A50 Back Together: An Innovative Procedure For Cranial Reconstruction as an Aid for Human Identification

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Learning Overview: After attending this presentation, attendees will better understand the potential of a new reconstructive approach to fragmented skeletal material.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing a new procedure to reassemble and reconstruct fragmented skeletal remains for a more comprehensive analysis

Human remains are frequently recovered fragmented from forensic contexts. Taphonomic factors and perimortem trauma and injuries can damage human remains recovered from clandestine graves. Therefore, an incomplete or broken skull can represent a challenge to the identification of an individual, osteometric analysis, and the interpretation of trauma to establish cause and manner of death.

A reconstructive approach is proposed to aid forensic experts (i.e., medical examiners, pathologists, forensic anthropologists) in achieving all the information from the human remains. This study proposes an innovative method that involves the use of reversible glue to connect the fragments. Non-permanent wax is then used to reconstruct the missing parts and stabilize the skull.

The reconstruction procedure is divided into three phases: cleaning, reassembling, and remodeling. All the phases are documented to maintain the value of the forensic evidence. The phases are carried out after a preliminary evaluation of the remains and evidence collection (e.g., trace and genetic evidence).

The bones, particularly the fractured areas, are cleaned with cold water. This preliminary step enables the expert to avoid any error caused by sediment and exogenous material in the fractures. All the fragments are classified and photographed before starting the reconstruction to guarantee a more straightforward process.

The reassembling is carried out with non-permanent reversible glue (Paraloid™ B-72 crystals mixed with acetone in a 60% solution). Consequently, if the reconstructed remains do not have enough solidity to undergo a forensic examination, some of the missing anatomical parts can be replaced with reversible wax, modeled on the missing bone's shape. The wax is a pigmented combination of beeswax, hydrated calcium sulfate, pine resin, and paraffin.

The procedures described in the present research have been extensively applied during a PhD project carried out at Liverpool John Moores University to allow the craniometric analysis of 400 skulls from two British medieval sites (Poulton, Cheshire, and Gloucester, Gloucestershire). The cranial reconstruction improved the collection from Gloucester by 69%, reassembling 76 skulls completely fragmented; while the Poulton collection has been improved by 56% (an additional 175 reconstructed skulls have been included). Furthermore, they were largely applied in different scenarios at the University of Florence, allowing the full reconstruction of skulls from archaeological excavations of different periods (Prehistoric, Etruscan, Medieval, and Historical). The success of these reconstructions has been demonstrated by the publication of the data obtained from the different sites.[1-5] In addition, the reconstruction approach has been applied in forensic cases that have been presented in the Italian court.

The method proposed allows a more comprehensive examination of the whole skull structure for the biological profiling of unknown individuals, as well as a better analysis of trauma and injuries, if present. Moreover, Computed Tomography (CT) and radiographic analysis can be performed on a reconstructed skull rather than on fragmented specimens; the data obtained can also be a more appropriate background for unidentified persons' facial approximations.

This research aims to propose a new reconstructive approach to fragmented skeletal material, particularly skulls, that can be damaged by taphonomic or traumatic events. This study also presents the benefits of using a pigmented wax to reconstruct missing anatomical parts to adequately analyze incomplete remains.

Reference(s):

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Forensic Anthropology, Skeletal Reconstruction, Taphonomy

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