ISSN No:-2456-2165

Cognizance Towards Forensic Dentistry-A Questionnaire based Study Among Dental Professionals

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Abstract:- Forensic odontology is a field of forensic science that involves the investigation of dentition and bite marks for identifying purposes. It employs the dentist's skills in identifying human remains, estimating age in incidents such as terrorist attacks, aeroplane, train, and road accidents, fires, mass murders or disasters, and natural disasters such as tsunamis, earth quakes, and floods, among others (Disaster Victim Identification-DVI), or when facial recognition is inconclusive because dental structures are the hardest and best protected structures in the body. These structures are resistant to breakdown and extreme temperatures, and they are among the last to decompose after death. The right handling and examination of dental evidence will assist legal authorities in recognising negligence, malpractice, fraud, or abuse, as well as the identification of unknowns. This study aims to provide dentists with an interesting role in the handling, examination, and evaluation of dental evidence in a criminal justice setting. Dentists must be educated on the fundamentals of forensic odontology.

- ***Aims & Objectives:***

The study's goal is to assess forensic odontology knowledge, attitude, and practise (KAP) among Kanpur dental practitioners.

- ***Material and method:***

A cross-sectional study was done on a sample of 200 dental practitioners from around KANPUR, and data was obtained using of a questionnaire. The questionnaire used in the study has been refined in light of the findings.

I. INTRODUCTION

The term forensic is derived from the Latin phrase for "of or before the forum." In modern usage, the term "forensic" is a synonym for "legal" or "court-related." As a result, forensic odontology is a legal practise.

Identification of a live or deceased individual is founded on the notion that all individuals are unique. Personal possessions such as clothing, jewellery, or finger prints are commonly used to identify human remains. Human dentition is thought to be a hard tissue counterpart to fingerprints. It is virtually as individual as a person's fingerprints.

Every tooth has different morphological appearances even identical twins do not have identical dentition. It gives resistance to fine chemicals and toxins to external influences like putrefaction, fire, explosions etc hence damage to tooth is not easy and immediate. To be turned to ashes, teeth must be heated over 500 degrees Celsius (932 degrees Fahrenheit). This opens up teeth for full post-mortem examination. This uniqueness of human dentition is used to assess bite mark injuries, teeth can be used to assess age by formative, degenerative and histological changes, race based on tooth sized and shape and sex based on tooth morphology and by DNA from teeth. Because orofacial tissues, palatine rugae, and lip prints are permanent and distinct to each individual, they can be used to prove identity through discrimination. These distinguishing characteristics make teeth important in identifying bodies in mass tragedies and

natural calamities, as well as in the investigation of numerous crimes through bite mark analyses.

Oxford encyclopaedia dictionary defines forensic as "of or used in the court of law". Science can be defined as systematic knowledge gained through study utilising the scientific method. Forensic science is the field of study that may be used in a court of law and is accepted by the court and the general scientific community to distinguish between truth and lies. A subspecialty of forensic medicine is forensic dentistry.

Some individuals use the term forensic odontostomatology for this field because it covers the entire orofacial region. The terms forensic dentistry and forensic odontology are frequently used interchangeably[1].

The cornerstone of forensic odontology is the positive identification of live or deceased individuals utilising the unique qualities and characteristics of teeth and jaws. In the case of death caused by another person, forensic dentistry may be beneficial in identifying both the victim and the perpetrator in certain medico-legal cases.[2]

Forensic odontology's main areas of operation include civil, criminal, and research. The civil class comprises malpractice and other types of fraud and neglect for which compensation is sought. Identification of both dead and live individuals falls under this category. Identification in the criminal sector includes teeth and bite marks that may be found on the victim, assailant, or some inanimate objects such as food items. Academic courses for undergraduate and postgraduate training, police forensic odontology training, and new research projects are all part of the research field.

- *Aims and Objectives*

- *To update understanding of forensic odontology and the role of dental surgeons in general.*
- *To review the recent methods of utilization of forensic odontology in medico-legal cases.*
- *To Analyse dental practitioners 'knowledge, attitude, and practise of forensic odontology in Kanpur.*

II. MATERIAL AND METHOD

A cross-sectional study was conducted on 200 dental practitioners from across KANPUR, with data collected via questionnaire. The questionnaire was designed for dentists who may encounter forensically fascinating cases on a daily basis. A questionnaire was used to collect data in a customised manner.

The questions were developed to assess knowledge, attitude, and practise (KAP). Information was gathered on themes such as the history of forensic odontology, facts about forensic odontology, estimating age and sex from teeth, the function of forensic in mass disasters, and testifying in court about forensic evidence, among others.

The questionnaire used in the study is elaborated with results.

III. RESULTS

The data for this study was acquired using a designed questionnaire and was collected from a sample of 200 dental practitioners from Kanpur. Care was taken to avoid bias and the sample chosen randomly. The questionnaire was of a general type and focussed on forensic odontology. The awareness of various general aspects of forensic odontology, that should be known to a reasonably qualified dental practitioner were kept in mind while designing the questionnaire and were assigned to the practitioner spontaneously without allowing any time whatsoever for preparation regarding the subject.

- *Question 1: - First Body Identified using Teeth was in 66 AD.*

The first use of a person's dentition in identification dates back to 49 A.D. Seventy-one percent of dental practitioners were unaware that the first body identified using teeth occurred in 49 AD. While only twelve percent were aware of this fact.

- *Question 2: -First Mass Death Identification using Dental Records was in Vienna.*

First mass death identification was in 1849 in the case of Vienna Opera House fire. This fact was only known to twelve percent of practitioners, while it was not aware to about seventy percent of dental practitioners.

- *Question 3: - Hitler and his Mistress Eva Brauna's Bodies were Identified by?*

His Dentist recognised the bodies of Hitler and his mistress Eva Brauna. Fifty-seven percent of dental practitioners were aware of this information, while around thirty-six percent were not.

- *Question 4: -According to Sansare K and Dayal PK, the First Example of Identification using Dentition in India Occurred in?*

The first identification occurred in 1191. Seventy-eight percent of dental practitioners were unaware of this fact, while only roughly 14 percent of practitioners were aware of it.

- *Question 5: Can you tell someone's Age by Looking at their Teeth?*

Ninety-two percent of practitioners were familiar with estimating an individual's age by inspecting the teeth.

- *Question 6: - Teeth Pattern is not as Unique as Finger Print Pattern.*

Teeth pattern is as unique as finger print pattern, this was known to about sixty percent of the practitioners, and this uniqueness of teeth pattern was not known to about twenty nine percent of the individual.

ISSN No:-2456-2165

- *Question 7: - Can Individual Identification be done from DNA Extracted from Tooth.*

Eighty five percent of the practitioners were aware of the fact that identification of an individual can be done from DNA extracted from tooth, and about eleven percent of practitioners did not know about this uniqueness of teeth.

- *Question 8: - Can a Dentist Identify Child Abuse.*

Eighty two percent of the dental practitioners agree to the fact that a dentist can identify child abuse, only thirteen percent of practitioners do not agree to it.

- *Question 9: - Can Dentist Testify as Expert Witness for Forensic Evidence*.

Yes, a dentist can testify as expert witness for forensic evidence, seventy one percent of practitioners agree to this, and only nineteen percent were not in favour of this statement.

- *Question 10: -Prosthesis of an Individual can be used in Identifying an Individual in an Event of Mass Disaster.*

Seventy percent of dental practitioners were aware of this information, while eighteen percent were unaware that an individual's prosthesis can be used to identify an individual in the event of a mass calamity.

- *Question 11: -Is Mass Disaster Identification is Completed in same Manner as Individual Identification.*

For these varying results were seen, majority of dental practitioners about forty five percent were not even aware of the fact. But about thirty eight percent of them were having the knowledge that, mass disaster identification is not completed in same manner as individual identification. In actual mass disaster identification is fundamentally the same as that in a routine comparative dental identification of a deceased individual.

- *Question 12: - Are you Aware of Antemortem and Post-Mortem Dental Records.*

Only forty four percent of practitioners know this fact, while about twenty nine percent of the practitioners do not know of this fact.

- *Question 13: - Bite Marks can be used in Linking a Suspect to a Crime.*

Ninety seven percent of dental practitioners are aware of this fact that bite marks can be used in linking a suspect to a crime.

- *Question 14: Do you keep dental records at your clinic?*

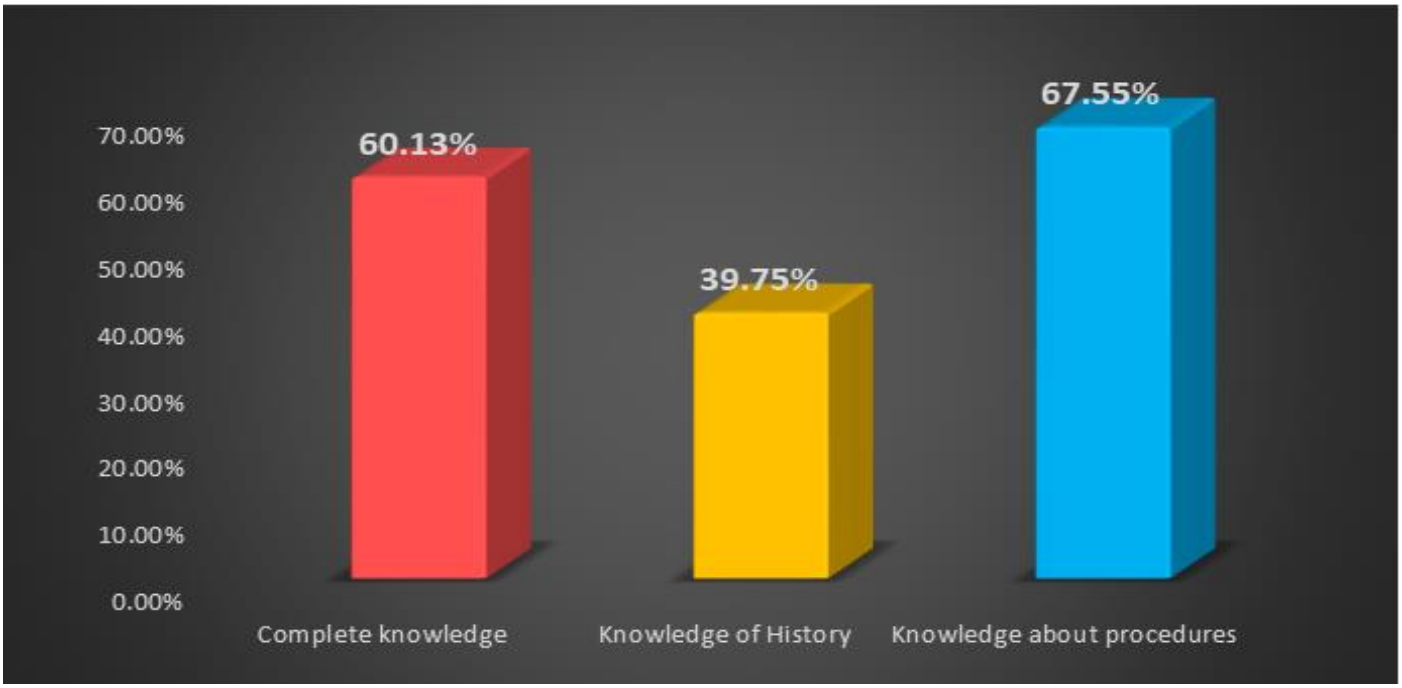
Approximately 82 percent of dental practitioners keep dental records in their practise.

- *Question 15: - Can Sex Determination be done by Teeth.*

Only sixteen percent of dental practitioners are aware that teeth can be used to determine sex, and approximately seventy percent of practitioners are unaware of this fact.

Table 1 Knowledge of Dentists about Forensic Dentistry

Parameters	Percentage
Average Knowledge of participants regarding forensic Dentistry	60.13%
Average Knowledge of participants regarding history of forensic Dentistry	39.75%
Average Knowledge of participants regarding various procedures in forensic Dentistry	67.55%



Graph 1: Knowledge of Dentists about Forensic dentistry

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IV. DISCUSSION

In this study, 60% of the private practitioners had complete knowledge of forensic odontology, nearly 40% were aware of the history of forensic odontology and almost 68% of private practitioners had knowledge of forensic odontology.

Forensic odontology has grown in popularity in a number of developed countries throughout the world. However, it has yet to achieve full pace in developing countries such as India. The death toll in India from the 2004 tsunami was over 15,000, but it is unclear whether all deaths were identified. This could have been achievable if there were enough forensic odontologists to identify victims.

In India, law enforcement officials typically seek the assistance of government-employed dental surgeons rather than non-government-employed dental practitioners with degrees in forensic odontology from universities outside India. As a result, there is a scarcity of skilled forensic odontologists in India, as evidenced by the few instances where forensic odontology has been successfully used to solve criminal cases or identify the deceased.

In addition to the relevance of age estimation for victim identification, age assessment has crucial medico-legal implications. For example, in the inquiry of the death of a small infant, it may be required to determine if the kid was stillborn or died after birth. This point can be resolved through microscopic study of tooth pieces. The presence of a neonatal line in the sections indicates that the infant was alive at birth. Furthermore, the amount of enamel and dentin built down after the neonatal line will provide an estimate of the time period between birth and death[5].

➢ *Age Estimate Methods are Classed as follows:*

- Methods for estimating the age of establishing dentition
- Methods for estimating the age of adult dentition

➢ *Age Estimation Methods can also be Categorised based on the Strategies used:*

- Clinical or ocular inspection
- Radiographic analysis
- Histological and biochemical techniques

➢ *Methods for Estimating the Age of the Forming Dentition:*

During the early stages of dental development, determining age with an accuracy of "plus or minus one year" is possible. A microscopic study of the teeth can also yield an age with an accuracy of "plus or minus a few days."

➢ *Radiographic Methods:*

- *Utilisation of Demographic Survey Charts:*

The deciduous dentition begins to calcify 2 to 4 months before birth (20-28 weeks in utero). Tooth formation continues until the completion of the deciduous molar, and the last deciduous molar forms between the ages of 3 and 4 years. The permanent dentition begins mineralization shortly before birth, gradually replaces the deciduous dentition from 7 to 15 years, and completes itself by 20-25 years of age. Thus, up until the second decade of life, the jaws include one or more partially formed teeth, and the level of development will represent the individual's age.

Jaws are radiographed in practise, and the condition of development of the entire dentition is compared to stages depicted on "standard charts." Kraus and Jordan conducted one of the first investigations in this area, providing data revealing stages of pre-mineralization and early mineralization of numerous deciduous teeth and the first permanent molar during intrauterine life.

The first standard chart to be widely used by the ADA was published by Schour and Massler in 1941, and it is regularly updated by the ADA. This chart is made up of a series of life-size paintings that depict 21 chronological stages of development from 4 months before birth to 21 years of age. Logan and Kronfeld (1933) conducted a survey of 30 American children on jaw resection. Radiographs of the jaws are compared to the chart, and the drawing that most closely approximates the state of tooth development revealed in the radiograph gives an indication of age. If the stage of development lies between two drawings, an estimate of the intermediate age is made.This graph does not distinguish between males and females.

Garn, Lewis, and Polacheck (1959) surveyed 255 children about the development of mandibular premolars and molars and compared their findings to Schour and Masler's chart. They discovered that the age range was three times that of the Schour and Massler chart..

Gustafson and Koch developed a chart for dentition development from 8 months before birth to 16 years of age, which was cited by Johanson (1971). This graph is based on aggregated data from 19 sources published between 1909 and 1964. Each tooth's growth is marked by four milestones: the start of mineralization, the completion of crown formation, the completion of root formation, and the end of root creation. This figure does not separate statistics for men and women. When the Gustafson and Koch chart is compared to the Moorrees, Fanning, and Hunt charts, the Gustafson and Koch chart shows that crown formation is complete 1 year later. Demirjian and Coworkers (1973) have developed a system for estimating the chronologic age based on 8 stages of tooth development.

- ✓ A: Cusp tips mineralized but not yet coalesced.
- ✓ B: Mineralized cusps are united, so the mature coronal morphology is well defined.
- ✓ C: Crown is about half formed, pulp chamber is evident and dentin deposition is occurring.
- ✓ D: Crown formation is complete to dentino-enamel junction, pulp chamber has a trapezoid form.
- ✓ E: Formation of inter-radicular bifurcation has begun; root length is less than crown length.

ISSN No:-2456-2165

- ✓ F_1: Root length is at least as great as crown length, root has funnel shaped ending.
- ✓ F_2: Root length is at least twice the crown length; root still has funnel shaped endings.
- ✓ G: Root walls are parallel, but apices remain open.
- ✓ G_1: Root walls are parallel, but apices not entirely closed. PDL space at apical ending is ≥1.0 mm.
- ✓ H: Apical ends of roots are completely closed and PDL has uniform width around the root [6].

Tables for developmental tooth stage and corresponding age scores are available. During the period of 14-20 years, third molars can be used for estimation of age. Van Heerden created a 5-stage system for measuring the mesial root of growing mandibular third molars on panoramic radiography. There is no substantial variation in 3rd molar development between males and females.

Table 2 Developmental Tooth Stage and Corresponding Age

		Length (mm)	**Age (Years)**
Stage 1	Crown complete, radiographic evidence of root formation	3.5 – 5.5	16.8– 16.9
Stage 2	Root length > 1/3, < ½	7-8.6	17.5
Stage 3	Root length > 2/3, but not complete	10 – 12.9	17.8– 17.9
Stage 4	Root fully formed with open apex	12 – 15.4	18.4– 18.5
Stage 5	Apex closed	15-16.1	18.9-19.2

Because of the rapid rate of development and the presence of many developing teeth, the accuracy of age prediction using tooth formation is higher in younger children than in older children. However, for the method of age estimation that uses radiographs to collect quantitative data on developing teeth, non-cooperation by very young children, difficulty getting clear radiographs in the anterior region of small jaws, and superimposition of permanent and deciduous teeth may impair the procedure's accuracy.

➢ *II. Histologic / Biochemical Methods:*

- *Age Determination using the Weight of Developing Dentition:*

Stack (1960) established an age determination approach based on the progressive increase in weight of growing tooth tissues. He has produced a regression line of rising dental tissue weight against age. The unknown's age can be determined by weighing the teeth specimen, which ranges from 5 months in utero to 7 months postnatally[6].

- *Age Assessment by Examination of Incremental Pattern of Tooth Formation:*

Variations in the rhythmic mineralization of the enamel prism give Ritzieus incremental lines. Anders Ritizeus (1837) was the first to describe it. The presence of a neonatal line in the enamel and dentin of deciduous teeth and permanent first molars shows development during the transition phase between intrauterine and extrauterine settings. Von Ebner incremental lines and Owners contour lines can be found in dentin. All of the lines outlined above can be used to estimate the age of a neonate or foetus at death[6].

The assumption for incremental line analysis in identification efforts is that these lines have the same pattern in an individual whose enamel forms at the same period in a specific dentition. The different teeth that form in one person produce the same pattern of incremental lines that is distinct from that of another individual, resulting in a "finger print" of enamel development that is unique to the individual5.

Miles (1958) established a method for calculating death age by measuring the thickness of enamel and dentin from the neonatal line and dividing it by the proper daily rate of production. Schour and Hoffman determined the rate of enamel and dentin apposition to be 16 mm/day.

Boyde (1963) presented an age estimation approach based on microscopic inspection of incremental marks seen in longitudinal ground sections of teeth. After finding the neonatal line, count the number of incremental lines that cross the enamel prism up to the edge of the forming enamel front. Assuming that each increment reflects one day's worth of enamel addition, the number of incremental lines represents the number of days of age.

Certain medications, such as tetracycline, and metals such as lead, strontium, and fluoride, produce incremental lines that may aid in determining the age of death. Sometimes the incremental patterns may also be used to match the teeth separated from the jaws of an individual[1].

V. CONCLUSION

This study, which was done among 200 dental practitioners to assess their knowledge of forensic odontology, found a lack of knowledge and practise among these study subjects. This study illustrates our country's current condition in the field of forensic odontology.

The forensic odontologist must have a broad foundation in general dentistry, including all dental specialties. He must also have a rudimentary understanding of the job of forensic pathologist and autopsy processes, as dental evidence is the most valuable and trustworthy way. Due to the extensive and difficult scope of forensic medicine, dental surgeons trained in forensic odontology can make unique contributions to the administration of justice, which is a crucial note of democracy.

This state of inadequate knowledge and lack of practise among these study areas, however, could be remedied if steps are done to incorporate forensic odontology into our

curriculum. Furthermore, if periodic conferences and seminars are held, dental practitioners and students would be able to expand their understanding of forensic odontology.

To summarise, when all other known ways of identifying an individual fail, forensic odontology is an important and one of the most reliable forms of human identification. Thus, the necessity of the hour is to update private practitioners' expertise and enhance their interest in forensic odontology.

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