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A88 A Test of the Passalacqua Sacral Age-Estimation Method in a Japanese Sample

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After attending this presentation, attendees will understand the applicability of the Passalacqua sacral age-estimation method to individuals of Asian (Japanese) ancestry.

This presentation will impact the forensic science community by providing error rates for a new age-estimation method in a sample different from that of the reference method and suggesting some revisions to the method.

Age estimation is an important component of the biological profile and provides key information in the identification of unknown skeletal remains. It is more difficult to estimate age in adults, but methods that are able to combine developmental and degenerative changes appear to be more successful than those that do not. It is important to test methods developed on certain populations in different groups, as the composition of the reference sample may affect the ability to accurately estimate age. To date, there is a dearth of data in United States research that concerns individuals of Asian ancestry.

Age estimation from the sacrum has generally focused on two areas: fusion of the adjacent sacral bodies and the sacral auricular surfaces. The method developed by Passalacqua scores seven developmental and degenerative traits of the sacrum and is based on individuals of African and European American ancestry from two American skeletal collections (Hamann-Todd and William M. Bass). Fusion of the S1/S2 and S2/S3 bodies, changes of the sacral auricular surface and apices, and porosity of the sacral auricular surface are scored as 1-incomplete/absence or 2-complete/presence. S1 ring fusion is scored as 1-incomplete, 2-fused, or 3-absorbed. The resultant scores are combined to produce a sequential seven-digit code with an associated phase and descriptive statistics. Differences in ancestry and sex were not found in the reference method, but it is currently unknown whether the method can be applied to individuals of Asian ancestry.

Sacra from Chiba and Jikei Universities Medical School documented collections were scored for the seven traits described by Passalacqua as well as three additional traits: overall bone quality, changes to superior articular facets, and S1 superior vertebral border (n=205; minimum age=17 years, maximum age=95 years). Individuals were pre-selected to create a distribution similar to that of the reference sample, but age was unknown at the time of data collection. Inaccuracy, bias, percent correct for 68% and 95% intervals, and Spearman's rho for assigned phase and known age were calculated. A Kruskal-Wallis test was run to check for differences between the sexes. To test the use of a summary score (all trait scores added) versus the seven-digit code/phase system, Spearman's rho was calculated for known age and seven-trait summary score and for age and ten-trait summary score. A random sample of 35 individuals from the Chiba collection was scored again to examine intra-observer error, and Goodman and Kruskal's gamma was calculated (two trials, ten traits). Statistics were run in computing and graphics programs and R version 2.14.2.

For the Japanese sample, the method performed with an inaccuracy of 11.85 years and bias of 0.37 years, indicating a slight tendency to overage. Older phases show increased inaccuracy as compared to younger, with a tendency to underage younger individuals and overage older individuals. For all but one phase, inaccuracy was higher in the Japanese sample than the reference method. When using 68% intervals, 54.2% of the individuals in this sample were classified correctly; the percent increased to 91.7% with 95% intervals. Of the 205 individuals scored, 61 were assigned codes that were not given in the reference article. For these individuals, a higher component score was interpreted as being older and the next "oldest" code/phase was assigned. To test if this affected overall correct classification, these individuals were eliminated from calculations; correct classification remained similar at 52.1% using the 68% interval and 93.8% using the 95% interval. There were no statistically significant differences in phase assignment between males and females (p=0.36). Spearman's correlations between known age and phase, known age and seven-trait summary score, and known age and ten-trait summary score were 0.62, 0.69, and 0.76, respectively. Goodman and Kruskal's gamma values for all but one of the ten traits were 1 or very close to 1, indicating excellent agreement between trials; bone quality was the exception (gamma=0.48).



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The results of this study indicate that the Passalacqua sacral age estimation method can be applied to Japanese individuals, though with slightly less accuracy than African and European American individuals. This difference may also be due to test samples performing less accurately than reference samples. The use of the 95% interval is more appropriate, but given the wide age intervals, this method should be used in conjunction with other age-estimation methods. The method is easy to apply and the use of binary scores reduces scoring discrepancies between multiple trials. Revisions to this method should consider the addition of additional degenerative traits and the use of a summary score rather than trait code.

Age Estimation, Sacrum, Error