TECHNICAL NOTE

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Obtaining Fingerprints from Mummified Fingers: A Method for Tissue Rehydration Adapted from the Archeological Literature

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ABSTRACT: Our laboratory was asked to help with the rehydration of mummified human fingertips that had been removed from a recently deceased, unidentified female. Using a solution that was found in the archeological literature, we were able to successfully rehydrate dermal tissues to the extent that fingerprints could be taken. We believe that this solution, which until now has not been described in the forensic literature, is effective, affordable, and relatively easy to produce and use.

KEYWORDS: forensic science, anthropology, mummification, dermatoglyphs, tissue rehydration

In October of 1994 a human body was found along a state highway in Hancock County, Indiana, near the city of Greenfield. The remains were in an advanced state of decomposition and the legs and thorax had been disturbed by carnivores. Large portions of the integument, including the hands and feet, had mummified. Police processed the scene and recovered the body and associated evidence. Subsequent anthropological analysis by the authors indicated that the remains are those of a middle-aged, white female who, unfortunately, has not yet been identified (1).

At the autopsy it was noted that some of the friction ridges on the fingertips were visible. With permission from the pathologist, a detective cut off the fingertips at the middle phalanges. For several months, six fingertips were curated by the police and all but one was preserved in a vial of tap water. The sixth was allowed to further desiccate in a petri dish.

It was hoped by the police that the water would act as a preservative. After several months, however, it was evident that the fingertips were shriveling. In late Spring of 1995, we were asked to assist with the restoration of the fingertips. We removed them from the vials and let them air dry. Unfortunately, the friction ridges had decomposed in the water and it was clear that dermatoglyphs could not be attained from these specimens. However, the one desiccated fingertip still had its cutaneous tissues, including the friction ridges, intact. The muscles and ligaments had decayed leaving only the bone and integument, which was dry and wrinkled. The skin had been cut free from the bone except for a hinge of tissue located at the distal end of the distal phalanx. We determined that this finger (a left 5th) would be a suitable candidate for rehydration.

Methods and Results

Several methods for tissue rehydration have been reported in the forensic literature (2–5). Haglund (5) provides an excellent review of various rehydration procedures. While most of them were useful at some level, according to Haglund, many had the potential for major drawbacks. For example, some require the use of harsh detergents that are capable of destroying cutaneous tissues. Other methods relied on relatively uncommon and expensive chemicals and/or required a great deal of labor. We conducted an expanded literature search for tissue rehydration methods in anthropological journals and discovered a method that is apparently little-known to forensic scientists. In 1921, Ruffer (6) published a study on Egyptian mummies that included a section on tissue rehydration techniques. His goals were to ". . . 1) soften tissues in order to render them less brittle, 2) to remove the colouring matter, and 3) to bring back consistency sufficient for histological examination" (p. 63). After several experiments, Ruffer discovered a solution that has subsequently been used by Walker et al. (7) for the rehydration of mummified pleural tissues.

The Ruffer rehydration method is attractive because of its simplicity and the availability of the solution constituents. Ruffer's (6) original formula called for 30 cm^3 of alcohol, 50 cm^3 of water, and 20 cm^3 of a 5% solution of carbonate of soda (p. 64). This solution was slightly modified by Walker et al. (7). In that study, the solution consists of:

- 10 g of Na_2CO_3 (sodium carbonate)
- 316 mL of 95% ethanol
- 684 mL of distilled water

Because it provided more specific descriptions of the solution constituents, we employed the Walker et al. adaptation.

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A test run of the rehydration solution was conducted on mummified human hand tissues (consisting mainly of integument and extensor muscle tendons) that were being curated in our laboratory. Before rehydration, the tissues of this specimen were very dry and brittle. After being completely submerged in the rehydration solution for 24 h the skin and tendons became soft and pliable. Despite their flexibility, the tissues were not fragile and did not fall apart or tear even upon manipulation. For the most part, the tissues felt surprisingly similar to living skin. In addition, all adhering dirt particles had been removed during the rehydration process.

The desiccated fingertip from Hancock County was completely immersed in the rehydration solution for 24 h. It was then removed and allowed to air-dry in a fume hood for a few minutes. Once dry, the previously desiccated and brittle tissues were found to be soft and pliable, similar to that of the rehydrated tissues in our test run. The details of the friction ridges were visible to the naked eye (Fig 1).

Fingerprints were taken by placing the loose skin of the rehydrated fingertip over the fingertip of the analyst, dusting it in black-graphite powder, and rolling it over clear tape. The tape was then placed over a sheet of clear acetate. Details of the fingerprint were evident on the tape and it was later submitted to the Indiana State Police for analysis.

FIG. 1—*Soft and pliable dermal tissues after rehydration. Note the excellent condition of the friction ridges.*

Conclusion

The Ruffer (6) method for tissue rehydration successfully restored a recently mummified human fingertip to the degree that fingerprints could be taken from its surface. This process of rehydration is appreciably simple, affordable, and the ingredients are readily available from laboratory supply companies. In addition, it is possible that this solution will adequately rehydrate many human tissues, and, thus, is not limited to the recovery of fingerprints (7,8). For example, it may be used to rehydrate tissues with distinguishing markings such as tattoos or birthmarks. While this study does not provide a new technique for rehydration, it does provide independent confirmation of the efficacy of the Ruffer (6) tissue rehydration method. Clearly, further tests are warranted.

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