Integrity of the DNA Extracted from Human Teeth Exposed to High Grades of Temperature as a Tool for Forensic Identification

Thesis

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Walaa Talaat

Dedication

To

MY DEAR PARENTS & SISTERS

Who gave me too much
And received too little

&

To My Husband & My Lovely Son

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List of Abbreviations

Abb.	Full term

A.....*Adenine*
AL .....*A Lysis*
ATL.....*A Tissue Lysis*
AW1.....*Wash 1*
AW2.....*Wash 2*
Bp.....*Base Pair*
C.....*Cytosine*
CODIS .....*Combined DNA Index System*
CT .....*Computed Tomography*
DNA .....*Deoxyribonucleic Acid*
DVI.....*Disaster Victim Identification*
FBI.....*The Federal Bureau of Investigation*
G.....*Guanine*
H_2O_2.....*Hydrogen Peroxide*
MDCT .....*Multi Detector Computed Tomography*
mtDNA.....*Mitochondrial DNA*
PCR.....*Polymerase Chain Reaction*
RFLP.....*Restriction Fragment Length Polymorphism*
SNP.....*Single Nucleotide Polymorphism*
SPSS.....*Statistical Package for Social Science*
STR.....*Short Tandem Repeat*
T.....*Thymine*
VNTR.....*Variable Number of Tandem Repeat*

Glossary of Terms

Alleles: is an alternative form of a gene (one member of a pair) that is located at a specific position on a specific chromosome.

CODIS:

13 core STR loci have been identified by FBI that are now routinely used in the identification of individuals in the United States.

Heterozygous:

The alleles are different.

Homozygous:

The alleles are of the same type.

Locus:

location of the allele on the chromosome.

Polymorphisms:

Variations in DNA sequence between individuals.

Single Nucleotide Polymorphisms (SNPs):

It is a single base sequence variation between individuals at a particular point in the genome.

STRs:

Short sequences of DNA, normally of length 2-7 base pairs that are repeated numerous times in non-coding regions.

Abstract

Introduction: Identification of burnt bodies is a great challenge as the ordinary methods of identification is impossible, so DNA is the only available method of identification. Teeth can be used as a source of DNA in charred bodies as they are largely protected from environmental and physical conditions.

Aim: This study was designed to assess integrity of the DNA recovered from isolated human teeth after being exposed to high grades of temperature as a tool for forensic identification.

Material and Method:

Extracted teeth were subjected to the following temperatures: 100ºC, 300ºC and 500ºC, teeth Pulp from teeth were retrieved by dental file, followed by extraction of DNA with Quiagen kit followed by PCR for amplification of the tested loci (D21S11, TH01, CSF1PO, D18S51, D7S820, D13S317), then gel electrophoresis was done to visualize DNA bands.
Results : No significant difference was found from control samples on exposure to 100ºC, on exposure to 300ºC there was significant difference from control in all tested loci except in TH01 while on exposure to 500ºC there was complete loss of DNA.

Conclusions: Dental pulp is a good source of DNA. Exposure to high grades temperatures degrades DNA from dental pulp and at 500ºC genomic DNA is completely lost

Key words:
Identification. Burn. Dental Pulp. STR

INTRODUCTION

Identification of severely burned human remains may pose a major problem for the forensic physicians. Law enforcement and health officials often have the responsibility for identifying the human remains found at the scene ***(Budowle et al., 2005).*** This helps family members by ascertaining the fate of their relative and allowing the remains to be handled in an appropriate manner ***(Binz, 2009).***

Identification of a corpse is essentially based on anthropology, odontology, fingerprints, radiology, and/or DNA typing. However, it can be complicated when the corpse is completely destroyed from mass disaster, putrefaction, drowning, or burning ***(Raimann et al., 2012).***

From a forensic perspective, fire is one of the most destructive forces in the universe. A physical fire can result in extensive soft tissue damage that conventional methods of identification are precluded ***(Rees and Cox, 2010).***

Identification is usually difficult in these cases since the elements used (such as fingerprints, sexual characteristics, physical constitution, ethnic group, stature and/or dental arch) can be modified by degradation, hampering a conclusive result ***(Raimann et al., 2012).***

DNA-based identity testing is a powerful tool for victim identification, it can be used to associate separated remains or body parts ***(Budowle et al., 2005).*** So, forensic specialists look for better preserved tissues to obtain DNA with good quality and amount to perform DNA analysis ***(Raimann et al., 2012).***

However, when dead body or its remains are severely burnt, bones and teeth are often the only accessible source of DNA. Due to their unique composition and structure, DNA molecules in bone and teeth are expected to be protected from environmental challenges ***(Hasan et al., 2014).***

DNA contained within the dentition can be extracted and profiled to identify the unknown by comparison to a known ante- mortem sample or to DNA profiles from relatives of the unknown individuals ***(Rees and Cox, 2010).*** So it is important to know whether exposure to extreme temperature influences the DNA content and its integrity in teeth ***(Vemuri et al., 2012),*** as many failed samples during human identification were accompanied by descriptions of challenging environmental exposures, especially burning ***(Zgonjanin et al., 2015).***

Aim of the Work

This study is intended to:

Assess integrity of the DNA recovered from isolated human teeth after being exposed to high grades of temperature as a tool for forensic identification.