INFERIOR TILT OF THE BASEPLATE INCREASES IMPINGEMENT AND THE RISK OF NOTCHING IN REVERSE SHOULDER ARTHROPLASTY – A 3-D MOTION ANALYSIS

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CONFLICT OF INTEREST

• Michael Amini
  – Stryker (consultant)
  – Wright (research support)
  – Orthofix (research support)
  – FX Shoulder (research support)
  – AANA (Committee member)

• None of the remaining authors have any COI
BACKGROUND

- Scapular notching refers to osteolysis of the scapular neck due to impingement of the humeral component inferiorly and posteriorly.

- This has been associated with poorer outcomes after RSA.
BACKGROUND

- Differences in techniques and design to address notching have been introduced, including:
  - Decreased neck-shaft angle
  - Inferior placement of the baseplate
  - Glenosphere lateralization
  - Glenosphere eccentricity
  - Inferior tilt of the baseplate
INFERIOR TILT

• Inferior tilt was originally promoted to decrease rates of baseplate failure

• Early cadaveric studies suggested that inferior tilt decreased scapular impingement
HOW DOES INFERIOR TILT AFFECT NOTCHING?

• Inferior tilting distalizes the humerus

• However, it leads to medialization and shortening of the scapular neck
HOW DOES INFERIOR TILT AFFECT NOTCHING?

A radiographic analysis of the effects of glenosphere position on scapular notching following reverse total shoulder arthroplasty

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- Retrospective review, 43 neutral tilt, 28 inferior tilt – no difference incidence of notching
HOW DOES INFERIOR TILT AFFECT NOTCHING?

Inferior tilt of the glenoid component does not decrease scapular notching in reverse shoulder arthroplasty: results of a prospective randomized study

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• Prospective RCT with 20 patients that had 10 degrees of inferior tilt, 22 with no tilt – no difference in notching between groups
OBJECTIVES

• Investigate the effect of inferior tilt on impingement in RSA using 3-D simulation software (Blueprint, Wright Medical, Bloomington, MN)
• Investigate the secondary effects of glenosphere lateralization and diameter, and neck-shaft angle on the magnitude of changes seen with changes in tilt
HYPOTHESIS

• We hypothesized that inferior tilt does not affect impingement.
METHODS

- 20 patients without glenoid bone loss underwent preoperative CT scan of the entire scapula and proximal humerus

- 25mm glenoid baseplate (PERFORM Reversed, Wright Medical, Memphis, TN) was digitally implanted along the inferior margin of the glenoid, centered anterior-to-posterior, matching the patient’s existing version, with full backside contact

- 16 total simulations for each patient. Variables:
  - Inferior vs neutral tilt
  - Neck-shaft angle of 135 vs 145
  - Glenoid lateralization of 0 vs +6
  - Glenosphere size of 36mm vs 42mm
OUTCOMES

• Primary outcome: impingement in external rotation with the arm at the side (ERS)

Scapular Notching After Reverse Total Shoulder Arthroplasty
Prediction Using Patient-Specific Osseous Anatomy, Implant Location, and Shoulder Motion

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Investigation performed at the Department of Orthopaedic Surgery, Cleveland Clinic Foundation, Cleveland, Ohio

• 16/17 patients with scapular notching impinged in ER with the arm at the side, 12/17 with adduction
RESULTS

• Inferior tilt led to a decrease in impingement-free ER at the side in ALL simulations (p<0.01 in all cases)
  – 27% average reduction

• The magnitude of this effect was greatest in medialized glenospheres (2.8x), less in smaller glenospheres (1.7x), and least in more valgus humeri (1.3x).
## RESULTS

<table>
<thead>
<tr>
<th>NSA</th>
<th>Diameter</th>
<th>Lateralization</th>
<th>Tilt</th>
<th>ER* at side</th>
<th>% reduction of ER*</th>
<th>P value</th>
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CONCLUSIONS

- Inferior tilt led to a consistent decrease for every implant configuration in ERS, which is the primary mode of in-vivo notching.
  - Likely a result of medialization and shortening of the scapular neck
CONCLUSIONS

• This effect is magnified when using a medialized glenosphere, a smaller glenosphere, and/or a more valgus humeral component.
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QUESTIONS?
REFERENCES