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The effects of high temperatures on human teeth and dentures

Conclusions regarding the degree on destruction and the influence of time

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Introduction

The identification of burned bodies correlates with an adequate quality and quantity of traces. This needs every effort by the rescue teams, the investigators, i.e. police, fire-fighters, forensic medicines and dentists at the place of the event. Dental photography, radiography and morphological methods to stabilize and save the fragile human skull are described.

Objectives

The purpose of this study was to examine the resistance of teeth and restorative materials to high temperatures and for forensic identification purposes (Benthaus and Teige 1998, Grundmann and Rötzscher 2000, Günther and Schmidt 1953, Rötzscher 2000, Roussow et al. 1999, Yamamoto et al. 1990).

Material and Methods

Five samples of teeth and four samples of dental materials were heated at the following temperatures (Table 1a and b):

Time (in min)	Temperature	Effects
5	400	Extreme longitudinally fissures in the crown of the front teeth with partial loss of continuity and black glowing plaque "metal shine".
15	400	Black "charcoal grey" of the extremely destroyed front teeth. Enamel slack, though invisible carbonization. Exposed dentinum splinter. Amalgam fillings blistered, still in the cavity.
30	400	Front teeth totally destroyed. Enamel broken, carbonized. Dentinum black coloured (carbonized), changing to white colour. Molars show only some fissures. Amalgam still in the cavity. Rests of the pulp. White ash in the cavum dentis.
60	400	Deep longitudinally fissures in the root. Spongiosa more dark than the compacta. Teeth not more in the alveole or broken at the collum dentis. Enamel "like thimble" removable.
45-70	1000-1100	Teeth totally carbonized. Cement fillings hard, visible in the ash. Amalgam amalgamize gold fillings. Silver and silver amalgam: small bullets. Phosphat cement fillings dazzling white.

Table 1a: Time (in minutes), Temperature (in °Celsius), Effects (Günther and Schmidt 1953)

Material	Time (in minutes)			
	8-10	13-16	20-25	45-75
Temporary fillings	fallen out of the front teeth	not to be found in general	-	-
Cemet fillings	constant	fallen out of the front teeth	in side teeth constant	white and hard in the ash
Amalgam	traces of mercury in front teeth	Ag-, Au-amalgam constant in molars, Cu-amalgam yellow-brown	not to be found in general	-
Castin materials	loosening in the cavity	fallen out of the front teeth	fallen out in general	metal bullets in the ash
Metal crowns	-	Au red coloured, Ag-Pd yellow-red coloured	rest of enamel at the margin, solder separated, Ag-Pd rough and dark grey	Au "bullets", Ag-Pd intact
Ceramic-crowns	burst or displaced	burst, teeth intact	-	solid crowns resp. facettes intact
Acrylic restaurations	front teeth burned	teeth until praemolars burned, anterior parts of dentures burned	-	total burned

Table 1b: Effects by post-mortal temperatures on dentures (1000°-1100° Celsius) (Günther and Schmidt 1953).

0 no damages
1 front teeth damaged (one or both jaws)
2 front and side teeth damaged, unilateral (one or both jaws)
3 front and side teeth damaged, bilateral (one or both jaws)
4 fragments of teh jaws, the teeth and/or roots included, remain
5 no teeth remain

Table 2. Degrees on destruction on human teeth by temperature (6 categories) (Andersen et al. 1995)

Sample 1

Fig. 1 Fragments of the jaws. The teeth and roots included, remain (degree 4). Front teeth are partial destroyed. Enamel broken, carbonized. Dentinum black coloured (carbonized), changing to white colour. Molars show only some fissures. Rests of the pulp. White ash in the cavum dentis (30 min, 400° Celsius).

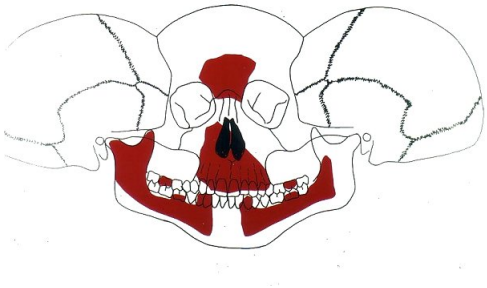

Fig. 2 Prepared skull (diagram) (Benthaus and Teige 1998).

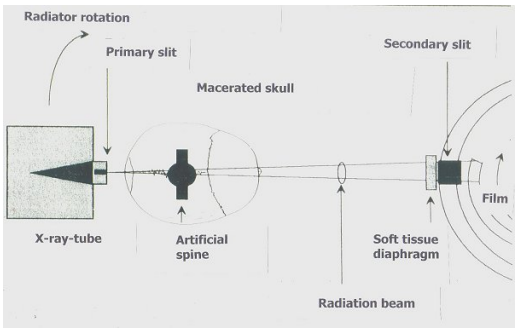

Fig. 3 The radiological technique (diagram) (Benthaus and Teige 1998).

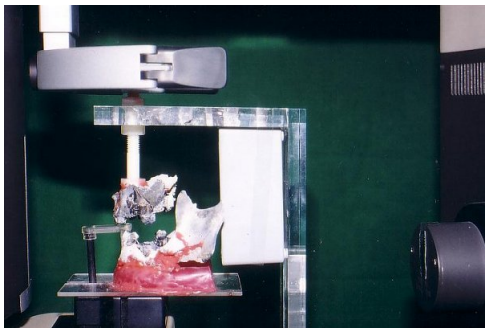

Fig. 4 The dissected lower jaw (pantomography) (Benthaus and Teige 1998).

Sample 2

Fig. 5 The skull of a 40-years old man, (burned in his flat). The front teeth of both jaws are damaged (degree 1). Black "harcoal grey" of the extremely destroyed front teeth (15 min, 400° Celsius) (Grundmann and Rötzscher 2000).

Fig. 6 View of the lower jaw after removal (left side) (Grundmann and Rötzscher 2000).

Sample 3

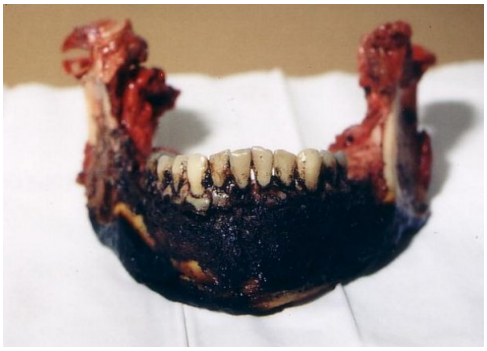

Fig. 7 The lower jaw of a 40 years old man (burned in his car on a highway). After removal (Grundmann and Rötzscher 2000).

Fig. 8 The lower jaw. After maceration (Grundmann and Rötzscher 2000). No destruction on teeth by temperature (degree 0).

Results

The expertness leads to conclusions regarding the degree on destruction of teeth to the influence of temperature and time. Combinations of dental restorations are as unique as fingerprints and their radiographic morphology as well as the types of filling materials used are often the main features in identification. Gold, silver amalgam and silicate fillings have varying resistances to high temperatures and are often unaffected even after prolonged exposure to fire.

Discussion and Conclusions

Positive identification of burned bodies by dental radiological and morphological methods is possible after stabilizing and saving the fragile human skull. The degrees on destruction are transferred to the P-M-DVI-Form (pink) together with the information where the victim (house, car, boat, aeroplane, train etc.) was found at the time of the event.

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Abbreviations

P-M-DVI-Form = Post-mortem-Disaster-Victim-Identification-Form

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ARBEITSKREIS FÜR FORENSISCHE ODONTO-STOMATOLOGIE

Abstract
Single teeth, fragments of the jaws, of the skull and restorative elements used in modern dental practice are important for identification purposes of dead bodies. These individual specific structures are fire resistant and remain radiopaque. They shrink significantly and are likely to fall out of the cavities after being burned, and it may be possible to identify the white filling materials used to restore teeth by their radiopacity and morphology.

Introduction
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The purpose of this study was to examine the resistance of teeth and restorative materials to high temperatures and for forensic identification purposes (Benthaus and Teige 1998, Grundmann and Rötzscher 2000, Günther and Schmidt 1953, Rötzscher 2000, Roussow et al. 1999, Yamamoto et al. 1990).

Proceedings
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Fig. 1 Fragments of the jaws. The teeth and roots included, remain (degree 4). Front teeth are partial destroyed. Enamel broken, carbonized. Dentinum black coloured (carbonized), changing to white colour. Molars show only some fissures. Rests of the pulp. White ash in the cavum dentis (30 min, 400° Celsius) Restoration of the fragments using red dental wax (Benthaus and Teige 1998)

Fig. 2 Prepared skull (diagram) (Benthaus and Teige 1998)

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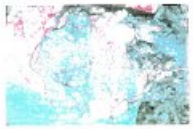

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THE EFFECTS OF HIGH TEMPERATURES ON HUMAN TEETH AND DENTURES. CONCLUSIONS REGARDING THE DEGREE ON DESTRUCTION AND THE INFLUENCE OF TIME.

XIème Congrès de l´A.F.I.O.,
27 et 28 Septembre 2001
à l´Amphithéâtre du Musée des Beaux Arts d´Orleans, France

A contribution of the German Association of Forensic Odonto-Stomatology

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