



## Clinical practice

## The application of CamScan 2 in forensic dentistry

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## ABSTRACT

Forensic dentistry plays a major role in body identification. The dental examination is very accurate and also, nowadays, in the time of a comprehensive fingerprint and DNA assessment, objectively supported. The identification, which is based on the dental documentation, leads up to 43–89% of a successful process. The purpose of the study is to describe the techniques employed by forensic odontology to identify human remains and also to provide details of some of the novel developments within this area. Comparative methods of dental identification of the unknown subject with pre-mortem clinical records, X-ray images, implant presence, superimposition and DNA analysis confirm the identity of the individual. It was shown that dental identification of a person is based on unique individual characteristics of the dentition and dental restorations, relative resistance of the mineralised dental tissues and dental restorations to changes resulting from decomposition and harsh environmental extremes such as conditions of temperature and violent physical forces.

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## 1. Introduction

The word forensic is powerful, emotive and formidable. It is defined as “pertaining to the law courts” and the word derives from the Latin forensic relating to matters of the ‘forum’, that is, the judicial courts of Rome. A review into the historical literature reveals many instances of science and medicine being practised for the purposes of enlightenment of the court. Indeed, included in the Capitularies drawn up by the bishops of the first Holy Roman Emperor (Charlemagne) were instructions to include medical expert testimony in cases of wounding, abortion, rape, incest, infanticide and suicide.<sup>1</sup> However, the modern public perception of the essence of the definition has subtly drifted from its original meaning as we tend, quite erroneously, to associate it with the police and investigative authorities rather than its true purpose which is to serve the courts of justice.

Forensic odontology is an integral part of forensic science that is most widely used for identification of living and deceased persons. The dental identification of humans occurs for a number of

different reasons, mainly in those cases when the body is fragmented or disfigured and visual recognition is not possible. Dental identifications have always played a key role in mainly natural and man-made disaster situations and, in particular, in the mass casualties associated with aviation disasters. The identification is essential from both the humanitarian and the religious points of view as well as for judicial reasons.<sup>2</sup>

The earliest recorded case concerns a female associated with Emperor Nero, who was identified after her death through the unique arrangement of her teeth. In the year 66 A.D, Nero's mistress, Sabina, got his wife killed by her soldiers and demanded to see the head of the victim in a dish. She recognised the head by a black anterior tooth. The first modern identification was based on a bridge presence. Dr. Joseph Warren was killed by a bullet that pierced his head in the battle of Bunker Hill (year 1775). His body was buried by the British in a mass grave. A year later, the people of Massachusetts wished to give a proper burial to Dr. Warren, and his body was later identified by Paul Revere by the ivory work which he had done for his friend when alive.<sup>3</sup>

The dental examination is very accurate and also, nowadays, in the time of a comprehensive fingerprint and DNA assessment, objectively supported. The identification, which is based on the dental documentation, leads up to 43–89% of a successful process<sup>4</sup>

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and it is still a method of choice. The importance of teeth for identification is because of their highly mineralised composition, which makes them resistant to the influences of the external environment. They are not changed by postmortem decomposition and usually withstand to flames, alkalis or even to weak acids.<sup>2,5</sup> One's teeth are also an excellent resource of DNA.<sup>6</sup> Mostly the identification results from a medical treatment and its documentation. The regular dental examination of patients is generally carried out at least once to twice a year, so their dental records represent an important source of identification data. Registration of dental records is mandatory in several European Union (EU) countries; health insurance companies require it and it is performed in dental private clinics as well.

The American Board of Forensic Odontology (ABFO) adopted Guidelines for the Bite Mark Analysis on 21 February 1984. These recommendations were later provided as an obligatory legal norm. The ABFO<sup>7</sup> recommended that the results of the dental identification should be divided into four categories as follows:

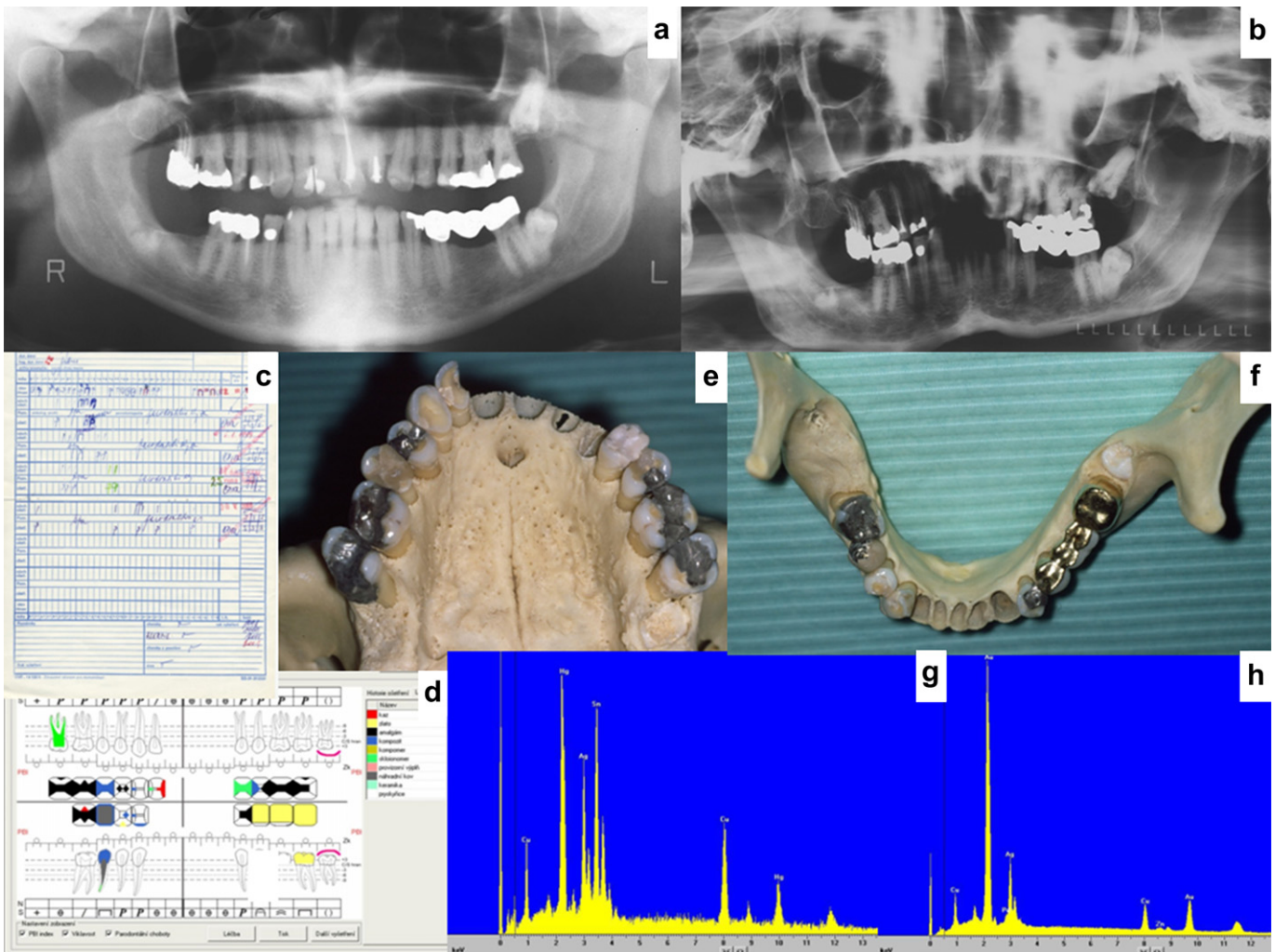
1. *Positive identification*: the antemortem and postmortem data match in a sufficient detail, with no unexplainable discrepancies to establish that they are from the same individual.
2. *Possible identification*: the antemortem and postmortem data have consistent features, but because of the quality of either the

postmortem remains or the antemortem evidence, it is not possible to establish the identity unambiguously.

3. *Insufficient evidence*: the available information is insufficient to form the basis for a conclusion.
4. *Exclusion*: the antemortem and postmortem data are clearly inconsistent.

Dental examination has several parts:

1. Macrophotography of the oral cavity
2. X-ray examination
3. Intraoral examination
  - a The number and the type of the teeth and their localisation in the jaws
  - b A presence of the filling – their material, size and shape
  - c The root canal treatment
  - d An occurrence of the fixed (crowns, bridges, etc.) and the removable prosthodontics
  - e An incorrect tooth eruption (ectopical teeth, unerupted teeth, etc.)
  - f Any orthodontic anomaly (open bite, cross bite, etc.)
  - g The fractures of the teeth and jaws play an important role, as well as any infectious focusses or anatomical anomaly such as torus palatinus.



**Fig. 1.** Comparative method of dental identification: a) antemortem orthopantomogram; b) postmortem orthopantomogram; c) antemortem dental documentation; d) postmortem dental documentation; e) skull – upper jaw; f) skull – lower jaw; g) chemical analysis of filling material, h) chemical analysis of alloy.

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