A54 Metric Pair-Matching of Calcanei in Commingled Remains Cases: A Case Study From South Africa

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The goal of this presentation is to highlight the use of osteometric sorting in commingled remains cases. After attending this presentation, attendees will understand the benefits of using metric analysis to assist in pair-matching elements before applying visual assessment.

This presentation will impact the forensic science community by expanding methods for resolving commingled remains cases, ensuring that the individuals are more complete and reducing the potential for mismatched elements. By utilizing osteometric sorting, the number of elements requiring visual pair-matching decreases; this is beneficial for improving time and costs for analyses in the field.[1]

Sorting commingled remains in order to re-associate skeletal elements of the individual has been investigated using both morphological and metric methods. Recent research has been conducted utilizing metric assessment to remove any subjectivity and increase the accuracy and repeatability. Pair matching a left element to its corresponding right element has traditionally been based on visual assessment and relies largely on the experience of the observer.[1-3] Pair matching using quantitative and statistical methods is known as osteometric sorting; this method relies on the ability to "formally characterize normal size and shape relationships" among skeletal elements.[1,2] Osteometric sorting of skeletal remains is possible for a number of long bones (e.g., the femur and humerus) and some smaller bones (e.g., metacarpals). Previous methods utilized for predicting element pairs has reduced the number of potential pairs requiring visual assessment.[1-3]

Research involving the pair matching of tarsal bones is scarce. This study tested the ability to pair match the calcaneus, similarly to Thomas' and colleagues' method, based on metric analysis and utilization of a statistic (M).3 The objectives were: (1) to investigate bilateral asymmetry of the left and right calcanei in the South African colored population for pairing unmatched human remains; (2) to investigate the degree of asymmetry between left and right calcanei within each individual; and, (3) to use the M-statistic to assess applicability for pair matching left and right calcanei.

In this experiment, left and right calcanei from 70 males and 70 females were measured (N=280) from the South African colored population group. Two additional re-samplings of the calcanei from 5 males and 5 females (N=20) were measured for inter- and intra-observer error analyses. Six measurements of the left and right calcaneus were assessed and the M statistics were calculated for each pair of measurements. The maximum value of M, and 90th and 95th percentiles of M for each variable, were tabulated for use in assessing possible pairs. When attempting to pair match calcanei, the value of M for the possible pair is compared with the tabulated values; if the value of M is greater than the 90th or 95th percentile of M, then the null hypothesis can be rejected. The values of M for males and females exhibited no statistically significant difference between the sexes, therefore pooled M statistics can be utilized to pair match. A test application was performed in which measurements of a left calcaneus were compared to a sample of 140 right calcanei (including the homolog). Values of M were compared to the 90th percentile of

M, 95th percentile of M, and the maximum value of M; this resulted in a reduction in the number of potential pairs requiring visual pair matching up to 90%, 93%, and 74%, respectively. Further analyses will compare this data to other population groups and the use of pooled values of M will be explored. These results may have the potential to assist in the re-association of individuals from commingled remains cases, no matter the population group nor the level of admixture of the sample.

Reference(s):

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3. Thomas R.M., Ubelaker D.H., Byrd J.E. Tables for the Metric Evaluation of Pair-Matching of Human Skeletal Elements. *J Forensic Sci.* 2013;58(4):952-6.

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