

Research Article

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Role of Dental Evidences in Persons Forensic Identification in Nineveh Province

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ABSTRACT

Aim of this Study: Underlining the method used in Nineveh as individual's identification and to emphasize the importance of dental components for person identification.

Methodology: ethically approved by the ethical research committee in the Nineveh Health Directorate/Ministry of Health. Modified questionnaire study formed to assess the role of forensic odontology in Nineveh and knowledge of the forensic medicine staff

Result: Demographical section shows thirteen's male group. In regard to specific unit positions in the FMD doctors form (15%), laboratory assistance (35%). In the specific knowledge questions about forensic medicine results where visual examination is the first step to identifying unclaimed bodies (45%), bone samples are the chosen answer (52%), in comparison to teeth (42.5%) used to estimate age. More than fifty percent claimed that forensic odontology is for dead person identification only. The respondents consider tooth structure to be the main part used (42.5%). More than 75% agreed that dentists have a great role in forensic odontology (33, 82.5%). The highest percentage gathers information from electronic sources: television, mobile phones, and radio (19, 47.5%). Thirty questions about forensic dentistry knowledge with one answer either yes or no or I don't know. Twenty-one answers show the highest agreement of the respondents on YES, while 7 answers show the highest percent of applicants disagreeing with the questions.

Conclusion: Forensic odontology provides a quick means of identification based on dental characteristics, treatment, and pathology in the context of comparative identification. Although FMD in Nineveh understands the significance of FD, they are not permitted to perform routine analyses of the remains; instead, they collect samples and send them to Baghdad, the primary center of forensic medicine.

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Keywords: Forensic Odontology, Forensic Medicine, Identifying Persons, Human Remains, Tooth Structures, Estimating Age

Abbreviations

FMD: Forensic Medicine Department

FD: Forensic Dentistry

AAFS: American Academy of Forensic Sciences

IAI: International Association of Identification

DVI: Disaster Victim Identification

PCR: Polymerase Chain Reaction

OAFME: Office of the Armed Forces Medical Examiner

Introduction

"Forensic odontology is a branch of dentistry which deals with the proper handling and examination of dental evidence and the proper evaluation and presentation of dental findings in the interest of justice" [1].

Forensic dentistry (FD) has developed into an essential component of a significant international forensic education institutions like "American Academy of Forensic Sciences (AAFS) as well as International Association of Identification (IAI)". Identification is the main cause to use forensic odontology. In accordance with the individualistic theory characteristics found in every individual's set of teeth, this discipline significantly aids in the identification of these problems [1].

In situations like tsunamis and earthquakes, there may be human remains. Landslides, bombings, terrorist attacks, and aircraft, train, and other accidents frequently resulted in severe mutilation and dead bodies that have been dismembered and recovered are beyond recognition [2].

Disaster Victim Identification (DVI) is a term for the process of identifying victims of a disaster. The human tooth is the most

durable part of the body and can withstand tremendous force without being damaged. Thus, it is possible that several teeth will be recovered in specific situations which the alternate method of identification like facial features and fingerprints are eliminated [3].

In general, the adult human teeth have a varied range of interspaces and sizes among people. Similarly, the way that how these teeth are positioned in various oral chambers in every individual is different. Precisely each tooth possesses a collection of special qualities known as “tooth class characteristics” which form the identifying bases [3].

The dental pathology, dental abnormalities, restorations, extractions etc. are a feature that aids in identifying individuals solely [1]. In addition to age, the forensic doctor can determine one’s gender, race or ethnicity, and other characteristics through using teeth [1].

Iraq passes through a multiple disasters and wars specifically Nineveh Province, which pass to many years of politically unstable and there were many random bombings that killed many innocent people.

Comparing ante-mortem dental records to post-mortem dental remains in order to verify a person’s identity is the core principle of dental identification. Because ante-mortem dental records data is typically unavailable in Nineveh, so on comparison procedure is nearly impossible. However, in this circumstance, a postmortem dental examination is still helpful to reveal other general personal data, such as race, age, sex and eating behavior, etc. that will lower the number of suspects (presumptive identification).

As well as DNA testing on dental components, including pulp, cement, and dentin, will prove the identity of the person who is being suspected or accused [4].

Depending on these bases, the goal of the current study is to first climax the significance of teeth in remains identification, its utility in estimating a biological profile (age, sex, race, etc.), and the state of dental evidence at the moment in forensics in general. Secondly, underlining the method used in Ninevah as an individual’s identification. Thirdly, to emphasize the importance of dental components used in Nineveh for person identification.

Identification

For a long time, identification in the aftermath of mass fatalities especially those caused by aviation disasters has relied heavily on tooth structures as proof of identity. Due to the limited size of fingerprint databases, dental identification continues to play a crucial role. Dental identification can have three different applications [5].

- The dental records of a dead person are compared to their medical records from before they died to see if they belong to the same person. Documents are all associated with the same person.
- When antemortem records are unavailable and there is no possible data referring to the identity of the subject, dental information can be obtained to narrow the search.
- When it’s not possible to compare dental records, one option is to use DNA profiling on oral tissues.

Responsibilities of Forensic Odontologist includes many duties as identify human remains, estimating age; identifying victims of a massacre; injury evaluation involving bite marks and case evaluation for child, partner abuse, as well as malpractice lawsuits that end up in civil court [6].

Age Determination

Dental maturity is a crucial factor in the valuation of maturity in kids and teenagers [7]. The quantity and order of the erupted teeth can accurately predict a person’s age. Radiographical examination can give a clue with more detail about mineralization at different stages and further aid in a more precise age range [8]. The mineralization of the teeth provides more accurate chronologic age estimation due to the stages of mineralization than bone mineralization since dietary and lifestyle changes and the hormonal condition of the person have less impact on the teeth.

With respect to this, the developmental phases of tooth development as described by Demirjian et al. are frequently used to estimate chronological age all over the world [9]. Gustafson created a technique for estimating adult’s age from a single tooth a long time ago [10]. The method makes use of several steps of regressive dental changes such as abrasion of teeth, periodontal loss, “coronal secondary dentine” forming the quantity of apical resorption, apposition of cementum, and attachment as well as the root’s openness.

Johnson approves Gustafson’s method for figuring out a person’s age, which is now mostly used by forensic experts to figure out a person’s age when they are adults. Kvaal also came up with another method: adults can figure out their age by measuring the size of the pulp in their teeth, which depends on their gender [11-13].

When assessing the victim’s age or the defendant’s age, the simplest method is to look at the oral cavity’s state of tooth eruption. The numerals and sequence can give an estimate of the age. In the case of children and teenagers, these data can be utilized in conjunction with observations of additional age estimation techniques for outcomes that are more accurate. All this can be based on the examination materials provided as well [14, 15].

Sex Determination

Although sex can’t be conclusive from teeth in some cases, teeth can provide information about someone in the absence of other evidence. A person’s sexual orientation outcomes may also be connected to and supported by other existing facts and data from experts in forensic science.

Odontometrics, “a technique to take measurements on the teeth has been used by scientists for sex determination” [16]. The basis for employing this strategy is the “sexual dimorphism” of the dimensions of the tooth size (bucco-lingual and mesio-distal).

In the past, these measurements have been used to determine a person’s gender. These dimensions are known as “linear measurements. Diagonal measurements”, however, are useful in proximally restored, crowded, and rotated tooth measurements [17].

Several dental indices, including the Incisor Index, the Mandibular-Canine Index, the Crown Index, and other metrics, were developed from the linear dimensions of teeth to demonstrate sexual dimorphism containing teeth. The canines of the mandible are shown to compare favorably to the maxillary canines in terms of sexual dimorphism [18].

The latest approach to determining sex from teeth is the presence of Barr bodies, or sexual pulp chromatin, in accordance with the technique Barr developed with Bertram, as well as the research that has been done to extract pulp tissue DNA as well as dentine through polymerase chain reaction (PCR) examination. Enamel

protein, due to its different patterns in males and females, has also been used for sex determination using DNA techniques [19-22].

Race Determination, Occupation / Habits and Cultural Practices
Some physical characteristics of teeth are known to demonstrate people's variety, which can be used to determine ancestry or ethnicity. However, determining a person's race according to the physical characteristics of their teeth is still being debated.

These traits, qualities, and job designations provide an understanding of a group's customs and cultural traditions. Properties of the teeth, including the upper incisor, are shoveled or scooped most commonly in children of Amerindians and Asian Mongoloids, with different characters of the tooth cusps as peg-shaped teeth that can be used to gauge the ethnic background of the person [23]. Sometimes dental restorations might reveal an individual's ethnicity. Techniques for specific restoration countries or regions could be distinct or not used at all anywhere else [24].

The use of costly repairs could also be an option, depending on an individual's socioeconomic standing. Additionally, it has been noted that teeth can offer crucial facts pertaining to the customs and professions of individuals. Those who sew clothes or suits hold needles between sewing with their teeth while biting thread; cobblers, carpenters, and, in between their incisors, electricians hold nails, pencils, and pens, distressing and opening bottle tops using their teeth [25].

Certain tobacco use, cigarette smoking, and other bad behaviors even the act of chewing can leave a mark on the teeth. Excessive dental deterioration has been noted in the mining sector and is due to the workplace's exposure to olivine dust. Sometimes artificial distortions result in identification of the individual and how they could be connected to the cultural behaviors of a specific population group, more often than not. In order to create the artificial distortion, incisors are best seen from the outside of the mouth [26].

Comparison between Dental Records and Teeth Anomalies

FD helps law enforcement agencies present dental evidence properly after it has been gathered at a crime scene or after a mass fatality. To determine who the deceased were, dentists can use a comparison of dental evidence with antemortem records.

Dental x-rays and the dentist's patient file can be used for such comparisons. Sometimes, antemortem photographs of family members can be compared to dental evidence, typically the front teeth. All of the information about an individual's teeth can be found in their dental records, which are organized using the International System of Numbering of the Dentition [27].

Tooth fillings, tooth loss, tooth surface/root outlines, adjoining teeth, particular teeth overcrowding, teeth diastema or spaces, twisting, tooth rotations and transpositions, absence teeth, spare teeth, and the presence of supernumerary cusps on the occlusal are all factors that are compared in a forensic dental comparison because they aid in categorizing populations and identifying individuals during forensic odontology and dental anthropology investigations [28].

The occlusion, or relationship between the mandibular and maxillary teeth, can be used to help identify a person. Like DNA profiling and morphological fingerprints, dental characteristics can potentially lead to a positive identification [27].

Bites in Human Tissue

Bite-mark analysis is fascinating and difficult. Bites cause laceration due to the force needed to pierce the skin. The tissue nature must be strong enough to carry on the bite's strength [29]. Since Roman times, people have been able to be identified by their distinctive jaws and teeth. When conducting a forensic investigation, it is often necessary to rely on the investigator's own subjective interpretation of evidence such as bite marks, which may have come from an unknown source and point to a potential perpetrator.

Patterned evidence, and bite-mark analysis in particular, has recently come under scrutiny, raising questions about its scientific validity and its role in legal proceedings. Most bite injuries are assessed from an elastic material like human skin and delivered under dynamic and variable conditions, it is reasonable to assume that the victim's injury will exhibit some inherent distortions.

The validity of this hypothesis has been established. The stakes are high when a forensic odontologist's opinion on who caused a bite mark injury, and this information should be enough to convince them to proceed with caution [30].

Lip prints (Cheiloscopy)

Lip prints, or cheiloscopy, are the study of the unique pattern formed by the folds and creases of the mucous membrane of the labial surface. The outer lip surface is highly irregular, with numerous bumps and grooves. Similar to fingerprints, each person's set of these is one-of-a-kind. A lip print is evidence of a surface having pronounced furrows. This characteristic can be used to determine a person's sex [31].

As such, the forensic odontologist's job is to compare the pre- and post-mortem dental records. The effectiveness and utility of bite-mark analysis in eliminating specific suspects cannot be overstated. Each person's teeth can serve as a unique identifier, similar to a fingerprint. When investigating a case involving bites mark, it is recommended that you seek the advice and assistance of knowledgeable colleagues.

Aim of this Study

Depending on these bases, the goal of the current study are firstly climax the significance of tooth in remain identification, its utility in estimating a biological profile (age, sex, race, etc.) and the state of dental evidence at the moment in forensics in general. Secondly; underlining the method used in Nineveh as individual's identification. Thirdly; to emphasize the importance of dental components used in Nineveh for person identification.

Material and Method

Ethical Approval: The study was ethically approved by the ethical research committee in the Nineveh Health Directorate/Ministry of Health (239 in 4/1/2023) Liscen No. 2023020.

Study Design: This study is based on a modified questionnaire form [32] to assess the role of forensic odontology in Nineveh by some questioners who list all workers in the Forensic Medicine Department (FMD) in Mosul City and Ninevah Province. The current study was an analytic cross-sectional study.

According to our search and knowledge, it's the first study performed in Nineveh Governorate. The study participants were all employees in the FM department.

FMD in Nineveh

According to the administrative order of the forensic structure (No. 32626), the total number of workers in the FMD in Nineveh is eighty-five: seventy-two permanent owners and twelve affiliated with other institutes. All distributed into five sections (examination of the dead, examination of a live person, radiological and sonar section, laboratory section, and statistical section). Table 1 explains the exact numbers of the staff and the number of participants in the research (the total number of participants included is 40).

Table 1: The total no. of workers in relation to the no. of participant sample

FMD Sections	Total No.	Participant No. and %	
Medical	15	10	25
Laboratory	15	11	27.5
Administrative	33	14	35
Legal	2	1	2.5
Health professions	5	2	5
criminal evidence	2	1	2.5
Total	72	40	

The researchers distribute the questionnaire forms to clarify the study's purpose and clinical importance to the department manager. The consent form and official approval to perform the survey were obtained from the department manager. A non-probability-suitable modified sampling technique was performed to enroll participants. The data was collected from February 1, 2023 to March 1, 2023. Through personal communication, the participants answer the list.

Questioners lists are formed from three self-answered parts. As principles, the demographic features of the participants (ten items) are the first, including gender, age, educational level, work experience, and position in the department. The second part of the questionnaire includes six main questions with different answers: yes, no, or I don't know. The last section of the questionnaire asked various questions with a single answer of yes, no, or I don't know.

The questions collected from different articles were then modified and translated to Arabic, which is the official language in Iraq [32]. In the third section, the questioning consisted of 30 questions. The review and edit established the validity of the question by a panel of experts to assess the mean score of the knowledge correctly.

The data were surveyed using SPSS version 25 descriptive and inferential statistics as means, standard deviation, and percentage/frequency.

Section One: includes the demographic information of the participant in regards to gender (male, female), age divided to (less than 30, 31-40, 41-50, and more than 51), and position of the participant in the FMD (manager, assisting manager, doctor, lab, others). In addition, years of work were also recorded (less than 5 years, 5-10, 10-15, 15-25, more than 25 years). Levels of education include secondary school, diploma, college, M.Sc., and PhD.

Section Two is formed from six main questions with different answers. The questions are: what is the first step to identifying unclaimed bodies? and what method is used to estimate age? What do you think about this specialty (forensic dentistry)? What is the most widely used method of identifying a person? Dental

professionals play a major role in helping towards a forensic dentist; do you know how? And the final question is: what is the source of your information regarding forensic dentistry?

Each question has different answers, and the participant chose the correct answer according to his knowledge as he works in FM.

Section Three: thirty more detailed questions from different views concerning forensic odontology with straight-forward answers (yes, no, I don't know). These are: Have you heard of forensic dentistry? Can we identify a person by their teeth? Can we know a person's DNA from their teeth? All individuals have the same jaw structures. Forensic dentistry helps estimate an individual's age. Forensic dentistry can establish a history of dental disease for an individual. Forensic dentistry does not apply to living accident survivors. Forensic odontology helps determine race; DNA cannot be extracted from dead bodies. Forensic dentistry assists with medical and legal issues. DNA can be extracted from the teeth of living individuals. Forensic dentistry helps identify some social factors related to lifestyle. Forensic dentistry assists in the investigation of physical abuse (domestic violence). Forensic dentistry can determine the sex of an individual. Forensic dentistry assists in the investigation of fatal accident victims. Everyone has a unique palate for scammers. Each individual has a unique dental imprint. Everyone has the same lip print or line.

FD helps determine the nature of someone's profession. Forensic dentistry helps determine the socioeconomic status of an individual. Forensic dentistry does not help parents neglect their children's teeth. Can sex be determined using Barr bodies? Could enamel or dentin serve as an aid in determining age? Should forensic dentistry be added to BDS students' curriculum? , Forensic dentistry can serve as the number one method for identifying unclaimed bodies. Do you know of any criminal cases that have been resolved with the help of FD? , Forensic dentistry assists in the investigation of bite episodes Do you know any forensic dentists in Nineveh?, As forensic experts, have you advised dentists to keep records of living people? How many dead bodies are seen per days that need forensic identification?

Sections 2 and 3 to some extent reflect the knowledge of the people who work in the FMD in Nineveh.

Result

In this questioner study divided in to three sections is:

Section One: Demographical Information: Table 2 shows the descriptive analysis of the sample. Twenty-three males (57.5%) participate in comparison to 17 females (42.5%), with most age groups ranging between 31 and 40 in a percent (42.5%), while the rest are distributed in the other age groups with the least percent aged more than 51 years old. In regard to specific unit positions of work in the FMD, the institution's director (1, 2.5%) and his administrative assistants (1, 2.5%) are included in the questioner, as are a group of the doctors (6, 15%), laboratory assistance (14, 35%), forming the higher percent as isolation from others, and various staff members (18, 45%). According to the period spent working in the FMD sections, which varied from less than 5 years to more than 25 years, the highest number (13, 32.5%) ranged between 10 and 15 years of work.

According to level of education, most of them are college graduates (26, 65.0%), and some of them have postgraduate degrees (PhD and Master's).

Table 2: Demographic Information of the Participant

Questions	Answers	Frequency	Percentage
Gender	Male	23	57.5
	Female	17	42.5
Age	Less than 30	6	15.0
	31 - 40	17	42.5
	41 - 50	12	30.0
	More than 51	5	12.5
Your Position in the FMD	Manager	1	2.5
	Assisting Manager	1	2.5
	Doctor	6	15.0
	Lab	14	35.0
	Others	18	45.0
Years of Work	Less than 5 years	12	30.0
	5 - 10	8	20.0
	10 - 15	13	32.5
	15 - 25	7	17.5
	More than 25 years	0	0
Level of Education	Secondary School		
	Diploma	11	27.5
	College	26	65.0
	MSc	2	5.0
	PhD	1	2.5

Section Two: Staff Information about Working in Forensic Medicine and Forensic Dentistry in general

Different question lists are chosen to be answered by the participants, formed from main questions with different answers, with the participant only ticking the correct answer he thinks is correct, as shown in detail in Table 3.

Q1. What is the first step to identifying unclaimed bodies? Most of the participants agreed on visual examinations (45%), although 30% claimed that finger prints are the first identification of bodies; on the contrary, they consider dental records to be of no value (4%) and only chose them as a first identification marker.

Q2. What method is used to estimate age? Bone samples are the chosen answer (52%), in comparison to teeth (42.5%).

Q3. What do you think about this specialty (forensic dentistry)? More than fifty percent claimed that forensic odontology is for dead person identification only.

Q4. What is the most widely used method of identifying a person? According to various answers from the respondents, they consider tooth structure to be the main part used (17, 42.5%). The least are related to bite marks (6, 15%).

Q5. Dental professionals play a major role in helping a forensic dentist; do you know how? More than 75% agreed that dentists have a great role in forensic odontology (33, 82.5%).

Q6. What is the source of your information regarding forensic dentistry? The highest percentage gathers information from

electronic sources: television, mobile phones, and radio (19, 47.5%). A quarter of the sample collected information from lectures, journals, and seminars (10, 25%). The rest of the sample collects information from both media and lectures.

Table 3: Staff Information about Working in Forensic Medicine and Forensic Dentistry

Q No.	Main Questions	Answers	Freq.	%
Q1	What is the first step to identifying unclaimed bodies	Fingerprints	12	30
		Dental records	4	10
		Visual examination	18	45
		Comparison of serum and genotyped DNA	6	15
		I don't know		
Q2	What method is used to estimate age?	bone sample	21	52.5
		Teeth	17	42.5
		DNA	2	5
		I don't know		
Q3	What do you think about this specialty (forensic dentistry)?	Only the dead	23	57.5
		Only living people		
		Both	17	42.5
Q4	What is the most widely used method of identifying a person?	bite mark	6	15
		Lip print	8	20
		tooth structure	17	42.5
		Mixed	9	22.5
	Dental professionals play a major role in helping towards a forensic dentist, do you know how?	By keeping all information and history in detail of the patient	2	5
Q5		By keeping all records and x-rays of the patient	1	2.5
		Preserving the above damage and keeping it in good condition for the benefit of the forensic dentist	4	10
		All of the above	33	82.5
Q6	What is the source of your information regarding forensic dentistry?	Electronic sources - television, mobile phones, radio, etc.	19	47.5
		Lectures, journals, seminars, etc.	10	25
		Both above	11	27.5
		any other source	0	0

Section Three: Questions Related to Staff Knowledge about Forensic Dentistry

Thirty questions focus on different areas, with one answer either yes or no or I don't know reflecting the knowledge of the applicants. In general, regardless of the exact percent of participants, the questions (1, 2, 3, 5, 6, 8, 10, 11, 12, 13, 14, 15, 16, 17, 19, 21, 22, 23, 24, 25, and 29) show the highest agreement of the respondents on YES, while the questions (4, 7, 9, 18, 20, 27, and 28) show the highest percent of applicants disagreeing with the questions. There is only one question, which is no. 26, and most participants don't know the answer. Table 4 gives the full details of the frequency and the percent. In question thirty, the authors ask about the number of dead bodies seen per day that need forensic identification; all responses are in the range of three.

Table 4: Questions Related to Staff Knowledge about Forensic Dentistry

	Questions	Yes Freq. %		No Freq. %		I don't Know Freq. %	
1	Have you heard about forensic dentistry?	28	70.0	5	12.5	7	17.5
2	Can we identify a person by teeth?	27	67.5	7	17.5	6	15.0
3	Can we know a person's DNA from teeth?	27	67.5	7	17.5	6	15.0
4	All individuals have the same jaw structures.	7	17	28	70	5	12
5	Forensic dentistry helps estimate an individual's age.	26	65	5	12.5	9	22.5
6	Forensic dentistry can establish a history of dental disease for an individual.	23	57.5	8	20	9	22.5
7	Forensic dentistry does not apply to living accident survivors.	11	27.5	16	40.0	13	32.5
8	Forensic odontology helps determine race.	20	50.0	5	12.5	15	37.5
9	DNA cannot be extracted from dead bodies.	8	20	29	72.5	3	7.5
10	Forensic dentistry assists with medical and legal issues.	31	77.5	3	7.5	6	15.0
11	DNA can be extracted from the teeth of living individuals.	27	67.5	7	17.5	6	15.0
12	Forensic dentistry helps identify some social factors related to lifestyle.	25	62.5	7	17.5	8	20.0
13	Forensic dentistry assists in the investigation of physical abuse (domestic violence).	20	50.0	8	20.0	12	30.0
14	Forensic dentistry can determine the sex of an individual.	20	50.0	10	25.0	10	25.0
15	Forensic dentistry assists in the investigation of fatal accident victims.	27	67.5	4	10.0	9	22.5
16	Everyone has a unique palate of scammers.	19	47.5	11	27.5	10	25.0
17	Each individual has a unique dental imprint.	23	57.5	7	17.5	10	25.0
18	Everyone has the same lip prints or lines.	8	20.0	20	50.0	12	30.0
19	Forensic dentistry helps determine the nature of someone's profession	20	50.0	14	35.0	6	15.0
20	Forensic dentistry helps determine the socioeconomic status of an individual.	12	30.0	19	47.5	9	22.5
21	Forensic dentistry does not help parents neglect children's teeth.	19	47.5	5	12.5	16	40.0
22	Can sex be determined using Barr bodies?	24	60.0	4	10.0	12	30.0
23	Could enamel/dentin serve as an aid in determining age?	25	62.5	2	5.0	13	32.5
24	Should Forensic Dentistry Be Added to BDS Students?	18	45.0	10	25.0	12	30.0
25	Forensic dentistry can serve as the number one method for identifying unclaimed bodies	16	40.0	11	27.5	13	32.5
26	Do you know of any criminal cases that have been resolved with the help of FD?	9	22.5	13	32.5	18	45.0
27	Forensic dentistry assists in the investigation of bite episodes.	6	15.0	20	50.0	14	35.0
28	Do you know any forensic dentist in Nineveh?	7	17.5	25	62.5	8	20
29	As forensic experts, have you advised dentists to keep records of living persons?	40	100				
30	How many dead bodies seen per day need forensic identification?	Ranged Three					

Discussion

Each living person on Earth has a unique identity, and compassionate societies must find a way to honor that identity even after death. Many things, including finances and family ties, may need to be taken care of after a person passes from this world [31].

Actually, some humanitarian arguments such as need for authorities to return the correct body to the next of kin, desire for family members to have closure regarding the whereabouts of a loved one who has gone missing as well as importance of memorializing a loved one's passing with a fitting ceremony that takes into account the specifics of the person's life and death force us to find the exact remain for each person identity [32].

Forensic odontology shows its central role by presenting the pieces of evidence from the oral and maxillofacial region (including the teeth) that will be used in a jurisdictional setting and recognized by the court of law and the general scientific community to affirmatively and rightly separate truth from untruth.

Forensic identifications are complex tasks that require a wide range of professionals to work together. Forensic odontologists, anthropologists, pathologists, serologists, criminalists, and other consultants may all play a role in the process. Teeth have been used as a DNA source in the management of large-scale disasters and natural calamities [33].

Dental forensics has had an impact on the course of history. Dentists can continue to serve an important function as long as they keep thorough patient records.

Variety of reasons and contexts are indicating to use teeth for human identification. Victims of homicide, car accidents, workplace disasters, house fires, and other gruesome deaths are often so badly disfigured that reuniting them with their families is neither possible nor desirable [33].

Visual identification is also complicated for people who have been dead for a long time before being discovered or for people who have been submerged in water. Identifying victims of natural or man-made disasters and especially in the case of mass fatalities typically associated with aviation disasters, through their dental structures has long been of critical importance. Because fingerprints do not yet have a comprehensive database, dental identification continues to be crucial.

The idea for this article comes from the specific situations which Iraq and specially Nineveh government pass through it; such different wars and missiles and mass disasters for more than 20 years. Physician and dentist all need to know the importance of forensic odontology accordingly authors in this article aim to highlight the role of forensic dentistry and emphasize the staff knowledge about that role.

Age

The American Board of Forensic Odontology's Age Assessment Committee collaborated on these criteria and rules. The goal of these norms and rules is to improve the accuracy and reliability of forensic dental age reports [12].

If accessible, other methods of determining age, such as those based in anthropology, should be investigated. All approaches to determining a person's age have their pros and cons, and they rely on there already being adequate population-specific reference data. By analyzing the teeth and surrounding tissues scientifically, forensic dental age assessment can provide an estimate of a person's chronological age. One medical-legal use involves determining a person's age of death to help limit a search for a missing or unidentified person [34].

Gender Identification

With the help of other specialists, a forensic odontologist

can determine the gender of the remains based on dental and cranial features. Gender-specific physiognomies include tooth topographies such as crown size, shape, root length, etc. Gender also manifests itself in the form and characteristics of the skull. These are helpful features that aid forensic odontologists in determining the sex of the deceased [16, 35].

Race Identification

Researchers have looked into the possibility of using tooth crown shape as a predictor of some types of human biology. French and German anthropologists and odontologists first demonstrated racial differences in physical traits like the number of cusps on molars [23].

Physical anthropologists have traditionally classified the world's peoples into three groups: the Caucasians, the Mongols, and the Negros's.

One way to tell people of different races apart is by looking at their DNA. The dentinal fluids of a deceased person can be used for identification and species discrimination for up to a year after their death. When the only cellular material is retrieved from bone or dental pieces, gender may be determined by the presence or lack of BARR bodies or sex chromosomes [36, 37].

Lip Print

Lip prints, which are made up of the creases and grooves in the labial mucous membrane (sulci labiorum), are the subject of cheiloscopy. The outer lip surface is highly irregular, with numerous bumps and craters. Such things are as individual as fingerprints. Furrow lines are evident on the surface of a lip print. This characteristic can be used to determine a person's sex [36].

Bite Mark

Like fingerprints, x-rays, and DNA, the pattern in a bite mark is one-of-a-kind. When it's a matter of life and death, people will sometimes resort to using their teeth as a weapon. Sometimes a person's teeth are the only means they have of protecting themselves from harm. Depending on the circumstances, the bite-mark pattern can be found in food, other objects, or on the victim of an attack or homicide [38].

Upper and lower dental arches, as well as the biting edges of the front teeth, are thought to be one of a kind for each person. The timing of when the front and back teeth come in plays a major role. By comparing the resulting dental configuration to other bite marks, we can estimate the likelihood that a specific person left their "calling card" on an object [38].

Humans, the clothes we wear, envelopes, gum, telephone receivers, and food all fall into this category. Bites typically leave marks on the skin, but they can appear anywhere on a human being.

Identification in Mass Disasters

Natural and man-made disasters, and especially mass disasters involving aviation, have long highlighted the importance of dental identification. Dental identification in a mass disaster situation is similar to dental identification in any other setting; however, the circumstances are much more challenging. Identification of victims of a disaster can only be accomplished with the help of trained specialists and the right forensic diagnostic equipment.

As a vital member of the identification team, the forensic odontologist is involved in every step of the process. It may be extremely difficult to identify victims in catastrophe scenarios due

to the high likelihood of increased destruction, fragmentation, and mutilation of human bodies [39].

In this article, the authors focus on the worker's knowledge in the FMD, reflecting their opinion in forensic odontology. The first section explores the fact that staffs are different in age, gender, qualifications, and even periods of work, mainly to cover all the variety in their job specified in FMD. Forty participants are shared in this study, forming more than half of the total number of workers, including the manager and his assistants.

Section One: From the descriptive analysis no wide difference in male to female percent, in regard to age author try to cover all the age range from less than 30 to above 50 to include the newly hired staff as well as the older one as well as different positions in the FMD from different sections to evaluate the knowledge of most of the staff. Part of them is in direct contact with the guidelines and protocols in dealing with the remains while the others are not in direct contact; they are responsible for administrative matters only and for communicating with the higher authorities in the capital.

Section Two: In Section 2, you'll find six primary questions with leading answers that show the staff's broad knowledge. Except for Question 6, respondents got it right in four of the five questions (Q1-45%, Q2-52.5%, Q4-42.5%, and Q5-82.5%), but they lied in Question 3 about the uses of forensic odontology, saying that it is only used to identify people who have already died. They are reasonably well-versed in FMD but less so in FD.

Third Section: In the third section, you'll find 30 more in-depth questions regarding FD, each with a yes/no or "I don't know" response option. Sixty-five to seventy percent of people who responded to the study agreed that a person's identity could be established using only dental records and that DNA could be recovered from teeth.

It is generally agreed that teeth may tell a lot about a person's age, gender, race, and even physical abuse, as well as their lifestyle. Forty people say they have teeth that aren't used for eating and are still alive because of accidents. A sizeable percentage of respondents (47.5%, 60%, and 57.5%, respectively) agree that the shape of their palate, the shape of their bare bodies, and the shape of their dental impression all contribute to their uniqueness as people.

Although the writers believe that a person's socioeconomic standing can be inferred from the state of their teeth, the participants are divided on whether or not this is actually the case.

Forty-five percent suggested that this topic be added to the BDS curriculum, and forty-five percent agreed that teeth are the first choice in identifying remains. A similar percentage of respondents said that neither the FMD nor any forensic dentists in Nineveh utilize teeth for identification purposes.

All respondents thought it was important for dentists in the governorate to maintain patient records. The FMD staff is competent and well-versed in the protocols and tasks assigned to FD in the process of identifying human remains.

Researches Comparison

As stated by Vij, Native Americans, Australians, and Melanesians, Indians and Eskimo people typically have huge teeth and wide crowns; Lapps and Bushmen are diminutive individuals with teeth that are relatively smaller [40].

In a study performed by Mohammed et al. (2013) evaluating the role of maxillary canines in forensic odontology (Iraq), they concluded that maxillary canines can be used in gender identification as an aid for forensic odontology [41].

Joseph et al. state that the overall accuracy of odontometric sex may be determined in 72% of cases. Moreover, both the upper and lower canines' show non-metric features that can also be considered in sexual dimorphism; the "canine" lingual surface between the medial lingual ridge and distal marginal ridge has both been sexually dimorphic. This ridge is more prominent and common in males than females [17].

According to a 2014 article by Muneer, both natural teeth and dental prostheses may withstand high temperatures and prolonged exposure to fire without deteriorating. Therefore, dentists can play a crucial role in determining the identities of people whose bodies have been severely damaged. The teeth can be used as a weapon, and if the victim is bit, they may leave clues to their identification. The forensic dentist's second main duty is analyzing bite marks. Accurate dental records are the basis for much forensic work, and the general practitioner plays a crucial role in supplying these documents [29].

Using dental X-rays, Khudhur et al. (2017) presented a biometric system for forensic human identification, concluding that dental biometrics is the most reliable technology in forensic cases [42]. This is because each person's teeth have unique characteristics that serve as an imprint.

Manikantan et al., in their 2017 review article, found that dental science has much to offer law enforcement authorities in the discovery and solution of crime via FD for people who cannot be identified visually or in any other way.

In addition to serving as a weapon, the teeth can sometimes reveal the true identity of the biter. The use of a person's tooth as the basis for positively identifying them based on their distinctive traits and characteristics has been widespread. As a result, dentists play a crucial role in maintaining patient confidentiality by keeping detailed records of patient care and sharing them with the appropriate authorities in the event of malpractice, carelessness, or child abuse fraud [43].

A 2019 review article focuses on FD and comes to the conclusion that teeth can be useful forensic evidence due to their uniqueness, stability, and comparability. The human dentition is also heterodont, meaning that the various teeth (incisors, canines, premolars, and molars) each have their own unique shape.

Occasionally, teeth will have abnormalities in their morphology, such as an additional cusp, a broken crown or root, Carabelli's cusp, peg laterals, a transposed tooth, a fused tooth, or a fusion. When other identification procedures, such as facial characteristics, fingerprints, or DNA typing, fail, as in the case of badly decomposed bodies, burned remains, mass tragedies, etc., such differences might aid forensic specialists in identifying bodies. Post-mortem dental profiles are compared with the deceased's pre-mortem dental records to determine identification [28].

Using dental forensics, Marsha stated in 2022 that between 70% and 80% of the victims of the Oklahoma City bombings might be identified; fifteen to twenty percent after Hurricane Katrina, ninety percent after the Asian Tsunami, and twenty percent following the September 11 catastrophe, to name a few.

Many dental clinics were damaged by the F5 tornado that struck Joplin, Missouri, making it impossible to retrieve records, especially paper-based ones. Premortem records from dental offices that perished but had computerized management systems and remote computer backup systems were useful [44].

The 2003 Iraq Freedom Operations provide a case study in how a widespread catastrophe might emerge in a country. According to W. Henry (2004), the Office of the Armed Forces Medical Examiner (OAFME) is still looking into a lot of cases, including those involving deaths in combat. The authors conclude that forensic dental identification is a fast and reliable method for identifying human remains. A majority (54%), but not all (16%), of identifications were made on the day of the postmortem examination [45].

Conclusion

The identification process begins with the creation of a biological profile of the unknown, which is then compared to both antemortem and postmortem data obtained from the examination of the remains. Using biometric data such as fingerprints, dental records, and to be absolutely sure of identification, scientists use techniques like DNA matching.

Several identifying characteristics of the individual can be reconstructed from an examination of the teeth and oral structures. Forensic odontology provides a quick means of identification based on dental characteristics, treatment, and pathology in the context of comparative identification. The field of forensic odontology is expanding and developing new tools, and teeth make great samples for biochemical analysis.

Although FMD in Nineveh understands the significance of FD, they are not permitted to perform routine analyses of the remains; instead, they collect samples and send them to Baghdad, the primary center of forensic medicine.

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References

- Goldman AD (1982) The scope of forensic dentistry. In: Cottone JA, Standish SM, Eds. *Outline of Forensic Dentistry*, Chicago: Yearbook Medical Publishers 15-19.
- Hinchliffe J (2011) Forensic odontology, Part 1. Dental identification. *Br Dent J* 210: 219-224.
- Williams LN (2013) An introduction to forensic dentistry. *Gen Dent* 61: 16-17.
- Monalisa H (2022) Development of a Non-Envelopment of a Non-Invasive DNA Extraction Method fraction Method from Teeth. Honors Theses. University of Mississippi 2547.
- Saxena S, Sharma P, Gupta N (2010) Experimental studies of forensic odontology to aid in the identification process. *J Forensic Dent Sci* 2: 69-76.
- Avon SL (2004) Forensic odontology: the roles and responsibilities of the dentist. *J Can Dent Assoc* 70: 453-458.
- Ambarkova V, Gali I, Vodanovi M, Bioina-Lukenda D, Brki H (2014) Dental age estimation using Demirjian and Willems methods: Cross sectional study on children from the Former Yugoslav Republic of Macedonia. *Forensic Sci Int* 234: 1-7.
- Olze A, Hertel J, Schulz R, Wierer T, Schmeling A (2012) Radiographic evaluation of Gustafson's criteria for the purpose of forensic age diagnostics. *Int J Legal* 126: 615-621.
- Demirjian A, Goldstein H, Tanner JM (1973) A new system for dental age estimation. *Hum Biol* 45: 211-227.
- Gustafson G (1950) Age determination on teeth. *J Am Dent Assoc* 41: 45-54.
- Kewal K, Tanuj K, Arun K (2015) Dental Evidence in Forensic Identification - An Overview, Methodology and Present Status. *The Open Dentistry Journal* 9: 250-256.
- Meenal V, Nikhil V, Rakhee S, Ashish S (2019) Dental age estimation methods in adult dentitions: An overview. Review Article. *Journal of Forensic Dental Sciences* 11: 57-63.
- Lu CK, Yee MCS, Ravi SB, Pandurangappa R (2017) Forensic age estimation of Chinese Malaysian adults by evaluating occlusal tooth wear using modified Kim's index. *Int J Dent* 2017: 4265753.
- Arofi K, Annisaa C, Nur A, Tito KG, Mohammad DS, et al. (2022) The Applicable Dental Age Estimation Methods for Children and Adolescents in Indonesia. *International Journal of Dentistry* 2022: 6761476.
- Kazmi S, Mânica S, Revie G, Shepherd S, Hector M (2019) Age estimation using canine pulp volumes in adults: A CBCT image analysis. *Int J Legal Med* 133: 1967 1976.
- Zorba E, Spiliopoulou C, Moraitis K (2013) Evaluation of the accuracy of different molar teeth measurements in assessing sex. *Forensic Sci Med Pathol* 9: 13-23.
- Joseph AP, Harisha RK, Mohammad PKR, Kumar VRB (2013) How reliable is sex differentiation from teeth measurements? *Oral Maxillofac Pathol J* 4: 289-292.
- Larissa C, Cardoso F, Carolina V, Lucena V, Julyana de Araújo O, et al. (2016) Odontometric analysis of molars for sex determination. *Braz J Oral Sci* 15: 35-38.
- Aspalilah Alias, Abdel Nasser Ibrahim, Siti Noorain Abu Bakar, Mohamed Swarhib Shafie, Srijit Das, et al. (2018) Anthropometric analysis of mandible: an important step for sex determination. *Clin Ter* 169: e217-e22.
- Kumar A, Akhtar MJ, Kumar B, Sinha RR, Kumar A, et al. (2018) Sex determination of human mandible in population of bihar by using metrical parameters. *Int J Med Res Prof* 4: 173-177.
- Laura MB, Lavinia CA, Codruta VT, Laura CR (2022) Cranial and Odontological Methods for Sex Estimation-A Scoping Review. *Medicina* 58: 1273.
- Dennis H, Scheila M, Ademir F (2022) Forensic Dentistry as an Analysis Tool for Sex Estimation: A Review of Current Techniques. *Research and Reports in Forensic Medical Science* 12: 25-39.
- Shivlal MR, Sudhir SR, Rahul RB, Rakhi MC, Monika K (2017) Racial Characteristics of Human Teeth. *Int J Forensic Odontol* 2: 38-42.
- Sankeertimala (2019) Racial, Occupational, and Cultural Variations in Human Teeth: Teeth as Evidence in Forensic Identification. *Int J Forensic Odontol* 4: 7-10.
- Rupinder K, Sahil S, Rajinder S (2014) A Study on occupational marks on teeth of tailors *Journal Indo-Pacific Academy of Forensic Odontology* 5: 15-21.
- Koichiro I, Midori T, Mitsumasa S, Chiaki S, Tatsuo Y (2022) Occupational Difference in Oral Health Status and Behaviors in Japanese Workers: A Literature Review. *Int J Environ Res Public Health* 19: 8081.
- Niveditha T, Janani R, Ramya R, Bharanidharan R, Ramesh Kumar A, et al. (2018) Antemortem dental records versus individual identification. *J Forensic Dent Sci* 10: 158-63.
- Pooja P, Shukla SK, Haque I (2018) Developmental dental anomalies and their potential role in establishing identity in post-mortem cases: a review. *Medico-Legal Journal* 87:

- 13-18.
29. Muneer GB, Shaheed I, Adil J (2007) Essential Guidelines for Forensic Dentistry. *Pakistan Oral & Dental Journal* 27: 7754402.
30. Duane S (2015) Forensic Odontology. *Journal of California Dental Association* 43: 293-294.
31. Faraz M, Arishiya TF, Subraya B, Ritesh GM (2022) Forensic Odontology. Copyright © 2022, StatPearls Publishing LLC. <https://www.ncbi.nlm.nih.gov/books/NBK540984/>
32. Mahmoud S, Nedal R, Adel F (2020) Public awareness of forensic odontology and willingness to enroll in a prospective dental registry: A survey conducted in Saudi Arabia. *Saudi Dental Journal* 32: 21-28.
33. Clark DH (1994) An analysis of the value of forensic odontology in ten mass disasters. *Int Dent J* 44: 241-250.
34. Asami R, Aboshi H, Iwawaki A, Ohtaka Y, Odaka K, et al. (2019) Age estimation based on the volume change in the maxillary premolar crown using micro-CT. *Leg Med* 37: 18-24.
35. Nagare SP, Chaudhari RS, Birangane RS, Parkarwar PC (2018) Sex determination in forensic identification, a review. *J Forensic Dent Sci* 10: 61-66.
36. Someda H, Gakuhari T, Akai J, Araki Y, Kadera T, et al. (2016) Trial application of oxygen and carbon isotope analysis in tooth enamel for identification of past-war victims for dis-criminating between Japanese and US soldiers. *Forensic Sci Int* 261: 1-5.
37. Kader F, Ghai M (2015) DNA methylation and application in forensic sciences. *Forensic Sci Int* 249: 255-265.
38. Maji A, Khaitan T, Sinha R, Sarkar S, Verma P, et al. (2018) A Novel Computer-Assisted Method of Bite Mark Analysis for Gender Determination. *J Environ Public Health* 2018: 7130876.
39. Dutta SR, Singh P, Passi D, Varghese D, Sharma S (2016) The Role of Dentistry in Disaster Management and Victim Identification: An Overview of Challenges in Indo-Nepal Scenario. *J Maxillofac Oral Surg* 15: 442-448.
40. Vij K (2011) Text book of forensic medicine and toxicology-principles and practice; 5th ed. New Delhi: Reed Elsevier India Private Limited- A Division of Elsevier 2011. <https://notesmed.com/wp-content/uploads/2021/05/Textbook-of-Forensic-medicine-and-toxicology-5th-edition-by-Krishan-Vij.pdf>
41. Mohammed N, Haider M, Abeer B, Sawsan M, Braa' Saheb M (2013) The role of maxillary canines in forensic odontology. *Pedodontics, Orthodontics and Preventive Dentistry* 109. *J Bagh College Dentistry* 25: 1-5.
42. Khudhur S, Croock MS (2017) Dental X-Ray Based Human Identification System for Forensic. *Engineering and Technology Journal* 35: 49-60.
43. Manikantan NS, Dhanya B (2017) Forensic odontology and its Applications. *International Journal of Current Research* 9: 63627-63630.
44. Marsha A Voelker (2022) Forensic Odontology. Crest® + Oral-B® <https://www.dentalcare.com/en-us/marsha-a-voelker>
45. Henry WE, Foss R (2004) Dental forensic support of operation Iraqi Freedom. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology* 98: 207.

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