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Effects of Femoral Torsion and Cam-Impingement on Passive Hip Range of Motion

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Summary:
Abnormalities in femoral torsion significantly outweigh the effect of cam-type impingement on passive hip rotational range of motion.

Abstract:
Introduction: Femoroacetabular impingement (FAI) represents an abnormal abutment between the bony acetabular rim and anterosuperior femoral head-neck contour that significantly alters passive hip range of motion (ROM). However, the extent to which this occurs in hips with concomitant alignment abnormalities of the proximal femur remains unclear. The purpose of this study was to investigate the effects of femoral torsion, cam-type FAI impingement, and their combination on passive hip ROM.

Methods: We prospectively analyzed a consecutive cohort of 220 patients (440 hips) presenting with unilateral or bilateral hip pain. Common diagnoses included symptomatic FAI, hip instability due to dysplasia, and/or excessive femoral torsion. Passive hip ROM was measured bilaterally with the patient placed in prone, supine, and lateral positions. Preoperative computed tomography (CT) scans with three-dimensional (3D) surface-rendered reconstruction of the entire pelvis, proximal femurs, and knees were analyzed for measurements of femoral torsion. Diagnostic findings of cam-FAI included an alpha angle exceeding 50 degrees on radial sequences of the head-neck junction and a femoral head-neck offset ratio less than 0.18.

Results: Overall, each incremental increase in femoral torsion yielded significantly increased hip internal rotation ROM at 90 degrees of hip flexion (IR-90 ROM; $p < 0.001$). In hips with femoral retrotorsion, IR-90 ROM did not vary significantly according to the presence or absence of cam-impingement (7.0 vs. 9.8 degrees; $p = 0.267$). Similarly, there was no statistically significant difference in IR-90 ROM between hips with normal femoral torsion and presence or absence of cam-impingement (12.4 vs 14.9 degrees; $p = 0.498$). In hips with femoral antetorsion, IR-90 ROM significantly decreased given the presence of cam-impingement (25.5 vs 18.4 degrees; $p = 0.006$). In contrast, the presence of cam-impingement significantly decreased hip flexion ROM in hips with femoral retrotorsion (105.1 vs 111.1 degrees; $p = 0.003$). Similarly, the presence of cam-impingement significantly decreased hip flexion ROM in hips with normal femoral torsion (107.6 vs. 113.1 degrees; $p < 0.001$). Finally, the presence of cam-impingement significantly decreased hip flexion ROM in hips with femoral antetorsion (108.7 vs. 115.1 degrees; $p = 0.005$).

Conclusion: Abnormalities in femoral torsion significantly outweigh the effect of cam-type impingement on passive hip rotational ROM. In contrast, the presence of cam-type impingement significantly decreases hip flexion ROM, irrespective of degree of femoral torsion. These findings help to inform surgical decision-making in patients with cam-type FAI or femoral torsion abnormalities.