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CORR Insights

CORR Insights®: Does Native Combined Anteversion Influence Pain Onset in Patients With Dysplastic Hips?

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Where Are We Now?

Cartilage degeneration leading to hip osteoarthritis is common, and anatomic anomalies leading to increased cartilage loads, such as acetabular dysplasia and femoroacetabular impingement may predispose patients to premature arthritis of that joint. In patients with dysplasia, while insufficient coverage (a low Wiberg center-edge angle) appears to predispose patients to arthritis, many hips developing to early osteoarthritis have normal center-edge angles and some have no other geometrical parameters known to be associated with hip pathology. Understanding the causes and mechanisms of cartilage degeneration and early osteoarthritis is key in mitigating or preventing their debilitating impact.

By examining both the hip and pelvis geometry, Kohno et al. considered unexplored geometrical parameters as indicators of elevated hip stress. They found that in dysplastic hips with cranial anteversion, the combined femoral and acetabular version indeed correlated with pain onset. This indicates a possible important relationship between acetabluar and femoral version on biomechanical parameters of the hip (contact hip stress, resultant hip force, the size of the load bearing area, for example).

Where Do We Need To Go?

The study by Kohno et al leaves us with several unanswered questions about the influence of femoral and acetabular version on hip osteoarthritis development. (1) How do femoral and acetabular version influence those biomechanical parameters? (2) In hips with varying degrees of anteversion, how might lateral coverage of the femoral head influence the joint loads? (3) Why did the patients with acetabular retroversion show earlier pain onset than those with anteversion? (4) In patients with different hip morphologies, how do these loads change across a range of body positions and daily activities? (5) What is the role of version in femoroacetabular impingement?

Kohno et al. suggest that preoperative individualized assessment of the acetabular and femoral version would be beneficial in planning of periacetabular osteotomies. Successful planning seems

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impossible without knowing the answers to the above questions. Studies of populations of patients contribute to our overall understanding of the impact of hip geometry on the pathological processes. However, looking at populations and averages do not provide surgeons with enough specific information about how changing the position of a patient's acetabulum might influence the loads that patient's hip endures. To achieve such individualized estimations of the influence of a particular operation on a particular patient's hip, we need mathematical modeling studies.

How Do We Get There?

A useful mathematical model should grasp the relevant problem, describe the effect of the femoral and acetabular version on biomechanical parameters in different body positions, and be simple enough for application in clinical studies including large cohorts of patients. If possible, the model should be implemented with user-friendly software. Retrospective studies of hips subjected to osteotomy can help validate the model by using images from the archive and patient records to correlate clinical status with biomechanical parameters; prospective studies then can confirm its utility. In order to be useful for preoperative planning, clinical studies should not show high-scatter of hip stress parameters (such as peak contact stress value and gradient of contact stress) with variations in acetabular and femoral version. By changing the geometry of the hip and pelvis, the surgeon can find a postoperative configuration corresponding to the most favorable stress distribution in different body positions. It should be noted that it remains unclear which biomechanical parameter(s) are the most relevant for long-term clinical results (potential candidates include peak contact stress, magnitude of the gradient of hip stress at a particular point in the load bearing area, and others). The current study by Kohno et al. shows that there remain poorly explored geometrical parameters that must be taken into account in any biomechanical analysis of hip loads. Their work can potentially encourage further efforts in this direction.