G2 Intra-Alveolar Photogrammetry Scanning of Empty Dental Sockets of Teeth Missing Postmortem for Root Morphology Analysis: A Case Study

Domenico Dellaia, DDS, Private Dental Clinic, Turin 10147, ITALY; Carlo Robino, University of Torino, Department Public Health Sciences, Torino 10126, ITALY; Greta Cena, MD, University of Torino, Torino 10126, ITALY; Elena Chierto, PhD, Laboratorio di Genetica Forense, Turin 10126, ITALY; Emilio Nuzzolese, PhD*, DSSPP, Sez. Medicina Legale, Università di Torino, Torino 10126, ITALY*

Learning Overview: After attending this presentation, attendees will have an understanding of how the identification process of human remains with teeth lost postmortem can still be performed by reconstructing the morphology of missing teeth roots using an intra-alveolar technique.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by presenting the results of the use of a photogrammetry tool used by dentists for prosthetics treatments and its application in the field of forensic dental identification.

Forensic odontologists may have to perform a dental autopsy of unidentified human remains with missing teeth lost postmortem. Root morphology and the shape of treated as well as sound teeth could offer identifying features that can be useful within the forensic dental identification process.[1-3] In order not to lose this data, several techniques have been proposed in order to obtain a replica of the empty alveolar socket of the skeletal remains and thus the morphology of the missing roots. Currently, intra-alveolar morphology of empty sockets may be assessed with Computed Tomography (CT) scanning, periapical and panoramic radiographs, and silicon or alginate impressions.[4-6] The present study aims to assess the intra-alveolar morphology in empty dental sockets using photogrammetry scanning to reconstruct the 3D shapes of the roots of teeth missing postmortem.[7] Photogrammetry has reached advances in the field of digital photography and combining with a specific software has made this tool reliable and accurate and a well-established resource in prosthetic dentistry.[8] In dentistry this device, similar to an intraoral camera, will eventually replace the existing procedures that involve taking impressions with impression materials (alginate or silicone), than making a casting.

A dry unidentified skull was used for this study. The upper jaw with empty dental sockets was scanned using an intraoral scanner. Roots were reconstructed digitally in three dimensions, then compared with the radiographic images. A set of ten records formed the database for the evaluation of empty dental sockets, and the digital models were rotated into the specific dental planes to allow the comparison.

This study is devoted to data recording using an intraoral scanner as an alternative impression tool but with the advantage of a contactless technique. It was determined that teeth missing postmortem do not necessarily invalidate the identification process.

Per this study, the use of photogrammetry through intraoral scanners is a preferable technique compared to any traditional impression technique as it preserves and protects human bone from any alterations. Also, an intraoral scanner using photogrammetry should become one of the auxiliary tools of a dental autopsy, as it is a portable device, allowing accurate recording in any scenario.

Reference(s):

1. Smith B.C. Reconstruction of root morphology in skeletonized remains with post-mortem dental loss. *J. Forensic Sci*. 1992; 37: 176–184, doi: http://dx.doi.org/10.1520/JFS13225J.
2. Van der Meer D.T., Brumit P.C., Schrader B.A., Dove S.B., Senn D.R. Root morphology and anatomical patterns in forensic dental identification: A comparison of computer-aided identification with traditional forensic dental identification. *J. Forensic Sci*. 2010; 55:1499–1503, doi: http://dx.doi.org/10.1111/j.1556-4029.2010.01492.x.
3. Law C.A., Bowers C.M. Radiographic reconstruction of root morphology in skeletonized remains: A case study. *J. Forensic Sci*. 41 (1996) 514–517, doi: http://dx.doi.org/10.1520/JFS13947J.
4. Johnson A., Jani G., Pandey A., Patel N. Digital tooth reconstruction: An innovative approach in forensic odontology. *J Forensic Odontostomatol* 2019. Dec;(37): 3-12:20.
5. Smith B.C. Reconstruction of root morphology in skeletonized remains with postmortem dental loss. *J Forensic Sci*. 1992 Jan; 37(1):176-84.
6. Capeletti L.R., Franco A., Reges R.V., Silva R.F. Technical note: Intra-alveolar morphology assessed in empty dental sockets of teeth missing post-mortem. *Forensic Sci Int*. 2017 Aug;277:161-165, doi: http://dx.doi.org/10.1016/j.forsciint.2017.06.006.
7. Kašparová M., Halamová S., Dostálová T., Procházka A. Intraoral 3D Scanning for the Digital Evaluation of Dental Arch Parameters. *Appl. Sci*. 2018, *8*, 1838.
8. Stuani V.T., Ferreira R., Manfredi G.P., Cardoso M.V., Sant'Ana A.C.P. Photogrammetry as an alternative for acquiring digital dental models: A proof of concept. *Medical Hypotheses*, 2019, 128; 43-49. doi: https://doi.org/10.1016/j.mehy.2019.05.015.

Missing Teeth, Photogrammetry, Human Identification

*Presenting Author