

# *American Board of Forensic Odontology (ABFO)*

## *Body Identification Information & Guidelines*

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### **ABFO BODY IDENTIFICATION INFORMATION**

#### **The importance of timely identification**

In the United States, the Medical Examiner or Coroner (ME/C) has the statutory responsibility and judicial authority to identify the deceased. The identification of unidentified living individuals is the responsibility of local, state or federal law enforcement agencies. Although it is ultimately these agencies that certify the identification it is the responsibility of the forensic odontologist to provide their opinion on the identity as it relates to forensic odontology. Those opinions are based on a standardized set of guidelines established by the forensic odontology community and are based on scientific best practices.

The positive identification of an individual is of critical importance for multiple reasons that include:

#### **For unidentified living individuals:**

- A positive identification is vital to reunite an unidentified living individual with their family members.

#### **For the human remains:**

- A positive identification is vital to help family members progress through the grieving process, providing some sense of relief in knowing that their loved one has been found.
- A positive identification and subsequent death certificate is necessary in order to settle business and personal affairs. Disbursement of life insurance proceeds, estate transfer, settlement of probate, and execution of wills, remarriage of spouse and child custody issues can be delayed for years by legal proceedings if a positive identification cannot be rendered.
- Criminal investigation and potential prosecution in a homicide case may not proceed without a positive identification of the victim.

### **Scientific Identification**

All methods of identification involve comparing antemortem data to postmortem evidence. Although a presumed identification is often established by contextual evidence, ideally, antemortem biometric data of the individual should be obtained and compared to the postmortem evidence to establish a scientific identification. Currently there are five general methods used to identify deceased human remains of which most require a presumptive identification in order to allow for the direct comparison of antemortem and postmortem biometric evidence. The five methods of identification are visual, fingerprint, DNA analysis, anthropologic/radiology and dental comparison.

## **Visual**

A non-scientific method, but is often used when there is little doubt who the individual is, when the remains are not decomposed, and/or the death was witnessed. However changes in appearance from illness, the circumstances of death, (fire, trauma, disintegration, etc.) and postmortem taphonomic effects, (decomposition, mummification, saponification, skeletonization, animal predation/scavenging, insect activity, etc.), may render it unreliable. Tattoos, scars, piercings, subdermal body modification, and soft tissue abnormalities are useful for visual identification, especially if the tissue is intact. It is important to note, that although personal effects were exchanged between individuals. However, they may offer important clues for a presumptive identification and assist in obtaining antemortem data on the individual to allow for a scientific are often found with the remains or at the scene (identification cards, jewelry, cell phones, etc.), they should never be used as the sole means of establishing an identification due to the possibility that these items identification.

In the future, the potential to establish a large facial image database based on facial recognition data may be possible; however, currently these databases are extremely limited in size. However, even these limited databases could be utilized to establish a presumptive identification and could assist in obtaining antemortem information in order to establish a more scientific basis of identification.

## **Ridgeology (Fingerprints)**

Ridgeology is an expedient biometric method of human identification, especially if the soft tissue of the fingers are intact, an adequate impression or image of the friction ridges can be obtained, and antemortem fingerprint records are available. Burned, decomposed, skeletonized and fragmented remains may be more difficult, if not impossible to image, however, newer techniques have reduced this problem. This method has the advantage of large known national and international databases and does not required a presumptive identification in order to obtain antemortem information.

## **Anthropology/Radiology**

Anthropology, combined with radiology relies on the unique characteristics of the skeleton to compare with antemortem medical imaging and records. Radiographs of skeletal anatomy, bony anomalies, healed fractures; pathological lesions, medical/surgical hardware and implants, or unusual qualities of the skeleton can be used to confirm identification. However, many individuals do not have antemortem skeletal imaging, or the images may not be available.

## **DNA**

Like other biometric methods of identification, DNA comparison relies on access to antemortem data to make a definitive identification. However, unlike other modalities, familial relationship can be established even when antemortem data is not available. In addition, like ridgeology (fingerprints) large national databases are currently being established that can reduce the need for a presumptive identification especially if the decedent has had contact with the justice system. Direct primary and secondary reference samples from the decedent during life are the best sources for identification and indirect DNA reference samples from biological relatives can prove useful in establishing a relationship. DNA testing requires more time, effort, specialized personnel/equipment, and higher cost than other identification methods. The majority of forensic

DNA tests are performed on nuclear DNA using polymerase chain reaction (PCR) amplification of the sample with short tandem repeat (STR) typing. Simultaneous analysis of mitochondrial DNA (mtDNA) may be necessary in order to improve the identification process. Forensic DNA analyses for human identification has seen a tremendous implementation since the President's DNA Initiative Program began in 2003. This program has facilitated funding, training, and assistance to ensure forensic DNA reaches its full potential to identify missing persons. From this program, the National Institute of Justice now provides funding to have DNA analysis done on unidentified remains and family reference samples, at no cost, by the Center for Human Identification at the University of North Texas, or by the FBI. Once the analysis is complete, the profiles (if they qualify) are entered into the FBI's CODIS system (Combined DNA Index System) and uploaded into the National DNA Index System.

### **Dental Identification**

Dental identification of a deceased person is a primary function of forensic odontology. The comparison of a missing person's antemortem dental records/evidence (i.e., written records, study casts, photographs/digital images and radiographs) with the postmortem dental evidence from unknown human remains has long been recognized as one of the most reliable means of positive scientific identification.

Though an individual's dental characteristics will often change during life (dental disease, restorations, extractions, etc.), changes after death are very slow. In fact, the dental condition at death has been shown to last in some cases for centuries.

When there is an alteration in an individual's dental condition that change is in one direction. This was described by Lorton and Langley: "The direction of change of status of a tooth is fixed; that is a tooth cannot have a filling on a surface and then proceed to a state in which there is no filling on that surface. It can only go from having no filling on a surface to a state in which there is one".

Likewise, once a tooth is extracted or otherwise missing, it cannot subsequently be present. This unidirectional change is significant during the verification process and must be considered during any comparison/search process

Forensic odontologists are responsible for identifying unknown human individuals by comparative dental analysis. This process requires comprehensive collection and processing of dental data in order to prove or disprove a human identification.

The forensic odontologist will evaluate and compare the two dental records, the postmortem and the antemortem material. It is their task to determine if the two records were made or could have been made from the same individual. Though most will employ similar techniques and routines, there can be some variation in the way that this comparison is executed. In the end however, for there to be a positive match all inconsistencies within the written records must be explained and distinguishing features must be demonstrable in the hard material evidence, i.e. radiographs, dental models, photographs, etc.

# Body Identification Guidelines

## OUTLINE

### **I. Collection and Preservation of Postmortem Dental Evidence:**

- A. The Remains - Examination Procedures
- B. Photography
- C. Jaw Resection
- D. Techniques for Dissection/Resection
- E. The Postmortem Dental Record
  - 1. Dental Examination
  - 2. Narrative Description and Nomenclature
  - 3. Dental Impressions
  - 4. Dental Radiology

### **II. Sources for Antemortem Data:**

- A. Local Agencies
- B. State Agencies
- C. Federal Agencies
- D. International Resources
- E. Insurance Carriers
- F. Other Sources

### **III. Comparison of Antemortem and Postmortem Evidence:**

- A. Dental features useful in identification

### **IV. Categories and Terminology for Body Identification:**

- A. Positive Identification
- B. Possible Identification
- C. Insufficient Evidence
- D. Exclusion

Some diplomates may follow alternative techniques that may be equally effective. It is not the purpose of these guidelines to invalidate other methods, but rather to describe methods that a majority of investigators employ.

## **I. COLLECTION AND PRESERVATION OF POSTMORTEM DENTAL EVIDENCE**

The postmortem dental examination is conducted by the authority and under the direction of the coroner/medical examiner or his designee, typically a forensic pathologist. Thus, the protocol for the collection of postmortem dental evidence, particularly decisions to incise the facial tissues for access or resect the jaws, is subject to approval by the regional coroner/medical examiner. The actual procedures to be followed in a dental identification case depend in large part on the condition of the remains (as well as other circumstances of the case).

### **A. Examination Procedures**

#### **1. Visually identifiable body**

- Photographs, radiographs, dental charting
- Dental Impressions, as applicable
- Resection by infra-mandibular dissection

#### **2. Decomposed/incinerated body**

- Photographs, radiographs, dental charting
- Resection and preservation of jaw specimens, if indicated

#### **3. Skeletonized remains**

- Photographs, radiographs, dental charting
- Preservation of jaw specimens, if indicated

### **B. Photography**

Photographic documentation of dental evidence can provide objective data which is often more graphic than the written chart. Photographs (with an accompanying scale) should be taken before and after appropriate cleansing. The ABFO #2™ right angle ruler is recommended. The photographs should be clearly labeled with the case number/name and date. All relevant photographic information should be documented.

#### **1. Recommended Equipment**

- Single lens reflex digital or 35 mm. film based camera
- Electronic flash (preferably point flash or ring light system)
- Cheek retractors
- Intra oral front-surface mirrors

#### **2. Film based photography**

- Color film (slide and/or print format)
- Black and white film, as required

#### **3. Photographic Views**

- Full face, lips retracted
- Close-up view of anterior teeth
- Lateral views of teeth in slightly open position, and in occlusion
- Occlusal views, maxillary and mandibular teeth
- Special views, as required

### **C. Jaw Section/Resection**

Facial dissection and/or jaw sectioning/resectioning, which may be necessary for full access to dental structures are done only with approval of the coroner/medical examiner. Ordinarily, the circumstances dictating decisions to resect are applicable as follows:

**1. Viewable Bodies**

Restricted opening due to rigor may require:

Intra oral incision of masticatory muscles, with or without fracture of the condyles

Breaking the rigor with bilateral leverage on the jaws in the retromolar regions

Waiting until the rigor subsides

Infra-mandibular dissection with or without mandibular resection

Removal of the larynx and tongue at autopsy may facilitate the visual examination of the teeth and/or placement of intra oral films. Again, the removal of these tissues should only be performed after the autopsy and with permission of the pathologist.

These tissues should either be retained by the pathologist or replaced with the body.

**2. Decomposed, Incinerated, or Fragmented Bodies**

Jaw resection in such cases facilitates dental charting and radiographic examination.

Careful dissection of the incinerated head, in particular, is required to preserve fragile tooth structure and jaws in situ. Radiographs should be made prior to manipulation of badly burned fragments. Mechanical (or chemical) sterilization of such tissue should be instituted where necessary.

**3. Skeletonized Remains**

Since the skull and mandible are readily separated from the remainder of the skeleton, resection of the maxilla is not required.

**4. Preservation of Evidence**

Jaw resection may be indicated in cases in which:

Body parts are to be transferred, with proper authorization, to other facilities for additional examination and testing.

A homicide victim is to be cremated.

There is other valid justification for preservation of the jaw specimens (state mandated law).

**D. Techniques for Dissection/Resection**

Selected techniques are described below. Other methods may be employed when indicated.

**1. Facial Dissection:**

Bilateral incisions of the face, beginning at the oral commissures and extending posteriorly to the anterior ramus, permit reflection of the soft tissues for better access.

Infra-mandibular Approach: Bilateral incisions are made across the upper anterior neck and extend to points posterior and inferior to the ears. The skin and underlying tissues are then reflected upward over the lower face thereby exposing the mandible.

**2. Jaw Resection:**

**Stryker Autopsy Saw Method:**

The soft tissue and muscle attachments on the lateral aspect of the mandible are dissected away by incisions which extend through the muco-buccal fold to the lower border of the mandible. Lingual attachments are similarly incised to include the internal pterygoid attachments to medial aspect of the rami and the masseter attachments on the lateral aspect. On the maxilla, facial attachments are incised high on the malar processes and superior to the anterior nasal spine. Stryker saw cuts are made high on the rami to avoid possible impacted third molars. Alternatively, the mandible may also be removed

by disarticulation at the temporomandibular joints. Bony cuts on the maxilla are made high on the malar processes and above the anterior nasal spine to avoid the apices of the maxillary teeth. A surgical mallet and chisel inserted in the Stryker saw cuts in the malar processes and above the anterior nasal spine are used to complete the separation of the maxilla. Remaining soft tissues in the soft palate and fauces are then dissected free.

**Mallet and Chisel Method:**

A mallet and chisel can be used to induce a “Le Fort” Type I fracture of the maxilla. The chisel blows are made below the zygomatic arch, high on the maxillary sinus walls bilaterally. Since it is virtually impossible to fracture the mandibular rami with the mallet and chisel, the mandible can be disarticulated at the temporomandibular joint in such cases.

**Pruning Shears Method:**

An alternative technique for resection of the jaws involves the use of large pruning shears. The soft tissue/muscle dissections are as described on page 10. The small blade of the pruning shears is placed within the nares and forced back into the maxillary sinus. A cut is then made along a plane superior to the apices of the maxillary teeth bilaterally. The mandibular bone cuts are performed by inserting the small blade of the shears high on the lingual aspect of the ramus near the coronoid notch bilaterally.

**E. The Postmortem Dental Record:**

While most morgues will have the standard autopsy equipment, the forensic odontologist may wish to assemble their own forensic kit to include mouth mirrors, explorers, camera equipment, anatomic dental charts, impression materials, cyanoacrylate, etc. Postmortem dental examinations might utilize anatomic dental charts, photographs, radiographs, models, tape recordings and/or narrative descriptions. The data collected should be comprehensive in scope since antemortem records are commonly not discovered until days, weeks or even years later. Accordingly, the post-mortem dental record will include all or most of the items given below.

**1. Basic Data:**

Case Number  
Date/time,  
jurisdiction/authority  
Location  
Putative ID, if any

**2. Body Description, General**

Approximate age  
Race, sex,  
condition

**3. Jaw Fragment(s) Description**

**F. Dental Examination:**

The universal tooth numbering system should be used. The record should reflect any missing dental structures or jaw fragments as well as those present and available for evaluation. The chart should illustrate as graphically as possible the following:

1. Configuration of all dental restorations (including prostheses), caries, fractures, anomalies, abrasions, implants (tooth replacement), erosions or other features for all teeth.
2. Materials used in dental restorations and prosthetic devices, when known.
3. Periodontal conditions, calculus, stain.
4. Occlusal relationships, malposed teeth; anomalous, congenitally missing and supernumerary teeth.
5. Intra oral photographs should be used to show anatomic details of teeth, restorations, periodontium, occlusion, lesions, etc.

## **G. Narrative Description and Nomenclature**

The anatomic dental chart may be supplemented by a narrative description of the postmortem findings with particular emphasis on unusual or unique conditions. Standardized dental nomenclature should be used as follows:

### **1. Universal Numbering System**

The system of numbering teeth that is used in the United States. The teeth are numbered from 1 to 32. The maxillary right third molar is #1, the maxillary central incisors are #8 and #9, the maxillary left third molar #16, the mandibular left third molar #17 and the mandibular right third molar is #32. The universal tooth numbering system plus the actual name of the tooth should be used (e.g. tooth #3, maxillary right first permanent molar)

### **2. Dentition Type and Tooth Surfaces**

Primary, permanent, supernumerary, and mixed dentition. Mesial, Occlusal, Distal, Facial and Lingual surfaces (MODFL).

### **3. Prosthetics and other Appliances**

- Crowns:** full, 3/4, 7/8, or onlay coverage restorations.
- Prosthetics:** Partial, full, or fixed dentures. Orthodontic bands, brackets, appliances, space maintainers and retainers. Mouth guards and night guards.

### **4. The FDI Numbering System**

Odontologists should be aware of the FDI/ISO system of numbering teeth. This system is used throughout much of the world other than the United States. Quadrants are numbered from 1 to 4. The maxillary right quadrant is 1, maxillary left 2, mandibular left 3 and mandibular right 4. Teeth are numbered from the midline to the posterior. Central incisors are #1, canines #3 and third molars #8. Teeth are represented by a two digit code with the quadrant first and the tooth second. Thus, the maxillary left first molar is 26 (pronounced 2-6).

## **H. Dental Impressions**

Impressions should be considered when bitemarks, rugae patterns or other evidence warrants the procedure.

### **1. Supplies and Equipment:**

Appropriate trays, plastic or metal, which can be modified to fit the mouth



Alginate or other American Dental Association approved dental impression material. Type III dental stone is the material of choice for pouring models. Plaster of Paris should not be used.

## **2. Impressions and Preparation of Models:**

Two sets of impressions, both maxillary and mandibular, are obtained in the conventional manner. Models should be trimmed and appropriately labeled with the case number and date. Also it is important to note that dental impressions on autopsy tables take longer to set.

## **I. Dental Radiology**

Postmortem radiographs graphically complement the visual examination/charting of the oral and perioral structures and can provide significant data essential for identification (see section III). In general, radiographs are required in cases where there is no putative ID, antemortem records have not yet been located and/or the jaws cannot be retained. Postmortem radiographs must be considered the prime method of identification. A comprehensive postmortem radiographic examination might include all or some of the following views, depending on the circumstances of the case.

### **1. Intra oral Radiographs**

Digital or analog dental bitewing and periapical radiographs of anterior and posterior teeth comparable in technique to those taken antemortem. (Bitewing views should be taken in the conventional “teeth in occlusion” manner but as an alternative periapical film can be used for separate views of the maxillary and mandibular teeth, using a horizontal bitewing angulation).

### **2. Dental Fragments, Dissociated Teeth**

Appropriate radiographs of all dental fragments, dissociated teeth, bone and restorations should be obtained. Occlusal or lateral plate film may be used for objects larger than a periapical film.

### **3. Edentulous Areas**

Periapical radiographs of edentulous arches or areas, especially the third molars, which may be impacted or previously extracted. Periapical radiographs of sockets of teeth lost postmortem should be taken, since antemortem radiographs of these same teeth may be the only evidence that becomes available.

### **4. Extra oral Radiographs**

Extra oral radiographs (e.g., lateral jaw, maxillary or frontal sinus and panoramic radiographs) are often useful.

### **5. Disposition of Radiographs**

Double pack intra oral film is recommended. One set of films should be retained by the forensic odontologist for his case file. The second set may be mounted and forwarded with a written report to the medical examiner/coroner for the master file. If digital radiology was utilized, the odontologist should have all the digital files backed up to an external source after electronically submitting the case records.

**NOTE:** *All duplicate/digital films should bear right and left notations.*

## **II. COMPARISON OF ANTEMORTEM & POSTMORTEM EVIDENCE**

This section deals with factors which may be present in both the antemortem and postmortem

dental evidence and can be useful for comparison purposes. Most dental identifications are based on restorations, caries, missing teeth and/or prosthetic devices which may be readily documented in the records. It should be noted, however, that the precipitous decrease in caries incidence in recent years will dictate greater reliance on other dental findings in the future. It is emphasized that, given adequate records, a nearly infinite number of objective factors have identification value (see Section IV). Thus, objective findings, particularly those which are unique to the individual, provide the basis for concordance or exclusion. Concomitantly, apparent discrepancies between the antemortem and postmortem evidence (e.g. errors in recording, dental treatment subsequent to the available antemortem record) must be resolved. The following subsections provide examples of objective findings in the teeth, periodontium, and/or jaws, which may be demonstrable in both antemortem and postmortem records. While the factors listed are by no means comprehensive, they may serve as a checklist and demonstrate the range of objective findings that may be applicable in difficult identification cases.

### **Dental Features Useful in Identification:**

#### **Teeth:**

Teeth present-erupted

Teeth present-unerupted/impacted

#### **Missing Teeth:**

Congenitally missing

Lost antemortem

Lost perimortem/postmortem

#### **Tooth Type:**

Permanent mixed dentition

Retained primary teeth

Supernumerary teeth

#### **Tooth Position**

Malpositions: facial/lingual version, rotations, supra/infra positions, diastemas, other occlusal discrepancies

#### **Crown Morphology**

Size and shape of crowns

Enamel thickness

Location of contact points, cemento-enamel junction

Racial variations: e.g. shovel-shaped incisors, Carabelli cusp, etc.

#### **Crown Pathology**

Caries

Attrition/abrasion/erosion

Atypical variations: e.g. peg laterals, fusion/gemination, enamel pearl, multiple cusps

Dens in dente

Dentigerous cyst

#### **Root Morphology**

Size, shape, number, dilaceration, divergence of roots

### **Root Pathology**

Root fracture, hypercementosis, external root resorption, root hemisections

### **Pulp Chamber and Root Canal Morphology**

Size, shape, number, secondary dentin

### **Pulp Chamber and Root Canal Pathology**

Pulp stones, dystrophic calcification

Root canal therapy: e.g. gutta percha, silver points, endo paste, nanoparticulates, posts, and retro-fill procedures

Internal resorption, apicoectomy, periapical pathology, periapical abscess/granuloma/cyst, cementoma, condensing osteitis

### **Dental Restorations**

Metallic restorations: amalgams, gold or non-precious metal crowns/inlays, endo-posts, pins, fixed prostheses, implants

Non-metallic restorations: acrylics, silicates, composites, glass ionomers, porcelain, zirconia, etc.

Partial and full removal prostheses

### **Periodontium**

Gingiva: morphology/pathology

Contour: gingival recession, focal/ diffuse enlargements, interproximal craters

Color: inflammatory changes, physiologic or pathologic pigmentations

Plaque and concretions oral hygiene status, stains, calculus

### **Periodontal Ligament: Morphology/Pathology**

Thickness

Widening (e.g. scleroderma), lateral periodontal cyst

Alveolar process and lamina dura, height/contour/density of crestal bone, thickness of inter-radicular alveolar bone exostoses, tori

Pattern of lamina dura (loss, increased density) periodontal bone loss

Trabecular bone pattern osteoporosis, radio-densities

Residual root fragments, metallic fragments

### **Maxilla and Mandible:**

Anatomical landmarks/pathology

Maxillary sinuses: size, shape, retention cyst, antrolith, foreign bodies, oral-antral fistula

Relationship to adjacent teeth, anterior nasal spine, incisive canal, median palatal suture, incisive canal size, shape, cysts

Pterygoid hamulus: size, shape, fracture

Mandibular canal/mental foramen: diameter, anomalous (bifurcated) canal, relationship to adjacent teeth, coronoid and condylar process size and shape, temporomandibular joint size and shape, hypertrophy/ atrophy, ankylosis, fracture, arthritic changes

**Other pathologic processes/jaw bones:**

Developmental/fissural cysts, hemorrhagic (traumatic) bone cyst, salivary gland depression, reactive/neoplastic lesions, metabolic bone disease

Other disorders inducing focal or diffuse radiolucencies or radiopacities, evidence of orthognathic surgery or prior evidence of trauma (e.g. wire sutures, surgical pins, etc.

**III. CATEGORIES & TERMINOLOGY FOR BODY IDENTIFICATION****A. Positive Identification**

The antemortem and postmortem data match in sufficient detail to establish that they are from the same individual. In addition, there are no irreconcilable discrepancies.

**B. Possible Identification**

The antemortem and postmortem data have consistent features, but, due to the quality of either the postmortem remains or the antemortem evidence, it is not possible to positively establish dental identification.

**C. Insufficient Evidence**

The available information is insufficient to form the basis for a conclusion.

**D. Exclusion**

The antemortem and postmortem data are clearly inconsistent. However, it should be understood that identification by exclusion is a valid technique in certain circumstances.

NOTE: The forensic dentist is not ordinarily in a position to verify that the antemortem records are correct as to name, date, etc.; therefore, the report should state that the conclusions are based on records which are purported to represent a particular individual.