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CORR Insights®: What Are the Reference Values and Associated Factors for Center-edge Angle and Alpha Angle? A Population-based Study

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Where Are We Now?

Dr. Daniel Cooperman spread femora over the table while he and Dr. Ray Liu explained the deformities of the proximal femur and its mechanical consequences to their travelling fellows at the Hamann-Todd Osteological Collection inside the Cleveland Museum of Natural History. The vast collection of anatomic specimens they shared helped us to understand the complex anatomy of the proximal femur and its relationship with the acetabulum. Abnormalities of the acetabulum and/or the femur combined with dynamic factors can damage the labrum and the cartilage at the acetabular rim, in the process known as femoroacetabular impingement (FAI) [4].

One can calculate alpha and center-edge angles in patients with FAI using plain radiographs, CT scans, and MRI techniques [9, 10], and based on these approaches, different studies have arrived at dramatically different estimates of the prevalence of FAI [1, 3, 10, 11]. Despite FAI's importance as one of a number of etiologies of hip osteoarthritis, the normal ranges for center-edge and alpha angles remain poorly characterized.

Making use of robust statistical methods, such as receiver operating characteristic curves, and analyzing interrater and intrarater reliability of radiographic measurements should be standard practice in any studies that explore normal radiographic anatomy of the human hip and the prevalence of FAI. The current study [2] provided a state-of-the-art and in-depth analysis of important reference values and how they vary in individuals of different sizes and sexes; it is important that future FAI studies use standardized methods and anatomic landmarks.

Where Do We Need To Go?

But it is difficult to fully appreciate the anatomic complexity of the proximal femur and the acetabulum using two-dimensional imaging alone. Three-dimensional (3-D) reconstruction makes this much easier, particularly in terms of the static relationships of the joint. Future studies should make better use of 3-D imaging tools to provide us with a more-complete understanding of the interaction between the proximal femur, acetabular rim, and related deformities like FAI that research is only beginning to characterize [7, 12], and to the degree possible, do so not just statically, but dynamically [8].

Obtaining quality and generalizable data that can distinguish between ethnic, demographic, and other anthropometric variables should be the ultimate goal of epidemiological and anthropometric research. There is an enormous quantity of data available for

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analysis—who will assemble all of this data and how will we analyze it?

How Do We Get There?

Technology can aid us in the understanding of complex articular pathologies; in particular, 3-D printing and computer simulation may have a role in how we study FAI. Theoretical models [6, 13] on how deformities at the proximal femur and acetabulum may affect the hip joint during motion can be dynamically brought to "life" using these technologies and testing those models [8] will help us to make better predictions for our patients. The use of skeletal collections, such as the Hamann-Todd Osteological Collection of the Cleveland Museum of Natural History can also aid in the better understanding of pathologies such as FAI [5].

In my view, the only way to develop more-extensive studies (particularly in the epidemiological and anthropometric areas) is to encourage collaboration and the creation of public datasets. These datasets can be administered by medical societies, universities, researchers, or experts in the field. Each dataset will have precise prerequisites for uploading data. Once given access, any researcher or clinician around the globe could upload cases, resulting in true collaboration for the sake of progress and knowledge.

There is no perfect moment to do this; collaboration can begin at a scientific meeting or just after rounds when the expert (dataset administrator) feels the need to create a public dataset. Next, the data administrator can contact a scientific society or research specialist to develop a datasheet. Google Sheets, for example, allows users to create and edit spreadsheets or datasheets for free. The administrator can invite other topic experts to revise the datasheet and add or modify variables. The datasheet is password protected and the administrator can publish, promote, and grant access to collaborators worldwide.

Another option is to simply ask for plain data (age, measurements, clinical scores), but the administrator or a volunteer will have to capture this data. The Google Sheets option, if wisely programmed with closed responses, will save time and large amounts of work. Researchers from a scientific society or university can analyze the data, and the administrator has the option to invite outside colleagues with interest in the topic to take part in examining the data as well.

I am aware of several clinical centers that treat an enormous number of patients, but they have limited research capability. These centers have valuable information that could be shared in a collaborative manner, much to the benefit of all involved.

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