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RESEARCH ARTICLE

KNOWLEDGE, ATTITUDE AND PRACTICE OF FORENSIC ODONTOLOGY AMONG 307 DENTAL PRACTITIONERS IN WESTERN MAHARASHTRA, INDIA

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ABSTRACT

Objectives: To analyze the knowledge, attitude and practice of forensic Odontology among 307 dental practitioners of western Maharashtra, India.
Materials and Methods: Data was collected by means of a questionnaire from a cross sectional sample of 307 dental practitioners of Western Maharashtra.
Results: 100% dental practitioners maintained dental records in some form, but ironically only 7 % of them maintained complete dental records. 93% of them were aware of the significance of maintaining records in forensic identification. Only 13% were aware that both parent counseling and child guidance referral clinic were essential in dealing with such victims while 14% dental practitioners were unaware of what their role is in identification of cases with child abuse. 26% dental practitioners used both eruption sequence and radiographs methods for age estimation. 51% dental practitioners were aware that DNA fingerprinting was the most sensitive method for forensic identification. 25% dental practitioners were unaware of the bite marks pattern of teeth. 89% dental practitioners did not have any formal training in collecting, evaluating and presenting dental evidence. 37% dental practitioners were not aware that they could testify as an expert witness in the court of law. 73% dental practitioners did not use identification code numbers on prosthetic devices and dental implants. Only11% maintained the identification code number records. 42% dental practitioners used the FDI system, 34 % used universal system and 24% used the Zsigmondy/Palmer method while maintaining dental records. 65% dental practitioners reported their inability for age and gender identification in cases of mass disasters.
Conclusion: Our study revealed that dental practitioners from this region have adequate knowledge of forensic odontology, but lack of formal training, inadequate forensic laboratories, poor attitude and lack of interest was prevalent.

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INTRODUCTION

Despite leaps in modern technology and medical breakthroughs that the last century has brought, our society is faced with fresh challenges in every conceivable area. Violent activities and natural disasters shatter the lives of so many individuals each day. Identification of individuals at the crime scene and disasters by dentists through dental records, assist those involved in crime investigation. But lack of adequate knowledge and training in forensic odontology among dental professionals is a major road block in achieving this goal. And hence the present survey was conducted to evaluate the knowledge, attitude and practice of forensic odontology among dental practitioners in Western Maharashtra, India.

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MATERIALS AND METHODS

A questionnaire was designed for practicing dental surgeons, who in their day to day practice might come across cases of forensic interest. A cross sectional study was conducted among 307 dental practitioners in western Maharashtra (Kolhapur, Karad, Satara and Sangli). Data was collected in a personalized manner by means of a questionnaire. The questions were both, open and closed ended.

Questionnaire format

1. **Do you maintain dental record in your clinic**.

a. (a)Yes (b) No.

2. If yes, which of the following are maintained

a. (a)Patient details. (f)Photographs.
b. (b)Medical history. (g) Study casts.
c. (c) Family history. (h)Radiographs.
d. (d) Clinical findings (i) Investigation findings.

e. (e) Treatment plan (j)Treatment log (k)Dental software technology.

3. Duration of maintenance of Dental records should ideally be

a. (a)1-2years (b) 2-5 years
b. (c)5-10 years (d) more than 10 years

4. Are you aware of the significance of maintaining records in identifying the deceased and crime suspects?

a. (a) Yes (b) No

5. How can you identify physical / neglective /sexual /psychological abuse of a child?

a. (a) Physical injuries (b)Scars. (c) Behaviour (d) All the above

6. What would you do if you identify signs or symptoms of child abuse

a. (a)Parent counseling (b) Child guidance clinic referral (c) Don't know.

7. How do you estimate the dental age of an individual by examining the teeth

a. (a)Eruption pattern (b) Radiographs. (c)Don't know.

8. Which of the following is the most accurate and sensitive method to identify an individual

a. (a)Visual identification (b)Finger prints
b. (c) Physical anthropological examination of bones and teeth.
c. (d) Serological comparison. (e) DNA comparison. (f)Don't 'know

9. Are you aware of the bite mark patterns of teeth?

a. (a)Yes (b) No.

10. Have you had any formal training in collecting, evaluating and presenting dental evidence?

a. (a)Yes (b)No.

11. Are you aware that you can testify as an expert witness in the court to present forensic dental evidence?

a. (a)Yes (b)No.

12. Do you use identification code numbers for your prosthetic devices or Dental implants

a. (a)Yes (b) No (c) Any other method –photographs /phone no /license number/etc.

13. Do you maintain the identification code number records

a. (a)Yes (b)No.

14. Which dental numbering system do you use in maintain the dental record.

a. (a)Universal Numbering system (b) Zsigmondy/palmer
b. (c) FDI (federation Dentaire International)

15. Can you identify the age and gender of the deceased in the event of a mass disaster?

Yes (b) No

KAP criteria (Preethi *et al*., 2011)

1. Knowledge – importance and significance of dental records, identification of child abuse, dental age estimation, and identification of bite marks and individuals as witness in the court.
2. Attitude and practice- towards maintenance of dental records and methods in assisting forensic dental identification.

RESULTS

Do you maintain dental record in your clinic, if so which of the following and how long?

100% dental practitioners maintained dental records in some form, but ironically only 7 % of them maintained complete dental records. 36% dental practitioners maintained records for 1-2 years, 30% upto 5 years, 32% for 5-10 years and only 2% maintained records for more than 10 years.

Are you aware of the significance of maintaining records in identifying the deceased and crime suspects?

93% dental practitioners were aware of the significance of maintaining records in forensic identification.

How can you identify physical / neglective /sexual /psychological abuse of a child? And on identification of such a child what would you do?

Though 89% dental practitioners were aware of all the signs and symptoms for identification of child abuse. Only 13% were aware that both parent counseling and child guidance referral clinic were essential in dealing with such victims. Tragically, 14% dental practitioners were unaware of what their role is in identification of cases with child abuse.

How do you estimate the dental age of an individual by examining the teeth?

63% dental practitioners used eruption sequence as a guide for age estimation, while 11% relied on radiographs. While only 26% dental practitioners used both methods for age estimation.

Which of the following is the most accurate and sensitive method to identify an individual ?

51% dental practitioners were aware that DNA fingerprinting was the most sensitive method for forensic identification, 44% assumed that visual identification, finger prints, anthropological examination and serological examination were the most accurate methods, while 5% dental practitioners did not know the answer.

Are you aware of the bite mark patterns of teeth?

25% dental practitioners were unaware of the bite marks pattern of teeth.

Have you had any formal training in collecting, evaluating and presenting dental evidence?

89% dental practitioners did not have any formal training in collecting, evaluating and presenting dental evidence.

Are you aware that you can testify as an expert witness in the court to present forensic dental evidence?

37% dental practitioners were not aware that they could testify as an expert witness in the court of law.

Do you use identification code numbers for your prosthetic devices or Dental implants?

73% dental practitioners did not use identification code numbers on prosthetic devices and dental implants.

Do you maintain the identification code number records?

Out of 27% dental practitioner who used dental identification code numbers, only 11% maintained the identification code number records.

Fig. 1. Preservation of dental structures in spite of decomposition

Fig. 2. Dental records

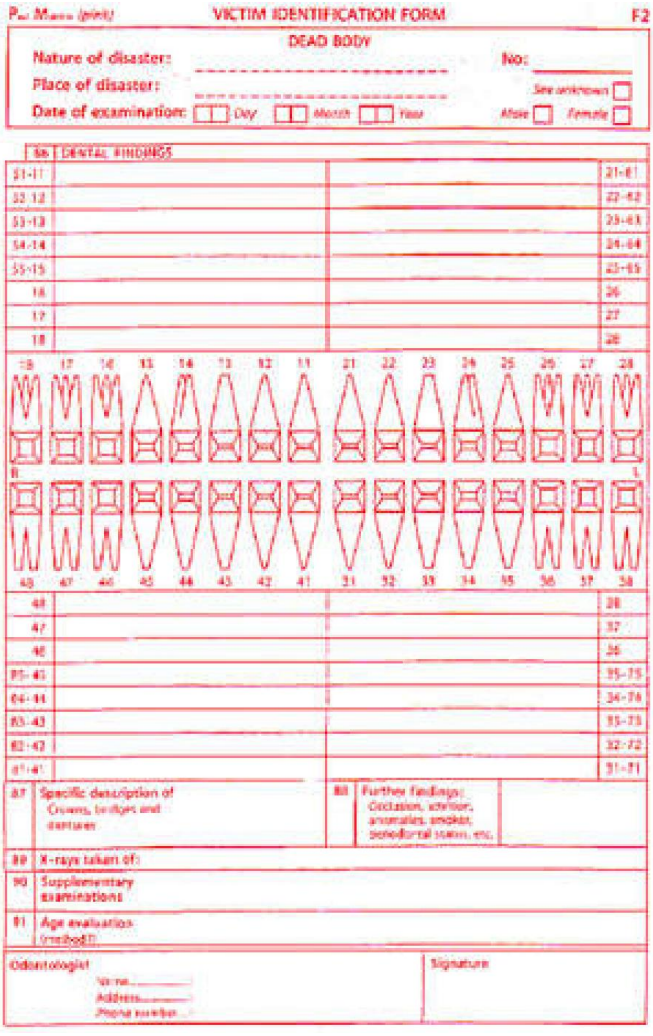

Fig. 3. Victim identification form

Fig. 4. Bite mark

Fig. 5. Bite mark evaulation

Which dental numbering system do you use in maintain the dental record?

42% dental practitioners used the FDI system, 34 % used universal system and 24% used the Zsigmondy/Palmer method while maintaining dental records.

How will you identify the age and gender of the deceased in the event of a mass disaster?

65% dental practitioners reported their inability for age and gender identification in cases of mass disasters.

DISCUSSION

Forensic Odontology, or forensic dentistry, was defined by Keiser-Neilson in 1970 as "that branch of forensic medicine which in the interest of justice deals with the proper handling

and examination of dental evidence and with the proper evaluation and presentation of the dental findings." (Keiser-Neilsen, 1980; Keiser-Neilsen, 1968) Dental structures and restorations may be the only parts of the body not destroyed, and they can be used even though they may be scattered over a wide area, such as occurs in aircraft accidents, terrorist attacks, partial incineration, fragmentation, and severe decomposition. (Fig. 1) The definite establishment of identity of a body essentially comes from a detailed comparison and matching of tangible ante mortem records and post mortem findings. (Levine, 1977) The dental record, also referred to as the patient's chart, is the official office document that records all of the treatment done and all patient-related communications that occur in the dental office. (Fig. 2&3) Beyond providing patient care, the dental record is important because it may be used in a court of law to establish the diagnostic information that was obtained and the treatment that was rendered to the patient. It can be used in insurance claim and defense of allegations of malpractice. Another way the dental record may be used is to help provide information to appropriate legal authorities that will aid in the identification of a dead or missing person. (Dental records) In the present survey conducted, 100% of the dental practitioners maintained dental records in fear of legal obligations and insurance, but very few maintained these records with the aim of forensic identification. In this study, only 7 % maintained complete dental records, while 93% did not maintain record with essential information like study casts, photographs, radiographs and blood groups, which would aid in forensic identification. It is necessary to maintain accounts to avoid action from Income Tax authorities under Section 44 AA of the Income Tax Act, 1961. Official records and documentation should be preserved for observation for a minimum of 8 years to avoid attracting penalties under Section 271 of Income Tax Act, 1961. (Astekar *et al*., 2011) The NHS Terms of Service, state that dental records should be kept for a period of two years. The Regulations state that treatment records, radiographs, photographs, and study models should be retained after the completion of any course of treatment and care, under a continuing care or capitation arrangement for this period, but claim for negligence could happen many years after the event, and that retention of records for the minimum of two years is inadequate. The defense organizations suggest that records be kept permanently. This is often impossible due to space constraints and so the advice given by defense organization is as follows,

1. Treatment Records, X-rays, Study Models, and Correspondence is to be retained for 11 years after the completion of treatment
2. For children, retention of records until the patient is 25 years old
3. Orthodontic Models - retain the original pre- and post-operative models permanently, discard any intermediates after a period of five years. (Charangowda, 2010)

In our survey 36% dental practitioners maintained records for 1-2 years, 30% upto 5 years, 32% for 5-10 years and only 2% maintained records for more than 10 years. That means very few practitioners knew the duration of dental record maintenance as stated by the law, which is a minimum of seven years to a maximum of ten years. (Neville *et al*., 2004) Child abuse is a non-accidental trauma or abuse inflicted on a child by a caretaker that is beyond the acceptable norm of child care. (Ambrose, 1989) The head and facial areas are frequently injured in such cases. These areas are exposed and accessible and the face and mouth are considered representative of the whole being. (Leung, 2008) In our study, though 89% dental practitioners were aware of all the signs and symptoms for identification of child abuse. Only 13% were aware that both parent counseling and child guidance referral clinic were essential in dealing with such victims. Tragically, 14% dental practitioners were unaware of what their role is in identification of cases with child abuse. Dental structures can act useful indicators to determine the individual's chronological age. The age of child can be determined by the analysis of tooth development and subsequent comparison to development charts, usually to an accuracy of approximately 1.6 years. (Soomer *et al*., 2003) The use of attrition and development of third molars have been suggested as means of age estimation in those individuals over 18 years, but both are unreliable. Newer techniques like aspartic acid racemisation (Ritz-Timme *et al*., 2000) and translucent dentine (Gustafson, 1950; Lorentsen and and Solheim, 1989) have been proposed and proved to be highly accurate in adult age assessment. In our survey, 63% dental practitioners used eruption sequence as a guide for age estimation, while 11% relied on radiographs. 26% used both methods for age estimation. Because of the resistant nature of dental tissues to environmental assaults, teeth represent an excellent source of DNA material. (Schwartz *et al*., 1991) When conventional dental identification methods fail, this biological material can provide the necessary link to prove identity. (Sweet and Hildebrand, 1998) In our study, 51% dental practitioners were aware that DNA fingerprinting was the most sensitive method for forensic identification, 44% assumed that visual identification, finger prints, anthropological examination and serological examination were the most accurate methods, while 5% dental practitioners did not know the answer. Bite mark analysis is one aspect of forensic odontology requiring an immediate response by the forensic dentist. The marks fade rapidly, both in the living and in the dead, changing appearance in a matter of hours; delay in examination may result in the loss of valuable evidence. (Fig. 4 & 5)The forensic dentist is also responsible for the examination of the dentition of those suspected of bite mark perpetration. (Vale and Noguchi, 1983; Harvey, 1976; Sweet *et al*., 1997) In our study, 25% dental practitioners were unaware of the bite marks analysis of teeth. The law enforcement authorities in India usually seek the help of dental surgeons in government service rather than dental practitioners who have degrees in forensic odontology from universities outside India and who are not in government service. The outcome is that there is a dearth of qualified forensic odontologists in India, which is evident by the rare instances wherein forensic odontology has been applied successfully in solving criminal cases or to identify the deceased. (Chandrasekharan, 2010) In our study, 89% dental practitioners did not have any formal training in collecting, evaluating and presenting dental evidence, due to the lack in institutions offering formal training and fully equipped laboratories of forensic odontology in India. The subject was not included as part of academic curriculum for dental students until recently and very few workshops and conferences have been conducted in forensic odontology for dental surgeons.

There are few places of stress more formidable than the witness chair in a court of law. After minutes, hours, days, and perhaps even weeks of testimony have dragged on, expert witnesses can find themselves drained to the point of collapse. In the final analysis, the dental witness should be capable of defending his

opinion and should be allowed the time and opportunity to prepare for testimony. (Dent Clin North Am. 1982) In our study, 37% dental practitioners were not at all aware that they could testify as an expert witness in the court of law. The reason for this could be lack of knowledge, interest and attitude due to the cumbersome and stressful situations that may arise from being an expert witness. A complete set of antemortem dental records may take days to reach the identification center, may be incomplete or incorrect, or may not exist at all. Thus a quicker and more accurate identification procedure for victims of mass disasters remains a goal of forensic science. (Vale and Noguchi, 1983; Harvey, 1976) Carlsen proposed that dentures should contain a metal plate with the name of the dentist and an identification number. Krfiger-Monsen listed detailed requirements for denture marking that were adopted by the U.S. Air Force School of Aerospace Medicine. However, according to Haines, edentulous people usually constitute only a small portion of the population in mass disasters. Thus the need remains for a reliable forensic identification system universally applicable in natural teeth and dentures. (Jakobsen *et al*., 1974; Sognnaes, 1976) In our study, 73% dental practitioners did not use identification code numbers on prosthetic devices and dental implants. Out of 27% dental practitioner who used dental identification code numbers, only 11% maintained the identification code number records. We suggest that such identification codes be standardized and used more routinely by dental practitioners to aid forensic identification. In our study, 42% dental practitioners used the FDI system, 34 % used universal system and 24% used the Zsigmondy/Palmer method while maintaining dental records. The FDI system is a more user friendly system due to the ease in usage as compared to the Universal system, and also allows easy transfer of dental records electronically in contrast to the Palmer Notation. Hence we suggest that the use of the FDI system of tooth numbering be made widespread for uniform maintenance of dental records. The identification of large numbers of casualties in mass disasters are complex and fraught with hazards, both physically and emotionally. (Jerman, 1970; Haines, 1973) The identification process is fundamentally the same as that in a routine comparative dental identification, but the inherent problems are magnified. (Morlang, 1996) Problems of body fragmentation, mutilation, commingling and incineration, idiosyncratic dental records from numerous regions, poor working conditions and psychological stresses all confound the identification process. The key to successful mass disaster identification is preparedness. (Clark, 1990) Many jurisdictions have dental identification teams and disaster plans in place. Mock disaster scenarios that help dentists prepare for the disaster situation have proven to be successful. (Morlang, 1986; Pretty *et al*., 2001; Woodward, 1982) Age is one of the essential factors in establishing the identity of a person. Estimation of the human age is a procedure adopted by anthropologists, archaeologists and forensic scientists. (Singh *et al*., 2004; Balwant Rai, 2006) This has helped forensic odontologists to solve cases in countries abroad, and could similarly play a very important role in solving cases in India. In our study, 65% dental practitioners reported their inability for age and gender identification in cases of mass disasters. The reasons for this could be either their lack of basic knowledge or confidence in answering this question.

Conclusion

In the present study among 307 dental practitioners regarding their awareness of forensic odontology, revealed adequate knowledge, but poor attitude and lack of practice prevailing among the dental practitioners of Western Maharashtra, India. The present scenario can be improved by starting formal training programmes in dental institutions, conducting workshops, continuing dental education programmes and conferences at state and national level for general practitioners and encouraging more research for academicians. Stress need to be given in the proper documentation, maintenance and preservation of dental records and prosthetic identification code numbers which will aid in achieving this goal.

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