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CORR Insights®: Femoral Morphology in the Dysplastic Hip: Three-dimensional Characterizations With CT

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We Are We Now?

A number of important elements related to femoral and acetabular deformity in patients with hip dysplasia remain incompletely characterized. These deformities have important

implications for both for hip-preserving surgery and for THA. Dysplastic femora have shorter necks, smaller and straighter canals, increased anteversion, and aspheric femoral heads in degrees that vary with the severity of dysplasia [1, 4]. We know that there are overlapping clinical presentations between patients with hip dysplasia and those with femoroacetabular impingement (FAI) because of femoral pathoanatomy, but the degree to which this is the case remains poorly defined.

In order to properly define three-dimensional (3-D) proximal femoral characteristics in patients with symptomatic hip dysplasia, Wells and colleagues used a low-dose pelvic CT scan as they planned for periacetabular osteotomy (PAO) surgery. The authors found the location of maximal femoral head and neck offset deformities, and determined whether cam-type femoral morphologies are more common to

certain subgroups of dysplastic hips. Additionally, the authors wanted to know the relationship (if any) between clinical ROM and impingement. They concluded that surgical correction for dysplasia must take into account proximal femoral morphology and the possibility of coexisting FAI, particularly after PAO correction. They found that the cam-type deformities and decreased head-neck offset in the dysplastic hip are common and should be closely assessed during PAO planning.

Where Do We Need To Go?

Planning for these surgical approaches rarely takes into account the many underlying morphological abnormalities existing in dysplastic hips. It is important for the orthopaedic surgeon to recognize the connection between the acetabulum and the proximal femur abnormalities in dysplastic hips. The authors of the current study show that if these malformations are not addressed, the patient likely will continue to have pain. We need to identify

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and resolve any abnormalities during the beginning of our initial evaluation of the patient.

Labral tears are treated using arthroscopy because soft-tissue is considered the main cause of hip pain symptoms. Acetabular labral tears are a potential cause of hip pain and are associated with trauma and hip dysplasia. However, the majority of patients with labral tears also have a structural hip abnormality that is detectable on conventional radiographs and rarely occurs in the absence of bony abnormalities [5]. Retroverted acetabulum, an abnormally small anterior femoral head-neck offset, and coxa valga are considered the most common hip abnormalities. These abnormalities may predispose the labrum to abnormal stress which could lead to a tear. Débridement of the labrum alone may provide some relief, which will be incomplete or only temporary if the underlying condition remains uncorrected.

In order to properly analyze whether subtle deformities can potentially lead to additional surgery, the indications for hip surgery must be redefined for both acetabulum and the femur. The global situation of the entire hip should be carefully considered before deciding on implementing any single surgical approach in isolation.

How Do We Get There?

A thorough knowledge of anatomic variations is necessary in order to properly treat and restore ideal hip biomechanics in acetabular dysplasia. Clohisey and colleagues assessed femoral anatomy regarding the head and neck offset in mild to moderate dysplasia utilizing radiographic imaging [2]. Their data demonstrated a high incidence of femoral abnormalities associated with acetabular dysplasia. These abnormalities may affect joint congruency and compound secondary impingement. Moving forward, I would like to see more and better-quality outcome studies in patients undergoing surgery for hip dysplasia. Currently available studies are evidence-based (controls should be incorporated), and short followup of procedures may disregard the natural history of the hip dysplasia.

Early detection of these femoral abnormalities in dysplastic hips is important in terms of prognosis and treatment. However, short-term results alone are insufficient to support any specific treatment for milder structural abnormalities. It is also uncertain how much of a role surgical treatment should play. Familiarity with the structural femoral bone abnormalities in dysplastic hips is important for an

ideal treatment plan [5]. The patients' lifestyles also play an important role in the development of symptoms and options for treatment.

Surgical correction for dysplasia should not solely focus on the acetabular side, but must also take into account proximal femoral morphology and possible coexisting FAI, especially after a PAO correction. Cam-type deformities and decreased head-neck offset in the developmental dysplasia of the hip are common and should be closely assessed during PAO. Future studies should focus on prospective evaluation of clinical (pain and function) and radiological (resultant bone abnormality leading to degenerative changes) outcomes of dysplastic hips with differing proximal femoral anatomies after PAO.

Dysplastic hips are complex and present variable anatomies with subtle differences. Radiographic evaluation demonstrates that dysplastic hips can show signs of coexisting radiographic impingement [2], but few studies have yet to comprehensively investigate head and neck offset. Additionally, few studies have identified the exact location of maximal deformity using 3-D remodeling [3]. Plain radiographs alone can be inadequate to assess the complex 3-D anatomy of the proximal femur and may miss the location of

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maximal head-neck deformity. CT scans could be very useful in these patients.

Another characteristic that is necessary to mention is the prevalence of relative femoral retroversion in this patient population. Relative femoral retroversion may be a risk factor for a poorer prognosis after hip arthroscopy for FAI. In fact, isolated cam impingement in non-dysplastic hips has been shown to correlate with decreased femoral anteversion. The indications for PAO remains unclear and the indications for surgical treatment of femoral torsional abnormalities at the time of surgery remain controversial. The current

study reports that, although uncommon, hips with relative femoral retroversion do exist in the dysplastic hip population.

Defining proximal femoral anatomy is of paramount importance to properly understanding the pathology in developmental hip dysplasia.

References

1. Argenson J-NA, Flecher X, Parratte S, Aubaniac J-M. Anatomy of the dysplastic hip and consequences for total hip arthroplasty. *Clin Orthop Relat Res.* 2007;465:40–45.
2. Clohisy JC, Nunley RM, Carlisle JC, Schoenecker PL. Incidence and Characteristics of Femoral Deformities in the Dysplastic Hip. *Clin Orthop Relat Res.* 2009;467:128–134.
3. Nakahara I, Takao M, Sakai T, Miki H, Nishii T, Sugano N. Three-dimensional morphology and bony range of movement in hip joints in patients with hip dysplasia. *Bone Joint J.* 2014;96B:580–589.
4. Sugano N, Noble PC, Kamaric E, Salama JK, Ochi T, Tullos HS. The morphology of the femur in developmental dysplasia of the hip. *J Bone Joint Surg Br.* 1998;80:711–719.
5. Wenger DE, Kendell KR, Miner MR, Trousdale RT. Acetabular labral tears rarely occur in the absence of bony abnormalities. *Clin Orthop Relat Res.* 2004;426:145–150.