Data Interoperability

ANSI NIST ITL: Proposed Dental Forensic Data Supplement

January 30, 2013
NIST Headquarters
Gaithersburg, MD, USA

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NIST
Chairman ADA JWG 10.12 On Forensic Odontology Informatics
Before I Forget

Thank You

ADA
Sharon Stanford
Gregory Zeller

NIST
Bradford Wing

Frank DePaolo
Naeem Ullah
Balancing Act
INTRODUCTION TO FORENSIC ODONTOLOGY
The Procedure

Antemortem Information

Postmortem Information

Identification
Odontology

- Ceramic Casing
- Highly Vascular
- Resistant to Crushing
- Resistant to Contamination
- Resistant to Heat
- Easy to find in Debris
- Good Source Of DNA
The Basics

Lingual

Occlusal / Incisal

Mesial

Distal

Facial
Why Is This Important

Occlusal

Mesial
1. A Postmortem specimen is obtained and coded
2. Antemortem records are obtained and coded
3. Check for Irreconcilable Discrepancies

| Antemortem 1 | Antemortem 2 | Antemortem 3 | Antemortem 4 | Antemortem 5 | Antemortem 6 | Antemortem 7 | Antemortem 8 | Antemortem 9 | Antemortem 10 | Antemortem 11 | Antemortem 12 | Antemortem 13 | Antemortem 14 | Antemortem 15 | Postmortem 1 |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|-------------|-------------|
4. Remove irreconcilable discrepancies
5. Rank data from most likely matches to least likely matches

- Antemortem 1
- Antemortem 3
- Antemortem 5
- Antemortem 6
- Antemortem 14
- Antemortem 12
Computer Data Review
HISTORY OF ADA COMMITTEE
Following 9/11 and Hurricane Katrina the American Dental Association (ADA) realized the critical role play by Dentistry in the DVI Disaster process.

- **Spring 2003** - ADA announces the formation of a Dental Forensic Committee.
- **Fall 2006** ADA Meeting Las Vegas - Formal proposal placed before ADA Standards Committee for Dental Informatics (SCDI) which was approved.
- **2006-2007** - Preliminary Seed documented created.
- **September 2007** - First meeting of working group ADA - San Francisco.
- **September 2007** - ADA round table on forensic odontology.
- **February 2008** - Second meeting of working group.
Question: Why are we doing this?

Answer: Electronic Health Records (EHR) have been mandated by The Department of Health and Human Services (HHS) by 2015. The creation of the National Health Information Infrastructure Initiative produce a three stage plan

- Stage 1 - Development within (HHS) for blueprint for implementation and policy.
- Stage 2 - (5 years) focuses on building collaboration among stakeholders.
- Stage 3 - (10 years) involves carrying out the plan in all relevant public and private sectors.
Computer Usage - Some Information

U.S. Solo Practitioners
- Use Computers: 74%
- Do Not Use Computers: 26%

U.S. Group Practitioners
- Use Computers: 79%
- Do Not Use Computers: 21%
How Can We Work Together?

ANSI NIST ITL:
Proposed Dental Forensic Data Supplement
The Goal

New Working Item Request - 2006

Specialty panel formed and Proposed a New ADA Specification No. 1058 - To formulate a new forensic dental data set of minimal and optional data that will aid in the determination of the identity of an unknown victim.
The Situation When We Started

- The ADA non-forensic literate members wanted to know what information to collect
- The practice management software companies were interested in helping but did not know what to do
- The DICOM group were comfortable transferring images but wanted guidance on other metadata
- The forensic community wanted to be certain that they were part of the decision making process
Committee Was Formed

BROAD CROSS-SECTION OF FORENSIC ODONTOLOGY

- Chairperson - Kenneth W. Aschheim, DDS
- ABFO - Bob Barsley, DDS ABFO
- AAFS - Thomas David, DDS ABFO
- ASFO - Ken Hermsen, DDS
- ACP and VA - Stephen Bergen, DDS
- A Ped D - Rhea M. Haugseth, DMD
- AGD - Jim Schneider DDS
- Ed - Mary Cimrmancic DDS
- AFIP - Duane R. Schafer, CAPT, DC, USN
- Pub Health - Robin Scheper, DMD
- Pub Health - Scott A. Trapp, DDS (ADA)
- Gov - NCIC (Gary L. Bell DDS)
- FBI-CJIS Cindy Johnston (observer)
- ME Odont - Lawrence Dobrin, DMD
- ME Radiology - Richard Weledniger, DDS
- ME Odont - Harry Zohn, DDS
- ME Anthropology - Donna Fontana, MS

- ADHA - Winnie Furnari, MS - Secretary
- Informatics - Mark Diehl, DDS
- Industry - Rad - Candy Ross, (Dexis)
- Industry - PMS - Zach Church, (Dentrix)
- Industry - Dianne Rose, (Insurance)
- ADA - Pamela Porembski, DDS
- ADA - Norman Schreiber, DDS
- ADA - Greg Zeller, DDS
- ADA - Sharon Sanford
Work Flow

Practice Management Software

Export

- Familial Data
- Dental History Data
- Tooth Data
- Mouth Information Data
- Radiographic Data
- Visual Image Data

Electronic Transfer

Import

Forensic Management Software

plass data

James McElvany, DMD
WinID3 for Windows

ANSI NIST ITL: Proposed Dental Forensic Data Supplement
Current Status

American National Standard/
American Dental Association
Specification No. 1058

Forensic Dental
Data Set

ADA American
Dental Association®
2010

Forensic Dental
Data Dictionary
Draft
Approved by
Terms and
Definitions
Nov-Dec 2010

Officially Known as ANSI
Standard 1058
November 16th 2012

SCDI Working Group Ballot
PROPOSED SPECIFICATION 1067 FOR STANDARD FUNCTIONAL REQUIREMENTS OF AN ELECTRONIC RECORD SYSTEM FOR GENERAL DENTISTRY

Version 0.99
DRAFT for TASK GROUP REVIEW ONLY
NOT FOR DISTRIBUTION

This is a draft document for review only. This document has not been approved by the ADA or ANSI and is not an American National Standard.

Please use the comment template provided with this draft to enter your comments.

Send any questions to:
Paul B. Lake - plake@ada.org
or Stan Denis - stfordata.com

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Requirement 2.32

The electronic dental system SHALL have the ability to reference the forensic dental dataset, e.g., ANSI-ADA Specification 1058.
Data Interoperability

STRUCTURE OF THE ANSI/ADA 1058
Framework For Postmortem Dental Data Set

- Visual Image Data Set
- Familial Data Set
- Dental History Data Set
- Tooth Data Set
- Mouth Data Set
- Radiographic Image Data Set
# Proposed Dental Forensic Data Supplement

## Familial Data Set - Dr. Dobrin

| 7.1.1 | Personal Data
| --- | ---
| 7.1.1.1 | Name
| 7.1.1.2 | Address
| 7.1.1.3 | Office Telephone Number
| 7.1.1.4 | Office Fax Number
| 7.1.1.5 | Office Mobile Telephone Number
| 7.1.1.6 | Office Pager Number
| 7.1.2 | Occupation
| 7.1.3 | Dental Insurance Information (Multiple Iterations Allowed)
| 7.1.3.1 | Name
| 7.1.3.2 | Address
| 7.1.3.3 | Office Telephone Number
| 7.1.3.4 | Office Fax Number
| 7.1.3.5 | Office Email Address
| 7.1.4 | Personal Information
| 7.1.4.1 | Date of Birth
| 7.1.4.2 | Social Security Number

## Tooth Data Set - Dr. Aschheim

| 9.1 | Tooth Data Set
| --- | ---
| 9.1.1 | Tooth Type
| 9.1.1.1 | Decayed
| 9.1.1.2 | Fractured
| 9.1.2 | Periapical Pathology
| 9.1.2.1 | Mild
| 9.1.2.2 | Moderate
| 9.1.2.3 | Severe / Excess Bone Loss
| 9.1.3 | Bone Graft
| 9.1.4 | Splinted to Adjacent tooth

**ANSI NIST ITL:** Proposed Dental Forensic Data Supplement

**ADA:** Review Of ADA Document
**FAQ - ANSI-ADA 1058**

**Question:** Why is the purpose of the Descriptors?

**Answer:** The purpose of the descriptors is to be certain that we are all talking the “same language”
FAQ - ANSI-ADA 1058

Question: How does it do this?

Answer: By proving a non-ambiguous description for most descriptors and giving an explanation to make sure it is applied in a consistent manner.
Question: Can you give an example?

Answer: Something as simple as a name can be ambiguous. What about nicknames, maiden names etc.. so

“Name - This Descriptor is used to describe the legal name of the patient as it would appear on official (government) documents.”

“Common Name Alias (“Nickname “) - This Descriptor should be used to describe a preferential name the patient uses.”
Question: How about a simple dental example?

Answer: “Broken Instrument - This descriptor is used to describe endodontic therapy in which one or more canals were obturated with any device that was accidentally separated during endodontic therapy. This descriptor can be used regardless of where any additional obturation materials coexist in the same or other canals of the tooth.”
How about another example?

**Question:**

**Answer:**

“Prefabricated Abutment - This descriptor is used to describe a connection to an implant that is a manufactured component usually made of machined high noble metal, titanium, titanium alloy or ceramic. This abutment is usually produced by an implant manufacturer and is patient independent. This descriptor can be used even if the abutment has been modified for use. This abutment attaches to a single implant and supports a single crown.”

“Custom Abutment - This descriptor is used to describe a connection to an implant that is a fabricated component, usually by a laboratory, specific for an individual application. A custom abutment is typically fabricated using either a casting process or milling process and includes computer milled abutments. This descriptor can be used regardless of the type of material utilized. This abutment attaches to a single implant and supports a single crown.”
**Question:** Is there a comparable document that the ADA has?

**Answer:** Yes the CDT codes
Question: So why are there so many codes?

Answer: If a Descriptor is missing there will be no way to electronically transfer a certain characteristic from one piece of software to another.
Question: Does the ADA really expect us to use all these codes?

Answer: • The ADA is not trying to reinvent the wheel
• The ADA is not creating a new coding system
• The ADA is not mandating anything to anyone
• The ADA is trying to give you the means to communicate but is not telling you how much to communicate
Question: What About NCIC NamUs and Other Government Agencies?

Answer: They have agreed to work with us by reviewing the documents. As with any agency they are will be free to use the standard if they choose.
Question: So what is next?

Answer: Integration into ANSI- NIST ITL
Data Interoperability

NIST INVolVEMENT
This standard defines the content, format, and units of measurement for the electronic exchange of forensic information that may be used in the identification or verification process of a subject.
Data Format for the Interchange of Fingerprint, Facial & Other Biometric Information

Purpose

- Standardizes data communication between law enforcement, criminal justice and other organizations
- Process biometric data
- Use the standard to exchange identity data
- Examples
  - Fingerprints, Palmprints and Plantars Prints
  - Faces, iris other body parts including scars, marks and tattoos (SMT).
ANSI / NIST-ITL 1-2011

- Type 1 - Defines the transaction
- Type 2 - Identification And Descriptive
- Type 4,9,13,14,15 - Fingerprint
- Type 7 - Temporary field
- Type 8 - Signature data.
- Type 10 - Image data
- Type 12 - Dental Data
- Type 16 - Miscellaneous images
- Type 17 - Iris image data.
- Type 18 - DNA and related data
- Type 20 - Parts of records
- Type 21 - Audio / visual recording

New Data Type
Lyon June 2011

- Met with Interpol DVI Odontology Section
- Discussion with Dr. Alain Middleton and René Pele of Plass Data
- Tentative agreement to review data compatibility
- Project critical to worldwide success of data transference
Discussion with Dr. Virginia Kannemann and Pedro Janices concerning the standard

Possible expansion to other dental forensic data (i.e. bitemarks)
Data Interoperability

ANSI-NIST ITL PROPOSED DENTAL FORENSIC DATA SUPPLEMENT
Forensic Odontology Standard

Type 10 Data

Face, Other Body Part, Or Scar, Mark, Tattoo (SMT) Image Record

Forensic Odontology Standard

Dental And Oral Data

Type 21 Data

Associated Context Data
Type 10 - Image data

- Any IMAGE (and metric data) of a human body part
  - X-rays, MRI, Cat Scans, Cone Beam, DICOM
  - Images of the human teeth. Lips etc.
- Suspected pattern injuries of intraoral origin on humans
- Suspect latent images of perioral or intraoral origin on a human body
Type 12 - Dental data

- Dental and Oral Comparison Data
Type 21 - Associated Context

- Images (any type) and other examination data on non-human objects or animals.
- Data concerning
  - casts and molds of impressions in skin or objects,
  - locations of those casts and molds
  - identification markers (such as barcode information, etc.).
- There are no changes required to the Type-21 record
Type 12 Records

Dental History Data Set
12.009

Tooth Data Set
12.010

Mouth Data Set
12.011
Type 2 Records

- Familial Data Set Type-2
- Dental History Data Set 12.009
- Tooth Data Set 12.010
- Mouth Data Set 12.011
Type 10 Records

- Familial Data Set
  Type-2

- Visual Image Data Set
  Type 10

- Radiographic Image Data Set
  Type 10

ANSI NIST ITL:
Proposed Dental Forensic Data Supplement
Question: Why are there three data types?

Answer: The dental supplement needs to fit within the framework of the previous ANSI-NIST Standard.
**Question:** But wait you said images can go into both Type 10 and Type 21 records what is the difference?

**Answer:** Type 10 data deals with images that originated from humans or is on a human. All other images are Type 21 images.
Question: Ok so all I need to worry about is Type 10 images and Type 21 images correct?

Answer: Almost there is one exception, something called a Type 20 image. Type 20 images come into play if the image is processed prior to sending. The processed image is a type 10 or type 21 image while the virgin unprocessed image is a Type 20 image.
Question: Can you show me an example?

Answer: Type 20  Type 10
Data Interoperability

ANSI-NIST DATA ISSUES AND SOLUTIONS
Data Issue - Granularity

- Degree of detail varies
- ADA Standard needs to better accommodate hierarchical dental codes (Plass DVI’s) as well as procedurally-based vs. conditional-based codes
Data Issue - Ambiguity

What is the difference?

- car - caries
  - aca - acute caries
  - cca - chronic caries
- cav - cavity

What is the significance in identification?

- cal - calculus
Data Issue - Specificity

Problematic
## Working Through the Issue's With Business Users

Submitted For Clarification To INTERPOL Odontology DVI on Plass Data 40+ Questions on ~150 Plass Data Dental Codes

---

<table>
<thead>
<tr>
<th>Plass</th>
<th>National Text</th>
<th>2010</th>
<th>Descriptor 2010</th>
<th>Complete Description 2010</th>
<th>2012</th>
<th>Descriptor 2012</th>
<th>Complete Description 2012</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>uif</td>
<td>unidentified filling</td>
<td>10.3.3.3.3</td>
<td>Other</td>
<td>This Descriptor should be used when the tooth material is mainly composed of a material whose composition is unknown.</td>
<td>10.3.3.3.3</td>
<td>Other</td>
<td>This Descriptor should be used when the tooth material is mainly composed of a material whose composition is unknown.</td>
<td>No Change</td>
</tr>
<tr>
<td>mcf</td>
<td>metal coloured filling</td>
<td>9.3.2.5.4.7 9.3.2.5.2.2</td>
<td>No Code</td>
<td>No Code</td>
<td>9.3.2.5.4.7 9.3.2.5.2.2</td>
<td>No Code</td>
<td>No Code</td>
<td>Ambiguous, By Metal Do You Mean Gold Or Gold And Silver? Is This Lab Fabricated Only, Such As An Inlay Or Onlay? If The Later Does This Include Amalgam?</td>
</tr>
<tr>
<td>amf</td>
<td>amalgam filling</td>
<td>9.3.2.5.4.1</td>
<td>Amalgam</td>
<td>This Descriptor should be used to describe any direct restoration that either radiographically or by documentation consists of a silver/mercury based alloy.</td>
<td>9.3.2.5.4.1</td>
<td>Amalgam</td>
<td>This Descriptor should be used to describe any direct restoration that either radiographically or by documentation consists of a silver/mercury based alloy.</td>
<td>No Change</td>
</tr>
<tr>
<td>gcf</td>
<td>gold filling</td>
<td>9.3.2.5.4.7 9.3.2.5.2.1</td>
<td>No Code</td>
<td>No Code</td>
<td>9.3.2.5.4.7 9.3.2.5.2.1</td>
<td>No Code</td>
<td>No Code</td>
<td>Ambiguous, How Is This Different From &quot;mcf&quot;?</td>
</tr>
<tr>
<td>tcf</td>
<td>tooth coloured filling</td>
<td>9.3.2.5.4.2</td>
<td>All Composite/Acrylic</td>
<td>This Descriptor should be used to describe any restoration that either radiographically or by documentation consists of any resin-based composite, including fiber reinforced.</td>
<td>9.3.2.5.4.2</td>
<td>All Composite/Acrylic</td>
<td>This Descriptor should be used to describe any restoration that either radiographically or by documentation consists of any resin-based composite, including fiber reinforced.</td>
<td>No Change</td>
</tr>
</tbody>
</table>
February 2012

Forensic Dental Data Set

Standard updated to allow for better compatibility with NamUs, NCIC and Plass Data

Request review of business users code due to ambiguity
Question: Are you finally going to do something about all those codes and make everyone use one set?

Answer: Coding choices and especially the degree of granularity is up to the individual business owners. ANSI-NIST ITL does not have the authority nor the mandate to tell any business owner what codes to use.

Our goal is to ACCOMMODATE not DICTATE by allowing systems to “talk to each other”
TYPE 12 RECORDS

DENTAL AND ORAL COMPARISON CANDIDATES DATA STRUCTURE
Proposed Model

- This is a conceptual model
- We will discuss format (XML) later
- Attempts to handling the granularity issue cannot completely solve “simple” to “detail” coding issue
- NO ONE WILL ACTUALLY UTILIZE CODES (ASCII CODE 65 = “A”)
- Conversion is within software
Table 1 Excerpt from Table 24: Type-4 record layout

<table>
<thead>
<tr>
<th>Field Number</th>
<th>Mnemonic</th>
<th>Content Description</th>
<th>Cond Code</th>
<th>Character</th>
<th>Value Constraints</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.004</td>
<td>FGP</td>
<td>FRICITION RIDGE GENERALIZED POSITION</td>
<td>M</td>
<td>N, I</td>
<td>0 ≤ FGP ≤ 15 or FGP = 255 integer See Table 8</td>
<td>6, 6</td>
</tr>
</tbody>
</table>

- Field Number
- Mnemonic
- Content Description
- Cond Code
- Assigned
- Assigned
- Assigned
- Condition code (Man / Opt)
Condition Codes

M  = Mandatory field
O  = Optional field
M↑ = Mandatory subfield
O↑ = Optional subfield
D  = Dependent subfield presence dependent upon certain conditions
### Table 1 Excerpt from Table 24: Type-4 record layout

<table>
<thead>
<tr>
<th>Field Number</th>
<th>Mnemonic</th>
<th>Content Description</th>
<th>Cond code</th>
<th>Character</th>
<th>Value Constraints</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.004</td>
<td>FGP</td>
<td>FRICITION RIDGE GENERALIZED POSITION</td>
<td>M</td>
<td>N</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

- **Character Type**: N / A / U / Hex Dec / Spec. Char. / Base 64
- **Min # of Char**: 0 ≤ FGP ≤ 15 or FGP = 255 integer
- **Max # of Char**: See Table 8

- **Value Constraints**

- **Character Min**: N
- **Max # of Char**: 3

- **Character Max**: 6
- **Constraints**: 6

- **Occurrence**: 6
### Structure of ANSI-NIST ITL

#### Table 1 Excerpt from Table 24: Type-4 record layout

<table>
<thead>
<tr>
<th>Field Number</th>
<th>Mnemonic</th>
<th>Content Description</th>
<th>Cond code</th>
<th>Character</th>
<th>Value Constraints</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,004</td>
<td>FGP</td>
<td>FRICITION RIDGE GENERALIZED POSITION</td>
<td>M</td>
<td>N</td>
<td>0 ≤ FGP ≤ 15 or</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>FGP = 255 integer</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>See Table 8</td>
<td></td>
</tr>
</tbody>
</table>

- Occurrence - Min
- Occurrence - Max
- Minimum Times Used
- Maximum Times Used
Forensic Odontology Standard

Prior Data

• Antemortem
• Historical Data

Postmortem

• Living Amnesiac Identity Verification
• Suspect Data

Current Data
Data Transfer For Dummies

UNAMBIGUOUS DATA TRANSFER

ANSI NIST ITL:
Proposed Dental Forensic Data Supplement
What is XML

- XML (Extensible Markup Language) is a flexible way to share information in a consistent way.
- It is used in the World Wide Web, intranets etc..
- Consists of two parts Tags and Data

<NameOfData> DATA </NameOfData>
<ToothNumber>18</ToothNumber>
<!--WinIDPrimaryCode-->MOD<!--WinIDPrimaryCode-->
<!--WinIDSecondaryCode-->EA<!--WinIDSecondaryCode-->
<!--WinIDCommentCode-->Root Canal<!--WinIDCommentCode-->
UDIM In XML

<ToothNumber>18</ToothNumber>
<UDIMStatusCode>MOD</UDIMStatusCode>
<UDIMConditionCode>cR</UDIMConditionCode>
<UDIMMaterialCode>mC</UDIMMaterialCode>
**Question:** Do we now need to memorize all those abbreviations?

**Answer:** As a user No. Only the programmers need to know it. It is invisible to the user and they will never use them. Do you know the ASCII table?
Question: Do we now need to memorize all those XML Tags?

Answer: As a user No. Only the programmers need to know it. It is invisible to the user and they will never use them. Do you know HTML?
Question: Do we now need to learn XML?
Answer: As a user No. Only the programmers need to know it. It is invisible to the user. Do you know C++ programming language?
Questions So Far???
Type 12 Records

LET'S GET STARTED
Field 12.001: Record Header

- It contains information particular to the encoding format chosen, in order to enable proper reading of the record.
  - In traditional encoding, this field contains the record length in bytes (including all information separators).
  - In NIEM-conformant XML encoding, this field contains the `RecordCategoryCode`, which is the numeric representation of the Record Type.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Encoding Specific</td>
<td>NA</td>
<td>NA</td>
<td>Encoding Specific</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Field 12.002: Information Designation Character

Mandatory

- The IDC shall be a sequentially assigned positive integer starting from zero and incremented by one up to a maximum of 99.
- IDC references are used to relate information items
- Two or more records may share an IDC to identify and link together records that pertain to different representations of the same biometric trait.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>1</td>
<td>2</td>
<td>0 &lt; IDC &lt; 99 integer</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Abbr: IDC

XML: biom:ImageReferenceIdentification
Field 12.003: Forensic Dental Setting

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>SUBFIELDS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Describes the forensic setting that carried out the analysis of the dental and oral data.

**Abbr:** FDS  
**XML:** biom:ForensicDentalSetting
**Field 12.003: Forensic Dental Setting**

<table>
<thead>
<tr>
<th>Mandatory Subfield</th>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>1</td>
<td>1</td>
<td>FACC=M,D,F,A,T,O</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Forensic Analyst Category Code**

**Forensic Organization Primary Contact Information**

**Forensic Source Country Code**
Field 12.004: Source Agency Identification ID

**Mandatory**

- Agency that originally prepared this record
- Not necessarily agency transmitting transaction
- Not necessarily agency that gathered the biometric samples and/or metadata.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1</td>
<td></td>
<td>None</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Abbr: SRC

XML: Pending
**Field 12.005: Capture Organization Name**

### Optional

- Agency responsible for collected the data
- This can be different from the agency entered in Field 12.004: Source agency / SRC

<table>
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<tbody>
<tr>
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<td>1</td>
<td></td>
<td>None</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Abbr: CON

XML: Pending
Question: Why do we need this information. It has nothing to do with a dental comparison.

Answer: This is a transfer of legal information and must follow the rules of concerning the evidence.
Quality Of Data

Comparison in Progress
Quality Of Data

Comparison in Progress
Field 12.006: Dental Subject Information

- Provides information about the donor subject at time of donation of sample

<table>
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<th>Value Constraints</th>
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<td>SUBFIELDS</td>
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<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Abbr: DSI

XML: biom:DentalSubject
Question: I thought a Type 2 records handles all information concerning a subject

Answer: It is suppose but some information is missing and it cannot be modified since it is controlled by the FBI
Field 12.006: Dental Subject Information

Subject Status Code

- It is an integer with one of the following values:
  - 0 = status of individual unknown
  - 1 = data obtained from a living person (for unknown deceased = antemortem)
  - 2 = data obtained from a decedent (for unknown deceased = postmortem)

<table>
<thead>
<tr>
<th>Character TYPE</th>
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<th>MAX #</th>
<th>Value Constraints</th>
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<th>Occurrence Max #</th>
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<tr>
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<td>1</td>
<td>DSC = 0 or 1 or 2</td>
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### Field 12.006: Dental Subject Information

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<th>Occurrence Max #</th>
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<td>Date</td>
<td>Encoding Specific</td>
<td>Encoding Specific</td>
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<td>1</td>
<td></td>
</tr>
</tbody>
</table>

1. **Subject - Last Contact Date**
2. **Subject - Range Of Last Contact Date Estimate**
3. **Subject - Person Birth Date**
4. **Subject - Range Of Birth Date Estimate**
5. **Subject - Death Time Estimate Rationale Text**
6. **Subject - Death Age Estimate Text**
Field 12.006: Dental Subject Information

Optional

Subject - Person Ethnicity Text

- Describes the ethnic group to which the subject belongs
- Not a fixed list, since terminology that is useful in one area may not be relevant in another. Certain ethnicity (e.g. 'Hispanic') may be meaningful in US but that meaningless or confusion) in Guatemala or Argentina
- Tribal membership (e.g. Zulu, Hopi) may be used

Abbr: DPET

XML: nc:PersonEthnicityText
### Field 12.006: Dental Subject Information

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
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<th>Occurrence Max #</th>
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<tr>
<td>N</td>
<td>1</td>
<td>1</td>
<td>DRAC = 0, 1 or 2</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Optional**

**Subject - DNA Records Availability Code**

**Subject Collection Location Description**
The code is selected from the following list:
- EDR - Electronic Dental Record System, conformant to ANSI / ADA Specification No. 1067
- FastID - Interface for completing the INTERPOL Disaster Victim Identification forms
- NamUS - The National and Unidentified Persons System
- NCIC - The National Dental Image Repository of the National Crime Information Center (NCIC) run by the FBI.
- PLASS - The DVI System International marketed by Plass Data Software A / S
- UDIM - The Unified Dental Identification Module (UDIM) of the Unified Victim Identification System (UVIS)
- WinID - Dental Identification System
- OTHER - The coding system is not listed but is formally documented
- NONE The ADA codes are entered directly based solely upon available data, whether from dental records, interviews or other sources

Abbr: OSNC

XML: biom:SystemNameCode
**Field 12.007: Original Dental Encoding System Information**

**Dependent**

2

**Original System Version Text**

- Describes the data system that was used in the original encoding.
- This item is optional unless OTHER is specified for OSN in which case it is mandatory and described the encoding system used.

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<tr>
<th>Character TYPE</th>
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<td>5000</td>
<td>None</td>
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</tr>
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</table>

**Abbr:** OSVT  
**XML:** biom:SystemVersionText
## Field 12.007: Original Dental Encoding System Information

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<th>Occurrence Max #</th>
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</thead>
<tbody>
<tr>
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<td>1</td>
<td>OTPC = 0, 1, 2 or 3</td>
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</table>

### Mandatory

**Abbr:** OTC PC  
**XML:** biom:ToothPermanenceCategoryCode

---

**Original Tooth Permanence Category Code**

- **Value**
  - 0 = Specified by tooth number
  - FastID, PLASS, WinID UDIM

- For Systems Like FastID, PLASS sent directly
- For systems which use a deciduous indicator y tooth (WinID and UDIM) the two pieces of information shall be used together to assign the correct tooth number according to ANSI / ADA Specification No. 3950 prior to inclusion in this record.
Field 12.007: Original Dental Encoding System Information

**Mandatory subfield**

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<th>Value Constraints</th>
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<th>Occurrence Max #</th>
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</thead>
<tbody>
<tr>
<td>N</td>
<td>1</td>
<td>1</td>
<td>OTPC = 0, 1, 2 or 3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Original Tooth Permanence Category Code**

1 = Unable To Determine At Tooth Level

- Unable to determine if the teeth are permanent or deciduous at the tooth level
- System allow a marker to indicate that deciduous teeth are present in the dentition.
- Permanent tooth number shall be used

Abbr: OTPC

XML: biom:ToothPermanenceCategoryCode
**Field 12.007: Original Dental Encoding System Information**

### Mandatory

<table>
<thead>
<tr>
<th>Character TYPE</th>
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<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
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<td>N</td>
<td>1</td>
<td>1</td>
<td>OTPC = 0, 1, 2 or 3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Original Tooth Permanence Category Code**

- **Code:** 2
- **Description:** Incapable Of Distinguishing Deciduous Teeth
- **Notes:**
  - Coding system incapable of distinguishing deciduous from permanent teeth.
  - The permanent tooth number shall be used.

**Abbr:** OTPC

**XML:** biom:ToothPermanenceCategoryCode

---

**NamUS**
Field 12.007: Original Dental Encoding System Information

Mandatory

<table>
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<tr>
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<th>Value Constraints</th>
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<tr>
<td>N</td>
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<td>1</td>
<td>OTPC = 0, 1, 2 or 3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

3 = Unknown

- Unknown whether the coding is capable of indicating deciduous and permanent teeth and / or whether the coding was performed using that capability.
- The permanent tooth number shall be used

Abbr: OTPC

XML: biom:ToothPermanenceCategoryCode
Field 12.007: Original Dental Encoding System Information

**Mandatory**

<table>
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<tr>
<th>Character TYPE</th>
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<th>Value Constraints</th>
<th>Occurrence Min #</th>
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</thead>
<tbody>
<tr>
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<td>2</td>
<td>ORDI = 11,21,31,41,51 or 99</td>
<td>0</td>
<td>1</td>
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</tbody>
</table>

**Original Restoration Data Granularity Code**

11 = Individual restorations including restored surfaces information and material composition are coded separately for each restoration in the tooth.

- Material inclusion may be optional
- Unknown material composition may be implicit or explicit.

Abbr: ORDG

XML: biom:RestorationDataGranularityCode
Field 12.007: Original Dental Encoding System Information

**Mandatory**

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<th>Occurrence Max</th>
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<tbody>
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<td>N</td>
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<td>2</td>
<td>ORDI = 11,21,31,41,51 or 99</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Original Restoration Data Granularity Code**

21 = Individual restorations including restored surfaces information are coded separately but all the individual material composition are combined into a single code for the tooth

- Material inclusion may be optional
- Unknown material composition may be implicit or explicit.

None

**Abbr:** OTPC

**XML:** `biom:ToothPermanenceCategoryCode`
Field 12.007: Original Dental Encoding System Information

**Mandatory**

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<td>N</td>
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<td>2</td>
<td>ORDI = 11,21,31,41,51 or 99</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Original Restoration Data Granularity Code**

31 = **Individual restorations** including restored surfaces are combined to a single code for the tooth. All the materials utilized in all the restorations are combined into a single code for the tooth.

- Material inclusion may be optional
- Unknown material composition may be implicit or explicit.

**Abbr:** OTPC

**XML:** biom:ToothPermanenceCategoryCode
### Original Restoration Data Granularity Code

41 = The presence of restorations without surface information is combined to a single code for the tooth. All materials utilized in all the restorations to restore the tooth are combined to a single code for the tooth.

- Material inclusion may be optional
- Unknown material composition may be implicit or explicit.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
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<tr>
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Abbr: OTPC

XML: Tribom:ToothPermanenceCategoryCode
Field 12.007: Original Dental Encoding System Information

**Mandatory**

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<tbody>
<tr>
<td>N</td>
<td>2</td>
<td>2</td>
<td>ORDI = 11,21,31,41,51 or 99</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Original Restoration Data Granularity Code**

99 = The level of detail contained in Field 12.011 concerning restorations, materials and / or surfaces is unknown.

Values 1-10, 12-20, 32-40, 42-50 and 52 through 98 are reserved for future use by ANSI / NIST-ITL

**Abbr:** OTPC  
**XML:** biom:ToothPermanenceCategoryCode
FAQ – ANSI-NIST ITL

**Question:** Why do we need this information. It has nothing to do with a dental comparison.

**Answer:** This is vital to understand the granularity of the data so that the receiving software can make adjustments for less granular detail.
Field 12.008: Transmittal Dental Encoding System Information

Mandatory

- Describe the last in the chain of systems involved in creating the record.
- This field is mandatory only if the record creation data reference / encoding system is different from the original system.
- If a chain of systems is involved, it is highly recommended that Field 12.902: Annotation information be used to log the chain.
- OSCI need not be a forensic data system or a system capable of formulating an ANSI / NIST-ITL conformant record or transaction. The purpose of this field is to specify the rules and definitions that were used to specify the data originally.

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<td></td>
</tr>
</tbody>
</table>

Abbr: TDES

XML: biom:SourceForensicDentalEncodingSystemInformation
**Mandatory**

### Transmittal System Name Code

- The code is selected from the following list:
  - EDR - Electronic Dental Record System, conformant to ANSI / ADA Specification No. 1067
  - FastID - Interface for completing the INTERPOL Disaster Victim Identification forms
  - NamUS - The National and Unidentified Persons System
  - NCIC - The National Dental Image Repository of the National Crime Information Center (NCIC) run by the Federal Bureau of Investigation (FBI).
  - PLASS - The DVI System International marketed by Plass Data Software A / S
  - UDIM - The Unified Dental Identification Module (UDIM) of the Unified Victim Identification System (UVIS)
  - WinID - Dental Identification System
  - OTHER - The coding system is not listed but is formally documented
  - NONE The ADA codes are entered directly based solely upon available data, whether from dental records, interviews or other sources

**Abbr:** TSNC

**XML:** `biom:SystemNameCode`
### Field 12.008: Transmittal Dental Encoding System Information

**Transmittal System Version Text**

- **Dependent**
  - Describes the data system that was used in the record creation encoding
  - This item is optional unless OTHER is specified for OSN in which case it is mandatory and described the encoding system used

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**Abbr:** TSVT  
**XML:** `biom:SystemVersionText`
Field 12.008: Transmittal Dental Encoding System Information

**Mandatory**

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<tbody>
<tr>
<td>N</td>
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<td>1</td>
<td>OTPC = 0, 1, 2 or 3</td>
<td>1</td>
<td>1</td>
</tr>
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</table>

**Transmittal Tooth Permanence Category Code**

0 = Specified by tooth number

FastID, PLASS, WinID UDIM

- For Systems Like FastID, PLASS sent directly
- For systems which use a deciduous indicator y tooth (WinID and UDIM) the two pieces of information shall be used together to assign the correct tooth number according to ANSI / ADA Specification No. 3950 prior to inclusion in this record.

Abbr: TTPC

XML: biom:ToothPermanenceCategoryCode
**Field 12.008: Transmittal Dental Encoding System Information**

**Mandatory**

<table>
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<td>1</td>
<td>OTPC = 0, 1, 2 or 3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Transmittal Tooth Permanence Category Code**

1 = Unable To Determine At Tooth Level

- Unable to determine if the teeth are permanent or deciduous at the tooth level
- System allow a marker to indicate that deciduous teeth are present in the dentition.
- Permanent tooth number shall be used

Abbr: TTPC

XML: biom:ToothPermanenceCategoryCode
Field 12.008: Transmittal Dental Encoding System Information

### Transmittal Tooth Permanence Category Code

<table>
<thead>
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<th>Character TYPE</th>
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<th>Value Constraints</th>
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<th>Occurrence Max #</th>
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<tbody>
<tr>
<td>N</td>
<td>1</td>
<td>1</td>
<td>OTPC = 0, 1, 2 or 3</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Mandatory**

**Value 3**

**Transmittal Tooth Permanence Category Code**

2 = Incapable Of Distinguishing Deciduous Teeth

- Coding system incapable of distinguishing deciduous from permanent teeth.
- The permanent tooth number shall be used

**Abbr:** TTPC  
**XML:** biom:ToothPermanenceCategoryCode
Transmittal Tooth Permanence Category Code

3 = Unknown

- Unknown whether the coding is capable of indicating deciduous and permanent teeth and / or whether the coding was performed using that capability.
- The permanent tooth number shall be used
Transmitted Original Restoration Data Granularity Code

11 = Individual restorations including restored surfaces information and material composition are coded separately for each restoration in the tooth.

- Material inclusion may be optional
- Unknown material composition may be implicit or explicit.

<table>
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<th>Character TYPE</th>
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<th>MAX #</th>
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<th>Occurrence Max #</th>
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<tbody>
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<td>2</td>
<td>TRDI = 11,21,31,41,51 or 99</td>
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Abbr: TRDG

XML: biom:RestorationDataGranularityCode
Field 12.008: Transmittal Dental Encoding System Information

Mandatory

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<th>Character TYPE</th>
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<th>Value Constraints</th>
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</thead>
<tbody>
<tr>
<td>N</td>
<td>2</td>
<td>2</td>
<td>TRDI = 11,21,31,41,51 or 99</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Transmitted Original Restoration Data Granularity Code

21 = Individual restorations including restored surfaces information are coded separately but all the individual material composition are combined into a single code for the tooth

- Material inclusion may be optional
- Unknown material composition may be implicit or explicit.

None

Abbr: TRDG

XML: biom:RestorationDataGranularityCode

ANSI NIST ITL: Proposed Dental Forensic Data Supplement
## Field 12.008: Transmittal Dental Encoding System Information

### Mandatory

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<thead>
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<td>2</td>
<td>TRDI = 11, 21, 31, 41, 51 or 99</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

### Transmitted Original Restoration Data Granularity Code

31 = **Individual restorations** including restored surfaces are combined to a single code for the tooth. All the materials utilized in all the restorations are combined into a single code for the tooth.

- Material inclusion may be optional
- Unknown material composition may be implicit or explicit.

**Abbr:** TRDG

**XML:** biom:RestorationDataGranularityCode
Transmitted Original Restoration Data Granularity Code

41 = The presence of restorations without surface information is combined to a single code for the tooth. All materials utilized in all the restorations to restore the tooth are combined to a single code for the tooth.

- Material inclusion may be optional
- Unknown material composition may be implicit or explicit.
Transmitted Original Restoration Data Granularity Code

99 = The level of detail contained in Field 12.011 concerning restorations, materials and / or surfaces is Unknown.

Values 1-10, 12-20, 32-40, 42-50 and 52 through 98 are reserved for future use by ANSI / NIST-ITL

Abbr: TRDG

XML: biom:RestorationDataGranularityCode
Field 12.009 Dental History Data Detail

Optional

- This optional field includes a subfield with a repeating set of information items. Each subfield has two mandatory information items. There may be multiple subfields.

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<th>Value Constraints</th>
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</table>

Abbr: HDD       XML: DentalHistoryDataDetail
Field 12.009 Dental History Data Detail

Mandatory

Dental History ADA Reference Code Text

- Corresponding to the data set descriptors in Section 7 of the ANSI / ADA Specification No. 1058 may be entered
- All the information in the chart
- Can be repeated multiple times

<table>
<thead>
<tr>
<th>Character TYPE</th>
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Abbr: HARC

XML: biom:ADARefERENCECODETEXT
### Field 12.009 Dental History Data Detail

#### Dependent

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<td>1</td>
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</table>

**Dental History Additional Descriptive Text**

- Used for those codes that require text

**Abbr:** HADT  
**XML:** `biom:AdditionalDescriptiveText`
Field 12.010 Tooth Data Detail

Optional

- Condition of each individual tooth
- This optional field includes a subfield with a repeating set of information items.
- There may be multiple subfields with the same tooth number.
- For systems that combine tooth conditions into a single subfield at the tooth level, one subfield is used per tooth.
- For systems that separate tooth conditions each condition shall be a separate subfield with the same tooth number, designated in TNU

Abbr: TDD

XML: biom:ToothDataDetail
Field 12.010 Tooth Data Detail

Optional

- All systems should be capable of receiving data relating to a single tooth in multiple subfields, even if tooth conditions in the destination system are expressed jointly at the tooth level.
- If a system is capable of expressing tooth conditions separately does receive information from a system that is not capable of expressing tooth conditions separately, the receiving system should take care concerning the assignment of ANSI / ADA Specification No. 1058 codes (listed in TTC) to individual conditions on the tooth. Any mappings should only be performed after examination of the OSTC, with the mapping decision clearly described in the appropriate reference data items of the destination system.

Abbr: TDD
XML: biom:ToothDataDetail
Field 12.010 Tooth Data Detail

**Mandatory Subfield**

1. Tooth Data Date Of Recording

- The Date the particular tooth number information was referenced

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td></td>
<td></td>
<td>Encoding Specific</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Abbr:** TCD

**XML:** nc:Date
### Field 12.010 Tooth Data Detail

**Tooth Data Date Of Recording Estimated Accuracy Range**

- Amount of time (plus and minus) of which TCD is the center point during which the death could have taken place.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN</td>
<td>3</td>
<td>15</td>
<td>Time Measure</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Abbr:** TCDR  
**XML:** Pending  

ANSI NIST ITL: Proposed Dental Forensic Data Supplement
Teeth shall be numbered utilizing the permanent and deciduous teeth codes in ANSI / ADA Specification No. 3950 (International Numbering System).

If the Permanent Or Deciduous Indicator (OTPC) indicates no distinction between deciduous and permanent teeth in the original encoding, the tooth shall be listed as permanent, even if the transmitted (or receiving) system is capable of distinguishing between the two types of teeth.
## Field 12.010 Tooth Data Details

**Mandatory**

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN</th>
<th>MAX</th>
<th>Value Constraints</th>
<th>Occurrence Min</th>
<th>Occurrence Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>300</td>
<td>Valid code from ANSI/ADA Specification No. 1058</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

### Tooth - Original System- Data Code

- The exact text utilized by the original system to code a tooth.
- Shall have a value of NONE if the original coding was performed by using the codes of ANSI / ADA Specification No. 1058 directly.

**Abbr:** TOET  
**XML:** biom:OriginalSystemToothEncodingText
Field 12.010 Tooth Data Detail

Mandatory

5

Tooth Data - ADA Reference Code Text

- Any code value in Section 9 of the ANSI / ADA Specification No. 1058 may be entered.

- The ANSI / ADA Specification No. 1058 coding system has a hierarchical arrangement so that codes with more nodes (represented by periods) provide greater specificity of the information concerning a characteristic.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN</th>
<th>MAX</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS</td>
<td>1</td>
<td>*</td>
<td>Valid code from ANSI/ADA Specification No. 1058 Section 9</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Abbr: TARC

XML: biom:ADARelativeCodeText
# Field 12.010 Tooth Data Detail

## Transmitted Tooth Encoding Text

- Utilized if the transmitting system is different than the originating system and tells of the translation that occurred when data was received.
- For OSN = NONE, there shall not be an entry in this information item.
- Record creation (transmitting) systems may have a different degree of coding then the original system which could dilute coding.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1</td>
<td>300</td>
<td>None</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Abbr:** TTET  
**XML:** biom:TransmittedSystemToothEncodingText
## Field 12.010 Tooth Data Detail

**Tooth ID Certainty Code**

- Some systems allow for an indication that tooth certainty may be in doubt:
  - **0** = Unspecified (the system does not have the capability of stating that there is uncertainty in the tooth number)
  - **1** = Certain
  - **2** = Uncertain

- If it is not entered, a TNCI of 0 is assumed.

<table>
<thead>
<tr>
<th>Optional Subfield</th>
<th>Character TYPE</th>
<th>MIN</th>
<th>MAX</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>N</td>
<td>1</td>
<td>1</td>
<td>TNCI = 0, 1 or 2</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Abbr:** TICC  
**XML:** biom:ToothIDCertaintyCode
## Field 12.010 Tooth Data Detail

### Tooth Additional Descriptive Text

- **Abbr:** TADT
- **XML:** `biom:AdditionalDescriptiveText`

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1</td>
<td>5000</td>
<td>None</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

- Used for codes that require text (by report)
Questions So Far???
EXAMPLE 1 - SINGLE SIMPLE RESTORATION

ITEM 12.010
## Plass Tooth Coding

### cef MOD

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.1</td>
<td>(Mesial)</td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.2</td>
<td>(Occlusal / Incisal)</td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.3</td>
<td>(Distal)</td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.4.2</td>
<td>(Composite)</td>
</tr>
</tbody>
</table>
## WinID Tooth Coding

**MOD E**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.1 (Mesial)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.2 (Occlusal / Incisal)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.3 (Distal)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.4.2 (Composite)</td>
<td></td>
</tr>
</tbody>
</table>
# UDIM Tooth Coding

## MOD mC

| 10A. 1 |
| 10B. 9.3.2.5.1.1 (Mesial) |
| 10A. 1 |
| 10B. 9.3.2.5.1.2 (Occlusal / Incisal) |
| 10A. 1 |
| 10B. 9.3.2.5.1.3 (Distal) |
| 10A. 1 |
| 10B. 9.3.2.5.4.2 (Composite) |
## NCIC Tooth Coding

**MOD**

<p>| | |</p>
<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.1 (Mesial)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.2 (Occlusal / Incisal)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.3 (Distal)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.4.9 (Other Rest.)</td>
<td></td>
</tr>
</tbody>
</table>
NAMUS Tooth Coding

10A. 1
10B. 9.3.2.5 (Restored)
Electronic Health Records

Two types of Data

- **Transactional Data** - based on the procedures done
  - This is the way dentist bill
- **Conditional Data** - base on evaluating the current status of a tooth
  - Identical to Forensics Data
  - HL 7
  - ICD-10-CM Medical Coding
  - SNOMED/SNODENT
  - EZ Code
### Electronic Health Record

**D2393 MOD**

- Resin-Based Composite - Three Surfaces, Posterior
- Date 10/12/2007

<table>
<thead>
<tr>
<th>Assembly</th>
<th>Surface Type</th>
<th>Notes</th>
</tr>
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<tbody>
<tr>
<td>10A. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.1</td>
<td>(Mesial)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.2</td>
<td>(Occlusal / Incisal)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.3</td>
<td>(Distal)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.4.2</td>
<td>(Composite)</td>
<td></td>
</tr>
</tbody>
</table>
EXAMPLE 2 - MULTIPLE COMPLEX RESTORATIONS

ITEM 12.010
### Plass Tooth Coding

<table>
<thead>
<tr>
<th>Category</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10A. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.2</td>
<td>(Occlusal / Incisal)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.4.1</td>
<td>(Amalgam)</td>
<td></td>
</tr>
<tr>
<td>10A. 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.2</td>
<td>(Occlusal / Incisal)</td>
<td></td>
</tr>
<tr>
<td>10A. 2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.4.9</td>
<td>(Other Restorative)</td>
<td></td>
</tr>
<tr>
<td>10A. 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.3</td>
<td>(Distal)</td>
<td></td>
</tr>
<tr>
<td>10A. 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.2</td>
<td>(Occlusal / Incisal)</td>
<td></td>
</tr>
<tr>
<td>10A.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.4.2</td>
<td>(Composite)</td>
<td></td>
</tr>
</tbody>
</table>

**ANSI NIST ITL:** Proposed Dental Forensic Data Supplement
Plass Tooth Coding

amf O cef MO uif O

10A. 1
10B. 9.3.2.5.1.2 (Occlusal / Incisal)
10A. 1
10B. 9.3.2.5.4.1 (Amalgam)
10A. 2
10B. 9.3.2.5.1.2 (Occlusal / Incisal)
10A. 2
10B. 9.3.2.5.4.9 (Other Restorative)
10A. 3
10B. 9.3.2.5.1.3 (Distal)
10A. 3
10B. 9.3.2.5.1.2 (Occlusal / Incisal)
10A. 3
10B. 9.3.2.5.4.2 (Composite)
### WinID Tooth Coding

**MO ES**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.3 (Distal)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.2 (Occlusal / Incisal)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.4.1 (Amalgam)</td>
<td></td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.4.2 (Composite)</td>
<td></td>
</tr>
</tbody>
</table>
### UDIM Tooth Coding

**DO mAC**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.3</td>
<td>(Distal)</td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.1.2</td>
<td>(Occlusal / Incisal)</td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.4.2</td>
<td>(Composite)</td>
</tr>
<tr>
<td>10A. 1</td>
<td></td>
</tr>
<tr>
<td>10B. 9.3.2.5.4.1</td>
<td>(Amalgam)</td>
</tr>
</tbody>
</table>
NCIC Tooth Coding

DO

10A. 1
10B. 9.3.2.5.1.1 (Distal)
10A. 1
10B. 9.3.2.5.1.2 (Occlusal / Incisal)
NAMUS Tooth Coding

F

10A. 1
10B. 9.3.2.5 (Restored)
The Problem With Transactionally Based Data
An Occlusal Amalgam Is Placed First

D2140 O

Amalgam - One Surface, Primary Or Permanent

Date 10/12/2007

10A. 1
10B. 9.3.2.5.1.2 (Occlusal / Incisal)

10A. 1
10B. 9.3.2.5.4.1 (Amalgam)
Next A DO Composite Is Placed

D2392 OD

Resin-Based Composite - Two Surfaces, Posterior

Date 10/12/2008

10A. 1
10B. 9.3.2.5.1.3 (Distal)
10A. 1
10B. 9.3.2.5.1.2 (Occlusal / Incisal)
10A. 1
10B. 9.3.2.5.4.2 (Composite)
Next A DO Composite Is Placed

D2392 OD

Resin-Based Composite - Two Surfaces, Posterior

Date 10/12/2008

Previous:
10A. 1
10B. 9.3.2.5.1.2 (Occlusal / Incisal)

10A. 1
10B. 9.3.2.5.1.2 (Occlusal / Incisal)

10A. 2
10B. 9.3.2.5.1.3 (Distal)

10A. 2
10B. 9.3.2.5.4.9 (Composite)

However it could also be.....

10A. 1
10B. 9.3.2.5.1.2 (Occlusal / Incisal)

10A. 1
10B. 9.3.2.5.1.2 (Occlusal / Incisal)

10A. 1
10B. 9.3.2.5.1.3 (Distal)

10A. 2
10B. 9.3.2.5.4.9 (Composite)
Procedural Based Codes

- Sequence is important
- The creation of a second filling does not negate the possibility that the first filling is still in place
- Certain assumptions can be made
  - The material of a filling placed on virgin surface can be determined
  - The material of a filling placed on non-virgin surface is always present but the removal of the previous material can never be determined
If the second filing starts like this.....

10A. 1
10B. 9.3.2.5.1.2 (Occlusal / Incisal)
10A. 1
10B. 9.3.2.5.4.9 (Other Rest. Material)
10A. 2
10B. 9.3.2.5.1.2 (Occlusal / Incisal)
10A. 2
10B. 9.3.2.5.1.3 (Distal)
10A. 2
10B. 9.3.2.5.4.9 (Composite)
Finally An O Composite Is Placed

D2391 O

But it could also be like this …..

| 10A. 1 |
| 10B. 9.3.2.5.4.2 (Composite) |
| 10A. 2 |
| 10B. 9.3.2.5.1.2 (Occlusal / Incisal) |
| 10A. 2 |
| 10B. 9.3.2.5.4.9 (Other Restorative) |
| 10A. 3 |
| 10B. 9.3.2.5.1.2 (Occlusal / Incisal) |
| 10A. 3 |
| 10B. 9.3.2.5.4.2 (Composite) |
| 10A. 3 |
| 10B. 9.3.2.5.1.3 (Distal) |
| 10A. 1 |
| 10B. 9.3.2.5.1.2 (Occlusal / Incisal) |

Resin-Based Composite - One Surfaces, Posterior

Date 10/12/2007

Previous:

10A. 1
10B. 9.3.2.5.1.2 (Occlusal / Incisal)
10A. 1
10B. 9.3.2.5.4.9 (Other Rest. Material)
10A. 2
10B. 9.3.2.5.1.2 (Occlusal / Incisal)
10A. 2
10B. 9.3.2.5.1.3 (Distal)
10A. 2
10B. 9.3.2.5.4.9 (Composite)
Finally An O Composite Is Placed

D2391 O

Resin-Based Composite - One Surfaces, Posterior

Date 10/12/2007

10A. 1
10B. 9.3.2.5.4.1 (Amalgam)
10A. 2
10B. 9.3.2.5.1.2 (Occlusal / Incisal)
10A. 2
10B. 9.3.2.5.4.9 (Other Restorative)
10A. 3
10B. 9.3.2.5.1.2 (Occlusal / Incisal)
10A. 3
10B. 9.3.2.5.4.2 (Composite)
10A. 3
10B. 9.3.2.5.1.3 (Distal)
10A. 1
10B. 9.3.2.5.1.2 (Occlusal / Incisal)
THE RULE:

Unless verified radiographically the only way to guarantee accuracy is to not transmit material data when a subsequent filling is placed on a previously restored surface of a previously restored tooth.
### Field 12.011 Mouth Data Detail

**Optional**

- Entry of information concerning the mouth

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subfields</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Abbr:** MDD  
**XML:** biom:MouthDataDetail
### Field 12.011 Mouth Data Detail

**Mouth Data Of Recording Date**

- Any code value in Section 10 of the ANSI / ADA Specification No. 1058 may be entered.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Encoding Specific</td>
<td>Encoding Specific</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>
### Field 12.011 Mouth Data Detail

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN</th>
<th>MAX</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN</td>
<td>3</td>
<td>15</td>
<td>Time Measure</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

- **Mandatory subfield 2**

- **Mouth Data Date Of Recording Date Estimated Accuracy Range**

- This is the amount of time (plus and minus) of which MCD is the center point during which the tooth data could have been originally collected.

**Abbr:** MCDR  
**XML:** Pending
# Field 12.011 Mouth Data Detail

**Mouth Data ADA Reference Code Text**

- Any code value in Section 10 of the ANSI / ADA Specification No. 1058 may be entered.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN</th>
<th>MAX</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1</td>
<td>3</td>
<td>Valid code from ANSI/ADA Specification No. 1058 Section 10</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Abbr:** MARC

**XML:** biom:ADARefERENCECODETEXT
Mouth Additional Descriptive Text

- Used for those codes that require text (by report)

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN</th>
<th>MAX</th>
<th>Value Constraints</th>
<th>Occurrence Min</th>
<th>Occurrence Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1</td>
<td>5000</td>
<td>None</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Abbr: MADT

XML: biom:AdditionalDescriptiveText

ANSI NIST ITL: Proposed Dental Forensic Data Supplement
### Optional

- Reserved For Future Use Only By ANSI/NIST-ITL

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserved For Future Use Only By ANSI/NIST-ITL</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Field 12.020: Comment / COM

#### Optional

- Optional text field

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>1</td>
<td>125</td>
<td>None</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>
These fields are user-defined fields. Their size and content shall be defined by the user and be in accordance with the receiving agency.
Field 12.902: Annotation information

Optional

- This is an optional field, listing the operations performed in order to prepare this biometric record type.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
</table>

Subfields

Abbr: ANN

XML: biom:ProcessAnnotation
Field 12.902: Annotation information

Optional ??

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td>Encoding Specific</td>
<td>Encoding Specific</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

1. Greenwich Mean Time / GMT
2. Processing Algorithm Name / Version
3. Algorithm Owner
4. Process Description
Field 12.993: Source Agency Name

Optional

- This is an optional field. It may contain up to 125 Unicode characters. It is the name of the agency referenced in Field 12.004: Source Agency / SRC.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1</td>
<td>125</td>
<td>None</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Abbr: SAN

XML: Pending
## Field 12.995: Associated Context

**Optional**

- Refers to one or more Record(s) Type-21.
- An example of the use of this field would be to transmit an image of an unidentified body at the location where it was discovered.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Subfields</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Field 12.995: Associated Context

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>1</td>
<td>255</td>
<td>Sequentially assigned</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

- **Mandatory Subfield**
  - 1: Associated Context Number
  - 2: Associated Segment Position
Field 12.997: Source Representation

Optional

- Used for biometric sample derived from a source representation in Record Type-20 (Type 20 - Parts of records derived from other record types)
- An example of the use of this field would be when data is extracted from a representation, such as a group photograph, which is stored in a Type-20 record. The facial image of the subject of the transaction may be segmented and placed in a Type-10 record.

**Abbr:** SOR  **XML:** biom:SourceRepresentation
### Field 12.997: Source Representation

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN</th>
<th>MAX</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>1</td>
<td>255</td>
<td>sequentially assigned</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Mandatory**

1. Source Representation Number
2. Reference Segment Position
Field 12.998: Geographic Sample Acquisition Location

Optional

- Location where the image(s) / sample(s) were acquired - not where it is stored.

- If different locations are applicable for the images / samples / data then separate instances of Record Type-12 should be created and transmitted jointly in the same transaction.

Abbr: GEO

XML: biom:CaptureLocation
Making it Happen

XML (Extensible Markup Language)
<?xml version="1.0" encoding="UTF-8"?>
<!-- ***************************** -->
<!-- RECORD TYPE 12 Forensic Dental Record-->  
<!-- ***************************** -->
<itl:PackageForensicDentalDataRecord>
Example XML For Type-12 Record

Record Category

WinID

Plass

<itl:PackageForensicDentalDataRecord>
  <!-- 12.001 -->
  <biom:RecordCategoryCode>
    12
  </biom:RecordCategoryCode>
Example XML For Type-12 Record

FBI - Information Designation Character

<!-- 12.002 IDC -->
<biom:ImageReferenceIdentification>
  <nc:IdentificationID>
    4
  </nc:IdentificationID>
</biom:RecordCategoryCode>
Example XML For Type-12 Record

Time Of Record

WinID

<!-- GMT -->
<biom:ProcessUTCDate>
  <nc:DateTime>
    2011-11-05T05:25:00Z
  </nc:DateTime>
</biom:ProcessUTCDate>
</biom:ProcessAnnotation>

Plass
Example XML For Type-12 Record

Location Of Record

<biom:DentalData>
  <biom:BiometricCaptureDetail>
    <!-- 12.998 GEO -->
    <biom:CaptureLocation>
      <!-- GRT -->
      <nc:LocationDescriptionText>
        Washington and Madison, Geneva, NY
      </nc:LocationDescriptionText>
    </biom:CaptureLocation>
  </biom:BiometricCaptureDetail>
</biom:DentalData>
Example XML For Type-12 Record

Organization Name

WinID

<!-- 12.005 CON -->
<biom:CaptureOrganization>
  <nc:OrganizationName>
    Hurricane Sandy DVI Team
  </nc:OrganizationName>
</biom:CaptureOrganization>
</biom:BiometricCaptureDetail>

Plass
Example XML For Type-12 Record

Subject Status Code

<!-- 12.006 DSI -->
<biom:DentalSubject>
<!-- DSC -->
  <biom:SubjectStatusCode>
    2
  </biom:SubjectStatusCode>
</biom:DentalSubject>

Data obtained from a living person
Example XML For Type-12 Record

Subject Last Contact Date

```xml
<!-- DLCD -->
<biom:SubjectLastContactDate>
  <nc:Date>
    2010-12-25
  </nc:Date>
</biom:SubjectLastContactDate>
```
Example XML For Type-12 Record

Person Birth Date

<!-- DPBD -->
<nc:PersonBirthDate>
  <nc:Date>
    1953-04-23
  </nc:Date>
</nc:PersonBirthDate>
</biom:DentalSubject>
Example XML For Type-12 Record

Dental Encoding System

<!-- 12.007 ODES-->
<biom:OriginalDentalEncodingSystemInformation>
  <!-- OSNC -->
  <biom:SystemNameCode>
    WinID
  </biom:SystemNameCode>
  <!-- OSVT -->
  <biom:SystemVersionText>
    Version 3.63
  </biom:SystemVersionText>
</biom:OriginalDentalEncodingSystemInformation>
Example XML For Type-12 Record

Original System Info

<!-- OTPC -->
<biom:ToothPermanenceCategoryCode>
  0
</biom:ToothPermanenceCategoryCode>
<!-- ORDG -->
<!-- ORDG -->
<biom:RestorationDataGranularityCode>
  31
</biom:RestorationDataGranularityCode>
</biom:OriginalDentalEncodingSystemInformation>

Permanent tooth specified by tooth number,
Restorations with individual restored surfaces of amalgam materials

ANSI NIST ITL:
Proposed Dental Forensic Data Supplement
Tooth Data

```xml
<!-- 12.010 TDD -->
<biom:ToothData>
  <biom:ToothDataDetail>
    <biom:CaptureDate>
      <nc:Date>
        2012-01-01
      </nc:Date>
    </biom:CaptureDate>
  </biom:ToothDataDetail>
</biom:ToothData>
```

WinID

Plass
Example XML For Type-12 Record

Tooth Info

WinID

#18

<!-- TID -->
<biom:ToothID>
37
</biom:ToothID>
<!-- TOET -->
<biom:OriginalSystemToothEncodingText>
MOD E
</biom:OriginalSystemToothEncodingText>

Plass

#37
Example XML For Type-12 Record

Tooth Info

WinID

#8

MO

<!-- TARC -->

<biom:ADAReferenceCodeText>
  9.3.2.5.1.1
</biom:ADAReferenceCodeText>

<biom:ADAReferenceCodeText>
  9.3.2.5.1.2
</biom:ADAReferenceCodeText>

Plass

#37

mo
Example XML For Type-12 Record

Tooth Info

WinID

#8 MOD E

<biom:ADARefERENCECODETEXT>
  9.3.2.5.1.3
</biom:ADARefERENCECODETEXT>

<biom:ADARefERENCECODETEXT>
  9.3.2.5.4.2
</biom:ADARefERENCECODETEXT>

<!-- TTET -->

<biom:TRANSMITTEDTOOTHENCODINGTEXT>
  MOD E
</biom:TRANSMITTEDTOOTHENCODINGTEXT>

Plass

#37 mod mod
Tooth Info

WinID

#8 MOD E

<-- TICC -->
<biom:ToothIDCertaintyCode>
  0
</biom:ToothIDCertaintyCode>
<-- TADT -->
<biom:ToothDataDetail>
</biom:ToothData>

Plass

#37 cef mod
Questions So Far???

Type 12 Records
Type 10 Records

DENTAL AND ORAL COMPARISON CANDIDATES DATA
Field 10.046: Subject

Optional

- If the image is a pattern injury or latent image on a person, this field is used to describe the victim.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>SUBFIELDS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abbr: SUB

XML: biom:SubjectData
Field 10.046: Subject

Mandatory Subfield

1 Subject Current Status Code

Possible entries are:

- 0 = Status of individual unknown
- 1 = Data obtained from a living person – victim or person unable to identify themselves
- 2 = Data obtained from a living person – as a candidate for comparison to a latent print or a pattern injury
- 3 = Data obtained from a decedent – victim, or unknown deceased
- 4 = Data obtained from a decedent – as a candidate for comparison to a latent print or a pattern injury

Abbr: SSC

XML: biom:SubjectStatusCode
Field 10.046: Subject

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN</th>
<th>MAX</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4</td>
<td>6</td>
<td>OSN= DICOM, EDR, FastID, NCIC, NEMA, PLASS, UDIM, WinID, OTHER or NONE</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

### Subject Body Status Code

- Information relates to an entire corpse or a separate body part
  - 1 = Whole
  - 2 = Fragment

**Abbr:** SBSC  
**XML:** `biom:SubjectBodyStatusCode`
### Field 10.046: Subject

**Dependent**

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1</td>
<td>5000</td>
<td>none</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Subject Body Class Code

- **Condition of the body**
  - 1 = Natural Tissue
  - 2 = Decomposed
  - 3 = Skeletal

**Abbr:** SBCC  
**XML:** `biom:SystemNameCode`
**Field 10.046: Subject**

**Subject Identifier Descriptive Text**

- A unique identifier for the subject of this record (who may not be the subject of the transaction)
- This is so that the victim or person unable to identify themself is distinguished from the record that carry information to be compared against pattern injuries or latent prints on the victim or person unable to identify themself
- It may be a name or a case number or other means of correlating the data to a particular person / file

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1</td>
<td>5000</td>
<td>none</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Abbr:** SIDT  
**XML:** biom:SubjectBodyClassCode
### Field 10.047: Capture Organization Name

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>4</td>
<td>1000</td>
<td>none</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Optional**

- Agency responsible for collected the data
- This can be different from the agency entered in Field 12.004: Source agency / SRC

**Abbr:** CON  
**XML:** biom:CaptureOrganization
Field 10.048: Pattern Injury Image Description

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>PIL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Optional**

- This field describes the pattern injury
Field 10.048: Pattern Injury Image Description

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANS</td>
<td>3</td>
<td>5</td>
<td>Value from Dental Supplement Table 2</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Pattern Injury Code**

- It is the pattern injury code
- See Table Dental Supplement 2.
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Requires Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1</td>
<td>Abrasion</td>
<td>No</td>
</tr>
<tr>
<td>1.2</td>
<td>Artifact</td>
<td>Yes</td>
</tr>
<tr>
<td>1.3</td>
<td>Avulsion</td>
<td>No</td>
</tr>
<tr>
<td>1.4</td>
<td>Contusion (ecchymosis)</td>
<td>No</td>
</tr>
<tr>
<td>1.5</td>
<td>Perforation (Incision)</td>
<td>No</td>
</tr>
<tr>
<td>1.6</td>
<td>Laceration</td>
<td>No</td>
</tr>
<tr>
<td>1.7</td>
<td>Petechial hemorrhage</td>
<td>No</td>
</tr>
<tr>
<td>1.8</td>
<td>Other</td>
<td>Yes</td>
</tr>
</tbody>
</table>
## Color Of The Pattern Injury

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Requires Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1</td>
<td>Red</td>
<td>No</td>
</tr>
<tr>
<td>2.2</td>
<td>Violet</td>
<td>No</td>
</tr>
<tr>
<td>2.3</td>
<td>Red</td>
<td>No</td>
</tr>
<tr>
<td>2.4</td>
<td>Violet / Magenta</td>
<td>No</td>
</tr>
<tr>
<td>2.5</td>
<td>Blue</td>
<td>No</td>
</tr>
<tr>
<td>2.6</td>
<td>Purple/ Black</td>
<td>No</td>
</tr>
<tr>
<td>2.7</td>
<td>Blue</td>
<td>No</td>
</tr>
<tr>
<td>2.8</td>
<td>Green</td>
<td>No</td>
</tr>
<tr>
<td>2.9</td>
<td>Dark Yellow</td>
<td>No</td>
</tr>
<tr>
<td>2.1</td>
<td>Pale Yellow</td>
<td>No</td>
</tr>
<tr>
<td>2.11</td>
<td>Brown</td>
<td>No</td>
</tr>
<tr>
<td>2.12</td>
<td>Other color</td>
<td>No</td>
</tr>
</tbody>
</table>
## Surface Contour

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Requires Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1</td>
<td>Flat</td>
<td>No</td>
</tr>
<tr>
<td>3.2</td>
<td>Curved</td>
<td>No</td>
</tr>
<tr>
<td>3.3</td>
<td>Irregular (such as on loose skin)</td>
<td>Yes</td>
</tr>
<tr>
<td>3.4</td>
<td>Unknown</td>
<td>No</td>
</tr>
</tbody>
</table>
## Shape Of Pattern Injury

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Requires Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Round</td>
<td>No</td>
</tr>
<tr>
<td>4.2</td>
<td>Ovoid</td>
<td>No</td>
</tr>
<tr>
<td>4.3</td>
<td>Crescent</td>
<td>No</td>
</tr>
<tr>
<td>4.4</td>
<td>Diamond</td>
<td>No</td>
</tr>
<tr>
<td>4.5</td>
<td>Rectangular</td>
<td>No</td>
</tr>
<tr>
<td>4.6</td>
<td>Irregular/Multiple</td>
<td>Yes</td>
</tr>
</tbody>
</table>
## Surface Tissue Characteristics

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Requires Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Fixed</td>
<td>No</td>
</tr>
<tr>
<td>5.2</td>
<td>Mobile</td>
<td>No</td>
</tr>
<tr>
<td>5.3</td>
<td>Unknown</td>
<td>No</td>
</tr>
<tr>
<td>Code</td>
<td>Description</td>
<td>Requires Text</td>
</tr>
<tr>
<td>------</td>
<td>--------------------------------------------------</td>
<td>---------------</td>
</tr>
<tr>
<td>6.1</td>
<td>Bone</td>
<td>No</td>
</tr>
<tr>
<td>6.2</td>
<td>Cartilage (including ears and nose)</td>
<td>No</td>
</tr>
<tr>
<td>6.3</td>
<td>Muscle (including buttocks)</td>
<td>No</td>
</tr>
<tr>
<td>6.4</td>
<td>Fat (including breasts)</td>
<td>No</td>
</tr>
<tr>
<td>6.5</td>
<td>Other (including penis, testicles, Achilles tendon)</td>
<td>Yes</td>
</tr>
</tbody>
</table>
## Cause Of Pattern Injury

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
<th>Requires Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1</td>
<td>Suggestive of animal origin</td>
<td>Yes</td>
</tr>
<tr>
<td>7.2C</td>
<td>Caused by NON-animal (e.g. ringworm)</td>
<td>Yes</td>
</tr>
<tr>
<td>7.2S</td>
<td>Suggestive of NON-animal organic agent causation</td>
<td>Yes</td>
</tr>
<tr>
<td>7.3C</td>
<td>Caused by NON-formally living organism</td>
<td>Yes</td>
</tr>
<tr>
<td>7.3S</td>
<td>Suggestive of NON-formally living organism causation</td>
<td>Yes</td>
</tr>
<tr>
<td>7.4C</td>
<td>Caused by other object (e.g. meat tenderizing hammer, zipper, chain, etc..)</td>
<td>Yes</td>
</tr>
<tr>
<td>7.4S</td>
<td>Suggestive of being caused by other object (e.g. meat tenderizing hammer)</td>
<td>Yes</td>
</tr>
<tr>
<td>7.5C</td>
<td>Caused by impact</td>
<td>Yes</td>
</tr>
<tr>
<td>7.5S</td>
<td>Suggestive of being caused by impact</td>
<td>Yes</td>
</tr>
<tr>
<td>7.6C</td>
<td>Caused by self-inflicted biting</td>
<td>Yes</td>
</tr>
<tr>
<td>7.6S</td>
<td>Suggestive of self-inflicted biting</td>
<td>Yes</td>
</tr>
<tr>
<td>7.7C</td>
<td>Caused by a bite mark from another human being</td>
<td>Yes</td>
</tr>
<tr>
<td>7.7S</td>
<td>Suggestive of a bite mark from another human</td>
<td>Yes</td>
</tr>
<tr>
<td>7.8C</td>
<td>Caused by an unknown human making a bite</td>
<td>Yes</td>
</tr>
<tr>
<td>7.8S</td>
<td>Suggestive of a human bite mark – unknown agent</td>
<td>Yes</td>
</tr>
<tr>
<td>7.9</td>
<td>Suggestive of a bite mark pattern but no determination made</td>
<td>Yes</td>
</tr>
<tr>
<td>7.1</td>
<td>Suggestive of not being caused by a bite but no determination made</td>
<td>Yes</td>
</tr>
<tr>
<td>7.11</td>
<td>Not caused by a bite</td>
<td>Yes</td>
</tr>
<tr>
<td>7.12</td>
<td>Inconclusive</td>
<td>Yes</td>
</tr>
<tr>
<td>7.13</td>
<td>No determination or speculation as to causing agent / unknown</td>
<td>No</td>
</tr>
</tbody>
</table>
### Field 10.048: Pattern Injury Or Latent Print Image Pattern Injury Descriptive Text

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1</td>
<td>1000</td>
<td>None</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

- **Dependent**

- **Pattern Injury Or Latent Print Image Pattern Injury Descriptive Text**

- Used to describe those PIC codes marked as requiring text in Table Dental Supplement 2 for pattern injuries

**Abbr:** PIDT  
**XML:** `biom:PatternInjuryDescriptiveText`
Field 10.049: Cheiloscopic Image Description

**Optional**

- Used only if Field 10.003 Image type / IMT is not SCAR, MARK or TATTOO.
- Specifies the location on the body where the (suspected) lip print occurred.
- If the (suspected) lip print is upon an object, the image shall be transmitted using Record Type-21, since Record Type-10
- This field may be also used for an image of the lips themselves, in which case, IMT shall be FACE.

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN</th>
<th>MAX</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUBFIELDS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Abbr:** CID

**XML:** biom:CheiloscopicImageData
### Optional

1. **Lip Print Width**

- The longest dimensions of the image measured with a standard ABFO #2 scale ruler

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN</td>
<td>1</td>
<td>100</td>
<td>None</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Abbr:** LPW

**XML:** `biom:LipPrintWidthValue`
Field 10.049: Cheiloscopy Image Description

Mandatory

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN</th>
<th>MAX</th>
<th>Value Constraints</th>
<th>Occurrence Min</th>
<th>Occurrence Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN</td>
<td>1</td>
<td>100</td>
<td>None</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Lip Print Height

- The shortest dimensions of the image, taken at a 90 degree angle from the width of the image measured with a standard ABFO # 2 scale ruler
Field 10.049: Cheiloscopic Image Description

Optional

3

Lip Print Descriptive Text

- Lip print description
- Typical entry may be: “Lip print with lipstick on the neck” or “image of the lips”.

Abbr: LPDT

XML: biom:LipPrintDescriptiveText
Field 10.049: Cheiloscopic Image Description

Optional

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1</td>
<td>1000</td>
<td>None</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Lip Print Descriptive Text

- Analyst may wish to include Suzuki and Tsuchihashi classifications
  - Type I – Vertical grooves
  - Type I’ – Partial length grooves
  - Type II – Branched grooves
  - Type III – Intersecting grooves
  - Type IV – Reticular grooves
  - Type V – Irregular grooves

Abbr: LPDT

XML: biom:LipPrintDescriptiveText
Field 10.050: Dental Visual Image Data

Mandatory

- Images of oral and perioral region
- Multiple subfields, each with a separate image

Abbr: VID

XML: biom:VisualImage Data
### Field 10.050: Dental Visual Image Data

**Mandatory**

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date</td>
<td></td>
<td></td>
<td>Encoding Specific</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Visual Image Capture Date**

- Date of imaging

**Abbr:** VCD

**XML:** biom:VisualImageCollectionDate
Field 10.050: Dental Visual Image Data

### Mandatory

- **Character TYPE**
- **MIN #**
- **MAX #**
- **Value Constraints**
- **Occurrence Min #**
- **Occurrence Max #**

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>AN</td>
<td>3</td>
<td>15</td>
<td>Time Measure</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

#### Visual Image Capture Date Estimate Range

- This is the amount of time (plus and minus) of which VCD is the center point during which the tooth data could have been originally collected.

- Format = YyyyyMmmDdd. Ex D05, means plus or minus 5 days from VUD.

**Abbr:** VCDR  
**XML:** biom:DateRangeText
### Field 10.050: Dental Visual Image Data

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
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<tr>
<td>NS</td>
<td>3</td>
<td>30</td>
<td>Valid code from ANSI/ADA Standard No. 1058, Section 11.2 (integers and periods are in the codes)</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Mandatory subfield**

### Visual Image ADA Reference Code

- Any code value in Section 11.2 of the *ANSI/ADA Standard No. 1058*
  - 11.2.2.1 Frontal View
  - 11.2.2.2 Buccal Right and Buccal Left Views
  - 11.2.2.3 Maxillary Palatal Right, Maxillary Palatal Left, Lingual Right and Lingual Left Views
  - 11.2.2.4 Occlusal Maxillary and Mandibular Views

**Abbr:** VARC  
**XML:** biom:ADARefERENCECODETEXT
Field 10.050: Dental Visual Image Data

Visual Image Additional Descriptive Text

- Additional free text information item
- An example is “post-mortem with lips retracted”
## Field 10.051: Radiograph Image Data

### Mandatory

- Used to describe a radiograph

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN</th>
<th>MAX</th>
<th>Value Constraints</th>
<th>Occurrence Min</th>
<th>Occurrence Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>RID biom:RadiographImageData</td>
<td></td>
<td></td>
<td>SUBFIELDS</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Abbr:** RID  
**XML:** biom:RadiographImageData
# Field 10.051: Radiograph Image Data

## Mandatory

1. **Radiograph Image Capture Date**
   - Date of imaging

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
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<tbody>
<tr>
<td>Date</td>
<td>Encoding Specific</td>
<td>Encoding Specific</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

Abbr: RUD

XML: Pending
Field 10.051: Radiograph Image Data

Optional

Radiograph Image Capture Date Estimate Range

- This is the amount of time (plus and minus) of which RUD is the center point during which the tooth data could have been originally collected.
- Format = YyyyyMmmDdd. Ex D05, means plus or minus 5 days from RUD.
Field 10.051: Radiograph Image Data

**Mandatory**

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
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<tr>
<td>NS</td>
<td>3</td>
<td>30</td>
<td>Valid code from ANSI/ADA Standard No. 1058, Section 12.5 (integers and periods are in the codes)</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

### Radiograph Size

- Radiograph size
- Any code value in Section 12.5 of the ANSI/ADA Standard No. 1058 may be entered.
- Only one value may be entered
- Each image requires a separate Type-10 record within the transaction.

**Abbr:** RGS

**XML:** `biom:ADARelativeCodeText`
Field 10.051: Radiograph Image Data

**Mandatory**

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td>NS</td>
<td>3</td>
<td>30</td>
<td></td>
</tr>
</tbody>
</table>

Valid code from ANSI/ADA Standard No. 1058, Section 12.5 (integers and periods are in the codes)

**Occurrence**

<table>
<thead>
<tr>
<th>Min #</th>
<th>Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Radiograph Size**

- 12.5.1 ISO/ANSI standard radiographic size film
- Examples of standard radiographic film sizes are:
  - 12.5.2 Child Periapical size 0 Film measures 7/8” x 1 9/16”
  - 12.5.3 Adult Periapical size 2 Film measures 11/4” x 15/8”
  - 12.5.4 Occlusal size 4 Film - 21/4” x 3”

**Abbr:** RGS

**XML:** biom:ADAResourceCodeText
Radiograph Image Series

- Any code value in Section 12.6 of the ANSI/ADA
- Standard No. 1058 may be entered.
  - 12.6.4 As a general rule, a full mouth series is composed of 18 to 20 films:
  - 12.6.4.1 Four bitewings
  - 12.6.4.1.1 Two molar bitewings (left and right)
  - 12.6.4.1.2 Two premolar bitewings (left and right)
  - 12.6.4.1.3 One extra wide bitewing may be substituted (left and right) but not preferred for forensic odontological identifications
  - 12.6.4.2 Eight posterior periapicals
  - 12.6.4.2.1 Two maxillary molar periapicals (left and right)
  - 12.6.4.2.2 Two maxillary premolar periapicals (left and right)
  - 12.6.4.2.3 Two mandibular molar periapicals (left and right)
  - 12.6.4.2.4 Two mandibular premolar periapicals (left and right)
  - 12.6.4.3 Six to eight anterior periapicals
  - 12.6.4.3.1 Two maxillary canine periapicals (left and right)
  - 12.6.4.3.2 Two mandibular canine periapicals (left and right)
  - 12.6.4.3.3 Two central incisor periapicals (maxillary and mandibular): Where size #1 periapical film is used, three incisor views are made in the maxilla (one for each lateral incisor and one for the centrals).

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
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<tr>
<td>NS</td>
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<td>30</td>
<td>Valid code from ANSI/ADA Standard No. 1058, Section 12.6 (integers and periods are in the codes)</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Abbr: RIS

XML: biom:ADAResourceCodeText

Field 10.051: Radiograph Image Data
Field 10.051: Radiograph Image Data

**Mandatory**

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
</tr>
</thead>
<tbody>
<tr>
<td>U</td>
<td>1</td>
<td>50</td>
<td>None</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**Radiograph Image In Series Text**

- Which radiograph image in series text
- This is used to specify which individual image in a particular series is conveyed in this subfield.
- For example, if code 12.6.4.2.1 is selected (Two maxillary molar periapicals), this information item would specify ‘right’ for one Type-12 record and ‘left’ for another instance of Type-12

Abbr: RIIS

XML: biom:RadiographImageInSeriesText
Field 10.051: Radiograph Image Data

### Optional

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
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<td>U</td>
<td>1</td>
<td>*</td>
<td>None</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

**Radiograph Practitioner Information Text**

- Free text information item. It should contain the practitioner’s name, address and telephone or other contact information.
- May also be used for additional explanatory text, such as any unique features associated with the radiograph.

Abbr: RPRI  
XML: biom:RadiographPractitionerInformationText
Field 10.051: NEMA DICOM Data

Optional

- Ideally, images are transferred electronically to the requesting agency in DICOM format. If the requesting agency does not have software that can read the DICOM format directly, then a DICOM Viewer with basic image export feature should be provided.
- Contains descriptions of data formatted according to the standard Digital Imaging and Communications in Medicine (DICOM) of the National Electrical Manufacturers Association.
- The data itself may also be included in this field.

Abbr: DICM

XML: Pending
Field 10.051: NEMA DICOM Data

**Mandatory**

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence</th>
<th>Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>1</td>
<td>1</td>
<td>Binary Base64 object</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

DICOM Data

- Base64 representation of the data.

Abbr: DICD

XML: Pending
Field 10.051: NEMA DICOM Data

**Mandatory**

<table>
<thead>
<tr>
<th>Character TYPE</th>
<th>MIN #</th>
<th>MAX #</th>
<th>Value Constraints</th>
<th>Occurrence Min #</th>
<th>Occurrence Max #</th>
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</thead>
<tbody>
<tr>
<td>ANS</td>
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<td>*</td>
<td>None</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

DICOM Source External File Reference Text

- Describing external file location

**Abbr:** DSEF  
**XML:** biom:SourceExternalFileReferenceText
Questions So Far???

Type 10 Records
USE CASE SCENARIOS
Use Case 1

Suspected Pattern Injuries Of Intraoral Origin on a Human Victim With Dental Records Available from a Human Potential Comparison Candidate and one Canine.

- **Type-1** record (mandatory)
- **Type-2** record
Use Case 1

Records associated with the victim

- **Type-10** record containing a photograph of the pattern injury and any associated metadata.
- **Type-21** (optional) image of the person when the victim was found or the location where the injury supposedly occurred (such as on the front porch of the house).
Use Case 1

Records associated with the human candidate for comparison

- **Type-10** record containing a dental images of the human candidate.
Use Case 1

Records associated with the canine candidate for comparison

- **Type-21** record containing a dental images of the canine candidate.
Use Case 2

Body exhumed in cold-case for identification (no soft tissue; but hair, bones and teeth intact) -- no fingerprints possible -- no facial features

- **Type-1** record (mandatory)
- **Type-2** record containing information about the subject of the transaction. In this case it would be the victim. Complete in accordance with instructions of the implementation domain (such as NORAM or INTERPOL or RCMP)
Use Case 2

Records associated with the victim

- **Type-10** records containing images of the body as it is exhumed, and artifacts still intact that were buried with the victim
- **Type-21** records containing images of the exhumation process and artifacts still intact that were buried with the victim.
- **Type-21** record with either digital images of the original autopsy with the location of the report’s location
Use Case 2

Records associated with the victim

- **Type-10** record with radiograph images of the subject. Note that one Type-10 record instance is required for each radiograph.
- **Type-12** record containing charting of the buried victim.
Use Case 3

Latent prints of possible perioral origin on a glass - With lip print images available from a comparison candidate.

- **Type-1** record (mandatory)
- **Type-2** record containing information about the subject of the transaction. In this case it would be the victim. Complete in accordance with instructions of the implementation domain (such as NORAM or INTERPOL or RCMP)
Use Case 3

Records associated with the victim

- A **Type-21 record** (Source representation record) would be created for the image of the glass including the image of the lip print.
Use Case 2

Records associated with the comparison subject

- **Type-10 record** would convey a lip print image from a potential comparison subject.
Type 20 Records

No Changes

DENTAL AND ORAL COMPARISON CANDIDATES DATA

ANSI NIST ITL:
Proposed Dental Forensic Data Supplement
FOR FURTHER INFORMATION:

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Kenneth Aschheim,
forensics@dental-nyc.com
212 988 2955

HTTP: //WWW.NIST.GOV/ITL/IAD /IG/
ANSI_STANDARD.CFM
Dental Research at the Office of Chief Medical Examiner

New York City
Coding Granularity

HOW MUCH DO WE NEED TO CODE??
Simple vs. Detail Coding

The Capulets

The Montagues

The Dentists

The Anthropologist
## Selective MFI Major Disasters

<table>
<thead>
<tr>
<th>Year</th>
<th>Type</th>
<th>Location</th>
<th>Deaths/Pct</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>Earthquake</td>
<td>Haiti</td>
<td>230,000</td>
</tr>
<tr>
<td>2008</td>
<td>Earthquake</td>
<td>China</td>
<td>87,476</td>
</tr>
<tr>
<td>2008</td>
<td>Storm</td>
<td>Myanmar</td>
<td>133,655</td>
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<tr>
<td>2007</td>
<td>Storm</td>
<td>Bangladesh</td>
<td>4,234</td>
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<tr>
<td>2006</td>
<td>Earthquake</td>
<td>Indonesia</td>
<td>5,778</td>
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<tr>
<td>2005</td>
<td>Earthquake</td>
<td>Pakistan</td>
<td>73,338</td>
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<tr>
<td>2005</td>
<td>Storm</td>
<td>United States</td>
<td>1,833</td>
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<tr>
<td>2004</td>
<td>Earthquake</td>
<td>Indonesia, Thailand, India</td>
<td>225,841</td>
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<tr>
<td>2004</td>
<td>Storm</td>
<td>Haiti</td>
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<tr>
<td>2004</td>
<td>Flood</td>
<td>Haiti</td>
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<td>Earthquake</td>
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<td>Extreme heat</td>
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<td>Storm</td>
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<td>India</td>
<td>2,541</td>
</tr>
<tr>
<td>1998</td>
<td>Earthquake</td>
<td>Afghanistan</td>
<td>2,323</td>
</tr>
<tr>
<td></td>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>987,191</strong></td>
</tr>
</tbody>
</table>

**Average:** 37,969
What We Know?

- We (NYC/USA) have handled disasters up to 3,000 victims
- This means that Software such as WinID, Plass (Interpol) and even UDIM tested up to 3,000 victims
- We have not had a database of antemortem and postmortem dental data big enough to test our readiness
- Dental Data is very specific i.e. fillings are not randomly placed
- We have never really been tested
We Need Data To Test The System
Total Victims: 2,823
Total Victims Identified: 1,058
Uniformed Officers Among Those Identified:
  - 189 FDNY
  - 20 PAPD
  - 14 NYPD
  - 3 Non-FDNY EMS
  - 7 Court Officers & Others
Remains Recovered: 19,497
Whole Bodies Recovered: 289
Debris Removed: 1,610,852 Tons
Background of Study

- Studies by Adams (2003) suggested that dental patterns formed by missing, filled, and unrestored teeth are very individualistic.
  - Statistical frequencies were found to be similar to mtDNA
  - Coding strategies did NOT affect frequency (except with significant postmortem loss)
- OdontoSearch Program
  www.jpac.pacom.mil
• Program calculates pattern frequency using either “Generic” or “Detailed” coding formats
• Appropriate for use when an antemortem and postmortem record match is discovered
• These results remove the subjectivity involved in making determinations on the strength of a match, especially when AM radiographs are not available.
• Results can be used to quantify to strength of a potential match between a missing individual and an unidentified body.
• It is NOT a tool for providing victim ranks.
We need to create a program to “transition data” from antemortem to postmortem data.
Ante-Post Transitioning Occurs in Four ways

- Codes **Do Not Change**
- Codes move in a **Logical Direction** of change via explainable discrepancies
- Codes move in an **Illogical Direction** of change via unexplainable discrepancies
- Codes do not move because of **No Information**
Identical

Antemortem

Postmortem

Antemortem Tooth #19  O Amalgam

Postmortem Tooth #19  O Amalgam

No Change
Reconcilable Discrepancy (Possible - “P”)

Antemortem Tooth #19 Virgin

Postmortem Tooth #19 O Amalgam

Logical Direction Of Change
Irreconcilable Discrepancy (Miss - “M”) ANTE To POST

Antemortem Tooth #19 O Amalgam

Postmortem Tooth #19 Virgin

Illogical Direction Of Change
reconcilable Discrepancy (No Information “N”)

Antemortem

Postmortem

Antemortem Tooth #19 MOD

No Information

Amalgam

No Information
We Created 10 separate database

- No Transitions Per Record (V)
- 2 Explainable Transitions Per Record (P2)
- 4 Explainable Transitions Per Record (P4)
- 6 Explainable Transitions Per Record (P6)
- 2 Unexplainable Transitions Per Record (M2)
- 4 Unexplainable Transitions Per Record (M4)
- 6 Unexplainable Transitions Per Record (M6)
- 1 Explainable / 1 Unexplainable Transitions Per Record (B2)
- 3 Explainable / 2 Unexplainable Transitions Per Record (B4)
- 3 Explainable / 3 Unexplainable Transitions Per Record (B6)
A Recipe For The "Perfect" Database

<table>
<thead>
<tr>
<th>Database</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect</td>
<td>5.0%</td>
</tr>
<tr>
<td>P2</td>
<td>7.5%</td>
</tr>
<tr>
<td>P4</td>
<td>7.5%</td>
</tr>
<tr>
<td>P6</td>
<td>2.5%</td>
</tr>
<tr>
<td>M2</td>
<td>7.5%</td>
</tr>
<tr>
<td>M4</td>
<td>7.5%</td>
</tr>
<tr>
<td>M6</td>
<td>2.5%</td>
</tr>
<tr>
<td>B2 (P1/M1)</td>
<td>20.0%</td>
</tr>
<tr>
<td>B4 (P2/M2)</td>
<td>20.0%</td>
</tr>
<tr>
<td>B6 (P3/M3)</td>
<td>20.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
What We Discovered

- Having a large scale reference database opens up many opportunities to test numerous scenarios and algorithms
- Evidence based testing is vital to determine effects of numerous scenarios
- Current software is able to function to the 30,000 victim level with excellent performance
Using the Data

THIS DATABASE HAS BECOME A TREMENDOUS TOOL FOR RESEARCH

WHAT ELSE DID WE DISCOVER
Data Codes Were Converted

Now What …..

SO NOW WE ARE LEFT WITH ONE SET OF DATA

WE NOW HAD A DATABASE OF 50,000 VICTIMS
Other Uses

Computerized Dental Ranking: A Look at a New Coding Strategy and an Optimized Ranking Algorithm

Bradley J. Adams, PhD, D-ABFA
Director, Forensic Anthropology Unit
Office of Chief Medical Examiner
City of New York

Kenneth W. Aschheim, DDS, FACP
Associate Clinical Professor
Biostatistics & Epidemiology
Assistant Chief Forensic Dental Consultant
Office of Chief Medical Examiner
City of New York
Question We Wanted Answers

- What is difficult to match and why
- Effects of miscoding
- Effects of fragmentation
- Effects of Bitewings versus Full Mouth Series
- Searching Ante against Post vs. Post against Ante?
- What Happens when sample size changes
- Types of Coding, Newer Algorithms and problems with All Virgin and All Edentulous Cases
The Virgin Effect

- We know that the lack of restorations make matching difficult however in a large database it becomes severed
- This is due to the fact that at least 20% of all data is either All ‘V’ or All ‘X’
- If a match gets stuck behind this block it get severely penalized (outliers)
- There may be a need for alternative metrics
- Since all virgins skew the data for TESTING purposes they were eliminated because they did not provide useful information
Let's Play Mythbusters

**STARRING:**

Kenneth Aschheim
Forensic Odontologist

Bradley Adams
Forensic Anthropologist
Bitewing Effect

Assume we a disaster of 30,000 victims with 400 full bodies found

What is the effect on ranking if instead of antemortem FMS we only had antemortem bitewings radiographs

- Would we have looked through
  - 10 % more records
  - 50 % more records
  - 100 % more records

- Would the results be the same if we had
  - 3000 Antemortem’s Records?
  - 30000 Antemortem’s Records?

- Could we even find it or would it be a “Needle in the Haystack”?
Myth # 1

The use of bitewing radiographs instead of a full mouth series greatly increases the number of comparison needed to get a correct identification.
Myth # 1

To test this myth we utilized a database of 400 postmortem records against two 30,000 Antemortem records, one with all FMX one with all BW
The Database Used

FMS Set

BW Set
How big are 30,000 Radiographs

- If we laid the radiographs end to end they would stretch almost 6 miles
- If you tried to walk past them at a fast clip it would take you over 2 hours
- If you wanted to compare them and it took 30 seconds a comparison you would need to work 24/7 for over 10 days
Horizontal Axis

- This axis measures the percentage of radiographs you need to look through before you find a match.
- Because forensic comparison software is so efficient, it is rarely more than 10% but for 30,000 Antemortem's that is 3,000 comparisons.

Percent Records That Need to be Looked at Before a Match is Found
Vertical Axis

- This axis measures the percentage of time that you would find a match after looking at X % of the images.
- Because forensic comparison software is so efficient most of the time, you need to look through less than 1% of the images before a match is found.
Cumulative Frequency

Percent Records That Need to be Looked at Before a Match is Found

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Cumulative Frequency

Percent Records That Need to Be Looked at Before a Match is Found

Data

FMX

BW

ANSI NIST ITL: Proposed Dental Forensic Data Supplement

Average 1.47%
Max 52.46%
Min 0.00%
Std Dev 4.43%
95% 8.84%

Average 1.73%
Max 23.26%
Min 0.00%
Std Dev 3.46%
95% 6.91%
### How Is This Possible?

#### Anterior Teeth

<table>
<thead>
<tr>
<th>Information (fillings +)</th>
<th>33,531</th>
<th>9.3%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Information (/, X, J)</td>
<td>326,469</td>
<td>90.7%</td>
</tr>
<tr>
<td>Total</td>
<td>360,000</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

#### Posterior Teeth

<table>
<thead>
<tr>
<th>Information (fillings +)</th>
<th>160,153</th>
<th>33.4%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Information (/, X, J)</td>
<td>319,847</td>
<td>66.6%</td>
</tr>
<tr>
<td>Total</td>
<td>480,000</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

- Posterior teeth are 3 x as likely to have identifiable features
- Posterior teeth are 4 x as likely to be filled
- Posterior teeth are 2 x twice as likely to be missing
- Posterior teeth are 6x as likely to have a unique feature (RCT, crowns)

---

**Anterior teeth simply carry a lot less data**

**This confirms results seen in OdontoSearch - Bradley Adams**
How Is This Possible - Part 2

**Possible Explanation**

- UDIM Algorithms are designed to handle fragmentation and BW by using percentages in ranking not absolute numbers (WinID).
- As we discovered from previous disasters our “golden proportion” database contained at least 75% of the records with at least one illogical direction of change.
- If the error was in an anterior tooth it would disappear and a 100% match score would occur.

### Database Percent

<table>
<thead>
<tr>
<th>Database</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfect</td>
<td>5.0%</td>
</tr>
<tr>
<td>P2</td>
<td>7.5%</td>
</tr>
<tr>
<td>P4</td>
<td>7.5%</td>
</tr>
<tr>
<td>P6</td>
<td>2.5%</td>
</tr>
<tr>
<td>M2</td>
<td>7.5%</td>
</tr>
<tr>
<td>M4</td>
<td>7.5%</td>
</tr>
<tr>
<td>M6</td>
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<td>B2 (P1/M1)</td>
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</tr>
<tr>
<td>B6 (P3/M3)</td>
<td>20.0%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
Myth # 1

Using radiographs with series greatly aids in the process of comparison and can lead to incorrect identification.
Myth # 2

Older radiographs substantially increases the number of comparison needed to get a correct identification.
Myth # 2

To test the myth we utilized a database of 400 postmortem records against three 30,000 Antemortem records showing differed degrees of logical change.
The Database Used

FMS Set

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>1</th>
<th>1</th>
<th>1</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ANSI NIST ITL: Proposed Dental Forensic Data Supplement
Myth #2

Myth substantially larger than number of comparison teeth.

BUSTED
Myth # 3

More miscoding per record substantially increases the number of comparison needed to get a correct identification
Myth # 3

To test the myth we utilized two databases of 400 postmortem records against 30,000 antemortem records one showing significant number of explainable discrepancies the other showing significant number of unexplainable discrepancies.
The Databases Used

FMS Set

![Diagram of FMS Set]
Myth # 3

We utilized two databases of records against 30,000 discrepancies, the other showing significant numbers of unexplainable discrepancies.
Using the Data

WHAT ELSE DID WE DISCOVER
Data loaded into a SQL Server

- Ability to see the results of multiple sorting options to multiple depths
- Combined with the “program” can test every possible combination of sorting options to multiple depth
- Can fine the “best algorithm” based on numerous benchmarks for different types of data and different sorting combinations
Conclusion

- Current algorithms utilizing detail coding can “list” matches in the top 10% of a comparison list at least 90% of the time.
- Since most forensic software can find matches relatively efficiently, algorithm improvements can only come in improvements in the matching the outliers.
- As fluoride becomes more prevalent, additional research may be needed with dealing the “Virgin Effect”
- Anthropologically stable landmarks should perhaps be included in Forensics software in order to deal with this problem.
- There are numerous scenarios still to explore…
Dental Age Determination

Dental Age of 0.0 Years
Dental Age of 0.5 Years
Dental Age of 1.0 Years
Dental Age of 1.5 Years
Dental Age of 2.0 Years
Dental Age of 2.5 Years
Dental Age of 3.0 Years
Dental Age of 3.5 Years
Dental Age of 4.0 Years
Dental Age of 4.5 Years
Dental Age of 5.0 Years
Dental Age of 5.5 Years
Dental Age of 6.0 Years
Dental Age of 6.5 Years
Dental Age of 7.0 Years
Dental Age of 7.5 Years
Dental Age of 8.0 Years
Dental Age of 8.5 Years
Dental Age of 9.0 Years
Dental Age of 9.5 Years
Dental Age of 10.0 Years
Dental Age of 10.5 Years
Dental Age of 11.0 Years
Dental Age of 11.5 Years
Dental Age of 12.0 Years
Dental Age of 12.5 Years
Dental Age of 13.0 Years
Dental Age of 13.5 Years
Dental Age of 14.0 Years
Dental Age of 14.5 Years
Dental Age of 15.0 Years
Dental Age of 15.5 Years
Dental Age of 16.0 Years
Dental Age of 16.5 Years
Dental Age of 17.0 Years
Dental Age of 17.5 Years
Dental Age of 18.0 Years
Dental Age of 18.5 Years
Dental Age of 19.0 Years
Dental Age of 19.5 Years
Dental Age of 20.0 Years
Dental Age of 20.5 Years
Dental Age of 21.0 Years
Dental Age of 21.5 Years
Dental Age of 22.0 Years
Dental Age of 22.5 Years
Dental Age of 23.0 Years
Dental Age of 23.5 Years
Dental Age of 24.0 Years
Dental Age of 24.5 Years
Dental Age of 25.0 Years
Dental Age of 25.5 Years
Dental Age of 26.0 Years
Dental Age of 26.5 Years
Dental Age of 27.0 Years
Dental Age of 27.5 Years
Dental Age of 28.0 Years
Dental Age of 28.5 Years
Dental Age of 29.0 Years
Dental Age of 29.5 Years
Dental Age of 30.0 Years

Dental Age of 15.6 Years
## Tooth Formation Standards (Smith, 1991) Males

<table>
<thead>
<tr>
<th>Developmental Stage</th>
<th>$I_1$</th>
<th>$I_2$</th>
<th>C</th>
<th>$P_1$</th>
<th>$P_1'$</th>
<th>$M_1$</th>
<th>$M_2$</th>
<th>$M_3$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C_i$ Cusp initiation</td>
<td>--</td>
<td>--</td>
<td>0.5</td>
<td>1.8</td>
<td>3.0</td>
<td>0.0</td>
<td>3.7</td>
<td>9.3</td>
</tr>
<tr>
<td>$C_{co}$ Cusps coalesced</td>
<td>--</td>
<td>--</td>
<td>0.7</td>
<td>2.4</td>
<td>3.5</td>
<td>0.2</td>
<td>3.9</td>
<td>9.7</td>
</tr>
<tr>
<td>$C_{oc}$ Cusp outline complete</td>
<td>--</td>
<td>--</td>
<td>1.4</td>
<td>2.9</td>
<td>4.2</td>
<td>0.5</td>
<td>4.7</td>
<td>10.4</td>
</tr>
<tr>
<td>$C_{1/2}$ Crown $1/2$ formed</td>
<td>--</td>
<td>--</td>
<td>2.1</td>
<td>3.7</td>
<td>4.7</td>
<td>1.1</td>
<td>5.1</td>
<td>10.9</td>
</tr>
<tr>
<td>$C_{3/4}$ Crown $3/4$ formed</td>
<td>--</td>
<td>--</td>
<td>2.9</td>
<td>4.5</td>
<td>5.4</td>
<td>1.6</td>
<td>5.6</td>
<td>11.6</td>
</tr>
<tr>
<td>$C_{cc}$ Crown completed</td>
<td>--</td>
<td>--</td>
<td>4.0</td>
<td>5.2</td>
<td>6.3</td>
<td>2.2</td>
<td>6.8</td>
<td>12.0</td>
</tr>
</tbody>
</table>

All ages in years. Values calculated by B. Holly Smith from Moorrees, Fanning & Hunt (1963a). Adapted from Table 9 in Smith (1991), and Moorrees, Fanning & Hunt (1963a).
# Tooth Formation Standards (Smith, 1991) Males

<table>
<thead>
<tr>
<th>Developmental Stage</th>
<th>(I_1)</th>
<th>(I_2)</th>
<th>(C_1)</th>
<th>(P_1)</th>
<th>(P_2)</th>
<th>(M_1)</th>
<th>(M_2)</th>
<th>(M_3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Root initiated (R_i)</td>
<td>--</td>
<td>--</td>
<td>4.8</td>
<td>5.9</td>
<td>6.9</td>
<td>2.8</td>
<td>7.1</td>
<td>12.8</td>
</tr>
<tr>
<td>Cleft initiated (R_{ci})</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>3.6</td>
<td>8.0</td>
<td>13.7</td>
</tr>
<tr>
<td>Root length (\frac{1}{4}) (R_{1/4})</td>
<td>--</td>
<td>5.4</td>
<td>5.7</td>
<td>6.9</td>
<td>7.7</td>
<td>4.6</td>
<td>9.4</td>
<td>14.5</td>
</tr>
<tr>
<td>Root length (\frac{1}{2}) (R_{1/2})</td>
<td>5.3</td>
<td>6.3</td>
<td>8.0</td>
<td>8.6</td>
<td>9.5</td>
<td>5.2</td>
<td>10.1</td>
<td>15.1</td>
</tr>
<tr>
<td>Root length (\frac{3}{4}) (R_{3/4})</td>
<td>6.5</td>
<td>7.4</td>
<td>9.6</td>
<td>9.9</td>
<td>10.8</td>
<td>5.9</td>
<td>11.1</td>
<td>16.3</td>
</tr>
<tr>
<td>Root length complete (R_c)</td>
<td>7.0</td>
<td>8.0</td>
<td>10.2</td>
<td>10.5</td>
<td>11.6</td>
<td>6.3</td>
<td>11.7</td>
<td>16.7</td>
</tr>
<tr>
<td>Apex (\frac{1}{2}) closed (A_{1/2})</td>
<td>7.7</td>
<td>8.6</td>
<td>11.8</td>
<td>11.9</td>
<td>12.7</td>
<td>7.6</td>
<td>12.9</td>
<td>18.2</td>
</tr>
<tr>
<td>Apex closed (A_c)</td>
<td>8.1</td>
<td>9.3</td>
<td>13.0</td>
<td>13.4</td>
<td>14.3</td>
<td>9.4</td>
<td>14.9</td>
<td>20.0</td>
</tr>
</tbody>
</table>

All ages in years

Values calculated by B. Holly Smith from Moorrees, Fanning & Hunt (1963a)

Adapted from Table 9 in Smith (1991), and Moorrees, Fanning & Hunt (1963a)
Questions So Far???

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