Journal Homepage: - www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI: 10.21474/IJAR01/4045
DOI URL: http://dx.doi.org/10.21474/IJAR01/4045

RESEARCH ARTICLE

EVALUATION OF RADIOLOGICAL CHANGES IN PRIMARY AND PERMANENT TEETH SUBJECTED TO HIGH TEMPERATURES: A FORENSIC STUDY.

M.Sri Ramya, V.V.Rao, M.S.Minor babu and Satyam M.

Manuscript Info

Manuscript History

Received: 19 February 2017
Final Accepted: 21 March 2017
Published: April 2017

Key words:-
radiological changes, temperatures, forensic.

Abstract

Purpose: This study aims to compare and evaluate the radiographic changes of extracted primary and permanent teeth, before exposure and after exposure to a range of high temperatures.

Methods: The samples consisted of sixty teeth divided into two groups of thirty primary and thirty permanent teeth. Samples were subjected to periapical radiographs. Samples were exposed to different temperatures. Radiographs were taken after exposure. Qualitative evaluations of pre versus post-incineration radiographic images were done.

Results: The results showed a number of significant radiographic details. At 200 degrees C there were no changes in primary and permanent teeth. At 400 degrees C fissures between enamel and dentin were found in crowns of both primary and permanent teeth, and at 600 degrees C fissures between enamel and dentin and within dentin in crowns of primary and permanent teeth were found, where as the roots of primary teeth showed fractures within the dentin and permanent roots showed relatively little changes.

Conclusion: Primary teeth showed more radiographic changes at higher temperatures. Radiographic evidences can be obtained through the incinerated teeth of the deceased which will aid in identification of the victim in forensic investigation.

Introduction:-

Forensic dentistry is of fundamental importance in Medico – legal investigations. Teeth have the highest resistance in extreme environmental conditions like fire, desiccation, and decomposition. The professional services of dental surgeon are not only restricted to examining and diagnosing diseases of orofacial structures and their treatment, but also includes social obligation to law and justice by giving evidence from tooth and jaw to determine age and gender, identifying living and dead persons, detect criminals and other legal aspects. Dental speciality plays a major role in helping the police, lawyers, investigators, and judges in court of law in restoring truth from tooth. Thus, it is an indispensable profession to the government.[1]The term "forensic" is derived from Latin, meaning a place where legal matters are usually discussed. Forensic dentistry or Forensic odontology is the science of dentistry as related to the law[2]. The role of the forensic dentist is to identify the deceased individuals.[3] The theory behind forensic dentistry is that "no two mouths are alike". Forensic dentistry or forensic odontology involves dentists' participation in assisting legal and criminal issues. It refers to examination and evaluation of dental evidence, which will then be transferred to the justice department.[2] Teeth exposed to thermal stress have the potential to not only aid in identification, but also in understanding the circumstances surrounding the fire.[4] In a report by the National Fire

Corresponding Author:- M.Sri Ramya.

Protection Association (USA), it was suggested that children are twice as likely as adults to become victims of a house fire. Children are more susceptible to the fatal effects of fires because of their inability to safely evacuate themselves. A child's risk is further increased due to their smaller airway which is associated with a greater incidence of mucous obstruction.[4] The few studies that have been conducted on deciduous teeth agree that more studies are needed for conclusive evidence. And also the apparent paucity of published data on effects of incineration on the deciduous teeth gives credibility to this study.

Radiographs are non abstract and observable when ante-mortem and post-mortem data are presented to the end users of forensic odontological reports. Indeed, "A picture is worth a thousand words", attributed to French leader Napoleon Bonaparte is an apt allegory here. The radiographic comparison exploits the matching of corresponding features at two levels of anatomical complexity – external shape and internal architecture – as opposed, for example, to one in photographs. Thus, the potential number of corresponding features between two radiographic images is far greater than between two photographs. Intraoral radiographs are an essential aid in dental practice as they are a component of most patients' dental records.[6]

A good knowledge about the radiological changes taking place in the dental hard and soft tissues due to extreme heat may prove to be of significance in fire investigations. Based on the above information this study was conducted to assess whether the study can serve as an aid to radiographic means of identification of human dental remains in cases of incineration by means of comparison between ante-mortem and post-mortem records.

Materials and Methods:-

Source of data: The samples were collected from, Lenora Institute of Dental Sciences.

Materials:-

Primary and permanent teeth, intraoral x-ray films, intra-oral x-ray machine, laboratory furnace.

Inclusion Criteria

Permanent teeth

- Extracted human primary and permanent teeth free from carious lesion and effects of external trauma [cracks , fissures or fractures]

Primary teeth

- As the extraction of clinically sound teeth in children is not justifiable in routine clinical practice, the primary molars to be used in the study were carious to some degree and the anterior teeth with marked root resorption.
- Over retained primary teeth.

Exclusion Criteria

Permanent teeth

- Teeth with carious lesions, fractures [coronal or radicular]
- Teeth with abnormal morphology and developmental defects

Primary teeth

- Grossly decayed teeth.

Teeth fulfilling the above criteria were selected for the study. The surfaces of teeth were cleaned mechanically followed by disinfecting the teeth in 0.5% sodium hypochlorite solution for one hour and stored in 10% formalin. The samples of sixty teeth were then divided into two groups- Group 1 of thirty primary teeth and Group 2 of thirty permanent teeth. (Table 1)

Procedure:-

The entire sample was subjected to radiography using Intraoral Films (E-speed film) with an intra-oral x ray Machine (BLUEX) and standardized exposure time of 0.3 seconds using paralleling technique. The distance between film and cone is 10mm. The radiographs were then developed.

Later the teeth were exposed to different temperatures of 200^0, 400^0 and 600^0 C in a laboratory furnace. The teeth were radio graphed in a similar fashion as the pre – heated ones. The qualitative evaluation of pre-incineration versus post-incineration radiographic images were done after considering a multitude of image properties including the following parameters-

Coronal:-
1. Shape
2. Dentino-enamel junction.
3. Cracks and fissures
4. Fragmentation and fractures in the crown.

Radicular:
1. Patency of the root canal,
2. Cracks or fissures within the root dentin
3. Fractures of the root itself.

The observations of the pre heated versus post heated radiographs, were then comparatively charted and descriptively analyzed.

Results:-

At the thermal stress of 200°C, both the permanent and primary teeth were intact and no changes were observed by radiographic examination in crowns and roots.

At the thermal stress of 400°C, eight samples of ten primary teeth showed fissures between enamel and dentin in crowns and two samples of them showed no changes. At the thermal stress of 400°C, eight samples of ten permanent teeth showed fissures between enamel and dentin in crowns and two samples of them showed no changes. No changes were observed by radiographic examination in roots of both the permanent and primary teeth.
At the thermal stress of 600°C, eight samples of the primary teeth showed fissures between enamel and dentin and within dentin and two samples showed fissures between enamel and dentin only. At the thermal stress of 600°C, nine samples of permanent teeth showed fissures between enamel and dentin and within dentin and one of the samples showed no changes.

At the thermal stress of 600°C, six samples of ten primary teeth roots showed fractures within the dentin, four samples showed no changes. In ten samples of the permanent teeth roots which were exposed to high thermal stress of 600^0 C three samples of them showed fractures within the dentin and seven samples of them showed no changes. (Table 2)

Discussion:-

Many factors may alter the research ‘‘in vivo’’, such as the duration of exposure to the fire, the modality of development of the fire, the speed of increment of the temperature as well as the substances used for the extinction of the fire.

In this study, once the pre-determined temperatures were reached, the samples were removed from the oven and allowed to cool at room temperature; therefore, all the specimens were subjected to a single and not extended thermal shock.

It was observed in the review of current literature that there is a paucity of published data on effects of incineration on the primary teeth. The present study was conducted to observe and record the findings obtained after subjecting the primary and permanent teeth to high temperatures with variations in the temperature.

In the present study teeth collected were stored in 10% formalin solution because it preserves 90% of secondary structure of proteins, insolubilizing them, it is readily available, cheap, fairly convenient to store, has long shelf life, preserves lipids well, and has been accepted as the closest thing there is to the perfect fixative, with no clear all-purpose alternative found to date.[7] Teeth are disinfected in sodium hypochlorite solution because it is the most commonly used disinfectant and also an antiseptic that has been used in dilutions ranging from 0.5% to 5.25%. Advantages of NaOCl include its ability to dissolve organic substances and its affordability.[8]

In this study it was observed that teeth were not strongly affected by the temperature up to 200°C. However, above 200°C, the teeth were affected by a progressive formation of fissures. The findings were in agreement with **Savio et al. 2006**[6] and **Shekhawat et al. 2016.**[9]

At 200°C, both the permanent and primary teeth were intact and no changes were observed by radiographic examination. At 400°C, eight samples of the primary and permanent teeth showed fissures between enamel and dentin. At 600°C, eight samples of the primary teeth and nine samples of permanent teeth showed fissures between enamel and dentin and within dentin.

Enamel and dentin shrunk with an increase in incineration temperature. As the water content of enamel is less than that of dentin, shrinkage was greater in the dentin and the resultant force leads to tissue separation at dentino enamel junction. This may be the reason for formation of fissures in between enamel and dentin at 400^0 C and 600^0 C temperatures.[4] Hydroxyapatite (HAP) has two types of water in its structure, adsorbed water and lattice water. Adsorbed water shows characterized reversibility, thermal instability from 25^0C to 200^0C, and weight loss without any effect on lattice parameters. Lattice water is irreversibly lost below the temperatures of 200^0C and 400^0C, which causes a contraction in the α-lattice dimension during heating. At higher temperature, the hydroxyapatite gradually dehydrates. Complete dehydration of hydroxyapatite cause lattice destruction, giving rise to a mixture of tricalcium phosphate and tetracalcium phosphate.[10]

Two samples of primary and permanent teeth at 400^0 C showed no changes and one sample each of primary and two samples permanent tooth at 600^0 C showed fissures in enamel and dentin changes. This may be due to the calcification differences in the teeth, which occur because of differences in supply of essential nutrients which may occur during the tooth formation.

Table 1:- Allocation of groups

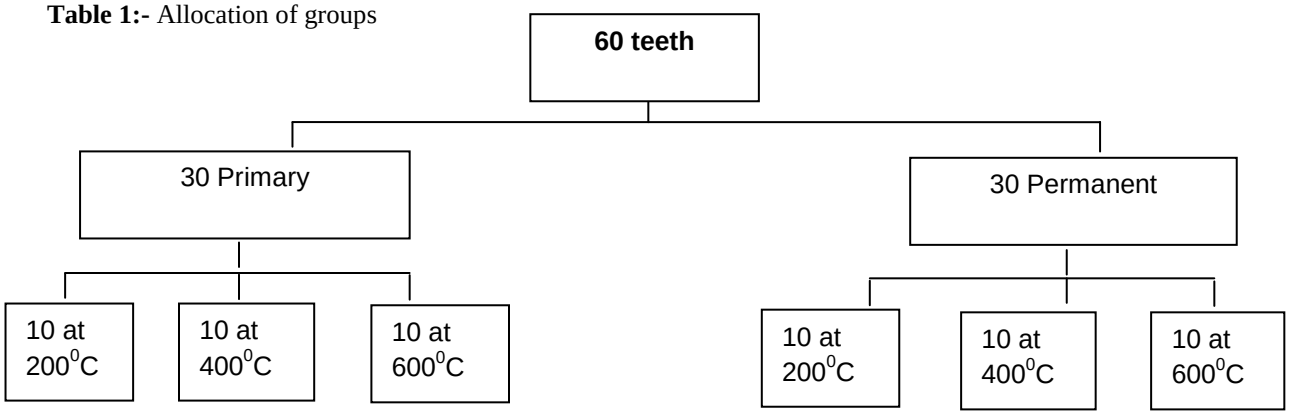

Table 2:- Table showing radiological observations in primary and permanent teeth

Temperature	Primary teeth		Permanent teeth	
	Crown	Root	Crown	Root
200^0C	No changes	No changes	No changes	No changes
400^0C	Fissures between enamel and dentin for 8 samples	No changes for 10 samples	Fissures between enamel and dentin for 8 samples	No changes for 10 samples
	No changes for 2 samples		No changes for 2 samples	
600^0C	Fissures between enamel - dentin and within dentin for 8 samples	Fractures within the dentin for 6 samples	Fissures between enamel - dentin and within dentin for 9 samples	Fractures within the dentin for 3 samples
	Fissures between enamel and dentin for 2 samples	No changes for 4 samples	Fissures between enamel and dentin for 1 sample	No changes for 7 samples

Fig.A.Changes seen in primary teeth at the thermal stress of 400 °C
Fig.B.Changes seen in primary teeth at the thermal stress of 600°C

Fig.C.Changes seen in permanent teeth at the thermal stress of 400 °C
Fig.D.Changes seen in permanent teeth at the thermal stress of 600°C

Conclusion:-

From the observations discussed in the study, it can be concluded that radiographic changes at higher temperatures in primary teeth are more evident compared to permanent teeth. Further investigations are required to substantiate the results of the present study before it can be practically implemented.

References:-

1. Gnanasundaram N. Tooth for truth (The glory of forensic dentistry). J Forensic Dent Sci. 2010;2:51-52
2. Chandra Shekar B R, Reddy C. Role of dentist in person identification. Indian J Dent Res. 2009;20:356-360
3. Pretty IA, and Sweet D. A look at forensic dentistry —Part 1: The role of teeth in the determination of human identity. Br Dent J. 2001;190(7):359-66.
4. S Karkhanis, J Ball, D Franklin. Macroscopic and microscopic changes in incinerated deciduous teeth. J Forensic Odontostomatol. 2009;27(2):9-19.
5. Chiam S. A note on digital dental radiography in forensic odontology. J Forensic Dent Sci. 2014;6:197-201
6. Savio C, Merlati G, Danesino P, Fassina G, Menghini P. Radiographic evaluation of teeth subjected to high temperatures: Experimental study to aid identification processes. Forensic Sci Int. 2006;10;158(2-3):108-116
7. Buesa RJ, histology without formalin. Ann Diagn Pathol. 2008;12(6):387-96
8. Root Canal Irrigants and Disinfectants. Endodontics. Colleagues for Excellence Published for the Dental Professional Community by the American Association of Endodontists. Winter 2011
9. Shekhawat KS, Chauhan A. Analysis of dental hard tissues exposed to high temperatures for forensic applications: An in vitro study. J Forensic Dent Sci. 2016;8:90-94.
10. Sugunakar Raju Godishala Swamy, Shyam Prasad Redd y Dorankula, Keerthi Muddana Ultrastructural Analysis of Incinerated Teeth by Scanning Electron Microscope – A Short Study. Journal of Clinical and Diagnostic Research. 2016;10(7):08-11.