

**American Board
of
Forensic Odontology**

Diplomates Reference

Manual

**Section VI
Appendix**

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American Board of Forensic Odontology, Inc.

DIPLOMATES REFERENCE MANUAL

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Scientific Methodology Review

One of the American Board of Forensic Odontology’s objectives is to improve the quality of its science.

- 1. Requirements for problem solving using the scientific method**
 - A.** The problem to be solved must deal with the natural realm involving natural conditions and events.
 - B.** The problem must be clearly defined and sufficiently limited in scope so that a hypothesis and a prediction can be developed.
- 2. Experimental Design Requirements**
 - A.** Problem defined
 - B.** Hypothesis developed
 - C.** Prediction made
 - D.** Data collected
 - E.** Evaluate data in light of hypothesis and prediction
- 3. Important Definitions**
 - A. Hypothesis:** a tentative explanation to account for an observed condition or event.
 - The hypothesis must be an explanation for the defined problem.
 - The hypothesis must be testable: requires that evidence (data) can be collected to support or refute the hypothesis.
 - B. Prediction:** an outcome or consequence that will result if the hypothesis is accurate. Probabilities can also be assigned based on the likelihood that the event will occur. Depending on the data available, statistical analysis can be performed to assign confidence intervals to the strength of the prediction.
 - C. Variable:** generally described as anything that can potentially change (or actively be changed by the investigator) for experimental purposes. When all variables have been identified, the investigator establishes the procedures for carrying out the experiment. In biological systems, investigators must sometimes analyze data collected from observing natural phenomenon when knowledge of multiple variables is not always possible.
 - D. Bias:** to prejudge or form an opinion before all the facts are known. A definition commonly found in the medical literature is “a process at any stage of inference tending to produce results that depart systematically from true values.” (Murphy, *The Logic of Medicine* Baltimore: John Hopkins University Press. 1976)
 - Rarely, an “expert” might develop an opinion in spite of factual information. An example would be “expectational bias” or diagnostic suspicion bias” when an investigator expects to find a certain outcome, then he/she intentionally or unintentionally finds the expected outcome.
 - Even with the best of intentions, the investigator can introduce factors that predetermine the outcome of the investigation. For example, a consultant who consciously or unconsciously has his/her opinion influenced because he/she believes that the referring agency is “always right.”

- A worst case scenario is the consultant whose opinion is affected by remuneration. These persons are frequently referred to as “hired guns.” The consultant is anything but neutral, impartial or objective
- Another term frequently seen in the literature is “previous diagnosis bias.” This type of bias could be seen when a “second opinion” consultant allows a previous diagnosis (opinion) given by the first consultant to influence the second consultant’s opinion. This type of bias could occur when you know and respect another consultant’s work and have that variable influence your opinion. It can also happen the other way - if you do not respect another “expert” or have had disagreements in the past, those previous experiences could knowingly or unknowingly influence your opinion.
- Whereas self-confidence is important, consultants can be “biased” toward believing their own opinion is the only acceptable opinion, refusing to acknowledge that an opinion differing from theirs can have value. An over inflated ego can interfere with sound judgment. Without proof to support the hypothesis, the philosophy of “experience equal expertise” has no scientific validity.
- Odontologists must scrupulously avoid all forms of bias.

E. Blinding: the process of assessment of raw data or information without prior knowledge of potential outcomes.

F. Validity: the ability of the test (hypothesis) to determine or detect that which you are testing. For example, flipping a coin may give you the right answers half of the time if there are only two possible outcomes for what you are testing. For instance, we could assign a decision on a bitemark case by mandating: heads=yes, the suspect’s teeth left that mark; tails=no, the suspect’s teeth did not leave that mark. Even though he/she will be right half of the time, an odontologist using that technique to form an opinion is incompetent and unethical

G. Sensitivity: the ability of a test to detect the true positives.

H. Specificity: the ability of a test to detect the true negatives.

I. Utility: the relative risks and benefits of a test or procedure. A test that has a high probability for a false result has low utility especially if the risks are high and the benefits low. For instance, the utility of bitemark analysis is based on whether the legal system is better off with it or without it.

J. Reproducibility: if the study is reproducible, another investigator testing the original hypothesis using the same parameters will arrive at the same (or very similar) conclusions.

K. Reliability: the consistency between measurements in a series of tests. Remember that the instruments used are only as accurate as the investigator using them.

L. Gold Standard: a test that is generally accepted as the most accurate of available tests. Also called a “reference test” that can be used as a comparison for any new test.

Suggestions for Effective Review of the Bitemark Literature, Evaluating Professional Presentations and for Assessing Abstracts

Be Skeptical:

- When reading the literature, check the journal, the title, the authors, the data and the conclusions. Carefully examine the materials and methods. Look closely at the experimental design.

- When reviewing an article, check the references cited. Are the references correctly cited? Are the cited articles, recent (if the technique hasn’t been tested and used in 50 years, there is probably a good reason for it), relevant and reliable? Have the authors done only a “key word search” and created a long list of references that when carefully examined do not support their assertions.

- The data should be meticulously examined. Question the validity of descriptive and inferential statistics. If a statistical analysis is not presented, lower your level of belief. Understand that the statistical analysis is only valid for the population studied; the conclusions presented may not be valid for another population. Carefully examine the study sample size. The number of cases studied or the size of the population (identified by the letter “n”) should be carefully examined. If the data presented is supported by an n=1, be very skeptical. It is extremely rare that any conclusions can be drawn from this sample size. After reviewing significant numbers of articles, Sacket et. al. and Yancey have shown that most published articles have little or no value. Even the most highly respected, refereed professional journals can publish invalid information. The chances are that the author(s) of the article you are reading have drawn at least partially invalid conclusions.

- If you attend an oral presentation, ask that the presenter show the raw data. Equally important, if you don’t see what the presenter is attempting to show in the photographic slides, radiographs, etc., ask the author to show it again - preferably in a public forum at the time of the presentation. If you could not see what the presenter is offering, it’s likely that no one else could either. If representation/clarification is not convenient, ask to see the data in private. If you are not allowed to carefully scrutinize the evidence, withhold belief.

- Suspend judgment on a test, technique or device until you have carefully examined all potential outcomes. If it appears “too good to be true”, it most likely is.

Beware of assertion without documentation:

- When reading case reports, remember that most case reports have relevancy for only that specific case. The reader should always remember the validity and statistical significance of n=1. Extrapolating the data from that specific case to other separate cases

is probably invalid in most instances unless there is proof that there is reason to horizontally integrate the data. Assertion without documentation, (“My opinion is correct because I’m the authority!”) is very common in bitemark articles and oral presentations. Making claims that have no scientific basis demonstrates the incompetence of the author(s). Beware of the “expert” who says “the evidence is there because I say it is there.”

- Remember that although the conclusions drawn may be correct, the process by which the conclusion was reached might not be scientifically valid (remember the example of the tossed coin). Or as they say in Texas, “Even a blind hog occasionally finds an acorn.” Some odontologists believe that because they may have been “right” in the past that they will always be “right” in the future. “I was right therefore I am an ‘authority’.” It is wise to remember that a consultation with an “authority” is not necessarily a consultation with science. A long list of credentials does not necessarily equate with credibility or accuracy.

- No author should believe that their assertions are correct because no one publicly questions or contradicts the presented material. For any number of reasons, it is not unusual for oral presentations to go unquestioned. It is common for the presenter to show only the data supporting the presenter’s hypothesis. Data that does not support the hypothesis can be selectively eliminated or kept private. When data or cases cease being reviewable in the public domain, that data loses all scientific credibility.

Beware of consensus opinions developed by a committee:

- Committees can be “stacked” with persons who are likely to support what they believe to be conventional wisdom. The committee opinion may not be based on science, but on the relative assertiveness of the various committee members. Carefully examine the credentials, publications and contributions of the individual committee members prior to accepting the statements proffered by the committee. If there are dissenting opinions from individual committee members, review the reasons for disagreement.

Summary of Scientific Reasoning Principles:

- Collect all the relevant information you need.
- Use the information collected. Don’t selectively ignore evidence or place unwarranted credence in unsound or irrelevant information.
- Don’t allow your opinion to be contaminated by “unblinding.” Don’t be biased. Maintain your impartiality.
- Use your knowledge effectively when making interpretations, drawing inferences or promulgating an opinion.

REFERENCES FOR THE EVALUATION OF LITERATURE

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[2] Sacket DL, Haynes BR and Tugwell P., *Clinical Epidemiology: A Basic Science For Clinical Medicine, 1989*. Little and Brown and Company. Boston, Toronto and London.

[3] Schor S, Karten I., “Statistical Evaluation of Medical Journal Manuscripts,” *JAMA: 1986; 140: 472-474*.

[4] Riegelman RK and Hirsch RP., “Studying a Study and Testing a Test: How to Read the Medical Literature,” *1989*. Little, Brown and Company. Boston, Toronto and London.

[5] Yancey JM., “Ten Rules for Clinical Research Reports,” *The American Journal of Surgery, 1990; 159: 534-538*.

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ID APPENDICES

SOURCES FOR ANTEMORTEM DATA

Antemortem data may include as dental radiographs, written records, models and collection of antemortem records is ordinarily the responsibility of the investigative agency that has access to missing person’s reports at the local, state or national level. However, the forensic odontologist may recognize additional characteristics. (e.g., prior orthodontic treatment) which could be helpful in establishing a putative ID. This section lists a variety of resource agencies and/or individuals that might provide assistance in locating records.

A. Local Agencies

Hospitals, Other Health Care Facilities
Dental Schools
Health Care Providers
Employer Dental Insurance Carrier
Public Aid Insurance Administrator

B. State Agencies

The following state resources are available if dental records for an unknown decedent cannot be obtained locally, and investigation provides leads as to a possible previous state of residence of the victim. A list of state agencies is maintained on the ABFO website: www.abfo.org

U.S. MILITARY RECORDS:

Department of Veterans Affairs
Service Record/Dental Records
P.O. Box 150950
St. Louis, MO 63115
National Personnel Records Center
9700 Page Ave.
St. Louis, MO 63132-5100
Contact Person: Barbara Bauman(314) 801-0589

DENTAL INSURANCE COMPANIES:

Delta Dental of California
California Department of Health Services
Sacramento, CA
(916) 464-0379
(916) 464-5703

FEDERAL AGENCIES

FBI National Crime Information Center (NCIC)
NCIC/FBI Building

10th and Pennsylvania
N.W. Washington, D.C. 20535
(202) 324-5049

Interpol
U.S. Dept. of Justice
Washington, D.C.
Military Records Depository
900 Page Blvd.
St. Louis, MO

INTERNATIONAL RESOURCES

UK Derek Clarke, London Hospital, Medical College
Canada, Robert Dorion, D.M.D., Montreal
Germany Dr. Klaus Raucher
Australia Dr. Kenneth Brown University of Adelaide, SA

INSURANCE CARRIERS

Mr. Lou Saporito
Director of Field Operations
Dental Relations Committee
The Health Insurance Association of America
1025 Connecticut Avenue, N.W.
Washington, D.C. 20036

Betty Hainsfurther
Council on Dental Care Programs
American Dental Association
211 E. Chicago Avenue
Chicago, IL 60611

Dr. John Thorpe
Illinois Blue Cross
233 N. Michigan
Chicago, IL 60601

Mr. Jim Bonk
Delta Dental Plan
Suite 1010
211 E. Chicago Avenue
Chicago, IL 60611

OTHER SOURCES

Family/Friends/Co-workers
Public Aid Insurance Administrator
Employer Dental Insurance Carrier
Prior Military Service
Prior Judicial Detention in County
State or Federal Institutions
Prior Hospitalizations (e.g. Chest Films, Skull Films)
Oral Surgeons, or Orthodontists in the Area
Veterans Administration Hospitals
Any Previous Areas of Residence
Chiropractic X-rays

WEBSITES

National

American Association of Missing and Exploited Children's Organizations (AMECO)
<http://www.amecoinc.org/clearinghouse.htm>

Center for Disease Control and Prevention. National Violent Death Reporting System,
<http://www.cdc.gov/ncipc/profiles/nvdrs/default.htm>

National Center for Missing Adults (NCMA)
<http://www.theyaremissd.org/ncma>

National Crime Information Center (NCIC)
<http://www.fbi.gov/hq/cjisd/ncic.htm> (not open to the public)

National Missing and Unidentified Persons System (NamUs)
<http://www.NamUs.gov> (National online repository for missing persons and unidentified dead cases)

The Doe Network (International Center for Unidentified and Missing Persons)
<http://www.doenetwork.org>

National Center for Missing and Exploited Children (NCMEC)
<http://www.missingkids.com> (Input from the public accepted 1-800-THE LOST)

North American Missing Persons Network (NAMPN)
<http://www.nampn.org>

National Dental Image Repository (NDIR)
Available only at Law Enforcement on Line Email images to NDIR@leo.gov

State and Local

California Missing Persons (1-800-222-FIND)

<http://www.ag.ca.gov/missing>

Clark County Coroners Office (Las Vegas, NV)

<http://www.acesclarkcounty.net/coroner/unid.htm>

Colorado Coroners Association

<http://www.coloradocoroners.org>

Florida Unidentified Decedents Database

<http://www.fluiddb.com>

Florida Unidentified Deceased Initiative

http://www.fdle.state.fl.us/cjst/mec/identifyingunidentifieddeceased/identifying_deceased.html

Fulton County Medical Examiner's Office

<http://www.fcmeo.org/uidtrifold.htm> (Unidentified Victim's Listings)

Georgia Unidentified Remains (Cases from the Georgia Bureau of Investigation)

<http://www.ganet.org/gbi/uidlist.cgi/>

Illinois State Police – Unsolved Cases

<http://www.isp.state.il.us/crime/unsolved.cfm>

Iowa Unidentified Persons and Bodies

http://www.dps.state.ia.us/dci/unidentified_bodies/index.shtml

John and Jane Doe Case Files (Coroner's Division of the Orange County Sheriff-Coroner, Santa Ana, California)

<http://www.ocsd.org>

Los Angeles County Coroner

<http://coroner.co.la.ca.us/htm/uipsearc.cfm>

Kentucky Office of the State Medical Examiner's Unidentified Remains Database

<http://www.unidentifiedremains.net>

LSU FACES Lab (Louisiana State University – Forensic Anthropology)

<http://www.lsu.edu/faceslab>

Maricopa County Sheriff Office (Maricopa County, Arizona)

<http://www.mcso.org/index.php?a=getmodule&mn=unsolved&page=getall>

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Maryland Missing Persons Network

<http://www.marylandmissing.com/home.html>

New York State's Unidentified

http://www.troopers.state.ny.us/wanted_and_missing/unidentified/

New York State Police

<http://www.ci.nyc.ny.us/html/nypd/html/missing/missing-unid.html>

Pennsylvania State Police Files

<http://www.psp.state.pa.us/psp/cwp/browse.asp?a=3&bc=o&c=20795>

Riverside County Sheriff/Coroner's Office (Riverside County, California)

http://www.riversidesheriff.org/coroner.org/unidentified_bodies.htm

South Carolina Unidentified Persons (South Carolina Coroner Association)

http://www.sc-coroners.org/unidentified_bodies.htm

Texas Unidentified Persons (Texas Missing Persons Clearinghouse)

<http://www.txdps.state.tx.us/mpch/>

The Chattanooga, Hamilton County Medical Examiner

<http://www.hamiltontn.gov/medicalexaminer/intro.htm>

Unidentified Bodies (Office of the Sheriff, Camden County, New Jersey)

<http://www.co.camden.nj.us/sheriff/unidentified%20bodies.htm>

Unidentified Human Remains (Michigan State Police Crime Laboratory)

<http://members.aol.com/stevenkl/remains.htm>

Unidentified Persons (Larimer County Medical Examiner Office, Colorado)

<http://www.co.larimer.co.us/coroner/coronerudp.htm>

Unidentified Remains.net (Kentucky State Medical Examiner Office)

<http://www.unidentifiedremains.net/>

International

Ontario Provincial Police (Ontario, Canada)

<http://www.opp.ca/investigative/unidentifiedremains/index.htm>

Saskatchewan Missing and Unidentified Persons (Saskatchewan Association of Chiefs of Police, Canada)

<http://www.sacp.ca/missing/index.php>

Dental Information in Missing and Unidentified Persons Cases

Introduction

Purpose

These guidelines were designed as a resource for those agencies, jurisdictions, and individuals who have an interest or a responsibility in missing person and/ or unidentified body cases. Dental verification has long been accepted as a reliable means of human identification, but many times the responsible officials do not completely understand the technical requirements of forensic odontology (dentistry). It is hoped that the information provided here will assist the forensic odontologist and law enforcement personnel in those cases that require or involve this type of evidence.

Missing Person Cases

The Missing Person Report

The missing person report begins with that first contact from a family member or friend. This is the most critical time in the entire process, and the most often neglected by police agencies. Often times the assignment to “missing persons” is either neglected or given to the most junior officer in the department with turnover commonly frequent. This makes it a seemingly unimportant duty, one that no one would want to have. It may not be illegal to be missing, but these cases are important to family members and without this information some cases will go unresolved. It is important and the assignment of personnel to this task should acknowledge that importance within the department.

It is during this initial contact that three things can be accomplished. Complete information regarding the missing needs to be recorded; the family needs to be reassured that their case is important; and favorable public relations for the agency within the community should be realized. This is the time to gather as much information as possible.

The reporting individual is already upset; as a result, the recording officer can do little that will cause him/her much additional grief at this time. Ask all of the questions now; returning later will surely only cause additional unnecessary anguish. Most law enforcement agencies have standard forms for recording missing person reports. It is important that these forms include adequate space for medical and dental information. Ask the reporting person about the missing person’s medical and dental history:

1. Name and address of dentist(s)
2. Did he/she go to the dentist regularly?
3. Did he/she have a regular dentist? Here? Previous home locations? Previous military service? Which branch?
4. Other dental sources (specialists): orthodontists (straightening), oral surgeons, periodontists (gum disease), endodontists (root canals), prosthodontists (dentures, partials, crown and bridge and implants).
5. Medical history, including physician names, hospitalizations, accidents, illnesses, etc. Be specific about head and chest injuries, these often result

in medical x-rays that show some dental features. Ask for this information now. As mentioned before, the family is already upset or they would not be reporting the disappearance. As a result, there is little that the recording officer can do to further this grief, unless he/she is completely insensitive. To return later for dental information can upset the family needlessly. What can be worse than to have an officer call thirty, sixty, ninety days later and state:

“We found a body we think may be your missing loved one. A visual identification is impossible. Can you give us the name of his/her dentist?” Does that sound cruel and insensitive? What if the body turns out not to be the suspected missing person? It happens all too often! There will be officers who read this, who will say: “Wait a minute. I’m not going to gather all of that information on every runaway kid and hooker that gets reported missing. They usually turn up in a few days anyway.” And he/she would be right. But taking the information at the initial report does not mean that those actual records have to be gathered immediately from those sources. When a reasonable time has passed (varies with the case) the data can then be located and collected. Some agencies actually use a return call on missing person cases. This lets them confirm that the person is still missing and it can have a positive public relations effect by letting the family know that they are still working the case. The time lag between report and follow up will vary with the particular case, but one to two weeks for most cases is probably appropriate. If there has been no contact during that period, then it is time to research and gather the dental data and share it with other agencies.

Gathering the Dental Information

There is no real need to delay collecting the dental information beyond thirty days. This should be viewed as a maximum time for gathering and reporting. In most cases, two to three weeks are more appropriate. When contacting a dental or medical office, the officer should appropriately identify himself/herself and explain the nature of the investigation and the information that he/she is requesting. Most offices will voluntarily cooperate fully; some states have laws that permit police access; and if not, a subpoena or threat of a subpoena, will usually facilitate access. Remember, this office may have information that could lead to other sources, i.e. previous dentists, specialist referrals, medical history, etc.

All available information should be retrieved. This will include:

1. Complete written records or good quality, readable photocopies. The originals are preferred.
2. Original radiographs or good quality duplicates. Again the originals are preferred. If duplicates are provided they need to be accurately labeled as to left-right orientation, and include all dates, etc.
3. Plaster or stone models (study models), if available.
4. Photographs if available. Some offices have prints or videos of patients in various stages of treatment.
5. Any other information that is available concerning that patient. Military records can be researched by contacting the nearest military base with the appropriate branch of service for the missing person. The military intelligence office is the resource for information concerning former

members. Try to obtain records from more than one office if possible, even if one is quite old. This will help to authenticate the antemortem evidence. If no leads are available from the missing person report, contacting local area dental offices and medical facilities may produce some positive results. Insurance companies and the state Department of Health and Welfare may also provide useful information. be imaginative; there is probably some information out there somewhere. Refer to the ABFO Body Identification Guidelines for further sources.

Using the Dental Information

The first thing to do after gathering this information is to include it in the missing person report. It should not just be filed away and forgotten. It has value to the case and as such it needs to be utilized. Whether a possible identity has been determined or not, the services of a forensic odontologist should be employed at this time. The process of deciphering and putting the dental information into a useable missing person dental form is rarely an easy task. Quite often the written dental record is incomplete or illegible. For this reason, a trained forensic dentist should be consulted for this task and the task of filling out forms from any local, state, or national dental data base programs.

Again, often these forms require some familiarity and experience to properly complete; and accuracy at this point is more important than speed.

The logical first step is to have the consulting forensic expert compare this newly acquired dental data with any available postmortem evidence. If no local match is found, the information should be shared with other local, regional and national agencies that are equipped to handle this type of data. A more detailed explanation of these programs is described below, under the heading "Search/Comparison Programs."

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Unidentified Body Cases

The Unidentified Body Report

Whenever a deceased body is discovered and especially when a timely identification is not anticipated, all available identifying physical evidence needs to be gathered and preserved. This should be accomplished before the body leaves the custody of the responsible investigative authorities. Besides fingerprints, photographs and DNA samples, dental information should be recorded in all cases involving a death, whenever there may be some present or future need to verify the identity of the individual with a degree of scientific certainty. Please refer again to the ABFO Body Identification Guidelines. Though it is usually the burned, decomposed, or severely traumatized case that ultimately requires dental identification, there is always the possibility that dental verification may be the only scientific method available in other less obvious cases. The conscientious investigator should never allow an unidentified body to be disposed of without taking fingerprints, if available. So it should be with any available dental evidence. In addition, with the increasing use of computer based dental comparison programs, it

may be that the ultimate clue to the true identity may come from the dental evidence. Rapid identification can be critical in case resolution. A trained forensic odontologist should be retained to perform the examination and necessary record-taking, so that all recorded information is accurate, complete and preserved properly. It is always best to do this immediately, and to do it right. This will greatly reduce the necessity of having to exhume the body at a later date and thereby incurring additional expenses, and embarrassment. Be complete and be accurate. And most importantly: Do it right the first time! It should be noted here that law enforcement should expect the following from any dental consultant that they employ:

1. A written forensic dental report of findings, recommendations and conclusions.
2. Copies of all documentation, including charting, photographs, models and radiographs.
3. Prompt completion of all examinations and reports, or an explanation of why more time is needed.
4. Completed submission forms for NCIC or other search/comparison programs.

Gathering the Dental Information

The dental examination is conducted under the authority and direction of the coroner/medical examiner and generally is carried out in a morgue, funeral home, or private consultant facility, as designated by each jurisdiction. The first concern is the retrieval and transportation of the body or body parts, including the dental evidence, intact to that/those facilities.

Severely Fragmented Body

In those cases that involve severely fragmented victims, the area should be carefully checked for any remaining and not readily apparent hard and soft tissue fragments. This may require the assistance of experts trained in fragment search and recover. Certainly, a grid search is recommended in most of these cases. Any recovered body parts or evidence should be placed in a body bag or other appropriate evidence container for transportation. It is important to note that this should be accomplished only after proper notation of the location of the fragment(s) has been made.

Decomposed Body

The decomposed body generally has the oral structures intact, but the decomposition process in many cases will cause the fibers which hold the teeth to the bone in the dental arches to breakdown. With this breakdown of the periodontal fibers, the teeth, especially those with straight roots (like the front teeth), can be easily dislodged and potentially lost prior to examination. Before moving the body, note the absence of any front teeth by separating the lips gently. If some are missing from open sockets, look to see if there are any teeth near the body. If not, those teeth may be found later during the examination. They are often located at the back of the mouth. If not found, the sight of the body should be revisited and searched for the missing evidence as described above. Action must be taken when moving the body so that any loose teeth are not inadvertently bumped and dislodged.

Severely Burned Body

In all severely burned cases, **EXTREME CAUTION MUST BE TAKEN** in transporting the body, not because whole teeth will dislodge but because the heat may have so desiccated and charred the crowns of the teeth that merely touching them may cause them to shatter. If the teeth appear likely to be fragile, close-up photographs of the dentition prior to careful transport may be helpful in reconstruction, if there is damage during the movement of the body. Above all, great care should be taken not to jar the body during transport. All surrounding debris which might contain dental evidence should be recovered as well, so that it can be inspected for dental fragments. Once in the examination facility, it is sometimes possible to reinforce the dental structures so that they are not as likely to fracture by spraying an adhesive over the teeth. Attempts to maintain as much intact tooth structure and its supporting bone may be critical in verifying the identity of the victim.

Skeletonized Body

In skeletonized cases, the teeth are readily visible but as in the decomposed cases, the soft tissue attachment between the teeth and the bone is no longer holding the teeth in the skeleton. Therefore, straight rooted teeth are easily and often lost. If the body has been buried or animal activity has caused the skeleton to be moved, it may be advisable to sift the surrounding ground for small bones, teeth or other evidence. These fragments can be tagged and brought to the facility for examination.

Preserving the Dental Information

A forensic odontologist should be retained to perform the examination and necessary record-taking so that all recorded information is accurate and preserved in such a way in the report as to facilitate potential comparisons. As stated earlier, a more complete technical outline for body identification, prepared by the American Board of Forensic Odontology, is available in the Journal of the American Dental Association. [3]

Visual Examination And Dental Charting This procedure is fairly straight forward. A complete visual inventory and written record of the remaining dental evidence is basic to any forensic dental examination. The investigating dentist should note and record any and all oral and dental features on a form designed for that purpose. This will form the basis for later comparisons in both verification and search activities.

The actual diagrammatic dental chart used is relatively unimportant. However, whatever chart is employed should allow enough space for adequate notations in either words and/or diagrams of all the existing conditions. It is also recommended that all charting designations for the individual teeth be made in the “universal numbering system” [3].

The visual examination and subsequent dental charting can be a relatively easy procedure or a very tedious difficult task, depending on the accessibility of the teeth and the condition of the remains. Where all of the teeth remain in the bony arches, forcing the jaws open, in some cases breaking the rigor mortis, and cleaning the teeth is all that is, necessary. In cases of

severe burning, it is sometimes necessary to carefully remove the upper and jaws so that cleaning and complete examination may be performed.

Dental Radiographs

Every postmortem dental examination should include the taking of dental radiographs (x-ray films). The reasons for this are twofold. First, a completely accurate dental charting without radiographs is not possible, since there are many conditions that are only detectable by this method, i.e. root canals, retained roots, impacted teeth, etc. And secondly, dental films are the hard evidence that will be needed to substantiate any conclusions in the case. Anyone can make recording errors on a chart; the radiographs are solid objective recordings of the actual dental characteristics. A thorough postmortem dental radiographic examination should include a complete series of periapical films of the available dental structures. Bitewing type films should also be included since they are the most common type found in dental records. No matter what types are taken, it is important that any films be properly angulated, well exposed, and well processed (developed and fixed). Besides periapicals and bitewings, there are several other different types of films available. These include panoramic, occlusal, and medical type films, such as lateral head and anterior/posterior skull views.

Bitewing Radiographs

These are the most common type of radiograph found in dentistry and therefore, likely to turn up as part of the antemortem dental record. In fact, quite often it is the only type of dental film available. Because they are taken of both jaws at the same time (in occlusion), these films generally show the upper and lower teeth in close approximation, therefore, depicting the full crowns of all of the teeth visible in the exposure. These films do not show the areas around the ends of the roots and therefore may not disclose some very useful information. If the jaws and teeth are severely fragmented or the teeth very fragile, it may be difficult to secure radiographs of this type for the postmortem dental record. None the less, every effort should be made to include bitewings in this examination.

Periapical Radiographs

The periapical dental film is taken of one jaw at a time, and it shows the bony structure at and around the end of the root as well as the entire teeth itself. Depending on the location and condition of the individual, usually two to four teeth will show fairly completely on one of these films. These should be taken in all areas of the dental arches, even those not containing visible teeth, since teeth or other characteristics can be impacted or hidden within the bony structures. A full set of these films should be taken along any bitewings films. A full set of periapical films will usually include about fourteen films of the standard dental size.

Panoramic Radiographs

This type of film provides a large single radiograph that shows most of the lower face including both jaws, the sinus cavities, nasal passages, lower portions of the eye sockets, and the angles of the mandible. The film is taken with the head stabilized in a cradle while the x-ray source and the film cassette both travel around the head. These films are not routinely taken in most dental offices; however they are common enough that their use in forensics has to be considered. They should be used for comparison to antemortem dental films cautiously if the antemortem films are

of a different type. This is because: (1) The film is so large that individual teeth and supporting structures are often overlapped and/or distorted, making comparison to other film types difficult and (2) the sheer logistics of positioning a decedent's head, jaw or jaw fragments, onto the machine may prevent the production of a quality image.

Medical Radiographs

These films are those radiographs commonly taken for orthodontic purposes or for diagnosis of head injuries, sinus problems and the like. These films usually show the entire skull from a particular view or exposure. While anatomical features such the sinuses, especially the frontal sinus in an anterior/posterior view or a Waters view, can be beautifully depicted, the visualization of the teeth is difficult due to overlapping of teeth, superimposition of the right and left sides of the arches and other types of distortion. All of these factors can make comparison of specific dental features very difficult.

Photographs

Although generally not as critical as the dental radiographs, dental photographs are very helpful in preserving the evidence, especially when there is some unique dental feature which would be difficult to describe otherwise. Photography can also provide a double check for possible recording errors. In addition, photographs, particularly those of the front teeth, may be useful for comparisons to antemortem photographs which show unusual features of these teeth. These photographs should include all those views that the investigating forensic dentist feels are important.

Study Models

Study models are seldom used to preserve evidence in identification cases. Due to fragility of the teeth in some situations and the breakdown of the soft tissue in others, taking impressions can, under certain circumstances, alter the existing evidence. However, for any given particular case, it may be a procedure that the examining forensic dentist would feel is necessary.

Preservation of Jaw and Tooth Fragments

In those cases where the dental evidence is minimal or questionable in some way, and/or if the body is to be disposed of by cremation, the dental evidence should be removed from the remainder of the body, marked and properly stored for future examination and study. Refer to the ABFO Body Identification Guidelines for information concerning removal and storage.

Skeletal Remains

These specimens should be thoroughly cleaned and stored in such a way as to insure retention of all dental evidence, keeping in mind that teeth are easily lost from their sockets.

Jaws with Soft Tissue Remaining

If necessary resect or remove the jaws from the supporting bone and muscle attachments. The specimen must be cleaned and then stored in a standard morgue formalin solution.

Authorization for Removal of Dental Structures

Resection of the deceased remains will require legal authorization before proceeding.

The form of that authority will vary depending on the jurisdiction in which the examination occurs. At the very least it is necessary to obtain permission for the resection from the coroner/medical examiner under whose authority the case falls. The methods of resection will vary with the situation and will include use of an autopsy saw, mallet and chisel, or pruning shears. A forensic dentist will be familiar with the technique most applicable to each particular case.

Using the Dental Information

Once all of the postmortem records are complete, these should become part of the unidentified persons file in the coroner/medical examiner's office. The logical next step after the report is completed is to have the consulting forensic dentist compare this newly acquired dental data with any available antemortem information. If no local match is found immediately, the information should be shared with other local, regional, and national agencies which are equipped to handle this type of data. A more detailed explanation of these programs is described below, under the heading "Search/ Comparison Programs".

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Search and Comparison Programs

Purpose

In most cases the dental identification of unknown human remains is simply a matter of directly comparing the postmortem dental records with the antemortem dental records of a suspected individual. Another more difficult case scenario might involve the discovery of a body when a possible identity is not apparent. In these instances some type of evidence found at the scene or on the body is used.

One of the most difficult, but more important tasks that a forensic dentist can be asked to accomplish is the identification of unidentified remains when the investigators have no idea of the possible identity. There are no leads to follow or possible acquaintances to interview. Until the development of computer technologies, this task was all but impossible.

With the use of computer comparison programs the antemortem and postmortem information can be entered into a data base and thousands of comparisons can be made in seconds generating a list of possible candidates, which can then be confirmed or rejected by visual comparison of the appropriate dental radiographs and/or other dental evidence. For this to be a truly effective tool for law enforcement, appropriate dental search/comparison facilities must exist. Without a useable, up-to-date data base, the various search procedures can not be accomplished.

Minimum Requirements

The concept of a computer data base of dental information is not new; the National Crime Information Center (NCIC) at the FBI has the capability to receive dental information. The National Missing and Unidentified Persons database, NamUs that was established in 2009 is a web based system that is much more user friendly for law enforcement, medical

examiners/coroners, victim advocates and the families of missing persons, than the NCIC system. Besides the demographics of the MUPs, biometric data can also be included in the record of an MUP, including dental radiographs, photographs, fingerprint and DNA data.

There are several issues that need to be considered when evaluating or establishing a “Search/Comparison” program.

1. The computer software program must be easy to use and have the capability to perform general and specific searches and dental characteristic comparisons.
2. The entry codes, forms, and procedures must be clear and uncomplicated, to reduce data errors.
3. Law enforcement offices with authority to submit data must be educated concerning the use and value of the program.
4. Mandatory reporting should be required of all law enforcement offices. It is clear to many who have experience with NCIC that the dental aspect of this program is not working effectively, as opposed to the NamUs system which has been proven to be effective and relatively easy to use. The problems and issues of the collection and entry of dental data with the NCIC system were addressed by Haglund in an article entitled “The National Crime Information Center (NCIC) Missing and Unidentified Persons System Revisited”, *The Journal of Forensic Sciences* Volume 38, Number 2, March 1993.[5] Further problems with the search algorithms of the NCIC system were addressed in an article by Bell 07/95 “Testing of the National Crime Information Center Missing/Unidentified Persons Computer Comparison Routine”, *The Journal of Forensic Sciences*, Volume 38, Number 1, January, 1993. [6] The issues concerning the failures of NCIC are not the purpose or in the scope of these guidelines. Certainly, the NCIC system provides a valuable reservoir of information for law enforcement. But it is very possible that the scope of the dental aspect of the NCIC program is too large to be a workable data base.

Besides NamUs another location for “Search/Comparison” programs is at the state or regional level. The “ideal” state run program would have the following characteristics:

1. Established under the State Department of Law Enforcement or State Police/Patrol.
2. Run by a trained forensic dentist.
3. Mandatory reporting requirements for (1) missing persons, (2) unidentified bodies, (3) released felons, and (4) parole/probation violators.
4. Education program for local and state law enforcement, and coroners/ medical examiners.
5. Cooperation and sharing of data with neighboring programs.

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WinID

History and development

The original Computer-Assisted Postmortem Identification (CAPMI) program was developed in the 1980s by Colonel Lew Lorton at the U.S. Army Institute of Dental Research. The program proved its usefulness in aiding identification procedures in the 1985 Gander plane crash. CAPMI was a DOS based computer program for PCs.

In 1990s personal computers were widely available and became more affordable. This was the year that Microsoft released Windows 3. It became clear that a user friendly dental computer identification program could be written. WinID was written in the Visual Basic (VB) programming language. The first two releases of WinID used a flat file for data storage.

WinID makes use of a graphical user interface and allows use of a mouse. WinID can store and display graphics in BMP, GIF and JPG file formats. Other Windows features incorporated in WinID include text-boxes, list-boxes, combo-boxes, menus, scroll bars, buttons, check-boxes and radio-buttons.

WinID was first used in an incident involving two planes in Quincy, Illinois in 1996. The victims were recovered and examined; antemortem records received and reviewed; identifications made and final reports generated within 72 hours. This incident established WinID's usefulness in mass disaster settings. This incident was the first response of a developing DMORT to an airline accident; the portable morgue was supplied by the National Funeral Directors Association.

WinID3 was released for use with the identification effort at the World Trade Towers in New York City in 2001. WinID3 incorporated the functionality of a Microsoft Access Database. WinID was able to handle the simultaneous challenge of the identification of victims of a Dominican bound American Airlines flight while the NYC Medical Examiner's office continued with the aftermath of September 11th.

In the mid-2000s, WinID3 incorporated the ability to interface with digital radiographic equipment. This led to the concept of a paperless dental identification system, where all postmortem dental information such as dental charting, WinID codes, and digital radiographs and photographs are directly entered into the computer. The paperless system was successfully used in the Hurricane Katrina disaster.

WinID3 uses a Microsoft Access Data Base. A new database is used for each incident. WinID3 comes with a training database known as sample.mdb. This database contains records and graphics from a small mass disaster and is used to familiarize novice investigators with computerized identification.

Each WinID3 database is composed of two tables: the antemortem table and the postmortem table. Each table holds either all the antemortem records or all the postmortem records for the incident. Each record is composed of fields. Examples of fields include: race, sex, height and primary code for tooth #4. Compilations and manipulations of data for report generation or research purposes can be handled either by WinID3 or by the use of the Microsoft Access program which is a component of Microsoft Office.

WinID Coding

WinID uses primary and secondary codes to classify individual teeth of a dentition. When using WinID it is important to remember that it is the restored surface of a tooth that is coded. The restoration itself is not coded. As an example a tooth with both MO and DO restorations is coded MOD and not MODO.

WinID Primary Codes

- **M** - mesial surface of tooth is restored.
- **O** - occlusal surface of posterior tooth is restored.
- **D** - distal surface of tooth is restored.
- **F** - facial surface of tooth is restored.
- **L** - lingual surface of tooth is restored.
- **I** - incisal edge of anterior tooth is restored.
- **U** - tooth is unerupted
- **V** - non-restored tooth – virgin
- **X** - tooth is missing - extracted
- **J** – The tooth is present but no other info is known.
Missing postmortem. Fractured crown. Avulsed tooth.
- / - no information about tooth is available.

WinID Secondary Codes

- **A** - Annotation - An unusual finding is associated with this tooth.
Specifics of the finding are detailed in the comments section.
- **B** - tooth is deciduous
- **C** - tooth is fitted with a crown. Shorthand for MODFL-C
- **E** - resin filling material.
- **G** - gold restoration.
- **H** - porcelain.
- **N** - non-precious filling or crown material. Includes stainless steel.
- **P** – Pontic: used only when tooth has been marked as missing with code “X”
- **R** - root canal filled.
- **S** - silver amalgam.

- **T** - denture tooth: used only when tooth has been marked as missing with “X”
- **Z** - temporary filling material. Also indicates gross caries (used sparingly).

Only the primary codes are used to rank records in WinID’s “best match” function. The secondary codes are used to help find records in WinID’s sorting and filtering functions.

In the best match mode WinID uses the primary codes to rank records. A specific postmortem record is compared to all the antemortem records on a tooth by tooth basis. An antemortem record can also be compared to all the postmortem records. When a tooth of one record is compared to a tooth of another record it is evaluated as: Hit, Miss, Possible or No-Information. A *Hit* is where there is a match such as an O code matching an O code. A *Miss* is where a comparison is not possible such as a postmortem V code compared to an X code. A *Possible* is generated when the postmortem record shows more dental work than the antemortem record, such as when an antemortem M is compared to a postmortem MOD. A *No-Information* is created when a / code is compared to any other code.

Running totals of the Hits, Misses, Possibles and No-Information are kept. It should be noted that for any specific comparison of one record to another record, the sum of the Hits, Misses, Possibles and No-Information will always equal 32.

After all the records are compared, the running totals are sorted to return ranked lists. WinID can return lists ranked by Most Hits, Least Miss Matches, Most Restoration Hits and Most Identifier Hits. Most identifier hits are generated from non-dental information such as age, race sex and blood type.

WinID will rectify any dental coding that is entered. The primary codes will be placed in an MODFL order, all entries will be capitalized, primary codes will be separated from secondary codes by a dash and extraneous entries such as numbers and punctuation will be removed. As an example when *q77mo@s* is entered WinID will return *MO-S*.

When coding for entry into WinID it is important to remember that records can be interpreted in many ways. The best coding will be coding that assures a record will achieve the highest placement in the best match function. Postmortem records are coded in a “what you see is what you code manner”.

Antemortem records are coded conservatively; radiographs are the best antemortem records. Written antemortem records should be used to confirm and amplify information seen on radiographs. It is better to use a / code for no-information, than to speculate and be wrong, thus moving the correct record further down the best match list. Always strive to minimize mismatches.

The coding team needs to be aware of some common errors that may place incorrect data into even the most meticulously kept records. *Flips* are where a restoration is placed in a tooth but the procedure is recorded as if it has been placed in the corresponding tooth on the other side of the mouth. An example is MO restoration placed in tooth #19 but recorded as #30-MO. *Flops*

are where a restoration is placed in a tooth but the procedure is recorded as if a different restoration had been placed. An example is MO restoration placed in tooth #19 but recorded as #19-DO. *Slides* occur when a tooth is miss identified as a nearby tooth. This is usually due to extraction and subsequent mesial drift. A example of a slide is when tooth #19 had been extracted several years ago, the resultant space closed by mesial drift, then a MO restoration is placed in tooth #18 but recorded as #19-MO.

When the A secondary code is used an entry must be placed in the comments section. The entry is used to record information for which no appropriate code exists. The comments section is the institutional memory of the dental identification effort. To facilitate searching, a tooth number should be associated with each entry into the comments.

WinID has the ability to use standard codes. Standard codes can be thought of as key-words. A search would come back with no matches if a “pedo” entry was compared to a “primary tooth” entry. Standard codes eliminate this source of ambiguousness and are available by pressing the *Standard Codes* button on the comments page.

Installing and Using WinID3

WinID is currently available for download at abfo.org. WinID3 was developed and written by James McGivney, DMD. Dr. McGivney provided WinID via the winid.com website at no charge to anyone wishing to use it for many years and his generosity in sharing this valuable software to the forensic odontology community is unequalled. In 2014 he donated WinID to the ABFO to maintain and distribute it and it is now available as a free download at the ABFO website.

WinID3 will run under the XP, Vista, 7, 8, 8.1 and 10 versions of the Windows operating system on PC type computers. Poor success has been reported with attempts to use WinID3 on MAC type computers emulating the Windows environment. No MAC version of WinID3 is contemplated.

To obtain WinID navigate your browser to abfo.org and follow the instructions on how to download and compete the end users license agreement, (EULA). .

It is best to use the default folder locations suggested by the WinID installation program. Using the default locations will ease networking WinID3 and create less problems when using others programs such as digital radiographic software.

When WinID3 is used in a network environment: Place the database (*.mdb) on the server. Install WinID3 on each workstation. Map the location of the database on the server to each workstation.

When WinID3 is installed, the program and other files are placed in a folder known as C:\program files\winid3\. These files are necessary for WinID3 to function properly and should not be modified or moved.

Other useful files can also be found in C:\program files\winid3\. These include four PowerPoint presentations on the uses of WinID, antemortem and postmortem coding forms, and English and Spanish versions of the user's manual.

Once WinID3 has been successfully been installed, navigate to C:\program files\winid3\, find the file *winid3.exe*, right click this file and select *create shortcut*. Drag the shortcut to the desktop.

To run WinID3 double click the shortcut icon on the desktop. Choose a database to use. The database sample.mdb is the only database available when WinID3 is first installed.

A new database should be used with each incident. To create a new database open the *File* menu, select *New Database*, type in a unique name for the new database, press *Open*. The new database will have one antemortem record and one postmortem record. Both records are named *Dummy*. Do not delete the Dummy records until actual antemortem and postmortem records have been added to the database.

When first opened, WinID3 displays two screens: the antemortem and postmortem screens. One or the other screen can be placed in front and thus becomes the current screen. To bring a screen to the front press its header bar or press either the *Ante* or *Post* button on the left menu.

Each screen is composed of several tabbed pages. To change tabbed page click the desired tab on the screen. The different tabbed pages include Name, Identifier, Dental Comments and Graphic. When the tabbed page is changed the record remains the same.

To navigate to a different record use the scroll bar at the bottom of the screen, or use the GoTo helper screen available on the left menu.

Information may be added into textboxes and combo-boxes on each of the tabbed pages of a record. This information is stored in a specific field of a specific record in the database. You can navigate to different fields by using the mouse or the tab button on the keyboard.

A graphic image can be associated with a specific record. Press the *Add Graphic* button found on the lower right of the Name tabbed page to add a graphic. Select a graphic from the list of displayed graphics. By default WinID3 expects all graphics to be placed in the C:\program files\winid3 folder. Once a graphic has been linked to a record, confirm it is the proper image by pressing the *Graphic* tab.

Use the *Add New* and *Delete Record* buttons on the left menu to add or delete records.

Press the NCIC 2000 button on the left menu to display the NCIC coding for the current record.

WinID3 can be displayed in various languages by selecting *Language* from the top *Display* menu.

Identification

WinID3 has a Best Match feature. Navigate to a record that you would like to identify. Make the record the front or current record. Press the *Best Match* button on the left menu. A screen with a number of ranked lists is displayed. The ranked lists display the best matches to the current record as calculated by various algorithms such as most hits and least mismatches. Double click on a record from any ranked list. A screen with three tabbed pages is displayed. Navigate through the tabs to display a comparison of identifier features, dental features or graphics.

Note the *Next Record* and *Previous Record* buttons at the bottom of the comparison screen. Use these buttons to move to the record that is below or above the displayed record from the ranked list. Scroll through records until a favorable comparison is found.

Antemortem and postmortem records can be filtered so that only records meeting specific criteria are displayed. Choose either the antemortem or postmortem screen. Press the *Filter* button at the bottom left of the screen. A screen with two tabbed pages is displayed. Enter desired filtering parameters and press *OK*. Only those records that pass the filter are displayed. The presence of the filter can be applied to the Best March function, so that only records that meet specific criteria are considered in the ranking algorithm. Be sure to turn off the filter when not needed, so that all records are available for use and display. In practice it is best to use a loose filter that allows more records to be selected than a tight filter that may exclude a critical record.

Another method of finding a match to a specific record is to persist a record's odontogram and graphic. This is accomplished by pressing the *Persist O+G* button on the left menu. Drag the persisted odontogram and graphic to a convenient location on your computer screen. If the record whose details have been persisted is antemortem filter the postmortem records and vice versa for a postmortem record. Use a prominent feature of the current record as the filter criteria. Display either the *Dental* or *Graphics* tabbed page of the filtered records. Now scroll through the records using the scroll bar at the bottom of the screen. Continue scrolling until a favorable comparison is made between the displayed odontograms or graphics.

Information about other features of WinID3 is available from the user's manual.

Currently a beta version of WinID on the Web is available for use at www.winid.com. It is hoped that in the future many features of mass disaster response, especially the interpretation and coding of antemortem dental records, can be accomplished at the computer. This will negate the necessity of bringing manpower to distant locations in response to a mass disaster.

Mass Fatality Incident Guidelines: The Development of a Dental Identification Team

Natural or man-made catastrophes often result in multiple casualties under circumstances that make their identification difficult. (1) It has long been recognized that under these circumstances, the use of dental records and x-rays by a team of trained forensic odontologists can greatly assist in the expeditious identification of the casualties. This facilitation of the identification and release of the victims to their families, not only provides a humanitarian service relieving the feelings of suffering and helplessness, but also satisfies several medico legal requirements. It is only a matter of time, when and where a mass fatality incident will occur. Based upon the significant role that forensic odontology has played in recent mass fatality incident response, it is the goal of the American Board of Forensic Odontology, Inc., to make available, to all who may have need, a simple but complete set of guidelines for the development of a dental identification team. Formal documentation of death demands positive identification. The degree of success in any mass fatality incident investigation is directly proportional to the degree of preparation. (2) These guidelines have been adopted as the official guidelines of the ABFO by unanimous vote of the diplomates, February 13, 1995, Seattle, Washington. A revision was completed in June 2010 by the MFI Subcommittee.

PURPOSE

These guidelines are designed as a resource for those agencies or jurisdictions who wish to develop an identification team either as a free standing unit or as a section of an overall mass fatality incident preparedness plan for a specific region. Realizing that no two mass fatality incidents are identical nor that the needs of all jurisdictions are the same, modification of any plan may be necessary. Based upon the combined experience of many diplomates with first-hand experience in the identification of multiple casualties, these guidelines are flexible. They provide a complete, but simple outline around which an organization can develop an identification team to suit its purposes.

TEAM DEVELOPMENT

Basic to any mass fatality incident identification team plan is the development of a concept of operation. How will your team function? Many states (3) have organized dental identification teams, some under the auspices of their state dental societies. The Council on Dental Practice of the American Dental Association has taken on the task of assisting and coordinating the activity. Will your team be integrated into an overall Emergency Government Plan for an entire state, or will it serve a county or region? Will your team be a part of a DMORT unit under the National Disaster Medical System? Understandably, all of these objectives may not apply in planning by prospective international teams outside the United States and Canada.

If trained odontologists are not available to form the core of the team, how will the training be accomplished? Will the team be dependent upon assistance from odontologists from other areas, or will it be free standing with the capability of handling all of its own functions? Once some of these questions are answered, those who are organizing the team can begin to consider the development of a plan, based upon five general areas:

1. Team personnel
2. Team organization
3. Equipment and supplies
4. Safety and health considerations
5. Facilities.

A bibliography in the addendum lists, as accurately as possible, many of the individual mass fatality incident dental identification team plans which are currently in print and available, together with a master list of all of the equipment and supplies which may be required in a mass fatality incident response. Consider that there is overlap between the odontologists, pathologists and funeral directors in the need for some of the equipment and supplies. Some of the equipment may be available from these sources and used jointly. Mutual aid agreements such as those which exist between the Disaster Dental Identification Teams in Illinois, Indiana, Michigan, Minnesota and Wisconsin may also be advantageous in the event of an extensive disaster.

OUTLINE OF A TEAM ORGANIZATION

I. Initial Organizational Planning

- A. Evaluate your need for a dental identification team
 1. Responsibility to the public
 2. Probability of an incident
 3. Existence of area or state teams
- B. Evaluate your resources for
 1. Trained dental personnel
 2. Equipment and supplies
 3. Financial assistance
 - a. State and local dental societies
 - b. State and local emergency management agencies
- C. Organizational implementation
 1. Team leadership
 2. Written organizational plan
 - a. Written participation agreement (4)
 - b. Written protocol with job descriptions
 - c. Flow chart for division of duties
 - d. Written record of participation and training
 - e. State and County Dental Associations
 - f. State Emergency Government Administration
 - g. State or local Medical Examiner/Coroner Office
 3. Sponsorship

II. Team personnel

- A. Source
 1. Diplomates of the American Board of Forensic Odontology
 2. Qualified odontologists
 - a. A nucleus of highly trained odontologist's is necessary to serve in a supervisory and instructional capacity

- b. The remainder of the team may be composed of dental personnel with skills in dentistry and limited training in forensic dentistry
- 3. Sufficient number of personnel
 - a. Consider your potential for a disaster and its' size, e.g.
 - (1) Major metropolitan area vs. small city or rural area
 - (2) International Jetport vs. local airport
 - (3) Presence of a geologic fault, volcano
 - (4) Reality of floods, hurricanes, or tornadoes
 - (5) Hazardous and explosive chemical industry
 - 4. Sources for personnel recruitment
 - a. Forensic organizations
 - (1) American Academy of Forensic Sciences
 - (2) American Society of Forensic Odontology
 - b. Dental societies
 - c. Dental schools' faculty

Comment: *Dental students are not recommended for dental identification teams*

- 5. Additional resources
 - a. National Disaster Medical Service, Disaster Mortuary Teams
 - b. Federal monetary assistance under Public Law 932.88
- B. Training resources
 - 1 .Initial training
 - a. Courses offered
 - (1) American Board of Forensic Odontology,
 - (2) Odontology section, AAFS
 - (3) American Society of Forensic Odontology
 - (4) University Dental Schools, Continuing Education Courses
 - (4) National and state dental meetings
 - (5) Various workshops and fellowships
 - b. Other resources
 - (1) Fire and rescue services locally
 - (2) DMORT annual training
 - (3) Hazardous Materials Teams (HAZMAT)
 - (4) Federal Bureau of Investigation Disaster Squad
 - c. Cost of training
 - (1) Individual's responsibility
 - (2) Sponsoring organization's responsibility
 - (3) Emergency government funds
 - 2. Scheduling of periodic continuing education or drills
 - a. Semiannual or yearly trainings are probably the most realistic
 - 3. Cross training of section members is highly desirable
 - 4. Objectives of training (5)
 - a. Familiarity with subject
 - b. Understanding dental identification
 - (1) Antemortem problems and procedures

- (a) Acquiring flight manifests and names
 - (b) Locating and securing dental records
 - (c) Problems with poor quality records
 - (2) Postmortem problems and procedures
 - (a) Gaining access to dental structures
 - (b) Obtaining postmortem radiographs
 - (c) Fragmentation and commingling
 - (3) Comparison section problems
 - (a) Coping with large numbers of records
 - (b) Computer versus manual searches
 - (c) Identification of fragmented and commingled remains
 - c. Learning to work with other identification specialists
 - (1) Fingerprint examiners
 - (2) Anthropologists
 - (3) Laboratory analysts
 - d. Become familiar with the concept of the Incident Command System-on line or through lectures
- D. Determination of the number of team members required
- 1. Based upon magnitude of the mass fatality incident
 - 2. The condition of the human remains
 - 3. Based upon number of shifts required (It is the consensus of experienced mass fatality incident response teams that working shifts, particularly the third, are to be avoided if at all possible. Normal working hours prove to be the least stressful.)
- E. Special skills required
- 1. Dentists with forensic training
 - 2. Oral surgeons, Oral pathologists
 - 3. Auxiliary personnel, Hygienists, Assistants for record compilation
 - 4. Computer assisted identification program specialists
 - 5. Psychologists trained in critical incident stress disorder (CISD)
 - 5. An experienced member to serve as a liaison with other sections of the investigative teams
 - 6. Amateur radio service operators for emergency communications
 - 8. Clergy
 - 9. Foreign language skills
- F. Staging area (may be the responsibility of emergency government; however the dental identification team should be familiar with this concept)
- 1. Location
 - 2. Transportation of team personnel to the morgue site
 - a. Private vehicles
 - b. Buses, vans or four-wheel drive vehicles
 - 3. Access to the disaster area by dental personnel for the recovery of fragmental dental evidence
- G. Legal considerations

1. Status of the team members as volunteers or employees
 - a. Worker's compensation or liability insurance to cover any injury or exposure
 - b. Responsibility for their health and safety
 2. Compensation of the team members
 - a. Rate
 - b. Establishment of the rate according to experience, training and skill
 - c. Responsibility for the time and record keeping
 - d. Agency or underwriter responsible for payment
 - e. Team members should be informed of their probable compensation prior to participation
 3. Consider a written agreement for team members (7)
 - a. Rules and regulations for participation
 - (1) Authorized photography only
 - (2) Authorized press interviews only by official spokesperson
 - (3) Procedure for activation and participation
 - b. Responsibilities
 - (1) Participation in continuing education
 - (2) Obligation to report changes in telephone or address
 - c. Code of ethics
 - (1) Nondisclosure of privileged information
 - (2) Report to staging area only when activated
 - (3) No unauthorized contact with the media
 4. Written authorization from Coroner or Medical Examiner to conduct a limited autopsy
 - a. Method to gain access to the teeth
 - (1) Viewable versus non-viewable cases
 - (2) Specific authorization for removal of jaws
 - b. Written authorization for the retention of any tissue
- H. Jurisdictional considerations
1. Conflict of any of the identification team guidelines with an existing emergency government disaster plan
 2. Limitation of the team's area of operation
 3. State or governmental licensure considerations applicable
 4. Mutual aid agreements already in effect for other dental identification teams
- I. Mobilization procedure (activation)
1. Method for both drills and actual notification
 - a. Phone tree
 - b. Fax
 - c. Computerized notification system
 - d. One individual solely responsible for placing all calls for activation is recommended:

- (1) Ability to confirm the team member's availability
 - (2) Ascertain the duration of assignment the team member can accept
 - (3) Assign a specific time to report or duty to be performed
2. Periodic update of telephone numbers and phone drill
 - a. Annually should be the minimum to keep records current
 - b. More frequently is desirable
 3. Determination of which team members are to be activated
- J. Security and identification of authorized team personnel
1. Photo identification cards
 2. Distinctive colored baseball caps
 3. Distinctive colored protective equipment
- K. Team organization / structure
- A. Can be divided into sections for specific training and duties
 1. Antemortem records section
 2. Postmortem, photography and x-ray section
 3. Comparison section
 - B. Size of sections determined by magnitude of catastrophe
 - C. Team leader, alternate team leader and section supervisors on call 24 hours at a time to effectively be able to activate the team
 - D. Units of the team can be organized regionally
- L. Equipment and supplies (a complete listing is found in the addendum)
- A. Equipment
 1. Dental X-ray unit(s)
 2. Dental instruments
 3. Autopsy equipment (available from Medical Examiner or Coroner office)
 - a. Bard Parker handles and blades
 - b. Stryker saw or bone cutters
 - c. Gurneys and tables
 4. Digital radiography and computer software, sensors
 5. Lighting (available from emergency government)
 6. Photographic equipment, digital cameras and flat bed scanners
 7. Computer hardware and software useful for large numbers of casualties
 8. Copy machine(s) and paper
 9. Consider having a back-up available for all equipment. (Redundancy is the hallmark of an excellent disaster plan-Murphy's Law)
 - B. Immediate availability of supplies and equipment
 1. Prior arrangements in place with potential suppliers are essential
 - a. Evenings, weekends and holiday contact numbers
 - b. Consider an alternate source just in case
 - c. Advance financial arrangements eliminate the need for cash at the time of procurement

2. Annual review of equipment needs and contact numbers of personnel authorized to provide emergency use of the equipment or provide the supplies must be accomplished
- C. Supplies (Exact items required and quantity will be determined by the individual team resources and needs. Remember that some supplies have a limited shelf life and must be replaced periodically)
 1. Batteries for cameras, photographic paper and printers for digital radiographs
 2. Dental charts (standardized format), manila envelopes, magic markers and colored pencils
 3. Rubber gloves (heavy duty); rubber aprons and face masks and shields or eye protection
 4. Protective footwear (rubber boots)
 5. Banker boxes for files
 6. Quantity of supplies is driven by the number of casualties
 7. Foot lockers or storage boxes for small equipment
 8. Responsibility for cleaning and sterilizing and returning instruments and equipment
 9. Responsibility for restocking supplies used
- D. Consider the other agencies involved as a resource for equipment and supplies.
 1. Medical Examiner or Coroner
 2. DMORT utilizing one of three LRAT (Logistical Response Assistance Teams) – Can deploy the DPMU (Disaster Portable Morgue Unit), providing equipment and supplies upon activation
 3. Fire and Rescue Service
 4. Emergency Government Coordinators
- E. Clean-up, storage and restocking of equipment and supplies
 1. Cleaning and sterilization of equipment can be accomplished by:
 - a. Local hospitals as a public service
 - b. Medical Examiner facilities
 2. Storage location between mass fatality incident responses (must be accessible at all times)
 - a. Airport warehouse facility
 - b. Emergency Government facility
 - c. Medical Examiner Office
 3. Responsibility for restocking supplies
 - a. Coroner or Medical Examiner
 - b. Emergency Government Office
 - (1) County
 - (2) State
 - (3) National-Federal Emergency Management Agency (FEMA)

c. The identification team

M. Safety and health of team members must be considered

A. OSHA regulations in the United States and WHIMS Rules in Canada.

Other regulations may apply internationally.

1. Team leaders must be aware of their responsibilities
2. Team leaders and team personnel must be properly trained and are aware of:
 - a. Radiologic hazards
 - b. Blood borne pathogens
 - c. Toxic chemicals
 - d. Hazardous debris
3. Team members must receive biologic hazard and blood borne pathogens training annually and be documented
4. A written plan and record of periodic training must be maintained
5. Avoid long hours or shifts (8)
 - a. Increases in critical incident stress
 - b. Increases in mistakes and accidents
 - c. Doesn't allow for cleaning the morgue site
 - (1) Safety and hygiene
 - (2) Professional appearance deteriorates

B. Immunizations

1. Immunizations should be required for:
 - a. Tetanus
 - b. Hepatitis B
 - c. Special situation immunizations for foreign locations
 - d. Tuberculosis
2. Cost borne by the sponsoring organization
3. Are health and immunization records kept and updated per OSHA regulations

C. Protective gear for personnel is a necessity

1. Team members must be trained in the use of this equipment (F.I.T. testing)
2. Protective equipment must be immediately available
 - a. Agency responsible for providing the protective equipment
 - b. Storage location
 - c. Responsibility for disbursing and maintaining it

D. Psychological debriefing and counseling should be available. Since this is a situation common to all disaster workers, it ordinarily is not the responsibility of the dental identification team to arrange for this service. However, dental team members should be aware that their work can be psychologically taxing.

1. Access to experts in post-traumatic stress counseling
2. Access to clergy

N. Facilities (Although this is the responsibility of the Coroner or Medical Examiner, many smaller jurisdictions have never experienced a catastrophe involving mass fatalities. It should, therefore, be considered by the experienced dental identification team, since they may provide valuable advice.)

- A. Adequate temporary morgue sites must be selected in advance
 - 1. All Coroner/Medical Examiner offices do not have a written disaster plan in place, so potential sites may not be in place
 - 2. Experienced odontologists may be able to assist them in developing this plan, because of their prior experience
 - 3. In general it is advantageous to plan for the use of existing facilities to their maximum before setting up a temporary morgue.
- B. Alternate sites also should be considered as a back up
- C. Sanitation facilities must be available at all of the potential sites
 - 1. Hot, running water and soap
 - 2. Toilets and toilet paper
- D. Arrangements for food and a rest area for team members
 - 1. Sources for food and drink
 - a. Salvation Army volunteers
 - b. Red Cross volunteers
 - c. Volunteers (e.g., service clubs, churches)
 - 2. Consider the maximum length of time a team member may work
 - a. This work is stressful
 - b. Be aware of post-traumatic stress disorder
 - c. Provide for mandatory periodic breaks
 - d. Rest in an area removed from the morgue is essential
 - 3. Consider rotating team members between sections frequently
 - 4. Provide chairs or stools for use of team members while working
 - 5. Standard working hours are the least stressful. Avoid shifts.
- E. Immediate reservation of blocks of hotel or motel rooms by the office of emergency government, or other authorized agency, for the use of disaster personnel is necessary to prevent the media from tying up all of the rooms available for miles around.
- F. Area perimeter security is the responsibility of the ranking law enforcement official present. However, the dental team must be aware of the necessity for perimeter security and be readily identified.
 - 1. Protection of personal effects of victims
 - 2. Excluding the curious and unauthorized
 - 3. Prevention of unauthorized photography by the media
 - 4. Can be provided by governmental or private agencies

Once these concepts have been established, those organizing the team can begin to consider expansion of the team to handle the identifications, as the magnitude of the disaster increases (9).

The team can then be organized to be able to handle casualties in ranges, e.g. 1 to 50, 50 to 150, 150 to 300 and 300+ (10). Working in shifts, around the clock, can be accomplished when necessary by the use of cross-trained supervisory personnel for each shift.

ADDITIONAL RESOURCES

The following references contain information on mass fatality incident dental identification team plans and although this listing is not comprehensive, it is provided as a source of additional information for those who may wish to research.

American Dental Association, *Proceedings, First National Symposium on Dentistry's Role and Responsibility in Mass Disaster Identification*, Chicago, Illinois.

Bell, G. L., *Manual of Forensic Odontology*, Chapter 7, Mass Disaster Dental Identification, published by the American Society of Forensic Odontology.

Besant-Matthews, P. E., *Report of the Delta 19 Aircraft Crash, Dallas, Texas, 1985, Disaster, Planning Checklist*

Braggeman, W., Durigon, M., and Keiser-Nielson, S., *Manual on Disaster Victim Identification*, International Criminal Police Organization - Interpol, 4.4.2.5, Dental ID Section.

FEMA, *Multiple Fatalities Disaster Response*, Student Manual, Emergency Management Institute, National Emergency Training Center, Emmitsburg, Maryland

Glazer, H. S., Editor, *Forensic Dental Team Identification Manual*, The Dental Society of New York, 1989.

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Johnson, L. T. and Simley, D. O., *Wisconsin Dental association Disaster Identification Team*, Milwaukee, Wisconsin, 1984

Morlang, W. M., *Mass Disaster Identification*, U. S. Air Force Medical Service, Brooks Air Force Base, San Antonio, Texas, 1993

Standish, M. and Cottone J., *Outline of Forensic Dentistry*

Warnick, A., *Forensic Dental Identification Team Manual*, The Michigan Dental Association, Lansing. Michigan, 1989

Wisconsin, State of, *State Statutes, Chapter 166, Emergency Government*

Wright, F. D., *Mass Disaster Dental Identification Team*, Ohio State Dental Association

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1 Field Disaster Identification, Preparation-Organization-Procedures, U.S. Department of Justice, Federal Bureau of Investigation, Hazen, R. J. and Phillips, C. E.

2 Mass Disaster Management, Morlang, W. M., U. S. Air Force Medical Service, Brooks Air Force Base, San Antonio, TX, 1993

3 The State of Washington was the first with a written plan developed by Dr. Gary Bell, *Mass Disaster Dental Identification Team*, 9730 Third Ave., NE, Suite 204, Seattle, WA 98115, 1983

4 Ohio State Disaster Dental Identification Team, Franklin Wright, DMD

5 Idaho State Dental Association Disaster Dental Identification Team Protocol, Gerald F. Jones, DDS

6 Ohio State Disaster Dental Identification Team, Franklin Wright, DMD

7 Personal communication, Greathouse, Danny W., FBI Disaster Squad

8 Personal communication, Greathouse, Danny W., FBI Disaster Squad

9 Mass Disaster Management, Morlang, W. M., U. S. Air Force Medical Service, Brooks Air Force Base, San Antonio, TX, 1993

10 Compiled from "Mass Disaster Management", U. S. Air Force Medical Service, Brooks Air Force Base, San Antonio, TX, Morlang, W. M., 1993, and from suggestions from the committee members and those Diplomates of the American Board of Forensic Odontology who attended the workshop on mass disaster team guidelines held at Seattle, Washington, February 13, 1995.

11 Cook County Medical Examiner Disaster Identification Team Protocol, John Kenney, DDS, MS

06/10

CHECKLIST OF SUPPLY AND EQUIPMENT REQUIREMENTS

Consider that other agencies or teams responding to a mass fatality incident investigation may also have need for the same supplies and equipment. The possibility of mutual use may exist, and the security of having a back-up unit is extremely valuable when a break down occurs. A frequently updated list of emergency contact personnel with telephone numbers of dental supply houses and other sources of equipment and supplies must be maintained. Specific responsibility for this task must be assigned to an individual team member.

Autopsy (Postmortem) Section Equipment and Supplies

Pruning shears (long handle)
Folding tables/chairs
Mallet & chisel
Plastic aprons
Surgical masks
Pm dental charts
Photo id badges
Gurneys
Dental mouth mirrors
Lead aprons
Lead gloves
Cheek retractors
Modeling clay
Large Ziploc bags
Molt mouth prop
Shoe covers
Flood lights
Extension cords
Surgical head covers
Fans
Surgical scrub soap & brushes
Bard parker handles/blades
Plastic gallon jugs
Hydrogen peroxide
Toilet paper
Large hemostats
Autopsy twine
Scrub suit trousers (s-xl)
Bite blocks
Flash lights/batteries
Tongue depressors
Plastic squeeze bottles
Ball point pens
Sharpie felt tip markers
Isolation gowns rubber gloves
4 x 4 gauzes

Blue paper towels
Goose neck lamps
Moveable partitions
Dental explorers
Handheld or portable dental x-ray unit
Orange oil
Toothbrushes
Cyanoacrylate cement
5-gallon plastic pails
Plastic (Saran) wrap
Digital Cameras
Laptop computer(s) with digital x-ray and WinID3 software, LCD monitors
Digital x-ray sensors
Sensor holders (Rinn and XCP)

Comparison Section Equipment and Supplies

Folding tables and chairs
Tooth development (Chart)
Millimeter Rule X-ray view box
Large manila envelopes
Tape, masking & surgical
Paper clips
Standard dental charts
Banker file boxes
Camera batteries
Clip boards
Odontology texts
File folders
ASFO Workbook Manual
FAX machine
Telephones
Computer(s)/ID software, printers, flatbed transparency scanner(s) etc.
Legal pads
Clip boards
Rubber bands
Labels, self-adhesive
Telephone directories
Tool box and tools
Extension cords
Magnifying glass
Staplers and staples
ADA Membership Directory