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**INTERACTION BETWEEN RACE AND SEX IN MEASURES OF HIP MORPHOLOGY: A POPULATION-BASED COMPARATIVE STUDY**

K. Edwards<sup>†</sup>, K.M. Leyland<sup>†</sup>, C.P. Arden<sup>‡</sup>, T.D. Spector<sup>§</sup>, A.E. Nelson<sup>||¶</sup>, J.M. Jordan<sup>||¶</sup>, M. Nevitt<sup>#</sup>, D.J. Hunter<sup>††</sup>, N.K. Arden<sup>†</sup>. <sup>†</sup>Univ. of Oxford, Oxford, United Kingdom; <sup>‡</sup>Med. Sch., Univ. of Leeds, Leeds, United Kingdom; <sup>§</sup>Twin Res. & Genetic Epidemiology, Kings Coll., London, United Kingdom; <sup>||</sup>Dept. of Med., Univ. of North Carolina at Chapel Hill, Chapel Hill, NC, USA; <sup>¶</sup>Thurston Arthritis Res. Ctr., Univ. of North Carolina at Chapel Hill, Chapel Hill, NC, USA; <sup>#</sup>UCSF Sch. of Med., San Francisco, CA, USA; <sup>††</sup>Chromatic Innovation Limited, Royal Leamington Spa, Warwickshire, United Kingdom

**Purpose:** Hip osteoarthritis is known to vary in prevalence between racial groups. The disease is reportedly more common in Caucasians compared to Asian populations, although the reason for this variation is unknown. This research will assess hip morphology in European Caucasian, American Caucasian, African American and Chinese populations, looking at the extent of variation between races and sexes.

**Methods:** A total of 880 x-rays representing 440 subjects were analysed in the study. X-ray data was obtained from three population-based cohorts including Chingford (CHIN), Johnston County Cohort (JoCo) and

measures, while African Americans were the only racial group to have significant variation in the femoral neck shaft angle between sexes ( $p=0.001$ ). No statistically significant differences were found between males and females in any racial group for the modified proximal femoral angle. Whereas both African Americans ( $p=0.024$ ) and Chinese ( $p<0.001$ ) had significant differences between sexes for Sharp's angle.

**Conclusions:** Racial variation was identified in measures of hip morphology between European Caucasians, American Caucasians, African Americans and Chinese, with some measures showing significant differences between the sexes in these groups. Chinese hips showed significant differences between males and females for the lateral centre edge angle and Sharp's angle, measures both relating to femoral head coverage and dysplasia. This may correlate with the findings of previous studies that report an increased prevalence of hip dysplasia amongst the Chinese, but suggests that this could vary by sex. Other measures that exhibited significant differences between the sexes included the femoral neck shaft angle, extrusion index and alpha angle. Future research may wish to further explore racial variation in hip morphology in relation to sex with an aim to understand its impact on the prevalence differences in hip osteoarthritis between population groups.

**Table 1. Summary of Descriptive Characteristics for Assessed Measures by Race and Sex**

| Measure                | European Caucasian females(chin) | American Caucasian females(JoCo) | African American females(JoCo) | Chinese females (BOA) | p-value    | American Caucasian males(JoCo) | African American males(JoCo) | Chinese males(BOA)   | p-value    |
|------------------------|----------------------------------|----------------------------------|--------------------------------|-----------------------|------------|--------------------------------|------------------------------|----------------------|------------|
| N                      | 148                              | 118                              | 118                            | 130                   |            | 120                            | 112                          | 134                  |            |
| LCE(mean/sd)           | 30.9 (6.2)                       | 31.4 (6.3)                       | 31.9 (7.3)                     | 23.6 (6.9)            | $p<0.0001$ | 31.4 (6.4)                     | 32.3 (6.9)                   | 26.8 (5.8)           | $p<0.0001$ |
| HTE (mean/sd)          | 3.54 (5.4)                       | 2.53 (5.7)                       | 3.01 (6.3)                     | 7.05 (6.1)            | $p=0.0050$ | 3.69 (5.2)                     | 2.35 (5.5)                   | 4.58 (5.4)           | $p=0.0054$ |
| DWR (mean/sd)          | .543 (.05)                       | .543 (.04)                       | .560 (.05)                     | .513 (.05)            | $p<0.0001$ | .538 (.05)                     | .545 (.05)                   | .508 (.05)           | $p<0.0001$ |
| EI(mean/sd)            | .169 (.07)                       | .126 (.07)                       | .131 (.07)                     | .212 (.07)            | $p<0.0001$ | .163 (.06)                     | .146 (.07)                   | .209 (.06)           | $p<0.0001$ |
| AP AA(median/IQR)      | 85.01<br>(47.2–93.8)             | 42.87<br>(39.9–46.4)             | 43.84<br>(41.8–47.5)           | 41.48<br>(39.3–72.1)  | $p<0.0001$ | 54.21<br>(45.4–80.8)           | 46.76<br>(42.9–68.4)         | 47.00<br>(42.2–71.6) | $p=0.0009$ |
| FNSA(mean/sd)          | 129.70 (4.7)                     | 129.80 (6.36)                    | 132.69 (5.65)                  | 128.53 (5.74)         | $p<0.0001$ | 129.50 (6.12)                  | 129.93 (4.73)                | 125.79 (6.58)        | $p<0.0001$ |
| mPFA(mean/sd)          | 82.04 (5.6)                      | 79.76 (5.7)                      | 80.19 (6.22)                   | 80.10 (4.51)          | $p=0.0025$ | 80.07 (5.66)                   | 78.74 (5.90)                 | 79.42 (5.51)         | $p=0.2077$ |
| Sharp's Angle(mean/sd) | 39.3 (4.1)                       | 39.5 (3.4)                       | 41.4 (3.9)                     | 41.3 (3.5)            | $p<0.0001$ | 38.1 (3.9)                     | 39.6 (4.0)                   | 38.9 (3.3)           | $p=0.0073$ |

Beijing Osteoarthritis Study (BOA). This provided data on European Caucasians (CHIN), American Caucasians (JoCo), African Americans (JoCo) and Chinese (BOA). Included subjects consisted of males and females between 45–75 years old who exhibited no radiographic evidence of hip osteoarthritis (Kellgren and Lawrence <Grade 2 or Croft <Grade 1). Morphometric data was obtained using OxMorf, a software program developed by the University of Oxford. Measurements of interest included angles and indexes related to femoral head coverage (Lateral centre edge angle (LCE), Horizontal toit extern (HTE), Sharp's angle and Extrusion Index (EI)), femoral head asphericity (AP alpha angle (AP AA)), acetabular dysplasia (Acetabular depth to width ratio (DWR)), alignment (femoral neck shaft angle (FNSA) and modified proximal femoral angle (mPFA)). Analysis was performed by three readers (KE, KL and CPA) who were blinded to race, sex and cohort along with demographic and clinical information. Descriptive characteristics including means and standard deviations were calculated for each measurement, with medians and interquartile ranges for alpha angle values. ANOVA, Kruskal Wallis and post-hoc pairwise Tukey's tests were used to compare groups.

**Results:** All three readers had good inter- and intra-reproducibility for assessed measures. Statistically significant differences were detected for age ( $p=0.0001$ ) and BMI ( $p<0.0001$ ) between groups for males and females. There were significant differences ( $p<0.05$ ) between all of the morphological measures between racial groups, with the exception of the modified proximal femoral angle in males (Table 1). The mean lateral centre edge angle was lower in Chinese who, in contrast to other racial groups, also exhibited a statistically significant difference between males and females ( $p=0.003$ ). The mean horizontal toit angle was higher in Chinese than in American Caucasians and African Americans, but no significant differences were found between sexes for any racial group. The acetabular depth width ratio was lower amongst Chinese, but no statistically significant differences were found for any racial group between sexes. American Caucasians were the only racial group to exhibit significant differences between males and females for both the extrusion index ( $p=0.001$ ) and alpha angle ( $p=0.001$ )