

A scoping review of websites for forensic odontology training programs

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KEYWORDS

Forensic Odontology,
Dentistry,
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ABSTRACT

Background: Forensic Odontology developed as a discipline in 1898 with the publication of its first textbook; however, 126 years later, a standardised core curriculum for formal training in Forensic Odontology has yet to be decided. This website scoping review aims to provide information on three main distinct categories (and 17 subcategories): Availability, Content, and Quality of Forensic Odontology education globally. The information on formal education programmes was gathered by conducting a web search using 'Google Search' in English, Arabic, Spanish, and French languages between June and July 2022.

Highlights: Fifty-six programmes from 18 countries met the inclusion criteria. Of the 14 master's and 42 diploma programmes, only 7.14% provided information on their websites from all the subcategories investigated. The highest numbers of master's and postgraduate diploma programmes were identified in Europe (18 programmes), South America (15), North America (11) and Asia (7). A practical aspect was included by 10 master's and 12 diploma programmes' websites. Research integration in various forms was included by 11 master's and seven diploma programmes.

Conclusion: Programme providers and applicants must critically consider the quality of the programme being designed or applied to as there are currently no international training standards in Forensic Odontology. This study has developed an 'International Database of Forensic Odontology Programmes' (IDFOP).

INTRODUCTION

In 1968 Keiser Neilsen described Forensic Odontology as, '*that branch of Odontology, which in the interests of justice, deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of dental findings*'.¹ Forensic Odontology is a Dental speciality and a subspecialty of Forensic Science that initially emerged to study the problems related to deaths with unidentified bodies.² However, the discipline soon expanded to include Age estimation, Bitemarks, Disaster Victim Identification, Malpractice and Jurisprudence, Abuse and Neglect in children and seniors, Cheiloscopy, Rugoscopy, and establishing an Odontobiography (sex; race; ancestry; general, oral, and psychological health; habits; profession; habits; socio-economic status).^{3,4}

Education and training in Forensic Odontology (FO) include significant challenges: availability, content, and quality. Although the need for training programmes was acknowledged more than half a century ago, there are few qualifying postgraduate FO degree programmes available worldwide despite the demand. Dentists and other professionals are offered many unregulated programmes such as workshops, online certificates, and similar didactic and cursory programmes on the subject are numerous;⁵⁻⁸ Moreover, such programmes do not qualify one to practice or teach the subject, and this is not made clear in advance by the programme administrators.⁹⁻¹¹ There is also a sparsity of undergraduate Dental programmes that consider the subject in the curriculum even when teaching expertise is available via their postgraduate programmes.¹²

In 1978, Herschaft and Rasmussen commented on the lack of depth in the FO curriculum.¹³ An ideal training programme would include a theoretical, a practical, and a research aspect, as suggested by several other authors.^{6,8,14} Forensics and Dentistry, being parts of science, present a kinaesthetic-tactile learning nature so they are constantly evolving, with techniques regularly being updated. The development of those fields depends on research, making research a highly desirable aspect of any training programme.¹⁵ The available programmes are varied in all aspects, including the curriculum, student eligibility criteria, and teaching faculty. Undergraduate students who have not been taught the topic are at the disadvantage of not knowing what to look for in a postgraduate programme.

This website scoping review aims to investigate information on the availability, content, and quality of FO education globally. The study objectives are: (i) to conduct a website scoping review of FO training programmes and (ii) to review the range of information provided by FO programme websites.

METHODS

The '*Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist*' (<https://www.prisma-statement.org/>) was used with modifications as a guide to conduct and for reporting this unconventional website scoping review.¹⁶ The method included the development of the review question; search; eligibility criteria; selection; extraction; result charting of the included websites; and synthesis of results.¹⁷ Registration of a scoping review protocol was not possible with PROSPERO.

Information sources, search and screening:

The web search engine Google Search was used to conduct this scoping review of websites as it was rated the best search engine for its speed and relevancy.¹⁸ The search strings in each language with rationale are illustrated in Table 1. The first five pages of the Search Engine Results Pages (SERP) for each search term were included in the review. The search was conducted between June 2022 to July 2022 without any filters using Google Search's default setting that lists results based on relevancy and to minimise duplicates.¹⁷

Eligibility criteria:

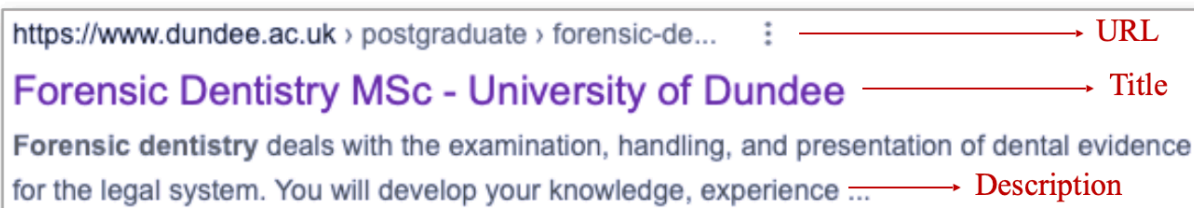
The inclusion criteria were master's and postgraduate diploma programmes to focus on the gold standard of postgraduate education in Dentistry.¹⁹ The search strings were restricted to the four INTERPOL languages (English, Arabic, Spanish, and French), however, universities originally from other languages were considered in the results within the first five pages due to existing translations from the web.²⁰ The exclusion criteria were undergraduate programmes, lectures, workshops, shadowing and fellowship programmes, short courses, etc., due to the insufficient training in such programmes. The screened results were individually exported onto Microsoft Excel's worksheet (version 16.64) following six steps, as seen in Table 2.

Table 1. Search strings used on 'Google Search' in each language with rationale

Language	Search string	Rationale
English	(i) Forensic Odontology Master (ii) Forensic Odontology Diploma (iii) Forensic Dentistry Master (iv) Forensic Dentistry Diploma	The words 'Odontology' and 'Dentistry' were used in the search as they are interchangeably used.
Arabic	(i) ماجستير في طب الأسنان الشرعي (ii) دبلوم في طب الأسنان الشرعي	In the Arabic language, the English words 'Dentistry' and 'Odontology' both translate to the term 'طب الأسنان', on 'Google Translate', ergo was the only term used.
Spanish	(i) <i>Maestría en Odontología Forense</i> (ii) <i>Diploma en Odontología Forense</i>	The words 'Dentistry' and 'Odontology' translated to 'Odontología' in Spanish on 'Google Translate', ergo was the only term used in the search.
French	(i) <i>Master en odontologie médico-légale</i> (ii) <i>Diplôme d'odontologie médico-légale</i> (iii) <i>Master en médecine dentaire légale</i> (iv) <i>Diplôme de médecine dentaire légale</i>	The English words 'Dentistry' and 'Odontology' are translated to 'Dentisterie' and 'Odontologie' respectively. Both words were used interchangeably, ergo included in the search.

Table 2. Steps involved in the recording of the results from the screening process

Step	Description
1. Date	The day the search was conducted.
2. Search term	The term used on the search engine to search relevant data
3. Result Page and number	The page number of the Search Engine Results Page (SERP). The result number was counted manually with the count starting from '1' on each page.
4. Result's web address	The Uniform Resource Locator (URL)/website link of each result - This was obtained by right-clicking on the result and selecting 'copy link'.
5. Result Screening (Title/Description)	When a search is conducted on 'Google Search', the results are displayed in the form of snippets. Figure 1 is an example of one snippet when the term 'Forensic Odontology Master' was searched on Google Search. This snippet consists of three parts, (i) URL, (ii) Title, and (iii) Description. Each result was labelled under 'Included' or 'Excluded' depending on the eligibility criteria based on the title and/or description of the result. When classed under 'Excluded', a reason was specified.
6. Result Screening (full website)	The results classed under 'Included' from Step 5 were screened by examining the entire website. The websites were accessed by clicking on the data stored under 'Result web address' on the Microsoft Excel worksheet from Step 4. The results were again classed under 'Included' and 'Excluded' (with reason specified) depending on the eligibility criteria based on the entire website.

Figure 1. Example of a result snippet on Google's search engine with parts labelled

Programme detail:

The included results from Step 6 of the ‘Result Screening Chart’ were investigated for programme details and charted using three categories: 1) Presentation, 2) Accessibility and 3) Educational aspects. Each category was investigated using different topics associated with

each category, as shown in Table 3. When the information provided by a programme website was incomplete, the programme administrator was emailed for more details. All data were recorded and analysed using graphs, charts, and maps default on Microsoft Excel’s worksheet (version 16.64).

Table 3. Result screening (full website) categories and subcategories

Data	Description			
1. Provider	Institution, university, organization, etc...			
2. Location	City and country			
3. Programme	Course title			
4. Duration/Study mode	Length of programme (months/years); full-time or part-time			
5. Language	Language the programme is delivered in			
6. Learning mode	Online face-to-face blended hybrid distance			
7. Eligibility Criteria	Requirements from students for application			
8. Teaching Faculty	Name and qualifications of the instructors			
9. Course content	Modules covered in the programme			
10. Forensic Odontology curriculum	Topics covered under Forensic Odontology			
11. Availability of Practical sessions	Yes or no. Investigation would include information on access to mortuary cadaver facility wet lab; dental lab; dental and tooth specimens; radiography and photography equipment; diverse radiographs (OPGs) for age estimation; bitemark analysis and comparison on a photo manipulation software; mock courts, report writing, mock disaster victim identification, etc			
12. Availability of Research	Yes or no. Investigation would include information on dissertation/thesis; research project; research article; journal publication, etc.			
13. Handbook	Digital student handbook or overview of the programme.			
14. How to apply	Application form or instructions for application to the programme.			
15. Fee & Funding	Tuition fee for each academic year; funding opportunities.			
16. Contact	Contact information for programme administration/faculty			
17. Status	Active Inactive Discontinued Under development			
Rationale (Category)	<table border="1" style="width: 100%; text-align: center;"> <tr> <td style="width: 33%;">Presentation</td> <td style="width: 33%;">Accessibility</td> <td style="width: 33%;">Educational aspects</td> </tr> </table>	Presentation	Accessibility	Educational aspects
Presentation	Accessibility	Educational aspects		

RESULTS

The search revealed 56 postgraduate programmes (14 master’s and 42 diplomas) available worldwide, as seen in Fig 2. Out of 195 countries, only 18 countries offered postgraduate programmes in FO, with the majority from

Central and South America and Europe, as illustrated in Table 4. Amongst the 52 providers were one medico-legal association, one online course provider, one national development agency, and 49 training institutes.

Figure 2. Adapted PRISMA Flowchart presenting the website selection process.

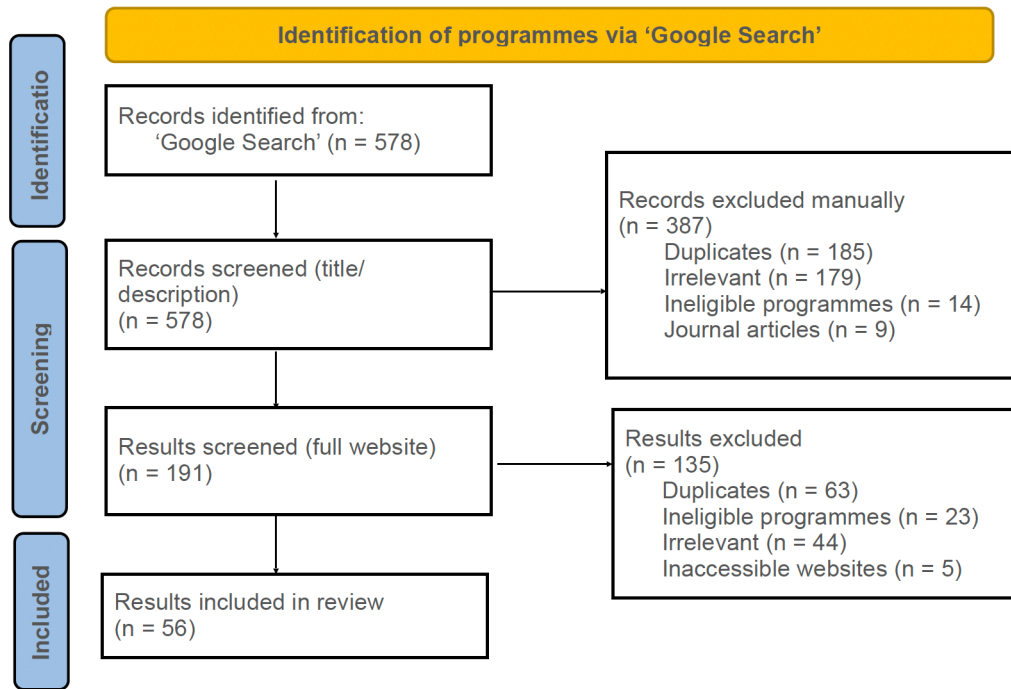


Table 4. Forensic Odontology Programmes providers identified

Provider	No. of	Location
<i>Universidad de Londres</i>	I	Mexico (10)
<i>Universidad Del Valle De Toluca</i>	I	
<i>Instituto Tecnológico Superior de Sinaloa (ITESUS)</i>	I	
<i>Colegio Nacional de Estomatólogos EH Angle (CNEAC)</i>	I	
<i>Universidad Autónoma de Coahuila</i>	I	
<i>Universidad Autónoma Metropolitana</i>	I	
<i>Centro Universitario de Ciudad de Juárez</i>	I	
<i>Instituto Para El Desarrollo Y Actualización de Profesionales</i>	I	
<i>Academia Mexicana de Ciencias Periciales</i>	I	
<i>ULA - Latin American University</i>	I	
<i>Universidad Científica del Sur (UCSUR)</i>	I	Peru (7)
<i>Instituto de Criminalística y Seguridad</i>	I	
<i>Universidad Nacional de San Martín Tarapoto</i>	I	
<i>Instituto de Desarrollo y Capacitación</i>	I	
<i>Instituto de Desarrollo Gerencial -IDG</i>	I	
<i>Universidad Peruna</i>	I	
<i>Instituto de Salud Oral (ISO)</i>	I	
<i>Odontocat</i>	I	Spain (6)
<i>Universidad Nacional Autónoma de México</i>	I	
<i>Escuela Internacional de Negocios - España</i>	I	
<i>Universitat Internacional de Catalunya (UIC Barcelona)</i>	I	
<i>Universidad Complutense Madrid</i>	I	

<i>Universidad de Sevilla</i>	I	
<i>Université de Lorraine</i>	I	France (5)
<i>Compagnie des Experts de Justice de Lyon</i>	I	
<i>Université de Bordeaux</i>	I	
<i>Université de Montpellier</i>	2	
<i>University of Dundee</i>	3	UK (4)
<i>University of Glamorgan (now University of South Wales)</i>	I	
<i>Universidad de Buenos Aires</i>	I	Argentina (3)
<i>Universidad del Salvador</i>	I	
<i>Universidad Nacional de Rosario</i>	I	
<i>University of Adelaide</i>	I	Australia (3)
<i>University of Western Australia</i>	I	
<i>University of Melbourne</i>	I	
<i>Asociación Colombiana de Medicina Legal y Ciencias Forenses</i>	I	Colombia (3)
<i>Universidad Cooperativa de Colombia</i>	I	
<i>Pontificia Universidad Javeriana</i>	I	
<i>Bharat Sevak Samaj</i>	I	India (3)
<i>National Forensic Sciences University</i>	I	
<i>JSS Academy of Higher Education and Research</i>	I	
<i>Universidad de la Frontera</i>	I	Chile (2)
<i>Universidad de Chile</i>	I	
<i>University of Pretoria</i>	2	South Africa
<i>Katholieke Universiteit Leuven (KU Leuven)</i>	I	Belgium
<i>Istituto Stomatologico Toscano</i>	I	Italy
<i>Lebanese University</i>	I	Lebanon
<i>Institute of Advanced Dental Sciences & Research & Health Services</i>	I	Pakistan
<i>University of Lisbon</i>	I	Portugal
<i>University of Peradeniya</i>	I	Sri Lanka
<i>University of Sharjah</i>	I	UAE
<i>University of Tennessee</i>	I	USA

The usual disclaimers of the faults in the information provided by the source apply in this study. First, the limitation of the selected languages may have excluded relevant results a priori. Second, the confirmation that some courses were found in other languages other than English, Arabic, Spanish, and French. For instance, a university was found in Italy even though the *Università degli Studi di Firenze* located in Florence, has been offering a master's programme for several years and it was not shown in the search. Similarly, a programme in Portuguese from the University of Lisbon, Portugal was shown as a result but other well-

known programmes in Portuguese from Brazil such as from the School of Dentistry of *Ribeirão Preto* (USP - University of *São Paulo*) and younger faculty of *São Leopoldo Mandic* were not included. In addition, no programmes have been removed from the results.

Information on the duration of programmes was made available by 11 master's and 30 diploma programmes (Fig 3) whilst the programme language was made available by 11 master's and 10 diploma programmes (Fig 4). Programmes from Sri Lanka, UAE, Pakistan, Colombia, France, and Lebanon did not provide language information.

Figure 3. Duration distribution of Master’s (blue) and Diploma (orange) programmes in months

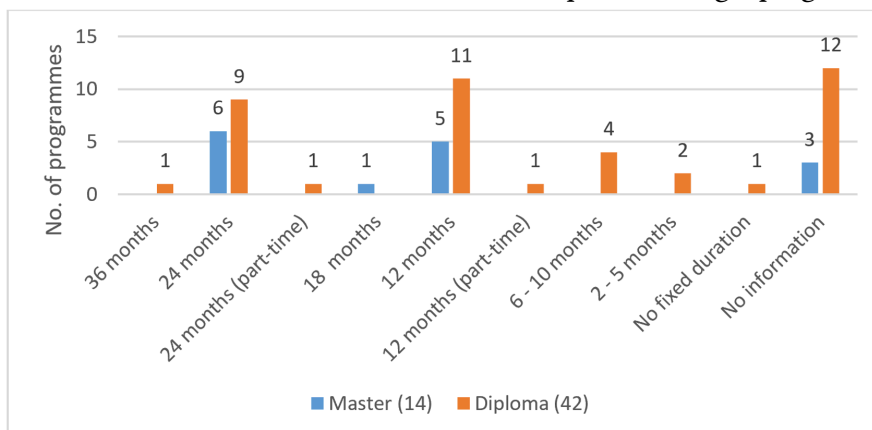
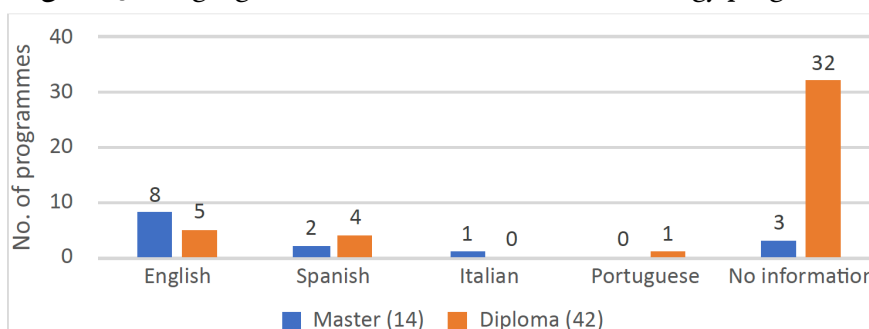


Figure 4. Language distribution of Forensic Odontology programmes



The learning mode was made available by 11 master’s programmes, with ‘Face-to-face’ being the most offered mode, followed by ‘blended’, and the least in ‘online’ and ‘hybrid’ methods. Out of 19 diploma programmes, ‘face-to-face’ and ‘blended’ modes were most offered, followed by ‘online’ and ‘distance’, and the least in ‘hybrid’ as seen in Fig 5. The admission requirements for 13 master’s programmes included professionals from ‘medicine/surgery’, ‘law/police’, ‘biology/

biotechnology’, and stomatology, with all 13 programmes including ‘dental surgery’. Out of 23 diploma programmes, the majority of professionals included ‘dental surgery’, followed by ‘medicine/surgery’, ‘dentistry’, ‘dental technology/hygiene’, ‘forensic/criminology’, ‘law/police’, ‘no prerequisites’, ‘biology/biotechnology’, ‘anthropology’, ‘medico-legal interns’, ‘biochemistry/chemistry’, ‘psychology’, ‘nursing’, and ‘stomatology’ as shown in Fig 6.

Figure 5. Learning mode distribution of Forensic Odontology

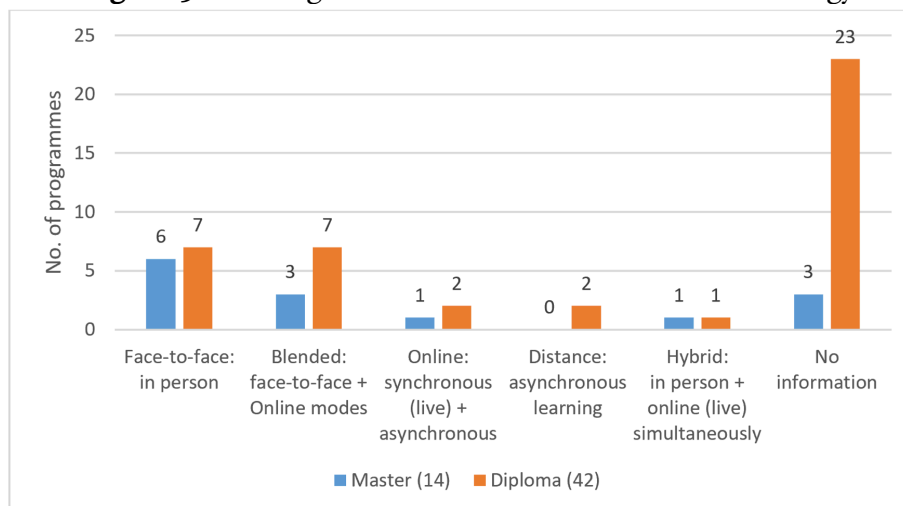
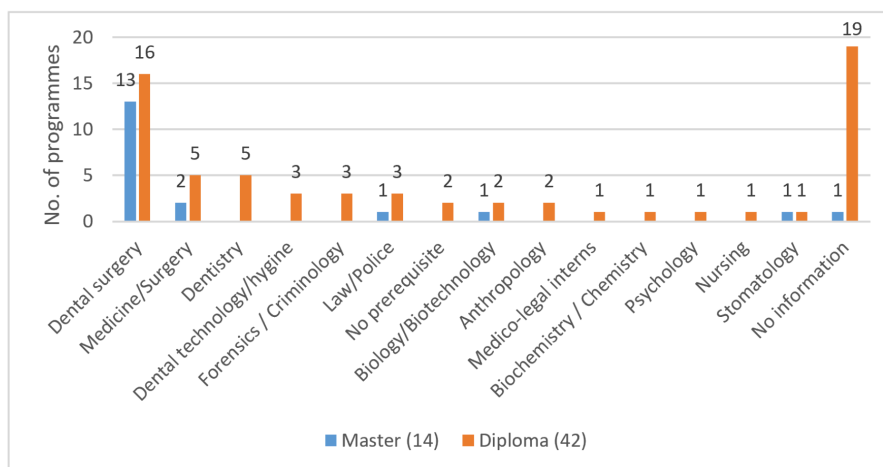


Figure 6. Acceptable professional backgrounds under Admission Requirements for Forensic Odontology Programmes



Amongst the eight master’s programmes that provided information on teaching faculty, five included professional qualifications with at least one forensic odontologist (FOst) each. Out of 21 diploma programmes, seven provided information on teaching faculty, and six programmes had at least one FOst, as illustrated in Fig 7. All 14 master’s programmes included their modules, of which 11 programmes elaborated on their curriculum with ‘dental identification’, ‘age estimation’, ‘bitemarks’, and ‘law’ included in all programmes apart from the one programme excluding ‘bitemarks’. Of the 26 diploma programmes that presented their modules, ‘law’ was included in many of them, followed by ‘dental identification’ and ‘age estimation’, with the least in ‘bitemarks’ as seen in Fig 8.

Figure 7. Availability of information on Forensic Odontology programme faculty

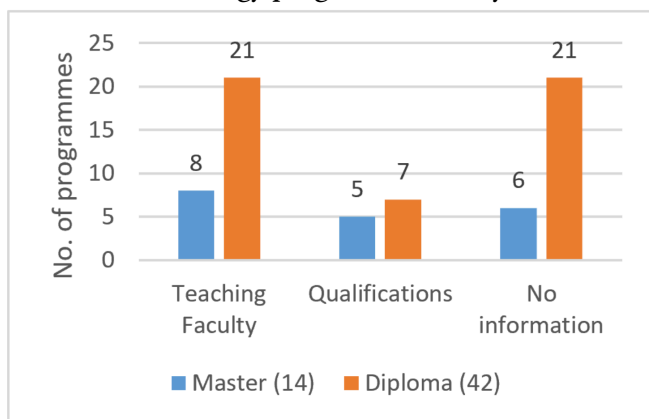
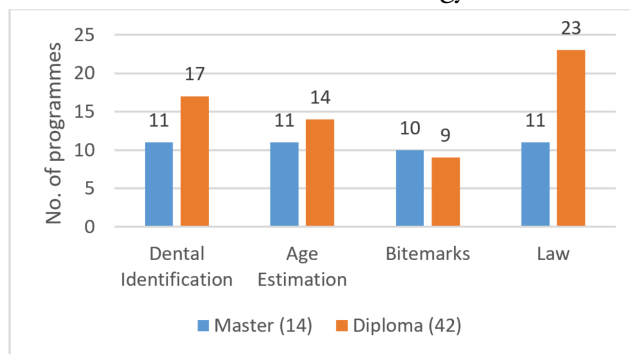


Figure 8. Distribution of basic topics in Forensic Odontology



Of the 11 master’s and 14 diploma programmes that shared their practical aspect, only six master’s and five diploma programmes listed the specifics. The practical activities relevant to FO included ‘mortuary/cadaver facility’, ‘mock DVI/Plassdata’, ‘mock trial’, ‘age estimation’, ‘bitemarks’, ‘reports’, ‘photography’, ‘radiography’, and ‘anthropology’. One master’s programme and two diploma programmes were theoretical, as shown in Fig 9. Information on research opportunities was made available by 11 master’s programmes, except one including ‘thesis/dissertation’, followed by ‘publication’, ‘research project’, and at the least, an ‘internship’.

Of nine diploma programmes that included information on research opportunities, most included ‘research project’, followed by ‘thesis/dissertation’, and at the most minor ‘assignments’, with one programme making research optional with a research facility available as illustrated in Fig 10.

Figure 9. Distribution of offers on practical experience practical aspect of programmes

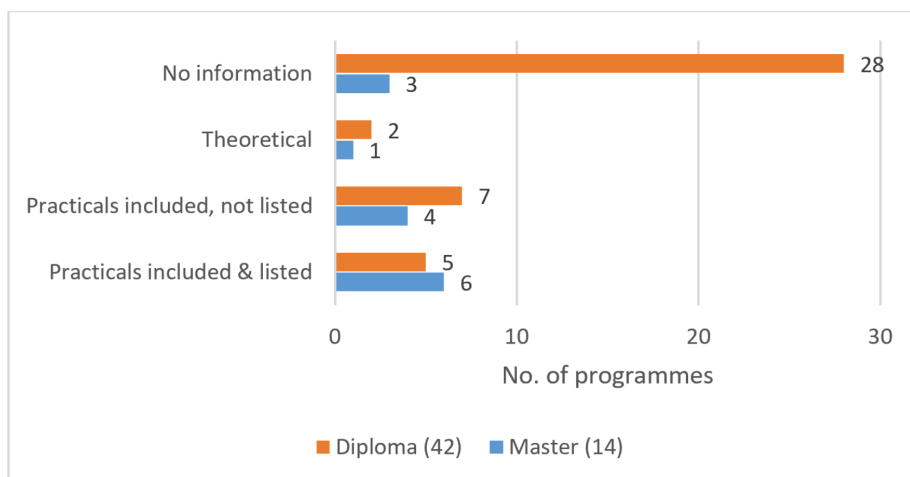
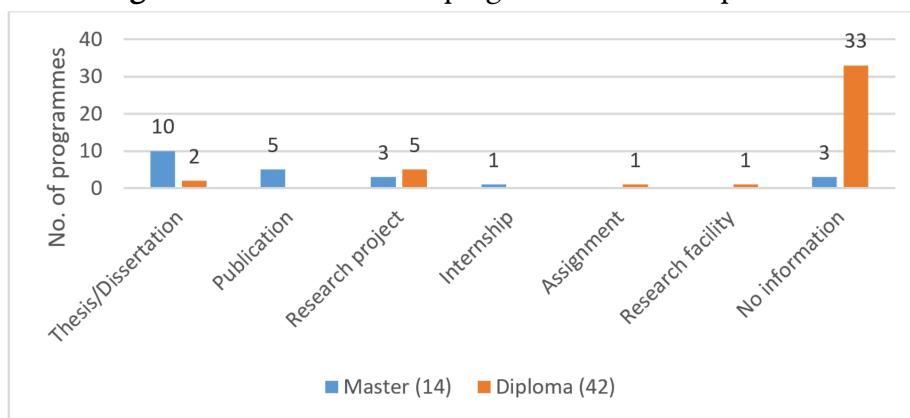
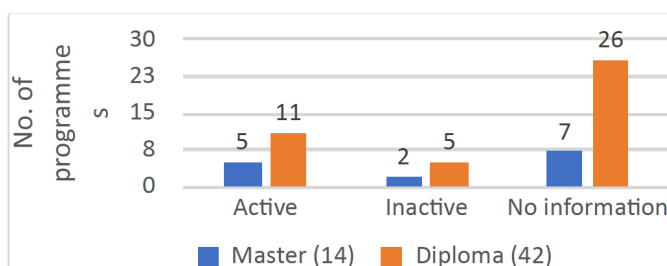


Figure 10. Distribution of programme research options



Student handbooks/programmes were made available by six master’s and three diploma programmes; the application process was made clear by five master’s and nine diploma programmes, and the fee and funding status was shared by 11 master’s and 23 diploma programmes. As of July 2022, according to the programme websites, five master’s and 11 diploma programmes appeared ‘active’ (currently running), with two master’s and five diplomas appearing ‘inactive’ (discontinued / on hold), as shown in Fig 11.

Figure 11. Distribution of programme availability



The review of programme details indicated that out of the 56 programmes, only 4 provided information on all 17 categories from Table 2. The remaining programmes were contacted via email for unavailable details, and responses were received from 8 programmes with further information. Only 3 provided complete information. All communications were made in English.

DISCUSSION

Programme identification:

The International Organization for Forensic Odonto-Stomatology (IOFOS) conducted two surveys on FO education, with the first in 1984 and the second in 2021, and countries with postgraduate programmes included Denmark, Hungary, Japan, Sweden, West Germany, Norway, Brazil, South Korea, and Iceland.^{21,22} However, programmes from the aforementioned countries were not identified by ‘Google Search’. A possible explanation for this could be that the

programmes are either not presented on websites, have been discontinued, or are in a language outside the limitations of this review.²³ The initiation of a Forensic Odontology programme can be decided by relevant civil and criminal cases documented within the country. An unpublished survey conducted by the authors of this review in 2020 received responses from trained FOs from countries including New

Zealand, Saudi Arabia, Switzerland, Syria, Oman, Nepal, Norway, Sweden, Malaysia, Canada, Indonesia, Brazil, Hong Kong, Finland, The Netherlands, Japan, Egypt, Panamá, and Denmark, clearly indicating a demand for it.¹⁹ The countries listed in Table 5 need trained personnel given their high numbers of missing persons, risk of natural disasters, rape cases, and refugees.²⁴⁻²⁷

Table 5. Countries shown in green boxes have been identified to run at least one postgraduate FO programme (Highest to lowest from left to right).

Category	Country				
Missing Persons (2022)	India	UK	Syria	Colombia	Mexico
Natural Disaster Risk (2021)	Vanuatu	Solomon Islands	Tonga	Dominica	Antigua and Barbuda
Rape (2022)	Botswana	Lesotho	South Africa	Bermuda	Sweden
Refugee host (2022)	Türkiye	Colombia	Uganda	Pakistan	Germany

Programme standards:

Duration:

Generally, credit assigned to programmes is based on the approximate number of hours a learner is expected to spend learning to achieve the learning outcomes. The UK Quality Code for Higher Education requires a minimum of 180 credits (approximately 12 months) for a Taught Master's programme (1,800 hours of learning = number of credits x 10). For example, the master's programme offered by *Istituto Stomatologico Toscano* seems to cover the duration required for 180 credits. A typical Postgraduate Diploma programme requires a minimum of 120 credits taking approximately six months (two academic terms) to complete in a full-time programme.^{28,29} For instance, the diploma programme offered by the Institute of Advanced Dental Sciences and Research and Health Services Academy, Pakistan has covered sufficient duration for the required 120 credits. This study, however, revealed diploma programmes less than six months in duration.

Admission Requirements:

All master's programmes required the applicant to be a Dental surgeon, the University of Peradeniya additionally required Dentist applicants to possess one year's work experience. Some diploma programme providers like *Universidad Nacional de Rosario*, *Universidad de*

Chile, *Pontificia Universidad Javeriana*, University of Adelaide, CNEAC, and more only accepted Dental Surgeons. The diploma programme by the University of Western Australia additionally required two years of work experience. As Neilsen stated, FO is a branch of Dentistry that examines Dental findings, ergo, education providers must make it clear to applicants that only Dentists will be qualified to practice FO as a profession after completion.¹

Faculty/Staff Profile and Employment Prospects:

Some programmes from this review provided faculty names, qualifications, titles, and even biography in contrast to programme administrators who even upon request responded with phrases like '*professionals experienced in the field*' when asked about their teaching faculty. It is undetermined if the faculty with the title 'Forensic Odontologist' underwent formal training. For instance, the programmes at *Universidad de Londres*, *UCSUR*, *Montpellier*, *Universidad Peruna*, and more, included their faculty members' names. The Universities of Adelaide, Sharjah, etc, additionally included faculty qualifications. The programmes by *Asociación Colombiana de Medicina Legal y Ciencias Forenses*, and *Universidad de Sevilla* further included faculty member's speciality and *Universidad de Chile* even included each member's title, for example, professor, demonstrator, etc.

The responsibility of teaching the subject frequently falls on Oral Pathologists, who are often not qualified FOs.¹³ With the first chapters on forensic odontology published in 1862 and 1882, the first textbook published in 1898, the first lecture delivered in 1899, and the 2004 Sumatra-Andaman earthquake resulting in a sudden boom in the number of programmes, is it still acceptable for this discipline to be taught by professionals who are not formally trained?^{12,23,30,31} In Syria, dental surgeons can get certified to practice Forensic Odontology upon completing an internship offered by the Ministry of Health; however, only a dental surgeon with formal postgraduate training in the discipline is permitted to teach. Designing a programme here requires a professor (10 years of experience) and an assistant professor (five years of experience) specialized in the discipline with a master's/PhD degree (WM Rihawi, personal communication, August 30, 2022). Another example, the Botswana police service is developing a state-of-the-art forensic laboratory; however, due to the lack of awareness of the discipline amongst dental practitioners, it employs no FOs to date (C Kgabi, personal communication, September 29, 2022).

Curriculum:

This study considered (i) Dental Identification/ Disaster Victim Identification, (ii) Age estimation/Dental Anthropology, (iii) Bitemarks, and (iv) Law (including Dental Jurisprudence and Malpractice) as the primary topics to analyse the programme content all though there is no clear understanding on what the primary and secondary topics in the field are according to the rank of importance.^{32,33} From the results, it is undetermined whether the lack of information available from the programme websites is due to incomplete information on their websites or if the topics are not taught. For example, the diploma programme at the *Universitat Internacional de Catalunya* (UIC Barcelona) listed the programme modules in addition to the areas covered under the FO module. A comparison of the Diploma programmes under 'Forensic Odontology Curriculum' and 'Duration' showed that programmes with all four primary topics were at least six months long indicating a minimum of six months is required to teach all four primary topics.

Applied and Collaborative Training:

Gradual introduction to graphic imagery is suggested in training as this may pose a psychological challenge. The practical part of the discipline is appreciated across several topics including dental Identification of the deceased either in the mortuary or a wet lab/cadaver centre, age estimation on radiographs, dental anthropology on human remains, comparative dental anatomy on human and animal dentition, dental profiling on dental remains, post-mortem photography and radiography, interpretation of bitemarks on photo manipulation software, mock DVI including chemical, biological, radiological, nuclear, explosive (CBRNE) disasters, mock trials, report writing, and more.^{10,12} Formal training programmes should provide facilities for such exercises.³⁴ For instance, results of a study that evaluated the ability of dental students to match simulated antemortem and post-mortem dental radiographs from human skulls compared to experts showed that dental students needed more post-mortem images before deciding on a match than did experts. They also scored false positives proving the importance of training.³⁵ Another study on the accuracy of dental registrations in forensic odontology among dental students proved several basic errors such as the incorrect judgement of the extent of single restorations and the confusion in naming groups of teeth such as mandibular premolars and molars.³⁶

To highlight some of the applied training opportunities, the masters programme at the University of Tennessee has mentioned the various facilities available for hands-on training including dry and wet labs, decomposition processing facility, and clandestine graves; *Universidad de Londres* (master's) included ballistic, anthropology, and forensic photography; CNEAC (diploma) included report writing, ear print, and facial reconstruction amongst many others; *Université de Lorraine* (diploma) included an internship. Forensic Odontologists may work as a part of a team within and outside the forensic unit, ergo collaborative exercises with Law, Policing, Forensic Pathology, Forensic Anthropology, and other relevant fields will help build communication skills that play a crucial role in Forensics.^{32,33} From reviewing the websites of three master's and the 33 diploma programmes it is unclear if they do not offer practical exercises

or simply have not mentioned it on their websites. However, no response was received upon request via email either.^{32,33}

Teaching Model:

Another finding from this study was the two purely theoretical diploma programmes, although diploma programmes are meant to be vocational, involving more hands-on activity. There are four types of teaching models commonly used, including (i) face-to-face, (ii) remote (asynchronous and/or synchronous), (iii) dual mode/hybrid (face-to-face + synchronous + asynchronous), and (iv) blended (face-to-face and/or synchronous and/or asynchronous). However, the ideal approach to delivering formal training in FO would be a model that accommodates some element of face-to-face practical experience on all aspects of forensic odontology, allowing learner-learner interaction.^{6,8,14,37} The review revealed that most master's and diploma programmes were either face-to-face or blended. The diploma programme at CNEAC mentioned they were delivered online (synchronously), however included practical activities including visits to a forensic institution. Conversely, the master's programme offered by KU Leuven is theoretical although delivered face-to-face.

Research Integration:

Without research, investigative methods would become obsolete rather than evolve. For instance, Systematic research is needed to record the evolution of methods with the development of research and technology, and they should be incentivised. A variety of methods should be created, and current ones should be tested in different populations. In addition, the work of a FOst involves rapid problem-solving and decision-making. For example, in a DVI operation (temporary mortuary), all necessary/conventional equipment may not be accessible in contrast to a permanent mortuary so the professionals will have to improvise with what is available. Being familiar with past research equips one with the various methods that have and can be used in different scenarios, easing the development of ad-hoc solutions.^{7,38}

Almost every master's programme included research in some form including a thesis dissertation, and sometimes publication in journals. While it is not a requisite for diploma programmes to incorporate research, the

Universities of Adelaide, Western Australia, Lorraine, Buenos Aires, and Salvador, Institute of Advanced Dental Sciences and Research and Health Services Academy, and *Pontificia Universidad Javeriana* included research, and the University of Lisbon made research optional.

Challenges in Forensic Odontology Training:

(i) Undergraduate Curriculum:

A critical factor in training is an applicant's compatibility with the discipline's scope. Unlike other specialisations in Dentistry, Forensic Odontology is not traditionally included as a module in the undergraduate Dental school curriculum.^{6,8,15,39} Dentists are often unaware of what the discipline entails, and this has resulted in individuals experiencing discomfort and unfortunate incidents/accidents, after enrolling on a postgraduate programme. This lack of awareness can be addressed by including FO in the undergraduate Dental curriculum. Given the factors mentioned prior, would it be deemed appropriate for an individual who is not a Dental Surgeon but received FO training, or is a dental surgeon with only theoretical FO training, or has been trained by individuals with no field experience in FO to identify victims in a complex mass fatality operation or give an expert opinion in a court of law which directly influences the court's decision? There is a handful of model curricula available in Forensic Odontology, albeit lacking teaching guidelines.^{5,6,32,33,40}

(ii) Standardised Postgraduate Curriculum:

This review has brought to light that most FO training programmes are similar only in differences, for example, the durations are diverse, teaching faculty are not all qualified Forensic Odontologists, admission requirements include students and professionals from varying disciplines, etc. However, there were also positive similarities, for example, Human Identification, Age Estimation, and Dental Jurisprudence and Malpractice seem to be included in several programmes, and most master's programmes included practical activities and a research component. There is a general lack of standardisation of programme structure and curriculum amongst all master's and diploma programmes in the core and essential aspects

that affect teaching and learning quality, which in turn affect the quality of the work produced in practice. Education providers must set minimum requirements for FO faculty such as postgraduate qualification in FO from a recognised programme, or registration with the local/national FO body, etc. to maintain the standards of training and quality of knowledge disseminated.

(iii) Awareness:

The challenge qualified Forensic Odontologists face in employment is often due to the lack of awareness of the scope, availability, and expertise of Forensic Odontology amongst Law Enforcement officers, Lawyers, Judges / Magistrates / Procurator Fiscals, Fire Fighters, First Responders, Forensic professionals, Refugee and Asylum agencies, and Cross-border

medical aid providers. This issue can potentially be addressed by FO organisations or qualified FOs by developing and delivering awareness programmes. Some institutions provide sanctuary to refugees and asylum seekers in higher education which ties in with the humanitarian cause of Forensic Odontology. Centres for education must provide staff and students with a safe space and practice ‘Equality, Diversity, and Inclusion’ by regularly training staff members and conducting impact assessments.⁴¹

The following is a suggested template based on the information gathered from this review and the Course Page Guide for New Websites by the University of Derby that could be used by education providers when developing or updating their FO programme’s website information.⁴²

Table 6. Template of Essential Information for Forensic Odontology Programme Websites

Category	Description
Programme title	full name of the programme with degree abbreviation received upon completion.
Programme Level	Master’s; Postgraduate Diploma; Mentorship
Programme Overview	detailed overview of the programme with aims and outcomes; programme accreditation and ranking.
Curriculum	programme structure including module titles and areas covered within the FO module; aims and outcomes for each module; practical activities; facilities (library, laboratory, cadaver centre/ mortuary access, study specimens, moot court, IT suite, etc); research options; collaborative exercises (with police departments, mortuaries, other programmes within and outside the training institution, etc).
Faculty Profile	name and title; biography; educational background; research interests; publication with link to research profile (ORCID, ResearcherID, Scopus Author ID, etc); teaching experience; professional affiliations; awards.
Admission requirements	programme eligibility criteria; prerequisites; additional requirements
Language	teaching language/s
Location	address of the education provider and the training location
Duration	full-time duration; part-time duration if available; start and end dates; holiday periods
Teaching model	face-face remote dual mode hybrid blended with a description of provided models
Assessment	engagement; exams; assignments; research projects; presentations; viva voce; thesis/dissertation submission process; degree completion criteria; certification
Employment Opportunities	enlisting on the local and national register of qualified Forensic Odontologists available to the court, law enforcement professionals, and first responders; list local and national mortuaries, DVI teams, Refugee and asylum providing agencies, museums with human dental remains, mentorship opportunities, networking opportunities, and other relevant options available.

Student services	academic skills support; referencing training and support; research ethics and integrity training; publishing advice; equipment loans; Equality, Diversity, and Inclusion training, career services; counselling; academic advisory service, etc.
Tuition and Financial Aid	tuition fee for national and international students, payment options, available scholarships or grants
Application Process	step-by-step guide for national and international applicants; deadlines; required documents; and fees.
Contact Information	programme coordinator; admissions office; and other relevant personnel.
Dates	official start date of the programme; orientation/induction; registration; academic calendar; deadlines
Programme Status	active on-hold inactive discontinued.
Collaboration	Police Department; Mortuary; Procurator Fiscal/Coroner/Medical examiner; other education providers or FO programmes; Refugee and Asylum organisations; FO organisation and associations; Forensic Laboratories
Additional information	Programme highlights; testimonials; accreditation; Networking opportunities; exchange programmes for students and staff;

Strengths and limitations:

The 'International Database of Forensic Odontology Programmes' (IDFOP) intends to be a source to provide potential applicants with all the information they must know before making a career decision.⁴³ The database will also serve as a guide to providers planning on designing a postgraduate programme and it will be available for download in Portable Document Format (PDF) format, allowing the viewer to search for specific terms or words on the document. The search was conducted in four languages which excluded programmes from more countries.^{25,37} Unlike a bibliographic systematic review, the quality assurance measures were limited by the significant number of results with reduced filter options, the small number of Search Engine Results Pages (SERP) included, and the varied reading and navigating approach within each result.¹⁷ However, the results may not accurately reflect the current state of the programmes, as websites are not always promptly updated, and some programmes do not disclose certain information. Irrespective of this, the juxtaposition of the various programmes can be challenging given they are from different countries and academic systems.

Considering the programmes that included information on curricular, practical, and research aspects, there were only six programmes (excluding inactive programmes) that provided

research facilities, and theoretical and practical training, on all four primary topics of dental identification, age estimation, bite marks, and the legal aspects that involve dental malpractice and evaluation of dental damage. The six programmes are as follows: (i) Master 2nd level in Legal and Forensic Dentistry at *Istituto Stomatologico Toscano*, (ii) Master of Forensic Odontology (MFOdont) and (iii) Master of Science in Forensic Dentistry (MSc) at the University of Dundee, (iv) Graduate Diploma in Forensic Odontology at the University of Adelaide, (v) Specialisation in Forensic Odontology (diploma) at the University of Lisbon, and (vi) Specialisation in Legal and Forensic Odontology (*Especialización en Odontología Legal y Forense*) at *Pontificia Universidad Javeriana*.

Future Perspectives:

The gaps in information on the IDFOP can be addressed by collecting information using methods other than a website scoping review. Considerations should be taken to improve possible future scoping or systematic review to include more languages and undergraduate programmes. The proposed 'International Forensic Odontology Programme Database' should be updated yearly and could be used as a basis for discussion about the quality and availability of education in Forensic Odontology. A future liaison between the programme leads and the Forensic Odontology Organization is suggested.

CONCLUSION

This scoping review gathered the number and content of programmes and concluded that Forensic Odontology has no international training standards. As postgraduate FO training programmes become increasingly popular, it is critical to take note of the quality of training, which could be indicated by (i) the recognition of the programme by the national dental council, Forensic Odontology associations or organisations, (ii) the inclusion of theory, practical, and research aspects, and (iii) the limitations of methods taught in the discipline. This scoping review gathered the number and content of programmes and concluded that there are no international training standards in FO.

As a result of this scoping review, an international database of postgraduate Forensic Odontology programmes has been created to facilitate the task of deciding on an appropriate training programme for future Forensic Odontologists.

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ETHICAL STATEMENT

This study reviews the existing Forensic Odontology programmes' websites and does not involve any experimentation on specimens or subjects. Thus, ethical approval was not required.

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