

## **Determination of Medicolegal Significance from Suspected Osseous and Dental Remains**

### **1.0 Principle, Spirit and Intent**

The laboratory should carry out its testing activities based on sound techniques and report its findings in such a way as to meet professional standards. The integrity of the laboratory's procedures, policies, laboratory testing, and reporting should remain above reproach at all times.

### **2.0 Purpose and Scope**

This document presents methods utilized in the determination of medicolegal significance from suspected osseous and dental remains. Practitioners of forensic anthropology should implement these guidelines to the fullest extent as applicable, practical and appropriate. In the absence of specific guidelines or in the case of conflicting procedures, the principle, spirit and intent should be met.

### **3.0 General Principles**

Accurate and timely determinations of medicolegal significance are essential in forensic investigations as they provide direction to law enforcement personnel and other medicolegal investigators. The following guidelines are organized into three areas: 1) recognition of osseous/dental remains from other types of material; 2) identification of human versus non-human remains; and 3) determination of medicolegal significance. The type of analysis required for making these determinations may vary depending on the condition of the specimens.

### **4.0 Best Practices**

#### **4.1 Approaches for the Recognition of Osseous/Dental Remains**

Segregation of osseous and dental remains from other types of material (e.g., rock, wood, and shell) is an acceptable practice in forensic anthropology. Several acceptable techniques are available for this type of analysis. Selection of techniques to be employed is primarily dependent on the size and overall condition of the specimen.

Acceptable classifications for the segregation of osseous and dental remains are as follows:

*Consistent with Osseous/Dental Remains:* The remains exhibit features that are consistent with bones or teeth.

*Inconsistent with Osseous/Dental Remains:* The materials do not exhibit features associated with bones or teeth, and they can be confidently removed from further consideration.

*Inconclusive:* The materials lack sufficient morphological and/or elemental features to make a definitive determination. In these instances, the default assumption should be that the material is osseous/dental and appropriate procedures should be followed until proven otherwise.

#### 4.1.1 Gross Techniques

Gross (i.e., visual) examination is an acceptable technique for identifying osseous and dental remains when the specimens are large, complete, or have diagnostic features. Grossly observable characteristics may include features such as the presence of trabecular bone, evidence of a vascular component, or the recognition of osteological landmarks.

#### 4.1.2 Microscopic Techniques

Microscopic examination is an acceptable technique for identifying osseous and dental remains, especially when the specimen is small and fragmented. A microscopic analysis of the specimen may be able to reveal features that are consistent with osseous and dental remains (e.g., cortical bone, trabecular bone, or cellular structures), or it may reveal features that are inconsistent with osseous and dental remains.

#### 4.1.3 Elemental Techniques

Elemental techniques, such as scanning electron microscopy/energy dispersive X-ray spectroscopy (SEM/EDS) analysis, are acceptable techniques for identifying osseous and dental remains, especially when the specimen is extremely fragmentary. This type of analysis is based on a comparison of the specimen's elemental composition with known reference samples.

### 4.2 Approaches for Differentiating Human from Non-human Remains

Assessment of osseous and dental material for human/non-human differentiation is an acceptable practice in forensic anthropology. Although it is possible for non-human remains to be of forensic significance (e.g., cases involving accusations of cruelty to animals, rustling, illegal hunting, or body part importation), in most instances non-human remains are not of medicolegal concern. Furthermore, in most medicolegal scenarios it is seldom of investigative significance to identify the non-human species.

Selection of methods to be employed in the determination of human versus non-human bone and teeth depends upon the materials available for examination and the overall condition of the remains. Analysis generally requires only gross examination, but the use of more technically complex approaches may also be warranted.

Acceptable classifications of human/non-human analysis are as follows:

*Diagnostic of Human:* The remains match known human reference specimens to the exclusion of other reasonable possibilities.

*Diagnostic of Non-Human:* The remains demonstrably match known non-human reference specimens to the exclusion of other reasonable possibilities.

*Inconclusive:* The remains lack sufficient morphological features to make a definitive determination. When the determination of human or non-human is unclear, the default assumption should be that the remains are human and appropriate procedures should be followed until proven otherwise.

#### 4.2.1 Gross Techniques

Gross (i.e., visual) analysis of specimens is an acceptable technique for differentiating between human and non-human remains. For complete or relatively intact bones, gross morphological differences are generally distinct enough to allow for human bones and teeth to be confidently segregated from non-human remains. Many of the bony landmarks and articular surfaces are functionally and morphologically different and unique to family or species. Similarly, human and non-human teeth are highly diagnostic to each species. Special consideration needs to be provided with subadult skeletal remains since they typically lack many of the landmarks and characteristics observed in adults and with pathologic remains that may be significantly altered by the disease process.

Differentiating human from non-human remains from a photographic review, as opposed to a physical examination of the actual remains, is acceptable. Submitted photographs should be of adequate quality to allow for an accurate assessment.

#### 4.2.2 Histological Techniques

If fragmentation is sufficient to preclude gross identification of human versus non-human remains, microscopic (i.e., histological) techniques can be employed as an acceptable method. The characteristics of the bone microstructure may be consistent or inconsistent with human bone, but caution is needed as there are exceptions. In human bone the distribution of osteons generally does not show a regular pattern; however, osteons showing no clear pattern are also found in some non-human animals. The presence of fibrolamellar, or plexiform, bone is usually an indication that the remains are non-human.

#### 4.2.3 Protein Radio Immuno Assay (pRIA)

When gross and histological techniques do not successfully distinguish human from non-human in a sample, pRIA can be employed as an acceptable technique for human/non-human differentiation. This antibody response method can distinguish human from non-human bone fragments, and it may also be able to identify the non-human taxon if necessary.

### 4.3 Approaches for the Determination of Medicolegal Significance of Human Remains

Not all human bones and teeth are of medicolegal significance. For example, human remains may *not* be of medicolegal significance when they are from archaeological contexts, disturbed cemeteries (although desecration may be considered a crime in most jurisdictions), anatomical teaching collections, ceremonial remains, and “trophy skulls.” Gross and radiocarbon analysis are acceptable methods for determining medicolegal significance of human remains. When remains are determined to be “not of medicolegal significance,” final disposition of these remains should follow the laboratory’s standard operating procedure and follow pertinent jurisdictional laws and policies.

Acceptable classifications of medicolegal significance:

*Remains are of Medicolegal Significance:* The remains and associated contextual evidence indicate that they are of forensic interest and should be analyzed in a manner consistent with established medicolegal guidelines.

*Remains are Not of Medicolegal Significance:* The remains and associated contextual evidence demonstrate no medicolegal significance. Their disposition should be handled in accordance with established guidelines.

*Inconclusive:* The remains and associated contextual evidence lack sufficient information to make a definitive determination of medicolegal significance. When the determination of medicolegal significance is unclear, the default assumption should be that the remains do have medicolegal significance and appropriate procedures should be followed until proven otherwise.

#### 4.3.1 Gross Techniques

Taphonomic or contextual indicators are commonly used to assess the medicolegal significance of human remains. For example, cemetery remains may retain clear markers of their decomposition history (e.g., distinct cranial warping and staining from lying on a flat, rigid surface; remnants from embalming; and associated burial hardware such as coffin portions). In many instances, scene context, archaeological provenience (the three-dimensional location of an item in relation to other items), and site formation processes may assist in the establishment of medicolegal context or significance.

#### 4.3.2 Radiocarbon Analysis

Radiocarbon analysis, with special attention to the modern bomb curve that resulted from thermonuclear testing between 1950 and 1963, may provide useful dating information that can help establish medicolegal significance. Interpretation should consider the age at death of the individual and the type of tissues sampled.

## 5.0 Unacceptable Practices

The following practices are considered unacceptable and should be avoided when determining the medicolegal significance of suspected osseous and dental remains:

- Utilizing specialized techniques such as SEM/EDS, pRIA, radiocarbon, or histological analysis without proper equipment or requisite training;
- Making gross morphological determinations of human versus non-human without proper training in human osteology, human variation, and a familiarity with non-human skeletal remains (e.g., training, a comparative collection of relevant taxa, and/or necessary reference material);
- Making a human/non-human differentiation from inadequate photographs.