




# Teaching of Forensic Dentistry in Khartoum, Sudan

Sarah Hag Ali <sup>1,\*</sup>, Ademir Franco <sup>1,2</sup> , Emilio Nuzzolese <sup>3</sup>  and Scheila Mânica <sup>1</sup> 

<sup>1</sup> Centre for Forensic and Legal Medicine and Dentistry, University of Dundee, Scotland DD1 4HN, UK; franco.gat@gmail.com (A.F.); s.manica@dundee.ac.uk (S.M.)

<sup>2</sup> Division of Forensic Dentistry, Faculdade São Leopoldo Mandic, Campinas 13045-755, SP, Brazil

<sup>3</sup> Section of Legal Medicine, Department of Public Health and Pediatric Sciences, University of Turin, 10126 Torino, Italy; emilio.nuzzolese@unito.it

\* Correspondence: sarahagali@hotmail.com

**Abstract:** Background: Dental professionals assist with legal and criminal matters through the practice of forensic dentistry which has evolved over the past century and is now a crucial component of undergraduate dental education in many nations. The need for formal training in the subject and its inclusion in dental curricula were acknowledged and addressed in the 1960s and 1970s. Aims: This study aimed to investigate the teaching of forensic dentistry in dental universities of Khartoum, Sudan, and to propose certain topics and teaching criteria to be standardized in forensic dentistry teaching in Sudan. Materials and methods: An observational, descriptive study was conducted, involving all undergraduate dental institutions in Khartoum, Sudan. Institutional websites were searched using the Google search engine to obtain the dental program curricula in English. The curricula were then analyzed to identify the presence of forensic odontology/dentistry teaching. Results: Of the 19 universities included in the study, five (26.3%) teach forensic dentistry in their undergraduate curricula, whereas 12 (63.1%) do not. Two universities (10.6%) indicated the presence of forensic dentistry teaching in their curricula but did not provide actual instruction. The teaching of forensic dentistry mainly occurred during the second, third, and fourth years of the dental program. Three universities considered it an independent subject, while two universities incorporated it into oral and maxillofacial pathology. Four universities provided lectures only, while one university combined lectures and practical sessions. Qualified forensic dentists taught the subject in four universities, while one university had general dentists as instructors. The main topics delivered are: (1) introduction to forensics, (2) human identification, (3) dental age estimation, (4) interpretation of bitemarks, (5) DNA in forensics, and (6) child abuse. Conclusion: Forensic dentistry training is currently undervalued in Sudan due to various limitations. It is recommended that all dental schools in Sudan offer opportunities for students to learn and become acquainted with forensic dentistry as part of their dental programs. The Sudanese Dental Council should establish formal coordination with academic institutions and experienced forensic dentists to ensure the quality and relevance of the proposed modular course within the educational system. Finally, additional topics including dental record-keeping and dental malpractice are suggested for inclusion in the current modules.



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## 1. Introduction

Forensic dentistry is the intersection of the dental and legal professions [1]. The discipline deals with the examination, handling, and presentation of dental evidence for the legal system [2]. In many nations, forensic dentistry has become a valuable component of forensic investigations due to continued education and demand over the last half-century [3].

The methods used in forensic dentistry have evolved through the evolution of humankind [4]. In a mass casualty crisis, forensic dentistry is the most typical role that dentistry plays [5]. Dentists may be contacted for post-mortem dental identification, disaster

victim identification, age assessment, and criminal cases involving bite-mark evidence [3]. Dentists are involved with the recognition of human abuse and the acknowledgment of the dental team's role in reporting abuse, as well as diagnostic and therapeutic examination and the evaluation of damage to the jaws, teeth, and oral soft tissues [6]. Moreover, they are expected to present dental evidence for the legal system; hence, they must have solid medico-legal training, which will allow them to perform adequately in medico-legal matters or as expert witnesses in court [7]. A dentist having forensic dentistry expertise plays an important role in the realms of justice, human rights, and humanitarianism, emphasizing the importance of this field [8]. Although there is a growing interest in forensic dentistry around the world, the subject still has a low workload and a small number of trained professors. One of the primary reasons for the lack of familiarity with the forensic dentistry discipline is that it is not included in the necessary material of undergraduate dentistry courses, and there are few graduate courses in this field [6]. It is unfortunate that this field is not recognized by some dental schools. This longstanding and worldwide lack of attention to the necessity of forensic odontology in universities will result in poor forensic odontology awareness among practicing dentists [9].

Young experts will determine the future of forensic dentistry; therefore, it is important to gain an in-depth understanding of their engagement with the topic. While there has been previous research [7,10] on the present state of forensic dentistry education amongst undergraduate and postgraduate students in several countries, none has focused specifically on studying the educational level of the discipline trainers. Discipline trainers are expected to have a thorough knowledge and understanding of their area of specialty to be able to deliver the necessary aspects of the topic that are essential for every dentist.

In Africa, there are several institutions providing dentistry at an undergraduate level. Khartoum, being one of the most populated cities in the African continent, is estimated to host 19.0% of the total population of Sudan, which reached an estimate of forty-five million people in 2021 [11]. It is unknown whether forensic odontology is included in any dental disciplines in Sudan. Furthermore, as forensic dentistry has been particularly prominent in the past years, being highlighted by recent events and television shows that have brought it to the public's attention, it is essential to build on previous work and expand the scholarly knowledge of this contemporary science.

This study is the first to investigate forensic dentistry education in Sudan and aimed to investigate the current situation in teaching forensic dentistry in universities of Khartoum, Sudan, and to propose certain topics and teaching criteria to gain forensic dentistry training experience. The objectives of this research are to identify the universities in Khartoum that provide forensic dentistry training at an undergraduate level, to identify and examine the content related to forensic dentistry training that is provided to dental students of Khartoum, Sudan at an undergraduate level, to assess the educational level of forensic dentistry trainers, and finally, to compare the teaching of forensic dentistry in different geographical areas of Khartoum. Reviewing what the dental schools of Khartoum are adapting to their educational system will inspire other schools to start planning and consider implementing a forensic dental education course [5].

## 2. Materials and Methods

This was an observational, descriptive study based on data available on the internet. A search for higher education institutions in Khartoum was performed by a single observer using Google search engine (Google LLC, Mountain View, CA, USA) between April 2022 and July 2022. All private and governmental institutions that provide dentistry at the undergraduate level in Khartoum, Sudan, were included. Higher education institutions with no official websites were naturally not included in this study.

The institutions' websites were searched for programs in forensic odontology/dentistry being taught at an undergraduate level. The most updated versions of the curricula (in the English language) to be evaluated were extracted from the involved institutions' official websites (Table 1). The tools used for data extraction were based on previous studies [12].

Quantitative and qualitative analyses of the data were performed using Microsoft Word version 2111. The quantitative information consisted of: (1) the number of higher education institutions, (2) the number of private higher education institutions, (3) the number of governmental higher education institutions, (4) the number of higher education institutions with an undergraduate program in dentistry, (5) the number of higher education institutions with curricula and (6) the number of higher education institutions with an undergraduate program in dentistry that included forensic dentistry. For higher education institutions that had websites but did not have their curricula available online, a collection of the curricula was performed via institutional contact or through alumni. The qualitative information consisted of (1) the length of the undergraduate course, (2) forensic-dentistry related disciplines, (3) the length of the forensic dentistry course, (4) the number of credit hours related to forensic dentistry, (5) the number of lectures per week, (6) the years in which forensic dentistry is taught, (7) the number of the course trainers, (8) their educational background, and (9) their nationalities (Table 2).

**Table 1.** The higher education institutions and ways in which the curricula were derived.

#	Institution	Website/Alumni
1.	University Of Medical Sciences And Technology (UMST)	<a href="https://www.umst-edu.sd">https://www.umst-edu.sd</a> (accessed on 16 January 2024) [13]
2.	University Of Science & Technology (UST)	<a href="https://ust.edu.sd/dentistry-college/">https://ust.edu.sd/dentistry-college/</a> (accessed on 16 January 2024) [14]
3.	Sudan International University	<a href="http://www.siu-sd.com/default.aspx">http://www.siu-sd.com/default.aspx</a> (accessed on 16 January 2024) [15]
4.	Ribat University	<a href="http://ribat.edu.sd/homepage">http://ribat.edu.sd/homepage</a> (accessed on 16 January 2024) [16]
5.	El Razi University	alumni
6.	University Of Khartoum	<a href="https://www.uofk.edu/en/">https://www.uofk.edu/en/</a> (accessed on 16 January 2024) [17]
7.	Al-Neelain University	<a href="https://www.neelain.edu.sd/">https://www.neelain.edu.sd/</a> (accessed on 16 January 2024) [18]
8.	International University Of Africa	<a href="https://en.iua.edu.sd/">https://en.iua.edu.sd/</a> (accessed on 16 January 2024) [19]
9.	Nile University	<a href="http://nileuniversity-edu.com">http://nileuniversity-edu.com</a> (accessed on 16 January 2024) [20]
10.	National University	<a href="https://nu.edu.sd/">https://nu.edu.sd/</a> (accessed on 16 January 2024) [21]
11.	Nahda College	<a href="https://nahda.edu.sd/ar/">https://nahda.edu.sd/ar/</a> (accessed on 16 January 2024) [22]
12.	Ibn Sina University	<a href="http://isu.edu.sd/">http://isu.edu.sd/</a> (accessed on 16 January 2024) [23]
13.	Al-Yarmouk College	<a href="http://www.yarmoukcollege.edu.sd/">http://www.yarmoukcollege.edu.sd/</a> (accessed on 16 January 2024) [24]
14.	Hayatt University College	<a href="http://www.hayattedu.com/">http://www.hayattedu.com/</a> (accessed on 16 January 2024) [25]
15.	Karary University	<a href="http://www.karary.edu.sd/">http://www.karary.edu.sd/</a> (accessed on 16 January 2024) [26]
16.	Fajr College For Science And Technology	<a href="https://fajr.edu.sd/index.php/ar/">https://fajr.edu.sd/index.php/ar/</a> (accessed on 16 January 2024) [27]
17.	Napata College	<a href="http://napata.net/en/">http://napata.net/en/</a> (accessed on 16 January 2024) [28]
18.	Bayan University	<a href="http://bayantech.edu.sd/">http://bayantech.edu.sd/</a> (accessed on 16 January 2024) [29]
19.	University Of Garden City	<a href="http://www.ugc.edu.sd/">http://www.ugc.edu.sd/</a> (accessed on 16 January 2024) [30]
20.	Imperial College University	No information found
21.	Assafa College	No information found

**Table 2.** Extraction tools used for studying the data.

1.	Data studied
2.	Length of the undergraduate course
3.	FD <sup>1</sup> related disciplines taught
4.	Length of FD <sup>1</sup> course
5.	Number of credit hours related to FD <sup>1</sup>

**Table 2.** *Cont.*

6.	Number of lectures/sessions per week
7.	Years in which FD <sup>1</sup> is taught
8.	Number of trainers for the FD <sup>1</sup> course
9.	Qualifications of FD <sup>1</sup> trainers
10.	Nationalities of FD1 trainers

<sup>1</sup> FD: Forensic Dentistry.

To maximize the benefits of the research and allow for qualitative changes in society, a report was sent to all dental institutions involved with the study.

### 3. Results

A total of 36 higher institutions were found in Khartoum, the Capital of Sudan, as being chartered, licensed, or accredited by the Sudanese higher education-related organizations: the Ministry of Higher Education, accreditation agencies, university associations, rectors' conferences or councils, qualification authorities, and other higher education-related organizations in Sudan with local, regional, national, or international coverage and focus. Of the 36 universities, 25 are private higher institutions and 11 are governmental higher institutions. 21 institutions provide a program in dentistry at an undergraduate level, of which 18 are private ones and three are governmental ones. Six curricula were derived from the institutions' official websites. The dental curricula extracted from all the universities provide the total number of semesters for the dental program. Seven of the higher education institutions with an undergraduate program in dentistry show evidence of forensic dentistry teaching in their program curricula and 12 do not show evidence of forensic dentistry teaching. Six of the seven are based in Khartoum proper, and one institution is based in Bahri. No institutions are based in Omdurman. The institutions that show evidence of forensic dentistry, as well as those that do not, can be seen in Table 3. It was found that in two of the seven schools (28.6%) that showed evidence of forensic dentistry teaching in their curricula, the subject is not being taught to dental students. Four of the five (80%) institutions that teach the subject are privately run. Table 4 shows a detailed description of the disciplines related to forensic dentistry that are taught at the five institutions. The most prevalent are: (1) introduction to forensics (overview), (2) human identification, (3) dental age estimation, (4) interpretation of bite marks, (5) DNA in forensics, and (6) child abuse (Figure 1).

**Table 3.** Evidence of forensic dentistry teaching within dental schools.

Higher Institutions	
+	–
University of Medical Sciences and Technology (UMST)	University of Science and Technology (UST)
El Razi University	Sudan International University
University of Khartoum	National Ribat University
International University of Africa	Al Neelain University
Nile University	Nahda College
National University	Ibn Sina University
Al-Yarmouk College	University of Garden City
	Hayatt University College
	Karary University
	Fajr College For Science and Technology
	Napata College
	Bayan University

+: evidence found on forensic dentistry teaching. –: no evidence found on forensic dentistry teaching.

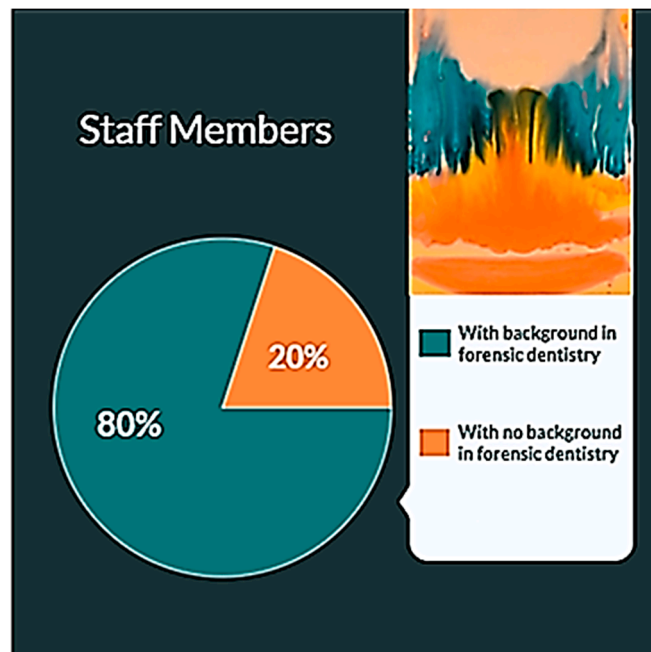
**Table 4.** Forensic dentistry disciplines being taught.

Higher Institution	FD Teaching Topics
1. Elrazi University	<ol style="list-style-type: none"> <li>1. The medical council act</li> <li>2. Drugs, and poisons act and other relevant laws</li> <li>3. Medical ethics. Hippocrates oath, doctor's oath, and the Helsinki declaration for human rights</li> <li>4. Legal responsibility and contract responsibility</li> <li>5. Medical negligence</li> <li>6. Interpretation of bite marks (to discuss personal identification)</li> <li>7. Importance of teeth marks in apple, cheese, or body surface</li> <li>8. Describe the size of bite marks is it of an adult, child, or animal</li> <li>9. How to investigate like photographs, swapping, and impressions</li> <li>10. Dead person identification from dentition in case of air crashes</li> <li>11. Saliva uses as legal evidence</li> <li>12. Identify unknown persons by age, sex, and race</li> <li>13. Age estimation by dentition</li> <li>14. How to confirm or exclude personal identity against antemortem dental records</li> </ol>
2. International University of Africa	<ol style="list-style-type: none"> <li>1. Introduction to forensic dentistry</li> <li>2. Dental age estimation in adults</li> <li>3. Dental age estimation in children</li> <li>4. Dental records in forensic dentistry</li> <li>5. Role of radiology in forensic dentistry</li> <li>6. Forensic human identification</li> <li>7. Forensic dental identification</li> <li>8. Dental autopsy</li> <li>9. Management of mass fatality cases and dental victim identification</li> <li>10. Uses of DNA in forensic dentistry</li> <li>11. Forensic and medical photography</li> <li>12. Bite mark analysis and management</li> <li>13. Child abuse and dental neglect</li> <li>14. Skull analysis and facial reconstruction</li> <li>15. Evaluation of malpractices in dentistry</li> <li>16. Courtroom tactics/legal documentation/ethics and morals</li> </ol>
3. Nile University	<ol style="list-style-type: none"> <li>1. Introduction to forensic dentistry</li> <li>2. Mass disaster</li> <li>3. Child abuse</li> <li>4. Drug abuse</li> <li>5. Sex and ethnic (racial) differences in tooth morphology and histological age estimation</li> <li>6. Determination of sex &amp; blood groups from buccal mucosa/saliva</li> <li>7. Dental DNA methods, Bite marks, rugae patterns &amp; lip prints</li> <li>8. Dental importance of poisons and corrosives</li> <li>9. Overview of forensic medicine and toxicology.</li> </ol>
4. National University	<ol style="list-style-type: none"> <li>1. Introduction to forensics</li> <li>2. Postmortem changes</li> <li>3. Forensic toxicology</li> <li>4. child abuse</li> <li>5. Bitemark analysis</li> <li>6. Human identification</li> <li>7. Lip prints</li> <li>8. Age estimation.</li> </ol>
5. Al-Yarmouk College	<ol style="list-style-type: none"> <li>1. Introduction to forensic dentistry</li> <li>2. Dental records in forensic dentistry</li> <li>3. Age estimation in adults and children</li> <li>4. Bitemark analysis</li> <li>5. Human identification</li> <li>6. Uses of DNA in forensic dentistry</li> <li>7. Child abuse</li> <li>8. Dental neglect</li> </ol>

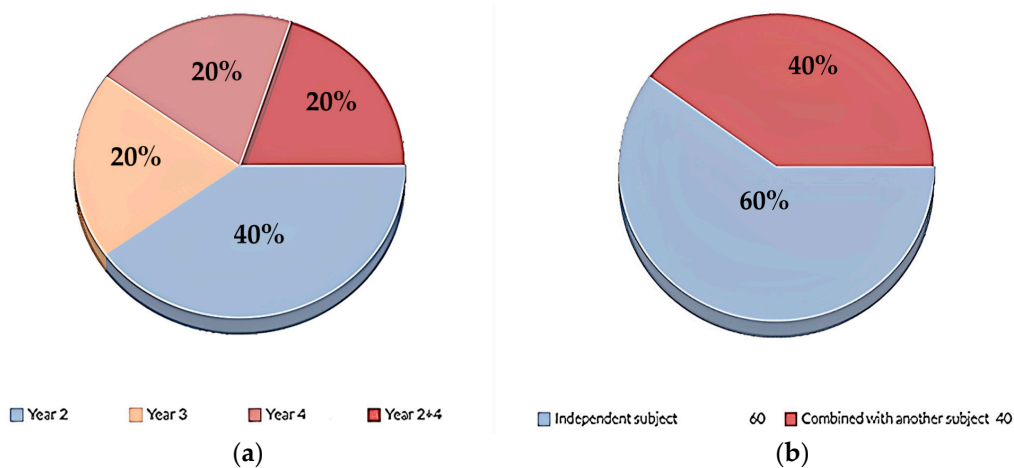


**Figure 1.** Most widely covered aspects of the topic within the institutions.

Of the five schools, only one does not have a staff member with forensic dentistry training; instead, those staff members are licensed, general dentists (Figure 2). All the staff members are of Sudanese nationality. The full length of the dental undergraduate program provided by the higher institutions of Khartoum is 5 years (10 semesters). Forensic dentistry is taught obligatorily as part of the dental program during the second year in two of the schools (40.0%), the third year in one school (20.0%), the fourth year in one school (20.0%), and over the second and fourth years in one school (20.0%). Three out of the five (60.0%) dental schools teach forensic dentistry as an independent subject in the dental program, whereas two of the five (40.0%) schools teach forensic dentistry as part of another dental subject, oral and maxillofacial pathology (Figure 3).



**Figure 2.** Distribution of staff members of all five institutions.



**Figure 3.** Timing style of the teaching of forensic dentistry. (a) Year of Forensic dentistry teaching; (b) Forensic dentistry teaching style.

The total number of credit hours dedicated to forensic dentistry was found to be between two and three hours. 1–2 lectures per week are provided by all institutions over a period of 2–30 weeks. There are no practical sessions offered in four institutions; instead, all the information is given in the form of lectures. One institution provides teaching in the form of lectures and practical sessions in which dental students are involved with dry human body remains during dissection room visits. Two of the five institutions teach dental record-keeping to their students.

#### 4. Discussion

The forensic dentistry practice has been growing in several developed countries around the world; however, utilizing it in the criminal justice system is minimal in Sudan. Only a few nations offer courses in this significant branch of the field of dentistry. According to the literature, further instruction and research is essential for this field [31]. Given the increasing prevalence of both natural and man-made disasters worldwide, forensic training for dental students is seen as being of the utmost importance to prepare young experts for the future for when the need arises. Forensic dentistry has a lot to offer law enforcement in the detection and solution of crime and in civil proceedings; hence, it is important for dental students to gain exposure to this specialized area during their dental education.

The field of forensic dentistry is gaining popularity in Sudan and around the world [32]. The Sudan Medical Council (SMC) is an independent, autonomous body that was established in 1968, and is the tenth accrediting agency that has received the World Federal of Medical Education Recognition Status. The recognition of forensic dentistry as a specialty varies from one country to another; in Sudan, it has been a recognized specialty in the SMC since 2013. There are approximately 35,000 registered dentists with the SMC, including only three registered forensic dentists. Divided by the Blue and White Niles, Khartoum is a tripartite metropolis consisting of Khartoum proper, and linked by bridges to Khartoum North called al-Khartoum Bahri, and Omdurman (Umm Durmān, Sudan) to the west [33]. Khartoum, the executive capital of Sudan, has twenty-one institutions that provide dental undergraduate studies, including 18 privately-run and three governmentally-run institutions [34]. In addition, dental students should become aware of the importance of dental record-keeping considering the contributions it makes to investigation and identification [5]. There is a poor dental record-keeping practice in Sudan [35], and accordingly, this emphasizes the need to educate students on maintaining accurate patient records for both treatment and medicolegal reasons. In the current study, dental records were found to be taught in less than half of the colleges, possibly because there is very minimal awareness of the retention of records among dental practitioners in Sudan. Furthermore, there are no standardized guidelines provided by the health authorities on keeping dental records [35].

The dentists of Sudan are becoming increasingly concerned about the lack of depth and organization of the forensic dentistry information available to dental students across the country. Patients' dental records consist of documents related to the history of present illness, clinical examination, diagnosis, treatment done, and prognosis. It is recommended that integrated education programs are implemented to raise dentists' awareness of the importance of accurate record-keeping in Sudan [35] as dental records remain the key to dental identification in forensic dentistry. In Sudan, a dental recording system remains an optional act in dental clinics and hospitals, resulting in the lack of a clear and mandatory record-keeping system [35]. Considering recent developments, it is worthwhile to reassess the aim, elements, and approach of forensic dentistry teaching.

Although forensic dentistry can be intellectually interesting, decisions made, particularly when dealing with evidence in criminal cases involving child abuse or sexual assaults or when identifying several victims, can have severe social repercussions [2]. A greater knowledge and awareness of forensic dentistry are necessary in the growing field of science. We aimed to explore in-depth the teaching of the subject in higher institutions based in Khartoum, the capital of Sudan, the third-largest country in Africa. We provided recommendations that outline a model undergraduate curriculum that would allow dental students the basic knowledge they need.

The current study relies on the curricula derived from online platforms to investigate forensic teaching. This strategy was the most suitable to achieve the study's primary aim considering the ongoing restrictions on access to relevant information caused by the COVID-19 pandemic situation as well as the political impasse the country is facing. The contribution this study is making to literature encourages higher education institutions to provide or enhance their forensic education to their undergraduate students. Moreover, it stimulates the development of a transparent relationship between the institutions and society, which in turn, facilitates further research.

Over a quarter (26.3%) of the dental colleges in Khartoum teach forensic dentistry to their undergraduate students. This finding reveals that forensic education is minimal in Sudan. Undergraduate teaching worldwide is less than 50.0%, which highlights the fact that not all universities offer undergraduate lectures in forensic dentistry [36]. It was found that almost all the forensic teaching is in Khartoum proper, rather than in Bahri or Omdurman, possibly because the former is more inhabited and has more higher education institutions. Even with the growing awareness, Sudan remains deficit of qualified experts in the subject with only a few trained specialists. This is possibly the main reason many colleges do not provide forensic dentistry education at any point in the dental years. In Sudan, forensic dentistry expertise and services are in high demand [35]. This is due to the increased mortality rates because of tribal and civil wars, traffic accidents, drowning, and suicide rates because of low economic status. A lack of awareness on keeping dental records for the use of forensic dental identification has been reported in Sudan [35]. Similarly, minimal knowledge and practice of the specialty has also been reported in some African nations [37].

With regards to the topics being taught at the universities, the most prevalent are: (1) introduction to forensics (overview), (2) human identification, (3) dental age estimation, (4) interpretation of bitemarks, (5) DNA in forensics, and (6) child abuse. It was found that dental colleges of Khartoum rely mainly on lectures, with few practical sessions involved, when delivering forensic education. This was also the case in a study carried out by Alistair Soon et al. [9]. Due to the low economic status of Sudan, the lack of teaching materials could negatively affect the quality of the education within teaching institutions. Lectures are a great approach to introducing students to forensic dentistry and ought to be a fundamental part of any forensic curriculum at a dental school. However, a practical simulation can give the students a hands-on learning opportunity. The hands-on exercise helps the students gain a greater understanding of the challenges encountered by forensic investigators as well as a better understanding of the identification process [5]. More importantly, caution needs to be taken when delivering practical sessions as they could have a psychological impact on the students due to the graphic nature of this field [8]. On the other hand, a



study conducted in the USA concluded that students should be given the chance to actively take part in all forensic science-related activities [38].

Regarding the timing in which the subject is incorporated into the five-year dental curriculum, the current study had findings that were in line with the study by Alistair Soon et al., where forensic dentistry is taught in the second and fourth years of dental school [9]. On the other hand, a study by Suman Shoro et al. recommended that teaching should take place during the second last or final year [31], possibly because it would enable the students to consolidate all their knowledge from other specialties and solidify their grasp of the significance of proper dental records and how they relate to forensic dentistry. Our recommendation is the teaching of the subject towards the final year or two of the dental degree, as dealing with human remains and death could have a negative psychological impact on younger students. A study conducted in Nepal agrees with teaching those topics towards the latter stages of undergraduate training [3].

Most of the teaching staff at the universities have experience with forensic dentistry (80.0%), which signifies the importance of lecturers who have expertise in the area and who would best reflect upon the reality of medico-legal cases. All lecturers are Sudanese; this suggests the increasing awareness of forensic dentistry in the country, possibly because of media coverage and recent publications on the subject, which leads to an increase in the number of qualified forensic dentists.

The American Academy of Oral Pathology and curriculum standards from 1982 and 1990 recommended that forensic dentistry be taught as part of oral pathology or oral diagnosis/medicine. However, recent studies have emphasized the need for an independent forensic dentistry department [37]. Those recommendations were interestingly visualized in the current study, where it is mainly (60.0%) taught independently and combined with oral and maxillofacial pathology less commonly (40.0%).

The authors recommend a basic modular course with certain teaching criteria that includes teaching forensics as an independent subject on a weekly basis for at least one full semester, ideally in the last year of the dental program. This plan would simply provide dental graduates with the basic principles and techniques of the subject, given that forensics is the branch of dentistry that is directly tied to both ethical and legal matters. It could also stimulate their interest in the subject, allowing them the opportunity to pursue further post-graduation education. A few practical sessions could be implemented if the facility allows. Digital simulations of human remains could be of great learning aid to students, instead of being exposed to actual, disrupted human remains. This is because they are less invasive, which would allow the students more comfort. First, an introduction to dental malpractice needs to be provided, as any dental practitioner needs to be aware of the legal implications related to it. Second, dental record-keeping should be emphasized by the lecturers and a graduate dentist should be aware of the major role it plays in the protection of the dental practitioner in the criminal justice system. It is also highly recommended that dental students are provided with the basic modular courses relevant to forensic dentistry, teaching of dental anatomy and development, and dental anomalies, as those topics will ensure the baseline of this complex specialty is well-understood. Lastly, introducing comparative dental analysis through exercises is recommended, as it will prepare the students to face the challenges of forensic dentistry, and will enhance their critical thinking skills.

Further research on forensic dentistry education and awareness is necessary, especially in developing countries like Sudan and in many of the African countries where the subject is yet to grow [39]. Due to the long-standing and widespread undervaluation of forensic dentistry in higher education, there is a risk of a lack of awareness of this field of forensic dentistry among dentists in practice [9]. Hence, future studies that call for the development of standardized guidelines for forensic education are recommended. Clear guidelines should be given by the dental authorities in Sudan for forensic education and these guidelines need to be strictly adhered to. Financial support from health authorities to universities will enable the establishment of adequate resources for forensic dentistry,

such as equipped laboratories within educational institutions. By addressing the current gaps in education and providing specialized training, this course can contribute to the development of a competent forensic dentistry workforce in Sudan.

## 5. Conclusions

The incorporation of a targeted modular course in forensic dentistry within the dental curriculum in Sudan is essential to meet the growing demand for skilled forensic professionals. However, it is important to note that forensic dentistry is currently greatly underestimated as a specialty in Sudan. While acknowledging the lack of funding and resources for teaching this subject, educational institutions need to prioritize it and aim to provide all their graduate dentists with education in this crucial field, which they may not even realize they are missing. The Sudanese dental authority should collaborate with experienced forensic dentists and forensic science institutions to ensure the quality and relevance of the proposed modular course.

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