Component Position: How I put it in the Safe Zone

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Accurate, reproducible positioning of the acetabular component greatest challenge: optimal positioning < 50% among best surgeons

BUT, only one of half dozen variable

Malchau et al; Charnley Award, 2010
Optimizing hip arthroplasty:

• *Cup alignment* entirely too narrow focus

• Current state of medical knowledge/technology indicates clinical results (and our goals) should extend far beyond cup alignment to all aspects of orientation of THA components: *limb length*, offset, sizing, seating, unrecognized fracture (to name a few)
Two approaches

- **Virtual reality**: utilization of advanced technology that provide *surrogates* to direct visualization of components: issues with accuracy, validation, cost

- **Intraoperative imaging**: the gold standard, but must meet rigid criteria of maintaining efficiency: cannot add too much time/cost or compromise sterility
Historically: Post-op (Recovery room) x-ray has been the standard practice 90-99% of hospitals

X-ray is the gold standard (clinically and legally);

*but post-op imaging is illogical*

Intraop imaging: will accept nothing less than perfection (or something close to it)

Post-op Imaging: will accept anything other than catastrophe

*(basically gathering incriminating evidence)*
Why is intraop imaging not been adopted in THA

• Adds too much time
• Disrupts work flow at a time when efficiency is paramount
• Quality of images not adequate to take measurements of interest to adequate degree of accuracy (3-5°, 2-4 mm)
• Must be able to be an iterative process to assess, make changes, reassess and document
This is changing rapidly

- Modifications of existing portable imaging; predominantly DR plate technology, allows imaging intraoperatively with on-screen display within 4-5 seconds.
- Imbedded software allows measurement of all parameters of interest.
- Mature technology, available today, 3-4 systems currently in use.
- It is not virtual reality, it is reality, it is the gold standard.
Advantages of Digital Imaging

• Higher quality images

• Faster service speed.

• Minimal impact on O.R. workflow.

• Eventual reduction in operating costs.

• Eliminate the processing of chemicals, processing dark room and film storage room.

• Eliminate outliers/returns to O.R.; may allow return to hard/hard bearings (C-O-C)
Pre-op image on screen, transmitted from office/PACS for comparison based on landmarks
Image with trials in place; verify pelvic tilt/rotation; reshot if necessary
Pelvic tilt/rotation adjusted with O.R. table; cup position modified, stem fit/fill, offset verified, cup seating, verified; added minutes
1º left hip; plan to lengthen; anticipate right revision THA
Verify pelvic rotation/tilt: based on pelvic inlet dimensions and mid-sacral to pubic line, rotate table to reproduce pre-op and/or computer modification of angles.
Conclusion

- Advances in technology (DR, digital radiography) have made *intraoperative digital imaging* a practical/feasible strategy to avoid *outliers* that increase complications and compromise results.

- Rapidly evolving technology, current status effective in consistently optimizing THA component placement.

- Excellent teaching tool; rapidly embraced at our center; successfully eliminated outliers/surprises.