Total Hip Arthroplasty: Hip Positioner Stability

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CLINICAL MOTIVATION & STUDY OBJECTIVE

- Component malpositioning during total hip arthroplasty (THA) can lead to complications such as wear, dislocation, osteolysis, and increase overall complication rate.[1] Therefore, correct placement of the components is vital
- Several steps in the THA procedure require forceful maneuvers that can cause the patient to shift from their original position
- Various methods for stabilizing the pelvis during surgery exist, but very little evidence exists quantifying the relative stability of each hip positioner, especially for overweight or obese patients

The aim of this study is to compare the stability of four commercially available hip positioners by tracking the rotation of the pelvis during a simulated THA.

METHOD

Specimen Preparation

- One full-body overweight cadaver (male, BMI: 28)
- The specimen was secured in the lateral decubitus position with the given hip positioner
- Hip positioners studied: Beanbag, Pegboard, Stulberg, ExactFit

Optical & Coordinate Setup

- An infrared marker and camera system (Optotrak 3D Investigator, NDI) was used to track the motion of the pelvis (marker mounted to rod inserted in the iliac) compared to the surgical table
- The hip coordinate system was defined using an infrared probe via fluoroscopic guidance according to ISB standards[2]

Simulation

- An orthopedic surgeon moved the leg to simulate the motions and forces applied during a standard THA
- The following movements were applied separately : Flexion, Extension, Internal Rotation, External Rotation, Push, and Pull
- Each movement was repeated for 30 seconds while data was collected

Data Analysis

- The primary outcome measured was the resultant rotation, defined as the Pythagorean sum of the maximum rotations found in each direction, in degrees, during each movement

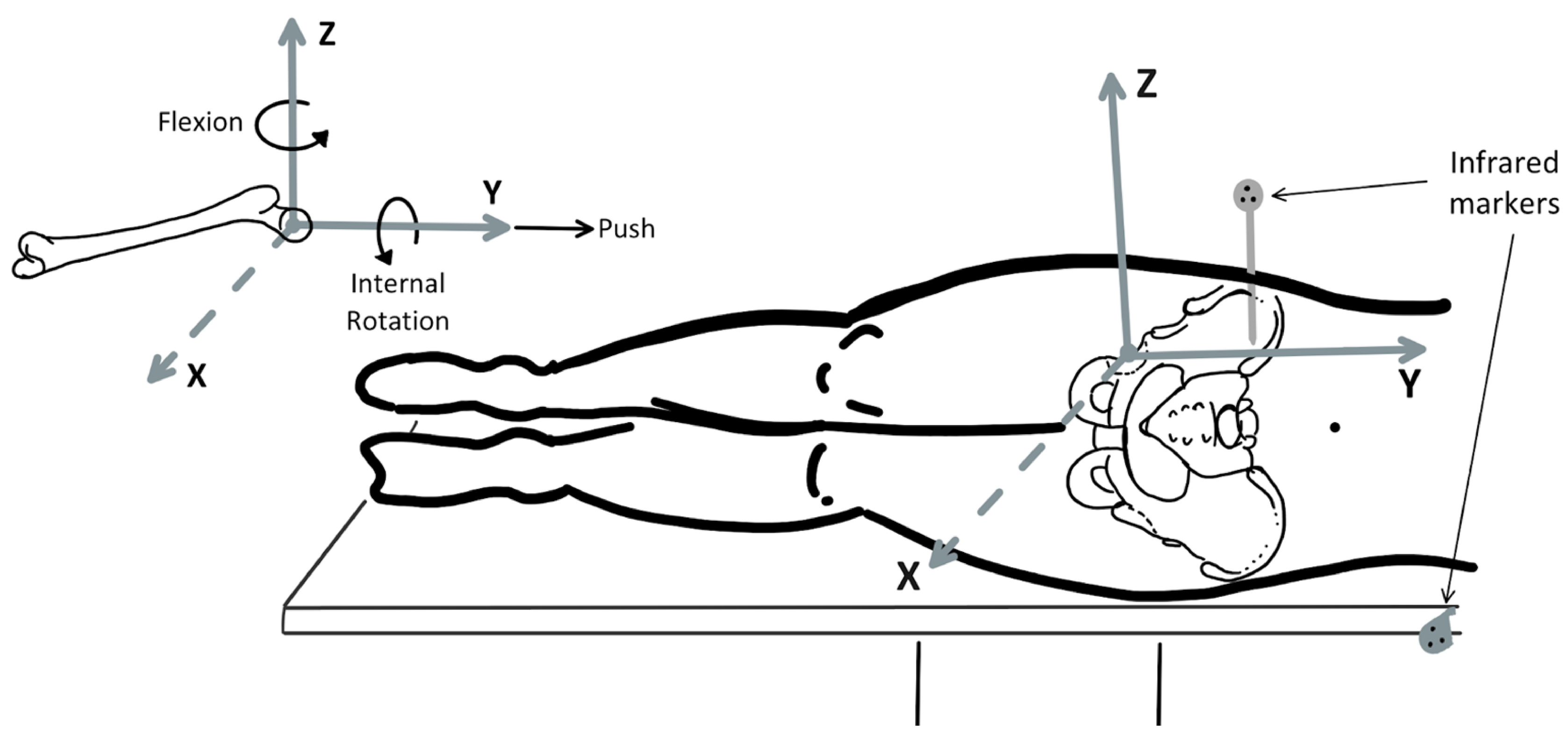

Figure 1. *Optical and coordinate system setup utilized for simulated THA*

Hip Coordinate System, defined following ISB Standards[2]:

- **Origin:** Center of the femoral head
- **Z axis:** Line parallel to a line connecting the right & left ASIS
- **X axis:** Orthogonal to Z, lying in the plane connecting both ASISs and the midpoint of the PSISs, pointing anteriorly

RESULTS

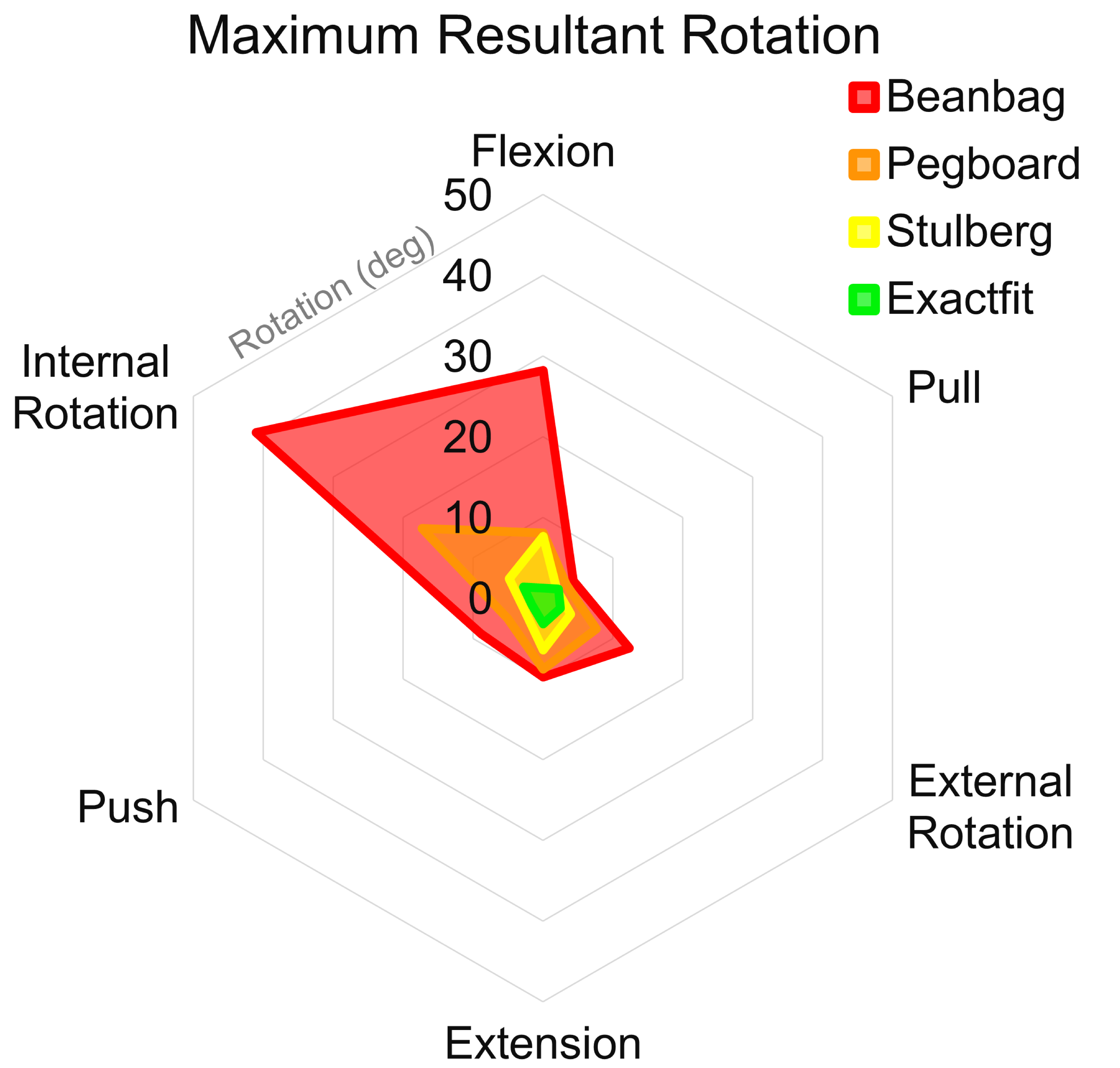

Figure 2. *Maximum resultant rotation that occur during each induced movement*

Table 1. *Maximum resultant Rotation observed during each induced movement*

	Flexion	Extension	Internal Rotation	External Rotation	Push	Pull
Beanbag	28.2°	9.8°	41.0°	12.3°	8.8°	4.3°
Pegboard	8.1°	8.8°	17.3°	7.7°	5.1°	3.3°
Stulberg	7.6°	6.4°	4.8°	3.9°	2.7°	2.0°
ExactFit	1.3°	3.2°	2.8°	2.5°	1.6°	2.2°

CONCLUSION

- Rotation of the pelvis during simulated motions of the pelvis varied widely based on hip positioner used
- As rotation of the pelvis alters the component positioning and may lead to implant malpositioning, motion should be limited

In this study, the ExactFit hip positioner provided the most stability and thus may reduce the risk of component malpositioning and related complications.

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