J Forensic Sci, Jul. 1979, Vol. 24, No. 3

TECHNICAL NOTE

B. G. Stephens,[1] *M.D.*

A Simple Method for Preparing Human Skeletal Material for Forensic Examination

The examination of partially or totally decomposed bodies that may have skeletal changes or injuries of potential evidentiary value is a common problem faced by forensic scientists. In many such cases, thorough cleaning of the bone may be required for the examination, understanding, interpretation, and documentation of the injuries as well as for obtaining quality photographic evidence for presentation to a jury. Unfortunately, thorough cleaning of the bone is often not performed because of the time-consuming nature of the preparatory work, the cost, and the necessity of maintaining insect colonies.

For the past few years, a method for cleaning skeletal material which is relatively simple and which requires only a small expenditure of time has been in use at the San Francisco Medical Examiner-Coroner's Office. Although cleaning by this method does not produce specimens typically as complete, white, or dry as those prepared by Dermestidae beetles or by boiling, they are more than adequate for photography, examination, forensic documentation, and court presentations. The method to be described is not as rapid as the antiformin method described by Snyder [*1*], but it requires no mixing of chemicals, involves no significant handling dangers, bleaches during the cleaning process, causes little or no damage to the bone, yields excellent detail, and uses inexpensive, readily available chemicals. This method produces the best results on decomposed material, requiring only defatting and drying for completion of the preparation.

Materials and Methods

Chemicals

Sodium hypochlorite, commercially available as household bleach (4.5 to 6%), is used for both cleaning and bleaching. Technical or purer grade acetone is used for defatting. Sodium hydroxide, 5 to 10 g/litre of diluted bleach solution, is also required.

Obtaining the Specimen

Bone, typically from decomposing portions of the body and frequently the skull, may be removed after complete autopsy and careful inspection. Decapitation may already have been accomplished by the decomposition process. If this is not the case, the cervical spine should be separated through the intervertebral disk at any space below C2 or C3. This procedure avoids damage to the area of the foramen magnum. When long bones or

Presented at the 30th Annual Meeting of the American Academy of Forensic Sciences, St. Louis, Mo., February 1978. Received for publication 3 Aug. 1978; accepted for publication 30 Nov. 1978.

[1] Chief medical examiner-coroner, Office of the Medical Examiner-Coroner, San Francisco, Calif.

larger portions of the spine are involved, the area may be carefully sectioned for convenience in handling. However, this must be done with great care and only as appropriate to avoid questions of mutilation artifact. Careful inspection to avoid resection in an injured area is mandatory.

Preliminary Preparation of the Specimen

The bone is carefully denuded of as much hair and flesh as is possible; care must be taken to avoid cutting into or scraping the bone. If the periosteum does not strip easily with tension, or in areas adjacent to injuries or fractures, only superficial tissues should be removed.

Cleaning of the Specimen

The bone is then immersed in a solution of sodium hypochlorite diluted with tap water. The exact ratio is not critical but the dilution should initially be tenfold or greater. The initial solution is at 50 to 70°C, but it is not necessary to maintain a specific temperature during the process.

The bone is soaked in this solution for 3 to 4 h. It is then removed from the solution and rinsed with water. Any additional tissue that can be stripped away is cleaned from the bone. Cleaning under a stream of water aids in the dissection process. The periosteum is lifted by gentle rubbing where possible; the elevated edge is used to pull the tissue away. Only areas totally resistant to such attempts should be scraped with an instrument. As soon as resistance is encountered, the resected tissue is trimmed away. After the removal of tissue, the bone is placed in freshly prepared sodium hypochlorite solution. If the tissue has been difficult to remove, the concentration of the bleach solution should be increased. If relatively large portions of the bone are being affected, the concentration of bleach should be decreased.

The above process is continued until all tissue has been removed and the bone is free of periosteum; this usually requires two to three days. At this point the bone will have a brown or reddish-brown color. It is then washed and placed in acetone overnight. The bone is then placed in a fume-hood to dry. The bone will take on a white color in direct relation to the degree of bleaching. Any remaining odor may be reduced further by additional defatting.

The inclusion of various combinations of proteolytic enzymes and mucolytic agents has not altered the time requirements or the outcome of the procedure. The degree of decomposition usually determines the rate of tissue removal and bone whitening.

Discussion

We have used this method for the preparation of more than 20 skulls as well as for several other portions of the skeleton. By regulating the area exposed, we maintained in one skull the depressed fracture of the external table that held trapped hair caught in the fracture. We have also maintained small fragments of bone in a compound fracture as well as delicate bones and anatomic reference points.

Another method of cleaning skeletal material, in use at the University of New Mexico School of Medicine,[2] involves maceration of defleshed skeletal material in clear water for a period of two days to two weeks in an uncovered container with the water being replaced every other day. The bone is then immersed in a solution of Biz® (about 120 to 240 ml/litre of water [½ to 1 cup per gallon]) at 82 to 93°C (180 to 200°F). The solution

[2] S. Rhine and A. M. Jones, personal communication, 1978.

is decanted and immediately replaced at least once during the procedure. The procedure is complete within two days, at which time the specimen may be allowed to dry slowly at room temperature. The specimen at this point is clean, degreased, and bleached. The Biz method cannot be used as a one-step process since some destruction of the bone appears to occur with prolonged soaking.

With the Biz method, decalcification and white powder formation, which may result from the use of high concentrations of sodium hypochlorite, are avoided. However, with the method reported here, which uses a bleach concentration of less than 10%, this has not been a significant problem even with skulls kept for three or four years. Although most skeletal material was photographed and then returned for burial, one skull prepared by the sodium hypochlorite method was recently used for facial reconstruction almost three years after death.

Summary

A method using dilute sodium hypochlorite for the cleaning of human skeletal material from decomposed bodies is described. With this simple procedure, which requires minimal expenditure of time and money, bones may be cleaned in a manner that produces specimens satisfactory for forensic examination, documentation of injuries, and jury presentation.

Reference

[1] Snyder, R. G., Burdi, A. R., and Gaul, G., "A Rapid Technique for Preparation of Human Fetal and Adult Skeletal Material," *Journal of Forensic Sciences*, Vol. 20, No. 3, July 1975, pp. 576-580.

Address requests for reprints or additional information to
Boyd G. Stephens, M.D.
Office of the Medical Examiner-Coroner
850 Bryant St.
San Francisco, Calif. 94103