ORIGINAL RESEARCH PAPER

Dental Science

HEAT-INDUCED ALTERATIONS IN ROOT CANAL OBTURATION: IMPLICATIONS FOR THE IDENTIFICATION OF FIRE VICTIMS

KEY WORDS: forensic, incineration, identification

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ABSTRACT

Detection and identification of human remains in situations in which they are calcined, disarticulated, and fragmented may be a challenging task. Forensic dentists investigate with incidents involving high temperatures (e.g. airplane crashes, natural disasters, house fires) and therefore information gained from experimental research was helpful for estimating temperature effect on tissue changes to then facilitate victim identification. Teeth may have differences in withstanding temperatures and compared with the adequate qualities and quantities of the traces of burned bodies. This relies on the previous records as well as the radiographs. This study was conducted on 60 extracted teeth which were parted into four groups of 15 teeth per group according to different temperatures. Group A - 200°C, Group B - 400°C, Group C - 600°C, and Group D - 800°C. According to changes on teeth surface temperatures can be categorized as intact, scorched, charred and incinerated. At 800°C, the tooth completely charred whereas at 200°C and 400°C the tooth showed both visual and radiographic changes. Knowledge of changes in human dentition and residues of root canal obturated teeth can help identification of bodies burned beyond recognition.

INTRODUCTION:

Teeth being the hardest organs of the human body have high resistance to taphonomic processes and also present great resistance to exposure to high temperatures. This makes their study an efficient means to identify individuals or human remains based not only on their morphological characteristics but also on dental treatment records such as root canal treatment.[1] Therefore, if there are dental records of an unknown individual who has died in casualty due to fire, information obtained from his/her remains can be compared to initiate the process of dental identification. The process of comparing information obtained from the body against dental life records is known as antemortem/ postmortem comparison and it allows determining whether the body or human remains belong to the missing individual.[2]

Fire is highest reason of morbidity and mortality throughout the world and identification of a body from hellfire is a difficult task. According to Norrlander body burns into five categories: 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.[3] Studying the effect of heat on teeth can be of help in establishing the situation for eg. if an accelerator was used and whether the blaze was the cause of death or the victim was dead before the fire. This mode of identification would be highly useful in cases where skeletal remains are discovered later.[4] Additional information obtained from the condition of available root canal filling material after a fire, enhances the possibility of an affirmative identification.

In recent years, dentistry has been benefited from a marked increase in the development of endodontic root canal filling materials specially advances in root canal filling techniques. With 40 million root canals being completed annually in the India, a very large pool of antemortem data is available to the forensic odontologist to make positive identifications. When complete and thorough dental records exist, individuals that have undergone surgical and nonsurgical root canal therapy may have materials present in the canal that may aid in identification.

AIMS AND OBJECTIVES

The present study aims to highlight the relationship between endodontics and forensic odontology, by illustrating the usefulness of endodontic radiographic records as legal evidence for the dental identification of fire victims. It also broadens the knowledge of resistance of the teeth, obturation material at different temperatures.

MATERIALS AND METHODS

This study was conducted in Department of Conservative Dentistry and Endodontics in Career Post Graduate Institute of Dental Sciences, Lucknow. In this study, 60 extracted mandibular first premolars teeth were collected. An access opening was prepared using Endo Access bur and Endo Z bur and canal patency was checked using No.10 K file. Then, the working length was determined by the radiographic method. The biomechanical preparation was done. The canal was copiously irrigated with 3% sodium hypochlorite and normal saline. The apical enlargement was done upto Protaper F2. All the teeth were obturated using Thermoplasticized gutta percha obturation technique and zinc oxide eugenol as a sealer and post-endodontic restoration was done with composite. Now, the radiographs and pre-incineration images of all the samples were taken. Then, the 60 teeth were divided into four groups of 15 teeth each:

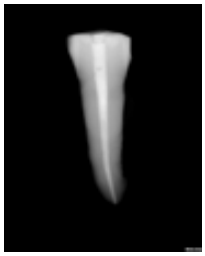
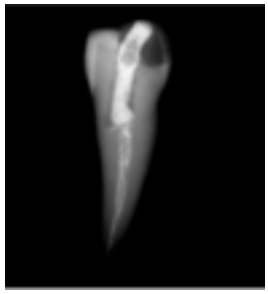
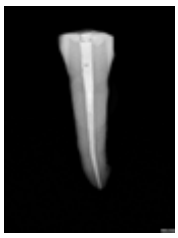
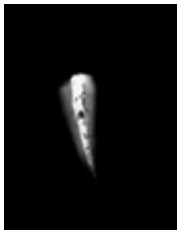
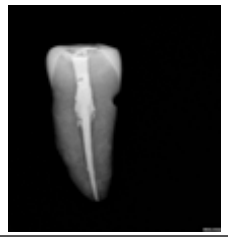
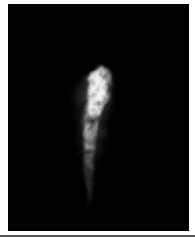
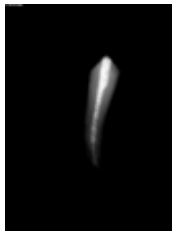
Group A -200°C,
Group B-400°C,
Group C-600°C,
Group D-800°C.

Teeth of specific subgroups were placed in a ceramic crucible and subjected to the respective temperatures. Teeth were placed in ceramic crucible in digital furnace present at our Department. Teeth were allowed to cool, and post-incineration radiographs and images were taken. The incinerated material was then examined for the changes and resistance to temperature using naked eye and Radiovisiography for forensic analysis.

RESULTS

The effect of varying temperatures on the root canal obturated teeth was observed morphologically as well as radiographically (Table 1).

Table 1 Morphological changes, Antemortem radiographs and Post-mortem radiographic changes at different temperature.

Temprature	Morphologic changes	Antimortem radiographs	Postmortem radiographs
200° C			
400° C			
600° C			
800° C			

- At 200° C, tooth remain intact and brownish discolouration seen morphologically but no apparent changes were seen radiographically.
- At 400° C, tooth remain intact but voids were seen in post-mortem radiographs.
- At 600° C, scorched (partially burned) appearance seen and radiographically honey-comb appearance seen in obturating material.
- At 800° C, tooth become charred and softening of obturating material occur that even covered the irregularities of root canal if present.

DISCUSSION

Forensic dental identification of the fire's victims is often a complicated task.[5] Knowledge of burnt human dentition and residues of filling substancel can help in the identification of charred bodies. With changing dental practice the technique of obturation has changed. Thermoplasticised obturation technique is gaining prevalence. So this study was designed to analyse susceptibility of thermoplasticised gutta percha to different temperatures.

The value of scientific knowledge of the effects that extreme heat has upon the dental tissues cannot be undersestmated.[6] The blackened charred teeth resulting from the early stages of heating are more stable than the 'porcelain white' teeth that result from exposure to prolonged high temperatures.

A scientific approach in a forensic dental examination, during the retrieval and its further analysis prevents the loss of valuable information. Therefore, the identification of mortals remains can be based on some dental features that are peculiar to that particular person and also be identified using the anatomical differences of their dentition along with the modifications made during dental procedures.

In our study, we have observed the visual and radiographic damage to the root canal obturated teeth due to fire. In our research, the root canal obturated teeth showed colour change as well as a change in the tooth structure. This is directly related to the level of carbonization and incineration of teeth. All of these changes were also described by Merlati *et al*. [7] They reported that there is a consistent correlation between exposure temperature and the associated changes with it, and it is possible to create a reliable baseline data. This data could be used in real life scenarios to estimate the temperature to which the dental hard tissues could have been exposed. Thus, small fragments of teeth can be identified from the burn remains, and a reliable estimation of the temperature of exposure can be made.

CONCLUSION

Teeth can thus be of great value in thermal history, to give a clue to understand the chain of events that may have occurred and can contribute in identifying human remains in a mass disaster involving fire.

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