H29 Orthopedic Devices and the William M. Bass Donated Skeletal Collection: Implications for Forensic Anthropological Identification

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The goal of this presentation is to demonstrate a chronology of orthopedic devices used in hip, knee, and shoulder arthroscopic surgeries in relationship to the osseous healing process. In doing so, it will provide summary statistics on the demographic profile of those exhibiting orthopedic devices within the William M. Bass Donated Collection compared to National Inpatient Survey (NIS) data.

This presentation will impact the forensic community and/or humanity by augmenting attendees' existing knowledge of the varieties of orthopedic devices and their manufacturers, the demographic profile of those receiving these orthopedic devices, and to examine the degree to which healing can be used in the forensic investigation.

This paper stands to demonstrate a chronology of orthopedic devices used in hip, knee, and shoulder arthroscopic surgeries in relationship to the osseous healing process. In doing so, it will provide summary statistics on the demographic profile of those exhibiting orthopedic devices within the William M. Bass Donated Collection compared to National Inpatient Survey (NIS) data.

Hemiathroplastic or total arthroplastic surgery involves prostheses used to replace arthritic damage and relieve pain in a joint complex. Prostheses are typically manufactured from stainless steel, titanium, or a cobalt/chromium alloy and contain wear-resistant polyethylene plastics anchored by bone cement. The design of prostheses are usually trademarked by a particular manufacturer, such as the Gunston knee™ or the Exeter Hip™. Ubelaker and Jacobs (1995) provided information on the identification of orthopedic device manufacturers enabling identification using company logos. However, manufacturers were not required to place logos on their products prior to 1993 (Ubelaker and Jacobs 1995). Prosthetics manufactured before1993 may not have these identifying logos and if present the logo may be obscured by new bone growth. Therefore, understanding the chronology of particular designs could help identify possible manufacturers, as well as indicate the timing of the surgery. Furthermore, understanding the osseous response to orthopedic devices in conjunction with the timing of implantation will provide a better time of insult estimation for the forensic investigator.

According the National Impatient Survey (NIS) more than 557,000 total hip or knee replacement surgeries occurred in 2002. Knee replacements have become the leading arthroscopic surgery performed in the United States followed by total hip replacements. According to the NIS, 381,000 knee replacements occurred in 2002 with those 65 or older accounting for 241,000 of these replacements. NIS also noted that females (235,000) out numbered males (146,000) on a 2 to 1 margin. However, NIS did acknowledge a growing trend for total knee replacements within the 45-65 age group (131,000 individuals) which is a 6 percent increase from the previous survey.

Hip replacements are not as common as knee replacements with 193,000 total and 114,000 of these going to those 65 years or older. Like knee replacements, hip replacements are more common in females (112,000) than males (81,000). Data for partial replacements and shoulder replacements are yet to be available.

The William M. Bass Donated Collection (N=436) was surveyed for individuals demonstrating partial or total hip, knee, and shoulder joint replacements. Demographic information for individuals displaying evidence of arthroscopic surgery were obtained and compared to the NIS statistics. Each device was observed for the presence of a logo, the location of a logo, and specific design characteristics. This information was compared to manufacturer data to determine the specific manufacturer of the appliance and the years for which that appliance was made. Also, the amount of osseous healing was noted. The results from these were compared to a chronology of specific device designs established using reference samples from the major orthopedic device manufacturers.

Very few individuals demonstrated early varieties of hip or knee replacements and few individuals demonstrated a shoulder replacement (N=2). Knee replacements are more common than hip replacements in the collection, but not to the predicted NIS amounts. Females (N=107) demonstrated a higher percentage of replacements, particularly knee replacements, compared to males (N=329), which corresponded to that which was predicted. Appliance designs varied greatly between individuals. However, far fewer logos could be found on the appliances suggesting that these cannot be solely relied upon to identify the manufacturer of an orthopedic device.

It was estimated that most individuals displaying orthopedic devices at a joint complex had these devices implanted within 10 years of death if not sooner than 5. This is supported by the minimal amount of osseous response on affected bones. Conclusions are limited by the degree of healing observed on the individual bones. More studies must be completed to fully appreciate the use of the osseous response in the timing of an insult.

It is necessary to continually update references, especially those involving manufacturing companies, for use by the forensic anthropologist.

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