DISPELLING THE "CSI EFFECT" MYTH
ANTHONY “RICK” CARDOZA, DDS, AND AMBER RILEY-BURNS, RDH, MS
THURSDAY, FEBRUARY 20
**Chicago Dental Society MWM & REGIONAL MEETING COURSE EVALUATION**

**Speaker:** ____________________________  **Date:** ____________________________

**Subject:** ____________________________  **Number of attendees:** ____________________________

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What topics of interest would you like to see covered in the future?  ____________________________________________________________

Comments (use reverse if you need additional space):  ________________________________________________________________

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Abstract

The Cedar Fire burned a large area of San Diego County in October 2003. By the time it was extinguished in mid-November, it had consumed more acres than any fire in California’s history. Fifteen people lost their lives because of the fire. Forensic dentistry played a prominent role in the identification of the victims.

On Saturday, Oct. 25, 2003, a lost hunter lit a signal fire hoping to be rescued. Instead, he started a massive wildfire. When it finally was extinguished weeks later, it had consumed more acreage than any fire in California history. The hunter was in an area called Cedar Creek, just east of the community of Ramona in San Diego County, deep within the hills of the Cleveland National Forest. The area was generally inaccessible due to the rough terrain and 30 years of underbrush growth. In San Diego County, the average rainfall is nine inches per year. However, the average rainfall had been well below normal the past several years. As a result, the dead brush had a moisture content of 2 percent to 3 percent compared to paper, which has a moisture content of 10 percent.

The fire began at sunset under fairly calm wind conditions. However, because of the extremely dry brush, it spread very rapidly and covered much ground. Air tankers were not allowed to respond that evening due to night flight restrictions and firefighters could not reach the fire’s Ground Zero. The fire grew rapidly in size, moving west toward Ramona.

Suddenly, in the early evening, the Santa Ana winds increased and shifted direction. The front of the fire increased to a width of five miles and moved rapidly toward eastern Ramona, the Barona Indian Reservation, and Wildcat Canyon/Muth Valley. As the fire grew in size and ferocity, it grew into a force of incredible destruction. Raging through Wildcat Canyon, its speed approached 60 miles per hour. The fire consumed 33,000 acres in one hour, equal to nine acres per second. At that point, all rescue personnel could do was to focus on saving lives. “A hundred fire engines would not have been enough. The crews were there to rescue people.”

By 9 a.m. the next morning, the fire had consumed more than 150,000 acres and traveled almost 20 miles west through the communities of Ramona, Barona, Wildcat Canyon/Muth Valley, Lakeside/Eucalyptus Hills, Poway (south), and into Scripps Ranch moving up to and over the 10-lane Interstate 15. By Sunday night, the Cedar Fire raged south and east through the communities of Santee (north), El Cajon (east), Crest, Harbison Canyon, and Alpine. In its first full day,

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it became the largest fire in San Diego County’s history. Three days later, the Cedar Fire earned the distinction of being the largest fire in California’s history consuming, more than 233,000 acres at an average of 6,000 acres per hour.3 The fire overran the entire community of Lake Cuyamaca, destroying 90 percent of the homes and devastating the surrounding state park. On Wednesday, the fire headed back toward Julian to the north and Pine Valley to the east. The fire raged for several more days and was not fully contained until Nov. 16, 2003.

The Cedar Fire ultimately burned more than 270,000 acres, destroying 2,232 homes. The fire was fought by 877 fire engines and 5,203 firefighters from 325 departments.4 The fire claimed 15 victims, including a firefighter from Novato, Calif.

**Purpose of Dental Identification**

Forensic dental identification specialists typically are the last conventional option for postmortem identification. DNA is also now utilized, but due to its high cost and the extensive time required for analysis, it is used sparingly or when no other option exists. This was seen recently in the identification of the remains of Laci Peterson, whose body was recovered headless and handless. Other forms of postmortem identification include visual, personal effects, fingerprints, scars, marks, tattoos, and medical radiographs.

Forensic dental identification has been successful because of the nature of the human dentition. Enamel is the hardest substance in the body and the only exposed portion of the skeletal system. Teeth are resistant to thermal damage and blunt force trauma. Therefore, the dentition remains stable during tissue decomposition. In addition, the dentition is unique to a specific individual. This includes not only the morphology of the coronal portion of the tooth, but also the morphology of the roots, pulpal chamber, and their relationship to their surrounding structures (i.e. sinus proximity, mandibular canal proximity, interproximal bony trabecular patterns etc.). If dental restorations are added, the unique combination for any given individual can factor into the millions.

There are numerous important reasons for identifying the deceased.5 A legal certification of death is necessary to consummate legal matters such as life insurance, wills, etc. There are family and personal reasons as well, including closure. In criminal investigations, it is important to establish the identity of the victim in order to proceed with the criminal investigation and to identify the suspect.6

In a blaze such as the Cedar Fire, the bodies often are burned beyond visual recognition. Personal effects are also destroyed or lost in the fire. Even if the personal effects are recovered, they may not be considered reliable due to the typical calamity surrounding a fire. A forensic anthropologist can examine the remains of the skeletal system and often can determine age, race and sex of the victim. Positive identification is best performed by examination of the surviving dentition by the forensic odontologist. However, in cases such as the Cedar Fire, where the temperatures were at times very high (1000°C), even the dental remains may be destroyed. Crowns may fracture or explode leaving only the roots. The bone may also be completely consumed leaving only scattered roots with no bony sockets for reference.

**Method of Dental Identification**

Forensic dental identification is most often accomplished by comparing the radiographs of the teeth of the decedent (postmortem) with the dental radiographs obtained from the dentist of the suspected victim (antemortem). Ideally, the antemortem radiographs furnished should be the *original* full mouth series. Often this is not the case. Children’s radiographs are typically bitewings only unless they have orthodontic records as well. Frequently, duplicate radiographs, rather than originals, are sent and they often have been either poorly duplicated and/or are not labeled right and left for orientation. In addition, the antemortem radiographic image may be of poor quality due to improper operator technique (cone cuts, overlapping interproximals, elongation/foreshortening, etc.) or poor processing (contrast, burned images, etc.). When poor antemortem radiographs are compared to an ideal postmortem radiograph, the two may not appear consistent. This could seriously hamper the identification effort.

In forensic dental identification, it is emphasized that good quality, properly mounted and labeled *original* antemortem radiographs be sent for comparison. In addition, copies of the victim’s dental treatment progress notes should be submitted as well. This allows the forensic dentist to verify dental treatment that was performed subsequent to the date of the radiographs.

**Identification of the Cedar Fire Victims**

The majority of the Cedar Fire victims died the first night in the Wildcat Canyon/Muth Valley area. This was...
due to the rapid movement of the fire along with the lack of advance warning to those in the path of the fire. Two more victims lost their lives after the first night. One victim died in the Alpine area; the other victim, a firefighter, died when flames overran the fire engine. Medical examiner investigators initially had difficulty recovering some of the bodies due to the persistent flames and the threat of injury. In addition, the severely burned remains were very fragile, which made recovery difficult.

The victims’ remains were examined by forensic pathologists and autopsies were performed. A forensic anthropologist then examined the remains and reassembled the skeletal structures when possible (Figure 1). While these examinations were occurring, investigators contacted each victim’s family, friends, physician, and dentist to collect information for use in identification.

In San Diego County, there are two primary forensic odontologists on call to perform postmortem dental exams, Norman “Skip” Sperber, DDS, and the author. Sperber was on call Oct. 28, 2003, and he examined the initial seven cases. The author was called the following day for the next set of exams. Due to the extreme heat, the victims’ remains were all badly charred; some were almost fully cremated.

With the antemortem radiographs in hand, the author took sufficient postmortem radiographs to allow for an adequate comparison. Sometimes, only one radiograph needs to be taken while at other times, a full mouth series must be completed. The author worked two evenings and one morning examining eight of the 15 victims. The examinations resulted in positive identifications for five of the eight victims. One of the unidentified victim’s remains was very severely charred. The only dental remains consisted of charred roots and fragments of burned bone (Figure 2). There were no bony socket fragments for orientation. Unfortunately, the only antemortem radiographs available were four bitewing X-rays taken when the decedent was a young teen, more than 10 years earlier. The root morphology could not be seen in the bitewings, so a comparison could not be made. The other two victims who could not be identified were almost fully cremated, with no identifiable dental or bony structures.

The next dental identifications were two severely burned bodies with intact skulls and jaws. The mandible and maxilla were resected and the dental identifications were completed (Figure 3). It is interesting to note that on one of the cases, the American dentist of record furnished his most recent radiographs (four bitewings) from about four years prior. Only the most recent radiographs had been requested by the medical examiner investigator. The decedent had subsequent major reconstructive dental treatment performed in

**Figure 1.** The burned skeletal remains are reassembled by the forensic anthropologist for examination.

**Figure 2.** The dental fragmented remains of a fire victim. The remains were almost fully cremated.

**Figure 3.** The mandible and maxilla have been resected from the body and are now ready for dental charting and radiography. Note the maxillary removable partial denture.
dentist. While he no longer had any of his treatment records concerning the decedent, he did recall placing the bridge. The Mexican dentist signed a sworn affidavit at the U.S. Consulate in Tijuana, Mexico, certifying he placed the bridge five years earlier. Though this identification was not ideal, the medical examiner and the author had a high enough degree of confidence to complete this case.

Discussion

Fire often plays a role in mass disasters, and the identification of the victims of the Cedar Fire once again illustrated the significant role forensic dental identification plays in a mass disaster. When one looks at the enormity of the Cedar Fire, the number of victims who perished could have been much greater if not for the heroic response of all emergency personnel. The author experienced these heroics firsthand the second night of the fire. Authorities instructed the author to evacuate his family to a safe area. The fire came within 300 yards of his residence. During the evacuation, the author witnessed several neighboring homes burning on the hillside.

With the following two cases, the decedents had suffered very extensive thermal damage, again almost to complete cremation. Only a small portion of the cranium remained, the jaws were almost completely missing except for select posterior molars. It was fortunate that in both cases the antemortem radiographs furnished were complete full mouth series. Identifications were completed for both.

The author’s final dental identification of the fire victims was one that involved international cooperation. On a set of remains that was nearly fully cremated, the medical examiner investigator was able to recover some dental root fragments and a three-unit porcelain fused to metal bridge (Figure 5). The victim’s family stated the decedent’s dental treatment was performed in Tijuana, Mexico. The medical examiner investigator spent nearly 10 weeks pursuing the leads in this case and finally was able to get the name of the decedent’s dentist in Mexico. Meanwhile, the author determined the bridge was a maxillary right posterior bridge with teeth Nos. 4 and 6 the abutments and No. 5 the pontic (Figure 6).

With the name of the Mexican dentist, the author contacted Leon Dychter, DDS, chief forensic odontologist for the Courts of the State of Baja California, Mexico. Dychter met with the Mexican dentist. While he no longer had any of his treatment records concerning the decedent, he did recall placing the bridge. The Mexican dentist signed a sworn affidavit at the U.S. Consulate in Tijuana, Mexico, certifying he placed the bridge five years earlier. Though this identification was not ideal, the medical examiner and the author had a high enough degree of confidence to complete this case.

Figure 4. The resected jaws of a fire victim.

Note the extensive crown and bridgework.

Figure 5. The dental fragmented remains of a fire victim. The remains were almost fully cremated but a crown and a three-unit bridge remained intact.

Figure 6. The intact three-unit bridge which was used for the identification.
of the author’s patients, friends and colleagues lost their homes in the Cedar Fire. It is safe to say that everyone in this community was affected in some way.

Summary

In conclusion, it is noted California is well represented with dentists experienced in forensic odontology. California has the highest number of certified forensic odontologists compared to other states in the nation. In addition, we now have the California Dental Identification Team as a statewide resource.

To maximize the effectiveness of our forensic resources, it is important for practicing dentists to keep complete patient records on file and continually update them, including the radiographs. The records may be needed for postmortem dental identification.

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References
WHAT IS FORENSIC ODONTOLOGY?
That branch of dentistry which deals with the proper handling and examination of dental evidence and the proper evaluation and presentation of dental findings in the interest of justice.

ROLE OF FORENSIC ODONTOLOGY
1. **Human Identification.** ID of human remains in various stages of decomposition.
2. **Mass Disasters.** Airplane crashes, hotel fires, floods, earthquakes, bombs, terrorist attacks, hurricanes, etc. More complicated due to larger numbers involved. Team of investigators required. Forensic training and experience important.
3. **Bite Mark Evidence.** Through history humans have used their teeth as weapons to bite their victims. Bite mark evidence has been admitted in U.S. courts for many years.
4. **Human Abuse.** Dentists are required by law to report suspected cases of abuse (child, spousal, elder). The physically abused child has consistent manifestations such as a torn frenulum, swollen lips, facial and body bruises, fractured teeth, bite marks, etc.

HISTORY OF FORENSIC ODONTOLOGY
1. **45-70 A.D.** Rome. Emperor Nero’s mother had her husband’s mistress killed and her head brought to her for ID by a discolored tooth. OR, Nero’s mistress had Nero kill his first wife and ID’d her by a canine.
2. **1776.** Boston. First forensic dentistry in American history. Paul Revere ID’s General Joseph Warren, a distinguished physician, who was killed during the Battle of Bunker Hill. The British stripped the body and buried it. The General’s body was later ID’d by Revere by means of a dental prosthesis which he had previously adjusted.
3. **1897.** Paris. 126 perished in a fire while attending a charity ball. First text on forensic dentistry was written on this disaster.
4. **1906.** England. First known use of bite mark evidence. Suspect was convicted of a burglary because of a bite mark left in cheese at the crime scene.
5. **1945.** Berlin. Adolph Hitler and Martin Bormann were ID’d on dental evidence.
7. **1978.** San Diego. PSA airliner collides with small private plane over residential area. 144 victims. Computer used to aid in dental ID’s.
10. **1979.** Florida. Ted Bundy, convicted of murder. Bite mark evidence was presented by the prosecution. Bundy, a serial killer, was executed in 1989.
11. **1981.** Lee Harvey Oswald, President Kennedy’s assassin, was exhumed and positively ID’d by his Marine Corps dental records.
12. **1982.** Contra Costa County, CA. “America’s worst tunnel fire” took seven lives.
13. **1985.** Worst year in history for air disasters. Two of the largest were the JAL crash with 520 aboard and the Arrow Airways crash in Gander, Newfoundland, with Army personnel aboard.
18. **1994.** El Dorado County, CA. Mountain lion kills woman jogging in Sierra Nevada foothills. Bite mark on victim helps to profile and identify the responsible lion.


24. **1993-2002. Dental** identifications of abducted/murdered girls in California. Polly Klaus, (Sonoma Co.); Christina Williams, (Monterey Co.); Juli Sund/Silvina Pelosso, (Yosemite); Xiana Fairchild, (Santa Clara Co.); Danielle Van Dam, (San Diego Co.).

25. **2003** California southland fires. 15 victims ID’d with dental records.

26. **2004-5** Southeast Asia Tsunami

27. **2005** Hurricane Katrina, LA.; D-Mort Teams utilized.

**WHERE DOES THE FORENSIC ODONTOLOGIST WORK?**

1. Medical Examiner/Coroner’s office, morgue.
2. Dental office or laboratory.
3. In the field at the crime scene, disaster site, cemetery, jail, etc.
4. Courtroom, attorneys’ offices.

**THE NEED FOR IDENTIFICATION**

1. **Death Certificate.** Necessary to consummate legal matters such as insurance, wills, business interactions, remarriage of spouse, lawsuits.
2. **Personal and Family Reasons.** After mysterious disappearance an ID can help end emotional strain of next of kin. Burial problems may result when multiple bodies of persons of different faiths.
3. **Criminal Cases.** Positive ID of victim essential in many cases. Relationship of victim to suspect is important.

**METHODS OF IDENTIFICATION OF AN UNKNOWN BODY**

1. **Visual.** Most frequent method. Friends or next of kin view body soon after death.
2. **Personal Effects.** Not always reliable since can be stolen or switched. May lead to subsequent ID by more reliable means. Clothing labels, glasses, jewelry, laundry markings, keys, belt buckles, etc.
3. **Fingerprints.** Most widely used scientific method in U.S. Sometimes no antemortem print records for comparison. Computerization of fingerprints has been very helpful.
4. **Dental.** Human dentition outlasts other body tissues after death. Restorations & prostheses resistant to physical & chemical deterioration. Almost infinite number of possible combinations of restorations, prostheses, missing teeth, sinus outlines, etc. X-ray exam of teeth & jaws provides objective data on restorations, root canals, pathologic processes, anatomic differences, etc.
5. **Skeletal Remains.** Age, sex, race, habits, occupation, disease status, stature. Determined by forensic anthropologist.
6. **Autopsy Findings.** Diseases, surgeries, healed fractures, arthritic changes, tattoos, needle tracts, moles, scars, etc.
7. **Association – Exclusion.** Comparison of postmortem data of the deceased with antemortem data of others.
8. **DNA Analysis.** Comparison of human genetic markers.

**DENTAL IDENTIFICATIONS**
Comparison of postmortem dental records to antemortem dental records.

1. **Antemortem Records.** Records of person when alive. Must have some idea of a tentative ID of the unknown in order to obtain antemortem records. In California antemortem dental records of reported missing people should be filed with the Department of Justice, Missing and Unidentified Persons’ Unit (MUPS) in Sacramento. These dental records are computerized for comparison with postmortem dental records.

2. **Postmortem Records.** Records taken of the deceased body. Photographs are taken of the head, face and jaws. (Taken with a scale, case number, date). A complete dental charting is performed, preferably by two forensic dentists. Dental radiographs (x-rays) of teeth and supporting bone. Dental models, if indicated.

3. **Comparison of Records.** Odontologist should take sufficient time to make an accurate comparison of antemortem and postmortem records. He/she should seek consultation with another odontologist when necessary. Do not allow circumstances surrounding an event and media attention to pressure him/her into a premature and perhaps inaccurate ID. The odontologist should be totally objective and never enter into an investigation with preconceived ideas.

**MASS DISASTERS**

When and where will the next disaster occur? It WILL happen. The local medical examiner/coroner is in charge. Forensic odontology is only one division of the identification process.

The forensic dental ID team should be organized ahead of time. There should be a list of experienced odontologists willing to help in case of a disaster. These dentists should understand the ID forms, charting methods and the use of the computer CAPMI (computer assisted postmortem identification) or WINID programs. In California several forensic dentists are members of DMORT (Disaster Mortuary Operational Response Team) a federal organization that can be called to help with a disaster that is too large for the local or state authorities to manage. (e.g. Alaska Airline crash in Ventura County, WTC terrorist disaster, Hurricane Katrina). In 2002 California forensic odontologists began forming a state team for DVI (dental victim identifications) in mass disasters. CALDIT (California Dental Identification Team) is a joint effort of the California Society of Forensic Dentistry, the California Dental Association (CDA) and the state Office of Emergency Services (OEM).

**BITE MARK EVIDENCE**

Since the mid-seventies bite marks have been well accepted by forensic odontologists, law enforcement officers and trial and appellate courts. The known bite mark cases probably represent a small percentage of all bite mark evidence. The majority of bite mark evidence may not be recognized by investigating officers or pathologists.

Bite marks may be found on living or dead individuals. They may be found on the victims or the perpetrator of the crime. They may be found on food, wood, plastic, leather, tape, etc. They may be found on any part of the body. They are common in sexual crimes, in child abuse or in acts of self-defense.
The American Board of Forensic Odontology (ABFO) has established a GUIDELINES FOR BITE MARK ANALYSIS which should be followed for the collection and evaluation of bite mark evidence. Research is continually being done in the field of bite mark evidence.

BITEMARK ANALYSIS

1. What is the degree of certainty that the mark or injury is a bite mark?
2. Was the mark inflicted by a human? By an animal?
3. Can the bite mark be individualized with reasonable dental certainty?
4. Can the bite mark be connected with the time frame of the crime?
5. Is the bite mark consistent with the type of crime? e.g. sexual crime, assault, child abuse?
6. Usually analysis is performed at morgue where bite is first recognized. Sometimes done at police station, emergency room, etc.
7. Saliva washing important first to determine blood type, presence of DNA. Photographs, impressions, tissues samples are taken.
8. May need to examine teeth of suspect. (court order necessary.) Take dental impressions, photographs, wax bites.
9. Bite mark analysis should be independently performed by at least two experienced forensic odontologists.
10. Sometimes bite marks are not of sufficient quality to be linked to a specific individual.

FORENSIC DENTAL ORGANIZATIONS


FORENSIC DENTAL TEXTS