

The relationship of forensic odontology with various dental specialties in the articles published in a National and an International Forensic Odontology Journal: A 5-year content analysis

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Abstract

Aims: The aim of this study is to assess the quantum of articles published by various dental specialties in a National and an International Forensic Odontology Journal from January 1, 2010, to December 31, 2014. **Settings and Design:** The present study is a 5-year retrospective content analysis study. **Subjects and Methods:** Data were collected from two forensic odontology journals (Journal of Forensic Odonto Stomatology [JOFOS] and Journal of Forensic Dental Sciences [JFDS]) which are subscribed by institutional library. The article contents were scrutinized by one investigator and categorized into nine individual dental specialties based on the new working classification proposed for forensic odontology. **Statistical Analysis Used:** The quantum of articles published by various dental specialties and the various focus areas in each specialty were assessed using Chi-square test. **Results:** Among all the published articles, a maximum number of articles were related to the Department of Oral Medicine and Radiology (32.6%) in JFDS with Cheiloscropy (46.7%) being more focused area and to the Department of Prosthodontics (25.7%) in JOFOS with Bite mark analysis (66.7%) being more focused area. **Conclusions:** There was a scarcity of information about the relationship of forensic odontology with various dental specialties in the articles published in JFDS and JOFOS. The editorial board of journals should expand and elaborate their scope of journals to various focus areas of forensic odontology. This will encourage the researchers to explore in the different focus areas which are most neglected as of now.

Key words: Dental specialties, forensic odontology, relationship

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Introduction

Forensic odontology is a promising and budding field of dentistry, which deals with the proper handling and examination of dental evidence and with proper evaluation and presentation of dental findings in the interest of justice.^[1] Although forensic dentistry has become an integral part of forensic science over the past century that utilizes dental or orofacial findings, it is still the most unexplored and intriguing branch of forensic sciences.^[2]

Forensic odontology, also called as forensic dentistry, is the study of teeth and jaws as evident in law and justice.^[3] Since the dental evidence is preserved after death, it is advantageous as it favors further investigations.^[4] Although a great leap of innovations in science is observed in the last few decades, technology is still lagging in ceasing the crime which is persisting in all aspects of life.^[5] This forensic odontology information is relevant in medical and dental practice for evaluating developmental progress, for educational purposes and in legal matters, particularly in criminal law and mass disaster situations.^[5]

Based on the relationship of different dental specialties with forensic odontology, a working classification for forensic odontology was devised.^[6] This was done by reviewing in detail the utilization of various dental specializations with forensic odontology by understanding its implications for performing research.

As we know, forensic odontology has grown immensely in world in recent years with initiation of many official journals, which publish articles related to forensic odontology. Even though forensic odontology is a vast subject, most of the research was concentrated mainly on limited topics by very few specialties of dentistry. There are many other topics yet to be resolute. Except few previous studies^[1,7] published by Shamim, there is a scanty of information regarding the relationship between distribution of articles to different dental specialties among forensic journals. Hence, the present study was undertaken to assess the relationship of forensic odontology with various dental specialties in the articles published in forensic odontology journals. Hence, the main objective of this study is to assess the relationship of forensic odontology with various dental specialties in the articles published in one National and International Forensic Odontology Journals published between January 1, 2010, and December 31, 2014.

Subjects and Methods

This study was a 5-year retrospective content analysis study. Ethical approval for this study was obtained from the Institutional Ethics Committee. All of the protocols for this study were performed in accordance with the Declaration of Helsinki. Forensic odontology journals subscribed by

institutional library were considered for data collection. The available two forensic journals were Journal of Forensic Odonto Stomatology (JFOS) (international) and Journal of Forensic Dental Sciences (JFDS) (national). All the published articles from the selected forensic odontology journals in the last 5 years were included in the study, i.e., January 1, 2010, to December 31, 2014.

All the articles published in English language in the last 5 years of selected journals are included in this study. The section on editorial, forensic medicine-related articles, book review, and conference proceedings in Journals were excluded from the study. The list of articles which fulfill the eligibility criteria were selected. Each articles' content was scrutinized based on the relationship of forensic odontology with other dental specialties. Based on the content, each published article was categorized into nine individual dental specialty articles according to new working classification proposed for forensic odontology.^[6] The dental specialties considered under different categories were oral pathology and microbiology, oral medicine and radiology, oral and maxillofacial surgery, pedodontics, periodontics, conservative dentistry and endodontics, prosthodontics, orthodontics, and finally Public Health Dentistry. The studies related to two or more dental specialties were included under dental inter-departmental category and studies related to both forensic dentistry and medicine were included under medical and dental category. Articles not included under any of the above-mentioned categories were included under miscellaneous category (knowledge, attitude and practices studies, questionnaire studies, etc.).

Each focus area in the new working classification proposed for forensic odontology was given a numerical code. After scrutinizing, each article was categorized into different focus areas according to new working classification proposed for forensic odontology, and a numerical code was assigned to that particular article. Thus, all the articles included in the present study were categorized and entered into a data entry sheet. The data were then entered into an Excel sheet in a personal computer and subjected to statistical analysis.

Statistical analysis

Results were analyzed using statistical package of social sciences (IBM corp. Released 2013 IBM SPSS statistics for windows version 22.0. Armonk, NY) The quantum of articles published by various dental specialties and the various focus areas of each specialty were assessed using Chi-square test.

Results

The present study was undertaken to assess the relationship of forensic odontology with various dental specialties in the articles published in one National and International Forensic Odontology Journals from January 1, 2010, to

December 31, 2014. Among 127 articles published in the last 5-year, 92 articles were selected from national and 35 articles were from international journal.

Among all the published articles, a maximum number of articles were related to the Department of Oral Medicine and Radiology (32.6%) in JFDS with Cheiloscopy (46.7%) being more focused area and to the Department of Prosthodontics (25.7%) in JFOS with Bite mark analysis (66.7%) being more focused area. The quantum of articles published by various journals under different dental specialties are mentioned in Table 1. The quantum of articles published under different focus areas by various

dental specialties, i.e. oral pathology, oral medicine and radiology, oral and maxillofacial surgery, pedodontics, periodontics, conservative dentistry, prosthodontics, orthodontics, public health dentistry are also mentioned in Tables 2-10, respectively.

Discussion

Recently, forensic odontology has evolved as a new ray of hope in assisting forensic medicine, but, this vital and integral field of forensic medicine is still in a state of infancy in India and many other parts of the world.^[8] It involves the application of dental sciences under various specialties

Table 1: Distribution of articles in different specialties

Department	Journal of Forensic Dental Sciences, n (%)	Journal of Forensic Odontology Stomatology, n (%)	Total, n (%)
Oral Pathology	16 (17.4)	3 (8.6)	19 (15.0)
Oral Medicine Radiology	30 (32.6)	6 (17.1)	36 (28.3)
Oral and Maxillofacial Surgery	1 (1.1)	4 (11.4)	5 (3.9)
Pedodontics	2 (2.2)	3 (8.6)	5 (3.9)
Periodontics	0	0	0
Conservative	3 (3.3)	0	3 (2.4)
Prosthodontics	16 (17.4)	9 (25.7)	25 (19.7)
Orthodontics	10 (10.9)	5 (14.3)	15 (11.8)
Public Health Dentistry	4 (4.3)	3 (8.6)	7 (5.5)
Dental Interdepartmental	2 (2.2)	1 (2.9)	3 (2.4)
Medical and Dental	2 (2.2)	1 (2.9)	3 (2.4)
Miscellaneous	6 (6.5)	0	6 (4.7)
Total	92 (100.0)	35 (100.0)	127 (100.0)
Statistical inference		Pearson $\chi^2=18.469$ df=10 *P=0.048	

*P<0.05 is considered statistically significant

Table 2: Distribution of articles in relation to focus areas under oral pathology

Department	Category	Area of focus	Journal of Forensic Dental Sciences, n (%)	Journal of Forensic Odontology Stomatology, n (%)	Total, n (%)
Oral Pathology and Micro Biology	Age estimation using ground sections (histological method)	Gustafson's technique	1 (6.3)	1 (33.3)	2 (10.5)
		Incremental lines of Retzius	2 (12.5)	0	2 (10.5)
		Perikymata	0	0	0
		Prenatal and postnatal line formation	0	0	0
		Racemization of collagen in dentin	2 (12.5)	0	2 (10.5)
		Cemental incremental lines	0	1 (33.3)	1 (5.3)
	Identification	Translucency of dentin	2 (12.5)	0	2 (10.5)
		Developmental disturbances of teeth	1 (6.3)	0	1 (5.3)
		Regressive alterations of teeth	1 (6.3)	0	1 (5.3)
		Tumors and cysts of oral cavity	1 (6.3)	0	1 (5.3)
		DNA profiling from teeth	6 (37.5)	1 (33.3)	7 (36.8)
Total		16 (100.0)	3 (100.0)	19 (100.0)	
Statistical inference		Pearson $\chi^2=8.793$ df=8 P=0.36			

Table 3: Distribution of articles in relation to focus areas under oral medicine and radiology

Department	Category	Area of focus	Journal of Forensic Dental Sciences, n (%)	Journal of Forensic Odontology Stomatology, n (%)	Total, n (%)
Oral Medicine and Radiology	Age estimation using radiographic method	Secondary dentin formation	1 (3.3)	0	1 (2.8)
		Changes in the orientation of mental foramen and inferior alveolar canal	1 (3.3)	0	1 (2.8)
		Eruption and formation of mandibular third molar	4 (13.3)	3 (50.0)	7 (19.4)
		Trabecular pattern in jaws	0	0	0
		Pulp/tooth area ratio of teeth	7 (23.3)	1 (16.7)	8 (22.2)
	Identification	Pattern of lamina dura	0	0	0
		Maintenance of dental records	1 (3.3)	0	1 (2.8)
		Dental charting	0	1 (16.7)	1 (2.8)
		Comparative dental identification	2 (6.7)	0	2 (5.6)
		Cheiloscopy	14 (46.7)	1 (16.7)	15 (41.7)
	Total	30 (100.0)	6 (100.0)	36 (100.0)	
Statistical inference	Pearson $\chi^2=10.63$ df=7 P=0.155				

Table 4: Distribution of articles in relation to focus areas under oral surgery

Department	Category	Area of focus	Journal of Forensic Dental Sciences, n (%)	Journal of Forensic Odontology Stomatology, n (%)	Total, n (%)
Oral and maxillofacial surgery	Identification	Dentoalveolar fractures	0	2 (50.0)	2 (40.0)
		Surgical repairs and implants	1 (100.0)	2 (50.0)	3 (60.0)
	Lefort I osteotomy procedure in autopsy	0	0	0	
	Total	1 (100.0)	4 (100.0)	5 (100.0)	
Statistical inference	Pearson $\chi^2=0.833$ df=1 P=0.361				

Table 5: Distribution of articles in relation to focus areas under pedodontics

Department	Category	Area of focus	Journal of Forensic Dental Sciences, n (%)	Journal of Forensic Odontology Stomatology, n (%)	Total, n (%)
Pedodontics	Age estimation	Eruption sequence	0	0	0
		Schour and Massler chart	0	0	0
		Demirjian's method dental maturation chart	2 (100.0)	2 (66.7)	4 (80.0)
		Nolla's calcification	0	0	0
	Child abuse	0	1 (33.3)	1 (20.0)	
	Total	2 (100.0)	3 (100.0)	5 (100.0)	
Statistical inference	Pearson $\chi^2=0.833$ df=1 P=0.361				

Table 6: Distribution of articles in relation to focus areas under periodontics

Department	Category	Journal of Forensic Dental Sciences, n (%)	Journal of Forensic Odontology Stomatology, n (%)
Periodontics	Age estimation	0	0
	Identification	0	0

in the identification of deceased individuals which most often carried out comparing ante and postmortem dental records.^[8] However, owing to scanty information on

forensic odontology in relation to various dental specialties, the present study was undertaken. Here, we assessed the relationship of forensic odontology with various dental specialties using articles published in two forensic odontology journals (JFDS and JFOS).

In the present study, among 127 (100%) published articles, most of the articles (28.3%) were from the Department of Oral Medicine and Radiology with Cheiloscopy (41.7%) as focused area. In JFDS, 32.6% of the articles published

Table 7: Distribution of articles in relation to focus areas under conservative dentistry

Department	Category	Area of focus	Journal of Forensic Dental Sciences, n (%)	Journal of Forensic Odontology Stomatology, n (%)	Total, n (%)
Conservative dentistry	Identification	Restorations	0	0	0
		Endodontic treatment	0	0	0
	Identification using radiographic method (periapical radiograph)	Root canal treated restorations	0	0	0
		Radiolucent and radio opaque restorative materials	1 (33.3)	0	1 (33.3)
	Effect of heat on restorative materials	2 (66.7)	0	2 (66.7)	
Total		3 (100.0)	0	3 (100.0)	

No statistics are computed because Journal of Forensic Odontology Stomatology had no published articles

Table 8: Distribution of articles in relation to focus areas under prosthodontics

Department	Category	Area of focus	Journal of Forensic Dental Sciences, n (%)	Journal of Forensic Odontology Stomatology, n (%)	Total, n (%)
Prosthodontic	Impression techniques	Bite mark analysis	0	0	0
		Palatal rugoscopy	7 (43.8)	2 (22.2)	9 (36)
	Identification	Dentures and prostheses	1 (6.3)	0	1 (4.0)
		Denture marking	0	0	0
		Bite mark analysis	1 (6.3)	6 (66.7)	7 (28.0)
		Palatal rugoscopy	7 (43.8)	0	7 (28.0)
	Sex determination	Impressions and casts	0	0	0
		Palatal dimensions	0	1 (11.1)	1 (4.0)
	Total		16 (100)	9 (100)	25 (100)
	Statistical inference	Pearson $\chi^2=14.528$ df=4 *P=0.006			

Table 9: Distribution of articles in relation to focus areas under orthodontics

Department	Category	Area of focus	Journal of Forensic Dental Sciences, n (%)	Journal of Forensic Odontology Stomatology, n (%)	Total, n (%)
Orthodontics	Age estimation	Cephalometrics	5 (50.0)	0	5 (33.3)
		Orthopantomography X-ray and hand wrist X-ray to determine pubertal state	2 (20.0)	0	2 (13.3)
	Identification	Tooth rotation and malposition	0	1 (20.0)	1 (6.7)
		Orthodontic appliances	0	0	0
		Orthodontic reconstruction	0	0	0
	Sexual dimorphism	Mandibular canine index and mandibular first molar index	3 (30.0)	4 (80)	7 (46.7)
	Race identification	Cephalic index	0	0	0
	Craniofacial superimposition		0	0	0
	Total		10 (100)	5 (100)	15 (100)
	Statistical inference	Pearson $\chi^2=7.286$ df=3 P=0.063			

were from oral medicine and radiology with Cheiloscopy as the stressed area (46.7%) while the Department of Prosthodontics had more articles published in JFOS with Bite mark analysis (66.7%) as the more focused area. Shamim in his study found that a maximum number of published articles in the JFDS were related to oral medicine and radiology and the finding of this study was in agreement with the present study.^[1] Shamim in his study found that a maximum number of published articles in

the JFOS were related to oral medicine and radiology and the finding of this study was in contrary with the present study.^[7] The availability of more published literature for comparison, feasible, and reliable methods of estimation and noninvasiveness of the procedures involved might have contributed to the observed findings of more number of articles related to oral medicine with Cheiloscopy as focus area and from prosthodontics with Bite marks as focus area. Besides, the extensive use of Cheiloscopy^[9,10] and Bite mark

Table 10: Distribution of articles in relation to focus areas under public health dentistry

Department	Category	Area of focus	Journal of Forensic Dental Sciences, n (%)	Journal of Forensic Odontology Stomatology, n (%)	Total, n (%)
Public health dentistry	Identification	Endemic fluorosis	0	0	0
		Socioeconomic grouping	0	0	0
		Dental caries			
		Periodontal disease			
		Oral cancer			
		Restorative materials			
		Mass disasters	2 (50.0)	3 (100.0)	5 (71.4)
		Dental fraud and malpractice	1 (25.0)	0	1 (14.3)
Elderly abuse	Total		1 (25.0)	0	1 (14.3)
			4 (100.0)	3 (100.0)	7 (100.0)
Statistical inference	Pearson $\chi^2=2.100$ df=2 P=0.350				

analysis^[7,11,12] as convincing evidence in crime investigations also might have contributed to these two being the focus areas in many articles published in recent past.

In the present study, we could not find any article from the specialty of periodontics, and very few articles were found related to conservative dentistry and endodontics. This finding is in agreement with the previous study.^[1,7] Gingival recession, root transparency, and root length could be effectively utilized for age estimation while gingival morphology and pathology, thickness and widening of periodontal ligament could be used for identification of a person. The uniqueness of restorations and endodontic procedures undertaken in an individual could act as conclusive evidence in any forensic investigations. The lack of published literature relating to periodontics and conservative dentistry in these two forensic odontology journals in recent past highlights the need for specialists from these two specialties to consider publishing their research related to forensic odontology in these journals as well.

Among all published articles related to oral pathology and microbiology in JFDS and JFOS, the most focused area was person identification using DNA profiling from teeth. The uniqueness of DNA sequence makes DNA profiling a method of choice in establishing identity of an individual. The resistant nature of dental tissues to environmental assaults, such as incineration, immersion, trauma, mutilation, decomposition, and microbial action, makes a tooth an excellent source of DNA material. In the tooth, dentin and pulp are rich sources of DNA which can be successfully extracted.^[13]

Among all published articles related to oral medicine and radiology in JFDS, the most focused area was person identification by Cheiloscopy (46.7%) and radiographic method of age estimation using eruption and formation of mandibular third molar (50%) in JFOS. Overall, most focused area was person identification by Cheiloscopy (41.7%). The

grooves present on human lips (Sulci labiorum) are unique to each person similar to fingerprints. Hence, Cheiloscopy techniques have an equal value in relation to other types of forensic evidence for personal identification and sex determination.^[10]

Among all published articles related to oral and maxillofacial surgery in JFDS, identification by surgical repairs and implants (100%) was the only focused area and identification by surgical repairs and implants (50%) and maxillomandibular and dentoalveolar fractures (50%) in JFOS. The placement of dental implants for missing teeth is becoming a trend in recent times, thereby increasing the likelihood that implants will be present in deceased victims and be detected in postmortem radiographic examination. This factor could have contributed to a raise in the number of articles in forensic odontology journals from oral and maxillofacial surgery.^[14]

Among all published articles related to pedodontics, age estimation using Demirjian’s method which utilizes dental maturation chart was the focused area in both Journals. In the current scenario, most of the age estimation modalities are invasive, requiring lengthy processing times, use of expensive instruments, and the services of an experienced pathologist to deduce the age of the person.^[15] The results of Sinha *et al.* imply that Demirjian’s method is a noninvasive procedure applicable to all age groups and for both genders with better accuracy than Nolla’s method, which had limited utility in younger age group.^[16]

Among all published articles related to prosthodontics in JFDS, the most focused area was person identification by palatal rugoscopy (43.8%) and person identification by Bite mark analysis (66.7%) in JFOS. Overall, most focused area was person identification by palatal rugoscopy (36%). Although DNA testing is the gold standard in forensic science, it cannot be used frequently owing to the expenses and other logistic considerations. Since rugae are not damaged from trauma due to their

internal position in the oral cavity and are insulated from heat by tongue and buccal fat pads, palatal rugoscopy has also been suggested as an alternative method of identification.^[17]

Among all published articles related to orthodontics in JFDS, the most focused area was age estimation by Cephalometrics (50%) and sexual dimorphism by mandibular canine index and mandibular first molar index (80%) in JFOS. This could probably be attributed to the fact that sex determination is one of the prime factors applied to assist in identification of an individual. Information concerning tooth size aids in age and sex determination of human remains. Sex determination using dental features is primarily based on the comparison of tooth dimensions in males and females or the comparison of frequencies of nonmetric dental traits such as Carabelli's trait of upper molars, deflecting wrinkle of lower first molars, distal accessory ridge of upper and lower canines, or shoveling of upper central incisors.^[18]

Among all published articles related to public health dentistry, the most focused area was person identification in mass disasters in both journals. The proper identification of dead is important not only for humanitarian and emotional reasons for the next-of kin but also for legal and administrative purposes. Dental identification plays a key role in disasters, especially in mass casualties associated with floods and earthquakes, the situations which have been highly recurrent in India in the last few decades. Following mass disaster, identification of individual victims by dental means is one of the most reliable methods identification in such situations.^[19]

Limitations

- Our study was an assessment of articles published under different dental specialties in a National and an International Forensic Odontology Journal
- The study considered articles published in the last 5 years. A larger study including all important forensic odontology journals published over a decade could better identify the relationship of forensic odontology with various dental specialties
- This was the first of its kind where the articles published by different specialties in forensic odontology domain were assessed in published journals. Hence, we could not compare our results with previously published literature.

Conclusions

The present study was an attempt to explore the quantum of articles published in the last 5 years by different dental specialties in forensic odontology domain in a National and International Forensic Odontology Journal. Among

the articles published in JFDS, majority was from Oral Medicine and Radiology (32.6%) with Cheiloscopy (46.7%) as the most focused area. In JFOS, the Department of Prosthodontics (25.7%) published maximum articles with Bite mark analysis (66.7%) as focus area. Overall, the Department of Oral Medicine and Radiology published maximum number of articles among various dental specialties (28.3%) in these two journals with Cheiloscopy as the most discussed focus area (41.7%). We could not find any article published by the Department of Periodontics in forensic odontology domain in these two journals, and very few articles were found from conservative dentistry and endodontics.

Recommendations

Among various focus areas in forensic odontology, only Cheiloscopy, Bite mark analysis, DNA profiling from teeth, Palatal rugoscopy, and Cephalometrics were most discussed while many other areas need to be considered by dental specialists. These kinds of studies will present an evaluation of the current trends in forensic odontology domain by various dental specialties. This facilitates researchers from various dental specialties to focus on many other areas which have never been focused. This will substantially add to the existing body of literature. The editorial boards of journals may also expand and elaborate the focus areas in forensic odontology and encourage publications from specialists in dentistry under latest focus areas while sustaining publications in other areas in practice.

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Conflicts of interest

There are no conflicts of interest.

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