Exactech® GPS™
Guided Personalized Surgery

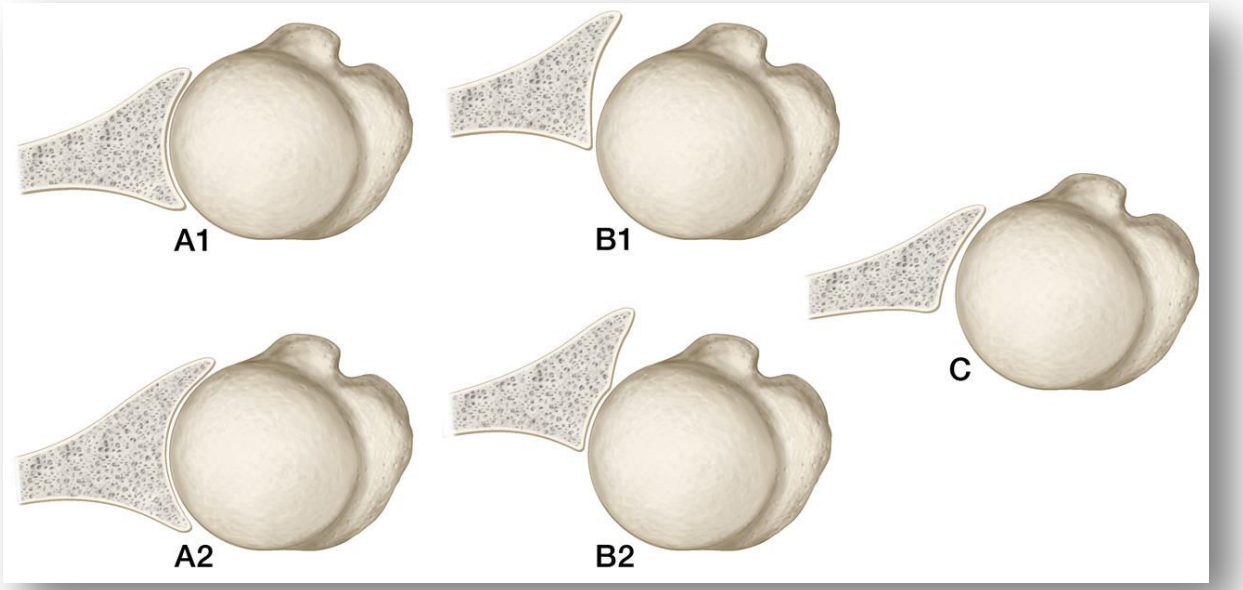
Rationale andTechnique

Moby Parsons, MD

THE
KNEE • HIP • SHOULDER
CENTER

Bone Erosion Due To Arthritis

- Shoulder arthritis can cause different patterns of bone wear and erosion to the socket.
- This wear can cause the socket to be abnormally oriented relative to the shoulder blade
- The humeral head can also shift backwards in the socket due to arthritis and come to rest on the back edge
- The most common but troublesome pattern that shoulder surgeons encounter is the B2



Anatomic Reconstruction

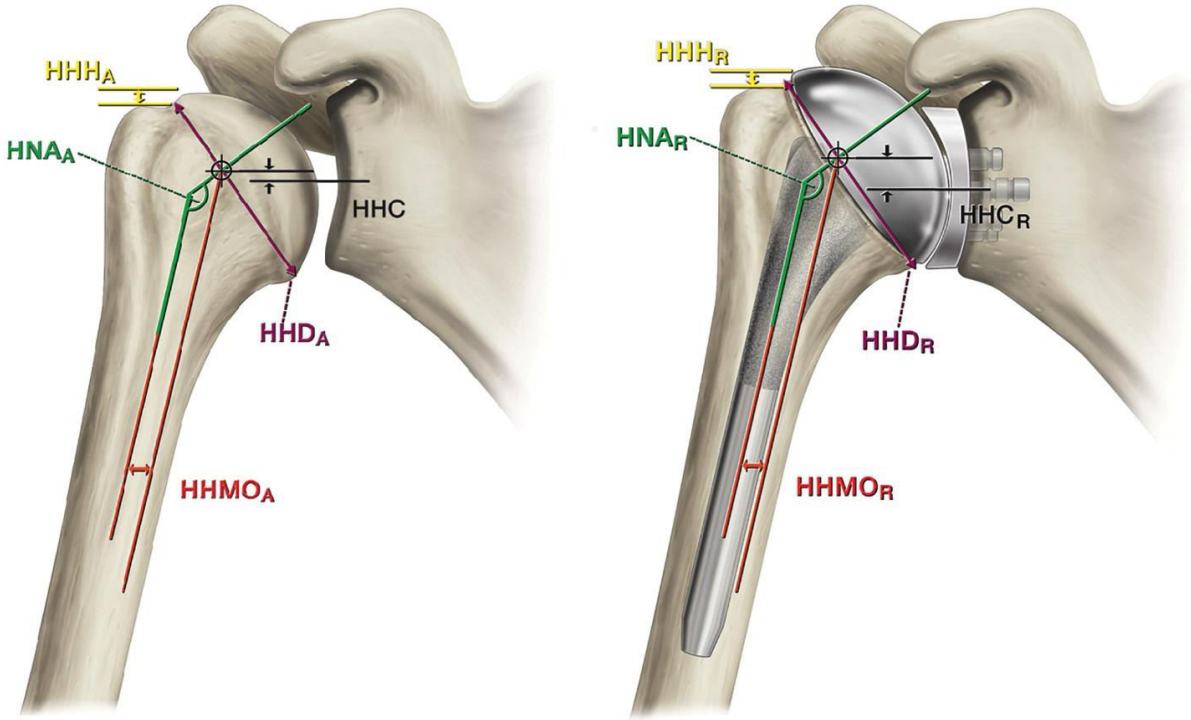
- Research has shown that the more accurately a surgeon can recreate normal anatomy with a shoulder replacement, the better the outcomes in terms of motion, strength and function

- Bone erosion and wear must be corrected at the time of replacement to restore normal relationships between the socket and shoulder blade

S92 Bulletin of the Hospital for Joint Diseases 2015;73(Suppl 1):S92-8

Correlation Between Clinical Outcomes and Anatomic Reconstruction with Anatomic Total Shoulder Arthroplasty

Pierre-Henri Flurin, M.D., Christopher P. Roche, M.S., M.B.A., Thomas W. Wright, M.D., and Joseph D. Zuckerman, M.D.



Risk of Leaving Wear Uncorrected?

- If the socket orientation is not corrected when the new implant is placed, too much backward tilt can increase the stress in the bone beneath the implant
- This results in premature loosening of the implant and failure of the surgery

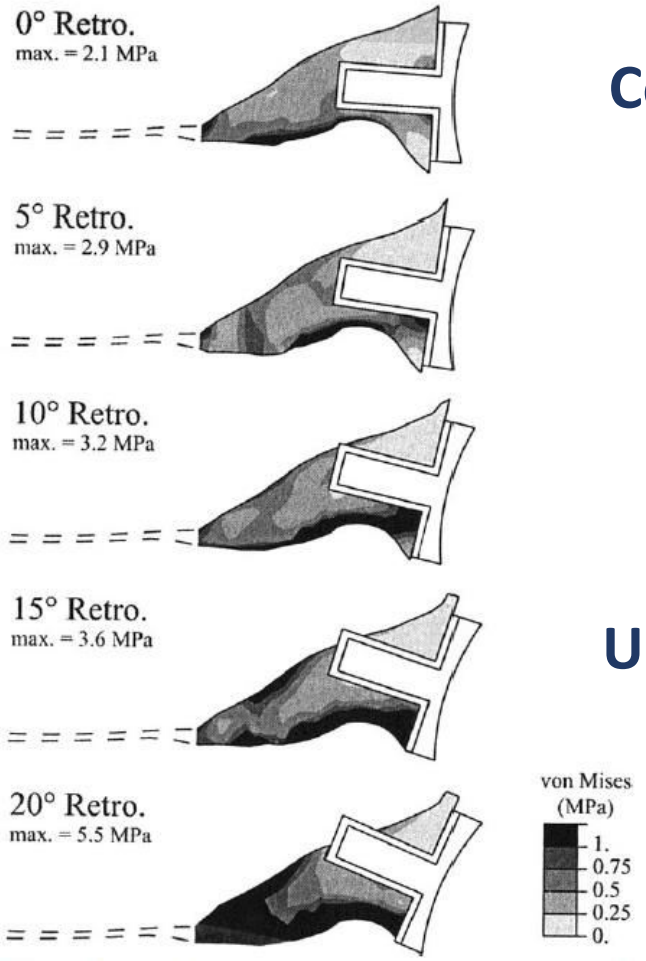


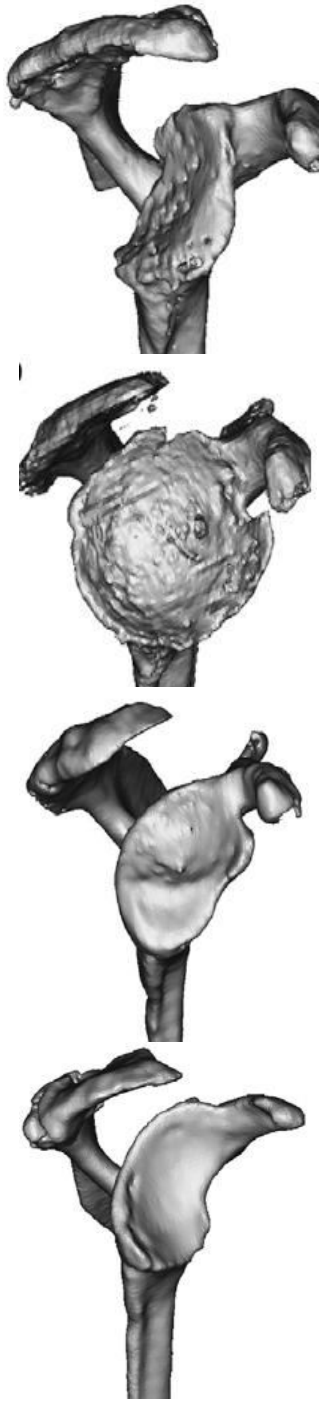
Figure 5 Glenoid intraosseous stresses (Von Mises) at 60° of internal rotation for the 5 different retroversions.

Corrected Wear

Uncorrected Wear

Advancements

- Augmented socket components have been developed to address bone loss from degeneration
- Advanced imaging is necessary to accurately identify patterns and degrees of socket erosion
- Recognizing patterns of bone loss and which implant provides the best reconstruction is imperative



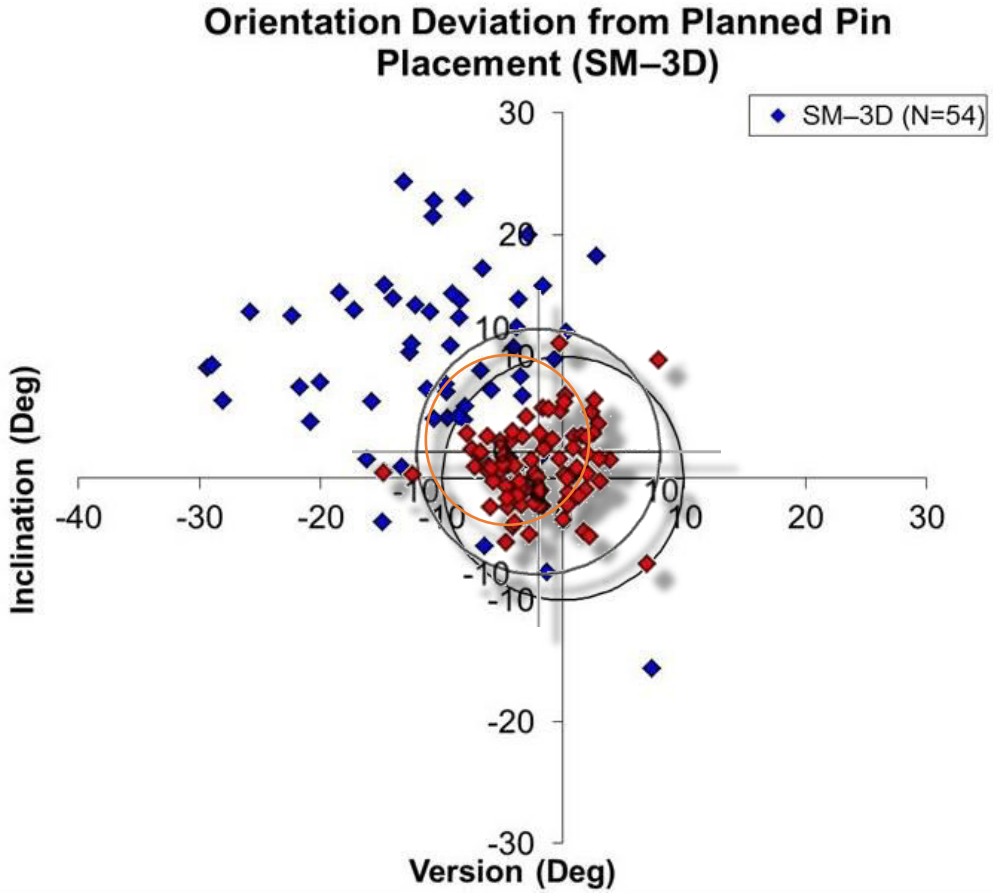
Glenoid Implantation Variability

- The blue dots in the graph show how much variability occurs in implant position when surgeons “freehand” or “eyeball” the position

- The red dots show that preoperative planning can improve the accuracy substantially

Three-Dimensional Preoperative Planning Software and a Novel Information Transfer Technology Improve Glenoid Component Positioning

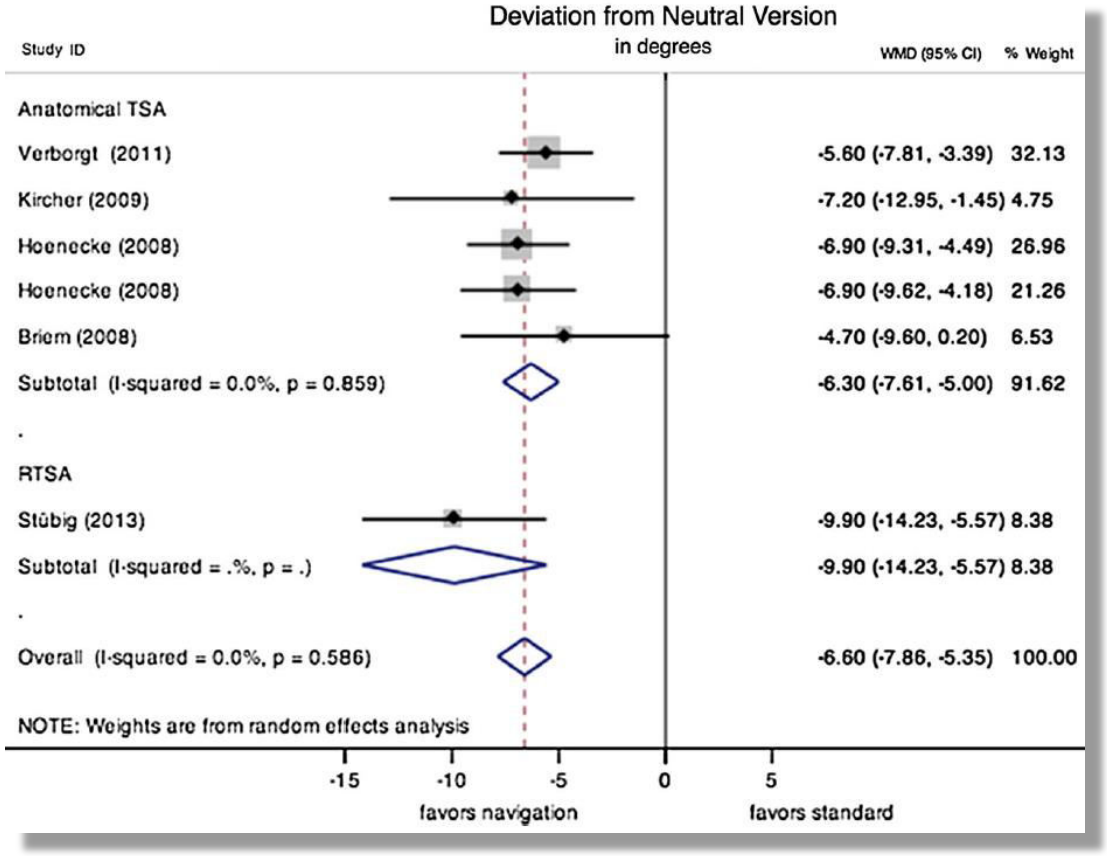
Joseph Iannotti, MD, PhD, Justin Baker, PhD, Eric Rodriguez, BS, John Brems, MD, Eric Ricchetti, MD, Mena Mesiha, MD, and Jason Bryan, MS



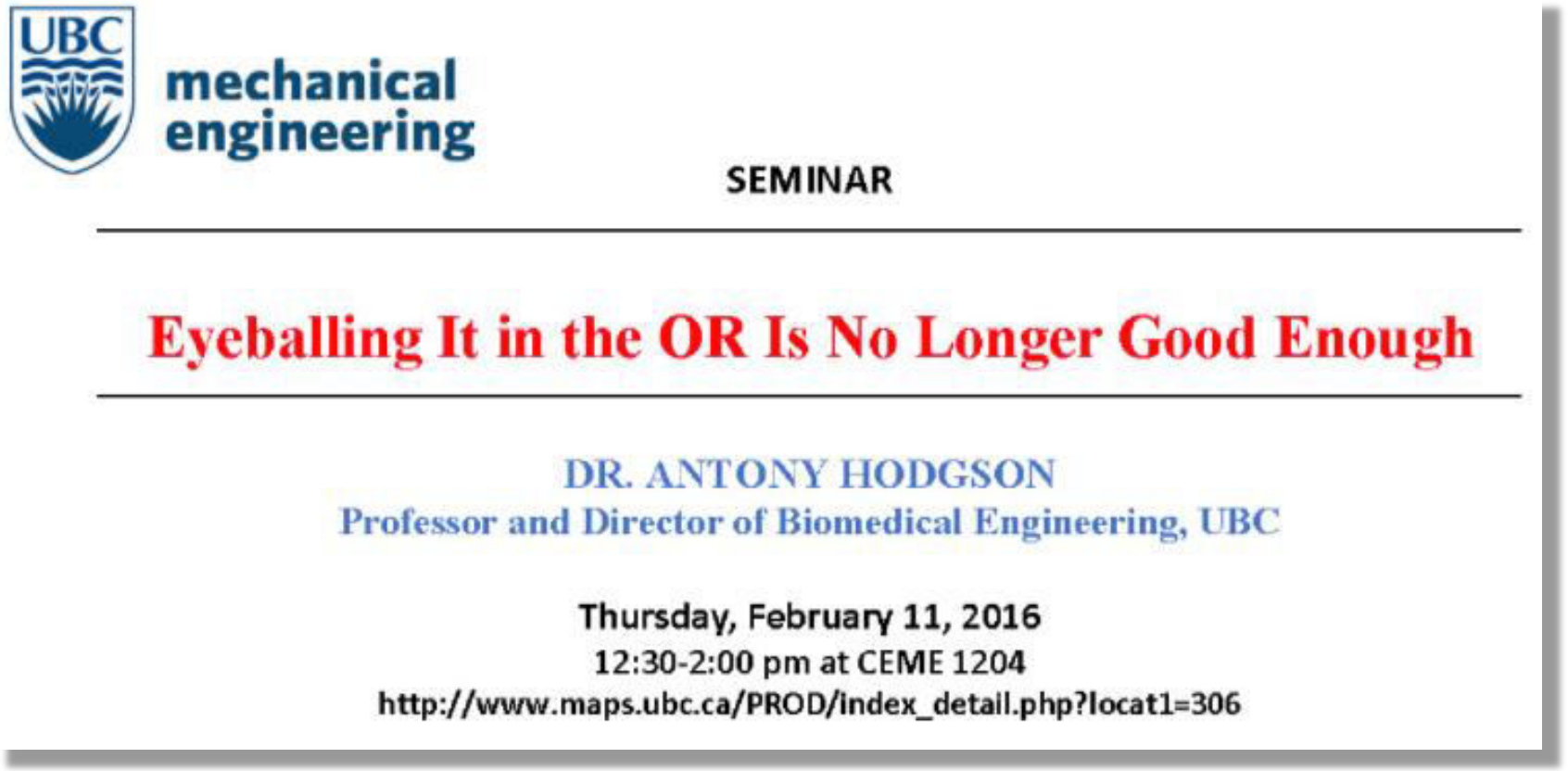
Glenoid Implantation Variability

- Further analysis demonstrates that surgeons can be off by as much as 10° in implant placement without planning or navigation

- This can lead to improper correction of wear patterns and subsequent premature failure of the shoulder replacement



With the technology available today…..



UBC mechanical engineering

SEMINAR

Eyeballing It in the OR Is No Longer Good Enough

DR. ANTONY HODGSON
Professor and Director of Biomedical Engineering, UBC

Thursday, February 11, 2016
12:30-2:00 pm at CEME 1204
http://www.maps.ubc.ca/PROD/index_detail.php?locat1=306

What is GPS?

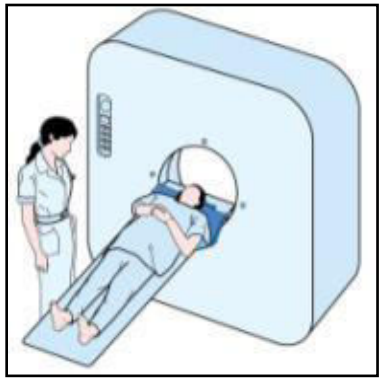
- GPS stands for ***Guided Personalized Surgery***

- It uses CT scan based preoperative planning along with intraoperative surgical navigation techniques to improve surgeon accuracy in implant placement and ensure:
  - Optimal position of implant to ensure best fixation in bone
  - Optimal implant selection to restore glenoid version with minimal glenoid reaming
  - Reproducibility of good results particularly in complex cases

GPS Shoulder Navigation Workflow

1. CT data collection (1mm)

Patients undergo and CT scan of the arthritic shoulder

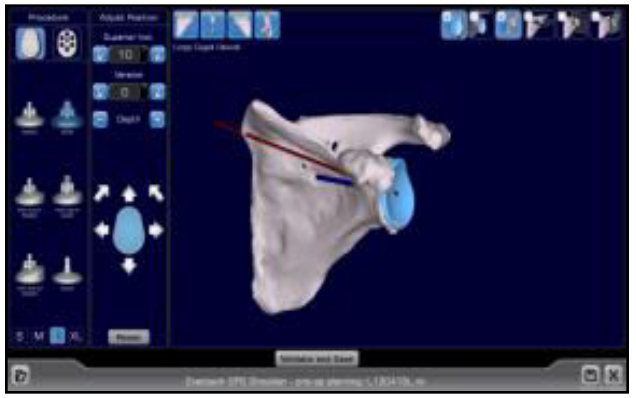


2. CT Segmentation → Blue Ortho

This scan is converted into a 3D model and imported into a proprietary planning software platform

3. Planning

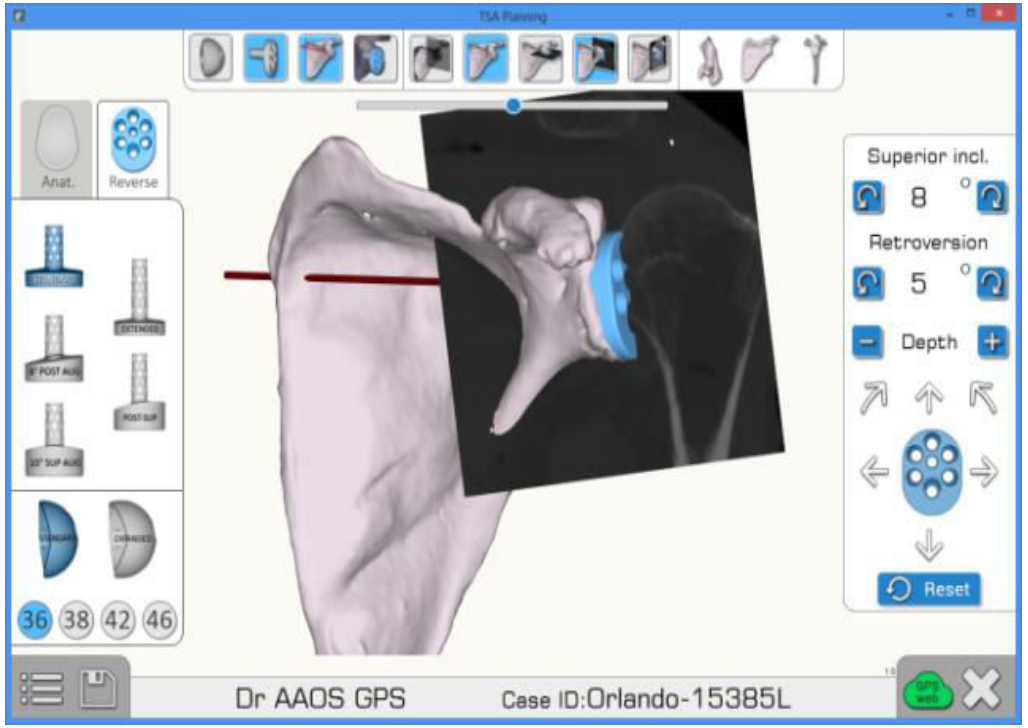
The case is then planned to determine the proper implant type and position. The plan is then brought to the OR and the case navigated to recreate the plan in real time

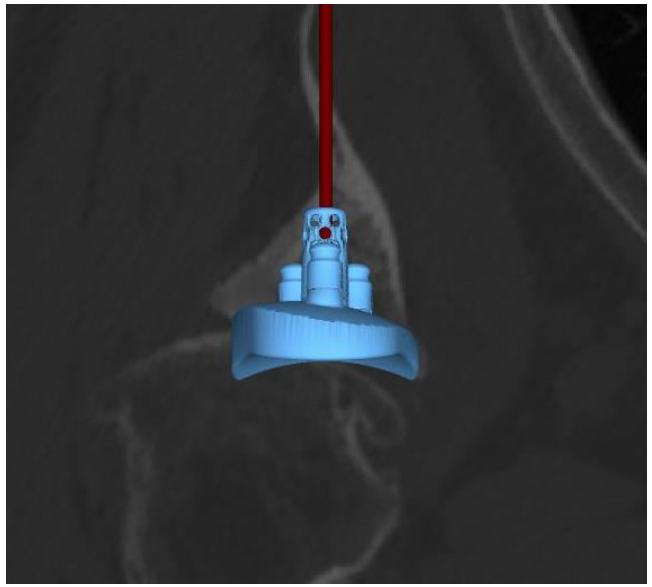


4. Navigation

GPS Shoulder Planning

- CT scans are uploaded are loaded into proprietary software platform
- Surgeons can then choose the best implant type and size
- Using both 2D and 3D images, the optimal implant position and orientation can be determined

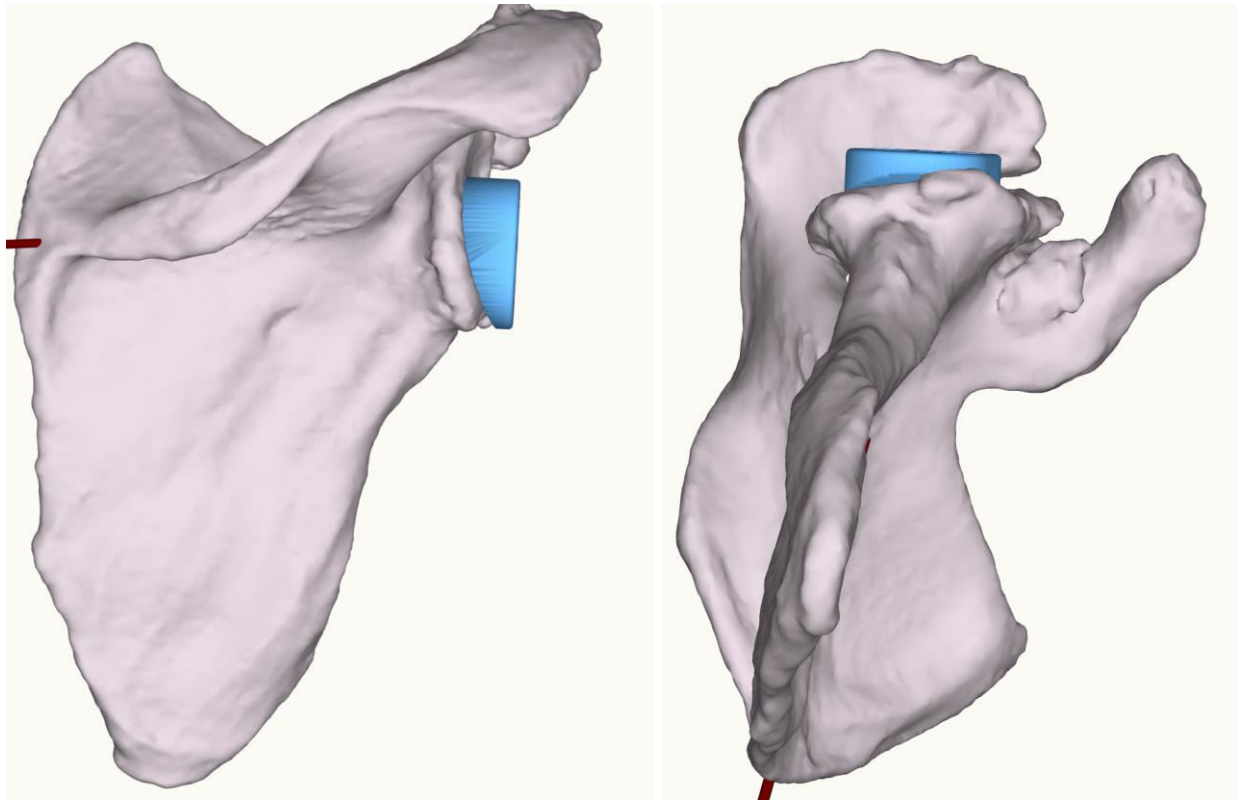




Pre-operative Planning

- High resolution image can be freely rotated in any plane to visualize the anatomy of the arthritic shoulder

- Both standard and reverse total shoulders can be planned allowing surgeons to choose the best implant to deal with glenoid anatomy and any wear complex wear patterns.

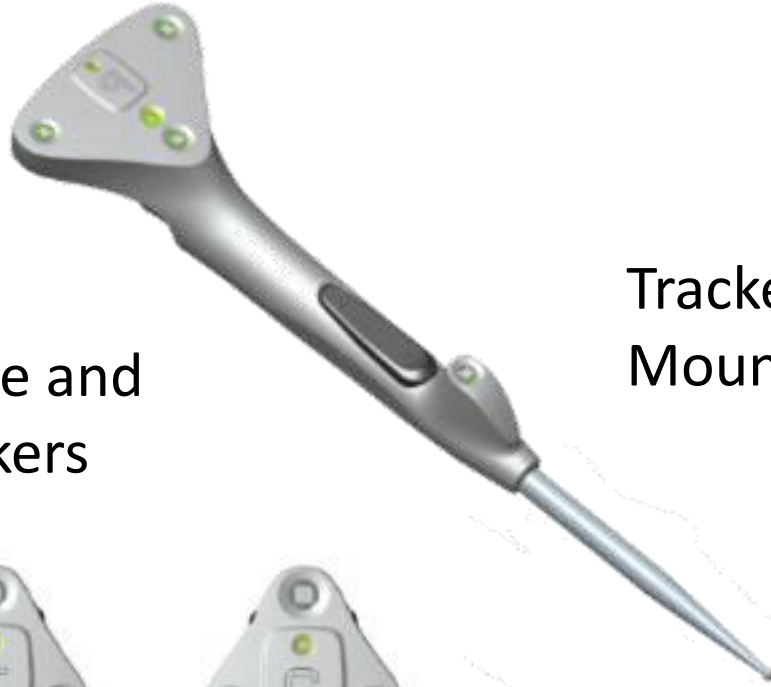


Component Overview

- Trackers allow the patients anatomy to be registered to the plan

- Intelligent instruments then allow the surgeon visualize the plan during the real OR case

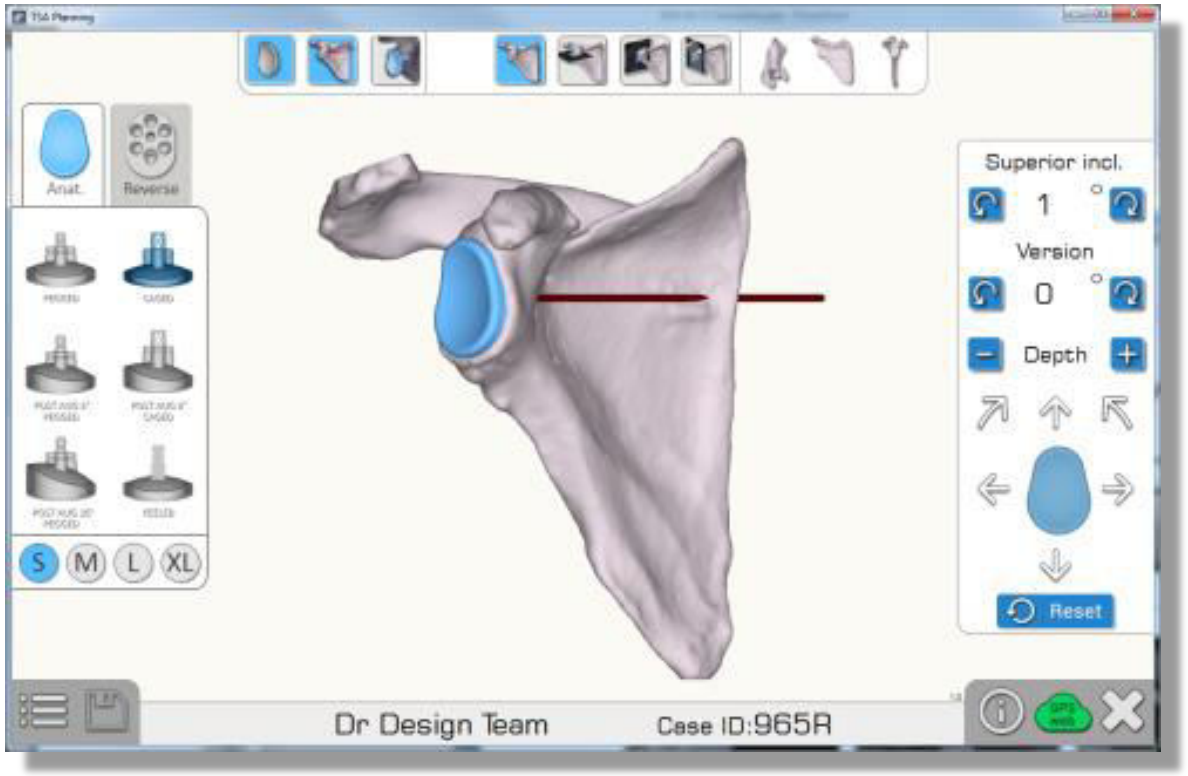
Probe and Trackers

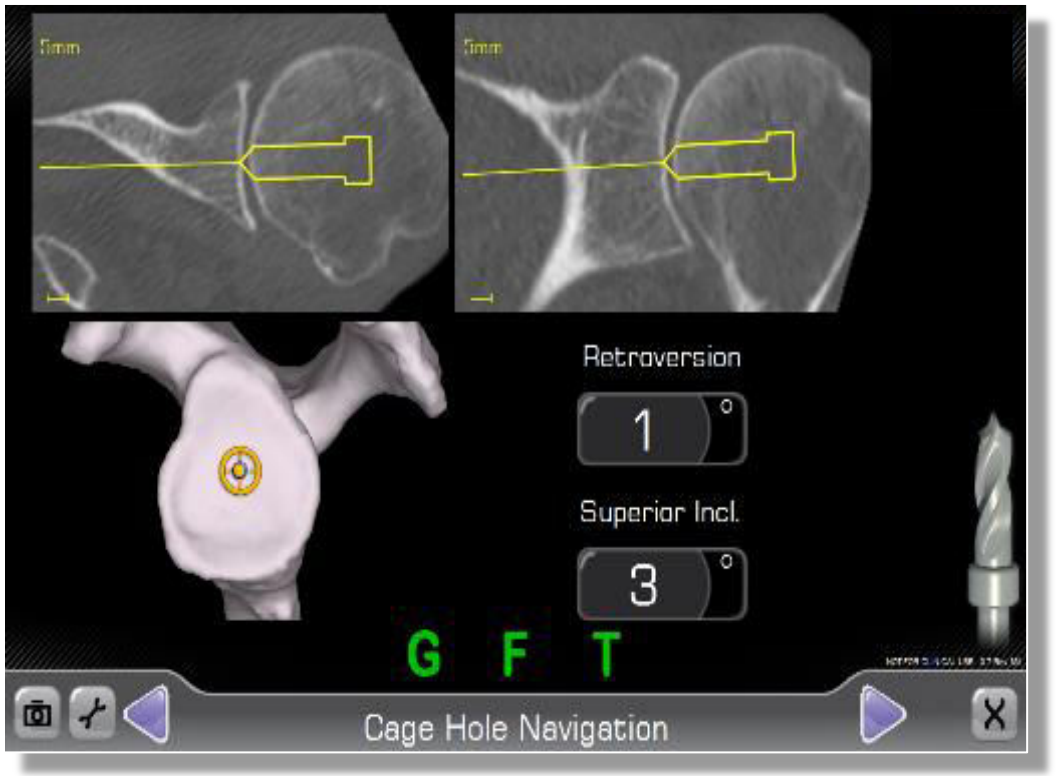


Tracker Mount

Instrument Navigation

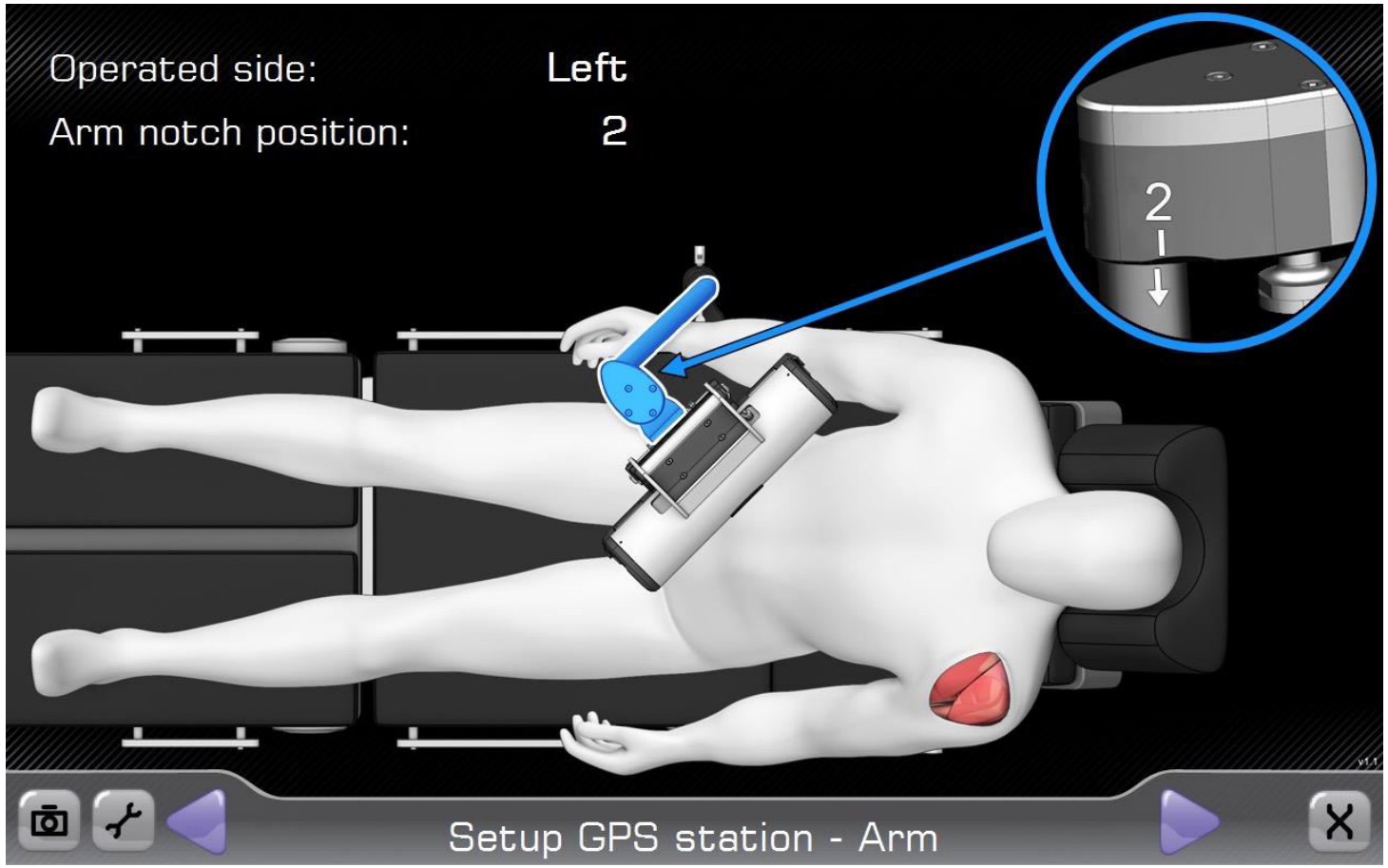
Plan Transfer



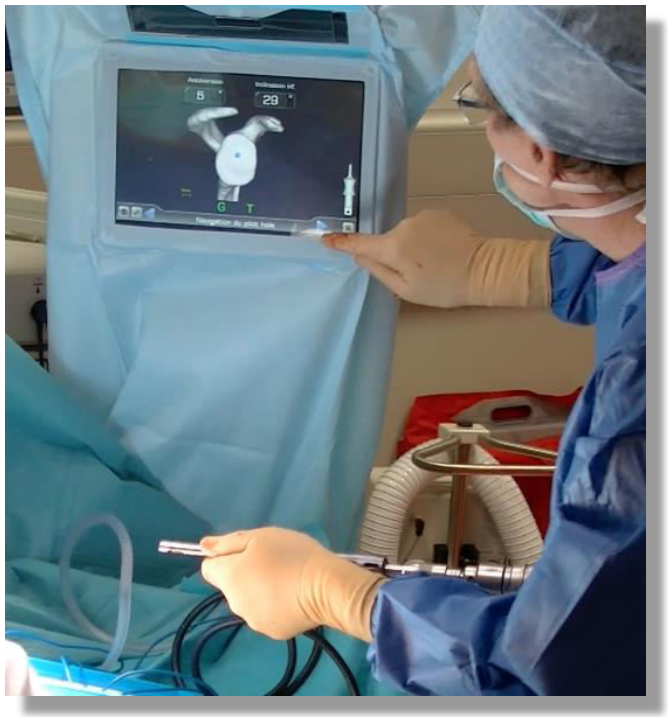


Plan transferred by USB drive to GPS system allowing surgeons to navigate the shoulder replacement in real time. This allows the surgeon to precisely recreate the plan during the case

Navigation GPS Set-up

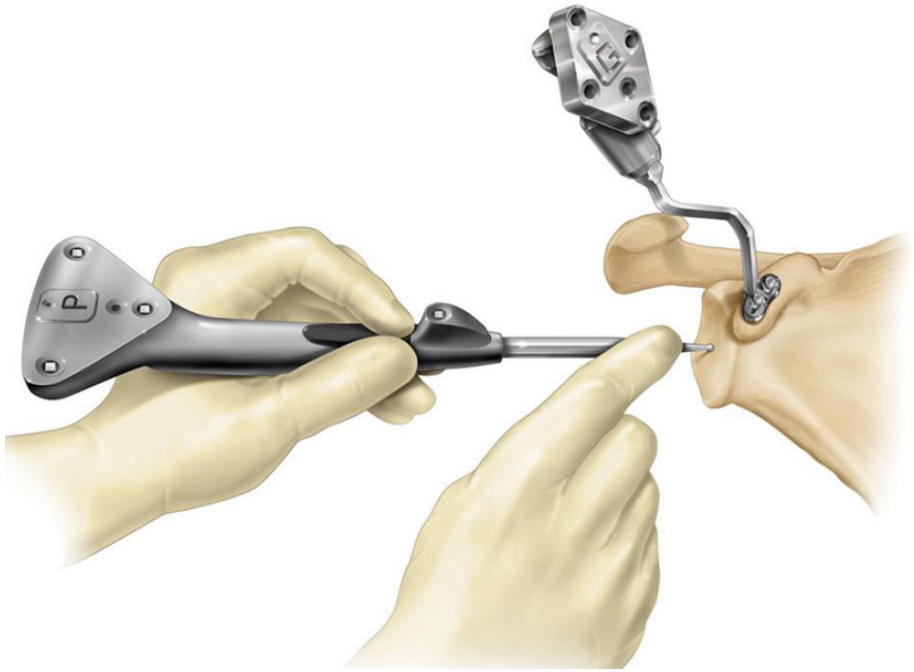


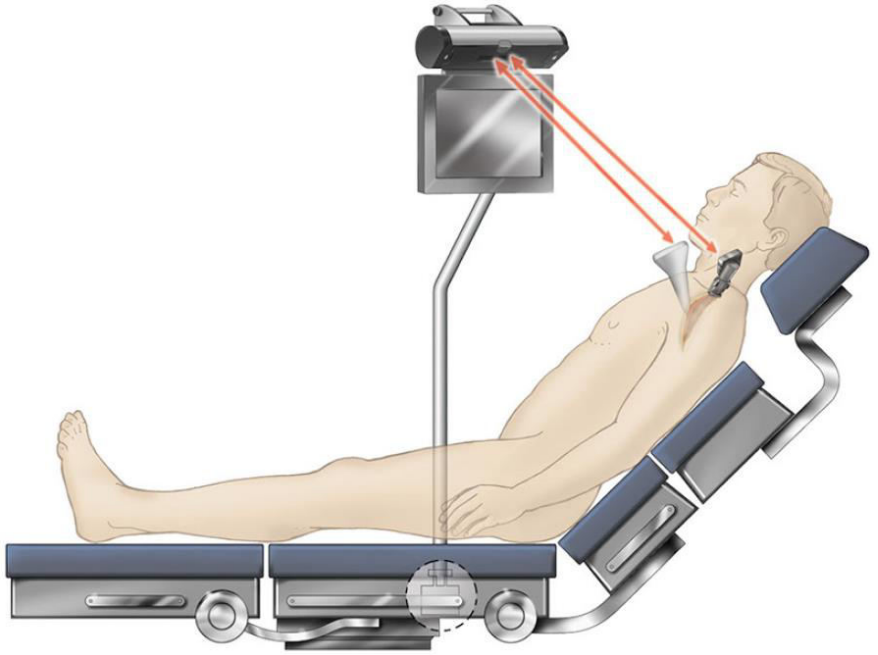
- The computer is positioned to that it can see the shoulder and instruments during the case
- The computer is sterilely draped into the field so the surgeon can interact with it while replicating the plan



Registration of CT with Boney Anatomy

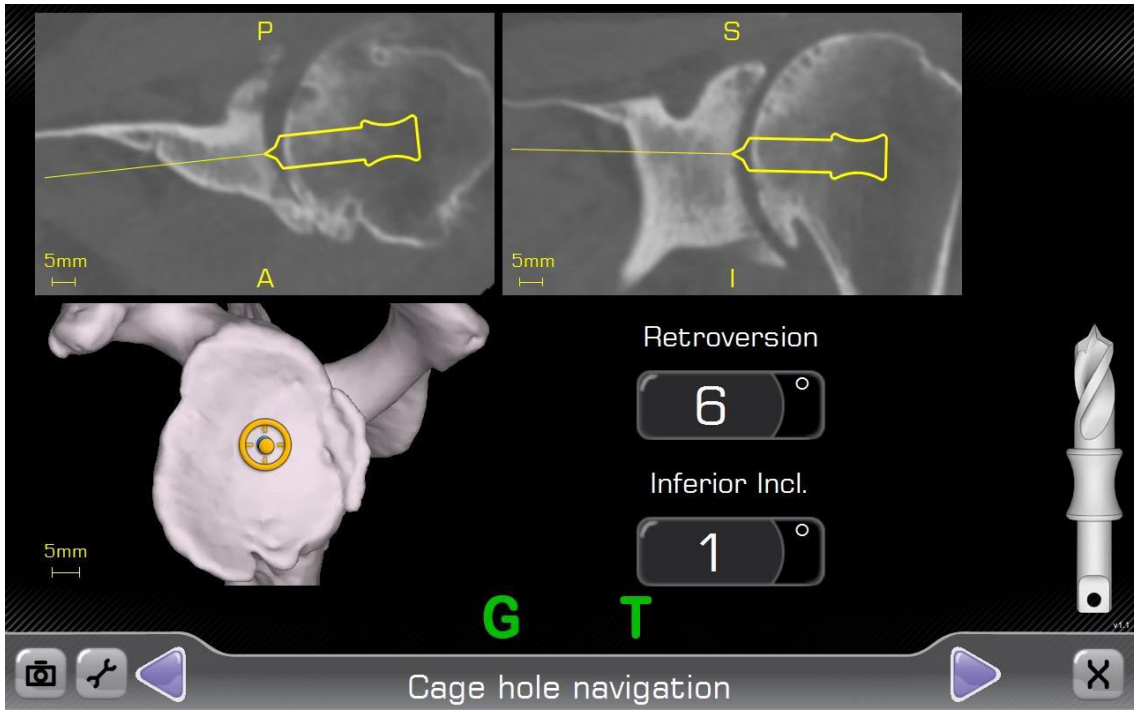
- Acquisition of anatomic landmarks registers the CT scan and plan to the patients anatomy
- This tells the computer where the actual shoulder blade is in space so the CT scan be overlaid on the real shoulder
- Registration is simple and takes ~2 minutes

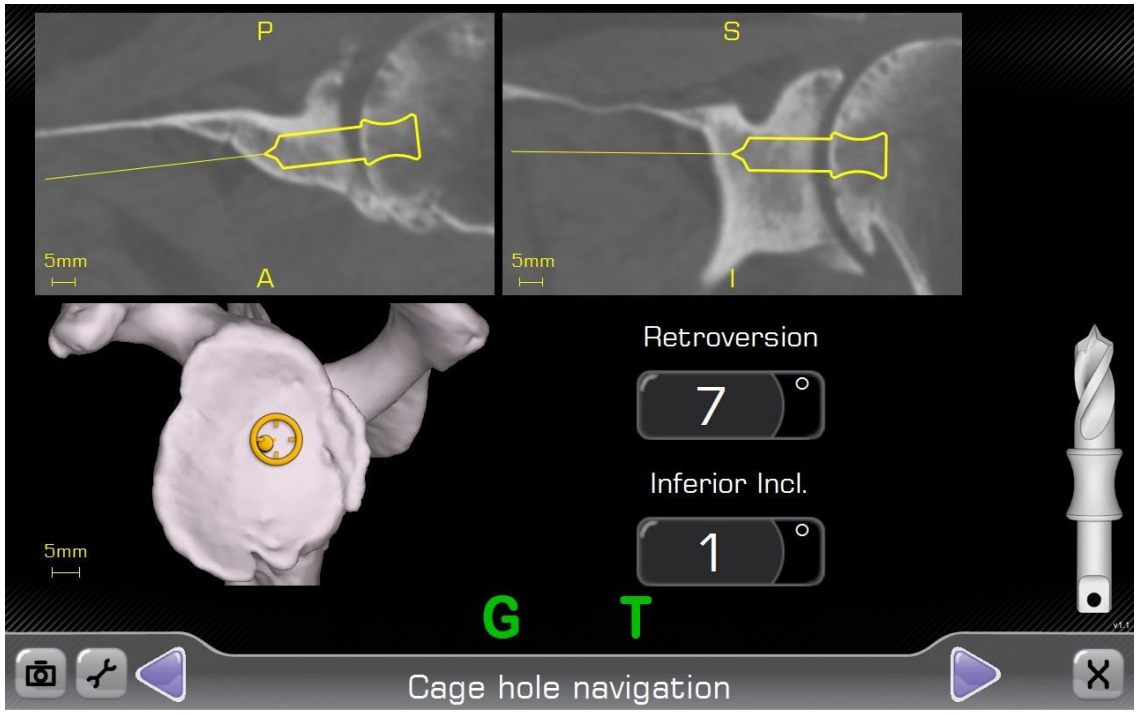




Real Time 3D Intraoperative Visualization

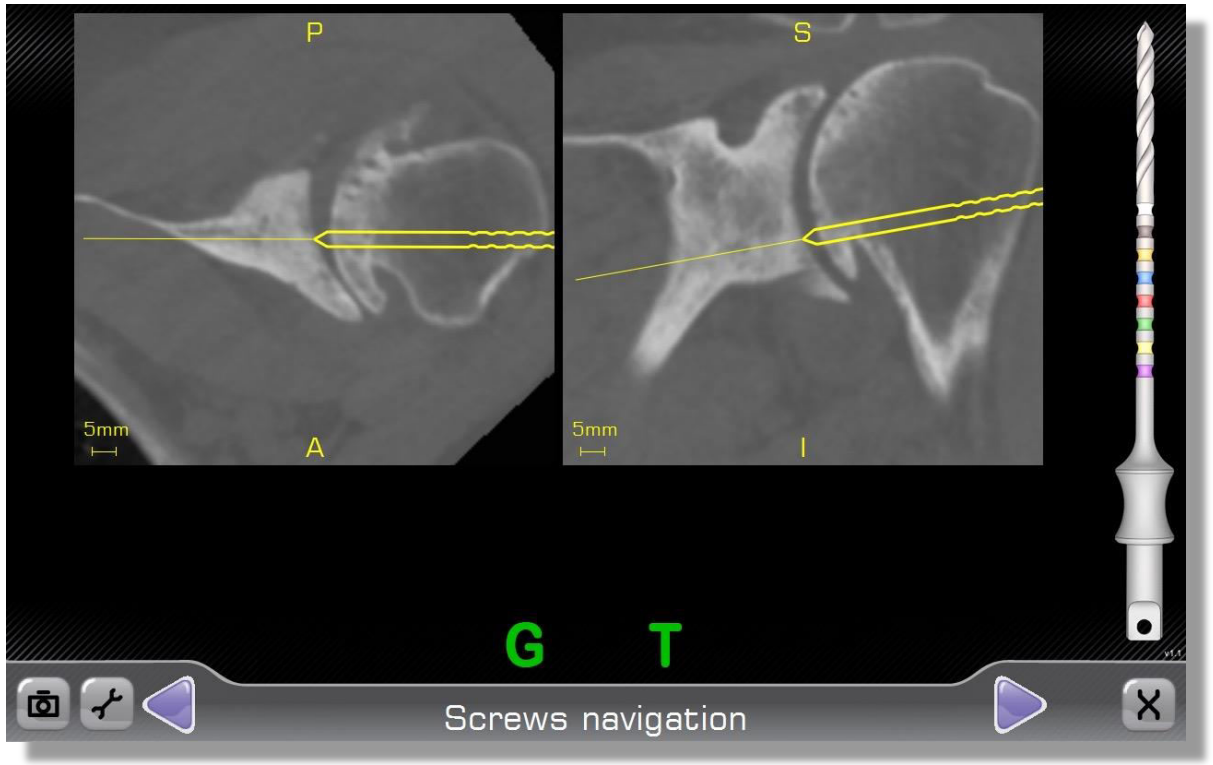
- During surgery, GPS gives the surgeon real time “X-ray” vision to see things in 3 dimensions
- This allows the surgeon to see exactly where and how to angle the instruments so the socket is placed precisely according to the plan
- This allows precise correction of wear patters and precision implant placement
- Without GPS, this is not possible

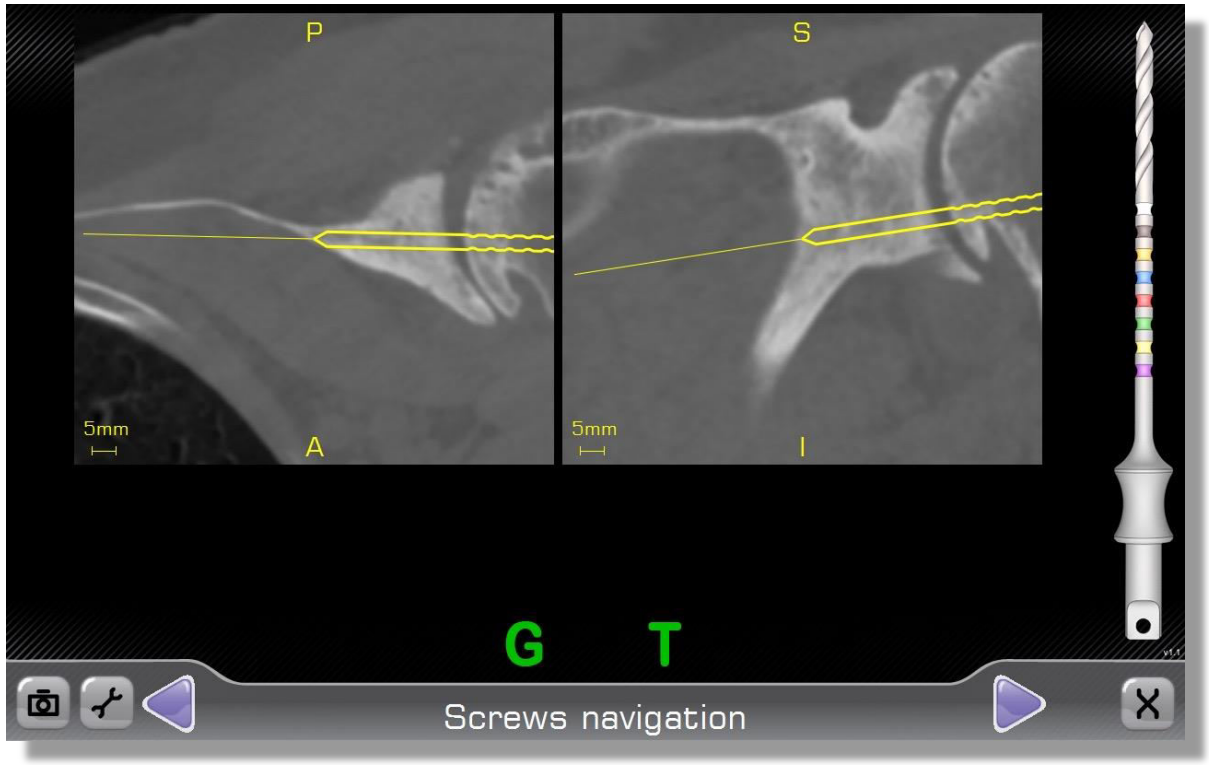




Navigating Maximum Screw Length

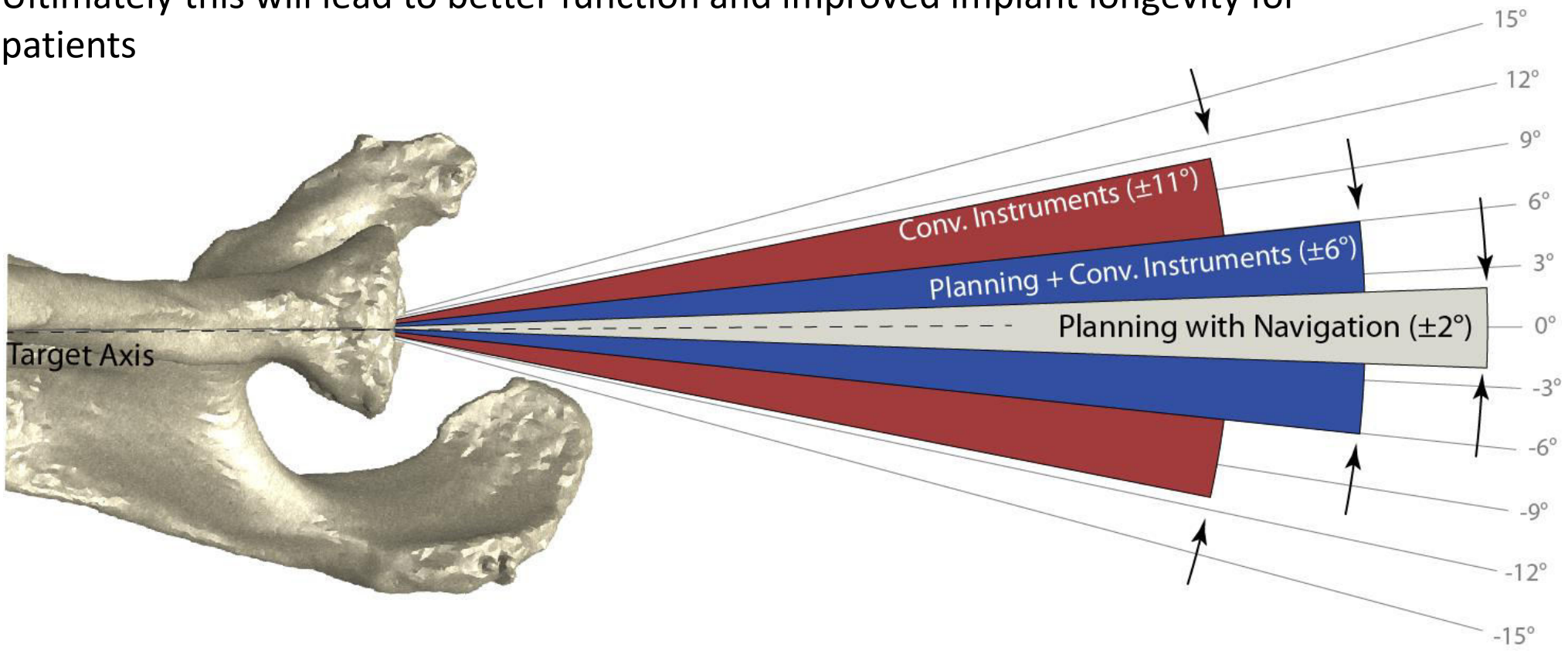
- Computer allows the surgeon to see the best trajectory for the drill to achieve maximum purchase in the bone
- This ensures the most solid fixation which reduces the risk of failure





Accuracy & Precision

- GPS can improve the accuracy of socket implantation from ±10° to ±2°
- In both simple and complex cases, this precision will lead to more secure implant fixation and better mechanics of the reconstruction
- Ultimately this will lead to better function and improved implant longevity for patients



Questions?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