

"Femoral Offset How to Measure Preoperatively"

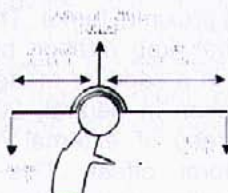
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Femoral Anteversion and Accurate Offset Measurement



Introduction

The importance of proper offset in total hip arthroplasty is well known. Inadequate offset causes a shortening of the proper abduction lever arm leading to a limp, lateral hip pain, increase joint reactive forces, impingement and possibly hip dislocation. Patients with increasing degeneration of the hip joint will have a progressive loss of range of motion, which seems to affect internal rotation more than external rotation. In-fact, most patients with severely degenerative hips will fall into external rotation. When an attempt is made to obtain preoperative anteroposterior (AP) radiographs of the degenerative hips, the perceived offset will be much less than the actual offset. The purpose of this study is to assess how

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much the rotation of the limb affects the measurement of offset.

Methods

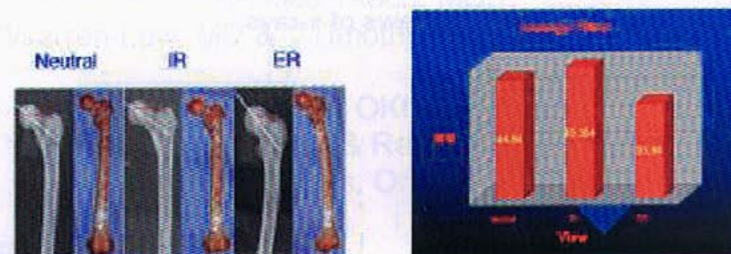
We took 10 cadaveric femurs and placed a Steinmann pin in the centre of the femoral head, through the neck and to the later cortex. We obtained radiographs of each femur in neutral, 20 degrees internal rotation and 20 degrees of external rotation. Offset was measured from each of these radiographs to assess the variability of offset in varying degrees of rotation.

Numerous authors have attempted to assess anteversion and femoral offset at the hip *in vitro* and *in vivo* with plane x-rays, special devices and modern imaging techniques including cross-sectional computed tomography. In each instance the technique has demonstrated some measurement error due to the anteversion of the proximal femur. The goal of our study is to assess the role that limb rotation plays in changing the inclination and offset in a cadaver model. Traditional AP and lateral radiographs taken in neutral, 20 degrees of internal rotation and 20 degrees of external rotation will alter the inclination and femoral offset. This may have clinical applicability to preoperative planning for total hip arthroplasty.

Ten cadaveric femurs had a Steinman pin placed through the femoral head through the femoral neck to the lateral cortex of the femur using Wright medical Hemi-Resurfacing Guide.

Radiographs taken in neutral, 20° internal rotation and 20° external rotation were taken.

Five senior residents and three orthopaedic staff faculty measured offset. Pin length was also measured.



Results

There was a statistical significant difference in measurement between raters, cadavers and rotation ($p < .001$). After controlling for rater and cadaver, there was statistically significant variation between the different view measurements ($p < .0010$). Pin length measurement was also statistically significant in comparing the different views ($p < .001$).

Discussion

Cadaveric femurs in 20 degrees of internal, external rotation will change the angle of anteversion and femoral offset, thereby, impacting applicability to patient imaging prior-to surgery.

Essentially the literature has surgeon's templating to a model that underestimates the offset due to a combination of the anteversion angle and the increasing loss of internal rotation which is dependent on the severity of osteoarthritis and changes as a result of limb positioning prior-to x-ray.

Results from our study indicate patients with radiographs taken in neutral or external rotation position will underestimate the actual femoral offset.

Reconstruction of the anatomic femoral offset is essential if restoration of the abductor moment arm and optimization of leg length, stability and implant load is to be achieved.

Note: Femoral offset can be underestimated by as much as 1cm depending on views of x-rays.

