cheiloscopy, and palatal rugoscopy. Finally, the research field is used to train dental and medical practitioners in forensic odontology. The most recent effective classification for forensic dentistry demonstrates a reliance on associating different dental spheres with forensic dentistry [4].

Dental identification has proven critical in identifying the deceased since AD 66, with the legal system acknowledging the first case in 1849 [5]. Forensic odontology's pivotal applications encompass identifying human remnants through dental records and aiding at the crime scene; determining the gender and age of the living or deceased through bite marks or physical injuries; and testifying in the court of law as an expert witness to present forensic dental evidence [6]. Since teeth can withstand decomposition and extreme temperature changes, dental validation evaluation and assessment are some of the most reliable and consistent identification methods [7].

Natural and manufactured disasters have become more common in recent years. Under these circumstances, the suspected bodies become disfigured beyond identification, highlighting the critical role of dental surgeons in identifying such people. Even though forensic dentistry is among the most established modern fields of dentistry in the world, the Pakistan Medical and Dental Council (PMDC) has included it in oral and maxillofacial surgery with five didactic lectures. In Pakistan, PMDC is the dictatorial body in charge of medical and dental education. In Pakistan, universities grant BDS degrees under PMDC regulatory frameworks. With the inclusion of forensic odontology in the bachelor programme, undergraduate students must now be taught about it [8]. A structured questionnaire was used to evaluate the level of knowledge, attitude, and practice of forensic odontology among dental practitioners in South Punjab.

METHODS

This cross-sectional study was conducted in the South Punjab from January to March 2023. The survey was conducted using a questionnaire based on previous studies. It included all the dentists who filled out the questionnaire, which was shared through social media as a Google form. The study included one hundred ninety-two complete forms received from registered dental surgeons. The study comprised both open-ended and closed-ended questions. The study consisted of three sections: demographics, knowledge, and evaluation of practice and attitude. IBM Statistical Package for Social Sciences (SPSS) version 25.0 was used to analyse the data collected from the questionnaire, utilising descriptive statistics. The results were presented in frequencies and percentages, allowing for a clear understanding of the data.

RESULTS

Demographic overview:

This cross-sectional study included 192 dental surgeons from January to March 2023. Table 1 depicts demographic information such as gender, age, education level, and practice location of the participants.

Table 1: Demographic Detail of Participants

Variable	Description	Frequency	
		#	%
Age	20 to 30 years	112	58.6
	31 to 40 years	79	41.4
Gender	Male	62	32.4
	Female	129	67.5
Education level	Graduation	134	70.2
	Postgraduation	57	29.8
Place of Working	Public Sector	104	54.5
	Private Sector	87	45.5

Child Abuse Recognition and Reporting:

In response to child abuse recognition and reporting questions, the study underscores critical aspects that demand special attention.

Q 1. How do you recognise physical/sexual/psychological abuse of a child?

The results reveal that 114 (59.7%) of participants primarily identify child abuse through behavioural changes, followed by 54 (28.3%) who rely on physical injuries. Notably, 23 (12.0%) employ other methods or express uncertainty about recognising child abuse. These findings accentuate the significance of understanding varied indicators and underline the necessity for widespread education.

Q 2. If you observed certain signs and symptoms of child abuse, what would you do?

Of the 192 participants, 87 (45.5%) indicated a preference for reporting child abuse directly to parents, while 60 (31.4%) favoured reporting to the police. Alarmingly, 44 (23.1%) expressed a stance of taking no action. The study underscores the crucial need for education on proper reporting procedures, emphasising the importance of involving childcare organisations as the primary responders. This insight serves as a call to enhance awareness and establish comprehensive reporting protocols within the community of dental surgeons.

Unclaimed and Deceased Body Identification:

Exploring the participants' knowledge of unclaimed and deceased body identification reveals an overarching theme, shedding light on the broader spectrum of forensic awareness.

Q 3. What is the foremost step in identifying unclaimed bodies?

The majority, 99 (51.8%), identified DNA comparison as the primary method, with 49 (25.7%) recognising fingerprint identification. Intriguingly, 22 (11.5%) mentioned visual identification, while 13 (6.8%) considered serological identification. A small fraction, 08 (4.2%), expressed uncertainty. This collective insight emphasises the multifaceted approaches involved in identifying unclaimed bodies.

Q 4. In a deceased body, age and gender can be identified by?

Concerning age and gender identification, 103 (53.9%) participants suggested examining an erupted tooth, while 37 (19.4%) favoured examining a selected tooth using DNA. 27 (14.1%) also indicated jaw examination and awareness of these identification methods. Notably, 24 (12.6%) expressed uncertainty. These combined responses underscore the diverse techniques used in deceased body identification, with a noteworthy emphasis on dental examination.

The study accentuates the holistic understanding within the participant group regarding the intricate processes of identifying unclaimed bodies. Importantly, it emphasises the pivotal role of visual identification, a cornerstone in forensic medicine practices.

Dental Identification Techniques:
This section consolidates findings from questions focusing on the participants' awareness and accuracy in using forensic dental methods in the identification process.

Q 5. Can enamel/dentin help in the determination of age?
A significant majority, 148 (77.5%), correctly acknowledged that enamel/dentin aids in age identification, citing incremental growth lines as the basis. However, 43 (22.5%) provided an incorrect response, highlighting potential areas for targeted education on dental forensic knowledge.

Q 6. Can teeth be used to obtain DNA?
Impressively, 180 (94.2%) participants correctly recognised teeth as a reliable source for DNA retrieval. Only a small fraction of 11 (5.8%) remained unaware of this crucial aspect. The study underscores a commendable awareness among dental surgeons regarding the forensic utility of teeth in DNA extraction.

Q 7. Are dental records useful for deceased and crime suspects?
An overwhelming 169 (88.5%) of participants expressed a positive view regarding the usefulness of dental records in forensic investigations. This resounding endorsement accentuates the awareness and acknowledgement of dental records as valuable tools in identifying deceased individuals and crime suspects.

Q 8. Can lip print patterns be used by humans for the identification of a population?
When asked about lip print patterns, 119 (62.3%) participants believed they were reliable for individual identification. However, 61 (31.9%) expressed scepticism, and 11 (5.8%) were unaware of this technique. This divergence in opinions underscores the need for further exploration and education on the forensic utility of lip print patterns.
These responses underscore the commendable awareness of participants regarding dental identification techniques. The study reveals areas of accurate understanding and identifies specific points where additional education could enhance forensic dental knowledge within the surveyed group.

Forensic Odontology Awareness and Training:
This segment compiles insights shedding light on the participants' awareness and training needs in forensic odontology.

Q 9. Do you know you can present forensic dental evidence?
A significant portion of 131 (68.6%) participants indicated awareness that they could be called upon as experts to present forensic dental evidence in court. However, a notable 60 (31.4%) remained unaware of this professional capability, indicating a potential gap in understanding dental professionals' role in legal proceedings.

Q 10. Do you know of any forensic odontologists in Pakistan?
A mere 29 (15.2%) of participants were aware of professional training centres in Pakistan, while 162 (84.8%) lacked information on such training opportunities. This underscores the need for increased awareness regarding available resources for forensic odontology education in the region.

Q 11. What is the source of your forensic odontology knowledge?
The overwhelming majority, 170 (89.0%), relied on mass media sources such as TV serials, radio, and the Internet for forensic odontology information. Only a small fraction, 21 (11.0%), turned to scientific publications, lectures, and conferences. This emphasises the importance of diversifying educational sources and promoting access to scientifically accurate information.

Q 12. Do you consider your current knowledge level in forensic odontology adequate?
A mere 45 (23.5%) of participants considered their current knowledge in forensic odontology adequate. The majority, 146 (76.4%), expressed a desire to enhance their understanding and skills in this field, indicating a clear need for additional training and education opportunities.

Q 13. According to PMDC, forensic odontology is taught during your course of study.
Surprisingly, 123 (64.4%) participants were unaware that forensic odontology is included in the dentistry curriculum as part of maxillofacial surgery. This highlights a critical gap in awareness about the formal education and training opportunities available to dental professionals.

Q 14. Do you want to get formal training in forensic odontology?
An overwhelming 183 (95.8%) of participants expressed a strong willingness to participate in formal training if provided the opportunity. This enthusiastic response emphasises the demand for structured educational programs in forensic odontology.

Q 15. Do you keep your patient's dental records?
Encouragingly, 164 (85.9%) of participants acknowledged the importance of maintaining dental records as part of their practice for effective patient care. This indicates a positive practice among the surveyed dental professionals.
These findings underscore the pressing need for increased awareness, training, and educational opportunities in forensic odontology. The study identifies specific areas where participants seek further knowledge, emphasising the importance of tailored educational interventions to enhance dental community forensic odontology skills.

Discussion
Forensic odontology can help solve cases and identify abuse victims and deaths. More outstanding expertise and understanding of forensic odontology among dental practitioners would be necessary in the expanding field of medicine. Forensic odontology has gained popularity in several developed countries worldwide [9]. It has yet to establish a significant presence in developing countries like Pakistan. The study investigated dental practitioners in South Punjab's knowledge, awareness, and practice of forensic odontology. Forensic odontology has a wide range of applications, including the ascertainment of the individuality of accused in criminal investigations, alleged adult or child abuse, determination of gender and age of a living or dead, presenting evidence as an expert witness in court, and identifying humans from desiccated and maimed remnants from mass calamities [10].
Le Moyne Snyder pioneered using lip prints to identify an individual in 1950 [11]. Different facets of lip prints, like permanency, gender determination, and morphological patterns, were studied amongst different population clusters. The researchers advocated that cheiloscopy may be an adjunct method in identification [11-13]. In our study, 119 (62.3%) participants responded that lip prints could be used for the identification of a populace, per the study carried out by Nagarajappa et al. and Rahman et al., who reported that about 70% of the practitioners responded positively to this question [13, 14]. A study in Karachi reported that 49.2% of respondents answered this question positively [15].
The ascertainment of individuality is required for personal, social, and legal reasons. Hence, forensic odontology's main focus is identifying an individual [16]. Visual inspection remains the first and primary step for identifying the unclaimed individual. In the present study, 99 (51.8%) participants said DNA comparison was a mainstay for identification. Only 22 (11.5%) said visual

identification is the first step, contrasting the study conducted in India, where 68% of the respondents reported visual confirmation as their first choice [9]. Our results were comparable to a study conducted in Karachi, where 54.3% of participants chose DNA comparison as their first choice [17].

Child abuse is a major social issue in almost every country, regardless of economic status, ethnic background, or race. Unfortunately, child abuse cases are being reported at an alarming level, necessitating early intervention by reporting them to childcare authorities as soon as they are discovered. According to research, parents may perhaps physically abuse their children, and nearly one in every ten children faces such brutality, with parents being the perpetrators in more than 80% of the cases [8]. However, the outcome of the current study exhibited that 45.5% of the practitioners advocated that it is imperative to notify the parents rather than the police or non-governmental organisations.

Dentists who assist in identifying the deceased individual(s) and in a criminal investigation are then expected to present their conclusions in a court of law as an 'expert witness' [18]. Most 131 (68.6%) dental practitioners knew they could give evidence as an expert witness in a court of law. The results are comparable with those of Rahman et al., who reported that 60% of participants were aware of this [14]. Another study by Hannah et al. reported that 93% of dentists knew it [19].

The hard tissues of the teeth can endure environmental assaults while preserving some of their original structure. Teeth are an excellent and accurate source of an individual's DNA due to their capability to tolerate decomposition [20]. Most techniques use nuclear DNA, but mitochondrial DNA, which is more abundant in the body tissue and can be used when nuclear DNA is inadequate, can also be used. Mitochondrial DNA is abundant in dental tissues such as dentin and cementum. DNA can be amplified from a minuscule quantity of source material using the polymerase chain reaction (PCR) technique, and this amplified DNA is then evaluated by comparing it to antemortem samples such as blood, hair, clothes, cervical smear, and biopsy [21]. When the participants were inquired about the presence of any forensic odontologist in Pakistan, remarkably, 162 (84.8%) were ignorant of it, comparable with the study by Akram et al., who reported that 92% were unaware of it [15]. 169 (88.5%) participants expressed a positive view regarding the usefulness of dental records in identifying deceased individuals or crime suspects. This is consistent with numerous studies conducted in India and Australia [6, 13, 22]. The accessibility and accuracy of these records are critical to the success of identification. Unfortunately, dentists' failure to keep proper records leads to uncertainty and makes dental recognition impossible [23].

Of one hundred ninety-two participants, 148 (77.5%) responded correctly that enamel/dentin could aid in the age determination of an individual, comparable with Sahni et al., who reported that 89% of participants were aware of it [9]. Most anthropologists, archaeologists, and forensic odontologists use the tooth as a dependable tool for estimating age. There are three types of age-related changes in teeth: formative, degenerative, and histological. Formative changes encompass crown/root completion and tooth eruption, serving as effective predictors until age 12. These degenerative variations include Periodontitis, secondary dentin and cementum apposition, root resorption, and root transparency. Histological measurements primarily include incremental enamel/dentin lines, neonatal lines, dentinal translucency, degrees of crown formation, root, etc. Incremental lines persist in the fossils, representing internal records and possibly a valuable tool in determining age. In terms of accuracy and simplicity, dentinal translucency is one of the morphophysiological parameters considered best for estimating dental age [24].

Only 45 (23.5%) participants considered their current knowledge adequate, and 183 (95.8%) showed a strong willingness to participate in forensic odontology if provided with the opportunity. In a study by Hannah et al., 41% of the participants thought they had adequate knowledge of forensic odontology, with 83% interested in undergoing formal training in forensic odontology [19]. While our study provides valuable insights into forensic odontology awareness among dental practitioners in South Punjab, it is essential to acknowledge and address certain limitations. Firstly, our study's sample size may influence the findings' generalizability. Additionally, the reliance on self-reported responses introduces the possibility of answer bias, as participants might have

provided socially desirable responses. Moreover, the study's cross-sectional nature limits our ability to establish causation or track changes over time. Despite these limitations, our findings offer a meaningful snapshot of the region's current landscape of forensic odontology awareness.

Conclusion

The study revealed that while most participants were aware of the significance of dental records and the potential of teeth as a source of DNA for identification purposes, there needed to be more understanding of specific methods and protocols. The study showcased a mixed response among participants regarding their actions upon discovering positive signs of child abuse. While many suggested informing parents, some advocated reporting directly to the police, indicating a need for greater clarity on proper procedures. The study highlighted that despite a relatively high level of awareness about the potential of dental records and teeth in identification processes, there was room for improvement in understanding forensic odontology. Many participants desired further education and training in this field, indicating a clear need for structured programs that enhance their expertise. While our study provides valuable insights, there are avenues for future research that could deepen our understanding of forensic odontology practices among dental practitioners. Firstly, future studies should explore the specific factors influencing practitioners' attitudes and practices related to child abuse reporting, aiming to develop more explicit guidelines for intervention. Additionally, longitudinal studies should be conducted to track changes in awareness and practices over time, providing a more dynamic perspective. Moreover, given the expressed desire for further education, future research could assess the effectiveness of specific training programs in improving practitioners' forensic odontology knowledge and practices. These recommendations could contribute to developing and refining forensic odontology education and practices.

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None to Declare

Ethical Approval

There is no ethical issue.

Competing Interest

There is nothing to declare.

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