Original Article

Trends in Forensic Odontology Publications: 2000–2015

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Abstract

Background: In recent years, forensic odontology is facing a wide recognition as a consequence of the crucial role the discipline has in many legal and criminal cases, and experts in the field are constantly in research of more accurate and advanced methods.

Materials and Methods: The contents of the most-known peer-review forensic journals were searched to identify the publications in forensic odontology from 2000 to 2015. They were categorized according to the topic, type, and origin of the publication.

Results: There is a significant increase in publications in the recent years which primarily focus on dental age assessment, bite mark analysis, and dental identification. Most of the publications were research papers, and the majority of research is conducted in a few selected countries.

Conclusion: It is fundamental that further research is needed to strengthen the forensic odontology investigation outcomes and to establish the standard protocols and international communications.

Key Words: *Forensic journals, forensic odontology/dentistry, publications, research*

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Introduction

Forensic odontology, the application of the science of dentistry to the field of law, includes several distinct areas of focus: identification of unknown remains, bite mark comparison, interpretation of oral injury, and dental malpractice. Forensic odontology has modern foundation developing methods and techniques to assist in legal matters.[1] In recent years, the number of publications and books related to forensic odontology has increased as a consequence of the wider recognition that the discipline is facing. The role of forensic odontology is crucial in many legal and criminal cases, and experts in the field are constantly in research of more accurate and advanced methods.

Whittaker (1982) reviewed Forensic Odontology literature and found that the majority of publications were case reports at the time.[2] Katz and Cottone reviewed the abstracts from the Annual Meetings of the Odontology Section of the American Academy of Forensic Sciences (AAFS) from 1980 to 1987 to find the topics/type of research.[3]

Aim

The scope of this work is to identify the trends in forensic odontology publications in peer-review journals for the years 2000–2015, regarding the topics, type, and country of origin of the publications. The results would create a map of the current research activity in forensic odontology.

Materials and Methods

The review material consisted of publications related to forensic odontology as those appear between 2000 and 2015 in the major international peer-reviewed forensic journals. Although the list of forensic journals is not exhaustive, the main and well-known journals where forensic odontology publications most commonly appear are Journal of Forensic Odonto-stomatology, Journal of Forensic Sciences, Forensic Science International, Journal of Forensic and Legal Medicine, American Journal of Forensic Medicine and Pathology, International Journal of Legal Medicine, Science and Justice, and others. All the issues of these journals from 2000 to 2015 were searched to identify the publications in forensic odontology, and each one was categorized according to its topic, type, and country of origin based on the first author's academic affiliation.

In addition, search using the keywords forensic odontology and forensic dentistry was performed in the main publishers' websites (Science Direct, Wiley-Blackwell, Springer, and Sage) to find relevant articles in other journals. The condition for an article to be used in this research was that the publication was listed in a peer-reviewed journal. Of course, they may be publications outside these journals, in national journals or other publishers, but for the purposes of this work, the selected material is considered large enough to give us a frame of current trends.

Each publication was categorized according to the topic: age estimation, bite marks, identification, mass disaster management, facial reconstruction, abuse, law and

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ethical issues (including expert witness and malpractice), anthropology and archeology, and education. Regarding the type of publications, they were classified into research, review, case report, and technical (new technique or improvement).

Results

The total number of publications in forensic odontology was 777 with a significant increase since 2006. From 2000 until 2005, they were 30 publications on average each year; in contrast, in the last 10 years, they were on average 60 per year. The largest number per year was achieved in 2011 with 90, whereas in 2000, the number of publications was just 22. The number of publication for each year can be seen in Figure 1. The majority of the publications were in the Journal of Forensic Sciences, Forensic Science International, and the Journal of Forensic Odonto-stomatology; these three journals hosted 73% of the total number [Figure 2].

The most frequently reported topics during this time were age estimation with 272 publications, followed by identification with 211 and bite marks with 96 [Figure 3]. In terms of expressing the percentage of the total number of publications, the results were: age estimation 35%, identification 27%, bite marks 12%, anthropology 8%, mass disaster management 7%, facial reconstruction 5%, and law and ethical issues 4% out of the total publications [Figure 4].

The age estimation publications for the last 15 years were further classified into those that refer to the development stages of the teeth, those studying changes in dental tissues and other techniques used for adults. The majority, i.e., 67%, were publications about tooth development [Figure 5]. The number of publications every year showed an increase since 2008 for tooth stage developmental age assessment, in line with the high demand of establishing accurate and reliable methods. The latter is important due to the refugee crisis and the necessity of assigning age to unaccompanied children and people with no documents.

Identification publications were further classified into five subcategories: methods based on records, imaging/radiology, denture marking, computer, and DNA. Record-based methods were the most frequent topic with 55%, and radiograph/imaging methods of identification were frequent with 23%. Computer and denture marking were seen each 6% and DNA was seen in 10% of the articles [Figure 6].

Most of the publications came as a result of research in 64% of the publications, 15% were review articles, and about 10% were either of the two other categories: case and technical reports [Figure 7]. There is a growing research type of publications after 2006, while the other types remain in about the same level [Figure 8].

The publications were classified based on the country of origin of the first author's academic institution with totally 57 countries found [Figure 9]. The top 15 countries which had on average at least one publication per year are seen in Table 1 with the USA to be in the first place followed by Australia and India, Italy, and the UK. These 15 countries gave over 80% of the total number of publications when they represent 33% of global population. This is in line with the fact that the dental schools to offer courses in forensic odontology are found only in selected countries (i.e., USA, Australia, India, UK, Belgium, and Italy) which as a consequence appear more frequently in forensic odontology literature.

Discussion

The results of the forensic odontology literature review suggest that in the last 15 years, there is a significant rise in the number of publications, especially after 2006, with age estimation and identification as the most common topics. Research is growing and less case reports appear in journals. However, the majority of academic work is concentrated in a few selected countries.

The increase of forensic odontology publications is because it is involved in more high profile cases, extended use of dental age estimation for refugees and asylum seekers with no ID documents. More postgraduate courses have also been established since 2000. In the aftermath of the Tsunami Disaster in 2005, the dental comparison methods have been

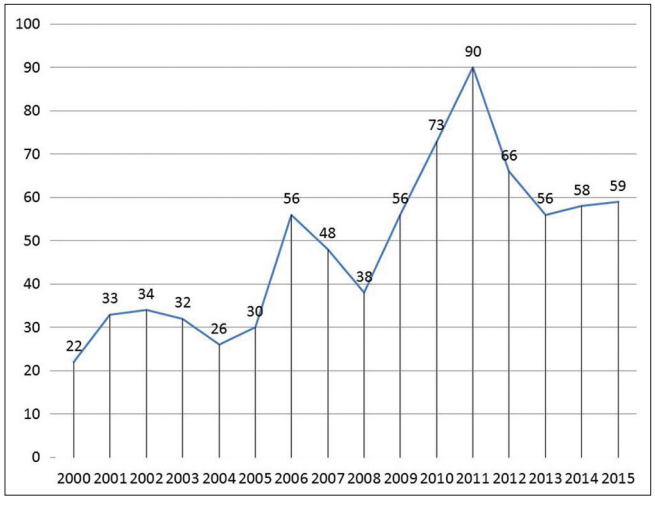

Figure 1: Annual distribution of the number of forensic odontology publications from 2000 to 2015

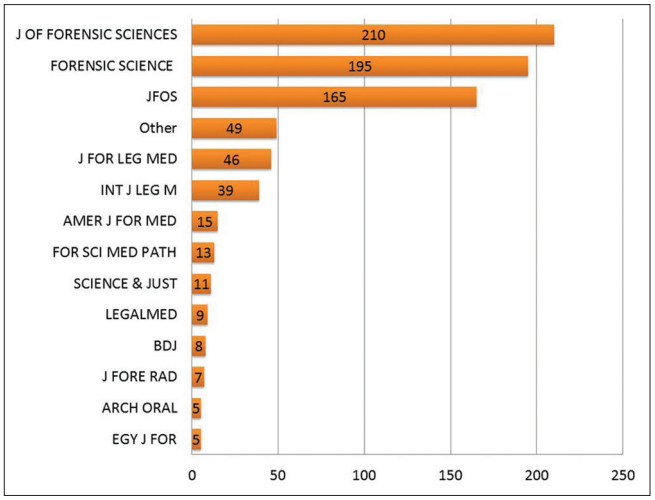

Figure 2: Number of forensic odontology publications per journal from 2000 to 2015

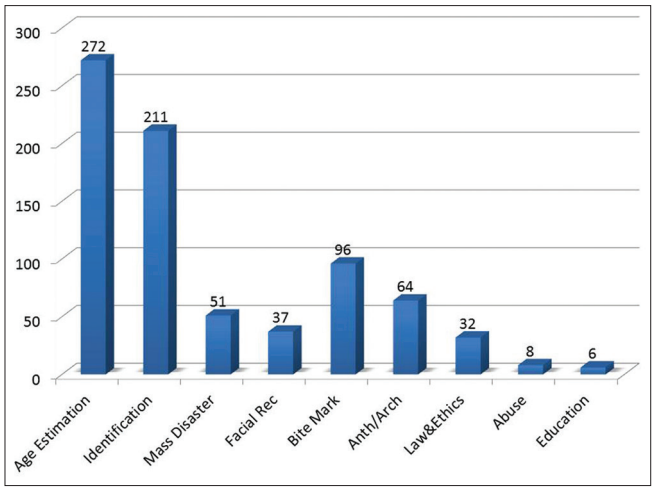

Figure 3: Number of forensic odontology publications per topic from 2000 to 2015

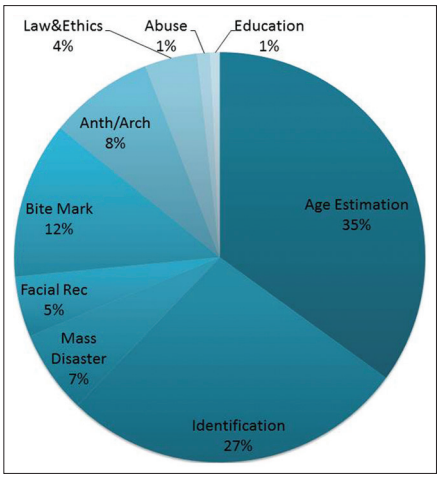

Figure 4: Percentage of forensic odontology publications per topic from 2000 to 2015

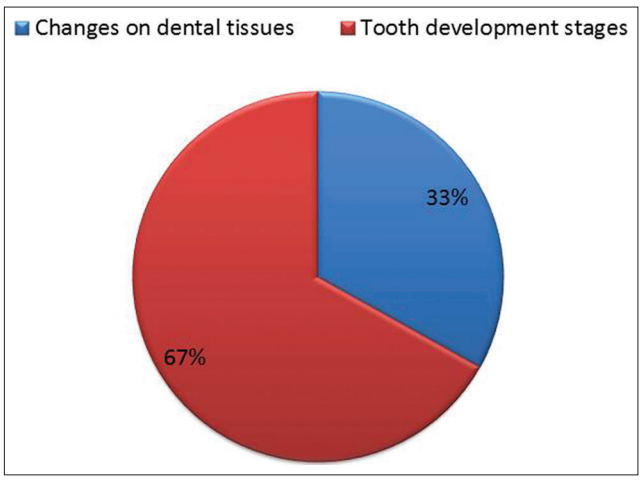

Figure 5: Percentage of age estimation publications per subcategory from 2000 to 2015

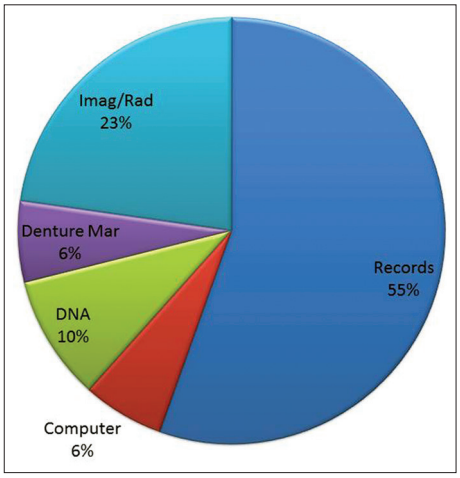

Figure 6: Percentage of identification publications per subcategory from 2000 to 2015

Table 1: The countries with higher number of forensic odontology publications based on the first author's academic institute affiliation

Country of institution	Percentage of all publications
USA	11.45
Australia	10.04
India	10.04
Italy	7.98
UK	7.72
Belgium	6.95
Brazil	5.79
Japan	4.25
Spain	3.35
Germany	2.96
Canada	2.70
South Africa	2.57
France	2.45
Turkey	2.31
New Zealand	2.31
Other countries	17.13

the primary identifier in 79% of cases and a contributor in another 8% of cases, a total of 87%.[4]

Despite the fact that Katz and Cottone in their review used different material (abstracts from the AAFS annual meetings) and had different categories, it was the only review regarding the past trends in forensic odontology.[3] The bite mark topic was the topic more frequently seen in Katz and Cottone review, but it should be stressed that, in their review, age estimation is included in identification category. The results for 2000–2015 were grouped to match the categories of 1988 review, and it was observed that identification is the most common topic in the last 15 years in contrast to the 1988 review where bite marks were the most popular. There was a primary focus on dental age assessment and identification research between 2000 and 2015 [Table 2]. However, it was sensible because the 1988 review was based on AAFS meetings to compare the topics of publications from the USA only. The comparison table shows that frequency of bite marks publications is almost the same; however, a significant increase is noticed for identification/age estimation. [Table 3].

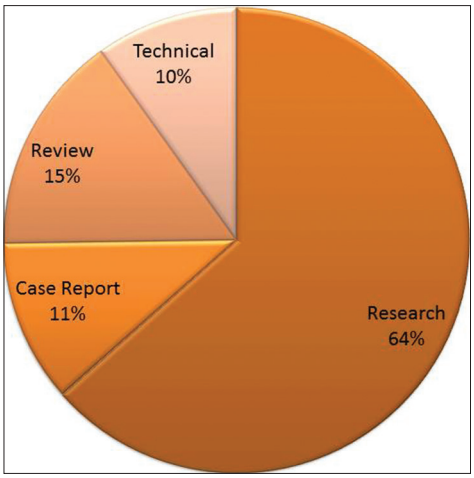

Figure 7: Percentage of forensic odontology publications per type of publication from 2000 to 2015

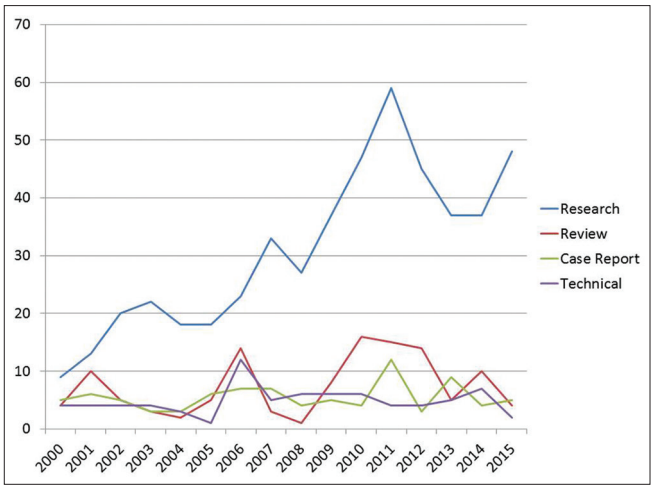

Figure 8: Annual distribution of the number of forensic odontology publications per type of publication from 2000 to 2015

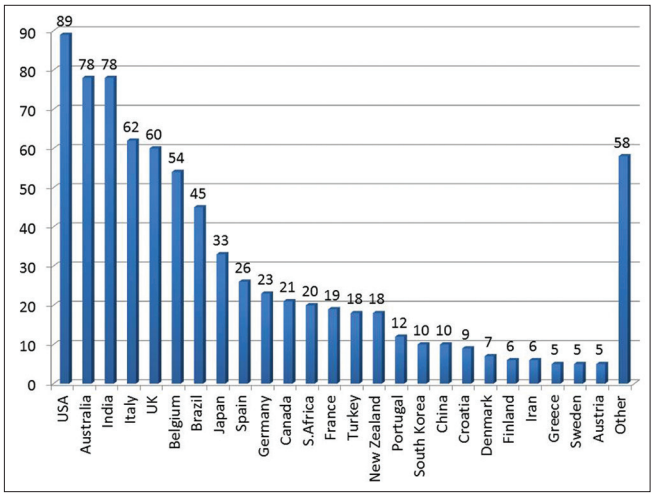

Figure 9: Number of forensic odontology publications according to the country of origin of the first author's academic affiliation from 2000 to 2015

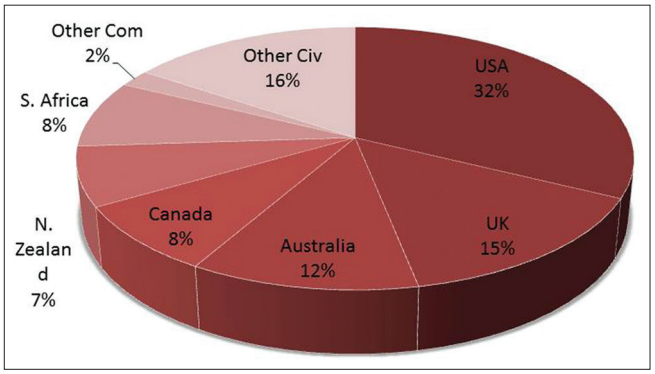

Figure 10: Percentage of bite mark publications according to the country of origin of the first author's academic affiliation from 2000 to 2015

Table 2: Comparison table of appearance of forensic odontology topics between publications in peer-reviewed journals in 2000-2015 and abstracts from the Annual Meetings of the Odontology Section of the American Academy of Forensic Sciences from 1980 to 1987

	2000-2015 (%)	1980-1987 (%)
ID/Age Estimation	62	28
Mass disaster	7	7
Bite mark	12	36
Law and ethics	4	11
Abuse	1	1
Misc	14	17

The 2000–2015 years saw the growing research type of publications after 2006 while the other types remain in about the same level. In the Katz and Cottone review, the case reports were the most common type with 42%; however, the authors did mention the increasing research type of academic work. The comparison shows the big increase of research type of publications in the recent years and the sharp fall of the case reports [Table 4].

The distribution of publications in forensic odontology literature referring to bite mark analysis does not show the same increase rate that is seen linked to age estimation and identification. The highest number was 16 in 2011. An interesting fact is that the majority of the overall bite mark publications come from common law countries [Figure 10]. A possible explanation perhaps could be that in these countries, the debate and the question regarding the admissibility and reliability of expert witness in bite marks cases are more active.

Conclusion

Forensic odontology appears more frequently in the literature, and there are opportunities to conduct research in various legal and forensic areas. It is fundamental that further research is needed to solve problems which raise doubts about the forensic odontology investigations and the disputes that arise over the value and reliability of the resulting interpretations. The research outcomes should target to strengthen the discipline by placing it sufficiently grounded in science.

It is more likely that age estimation and identification will continue to be the most common topics, but more research

Table 3: Comparison table of appearance of forensic odontology topics between USA publications (only in peer-reviewed journals) in 2000-2015 and abstracts from the Annual Meetings of the Odontology Section of the American Academy of Forensic Sciences from 1980 to 1987

	USA publisher	1980-1987
ID/Age Est	47	28
Mass disaster	9	7
Bite mark	35	36
Law and ethics	2	11
Abuse	2	1
Misc	5	17

Table 4: Comparison of frequency of type of academic work in forensic odontology between publications in peer-reviewed journals in 2000-2015 and abstracts from the Annual Meetings of the Odontology Section of the American Academy of Forensic Sciences from 1980 to 1987

	2000-2015 (%)	1980-1987 (%)
Research	64	22
Review	15	14
Case report	11	42
Technical	10	21

time is anticipated for bite mark analysis to improve technique and strengthen the value and reliability of the results interpretation. Further, we may see more publications regarding the establishment of international standards for the education, training, and practice in forensic odontology, as we face the challenge of globalization and it becomes necessary for forensic odontologists to cooperate and abolish practicing in isolation.[5]

The research could go a step further and benefit by the use of advances and results from other scientific fields. DNA technology, computer innovations, and psychology tests on the performance of human observers could be applied in the future forensic odontology projects concerning identification, age estimation, and bite marks. These advances should be reflected in forensic odontology training courses by having the curriculum content constantly updated for the benefit of the discipline and the community it serves.[6,7]

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Conflicts of interest

There are no conflicts of interest.

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