A40 Does Aluminum Transfer to Bone When Used as a Packaging Medium? A Test Using X-Ray Fluorescence Spectrometry

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After attending this presentation, attendees will be familiar with the use of aluminum foil as a packaging medium for fragile skeletal material and understand whether this form of packaging affects the elemental properties of bone.

This presentation will impact the forensic science community by determining whether the use of foil to package skeletal material results in the transfer of aluminum to bone and by questioning whether foil should continue to be recommended as a packaging medium when subsequent elemental analyses may be performed on bones.

Skeletal evidence recovered in the field is typically placed into a packaging medium to preserve and transport the material to the morgue, laboratory, evidence storage, or other destination. Preferred packing methods involve considerations for preventing loss, cross-contamination, or deleterious change. Materials such as paper products (including paper bags, envelopes, and cardboard boxes) are often recommended for packaging skeletal material to offer protection and also to prevent mold growth, tissue breakdown, or other changes associated with confining the material with moisture.

Skeletal material that is burned or highly weathered is often considerably more fragile and at high risk for fragmentation during packaging and transportation. One method that has been suggested to stabilize and protect fragile skeletal material is to carefully wrap it in aluminum foil. This approach offers protection against further fragmentation and also maintains the relative anatomical positioning of bones and teeth at the time of recovery in the event that fragmentation does occur in transit. However, traces of aluminum are known to leach from foil and other aluminum packaging materials into food products and it is currently unknown whether transfer/leaching of aluminum or other elements to the bone may also occur. Chemical and elemental analyses are becoming more common in forensic anthropological examinations and transfer of aluminum or other elements to bones from packaging materials, if it occurs, could result in skewed elemental test results. This study used X-Ray Fluorescence (XRF) spectrometry to test whether the use of aluminum foil to package bones results in the transfer of aluminum from the foil to the bone.

Twenty-six deer bones were used in this study. Each bone was burned on one end using a hand-held butane torch, leaving the other end unaltered. Prior to placing the bones into aluminum packaging, each end of each bone was sampled twice using a hand-held XRF device to determine the baseline elemental profiles. A standard 120-second collection time was used and the data were saved as total photon counts in spread sheets. One specimen (used as a control) was packaged in brown paper with no foil and maintained at room temperature. The remaining 25 specimens, in sample groups of five, were then packaged in five different ways. Five specimens were packaged in new, flat foil and stored at room temperature. Since crumpling foil disrupts bonds and may increase the likelihood of aluminum transfer, five specimens were placed into foil that had been crumpled prior to use, and then stored at room temperature. Since elevated temperatures may also increase the likelihood of aluminum transfer, five specimens in flat foil and five specimens in crumpled foil were stored in the trunk of a car where temperatures reached up to 110°F. Finally, one group of bones was placed in foil, then exposed to excessive heat using a torch. Specimens were maintained in their packaging and stored for a period of six weeks.

After six weeks, each end of each bone was again tested using XRF. Paired t-tests of each of the five sample groups before and after six weeks in the aluminum packaging were used to determine whether the mean aluminum levels of the bone surface changed as a result of prolonged contact with aluminum foil. None of the differences in mean aluminum levels for any of the sample groups were significant ($p>0.05$ for all groups). These results indicate that, even when physically compromised aluminum foil is used, and even when foil-packaged specimens are exposed to very high temperatures, significant aluminum transfer to the bone does not occur. Aluminum foil can therefore continue to be recommended and used as a packaging medium for bones without the risk of affecting subsequent elemental analyses.

Forensic Anthropology, Evidence Packaging, Elemental Analysis