

# Decreased “Polarity” is associated with Instability after THA regardless of Hip-Spine Classification: A new method to assess Functional Combined Version on Lateral Seated Radiographs

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Abstract body using the following format: abstract information must not appear on or outside the margins. Abstracts must be created in a Word document formatted to 8.5” x 11” (21.59cm x 27.94cm) with the following margin settings: Top & Bottom 0.75 inch (1.91cm); Left & Right 0.75 inch (1.91cm). Font should be 10 points for the Title and 8 points for all authors, institutions, disclosures, and body sections. Times New Roman is the only font approved for use. (If noting a brand name of a product you used, please do not list the city, state or country.)

**INTRODUCTION:** Component positioning in total hip arthroplasty (THA) is a major factor contributing to overall hip stability. Research has focused on establishing “safe” ranges of acetabular component positioning and combined anteversion of acetabular and femoral components that confer the greatest stability. More recently, the impact of spino-pelvic mobility on functional acetabular component position in standing and sitting positions has been emphasized, however, this analysis did not include femoral component version. A recent angle called polarity refers to an angle formed by the head-neck axis (neck angle) and the acetabular angle, such that a polar axis angle of 90 degrees represents ideal stability where the forces of the hip are most concentric. The goal of this study is to compare the polar axis between patients that experienced a postoperative dislocation versus a matched control group without dislocation.

**METHODS:** An institutional database was queried for patients who experienced a prosthetic hip dislocation after unilateral primary THA. Patients with postoperative full length standing and seated anterior-posterior (AP) and lateral images were included in the dislocators group. Patients were matched 2:1 with a control group of postoperative primary THA patients that did not experience a dislocation. Matching was performed by age, BMI, sex and hip-spine classification. Measurements for hip-spine classification, acetabular angle, neck angle and polar axis of the prosthetic hips were performed in a standardized fashion.

**RESULTS SECTION:** Thirty-seven patients were included in the dislocators group and 74 patients were included in the control group. Lateral seated neck angle and lateral seated polar axis measurements were significantly lower in the dislocator group when compared with controls (20.5 vs 33.1,  $p<0.001$ , 70.8 vs 83.2,  $p<0.001$ , respectively). When comparing hip-spine classification within the dislocators group, there were no significant differences in any lateral seated measurements when comparing patients with 1A vs. 2B spine class (polar axis 68.1 vs. 70.0,  $p=0.87$ ) suggesting that the polarity angle is the main factor associated with instability after THA.

**DISCUSSION:** Patients who experience postoperative instability have a significantly lower polar angle on lateral seated radiographs. A lower polar angle indicated a less concentric articulation. In this cohort, the lower polar angle is driven more strongly by decreased functional femoral anteversion. When planning primary THA or revising a THA for instability, the lateral seated imaging should be used to plan component positioning with the goal of creating a concentric hip with a polar angle  $> 70$  degrees, however, further study and external validation is needed to confirm these findings.

**SIGNIFICANCE/CLINICAL RELEVANCE:** The preliminary findings in this study may help identify an clinically relevant and important measurement to assess post-operative implant positioning that may influence the rate of dislocation in patients that underwent a THA. This may help surgeons with pre-operative planning and identify patients who may be at a higher risk of dislocating their implant.

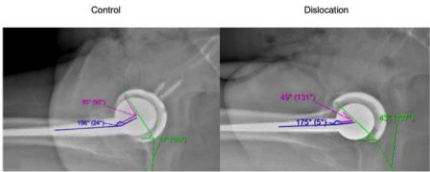
## IMAGES AND TABLES:

Table 1. Polarity Measurements in Standing and Seated Lateral Radiographs

	Dislocators (n=37)	Controls (n=74)	p-value
Lateral Seated Neck Angle	20.5	33.1	$<0.001$
Lateral Seated Acetabular Angle	45.5	49.5	0.13
Lateral Seated Polar Axis	70.8	83.2	$<0.001$
Lateral Standing Neck Angle	13.3	10.1	0.18
Lateral Standing Acetabular Angle	35.1	33.9	0.5
Lateral Standing Polar Axis	133.6	126.9	$0.03$

Table 2. Comparison of Measurements in Hip-Spine Class 1A vs. 2B Patients with Prosthetic Dislocation

Hip – Spine Class	Lateral Seated Neck Angle	Lateral Seated Acetabular Angle	Lateral Seated Polar Axis
1A (n=11)	17.9	46.7	68.8
2B (n=9)	24.1	40.2	70.0
p-value	0.32	0.21	0.87



**Figure 1.** Measurements of neck angle (blue), acetabular angle (green) and polar axis (pink) on seated lateral imaging. The control patient shows a more concentric head reduction with polar axis of 85 degrees vs. 49 degrees in the patient who experienced a post-operative prosthetic dislocation.