

## TECHNICAL NOTE

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### A New Method for Softening Mummified Fingers

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**REFERENCE:** Zugibe, F. T. and Costello, J. T., "A New Method for Softening Mummified Fingers," *Journal of Forensic Sciences*, JFSCA, Vol. 31, No. 2, April 1985, pp. 726-731.

**ABSTRACT:** Proposed methods for softening mummified fingers have been either unsuccessful in adequately softening the fingers or have been highly destructive. A simple technique based on an entirely new concept utilizing disodium ethylenediamine tetracetic acid in a detergent solution adjusted to a pH of 7.5 has been successfully used to obtain satisfactory to good fingerprints over the past ten years in every case attempted.

**KEYWORDS:** pathology and biology, fingerprints, mummification

Even though many individuals, particularly women and children, do not have fingerprints on file, fingerprinting still ranks first as the most widely used method in making definitive identifications. This is primarily due to the fact that it is the only procedure that is backed up by a large centralized file of prints to draw from thereby permitting identifications in many cases where there is no suspect. Fingerprint identifications can also be made in instances where a person has never been fingerprinted but there is a suspect, by using latent prints obtained from objects found in the suspect's home.

Odontological identification ranks second and is only successful in situations where you have a definite suspect, since there is currently no centralized file of dental charts and X-rays. The same holds true for all other methods used in identification including X-rays, physical description, anthropological studies, items of clothing, jewelry, operative scars, tattoos, skeletal abnormalities, and so forth. All of these require a suspect; the more facts gathered, the greater the probability of identification. Fingerprinting procedures require that the fingers be in reasonably fair condition to obtain a good set of prints. Unfortunately, that is not always the case. Decomposed bodies, fire victims, and mummified bodies present the most difficulty to the forensic science specialist entrusted with the task of identification. The use of "skin slip" from the fingers of water immersed or "most" decomposed bodies has resulted in excellent prints in many cases. Destruction of the ridge patterns by conflagrations and advanced decomposition, however, presents an impossible situation and, in these cases, other modalities must be relied on for a positive identification.

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Current methods to soften mummified fingers leave much to be desired. They have been either unsuccessful in adequately softening the fingers or have been highly destructive. These methods include soaking in cool or warm glycerin or glycerin mixtures, injecting glycerin and other softening agents into the subcutaneous region of the pads, heating in physiological saline, soaking in mixtures of various oils, and soaking in sodium or potassium hydroxide alone or in formalin. A more recent method [1] using a taxidermy tanning solution consisting of 0.1 L (2 oz.) of saturated salt solution and two drops of 50% sulfuric acid afforded inconsistent results.

Our interest in obtaining fingerprints from mummified fingers resulted from the investigation of a brutal homicide of a young nude female that was discovered by two hikers in a wooded area off a mountain trail. At that time, the body was deeply pigmented and very dry, and the fingers and toes were shriveled, badly mummified, and extremely hard. The deceased was lying in a supine position with legs outstretched and hands above the head in a flexed position. The eyes and lips were dried out and the back was moist and decomposed. When an autopsy was performed the next morning, the pigmentation had become much darker and decomposition of the back appeared more extensive. The orbits were ecchymotic, bilaterally, the right ear and the surrounding area was markedly swollen, a lump was noted on the bridge of the nose, and contusions and scratch abrasions were noted on the anterior aspect of the neck. The cause of death was determined to be manual strangulation.

Attempts at identification of the body was fraught with difficulty. Initial attempts to soften the fingers using the glycerin methods, warm saline, oil mixtures, and museum techniques to obtain fingerprints were completely unsuccessful. The FBI referred us to a method using potassium hydroxide in formalin that we decided to try first on the mummified skin of the proximal joint of the finger. This method was abandoned because it proved to be too destructive. Other methods of identification including dental charting, dental X-rays, full body X-rays, anthropological studies, hair studies, immunological testing, artist drawings, facial cosmetology, and descriptive profiling were all performed. This information was teletyped to various law enforcement and missing person agencies to no avail.

Since necessity is the mother of invention, we decided to try a scientific approach using a chelation method in an attempt to substitute calcium bridges with sodium. This was tried with disodium and tetrasodium ethylenediamine tetraacetate at different pHs using some mummified palm skin. This proved to be effective without pH adjustment over three to four days, but the time was reduced to one to two days when used in a detergent solution with the pH adjusted to 7.5 with 0.01N hydrochloric acid. The following technique was found to afford satisfactory to excellent fingerprints and was highly reproducible in every case attempted. (A badly mummified hand [Fig. 1] is used to demonstrate the entire procedure.)

## Method

### *Solutions*

1. 1% acetic acid,
2. a saturated solution of Coleo detergent (Colgate Co.), 200 mL, and
3. softening solution:

Add 10 g of disodium or tetrasodium ethylenediamine tetraacetate to the saturated solution of Coleo. Adjust to pH 7.5 with 0.01N hydrochloric acid.

### *Procedure*

Label ten vials from 1 to 10 (Fig. 2). This corresponds to the ten fingers beginning with the right thumb (1) and continuing consecutively to the right little finger (5) then to the left thumb (6) and consecutively again to the left little finger (10). Add 1% acetic acid to each



FIG. 1—A badly mummified hand.



FIG. 2—Ten vials labelled from 1 to 10.

container. Disarticulate the distal joint of each finger by careful dissection (Fig. 3) and place each distal phalanx into the respective container containing the acetic acid for about 1 h. Next, wash in running water for about 5 min then add the Coleo solution to each container and allow to soak for about 1 h. Pour off the Coleo solution and add the softening solution to each container until the pads are supple and soft enough to dissect (about 6 to 20 h depending on the degree of hardness).

Remove the finger pads from each distal phalanx as follows: using a sharp scalpel, make an incision along the sides and top of the fingers staying as close to the nail as possible (Fig. 3). The dissection is then continued using a pair of sharp-sharp scissors (preferably curved) and the skin pads completely separated from the underlying bone. Place the skin pads in the softening solution for 12 to 24 h. Using a rubber glove, place a skin pad on filter paper or paper toweling, ridge side down, while pressing firmly and rubbing the back of the pad (Fig. 4). Gently trim any excess tissue from the back of the skin using the curved scissors. Place the pads in the softening solution for 4 to 24 h as necessary depending on the degree of mummification. Again place the pads on filter paper or paper towels, ridge side down, while

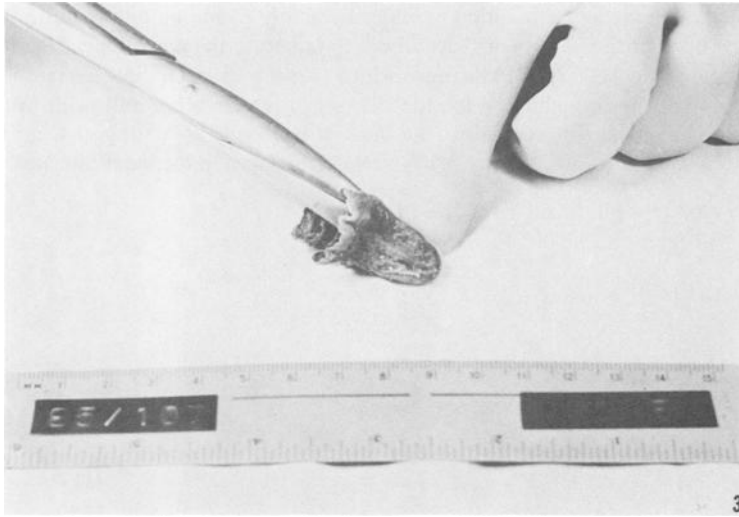


FIG. 3—The distal joint of each finger is disarticulated by careful dissection.

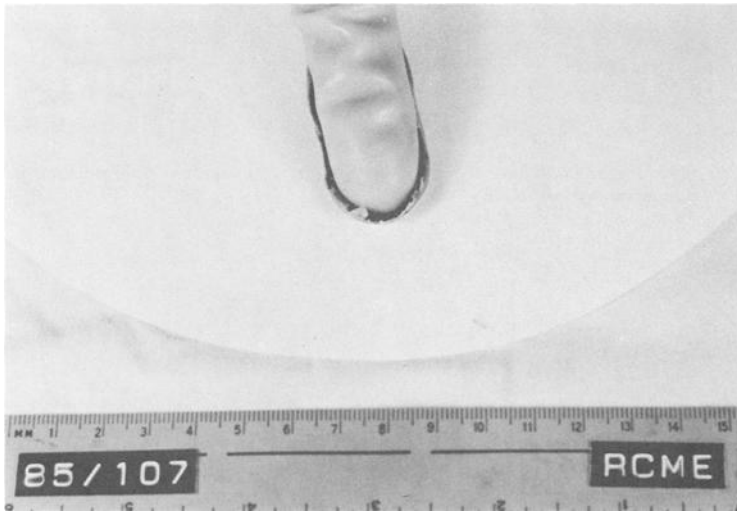
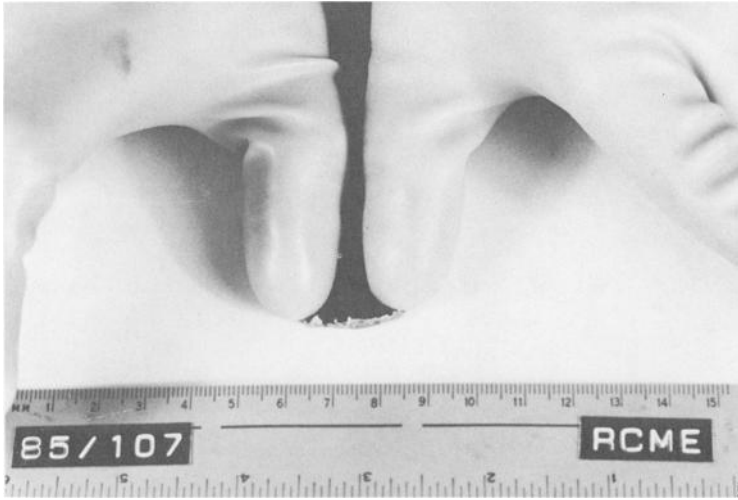


FIG. 4—With a rubber glove, a skin pad is placed on filter paper or paper toweling, ridge side down, while pressing firmly and rubbing the back of the pad.

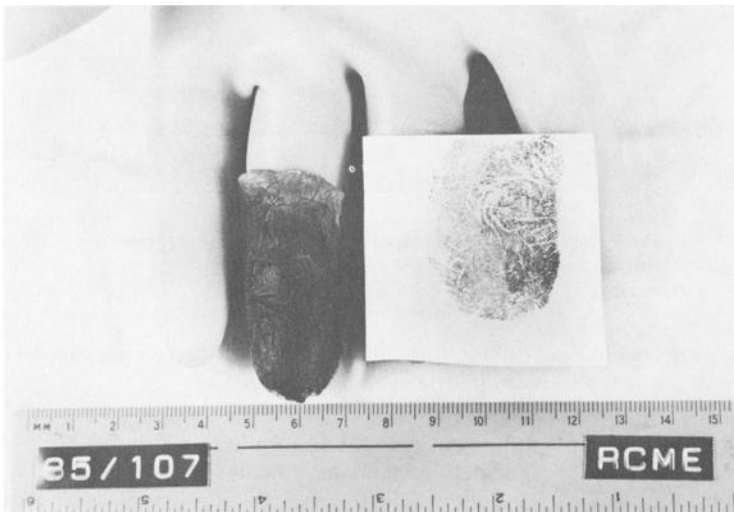
rubbing and pressing out the wrinkles. Carefully release any bound tissues that prevent flattening using the curved scissors as indicated above.

Remove any remaining wrinkles as follows: grasp the left edge of the skin pad with the left thumb and index finger so that the thumb is to the back of the pad and the side of the left index finger is flexed in front. The right edge is concomitantly grasped in the same manner using the right hand. Align both thumbs so that they are parallel to each other, then stretch the skin gently by using a rolling action of the thumbs toward the center of the pad. While holding the pad taut, press the pad firmly against the filter paper or paper toweling for about

1 min (Fig. 5). Release any remaining wrinkles by gently trimming any binding strands of tissue on the back of the pads being careful not to puncture the pad. Repeat the stretching procedure again, if necessary. Dry the pads with paper towels, then dip each pad in acetone and dry again with the toweling. Wipe the ridges gently with ether and print in the usual manner using the index finger against the back of each pad as a support (Fig. 6). After fingerprinting each pad, place them in 1% acetic acid solution for indefinite storage.



**FIG. 5—** While holding the pad taut, the pad is pressed firmly against the filter paper or paper towel for about 1 min to remove wrinkles.



**FIG. 6—** The ridges are gently wiped with ether and printed in the usual manner using the index finger against the back of each pad as a support.

## Results

All of the finger pads were rendered soft and firm resulting in satisfactory to good fingerprints. The prints were then submitted to the FBI where a positive identification was made. This method proved successful in making satisfactory to good fingerprints in every case attempted over a ten-year period.

In one case involving the identification of a body with badly mummified fingers, a fingerprint division of a local law enforcement agency insisted on making prints using a modified potassium hydroxide method familiar to them. Against our better judgement, we let them have the fingers of only one hand and we concomitantly processed the other hand using our method. The fingers processed by the law enforcement agency were totally destroyed in the solution and the identification was made using our fingerprints.

In another case, we were able to test the effectiveness of this method on mummified fingers of relatively long duration, a hand that was severely mummified for over five years (Fig. 6). Although we already knew the identity of the deceased who had fingerprints on file, we submitted the prints we obtained to the FBI for identification in the usual manner. The identity was confirmed within 48 h.

## Conclusion

A simple chelation technique based on an entirely new concept using disodium ethylenediamine tetracetic acid in a detergent solution adjusted to a pH of 7.5 has been successfully used to obtain satisfactory to good fingerprints from mummified fingers.

## Reference

- [1] Richardson, L. and Kade, H., "Readable Fingerprints From Mummified or Putrified Specimens," *Journal of Forensic Sciences*, Vol. 17, No. 2, April 1972, pp. 325-328.

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