



EMERGING TRENDS IN FORENSIC ODONTOLOGY- A SYSTEMIC REVIEW

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ABSTRACT

An expanding area of forensic science is forensic odontology, which aids in the investigation and prosecution of crimes in civil proceedings. A comprehensive understanding of dental science across disciplines is also necessary for forensic dental fieldwork, which plays a larger role in helping to identify victims of child abuse, rape, and other crimes against humanity. Forensic dentistry primarily plays the tasks of identifying individuals, detecting morphological variances and associated disorders, and keeping track of information that endures throughout life. However, forensic odontology has recently demonstrated a significant influence over molecular and genetics. Thus, during the next ten years, there will be a significant increase in demand for orthodontic specialists. Consequently, it is crucial to know further knowledge of forensic odontology. So, this piece of writing gives an overview of forensic odontology, emerging trends and advancements, and limitations in the field.

KEYWORDS : forensic odontology, DNA fingerprinting, facial reconstruction, denture markers, tongue imprints, comparison microscopes.

INTRODUCTION

The terminology forensic means 'court of law' and odontology refers to the study of teeth. According to Keiser Nielson 1970, defined "that branch of forensic medicine which in the interest of justice deals with the proper handling and examination of dental evidence with the proper evaluation and presentation of the dental findings. In the present scenario, forensic odontology has become a crucial part of the American academy of forensic sciences (AAFS). The primary goal of forensics is the management and finding a solution in the law and criminal proceedings. Forensic odontology involves key structures present in the oral cavity that has their uniqueness over other parts of the body. The unique strongest and indestructible part of the oral cavity that helps identify the victim is the teeth.

Adult human dentition involves four types of teeth incisors, canines, premolars, and molars. All four greatly vary in their structures, width, and interspaces for all individuals. They remain unchanged and survive after the death of the person, stay in extreme environmental calamities, fire disasters, airplane crashes, road accidents, and bomb blasts where significant methods like fingerprints, facial features, and markers are easily vulnerable

Apart from using teeth as a forensic tool, other methods like using personal identification such as height, age, the structure of the body, birthmarks, and medical information such as footprints, tattoos, and scars are easily destroyed during the disaster. so, identification through dental is considered superior to all others because dental tissue is less decomposed burnt, and dismembered

Though tooth is used as an identification tool in forensic odontology, there are so many advances incorporated in recent decades other than the dental field like DNA fingerprinting, facial reconstruction denture identification, comparison microscopes, and tongue prints over conventional methods like rugoscopy, cheiloscopy, estimation of and bite marks. The older techniques like data collection methods underwent a transformation into dental record

maintenance was astonishing. The article provides an overview of currents trends, advances, and limitations used in forensic odontology

Recent Advances In Forensic Odontology**Dna Analysis**

DNA analysis is an emerging tool and gains importance when conventional methods fail due to autolytic processes, distortions, and traumatism. DNA present in the cells of vital teeth tends to valuable source of information because they are highly resistant to vulnerability. In tooth high sources is present over the regions of dentin and pulp which should be extracted. DNA from the root body is having an abundant number of DNA molecules which is of good quality and purity an important advantage in DNA analysis.

Extraction of DNA from the tooth is done mostly by the horizontal sectioning procedure in which the tooth should section 1mm below the cemento-enamel junction leaving the remaining tooth structure on the facial surface. Other methods of sectioning are

- Conventional endodontic access
- Cryogenic grinding
- Vertical splining
- ISOLATION METHODS
- DNA isolation can be performed by
- Phenol-chloroform method
- Silica-based DNA extraction methods
- Chelex 100
- Commercial DNA extraction kits

once DNA is extracted, it should be analyzed. Chelex 100 is one of the most effective procedures for isolating DNA from forensic evidence that has been created. Then, the polymerase chain reaction was used to multiply the DNA, producing a large number of replication copies, and a DNA profiling system should be used to identify the victim.

Currently, DNA profile systems are accepted as legal proof in the inquiry of paternity and human identification. DNA technology is used in forensic dentistry to address many

ethical and legal issues, but the field is still evolving quickly to address many mysteries in the human genome.

Facial Reconstruction

The face is a unique identity to every human and it is a boon to every mankind. In the majority of bigger accidents human tends to lose all parts of the body but the skull is retained in many cases and provide an inimitable means of identification. The computerized facial reconstruction method is one recent advance trend seen in forensic dentistry. Facial reconstruction goals are to replicate the similarity features close to the deceased person. This can be achieved by 2D and 3D Tools. Both tools are operated with manual and automated computer aids.

Two-dimensional Facial Reconstruction.

There are two methods in two-dimensional facial reconstructions. First using facial Manchester reconstruction was used to draw the musculature of the face and superimpose it. In the other method, drawing is done directly over the skull photographs and blended digitally using new software and access the overall facial form and appearance.

Three-dimensional Facial Reconstruction

The first digital technique used in 3D construction was proposed by Moss. The computerized facial reconstruction was divided into two categories. Automated systems and modeling systems. Both systems execute the application of mean tissue thickness for given anatomical landmarks. For any system used to construct faces, there are two phases, the preparatory phase, and the reconstructive phase

A separate case file with the case number, a proper certificate from the legal entity, and a letter obtained from the archives of the institution should be filed. To avoid any contamination skull should be kept in a protected environment and handled with a humanitarian approach. Position of any part of the skull can be done with waxes, clay, or glues, and for reconstruction, the skull should be placed in Frankfurt horizontal plane and primary facial reconstruction like eyes, ears, and mouth are constructed with the help of clay

Though it offers value in recognizing law enforcement, historical research, and museum still much research is undergoing to make easy use of a facial reconstruction

DENTURE IDENTIFICATION METHODS

Denture labeling is an essential and helpful one in identifying the proprietor of the denture in case of missed, or deceased bodies in forensic dentistry. Denture markers show a rapid and accurate method other than fingerprints for the identification of victims. It plays a vital role in the positive identification of the victim. Denture markings are majorly classified into two types of surface marking methods, engraving, scribing, and inclusion systems.

The most widely used methods are engraving and inclusion methods. Engraving involves the marking of models during the fabrication process. The main disadvantage is it causes soft tissue irritation that progressively leads to diminishing of the marks. The inclusion method is applicable for lead paper labeling, denture barcoding, and computer-printed denture micro labelling systems. The inclusion system involves replacement in the fabrication of common pink acrylic powder with the addition of a second white clear acrylic powder upon which inscribe the name and service number of the denture wearer is, the only disadvantage is that weakens the denture structure and causes porosity. The medium used in the denture markers are paper, onion fibred glasses, and media usually written with the help of pen or typewritten. In the case of the patient using inclusion markers in denture markers, it is preferable to use metallic in order to withstand postmodern

assaults. It is ideally required that the mark should be biologically inert and possible to retrieve after a mishap. The most preferred position for placing a marker is along with the posterior flange under the teeth of mandibular dentures.

Denture marking follows the same stages as denture processing up until packing is complete. The flask should then be unsealed, and a strip of approximately 5 cm by 2 cm should be placed on the denture's thickest, non-tissue-bearing portion. To replace the gap left by the missing denture, open the foil, remove the foil strip, and wet the region with monomer and clear acrylic to fill the void of the dentures

Comparison Microscopes

The comparison microscope was first invented by Sir Calvin Goddard who was US Army working with the Bureau of Forensic Ballistics in New York. Two microscopes are placed next to each other and the optical path of each microscope is connected with an optical bridge. The observer simply looks and compares specimens side by side and even superimposes the image. One greater advantage of a comparison microscope in forensic odontology is to confirm the sex of an individual by the presence or absence of Y chromatin. A conventional microscope has several disadvantages and less resolution. To overcome the problems, a prototype virtual comparison microscope (VCM) was discovered. It optimizes parfocality and paracentricity to maintain clarity and utilizes the images of bullets and their fragments. The cutting edge of the microscope enables the investigator to view extremely small fragments of a specimen with significantly improved magnification and clarity.

Tongue Imprints

The tongue is the movable muscular organ in the body within the oral cavity. It is a unique organ of an individual even varies for an identical twin. The analysis of shape, texture, and color reveals visible differences between one person to another person thereby the tool is helpful in identifying the victim in the crimes. For the application of tooth imprints the impression of the tongue including the lingual border along with photographic images helpful in identifying the victim along with rugoscopy and cheiloscopy. Tongue impressions are made with alginate impressions followed by the cast being poured onto it. With the aid of digital software, digital images of the tongue are obtained. The impression is preserved with the help of the alginate molding technique and duplicated whenever it is needed. Tongue prints have extended their application and become a new identity in the member of biometrics. Biometric analysis was done with three views such as profile, right lateral view, and left lateral view. The major advantage of using tongue imprints is an internal organ which makes it least vulnerable to the security breach and also a hassle for identification purposes. So, tongue verification gives future better biometric approach

CONCLUSION

As forensic odontology plays a key role in law enforcement and medico-legal cases, there is an emergency need in promoting this unique specialty all over the world. Forensic odontology has attained a great scope and achieved giant strides over the past decade through various technological advancements and taken the specialty to the next forum. So, the dentist should have an interest in implicating forensic odontology along with the profession and clinical setup. It is imperatively emphasized to the government and other regulatory associates to use forensics in all kinds of investigations. Though forensic odontology has reached peaks still it abided with technical errors and sensitive queries that should be ruled out

Conflict Of Interest

The author confirms that this article has no conflict of interest.

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REFERENCES

1. Menon PA, Kumar NA. Recent advances in forensic odontology: An overview. *J Forensic Sci Med* 2021;7:105-8
2. Jeddy N, Ravi S, Radhika T. Current trends in forensic odontology. *J Forensic Dent Sci* 2017;9:115-9
3. Verma AK, Kumar S, Rathore S, Pandey A. Role of a dental expert in forensic odontology. *Natl J Maxillofac Surg* 2014;5:2-5.
4. Balachander N, Babu NA, Jimson S, Priyadharsini C, Masthan K. Evolution of forensic odontology: An overview. *J Pharm Biocall Sci* 2015;7:S176-80
5. Sylvie Louise Avon *Journal-Canadian Dental Association* 70 (7), 453-458, 2004
6. BC Manjunath, BR Chandrashekar, Melkundi Mahesh, RM Vatchala Rani *Journal of forensic and legal medicine* 18 (5), 191-197, 2011
7. B Kavitha, A Einstein, B Sivapathasundharam, T Saraswathi *Journal of forensic dental sciences*, 08-10, 2009
8. Arpita S, et al. 3D forensic facial reconstruction: a review of the traditional sculpting methods and recent computerised developments. *Int J Forens Sci* 2018; 3: 000134
9. KP Divakar *International journal of biomedical science: IJBS* 13 (1), 1, 2017
10. Gosavi S, Gosavi S. Forensic odontology: A prosthodontic view. *J Forensic Dent Sci* 2012;4:38-41.
11. Nikita Kareker, Meena Aras, Vidya Chitre *the Journal of Indian Prosthodontic Society* 14, 4-13, 2014
12. Arjun Kundu, Michael Streed, Paloma J Galzi, Abraham Johnson *medico-Legal Journal* 89 (2), 106-116, 2021
13. Zakirulla M, Meer A. Modern tools in forensic dentistry. *J Contemp Dent* 2011;2:28-32.
14. Singh NN, Gowhar O, Ain TS, Sultan S. Exploring trends in forensic odontology. *J Clin Diagn Res* 2014;8:ZC28-30
15. Radhika T, Jeddy N, Nithya S. Tongue prints: A novel biometric and potential forensic tool. *J Forensic Dent Sci* 2016;8:117-9