## A4 A Test of Quantitative Age-At-Death Estimation of the Pubic Symphysis Using the forAge Program

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The goal of this presentation is to test the method of age-at-death estimation from the pubic symphysis proposed by Slice, Algee-Hewitt, Stoyanova, and colleagues on the Texas State Donated Skeletal Collection.[1-3] After attending this presentation, attendees will understand some of the implications of this novel age-at-death estimation technique to better interpret the results from forAge analysis.

This presentation will impact the forensic science community by helping shed light on avenues for amending or expanding on this novel age-at-death estimation technique.

This preliminary test of the objective age-at-death estimation methodology, as proposed by the aforementioned authors, examined the accuracy and bias of age-at-death estimation provided by the forAge program.[1-3] The forAge program performs shape analyses of 3D surface models, calculates surface parameters, and outputs an age-at-death estimation. After attending this presentation, attendees will understand some implications of this novel age-at-death estimation technique to better interpret the results from forAge analysis.

The left pubic symphysis of 50 modern White males and females from the Texas State Donated Skeletal Collection and 12 male casts from the original Suchey-Brooks method were scanned using the NextEngine® 3D Desktop Scanner following the methods of Stoyanova et al.[3] The individuals ranged in age from 18 to 94 years old, with a mean age of 60.88 years.

Excess data were removed to isolate the symphyseal surface in ScanStudio™ v2.0.2. The surfaces were divided into three groups for analysis: (1) original surface scans (with holes); (2) edited surface scans (holes filled); and, (3) Suchey-Brooks cast surface scans. Surfaces with holes were filled in MeshLab v2016.12 and saved as separate files. Scans were then exported as ASCII PLY files and uploaded into the forAge program.

Point estimates generated by forAge were analyzed for accuracy, bias, and correlation against reported age at death. Differences in age-at-death estimates between surface scans with and without holes were compared using paired *t*-tests. Lastly, paired *t* -tests compared the means of age-at-death estimates from the Suchey-Brooks casts scanned by this study and between this study and Stoyanova et al.[3]

Analysis of the Original Surface Scans exhibited high inaccuracy in age-at-death estimation, with a bias toward under-aging individuals more than 40 years old and over-aging individuals less than 40 years old. This study revealed greater levels of inaccuracy in age-at-death estimation compared to Stoyanova and colleagues.[1-3]

Surface scans with fluctuating surface topography tended to produce holes in the mesh. Analyses comparing age-at-death estimates between original surface scans with holes and edited surface scans with no holes resulted in no significant differences. Thus, this study advises against filling holes in the surface scans.

Scans of the Suchey-Brooks male pubic symphysis casts were used to test for interobserver error between the two contributors of this study and between the first contributor of this study and the Stoyanova study.[3] The age-at-death estimates between the two contributors of this study exhibit no significant differences except in one shape measure. The age-at-death estimates collected by the first contributor were significantly different for each shape measure compared to those published by Stoyanova et al.[3]

The disparities between this research and Slice, Algee-Hewitt, and Stoyanova et al. may best be explained by the differences in the sample distribution, which had more individuals more than 40 years of age, while the previous studies had more individuals less than 40 years of age.[1-3] High inaccuracy may be due to the inability of the shape measures to account for minute differences in the surface topography of older individuals, such as increased porosity and excess bony growth. Since the same standardized casts were scanned in these analyses, the significant differences observed in age-at-death estimation from the casts may be explained by differences in scan parameters and image processing (i.e., bracket vs. single scans). Overall, this research may shed light on avenues to amend or expand on the original research.

**Reference(s):**

1. Slice D., Algee-Hewitt B. Modeling bone surface morphology: A fully quantitative method for age-at-death estimation using the pubic symphysis. *J Forensic Sci*. 2015:60(4):835–43.
2. Stoyanova D., Algee-Hewitt B., Slice D. An enhanced computational method for age-at- death estimation based on the pubic symphysis using 3D laser scans and thin plate splines. *Am J Phys Sci.* 2015:136:39-50.
3. Stoyanova D.K., Algee-Hewitt B., Kim J., Slice D.E. A computational framework for age- at-death estimation from the skeleton: Surface and outline analysis of 3D laser scans of the adult pubic symphysis. *J Forensic Sci.* 2017:1-11.

**Age-At-Death, Pubic Symphysis, Surface Scans**



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