



## Physical Anthropology Section - 2014

### H24 The Use of Enthesopathies in the Femur and Os Coxa for Assessing Age

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After attending this presentation, attendees will understand the value of enthesopathies in the femur and os coxa for assessing age.

This presentation will impact the forensic science community by examining a new method of age prediction from skeletal remains.

Enthesophytes commonly are examined in bioarchaeological research for their relationship to activity. While the value of these markers for assessing activity patterns remains questionable, results from such studies consistently show that they are significantly correlated with age in historic and prehistoric populations. The present study explores whether enthesophytes in the femur and os coxa are correlated with age in a contemporary population and, if so, can be used to: (1) generate age predictions, and, (2) narrow age estimates for older individuals.

The study sample is comprised of 200 White individuals (100 of each sex) over 40 years of age from the William M. Bass Donated Collection. Four areas on the femur and five on the os coxa were scored for the degree of enthesophyte formation based on methods modified from Mariotti and colleagues.<sup>1</sup> These areas included the lesser trochanter, spiral line, gluteal tuberosity, linea aspera, iliac tubercle, posterior iliac crest, ischiopubic ramus, and inferior and posterior ischium. Using raw scores, intra-observer error was assessed in a subsample of 30 individuals using the Wilcoxon signed rank test. For the entire sample, chi-square was used to examine the relationship between raw scores and ten-year age categories. Additionally, because several studies note a correlation between body size and enthesophyte size, raw scores were adjusted for body size by dividing each score by femoral head diameter. Linear regression analyses then were used to examine the relationship between adjusted scores and age.

Results indicate the following. Significant intra-observer differences were noted in one variable, posterior iliac crest ( $Z=-2.121$ ,  $p=.034$ ); therefore, this variable was excluded from further analyses. Based on raw scores, among males, five of eight variables (lesser trochanter, gluteal tuberosity, linea aspera, ischiopubic ramus, and posterior ischium) are significantly correlated with age category. In females, only three of eight (spiral line, iliac tubercle, and posterior ischium) are significantly correlated.

Individual regression analyses show that adjusted scores for all variables are significantly correlated with age in males; however, in females, only four are significantly correlated (lesser trochanter, iliac tubercle, and inferior and posterior ischium). None of the variables exhibits particularly strong associations ( $R^2$  ranges from 0.039 (posterior ischium, females) to 0.176 (lesser trochanter, males)). Forward Stepwise regression indicates that, for males, the lesser trochanter ( $\beta=233.171$ ,  $p=0.002$ ) and gluteal tuberosity ( $\beta=219.6244$ ,  $p=0.005$ ) are the crucial predictors of age ( $F=14.466$ ,  $p=0.000$ , adjusted  $R^2=.226$ ). For females, the lesser trochanter ( $\beta=276.11$ ,  $p=0.001$ ), linea aspera ( $\beta=-243.01$ ,  $p=0.013$ ), and iliac tubercle ( $\beta=241.00$ ,  $p=0.000$ ) are the crucial predictors ( $F=11.697$ ,  $p=0.000$ , adjusted  $R^2=0.245$ ).

Lastly, the frequency of the most severe enthesophyte expression ("Score 3" or "gross morphological alteration") was examined to determine its use for narrowing age estimates in older individuals. Among males, for four variables (lesser trochanter, spiral line, gluteal tuberosity, and ischiopubic ramus), 75% of individuals with the most severe expression were aged 70 years and above. In fact, for the latter three variables, the severe expression was never found below 60 years. Among females, for six variables (lesser trochanter, iliac tubercle, inferior ischium, spiral line, gluteal tuberosity, and linea aspera), 70% of individuals with the more severe expression were aged 70 years and above; for the latter three variables, the severe expression was never found below 60 years.

The current study demonstrates that significant relationships exist between age and enthesophyte scores in the femur and os coxa, but the relationships are not strong enough to generate reliable age predictions. Confounding factors might include methodological limitations: neither ordinal categories nor simple visual assessment appears to be sufficient for capturing enthesal morphological variation within age categories. Conversely, the frequencies and age distribution of scores suggest they can be used to corroborate age assessments based on other methods. Additionally, in situations where traditional areas used for aging are not available, gross morphological alterations at certain entheses can suggest an age greater than 60 years or, in some cases, 70 years.

#### References:

1. Mariotti V, Facchini F, Belcastro MG. The study of entheses: proposal of a standardized scoring method for twenty-three entheses of the postcranial skeleton. *Coll Anthropol* 2007;31:291-313.



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**Age Estimation, Enthesopathies, Anthropology**