University of Victoria | Graduate Studies

Notice of the Final Oral Examination for the Degree of Doctor of Philosophy

of

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MSc (University of Toronto, 2010)
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"Osteoarthritis of the Human Skeleton: An Evaluation of Age, Activity, and Body Size in Load-Bearing Joint Regions"

Department of Anthropology

Monday, April 18, 2016
10:00AM
David Turpin Building
Room A144

Supervisory Committee:
Dr. Helen Kurki, Department of Anthropology, University of Victoria (Supervisor)
Dr. Lisa Gould, Department of Anthropology, UVic (Member)
Dr. Darlene Weston, Department of Anthropology, UBC (Outside Member)

External Examiner:
Dr. Angele Lieverse, Department of Archaeology and Anthropology, University of Saskatchewan

Chair of Oral Examination:
Dr. Gary MacGillivray, Department of Mathematics and Statistics, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Osteoarthritis (OA) is the most common joint disease in human populations with onset and severity influenced by mechanical loading, aging effects, genetics, anatomy, and body mass. Despite major advancements in knowledge, the aetiopathogenesis of OA is complex and still poorly understood. Lack of standardization in methods to quantify skeletal OA make it difficult to study the effects of interacting explanatory variables on arthritic response, and prevents comparison of results between bioarchaeological studies. Joint changes of OA as a function of both the natural aging process and of mechanical stress can make an individual appear older than their chronological age, potentially impacting current methods to derive accurate skeletal age at death estimates, particularly in load-bearing regions.

This project addressed these issues through three studies, using a large skeletal sample of modern Europeans for which sex, age, and occupation were available. The first study used principal component analysis (PCA) as a standardized procedure to compute aggregate scores for joint complexes and a systemic measure of OA in each region of the lumbar spine, pelvis, and knee. The second study analyzed the composite scores with a multiple regression model to determine the relative contribution of three predictors: age, activity, and body size, and their effect on skeletal expression of OA in each region. Body size (stature and mass) was calculated from postcranial skeletal measurements; torsional strength (*J*) of the femoral midshaft was calculated from three dimensional surface models, size standardized and used as a proxy for measure of activity. The third study considered the effect of OA severity on the validity and reliability of three methods to estimate age at death from load-bearing joints of the os coxa: the pubic symphysis, auricular surface, and acetabulum. The study was designed to determine whether OA in adults acts as a potential limitation or benefit in deriving accurate skeletal age at death estimates from pelvic joint morphology that will contribute to standardized methods in establishing physiological degeneration of the skeleton due to aging.

Body size and activity factors did not contribute significantly to OA pathology outside of the age-related expression in either of the lumbar vertebrae or knee regions, and only demonstrated a weak association at pelvic joints. Differences in adult patterns of age are reflected in joint arthritic changes of the os coxa and OA severity has an effect on the accuracy of age estimates from the pelvis; those with OA consistently aging faster in all three joint areas. This influence is most significant for young individuals at the auricular surface and pubic symphysis, over-aging at both. Oldest persons with little arthritic patterning at the acetabulum were under-aged, but accuracy of the age estimate improved as OA severity increased. Systemic measures of OA determined through PCA as an indicator of age, appears useful to identify the very old, but may also help to distinguish between systemic age-related stresses and localized biomechanical effects. Interpreting OA as evidence for old age, measures of habitual activity, and larger body mass should be exercised with caution in skeletal populations.