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Characterization of Femoral Morphology in the Borderline Dysplastic Hip: Patient-Specific 3-D CT Modeling

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Introduction: Overlap between hip dysplasia and femoroacetabular impingement (FAI) due to underlying femoral deformities is increasingly recognized but poorly defined, especially in borderline dysplastic hips. Little is known about the head-neck geometry and version of the femora. Our goal was to define the three-dimensional femoral anatomy in borderline dysplastic hips using low dose CT scans and patient specific three-dimensional models.

Methods: We analyzed 36 hips with symptomatic borderline acetabular dysplasia (LCEA 20-25) that underwent low dose pelvic computed tomography scan (Low-dose CT scans (0.75-1.25 mSv, equivalent to 3-5 AP pelvis radiographs). CT scans were assessed in a CT-based computer modeling software program to generate patient-specific, 3-dimensional models. Inclusion criteria were LCEA angle 20-25° and Tönnis grade 0 or 1 on plain AP radiographs. Hips were characterized with regards to version, neck shaft angle, femoral head diameter, head neck offset, femoral neck length, femoral offset, head center height, trochanteric height and alpha angle using CT 3-D patient specific reformats.

Results: Average age was 26 years (range, 13-60 years) with 33 females (92%). Mean LCEA and Tönnis angle was 22°± 2° and 11°± 4°. Mean femora was 18°± 11° of anteversion. Eleven hips (31%) had excessive femoral anteversion (>20°) and three (8%) had relative femoral retroversion (≤5°). One hip had > 35° of femoral anteversion. Thirteen hips (36%) had alpha angles ≥55° and were classified as cam morphology. Mean max alpha location was 1:45 (± 45 minutes) and mean max alpha angle was 52° (± 9°). 81% of hips had anterior head-neck offset ratio of ≤0.17.

Conclusions: Treatment of borderline dysplasia must not solely focus on the acetabular side but must also take into account proximal femoral morphology and possible coexisting FAI. Cam-type deformities and decreased head-neck offset are common and should be closely assessed relative to diagnosis and treatment.

Notes