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Maxillary sinuses' height/width/depth of Brazilian subjects and influence of sex, age, skin color, and nutritional status: A CBCT study

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ABSTRACT

The purpose of this study was to perform linear (two-dimensional) measurements of maxillary sinuses (MS) using cone-beam computed tomography (CBCT) images, analyze the influence of sex, age, skin color, and nutritional status, and verify differences between the right and left sides. The sample consisted of CBCT images of 238 living Brazilian subjects (139 women and 99 men). Linear measurements of maximal height, width, and depth of the right and left MS were performed with the DDS-Pro® 2.12.0_2021 software (DPP Systems, Czestochowa, Poland). All data were submitted to the statistical analysis to validate potential significant differences ($p > 0.05$) for sex and age and correlation to skin color and BMI. The TEM, rTEM, and R were used for intra- and inter-examiner assessments. There were differences between the sides, with significantly higher measurements on the right side for MS height and on the left side for width and depth. The MS width was only greater ($p > 0.05$) in men. Adult individuals (18 years or older) had higher MS height measurements than the other age groups. The measurements for skin color and BMI did not show significant differences, and it was impossible to confirm a relationship between the parameters measured. The measurements of MS height and width showed significant differences between the right and left sides and anatomic variability between the sexes for MS width, which can help analyze sexual dimorphism. There were also significant differences between the age groups. There was no significant difference in the measurements for skin color and nutritional status.

Introduction

Anthropological methods are used when bodies are found and taken to the Legal Medical Institute without suspicions of their identities [1]. In this case, to assist the identification process, analyzing the bones of the skull, pelvis, and femur, paranasal sinuses, among others, is convenient to determine individual characteristics [2]. From skeletal characteristics, the accurate characterization of sex is an essential step in forensic investigations [3,4], because sex estimation is one of the most important analyses in the forensic context [5]. For expert interpretations, age must be estimated to establish the civil and criminal age of majority, which has an important forensic function in the human identification of corpses [6]. Ancestry estimates are performed with morphological characteristics and skeletal measurements, which facilitate the compatibility with established ancestral groups [7].

Paranasal sinuses are structures arranged in both facial hemispheres and categorized according to their anatomical relationships into maxillary sinus (MS), ethmoid sinus (ES), frontal sinus (FS), and sphenoid sinus (SS) [8–10]. Considering the particularities of their contours, paranasal sinuses are valuable for human identification, as they provide information and reduce the risk of errors by forensic professionals during investigations [11–14]. Located in the maxillary bones, maxillary sinuses are the first to develop and the largest among paranasal sinuses [15]. The formation of MS starts in the 10th week of fetal development. From the 17th to the 20th week and the 25th to the 28th week, there is a rapid growth of MS [16]. At four years old, the sinus floor relates to the roots of first premolars and, at five years old, to second molars. It may extend to third molars and/or first premolars and sometimes to canines, appearing in a pyramid shape [17] with an alveolar process as the base and the orbit floor as the roof [18].

To visualize paranasal sinuses, different imaging tests are used, such as Waters and panoramic radiographs, Computed Tomography (CT),

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