



Case Report

Estimation of date of death through wound healing of an extraction socket: A case report



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ABSTRACT

Surgical extraction of teeth due to dental pathologies is a relatively common procedure in modern man. The healing of the wound that results occurs in gradual and sequential stages, such that the analysis of this repair process can be very useful in forensic investigations on human remains. The following study reports on a particular case where the remodeling of a tooth socket allowed an estimation of the time that had elapsed from the day of the surgical extraction of the tooth to the time of death. The corpse was that of a woman of 34 years. It was in an advanced state of decomposition, as it was largely skeletonized. Macroscopic, radiographic, and histological examinations of the oral cavity showed the initial stages of alveolar bone remodeling of the first left mandibular molar, which was characterized by: (i) a small reduction in the vertical height of the vestibular surface with respect to the theoretical original position of the tooth; (ii) resorption of the intra-alveolar septum and lamina dura; and (iii) formation of new immature bone, which covered the entire inner surface of the socket. This study established that the subject died 13–42 days after the tooth extraction. Knowing the date of the dental extraction provided by the police investigation, it was possible to provide an estimate of the date of death.

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1. Introduction

According to Dalitz [1], surgical tooth extraction as a consequence of dental disease is a relatively common procedure in modern man. Healing of the resulting extraction socket appears to progress in an ordered and sequential manner. This can be of great value in forensic investigations of unidentified human remains, as it can provide some degree of accuracy for the estimation of the period of time that has elapsed between the antemortem extraction of a particular tooth and the time of death of that person. If the identity can be established for human remains that have a healing tooth-extraction wound or have bone changes related to the recent removal of teeth, and if the dental history of the subject is known, then this information can provide positive contributory evidence, or indeed negative evidence, toward identification of the time of death [1,2].

The aim of this paper is to report on a case where the remodeling of a tooth socket of a young woman allowed the

estimation of the time that had elapsed from the day of the surgical extraction of the tooth to the time of the death of the subject.

2. Case history

2.1. Discovery of the corpse and autopsy findings

On August 26, 2014, a corpse was found among weeds near a pylon under a viaduct of the A14 motorway near the town of Vasto (Chieti province, Italy). The corpse was in an advanced state of decomposition, as it was largely skeletonized. In particular, the cranium, thorax and upper limbs were completely skeletonized, while the pelvis and lower limbs showed mummified soft tissues (Fig. 1). These were characterized by a parchment-like texture (i.e., 'old leather') and were strongly attached to the skeleton. External and internal examination of the corpse revealed no pathological findings. Toxicological examinations did not reveal any extra relevant details concerning use of alcohol or pharmaceuticals, or of drugs of abuse.

A few days later, the corpse was identified through DNA analysis. According to the information from the police and the forensic investigation, the corpse belonged to a woman of 34 years who had gone missing in Vasto on March 28, 2014.

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Fig. 1. Detail of the thorax, cranium, and mandible.

On September 12, 2014, at the morgue of the Vasto cemetery, our expert working group in physical anthropology analyzed the corpse to evaluate the presence of possible skeletal injuries and/or other evidence that might be linked to the cause of death. The delay between the autopsy and the physical anthropological investigation was the consequence of the absence of involvement in Chieti province of physical anthropologists in the initial stages of the forensic work, including the recovery of skeletal remains, determination of the postmortem interval, and the identification procedure. When the forensic investigation is at a standstill, the forensic pathologist will sometimes contact the forensic anthropologist.

2.2. Physical anthropological examination

Detailed macroscopic examination of the mummified areas and the single bone elements indicated that they were well preserved, and that there were no signs of traumatic lesions or other skeletal evidence that might have been correlated to the cause of death. During the macroscopic examination of the oral cavity, the absence of nine permanent teeth was recorded: three in the maxilla (i.e., second left premolar, two third molars), and six in the mandible (i.e., two first and second premolars, first left molar, third left molar) (Fig. 2). The macroscopic analysis that was carried out in situ in the morgue of Vasto cemetery did not allow any assessment of whether the absence of the three third molars was antemortem (i.e., whether the respective sockets were completely remodeled) or whether they corresponded to agenesis (i.e., whether they were due to the lack of formation of the dental germs during tooth development). The maxillary second left premolar and the two first and second premolars of the mandible were lost postmortem, because there were no signs of alveolar bone remodeling. However, it was noted that the socket of the mandibular left first molar showed the initial stages of bone remodeling. This observation allowed the possibility to ascertain the time of death of the subject if the dental history records of the missing person could be obtained. Therefore, our investigation was focused on an analysis of this single socket, which is detailed in this case report.

After photographic documentation of the oral cavity, we proceeded to isolate the region that contained the socket of the mandibular first molar using a vibrating saw, to allow a more detailed study in the laboratory. The mandibular fragment was subjected to macroscopic morphological examination, and radiographic and histological analysis. A radiographic image of the anteroposterior view was obtained by X-ray analysis (45 kV, 5 mAsH) at the Department of Radiology of the Villa Serena Hospital (Città S. Angelo, Pescara, Italy), and it was examined by a

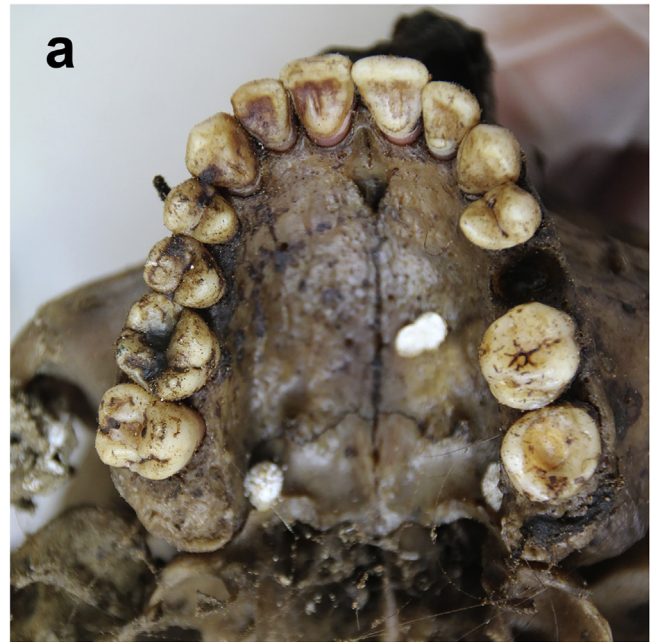


Fig. 2. (a) Maxilla showing the absence of three permanent teeth: the second left premolar, and the two third molars. (b) Mandible showing the absence of six permanent teeth: the two first and second premolars, the first left molar, and the third left molar. For both the maxilla and mandible, the premolars were lost postmortem. The macroscopic analysis in situ did not allow determination of whether the third molars were lost antemortem or they were agenetic. The mandibular left first molar (arrow) was lost antemortem, with initial stages of bone remodeling seen.

radiologist. Histological sections of the untreated mandibular sample (non-decalcified and not embedded in resin) were produced using a microtome (SP1600; Leica) with a diamond blade. The relevant tooth socket was sectioned at the level of the impression of the mesial root of the molar. Unstained thin sections of 60 μm and 100 μm thickness were obtained, which were observed at 40 \times magnification under an optical microscope (BX41; Olympus). The images were captured using a digital camera (Moticam 2300) connected to the optical microscope. The histological sections were performed by physical anthropologists at the University Museum of 'G. d'Annunzio' University of Chieti-Pescara (Italy).

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