G9 Selecting the Skeletal Mandibular Identifiers With the Strongest Potential for Human Identification on Panoramic Radiographs

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Learning Overview: After attending this presentation, attendees will understand that the mandible proves to be valuable for identification through its skeletal morphometric identifiers, and attendees will also learn how to implement the proposed method in forensic casework.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing the basis for an alternative identification method based on skeletal mandibular traits.

Background: The gold standard of odontological identification relies on dental treatment, morphology, and morphometry comparisons between antemortem and postmortem dental files.[1] However, the decrease in dental restorations reduces the occurrence of unique dental identifiers.[2] Nevertheless, dental radiographs contain more than just dental information. For instance, panoramic radiographs depict the entire mandible. Therefore, the current study aimed to select the best mandibular morphological traits with a strong identifying capacity.

Material and Methods: One hundred eighty-five digital panoramic radiographs (94 males and 91 females; age range 16–66 years) were retrospectively collected from a private dental clinic in Brussels, Belgium, and imported into image enhancement software. Four landmarks were located on the mandible, namely the most superior point of the Condyle Right/Left (CONR/L), the most superior point of the Coronoid Right/Left (CORR/L), the most superior point of the mandibular Lingula Right/Left (LINR/L), and the most mesial point of the Mental Foramen Right/Left (MMFR/L). Based on the landmarks, five linear measurements were performed bilaterally. Using the linear measurements, six angles and ten ratios were calculated.

In order to determine and quantify the identifying capacity, three groups of statistics were considered: (1) inter-observer agreement quantified by Intra-Class Correlation (ICC) and Within-Subject Coefficient of Variation (WSCV); (2) mean "potential set," which represents the percentage of subjects in the antemortem reference dataset one at least needs to consider in order to detect the target (i.e., the unknown subject); and (3) Spearman correlation between parameters.[3] Based on those statistics, a selection of parameters was conducted to establish a three-step univariate cascade (high caseload [e.g., mass disaster]) as well as a multivariate cascade (low caseload). The cascades provide the user with an easy and practical application of the selected parameters, with the benefit of further narrowing the antemortem dataset as the user progresses through the steps of the cascade.

Results: In the univariate setting, the following parameters proved to have the best identifying capacity: ratio 3 on the right side (between lines CONR–CORR and LINR–MMFR) with ICC 0.90, WSCV 4.8%, and mean potential set 13%; ratio 4 (between lines CONR/L–CORR/L and MMFR–MMFL) with ICC 0.92, WSCV 8.9%, and mean potential set 13%; and angle 4 on the left side (between landmarks LINL, MMFL, and MMFR) with ICC 0.91, WSCV 1.2%, and mean potential set of 18%. The correlation coefficients between angle 4 and ratios 3 and 4 ranged from 0.01 to 0.33, indicating that they provide complementarity rather than overlapping identifying information. Combining parameters in the multivariate setting, the identifying capacity improved drastically: all ratios combined (mean potential set 1.3%) and all angles combined (mean potential set 2.6%).

Conclusions: Specific univariate and multivariate cascades were provided to select the parameters with the best identifying capacity, based on morphometric mandibular traits. In high caseload assignments, a single ratio or a single angle already narrows the set of potential matches, but the mean potential set remains relatively large. Combining all ratios or all angles drastically increases the certainty of the match, and is therefore recommended, especially in low caseload assignments.

Reference(s):

1. Valck E. de. Major incident response: Collecting ante-mortem data. *Forensic Sci Int* 2006; 159 Suppl 1: S15-9.
2. Pretty I.A., Sweet D. A look at forensic dentistry—Part 1: The role of teeth in the determination of human identity. *Br Dent J* 2001; 190: 359–366.
3. Eliasziw M., Young S.L., Woodbury M.G., Fryday-Field K. Statistical methodology for the concurrent assessment of interrater and intrarater reliability: Using goniometric measurements as an example. *Physical Therapy* 1994; 74: 777–788.

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