



Role of Dentistry in Forensics: a Historical Review

KEYWORDS

Forensic dentistry, Identification, Dental Records

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ABSTRACT

Forensic odontology, or forensic dentistry, is one of the most unexplored and intriguing branches of forensic sciences. It primarily deals with identification, based on recognition of unique features present in individual's dental structures. This paper includes all the cases till now where forensic dentistry played a role in identification or investigation.

INTRODUCTION

Establishing the identity of a living person may seem like an easy task; the person, or their friends or family, can simply be asked their name or other identification marks can be used for his/her identification. While in case of death, a body may be too disfigured due to trauma to allow for easy identification. This is common in case of high velocity crashes (e.g. cars, airplanes), fires, explosions or decomposed skeletal remains. Though sometimes difficult, identification remains a necessary task. Living individuals for whom identification is required may include wanted criminals attempting to elude custody, amnesia victims, comatose victims, victims of disfiguring trauma or persons who require identity confirmation following identity theft. Deceased individuals requiring identification may include homeless individuals, undocumented immigrants, burned bodies, decomposed or skeletal remains & individuals who sustained significant facial trauma that precludes visual identification¹.

Forensic is derived from the latin word 'forum' which means 'court of law'. Odontology refers to the study of teeth. Forensic odontology, is therefore, has been defined by **Federation Dentaire International (FDI)** as 'that branch of dentistry which, in the trust of justice, deals with the proper handling and examination of dental evidence, and with proper evaluation and preservation of oral findings'. Forensic Odontology, or forensic dentistry, was defined by **Keiser-Neilson in 1970** as "that branch of forensic medicine which in the interest of justice deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of the dental findings."

Forensic dentistry plays an important role in identification in manmade or natural disasters- events that result in multiple fatalities may not be identifiable through conventional methods². Age estimation of the living as well as of cadavers relies heavily on data regarding growth and developmental stages of the individual as obtained from dental and skeletal radiographs.

SIGNIFICANCE OF DENTAL RECORDS AS A EVIDENCE

The diversity of dental characteristics is wide, making each dentition unique. The dental enamel is the hardest tissue in the body, and would thus withstand peri- and post-mortem damages, and so would dental materials adjoined to teeth. Being diverse and resistant to environmental challenges, teeth are considered excellent post-mortem material for identification with enough concordant points to

make a meaningful comparison³.

FORENSIC DENTISTRY TILL NOW

Identification by dental means is not a new technique. It has been said that **Nero's mistress, Sabina, in 66 A.D.**, satisfied herself that the head presented to her on a platter was Nero's wife as she was able to recognize a black anterior tooth⁴. In **1193, Jai Chand**, the Raja of Kanauji, was murdered after being taken prisoner and was identified by his false teeth when he was found among those slain. Similarly the Earl of Shrewsbury was killed in the battle of **Castillon in 1453**. Hisherald was able to identify him by his teeth¹.

Charles the Bold, Duke of Burgundy, after inheriting additional lands, decided to create an independent state between France and Germany. He was killed in the battle of Nancy in **1477** while trying to accomplish the task. The Duke's page was able to identify him according to his dentition, as he had lost some teeth in a fall years previously¹.

In **Boston in 1776**, at the battle for Breed's Hill, Dr. Joseph Warren was killed. His face was unrecognizable as he suffered a fatal head wound. His dentist identified the decaying body of Dr. Warren by the small denture that he had fabricated for him. The denture was carved in ivory and was held in place by silver wires. The identification made it possible to bury Dr. Warren with full military honors on April 8, 1776¹.

The first case of forensic dental age estimation can be traced back to **1846**, when **Dr. Recamier** examined the teeth of a skeleton to solve the dispute related to the death of & identification of Prince Louis XVII in 1795 at the age of ten years two months from advanced tuberculosis of the lymph nodes (scrofula). All 28 teeth were present & third molars could be seen at the time of examination concluding that age is between fifteen or sixteen years. Dr. Recamier's age assessment was accepted and the body was reinterred in an unmarked place. The quest for the Dauphin continued and in 1897, a relative of Louis XVII gained permission to again search for the coffin. A coffin was found that contained the skeleton of a young male. Based on tooth development, three experts aged the remains at between sixteen years plus and eighteen years plus. It was concluded the remains were not those of the Dauphin¹. The modern forensic case started in 1897 in disaster victim identification in Paris by a general dentist⁴.

Another reported in **1849** when **Dr. John Webster** was found guilty of murdering Dr. George Parkman, a respected professor at Harvard University. At Webster's trial for murder, Dr. Nathan Cooley Keep, a dentist, identified the teeth as part of an upper and lower denture he had made for Dr. Parkman three years earlier. He recalled the circumstances of the denture's construction in exact detail, as Parkman had been anxious about having the dentures ready for the opening of a new medical college at which he was to give a speech. The day before the event, when some of the bottom teeth collapsed during the baking process, Dr. Keep and his assistant worked through the night and fitted the denture some thirty minutes before the ceremony. Dr. Parkman returned in a short time and complained that the lower cramped his tongue. An adjustment was made by grinding away portions of the inside of the lower denture. Dr. Keep fit portions of the lower denture to models he had retained in the production of it and showed the court where he had done the grinding adjustment of the lower denture. The dental evidence was overwhelming and Webster was found guilty and hanged. The Parkman-Webster case represents the first case of a dentist giving expert testimony in courts in the United States¹.

Dr. Zsigmondy published a method of numbering teeth in **1861**. He numbered permanent teeth from one to eight from the anterior midline and distinguished the quadrants by placing the numbers in segments of a cross. Deciduous teeth were designated with Roman numerals. Palmer later made similar proposals in 1891. In 1883, Dr. Cunningham proposed numbering all teeth from one to thirty-two. Numbering the teeth in this manner, starting with the upper-right third molar (1) and ending with the lower-right third molar (32), is commonly known as the universal system and is widely used in the United States. In this system the deciduous teeth are lettered from A to T in the same pattern. Rest of the world uses the Federation Dentaire Internationale (FDI) numbering system, which is similar to the system proposed by Dr. Zsigmondy. Denture marking to assist in identification was first proposed by Cunningham¹.

In the United States, in **1869**, two women victims of a boat fire on the Ohio River were subsequently returned to Philadelphia, where one of the bodies was misidentified. The family dentist later examined the bodies and was able to correctly identify them¹. Another case was in **1873** in Baltimore where dental characteristics were matched according to the witness statement. It was found that the dead body was of different individual. The correct identification was carried out later on another body found at different location¹.

After shooting President Lincoln on April 14, 1865, John Wilkes Booth escaped and took final refuge in a barn on a farm in Virginia. The U.S. Cavalry located him there on April 26. They surrounded the barn and set it on fire. Booth exited, was shot, and died at the scene. In later years, it was rumored that he had somehow escaped, was alive, and living abroad. Because of this rumor, his body was disinterred and examined in 1893. The family could not visually identify the body, but the family's dentist was able to recognize his work as well as a peculiar "formation" of the jaw that he had noted in his records during a dental visit for the placement of a filling¹.

Koenig W in **1896**⁵ was taking intraoral films of the teeth, leading the way for the science of Forensic Odontology which has flourished only since the 1940s. In **1903**, the Irquouis Theatre in Chicago burned and 602 of the 1,842

patrons in the theatre died. Although no records of the identifications can be found today, Dr. Cigrand stated in his article that "hundreds" were "unmistakably identified" from their dental records¹.

In **1905 and 1906**, two cases were reported concerning tooth marks left in cheese. In the 1905 case in Germany, a robber bit into the cheese then left it on a windowsill. Plaster casts of the cheese were later interpreted to be from a pipe smoker. Similar man was found among the suspects. The 1906 British case involved a store break-in. The dentition of a store worker fit "exactly" a cast of the cheese¹.

Dr. Keith Simpson described a most interesting case in which dentures were useful for the identification of a body placed in an acid bath. A set of upper and lower dentures was found and were identified by the victim's dentist¹.

In **1931**, **Broadbent** introduced roentgen cephalogram to visualize the growth patterns of maxillofacial skeleton and its changes for identification procedures. After the end of World War II, rumors were rampant that Adolf Hitler had escaped with his wife, Eva Braun. They had in fact died together in **1945**, but their bodies had been burned and then buried in secret by Russian soldiers. Due to a lack of antemortem and postmortem records, it was a challenge to dispel the rumors. Finally, pieces of Hitler's jaw were found that showed remnants of a bridge, as well as unusual forms of reconstruction, and evidence of periodontal disease. Hitler's identity was confirmed when the dental work matched the records kept by Hitler's dentist, Hugo Blaschke¹.

Although bitemark evidence had been used earlier, the **Doyle v. State** case in Texas in **1954** marked the first time that this type of dental evidence was used in court in the United States. Like in some earlier cases, Doyle, in the process of committing a burglary, allegedly left the imprint of his dentition in a partially eaten piece of cheese. The analysis of the evidence was made by having the suspect bite into another piece of cheese for the comparison. Dr. William J. Kemp, a dentist and longtime dental examiner for the State of Texas, testified that the bites in both pieces of cheese matched¹.

Moorees in **1963**⁶ studied the pattern of tooth formation and root resorption of three deciduous teeth i.e. canine, first molar and second molar to establish the chronological age of an unknown specimen or developmental age in the living child. **Demirjian** in **1973**⁷ conducted a study to derive a method of estimating dental age based on the developmental stages of the teeth (seven mandibular teeth on the left side of the jaw).

Several years after the assassination of **John F. Kennedy**, an English author named Michael Eddowes raised suspicion concerning the identification of Lee Harvey Oswald. It was his belief that the body buried in 1963 in Oswald's grave was really that of a Russian spy. To set the record straight, the body was exhumed and a positive identification of Oswald was made on **October 4, 1981**, with the aid of military antemortem dental records¹.

Happonen RP in **1991** recommended the use of orthopantomography in human identification⁸. **Kvaal** in **1995** formulated a method to estimate the chronological age of an adult from measurements of the size of the pulp on full mouth intraoral periapical radiographs⁹.

Vandevoort FM in 2004 used the X – Ray Microfocus Computed Tomographical Scanning for teeth to correlate dental age with an individual's chronological age based on the calculated volume ratio of pulp versus tooth volume measured, an X-ray microfocus computed tomography unit (microCT) with 25 microm spatial resolutions was used to non-destructively scan. Although rather time consuming, this technique shows promising results for dental age estimation in a non-destructive manner using X-ray microfocus computed tomography¹⁰.

Nuzzolese E in 2008 evaluate human identification by radiographic dental implants recognition with unknown victims having no prior dental records available¹¹.

In 2009 **Karen B, Gupta C** verified the dimorphism in human maxillary & mandibular canines in establishment of the gender¹². Other significant dental identification cases in recent years include those concerning the Symbionese Liberation Army (1973–1975), the Los Angeles police shootout (1974), Jonestown in Guyana (1978), the terrorist attacks on the World Trade Center and the Pentagon (2001), Tsunami (2004) and Hurricanes Katrina and Rita (2005)¹.

SUMMARY

Day by day forensic dentistry is becoming the most prolific tool of identification in forensic purposes. Antemortem and post-mortem dental records comparison is a common procedure in the identification of unknown human remains in most forensic facilities throughout the world.

There are three major areas of activity embracing current forensic odontology namely:

- The examination and evaluation of injuries to teeth, jaws, and oral tissues resulting from various causes.
- The examination of marks with a view to subsequent elimination or possible identification of a suspect as the perpetrator.
- The examination of dental remains (whether fragmentary or complete, and including all types of dental restorations) from unknown persons or bodies with a view to the possible identification of the latter

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