

OSAC PROPOSED STANDARD 2021-N-0010 Standard for Skeletal Preparation and Sampling in Forensic Anthropology

Forensic Anthropology Subcommittee
Medicine Scientific Area Committee (SAC)
Organization of Scientific Area Committees (OSAC) for Forensic Science



OSAC Proposed Standard

OSAC 2021-N-0010

Standard for Skeletal Preparation and Sampling in Forensic Anthropology

Prepared by
Forensic Anthropology Subcommittee
Version: 2.1
December 2023

Disclaimer:

This OSAC Proposed Standard was developed by the Organization of Scientific Area Committees (OSAC) for Forensic Science. It is a completed work product of the OSAC and has been approved for listing on the OSAC Registry. This OSAC Proposed Standard will be submitted to a standard developing organization and is subject to change.

This OSAC Proposed Standard has completed an open comment period and a rigorous technical and quality review by the originating OSAC unit (e.g., subcommittee), their parent body (e.g., scientific area committee), and the OSAC Standards Review Panel.

OSAC encourages the forensic science community to implement this OSAC Proposed Standard in practice, as it represents the best guidance available and is approved by OSAC.

There may be references in this OSAC Proposed Standard to other publications under development by OSAC. This OSAC Proposed. The forensic science community may use the Standard before the completion of such companion publications.

Any identification of commercial equipment, instruments, or materials in the OSAC Proposed Standard is not a recommendation or endorsement by the U.S. Government and does not imply that the equipment, instruments, or materials are necessarily the best available for the purpose.

Visit OSAC's website for more information about the [Registry approval process](#).

Version No.	Issue Date	Section	Reason
2.0	November 7, 2023	--	Added to the OSAC Registry and publicly announced.
2.1	December 21, 2023	All	Format and font updates only. No content changes made.

Forward:

This Proposed Standard will be submitted to a standards developing organization and is subject to change.

This standard is intended to assist forensic anthropology practitioners when sampling and preparing skeletal remains for forensic analyses and curation.

In order to make skeletal material and features more accessible for forensic anthropological analyses, and to procure material that may have additional investigative value, it is sometimes necessary to sample and/or prepare skeletal remains. This standard recognizes the need to document the condition of remains upon arrival at the forensic anthropology laboratory and throughout the process of preparation and sampling. This standard emphasizes the importance of preparing and/or sampling skeletal remains in a manner that limits or prevents their contamination, unnecessary destruction, and/or adverse alteration.

Keywords: *forensic anthropology; skeleton; sampling; maceration*

Table of Contents

1	Scope	5
2	Normative References.....	5
3	Terms and Definitions	5
4	Requirements.....	6
	Annex.....	8

Standard for Skeletal Preparation and Sampling in Forensic Anthropology

1 Scope

This standard sets forth techniques and requirements for sampling and preparing skeletal remains for examination and curation. Its goal is to facilitate sampling and preparation in a manner that limits or prevents contamination, unnecessary destruction, and/or adverse alteration of the remains. The standard addresses the following aspects of evidence collection and handling: the documentation, preparation, and preservation of skeletal material for forensic anthropological analysis and future/downstream analyses (e.g., DNA or isotopic testing).

2 Normative References

There are no normative reference documents. Annex A, Bibliography, contains informative references.

3 Terms and Definitions

For the purposes of this document, the following definitions apply.

3.1

forensic anthropology laboratory

Any facility used in the analysis and/or testing of human skeletal remains of medicolegal significance.

3.2

entomological preparation

The removal of soft tissue from skeletal remains using carrion beetles (typically *Dermestes maculatus*).

3.3

maceration

The removal of soft tissue from skeletal remains through prolonged immersion in a liquid bath.

3.4

mechanical preparation

The removal of soft tissue and other materials from skeletal remains using tools.

3.5

skeletal preparation (processing)

The removal of soft tissue and/or other materials from skeletal remains through mechanical, maceration, and/or entomological methods.

This Proposed Standard will be submitted to a standards developing organization and is subject to change.

3.6

skeletal reconstruction

The reassociation of bone and tooth fragments that originated from the same skeletal portion.

4 Requirements

4.1 General

In order to make skeletal remains and features more accessible for forensic anthropological analyses, and in order to procure material that may have additional investigative value, it is sometimes necessary to sample and/or prepare skeletal remains or other tissues associated with skeletal remains. The condition of the remains upon arrival at the forensic anthropology laboratory and throughout the process of preparation and sampling shall be documented. Any alterations caused by the process of sampling and preparation shall also be documented.

4.2 Procedure

4.2.1 General Requirements

4.2.1.1 All human remains shall be handled with appropriate personal protective equipment to ensure safety of the practitioner and limit contamination of the evidence.

4.2.1.2 Photographs shall be taken prior to any sampling or preparation of remains.

4.2.1.3 . All artifacts caused by sampling or preparation of remains shall be documented.

4.2.1.4 Any alterations made during the preparation process shall be documented.

4.2.1.5 Tools used in preparation and sampling should be documented.

4.2.1.6 All applicable data collection procedures (e.g., visual examination, metric analyses), as well as photographic documentation shall be completed before a skeletal element undergoes sampling.

4.2.2 Sampling

4.2.2.1 Sampling skeletal remains may be required for other analyses such as DNA, histological examination, isotope, scanning electron microscopy (SEM), energy dispersive spectroscopy (EDS), etc. The type of sample will depend on the type of testing anticipated and the SOPs for the forensic anthropology laboratory and/or testing facility's requirements.

4.2.2.2 Sampling shall be conducted with the permission of the relevant jurisdictional authority and with a specific investigative objective (e.g., DNA testing, isotopes, histology).

4.2.2.3 When sampling, techniques and equipment shall be employed that reduce and control contamination, (e.g., the use of blades or saws that are new and/or have been treated with bleach and/or UV light).

4.2.2.4 Samples shall be treated as evidence (e.g., handled and packaged to prevent loss, tampering, contamination, and/or deleterious change; packaging that is labeled to include a unique case identifier and a brief description of contents; documentation of the sample's collection/separation from parent evidence, transfer, analysis, and disposition in a chain of custody).

4.2.2.5 When appropriate, sampling of skeletal remains shall be taken from regions of bone not typically used in establishing a biological profile, supporting a personal identification, or are otherwise analytically relevant (e.g., age indicators, restored teeth, areas of trauma, measurements).

4.2.3 Skeletal Preparation

4.2.3.1 When possible, medical imaging (e.g., radiographs, CT imaging) shall be taken of remains prior to skeletal preparation to detect or visualize objects such as foreign material as well as features related to development, variation, trauma, surgical intervention and/or pathological conditions.

4.2.3.2 Physical measures (e.g., drain strainers, trays/containers) shall be in place to prevent the loss of small bones, teeth, or other evidentiary items.

4.2.3.3 When washing skeletal remains is not sufficient, there are three general approaches for effective skeletal preparation: mechanical, maceration, and/or entomological.

4.2.3.3.1 Mechanical preparation, if required, shall minimize the risk of alteration to the skeleton. Instruments such as scalpels or scissors should be utilized in a manner that mitigates damage. For example, scalpel damage can be avoided by holding the blade parallel to the surface rather than at a steep angle.

4.2.3.3.2 Sampling shall be performed prior to maceration. Maceration is typically through immersion in a water bath. Immersion times and temperatures shall be monitored throughout the maceration process to maintain the integrity of the skeletal remains. Chemical detergents and additives may be used to facilitate the breakdown of adhering soft tissues, degreasing, and protein degradation.

4.2.3.3.3 Entomological preparation of skeletal material may be performed using dermestid beetles. See, for example, Sanger Ciarlegio, et al. (2020) for details on establishing and maintaining a colony. Exposure time to the dermestid colony shall be monitored to achieve denuded skeletal material and to prevent damage and the loss of skeletal remains.

4.2.3.4 Decisions regarding preparation method(s) shall include considerations of the condition of the remains, the types of analyses anticipated, and whether long-term curation is needed.

4.2.3.5 Disposition of soft tissue shall follow appropriate jurisdictional regulations (e.g., biohazard waste, medical cremation).

4.3 Considerations

Skeletal elements may be labeled. Remains retained for extended periods of time should be labeled. Labels shall be removable. For example, if labeling individual skeletal elements using permanent ink, a removable acrylic base coat should be used.

The practitioner shall maintain close coordination and collaboration with the medicolegal authority, particularly for the following:

- Unexpected evidence (e.g., tattoos, finger or palm prints, projectile, trauma);
- Destructive testing of the entirety of the remains

In the event that remains require reconstruction or stabilization, the process and materials used shall be documented. The methods or materials shall be reversible.

The following practices are deleterious to the conservation of skeletal evidence and shall be avoided:

- Unnecessary use of chemicals that damage or destroy skeletal remains (e.g., prolonged exposure to bleach or hydrogen peroxide);
- Excessive maceration and/or heat (e.g., prolonged exposure to heat, boiling);
- Unnecessary alteration or destruction of skeletal remains;
- Unnecessary reconstruction or stabilization of skeletal remains (e.g., plastic-based, synthetic stabilizers)

Annex

(informative)

Bibliography

- 1] Arismendi JL, Baker LE, Matteson KJ. 2004. Effects of processing techniques on the forensic DNA analysis of human skeletal remains. *Journal of Forensic Sciences*, vol. 49, no. 5, pp 930-934.

- 2] Hangay G, Dingley M. 1985. *Biological Museum Methods*. Academic Press, Cambridge, MA.
- 3] Lee EJ, Luedtke JG, Allison JL, Arber CE, Merriwether DA, Steadman DW. 2010. The effects of different maceration techniques on nuclear DNA amplification using human bone. *Journal of Forensic Sciences*, vol. 55, no. 4, pp. 1032-8.
- 4] Rennick SL, Fenton TW, Foran DR. 2005. The Effects of Skeletal Preparation Techniques on DNA from Human and Non-Human Bone. *Journal of Forensic Sciences*, vol. 50, no. 5, pp. 1-5.
- 5] Sanger Ciarleglio. JE, Perez KM, Motola HL, DiGangi EA. 2020. Recommendations for maintaining a dermestid beetle colony (*Dermestes maculatus*) for processing human remains. *Journal of Forensic Sciences*, vol. 65, no. 5, pp 1698-1703.
- 6] Steadman DW, DiAntonio LL, Wilson JJ, Sheridan KE, Tammariello SP. 2006. The effects of chemical and heat maceration techniques on the recovery of nuclear and mitochondrial DNA from bone. *Journal of Forensic Sciences*, vol. 51, no. 1, pp. 11-17.