

A30 Does Age Matter?! An Age Study on Maxillary Sinus Morphologies in Human Identification

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Learning Overview: After attending this presentation, attendees will understand the potential of using age-related morphological evaluations of maxillary sinuses for identification purposes.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by providing insights into age-related changes of maxillary sinus morphologies and how those can be used in human identification.

Introduction: Maxillary sinuses are located behind the cheekbones and are the largest of the paranasal sinuses. Pneumatization of the sinuses remains throughout the whole life of an individual and starts around the third month of fetal development.^{1,2} Paranasal pneumatization has previously been determined using measurements, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), and radiographic imaging as well as liquid injections.³ Especially in forensic casework, radiographic imaging proves useful, as maxillary sinuses are visible on most dental overview images.⁴ Pneumatization varies extremely between individuals and is influenced by age.⁵ Furthermore, age estimation is one of the key factors adding to a biological profile aiding in forensic cases. Therefore, an understanding of age-related changes in maxillary sinus morphologies is crucial to adapt this knowledge for biological profiling.

The aim of this study is to assess and classify age-related changes on maxillary sinus morphologies and to quantify their variability for human identification purposes.

Materials and Methods: For this study, a total of 690 digital radiographs were collected, deriving from two collections of the American Association of Orthodontists Foundation (AAOF) Craniofacial Growth Legacy Collections Project. Within the framework of those longitudinal studies, radiographs were taken of the same individuals on a semi-annual or annual basis for the purpose of determining how the skull grows between ages 2 to 70 years. Only standardized anteroposterior radiographic images were used for evaluations.

In this study, morphological growth was evaluated using Photoshop® and SHAPE™ ver. 1.3, applying elliptic Fourier analyses. Analyses of Variance (ANOVA) statistics were applied to quantify the variability of the maxillary sinus morphologies. The analyses were all performed sex-specific and compared between left and right maxillary sinus. Individuals with pathological changes in the maxillofacial area were excluded from the study.

Results: Not all of the collected data have been analyzed to date. However, study hypotheses as well as intermediary results indicate significant morphological variations between each individual's differently aged sinus morphologies, as well as between age groups. Furthermore, morphological changes can be clustered into meaningful age ranges and calculations of morphological variation show potential to be used in human identification. Inter-rater reliability displays high degrees of agreement both in processing sinus morphologies as well as clustering and calculation of variation. These results combined with the frequent availability of the structure on dental overview images reveal the high potential of age-related variability assessments of maxillary sinus morphologies. Further studies will discuss the opportunity of applying age-clustered morphologies as a blueprint in real-life scenarios.

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Maxillary Sinus, Age Study, Morphological Evaluation