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Review Article

# Forensic Odontology & Endodontics: Clinical Role & Perspectives

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## Abstract

The forensic odontology is the study making use of the human dentition throughout each stage of dental evaluation. The key element for identification includes their radiographic morphology and filling materials. The knowledge of detecting this is a valuable tool mark in the presumptive identification of the dentition of a burned victim. Dental identification of a deceased individual is a core task in forensic odontology. The accurate recording of clinical dental procedures has become more important over time due to the increasing trend of medicolegal issues worldwide. Previous reports have discussed the practical usefulness of endodontic evidence for human identification. Advances in endodontic imaging, root and root canal anatomy, and biomaterials have been consistently emerging in endodontic research and practice. This paper throws light on the clinician's role & perspectives in forensic odontology & endodontics.
**Keywords:** The Forensic Odontology & Endodontics, Knowledge Dental Identification.


## INTRODUCTION

Fire injury is considered to be one of the major causes of morbidity and mortality throughout the world and identification of a body from the fatal fire remains a difficult task [1]. Burn injuries can manifest in the form of superficial burns, destruction of the epidermis, dermis, and necrotic areas in the underlying tissues, total destruction of the skin and deep tissue, and burned remains [2]. Identification of human remains in any mass disasters is generally a difficult assignment. Forensic odontology is a dental specialty which applies dental knowledge and expertise to solve medico-legal issues. Forensic identification with the aid of comparing recorded dental features and treatment against those of a postmortem dentition, is one of its important role [3, 4]. The distinctiveness of human teeth has facilitated personal identification throughout history [5]. In addition to this since the teeth are the most indestructible components of the human body and may remain intact for many years after a person's death, they become very important for forensic evaluation [4]. Teeth have the highest resistance to most environmental effects such as fire, desiccation, and decomposition [3]. Root canal morphology and posttreatment endodontic radiographs present particularly a valuable source of features that would facilitate individuation.

### Distribution of DNA within teeth

In forensic identification cases, where human remains are extremely damaged or degraded, teeth and bones are often the only available sources of DNA. Advances in DNA extraction techniques and short-amplicon DNA typing have greatly increased our potential to identify human remains previously considered to be too compromised for genetic analysis [6]. Enamel which covers the crown of the tooth is the hardest tissue in the human body. It is acellular, and contains no DNA. This tissue provides a physical barrier protecting the cells within the tooth from external conditions such as heat, UV light, moisture and microbes. The dentine/pulp complex makes up the bulk of the tooth and, in contrast to enamel, is highly cellular. The cells that occur in the highest number in pulp tissue are the odontoblasts, which number approximately 11,000 per mm2 and fibroblasts, which have been estimated at 1000 per mm2. Thus, as approximately 80 diploid cells can yield the minimum DNA quantity required for STR typing, pulp is a valuable source of DNA. However, pulp may be in limited quantity or even absent in aged and/or diseased teeth. Pulp and cementum are considered to be the most valuable sources of nuclear DNA in the tooth and both these tissues in addition to the dentine are good sources of mtDNA. Enamel is important in the preservation of dentine and pulp but is devoid of DNA. Therefore, if enamel is sampled with the other tooth tissues, it will probably have a dilution effect and the high concentrations of minerals, including calcium, may complicate the extraction process and inhibit PCR amplification. Large-scale studies using full tooth grinding and powdering techniques have previously reported high DNA typing success rates from teeth. However, optimal tooth selection and sub-sampling of teeth prior to DNA extraction are likely to further improve DNA profiling success rates [7, 8].

**Dental Radiographs**

Dental radiographs are considered the most reliable source of antemortem data in the human identification field [9]. Specifically, dental radiographs allow for a close post-mortem duplication of ante-mortem evidence, consequently enabling an optimal comparative procedure. In addition to this, root canal treatments are less modified in the clinical routine if compared to dental interventions performed on the dental crown. Thus, endodontic identifiers are maintained for a longer period as forensic tools [9]. In certain critical situations, such as major fire disasters, the dental structures become fragile [10]. However, it is believed that endodontic filling materials remain preserved up to 1100° Celsius, allowing for human identification processes [11]. Bonavilla *et al*., confirmed the preservation of microscopic structural patterns of root sealers and gutta percha exposed to high temperatures [12]. A recent study highlights the legal importance of storing and updating clinical records which allow for a positive dental identification based on endodontic treatment. Endodontists must be aware of the proper techniques for optimal radiographic dental assessment, making feasible a post-mortem radiographic duplication for the comparative human identification process [13]. A recent study demonstarated a linear regression with the biological age [14]. Compared to mCT, cone-beam CT in dental use provides plenty of 3D volume information of the teeth on living individuals in the target area by a single scan. The measurement of the volumes of both pulp and tooth in order to calculate the ratio for the living individuals can be operated non-destructively. Later on, after the appropriate intercept and slope determined based on sufficient datasets, the method can be applied to age estimation [14]. The reason why there was no statistical evidence that the relation between the pulp–tooth volume ratio and age differs between the types of teeth. The observed relation between the pulp–tooth volume ratio and age was stronger for women than for men but was not found statistically different [15]. The ratio of the variables indicating secondary dentine formation observed on the studied 3D radiological images is inferior related to age than the variable ratios indicating secondary dentine formation measured by Kvaal *et al.*, on 2D radiological images [16]. The dental age-related parameters are subdivided whether they indicate developmental, morphological, or biochemical tooth changes. Secondary dentine apposition is a significant morphological dental age predictor [15, 17]. The formation of secondary dentine may be caused by attrition, abrasion, erosion, caries, changes in osmotic pressure throughout the pulp chamber, or aging and decreases the volume of the dental pulp chamber [18]. Therefore, the volume changes of the pulp chamber in intact teeth are considered as a dental age predictor. Although the apposition of secondary dentine is not homogenously spread over all the walls of the pulp cavity and even differs in relation to the examined tooth type, bucco-lingual and mesio-distal pulp width as well as the pulp cavity height decreases with aging [19]. These variables can be measured on the involved tooth after extracting and sectioning it or on its two-dimensional (2D) dental radiographs. More specifically, the last two variables can be applied for radiological age estimation on living individuals without tooth extraction. Similarly researchers have tried to relate the ratio of the surface area of the pulp and the surface area of the tooth measured on clinically obtained 2D dental radiographs to chronological age [15]. A recent study proposed techniques for measuring dental volumes, we propose a method based on the assimilation of the root and pulp chamber to geometric solids whose measurements were quicker and easier to be obtained thus facilitating the implementation of the method into the daily forensic practice for estimating age [21]. The proposed procedure, which includes image selection and analysis, a preprocessing step (drawing the details of the images manually), and measurement and calculation procedures with a simple electronic excel sheet, allows us age estimation in less than 15 minutes. This method has a significantly shorter processing time when compared with the one-hour needed for the method proposed by Yang *et al*., [14] the 3-hours needed per tooth for the technique proposed by Aboshi *et al*., [21] and also by Star *et al*., [15] using a similar radiological approach based on mCT or CBCT.

**Future Trends**

Inspite of the increasing use of tooth tissues in forensic investigations, little liyterature is available on the processes of decomposition of these mineralised tissues, on the location of DNA following post-mortem diagnosis, or on the outcomes of various sampling techniques. Further in-depth investigation is required to understand the interaction between tooth mineral and DNA and how this changes in the post-mortem environment. Assessments of post-mortem changes in teeth over a time period applicable to forensic investigations would also be extremely valuable. This knowledge would allow the more appropriate selection of tissue for DNA extraction, as well as a moreinformed choice of technique used to liberate the DNA, increasing the efficiency of the extraction process [6].

## CONCLUSION

Despite the constant refinement of dental techniques, materials and facilities, the conventional radiographs, routinely performed in the clinical practice, are still the most common source of forensic antemortem data for the human identification process. With regards to this, endodontics becomes a valuable specialty in the forensic scope, once periapical radiographs are often performed.

## REFERENCES


1. Ranganath, A., & Nasim, I. (2017). Effect of high temperatures on root canal obturation–an aid in forensic identifications. *Journal of Advanced Pharmacy Education & Research*, 7(3):256-258.
2. Ferreira, J. L., Espina, A. L., Barrios, F. A., & Mavarez, M. G. (2005). Conversation of oral and facial Structures of burned cadaver. *Ciencia Odontologica*, *2*, 58-65.
3. Forrest, A. S. (2012). Collection and recording of radiological information for forensic purposes. *Australian dental journal*, *57(1)*, 24-32.
4. Reesu, G. V., Augustine, J., & Urs, A. B. (2015). Forensic considerations when dealing with incinerated human dental remains. *Journal of forensic and legal medicine*, *29*, 13-17.
5. Berman, G. M., Bush, M. A., Bush, P. J., Freeman, A. J., Loomis, P. W., & Miller, R. G. (2013). Dental identification. In: Senn, D. R., Weems, R. A., editors. Manual of Forensic Odontology. USA: CRC Press, Taylor and Francis Group; 75-127.
6. Higgins, D., & Austin, J. J. (2013). Teeth as a source of DNA for forensic identification of human remains: a review. *Science & Justice*, *53*(4), 433-441.
7. Miloš, A., Selmanović, A., Smajlović, L., Huel, R. L., Katzmarzyk, C., Rizvić, A., & Parsons, T. J. (2007). Success rates of nuclear short tandem repeat typing from different skeletal elements. *Croatian medical journal*, *48*(4), 486.
8. Edson, S. M., Ross, J. P., Coble, M. D., Parson, T. J., & Barritt, S. M. (2004). Naming the dead-confronting the realities of the rapid identification of degraded skeletal remains. *Forensic Science Review*, *16*(1), 63-88.
9. Franco, A., Thevissen, P., Coudyzer, W., Develter, W., Van de Voorde, W., Oyen, R., ... & Willems, G. (2013). Feasibility and validation of virtual autopsy for dental identification using the Interpol dental codes. *Journal of forensic and legal medicine*, *20*(4), 248-254.
10. Hill, A. J., Lain, R., & Hewson, I. (2011). Preservation of dental evidence following exposure to high temperatures. *Forensic science international*, *205*(1-3), 40-43.
11. Savio, C., Merlati, G., Danesino, P., Fassina, G., & Menghini, P. (2006). Radiographic evaluation of teeth subjected to high temperatures: Experimental study to aid identification processes. *Forensic Science International*, *158*(2-3), 108-116.
12. Bonavilla, J. D., Bush, M. A., Bush, P. J., & Pantera, E. A. (2008). Identification of incinerated root canal filling materials after exposure to high heat incineration. *Journal of forensic sciences*, *53*(2), 412-418.
13. Silva, R. F., Franco, A., Picoli, F. F., Nunes, F. G., & Estrela, C. (2014). Dental identification through endodontic radiographic records: A case report. *Acta stomatologica Croatica*, *48*(2), 147-150.
14. Yang, F., Jacobs, R., & Willems, G. (2006). Dental age estimation through volume matching of teeth imaged by cone-beam CT. *Forensic science international*, *159*, S78-S83.
15. Star, H., Thevissen, P., Jacobs, R., Fieuws, S., Solheim, T., & Willems, G. (2011). Human dental age estimation by calculation of pulp–tooth volume ratios yielded on clinically acquired cone beam computed tomography images of monoradicular teeth. *Journal of forensic sciences*, *56*, S77-S82.
16. Kvaal, S. I., Kolltveit, K. M., Thomsen, I. O., & Solheim, T. (1995). Age estimation of adults from dental radiographs. *Forensic science international*, *74*(3), 175-185.
17. Bodecker, C. F. (1925). A consideration of some of the changes in the teeth from young to old age. *Dental Cosmos*, *67*(6), 543-549.
18. Solheim, T. (1992). Amount of secondary dentin as an indicator of age. *European Journal of Oral Sciences*, *100*(4), 193-199.
19. Morse, D. R. (1991). Age-related changes of the dental pulp complex and their relationship to systemic aging. *Oral surgery, oral medicine, oral pathology*, *72*(6), 721-745.
20. Pinchi, V., Pradella, F., Buti, J., Baldinotti, C., Focardi, M., & Norelli, G. A. (2015). A new age estimation procedure based on the 3D CBCT study of the pulp cavity and hard tissues of the teeth for forensic purposes: A pilot study. *Journal of forensic and legal medicine*, *36*, 150-157.
21. Aboshi, H., Takahashi, T., & Komuro, T. (2010). Age estimation using microfocus X-ray computed tomography of lower premolars. *Forensic science international*, *200*(1-3), 35-40.