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Barr Body in Pulp Tissue- A Key Aid in Gender Determination

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Abstract

The identification of a person is required when the body is disfigured or mutilated beyond recognition as a result of barbaric crimes, workplace and motor vehicle accidents, aviation and navy disasters, wars, fire, flood, manmade and natural mass disasters and casualties, and in circumstances where the body is in an unrecognizable, decomposed state. Forensic odontology is the branch of dentistry which aids in identifying human remains. Teeth are one of the most robust structures of the human body and offer high impedance to the immediate and cumulative effects of adverse environmental conditions. Since the pulp is enclosed in hard tissue structures, it becomes a reliable means for determination of sex. Forensic science has long been dependent on fingerprints or some identification mark on the body of a deceased individual. But in the absence of such evidence dental indicators assist successfully in the identification process. Sex determination becomes the priority in the process of identification of a person. This article reviews upon the gender determination using barr body extracted from pulp tissue.

Key Words: Gender determination, Barr body, Forensic odontology, Pulp Tissue

Introduction

The word "forensic" is originally a Latin word which means forum or a place where legal matters are discussed. Forensic science is defined as a discipline associated with the application of science and technology for detection and investigation of crime and administration of justice, requiring the coordinated efforts of a multidisciplinary team [1]. Forensic odontology (FO) or forensic dentistry is defined as the science dealing with evidence from dental and oral structures. The man responsible for establishing FO as a speciality branch is Dr. Oscar Amoeda (Father of FO), who identified the victims of a fire accident in Paris, France in 1898.

Forensic plays an important role in the following

- Identification of individuals in criminal investigations and/or mass disasters
- Age estimation
- Analysis of jaws, teeth, and oral soft tissues in cases of trauma
- Identification, examination, and evaluation of bite marks, which appear to be a common finding in sexual assault and personal defense situation
- As an expert witness in the legal case.

The identification of a deceased person is important for humanitarian and emotional reasons but more importantly, it holds great importance for legal and administrative purposes. This identification process should be able to withstand legal scrutiny, it

therefore represents medicolegal and anthropological task. Hence, it is important to make scientific identification which becomes extremely difficult in mass disaster situations [2-4] or in matters of genocide crimes. Forensic odontology plays a pivotal role in cases of mass disaster where the injuries make it impossible to identify individuals. The teeth being hardest and most resistant tissue in the body provides advantage over other methods of identification as teeth can survive high ranges of temperature, decomposition and extreme conditions [5]. Gender determination is one of the most important steps in forensic identification which can be done by a variety of methods such as observing the external genital characters, biochemical analysis, or molecular methods from chromosome analysis for amelogenin. Since tooth is the hardest tissue, it remains unaffected after death and provides a method for identification of individual, living or nonliving, for anthropological, genetic, odontologic, and forensic investigations [6]. In cases, where all other tissue has decomposed, pulpal tissue acts as a good source for DNA analysis as it remains intact and can resist various natural and manmade disasters thereby, preserving the soft tissue within [7]. It was in 1949 that Barr and Bertram found that there was a difference between male and female cells. They concluded that in female cells, there was a small chromatin condensation at the nuclei of nerve cells of cats. This condensation is known as Barr body or Barr chromatin. This Barr Body is also found in bone cells, cells of the retina, and oral mucosal cells [8]. Barr Body found in dental pulpal tissue can be used for gender determination. A Barr-body is X-chromatin in its inactive form that appears as an intranuclear structure or as a mass usually lying against the nuclear membrane in all female somatic cells and is seen only during the Interphase phase of cell cycle [9]. They are seen in females only and hence they are often termed as 'CHROMATIN POSITIVE', while the males are deemed 'CHROMATIN NEGATIVE' [10]. Barr body can be observed with most of the nuclear stains such as hematoxylin and eosin (H and E), thionine, Papanicolaou, Feulgen, cresylviolet, giemsa, acetoorcein, and under fluorescence such as acridine orange (AO) [11].

Methods for pulp tissue extraction

➤ **Conventional endodontic access:** The simplest method is to prepare a conventional access cavity on the tooth and excavating the pulp using a suitable hand instrument. The morphology of the pulp chamber and the design of the access

opening may make it difficult to approach the pulp.

- **Vertical split:** In this method, the tooth is sectioned along the long axis of the tooth [6]. This method provides for easy excavation of the entire pulpal tissue with minimal chance of contamination.
- **Horizontal spitting:** Horizontal splitting is essentially the same procedure and is done when the crown structure is to be preserved. A horizontal section through the cervical root, subjacent to cemento-enamel junction avoids most restorations and provides the operator access to both the radicular and coronal pulp chambers
- **Crushing entire tooth:** Dental pulp for DNA analysis is often obtained after crushing the tooth. The main disadvantage of this method is that the tooth is completely destroyed so further radiographic, anatomical or biochemical studies are no longer possible.

Duffy et al conducted a study to assess sex chromatin in artificially mummified and heated pulp tissue and found that sex chromatin (both Barr bodies and F-bodies) is shown to preserve in dehydrated human pulps up to one year and human pulp tissue retains sex diagnostic characteristics when heated to 100°C for up to 1 hr [12]. In another study by Duffy et al. 1991, stability of pulp nuclei was found to be ranging from 4 days to 2 weeks in the pulp tissue retrieved from coastal environment [13]. Mehendiratta et al conducted a study to find out the series of various changes which occur during the process of putrefaction of the dental pulp in a coastal environment like that of Southern India and concluded dental pulp buried in a coastal environment goes through a specific series of morphological and histological changes which can be interpreted up to 144 h from burial, after which pulp ceases to exist.

However, Suazo et al conducted a study to determine the effect of high temperatures on the diagnostic performance of the Barr chromatin observation on teeth and concluded that it was only possible to evaluate the samples from groups subjected to 200 and 400 degrees C [14].

Conclusion

The number of deaths occurring in mass disaster due to natural calamities and terrorist activities is on an incline., keeping this in mind, positive identification of victims is very important. In such a situation, dental comparison is an excellent method for making

positive identification. The role of a dentist during mass disaster is well-defined in other developed countries as compared to India. The role has to be identified, delineated, and assigned along with proper training to be provided to the dentist, with effective planning, education, and training, dentists can play a significant role in responding to mass disaster or other unforeseen events.

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