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CORR Insights®: Is Increased Acetabular Cartilage or Fossa Size Associated With Pincer Femoroacetabular Impingement?

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Where Are We Now?

Pincer-type femoroacetabular impingement (FAI) is defined as either a focal or global overcoverage of the femoral head by the acetabulum [2]. This pathoanatomy is thought to cause impingement and injury to the acetabular labrum,

resulting in secondary injury to the articular cartilage and in some patients, osteoarthritis (OA) [4]. On the other end of the spectrum is acetabular dysplasia, where the femoral head is undercovered by the acetabulum leading to a decrease in the amount of weight bearing articular cartilage. Subsequently, increased forces across the joint can, in some patients, lead to OA [3, 8, 12].

Pincer FAI has been defined variably, including a lateral center-edge angle (LCEA) over 40° or 45° and/or an anterior center-edge angle (ACEA) over 40°. Acetabular profunda, acetabular protrusion, or the presence of a crossover sign are also used to describe pincer FAI [2].

There has been little consensus regarding a radiographic definition of pincer FAI [6]. In a cross-sectional study, Gosvig and colleagues [5] reported a relationship between pincer

morphology and radiographic OA [5]. Conversely, one prospective study [11] reported no relationship between pincer FAI and OA development, while another prospective study reported a protective effect of pincer FAI on the development of OA [1]. Acetabular dysplasia is more-consistently associated with the development or presence of OA [1, 11]. In one of those studies [1], patients with an LCEA over 40° and an ACEA over 40° had a relative risk of developing incident OA over a 5-year period of 0.34 compared to the rest of the cohort, meaning they were three times less likely to develop OA.

In turn, pincer treatment with acetabuloplasty has been associated with poorer outcomes of hip preserving surgery when compared to other indications [7, 9]. This makes furthering our understanding of pincer FAI a critical focus of research in the field of hip preservation surgery. Pun and colleagues have reported on a measure of pincer FAI looking at acetabular fossa size and size of the weight bearing cartilage that is present in the acetabulum. This adds to prior work by

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Steppacher and colleagues [10], who similarly identified that patients with different morphologies of pincer FAI have differing amounts of weight-bearing cartilage in their acetabulum.

Where Do We Need To Go?

While Pun and colleagues have advanced an interesting anatomic and radiologic concept to further our understanding of pincer FAI, further study is needed to validate this concept. The increased weight-bearing articular cartilage area in the Type 1 pincer acetabulum—where there is a smaller fossa and more weight-bearing cartilage—may explain why some natural history data suggests a protective effect of acetabular overcoverage on the development of OA [1], as the forces on the joint may have been distributed through a larger surface area. In addition, this new understanding of acetabular subtypes in pincer FAI may also help explain some of the heterogeneous outcomes from the treatment of the pincer hip [7, 9]. We now must take this concept and apply it in a larger scale to patients in our practices to determine the prevalence of these two subtypes of pincer acetabula. In turn, we need to understand our ability to differentiate between the two subtypes; can we do this reliably with clinically available imaging? Once we successfully

diagnose those with Type 1 pincer versus Type 2 pincer acetabula, where there is a larger fossa and less weight-bearing cartilage, we then can inquire whether patients with Type 2 pincer acetabula report worse outcomes with acetabuloplasty compared to those with Type 1 pincer acetabula, or whether these patients with Type 2 pincer acetabula develop more-rapid joint development of OA. If this is the case, then a change in practice may be needed with the adoption of reorienting acetabular osteotomy for the Type 2 pincer acetabulum. Further study would then be needed to determine whether this change leads to better patient reported and radiographic outcomes after intervention.

How Do We Get There?

Although the authors of the current study present acetabular fossa size and size of weight bearing cartilage in the acetabulum as a potential important variable in determining appropriate treatment of pincer FAI, we need more studies to validate this concept. First, epidemiologic studies looking at those with the diagnosis of pincer FAI must be done to calculate the prevalence of each of these subtypes and whether we can reliably differentiate between the two. We will need to understand the intra- and inter-rater reliability of our

diagnostic methods. Preliminary laboratory-science studies on finite element models of the hip joint could provide computational data to support the hypothesis that these two subtypes of pincer acetabula have differing mechanical properties. In addition, cadaveric experiments of hip joint articular cartilage pressures could be performed investigating the effect of increasing the acetabular fossa size and therefor decreasing articular cartilage surface area on the cartilage contact pressures in the pincer hip. This could then be translated into humans using dual-plane fluoroscopy computer models to understand the in-vivo mechanical differences between pincer hips with larger (Type 1) or smaller (Type 2) weight-bearing articular surfaces.

Retrospective clinical studies looking at the patient reported and radiographic outcomes of acetabuloplasty for the Type 1 and Type 2 pincer hips could provide insight as to whether either of the subtypes is prone to poorer outcomes or OA progression. Given the heterogeneity of treatment protocols among centers that treat pincer FAI, multicenter collaborations could likely identify and potentially match similar patients who underwent either acetabular reorientation or acetabuloplasty for comparative studies. Prospectively collected uniform data from the Academic Network of

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Conservation Hip Outcome Research group may be able to support such a study. Ultimately, randomized studies comparing acetabuloplasty to acetabular reorientation for each variant of pincer FAI would provide Level 1 evidence to answer this question. However, this is unlikely to be feasible given the need for clinical equipoise of the investigators, the low incidence of isolated pincer FAI in young patients undergoing surgical intervention for hip pain, and the difficulty in completing randomized studies in surgical interventions. Therefore, further prospective cohort analysis looking at these new three-dimensional imaging measures and acetabular subtypes will likely provide us the best available information to guide future treatment of patients with pincer FAI.

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