



## **Forensic Odontology Knowledge Analysis among Undergraduates Dental Students in Saudi Arabia**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors contributed to data analysis, drafting and revising the article, gave final approval of the version to be published and agree to be accountable for all aspects of the work. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aims:** This study aims to measure the knowledge and awareness level towards Forensic odontology and Bite mark analysis among Dental students in Saudi Arabia.

**Study Design:** This is an observational cross-sectional study.

**Place and Duration of Study:** Conducted in Saudi Arabia from July to August 2021.

**Methodology:** The study's population consisted of Dental undergraduate in Saudi Arabia. Our Inclusion criteria: Male and Female, Private or Public, Dental Intern and dental students in Saudi national or non-Saudi. And Agree to Participate. The sample size was estimated using the Qualtrics calculator with a confidence level of 95%; a sample size of 386. Google Form was used as study tools the questionnaire contained 8 Questions. The First question includes information

about years of study, the second question Name the College of a student, and other questions include questions on knowledge about Forensic odontology and Bite Mark analysis, and would they wish this specialization would be Available to us in Saudi Arabia

**Results:** A total of 386 participants completed the survey questionnaire. The results showed that the 75.4% of the study participants were females compared to 24.6% of them were males. it can be noted that approximately 75% of the study participants were in advance levels of their education (fourth year or after) compared to 25% of students were at inception phase of their study.

**Conclusion:** Every dental student must have knowledge of forensic dentistry because it is important to preserve the rights and assist the legal and security authorities in identifying victims and suspects and gaining awareness to accurately.

*Keywords: Bite Mark; dental undergraduate; forensic odontology; Saudi Arabia.*

## ABBREVIATION

ADA : American Dental Association

## 1. INTRODUCTION

Forensic odontology is a dental specialty that has contributed to solve a great many criminal cases [1]. Over the last century, forensic dentistry has evolved into a major part of forensic medicine. This has been possible as the efforts of many scientists to the efforts of individuals such as Amoedo, Gustafson, Sognaes, Keiser-Nielsen, Suzuki, Whittaker, and Clement, name a few. They established that forensic dentistry plays a critical role in the identification of remaining human teeth remains [2]. A forensic odontologist is a trained dentist who can produce evidence by examining the characteristics of humans' lips, teeth, jaws and palates. Also concerning age, gender, race, jobs, socioeconomic status [1]. The most difficult challenge in forensic dentistry is identifying, extracting, and examining the bite mark [3]. Bite mark analysis and contrast is a difficult task [4]. The judicial system can use bite mark analysis as evidence and as part of the legal process, members of the justice system often consult with odontologists during a criminal investigation to protect living victims, and/or to locate dead bodies. Human biometrics are methods that help to recognize individuals, such as fingerprints, palm veins, DNA, and iris [1]. Forensic odontology also helps to identify victims of in mass disasters which involve identification of the victims in complex stages of corporal destruction such as airline accidents, earthquakes or train accidents [5]. Bite marks can identify on both the living and the dead and may be antemortem or post-mortem injuries [2]. bite mark analysis gives important information in different cases [6]. traditional bite mark analysis procedures depend on examining photographic photographs in which a bite is matched to a

model of the suspect's teeth. The condition and orientation of the photos of the bite mark and the accuracy of the suspect's dentition impression are of significant importance to the forensic odontologist [4]. To collect the evidence in bite mark analysis we Take evidence from the victim and start a collection of evidence from the suspect.

**Collection of evidence from the victim:** The following important details will be registered for both the living and the deceased victims: Demographics, location of the bite mark, shape of the bite marks, color & size of the mark and Type of injury [4]. An important ingredient of dental forensic examination is photography. Should be take numerous photographs of the injury immediately. Because photographs can reveal the maxillary and mandibular teeth, their characteristics, abnormalities, and dental treatment, it is frequently requested by magistrates and investigators [7]. shots would include in color and black and white, on and off camera flash, an overall body shot showing the location of the injury, If the bite is on a movable anatomic location, then several body positions should be adopted in order to assess the effect of movement. and all the photographs should be taken with the camera at 90° (perpendicular) to the injury [4]. By swabbing the bite site, DNA present in salivary trace evidence can be recovered. The double swab procedure entails moistening the region with a sterile saline swab and then removing the moisture with a second dry wipe before sending both swabs for analysis [7]. according to studies the amount of saliva is about 0.3ml that deposited with a bite mark and distributed over a large area of 20 cm. After the bite is inflicted and before the area is cleaned the Swab should be taken as soon as possible. Then, using the other analysis such as salivary trace evidence of biter's exfoliated epithelial cells, DNA fingerprinting. it is necessary to make

an impression if the bite marks have penetrated the skin by ordinary plaster of Paris or dental stone which is used initially for the purpose., rubber-base and silicone-base impression compounds are preferred now-a-days. there are two methods for making impressions: Method I: Pour the material covering the bite area. Place wire gauze and inject additional material over it. Method II: A special tray is constructed using cold cure confining to the shape of bite mark and impression is made. Master casts must be poured with type IV stone and duplicate casts should also be made. Either visible light cure or epoxy resin clear material can be used to make stable rigid model. we can collect the evidence from the victim by we can collect the evidence from the victim by finger print lifting tape and lift the non-perforating bite marks after brushing the bite mark with finger print lifting powder.

**Collection of evidence from the suspect:** Inanimate items, food, and things on which test bites are taken are all meticulously shot. Hard and soft tissue components, TMJ health, and the facial asymmetry muscle zone are all examined during an extra oral examination. Two impressions of upper and lower arch with specified material called ADA (American Dental Association) and followed by getting dental casts type II stone called master cast. Duplicate casts can be obtained from master cast [7]. One the interesting development in gathering bite mark evidence from the body victims is the creation of bite mark 3D images. This is achieved with specialist software [4].

**Bite Mark Analysis and Identification:** The basic of forensic odontology is the accuracy of analysis of a living person by characteristics of the teeth and jaws and individual traits. The bite marks found on a person can be used to identify the criminal One can accurately match the bite marks to the indicted biter's dentition. In addition to, to provide the individual information about the suspect, the most important thing in bite mark analysis is to identify patterned injury as a human bite mark followed by pattern analysis of the bite mark. or an offender and relate the person who is involved in the crime Bite marks that can be used in comparisons with high evidence value with the suspects' teeth will include marks from each tooth that record different characters. Human bites appear as an arch on the skin is indicates to surface abrasion on the skin surface or subsurface hemorrhage. The most common type of bite mark is Contusions. It can be determined from the type of bleeding beneath the skin

whether the victim was alive or dead at the time the bite mark was delivered. It is important to have individual characteristics in the bite mark to identify the criminal [7]. Time delay usually affects bite analysis. so, the fastest forensic team took the record it gives a better analysis [5]. the process of bite analysis is complex, it's done by forensic odontologists team, it's not only the role of forensic odontologists but also dental specialists have a significant role to play in maintaining clear dental records and including all the information available to allow legal authorities to detect and identify unknown persons [6]. Dental analysis and records play an important role in identification a grossly decomposed dead body that is difficult to identify visually. When this occurs, a variety of methods of dental identification are used. This is due to the capability of dental tissues to withstand high temperature, humidity and pressure [8]. the primary purpose of maintaining dental records is to deliver quality patient care and follow-up. Because the capability of dental tissues to withstand high pressure, humidity and temperature a variety of methods of dental identification are used [8] the primary purpose of record in dentistry is to deliver quality care and follow-up for the patient [9]. So, each dentist should know his or her responsibility toward forensic odontology, because understanding the forensic field give the dentist another reason to keep a legally acceptable record and help legal authorities to identify the victims and Suspect [6].

## 2. MATERIALS AND METHODS

This is an observational cross-sectional study conducted In Saudi Arabia, contain a structured questionnaire that was developed by authors. The study carried out from July to August 2021. The study's population consisted of Undergraduate dental students in Saudi Arabia. The sample criteria include: Male and Female, Private or Public, Dental Intern and dental students in Saudi national or non-Saudi. The sample size was estimated using the Qualtrics calculator with a confidence level of 95%; a sample size of 385. Google Form was used as study tools the questionnaire contained 8 Questions. The First question includes information about years of study, the second question Name the College of a student, and other questions include questions on knowledge about Forensic odontology and Bite Mark analysis, and would they wish this specialization would be Available to us in Saudi Arabia. Dental students collected the information using the

google form link. The survey instrument was a questionnaire in the English language, containing questions regarding Forensic odontology and Bite Mark analysis knowledge. Data collection was done in the form of the participants' responses to the questions. The questionnaire included demographic features Dental students from all years of study plus internship. The participants were asked knowledge about forensic odontology and importance of the bite Mark analysis in forensic dentistry to discovering the identity of persons and criminals, and awareness of responders about this. Data was data were analyzed by Statistical Package of Social Science Software (SPSS) program, version 20 (IBM SPSS Statistics for Windows, Version 20.0. Armonk, NY: IBM Corp.).

### 3. RESULTS

A total of 386 participants completed the survey questionnaire. The results showed that the 75.4% of the study participants were females compared to 24.6% of them were males. Moreover, the majority of the study participants were Saudi compared to 21.5% of the study respondents were non-Saudi. In terms of education level, it can be noted that approximately 75% of the study participants were in advance levels of their education (fourth year or after) compared to 25% of students were at inception phase of their study. The results also

indicated that around half of students live in Southern and Eastern. Table 1 presents the sociodemographic characteristics of the study participants.

The responses to individual knowledge statements are listed in Table 2. 55.2% of the study participants heard about the forensic odontology when they were asked about the forensic odontology compared to 44.8% of students had no idea about this branch of dentistry. It is apparent from this table that two-third of the study participants believed that this branch of dentistry applies to living person whilst 46.4% of student dentist thought this specialty can be applied to dead person only. However, it can be seen from the data in Table 2 that approximately half of the study respondents answered this specialty of dentistry can be applied for dead and lived individuals. The most interesting aspect of this table is that when student dentists were asked about strategies to identify person, more than half of the study participants believed that dentists can employed variety of approached to identify person (56.0%). Moreover, the second common method to identify person is that handprint (30.3%). However, other approaches were determined as least common methods to be used in identifying person (Bite mark 6%; Lip print 4.7%; body weight 2.3%; and Skin color 0.8%)

**Table 1. Sociodemographic characteristics of participants (n = 386)**

Characteristics	Frequency	Percentage
<b>Gender</b>		
Male	95	24.6%
Female	291	75.4%
<b>Nationality</b>		
Saudi	303	78.5%
Non-Saudi	83	21.5%
<b>Education Level</b>		
1st year	5	1.3%
2nd year	21	5.4%
3rd year	64	16.6%
4th year	79	20.5%
5th year	57	14.8%
6th year	75	19.4%
Intern	85	22.0%
<b>Which city?</b>		
Northern region	29	7.5%
Southern region	72	18.7%
Western region	187	48.4%
Eastern region	70	18.1%
Central region	28	7.3%

**Table 2. Study participants knowledge about forensic odontology (n = 386)**

Items	Frequency	Percent
<b>Have you heard about forensic odontology?</b>		
Yes	213	55.2%
No	173	44.8%
<b>What do you think about this speciality?</b>		
Dead persons only	179	46.4%
Living persons only	20	61.7%
Both	187	48.4%
<b>What a method to identify a person?</b>		
Bite mark	23	6%
Body weight	9	2.3%
Lip print	18	4.7%
Handprint	117	30.3%
Skin color	3	0.8%
Mixed	217	56.0%
<b>Dental professionals have a major role to play for help toward the forensic odontologist, do you know how?</b>		
By keeping all the information and history in details for the patient	20	5.2%
By keeping all the records and radiograph for the patient	7	1.8%
Preserving was mentioned above from the damage and keeping it in good condition so the forensic odontologist can benefit from it	8	2.1%
All of the above	351	90.9%

The results, as shown in Table 3, indicate that 60.1% of respondents reflected those teeth is one of methods can be used to identify person whereas 39.9% disagreed that teeth are not reliable approach to identify person. More than half of the study participants (51%) agreed that DNA is an accurate and sensitive means of identifying person compared to 49% of students reported that DNA can be used to identify person. Furthermore, 51% of student expressed agreement that each person has a unique lip print. When asked if forensic odontology estimates the age of an individual from its teeth, just over the half of participants (59%) responded a person age can be identified by teeth. When asked about the accuracy and sensitivity of forensic odontology to identify the sex by the tooth and jaw shape, 52.6% of participants responded positively. Finally, two-thirds of the surveyed participants (74.6%) said that they had no ideas for a method to take bite marks and how to analyze it.

The results of relationship appeared that females' students heard more commonly about forensic odontology compared to males' students. The level of significance was ( $p < 0.05$ ). In addition, Saudi students indicate that they heard about this specialty of dentistry compared

to non-Saudi students. Furthermore, students in advance levels were well informed about forensic odontology compared to beginner students. However, there is no statistical relationship between demographic data of the study participants and a major role to play for help toward the forensic odontologist, as showed in Table 4.

#### 4. DISCUSSION

This study examines the dental student's knowledge and bite mark analysis of forensic odontology. The results revealed that the majority of the study participants informed about the forensic odontology specialty. This result accords with our earlier observations, which showed that the majority of undergraduate dental students have heard about the forensic odontology [10]. In addition, this finding broadly supports the work of other studies in this area linking dental specialty and knowledge of forensic odontology which highlighted that undergraduate student are well informed about the new branch of deontology. Additionally, knowledge about bite marks was found to be adequate among postgraduates than the undergraduates in the present study, which is similar to studies by [11]. Other studies revealed

that the knowledge about bite marks was not known to 18% of the dental practitioners [12]. These results concur with those reported in [13] who stated that 87% of dental undergraduate students knew the meaning of forensic odontology, forensic odontology a part of forensic medicine, and role of forensic odontology in the criminal analysis. This study supports evidence from previous observations which mentioned that the students' knowledge on forensic odontology and what it deals with, was significant with the year of study where final year students are more aware about forensic odontology (P value = 0.00(<0.05)) which is statistically significant. This concludes that most of the participants have knowledge and awareness on the role of forensic dentistry among dental undergraduates. Whereas, 2016 Ali, Sardar [14] indicated that 83.7% participants had no formal training in the field of forensic odontology. 84.8% concurred that their present knowledge and awareness about forensic odontology is not adequate.

Furthermore, the current study results indicated that more than of the study participants showed that forensic odontology is mainly used for lived person whilst the rest of participants believed that it is used to dead person. It is encouraging to compare this figure with that found by 2016Ali,

Sardar [14] who found that 87% respondents agreed that dental records are useful in identifying the deceased and crime suspect.

Interestingly, the main method can be used to identify person is a combination of technique which includes bite mark, handprint and lip print which are account for 40% of explanation. This is consistent with other studies which appears that 64.7% of the study population felt that forensic experts are able to determine the gender of an unidentified individual whereas the remaining group of population disagreed with the statements that forensic odontology can be used to differentiate person [15].

The results of the role of forensic odontology corroborate the findings of a great deal of the previous that forensic odontology is used in dentist clinic to record the patient information. Consistent with the literature, this research found that participants who reported using forensic odontology 9.9% maintained their dental records, of which only 17.4% maintained dental records for more than 3 years while 53.3% maintained for less than 3 years. 54 % had no awareness how to identify bite mark [14]. However, other studies reported a contrasted findings which demonstrated that sixty-two percent of the dentists were maintaining no records at all [16].

**Table 3. Study Participants Responses on Bite Mark analysis (n = 386)**

<b>Subscale</b>	<b>Frequency</b>	<b>Percent</b>
<b>Can we identify a person by the teeth?</b>		
Yes		60.1%
No	232	39.9%
	154	
<b>Can we know the DNA of person from the teeth?</b>		
Yes		51%
No	197	49%
	189	
<b>Is there a lip print for each person?</b>		
Yes	197	51%
No	189	49%
<b>Is it possible to determine the age from the teeth?</b>		
Yes		
No	228	59.1%
	158	49.9%
<b>Can we identify the sex by the tooth and jaw shape?</b>		
Yes	203	52.6%
No	183	47.4%
<b>Do you have an idea for a method to take bite marks and how to analyze it?</b>		
Yes	98	25.4%
No	288	74.6%

**Table 4. Relationships between level of knowledge and participant characteristics**

Subscale	Gender		$\chi^2$	p	Nationality		$\chi^2$	p	Education level		$\chi^2$	p	Living city		$\chi^2$	p
	M	F			S	NS			Beginner	Advanced			Western	Others		
Have you heard about forensic odontology? (Correct)	51	162	2.3	0.02	174	39	3.47	0.02	97	78	1.68	0.01	70	85	4.21	0.33
Dental professionals have a major role to play for help toward the forensic odontologist, do you know how? (By keeping all the information and history in details for the patient)	9	11	4.2	0.41	13	7	4.02	0.32	73	103	2.36	0.01	84	91	1.08	0.21

Another point evolved from the study is that 60% of undergraduate dental students believed that bite analysis can be used by dentist to identify person. These results are agreed with those reported elsewhere which reflected that dentist students attributed the use of forensic odontology in determining person [17].

The officially authorized settlements of domains where a deceased record is required is a further motive. For issuance of death certificate, a confirmation of individuality is required. It is due to these causes, dental identification acquires a prime liability for detecting remains when changes in postmortem occurs, damage to traumatic tissue occurs or not having fingerprint verifications which invalidate the use of visual or fingerprinted [15].

Similarly, the results of the present study revealed that half of the study participants agreed that DNA of person can be identified from teeth. This result is supported by previous findings which highlighted that DNA as accurate and sensitive method of comparison and teeth as source of DNA was 128 (66%) and 122 (63%) [13]. Moreover, 2016Ali, Sardar [14] indicated that 54.4% of undergraduate dental student believe that DNA comparison method can be identified from a person tooth.

The current study findings reiterated that each person has a lip print. Bite mark analysis helps in identification of an individual and its age. Teeth may be used as a weapon and may leave the mark of a biter. Bite mark registration plays a pivotal role in the forensic field. In our study, 59.1% were aware of bite mark patterns to identify age, 52.6% agreed they would identify the sex by the tooth and jaw shape. This result is consistent with those reported in a study of Bhargava 2012, Bhargava [18] who supported the role of teeth in determining person gender and age.

In conclusion, this study reveals that there was a good knowledge and awareness of forensic odontology among the participants and its utilization. In addition, it should be more focused on the bite mark analysis as core topic in dental curriculum at undergraduates' levels.

## 5. CONCLUSION

Every dental student must have knowledge of forensic dentistry because it is important to preserve the rights and assist the legal and

security authorities in identifying victims and suspects and gaining awareness to accurately. Based on the study that was conducted and its results, The majority of students have the knowledge and awareness of forensic dentistry, and since there are students who need guidance and increase their knowledge about forensic dentistry and the bite mark, attention and urge should be taking during conferences, research activities, and courses to clarify what is forensic dentistry and recognize their duty toward it and the method of bite mark and how to help the dental record reveal the identity through the complete and correct registration of the record all the necessary information used by the security and legal authorities in a way that preserves person's identity and right.

## CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the authors.

## ETHICAL APPROVAL

This research was approved by the Institutional Review Board at AlFarabi dental college in Jeddah, Saudi Arabia, KSA (reference: IRB-20-08/4).

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## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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