Patient Specific Instrumentation for Glenoid Preparation

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Disclosures

• Royalties/MAB – Imascap, Conextions, Kator, Genesis, Intrafuse, Cayenne Medical
• Consultant – Cayenne Medical

Introduction

• TSA and RSA provide reliable pain relief/functional improvement
• Why do we need Planning and PSI in 2017 in shoulder arthroplasty?
• High variability still exists
  – 1.) Set higher goals for ourselves
  – 2.) Expansion of indications
    – treating more difficult pathology
  – 3.) More surgeons w/ less expertise performing

Precise restoration of Size and Version

Increased difficulty of pathology tx’d
Planning VS. PSI

- Computer planning - 3D CT scan + computer software
- PSI - 3D Planning; patient specific guide created from the plan
- Questions to determine utility
  - Does 3D planning alone improve implant alignment compared to standard 2D planning?
  - Does PSI improve implant alignment vs. 3D planning alone or 2D planning?
  - Does the improved alignment result in improved outcomes or survival?

3D Computer Planning In Anatomic TSA

- Iannotti et al JBJS Am 2014
  - In vitro
  - Bone models; patients with gh arthritis
  - Standard instruments/2D planning vs standard instruments/3D planning
  - Accuracy of pin position
    - improved by 4.5° version; 3.3° inclination
- Iannotti et al. JBJS Am 2015
  - Clinical study
  - Standard instruments/2D planning vs standard instruments/3D planning
  - Improvement version and inclination using 3D planning w/ standard instruments

3D Planning and Standard Instruments

88 year old female
Endstage RTC Arthropathy
Severe E2 gelenoid
AFE = 10
Templated baseplate and glenosphere w/ superior bone graft

Templated inclination on 3D templating program between 0 and 5 degrees of superior inclination (best fit sphere)

Templated Gerber Beta angle = 91 degrees

CT SHOULDER MRI, CONT RT
O:
02457300
VHR3051
12/30/44

512 x 512
viewed at 50%

Almost Identical To Preop Plan It

1.5 years postoperative
Healed graft
Asses score 83 (preop 23)
3D Planning and PSI in Anatomic Total Shoulder Arthroplasty

- Iannotti et al JBJS 2014
  - Cadaveric Study
  - PSI vs. 3D planning w/ standard instruments
  - PSI improves version and inclination accuracy compared to 3D planning only

- Hendel, Iannotti et al JBJS Am 2012
  - Clinical study
  - PSI vs. 2D planning w/ standard instruments
  - PSI improves version and inclination accuracy vs 2D planning
  - Only seen if > 16 degree retroversion

- Iannotti et al JBJS 2015
  - Clinical study
  - PSI vs. 3D planning w/ standard instruments
  - No improvement in version or inclination using PSI compared to 3D planning only

In lab – PSI better than 3D planning in clinical – PSI better than 2D planning but equal to 3D planning…only 1 study!

3D Planning and PSI in RSA

- Levy, Frankle JSES 2014
  - In vitro cadaver study
  - Used PSI to implant baseplate; accurate at reproducing 3D plan

- Heylen et al JSES 2016
  - 24 patients undergoing RSA
  - 12 w/ standard instruments; 12 w/ PSI
  - Larger std. dev of inclination in non-PSI
  - Extreme postop inclination angles less likely with PSI (p=0.02)
  - **PSI versus 3D planning alone or 2D planning vs 3D planning alone**

3D Planning and PSI

- 53 year old male
- Nondominant shoulder
- 18 degrees retroversion on 2D plan
85% posterior subluxation

Planned to anatomic TSA to 10 degrees of retroversion

- Guide planned and created
- Utilized to position glenoid center guide pin intraop
Key Points About 3D Planning - #1

- Understand relationship between 2D and 3D measures; most data is based on 2D
- 2D version – use scapular axis (Freidman’s line); 3D version – best fit sphere
- 2D CT – underestimates retroversion compared to 3D CT
  - Budge et al; Terrier et al
    - 2D retro – underestimates 3D by 2 to 3 degrees

Key Points About 3D Planning - #2

- Understanding glenoid inclination – critical for RSA
- Current 2D recs for RSA – neutral or slight inferior tilt on standing true AP
  - Both glenohumeral and scapulothoracic position
- 3D planning
  - Does not account scapulothoracic rotation
- My current 3D planning goals
  - 0 to 5 degrees of superior inclination for RSA
  - Results in neutral/slight inferior tilt on standing true AP
Conclusions

• High variability still exists w/glenoid component placement
• Anatomic TSA - 3D planning alone and PSI both improve glenoid position compared to 2D planning in vivo and vitro
  – **In vitro**, PSI improves glenoid position over 3D planning
  – **In vivo**, No clear benefit of PSI over 3D planning...1 study
• RSA - PSI improves baseplate position in vivo and in vitro compared to 2D planning
  – No data comparing PSI vs. 3D planning alone or 3D planning alone vs. 2D planning
• No clinical data supporting improved outcomes/implant longevity due to planning/PSI
• Research required to confirm improved position results in improved PROs and survivorship