F23 Anthropological Measurement of the Juvenile Mandible and Dental Assessment Using Multi-Detector Computed Tomography

Alison L. Brough, BSc, University of Leicester, Forensic Pathology Unit, RKB, Leicester Royal Infirmary, Leicester, LE2 7LX, UNITED KINGDOM; Bruno Morgan, PhD, Leicester Royal Infirmary, Imaging Department, Leicester, UK LE2 7LX, UNITED KINGDOM; Sue Black, PhD, University of Dundee, Centre for Anatomy and Human Identification, Dundee, UK DD1 5EH, UNITED KINGDOM; Guy N. Rutty, MD, University of Leicester, Forensic Pathology Unit, Robert Kilpatrick Building, Leicester, LE2 7LX, UNITED KINGDOM; and Catherine Adams, BDS, Cardiff Medicentre, Heath Park, Cardiff, CF14 4UJ, UNITED KINGDOM*

After attending this presentation, attendees will understand the principles of odontological and anthropological identification of juvenile remains, multi-detector computed tomography (MDCT), three-dimensional imaging, and the necessary research required for the implementation of a virtual anthropological examination for juvenile age determination.

This presentation will impact the forensic science community by providing vital data which supports the implementation of a virtual/near virtual anthropological examination for the identification of juvenile remains. As the primary demographic feature used in the identification of juvenile remains is age estimation, determining the accuracy and repeatability of measurements derived by traditional and MDCT measurements would be a vital preliminary step in validating the utility of MDCT analysis in special situations such as forensic and disaster victim investigations (DVIs). This would accelerate the process of anthropological assessment and remove the necessity to deflesh remains, which may also be more ethically and morally acceptable, particularly when dealing with young victims and offers significant health and safety benefits for practitioners.

Anthropological examination of defleshed bones is routinely undertaken in medico-legal investigations to establish an individual's biological profile (age, sex, stature and ethnicity). However, when dealing with the recently deceased the removal of soft tissue from bone can be an extremely time consuming procedure that requires the presence of a trained anthropologist. In addition, due to its invasive nature, in some disaster victim identification (DVI) scenarios the maceration of bones is discouraged by religious practices and beliefs, or even prohibited by national laws and regulations. Radiological imaging modalities have been used in forensic practice as an adjunct to traditional anthropological techniques for many years. Currently, three different radiological techniques may be used in the investigative process; plain x-ray, dental x-ray, and fluoroscopy. However, recent advances in multi-detector computed tomography (MDCT) means that it is now possible to acquire morphological skeletal information from high resolution images, reducing the necessity for invasive autopsy procedures. Currently there is no standardised protocol for MDCT measurement of juvenile remains. In order for this "virtual approach" to be implemented and accepted internationally as part of a forensic investigation, accuracies must be shown to be comparable to that of traditional anthropological techniques. A series of studies conducted by the Developing Human Research Group, based at the University of Leicester, utilises skeletal material from the Scheuer Juvenile collection in order to construct a protocol for the measurement and age assessment of the entire immature human skeleton.

In this study, twenty juvenile mandibles were scanned using a truck mounted 16-detector CT scanner. This simple was used to construct a protocol for the measurement and age assessment of the immature human dentition. The results of this study illustrate that there is no significant difference between the measurements taken by MDCT and those by direct osteometric methods. MDCT had greater flexibility of measurements and offered the opportunity to take measurements not easily made on dry bone. This research assesses the value of these new measurements in addition to considering the limitations and the potential applications of this virtual approach.

Forensic Anthropology, Multi-Detector Computed-Tomography, Imaging

