TECHNICAL NOTE

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Methods for Physical Stabilization of Ashed Teeth in Incinerated Remains

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ABSTRACT: Methods for physically stabilizing the extremely fragile ashed teeth that are often encountered in incinerated human remains were investigated.

Results of a questionnaire sent to forensic anthropologists and forensic odontologists disclosed that, for these two groups, the most popular methods currently used are impregnation with a solution of polyvinyl acetate or application of cyanoacrylate cement, respectively.

In addition, extracted human teeth were incinerated in the laboratory and impregnated with commercially available preparations of either cyanoacrylate cement, clear acrylic spray paint, hair spray, spray furniture varnish, clear fingernail polish, quick-setting epoxy cement, Duco® household cement, polyvinyl acetate polymer in acetone, or self-curing clear dental acrylic resin. Every substance tested successfully stabilized the incinerated teeth. Clear acrylic spray paint was judged the most efficacious overall because of its ease of application, availability, inexpensiveness, and rapidity of setting.

KEYWORDS: odontology, human identification, dentition

A situation frequently confronting forensic scientists is the extreme fragility of the teeth in incinerated human remains. Medical examiners, forensic odontologists, and forensic anthropologists often attempt to recover the teeth from a charred body only to have them disintegrate despite the most careful handling (Fig. 1). This may be a significant problem if preservation of the dentition is desired for evidentiary, instructional, or archival purposes.

Over the years, methods for stabilizing burned dental hard tissues have been documented only infrequently [*1*]. Also, new impregnation materials with potential for use in this area are constantly being developed, but there have been few reports of their use

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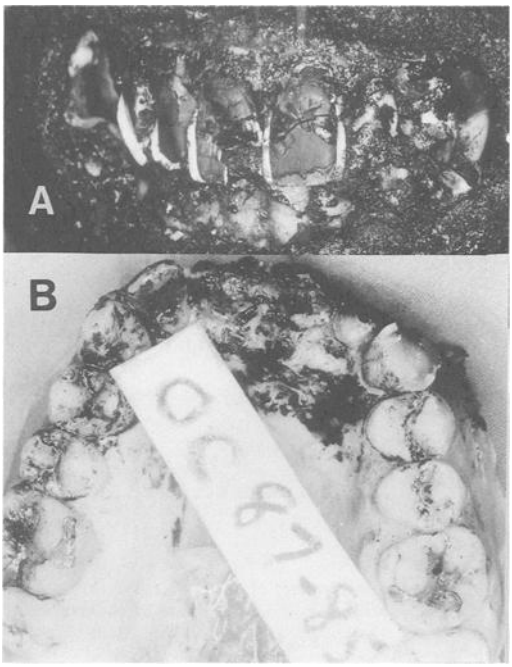

FIG. 1—*Teeth from human remains incinerated in a house fire before* (a) *and after* (b) *resection with a Stryker® autopsy saw. Note the fragmentation of the anterior teeth after resection in contrast to the relative preservation of the posterior teeth.*

[*2–4*]. The present study was an attempt to identify techniques and materials used by forensic science investigators to preserve incinerated ashed teeth and to determine which of these are most effective.

Materials and Methods

A short questionnaire was mailed to 81 forensic odontologists and 73 forensic anthropologists selected from the American Academy of Forensic Sciences (AAFS) Membership Directory. All were board certified or were deemed to be active in their forensic science disciplines. The questions asked were (1) "Do you consider fragility of teeth in incinerated human remains a significant problem?" and (2) "Do you routinely use any special method for physically stabilizing fragile incinerated teeth?" Responders were also asked to identify the materials and methods that they used and to make any additional comments that might be useful. The materials most commonly used are indicated in Table 1.

Extracted, single-rooted human teeth were obtained from the Department of Oral Surgery of the College of Dentistry, University of Tennessee, Memphis, Tennessee, and preserved in 10% buffered formalin until used. The tooth roots were embedded in standard dental soldering investment in sets of three. The sets of teeth were incinerated in a dental laboratory porcelain furnace for 20 min at 800°F (427°C). After cooling, the teeth were treated with one of various stabilizing substances (Table 2). Each set was tested for fragility by vibration on a dental laboratory plaster vibrator on which a vise for securing the specimens was mounted.

TABLE 1—*Materials used by 34 forensic scientists to stabilize incinerated teeth.*

Material	Number of Scientists
Cyanoacrylate (Crazy® glue, Superglue®)	8
Polyvinyl acetate (PVA)	8
"Glue"	3
"Wax"	3
Duco® cement	2
Spray acrylic	2
Clear self-curing dental acrylic	2
Dental bonding agent	2
Bioplastic®	1
Transparent tape	1
Clear fingernail polish	1
Dental "sticky" wax	1

TABLE 2—*Materials tested for stabilizing incinerated teeth.*

Material	Application
Cyanoacrylate (Superglue®, liquid)	tube/drop
Acrylic spray (Krylon®, clear No. 1303)	spray[a]
Hair spray (Style Superhold®, unscented)	spray[a]
Spray varnish (Illinois Bronze®, clear, satin)	spray[a]
Fingernail polish (Hard as Nails®, clear)	brush
Epoxy cement (Devcon 5-Minute®)	brush
Epoxy cement (Devcon 5-Minute®) 1:1 in acetone	brush
Household cement (Duco®)	brush
Household cement (Duco®) 1:1 in acetone	brush
PVA polymer (Union Carbide®) ~5% in acetone	brush
PVA polymer (Union Carbide®) ~1% in acetone	brush
Acrylic resin (Coe®, orthodontic, self-cure, clear	brush

[a]Applied in 3 coats with 3-min drying between coats.

Results

Of 154 questionnaires sent, 97 (63%) replies were returned. Among the responders, 64 (66%) considered fragility of incinerated teeth to be a significant forensic science problem at least occasionally. Of the others, several indicated that, in their experience, any difficulty could be circumvented by techniques such as very careful handling (or examining the remains before they were moved), photographing the teeth before handling, or using the special technique of removing the tongue through the floor of the mouth and making dental radiographs by inserting the films through the opening. Others commented that the problem is, at most, rare because the posterior teeth are usually protected by soft tissue, or at least roots are present, providing sufficient material for dental identification.

There were 34 responses in which materials for stabilizing the teeth were given (Table

1). The techniques most commonly specified were impregnation with cyanoacrylate cement, most popular among odontologists, and with polyvinyl acetate (PVA), mentioned most often by anthropologists.

Among the several substances tested in our laboratory (Table 2), every one adequately increased physical stability sufficiently to preserve the macroscopic morphology of charred teeth satisfactorily. Several minutes of test vibration on the dental laboratory plaster vibrator failed to disrupt incinerated teeth that had been impregnated using any of our methods, while untreated specimens, in contrast, immediately fragmented upon activation of the device. Likewise, fairly firm tapping of treated burned teeth with a pencil or attempts to scratch them with a fingernail showed them to be physically stable.

It therefore appears that any of the methods tested would be of value in stabilizing charred teeth for forensic science preservation. For that matter, the substances used for impregnation would obviously be useful for preserving a number of types of highly fragile, porous specimens. Some materials, however, showed disadvantages in comparison with others. For example, a relatively long setting time, difficulty of application due to viscosity, and imparting an unnatural sheen to the specimen were undesirable characteristics of some of the substances.

In our opinion, the most advantageous impregnation material for stabilizing incinerated teeth is clear acrylic spray paint, and the second best is probably cyanoacrylate cement. Both are readily available, inexpensive, easily portable, provide excellent permeation, and set to hardness within a few minutes. Acrylic spray, on the other hand, is somewhat easier to apply, particularly to *in situ* teeth in burned remains. If the setting time is not a problem, such as with archaeological or curated specimens, PVA is also suitable.

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