G13 The Application of an Intraoral Scanner to Identify Monozygotic (MZ) Twins

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Learning Overview: After attending this presentation, attendees will have learned of the possible usage of an intraoral scanner for human identification based on palatal morphology.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by introducing attendees to a quick, easy-to-use, affordable method for forensic identification with an intraoral scanner. If among the victims there are MZ twins, this method will be able to help the forensic odontologist identify them.

Background: DNA base identification is a proper and high specificity method.[1] However, identification could be challenged in a situation where there is no database or the DNA sequence is almost identical, as in the case of MZ twins.[2] The aim of this study was to introduce a novel forensic method for distinguishing between almost identical MZ twins by means of an intraoral scanner using the 3D digital pattern of the human palate.

Methods: The palatal area of 64 MZ twins and 33 same-sex Dizygotic (DZ) twins (DZSS) and seven Opposite-Sex Dizygotic twins (DZOS) were scanned three times with an intraoral scanner. From the scanned data, a Stereolithography (STL) file was created and exported into the GOM Inspect® inspection software. All scans within a twin pair were superimposed on each other. The average deviation between scans of the same subject (Intra-Subject Deviation [ISD]) and between scans of the two siblings within a twin pair (Intra-Twin Deviation [ITD]) was measured. One-sided tolerance interval covering 99% of the population with 99% confidence was calculated for the ISD (upper limit) and the ITD (lower limit).

Results: The mean ISD of the palatal scan was 35.3µm ± 0.78µm. The calculated upper tolerance limit was 95µm. The mean ITD of MZ twins (406µm ± 15µm) was significantly ($p < 0.001$) higher than the ISD, and it was significantly lower than the ITD of DZSS twins (594µm ± 53µm, $p < 0.01$) and the ITD of DZOS twins (853µm ± 202µm, $p < 0.05$).

Conclusion: The reproducibility of palatal intraoral scans proved to be excellent. The morphology of the palate shows differences between members of MZ twins despite their almost identical DNA, indicating that this method could be useful in forensic odontology.

Reference(s):

1. Allwood, J.S., N. Fierer, and R.R. Dunn. 2020."The Future of Environmental DNA in Forensic Science. *Appl Environ Microbiol* 86 (2). https://doi.org/10.1128/AEM.01504-19. https://www.ncbi.nlm.nih.gov/pubmed/31704676.
2. Martini, M., I. Bufalari, M.A. Stazi, and S.M. Aglioti. 2015. Is that me or my twin? Lack of self-face recognition advantage in identical twins. *PLoS One* 10 (4): e0120900. https://doi.org/10.1371/journal.pone.0120900. https://www.ncbi.nlm.nih.gov/pubmed/25853249.

Palatal Rugae, Human Identification, Intraoral Scanner