C2 Ear Asymmetry—A Preliminary Evaluation of Identification Accuracy for Forensic Purposes

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Learning Overview: After attending this presentation, attendees will have important updates about the correlation between measures of the ear and will have the opportunity to appreciate how these can be useful for personal identification in the forensic field.

Impact on the Forensic Science Community: This presentation will impact the forensic science community by considering the possibility of a correlation between the measures relating to the ear and its application in the context of personal identification in the forensic field.

In the modern age, the identification of the living has become a major challenge in the field of forensic science. To achieve this goal, forensic sciences have focused on biometrics, a method to classify and identify the physiological and behavioral traits of an individual. The study of biometric parameters was focused for forensic purposes to ensure an accurate assessment in the identification process.

Facial features, such as the eyebrows, nose, lips, ears, or details, such as scars or tattoos, are useful parameters to identify a person of interest in the forensic context. These features are considered important because of their rarity in form, position, and size across different individuals.

Among these parameters, the ear has attracted much interest given its inter- and intra-individual uniqueness. The main challenge is regulated by defining how the uniqueness of this biometric parameter is distinctive for each individual. Forensic sciences have been studying this anatomical element for many years thanks to the non-intrusiveness of the methodologies provided. The analysis of the external ear makes it possible to observe and record its characteristics by simple observation and scanning. The uniqueness and permanence of the ear characteristics have been made into a biometric identifier. It has been observed that the shape and structure of the ear remain permanent from about 8 to 70 years of age.

The morphological and metric study of this body component demonstrates a high degree of individual uniqueness. However, the ear is often partially covered and thus difficult to visualize and measure. Furthermore, the resolution of surveillance video may not allow accurate measurement of some key components. This limits the use of the ear in some cases of video surveillance identification.

The present study aims to quantify intra- and inter-individual variability in metrics associated with the ear. By subjecting the ear to nine measurements, the goal is to study the extent to which these metrics differ between individuals and to quantify variation in the same individual between the right and left ears.

Nine ear measurements from 35 individuals with ages ranging from 4 to 76 years (mean=32.9, SD=15.9) were studied. For each measurement, the difference between left and right ears, the Coefficient of Variation (CV) across all individuals, and the correlation between each measurement were calculated. The association between each measurement and sex, age, height, and history of boxing or rugby was also examined.

Pearsonian correlation among the nine measurements ranged from 0.48 to 0.91, indicating the nine metrics are highly correlated within each individual. CVs ranging from 12.1% to 31.5% were found, suggesting some measures are more suitable for identification because of greater inter-individual variation. These data will help to develop these measures for the purposes of identification and differentiation among individuals.

Ear Asymmetry, Personal Identification, Forensic Anthropology