Preoperative Planning in Total Shoulder Arthroplasty

Why do I need a CT scan?

Total shoulder arthroplasty (TSA) has emerged as a highly effective surgery for treating shoulder arthritis, rotator cuff tear arthritis, complex shoulder fractures, and other shoulder issues. Before surgery, preoperative planning serves as the foundation for surgical success by ensuring precision, optimizing outcomes, and minimizing complications.

A computed tomography (CT) scan is the cornerstone of preoperative planning, offering excellent detail and accuracy in looking at the anatomy and pathology of the shoulder joint. While x-rays provide valuable baseline information, CT imaging allows surgeons to visualize complex bone structures in three dimensions. This capability is particularly critical for addressing the challenges unique to TSA which may not be apparent on x-rays.

1. Detailed Assessment of Glenoid Morphology

- The glenoid (socket) is often the most challenging part of the shoulder joint to manage in TSA due to its variability in shape, orientation, and bone loss patterns.
- CT scans provide precise measurements of glenoid version (angulation relative to the scapula) and inclination, which are critical for proper implant placement.
- They help identify and quantify posterior glenoid loss, which is commonly seen in arthritis and can lead to challenges such as instability and failure if not addressed.

Glenoid Measurements

17° Natural superior inclination

39° Natural retroversion
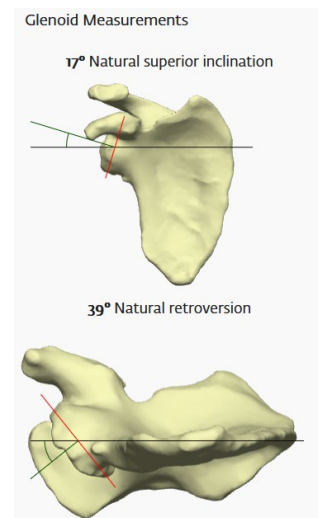
2. Evaluation of Bone Quality and Deficiency

- A CT scan reveals the thickness and density of both the glenoid and humeral bone stock.
- This information is essential for identifying bone loss, which may require extra measures such as bone grafts, augmented implants, or a different type of TSA altogether.
- The quality of bone in the glenoid vault is critical for achieving secure fixation of the glenoid component.

3. Preoperative Planning with 3D Reconstructions

- Advanced CT imaging with three-dimensional (3D) reconstruction allows surgeons to create a virtual model of the shoulder joint.
- These models enable precise preoperative templating, allowing for simulation of implant placement and alignment.
- Surgeons can anticipate the need for correction of deformities, such as retroversion, or for adjustments in implant positioning.
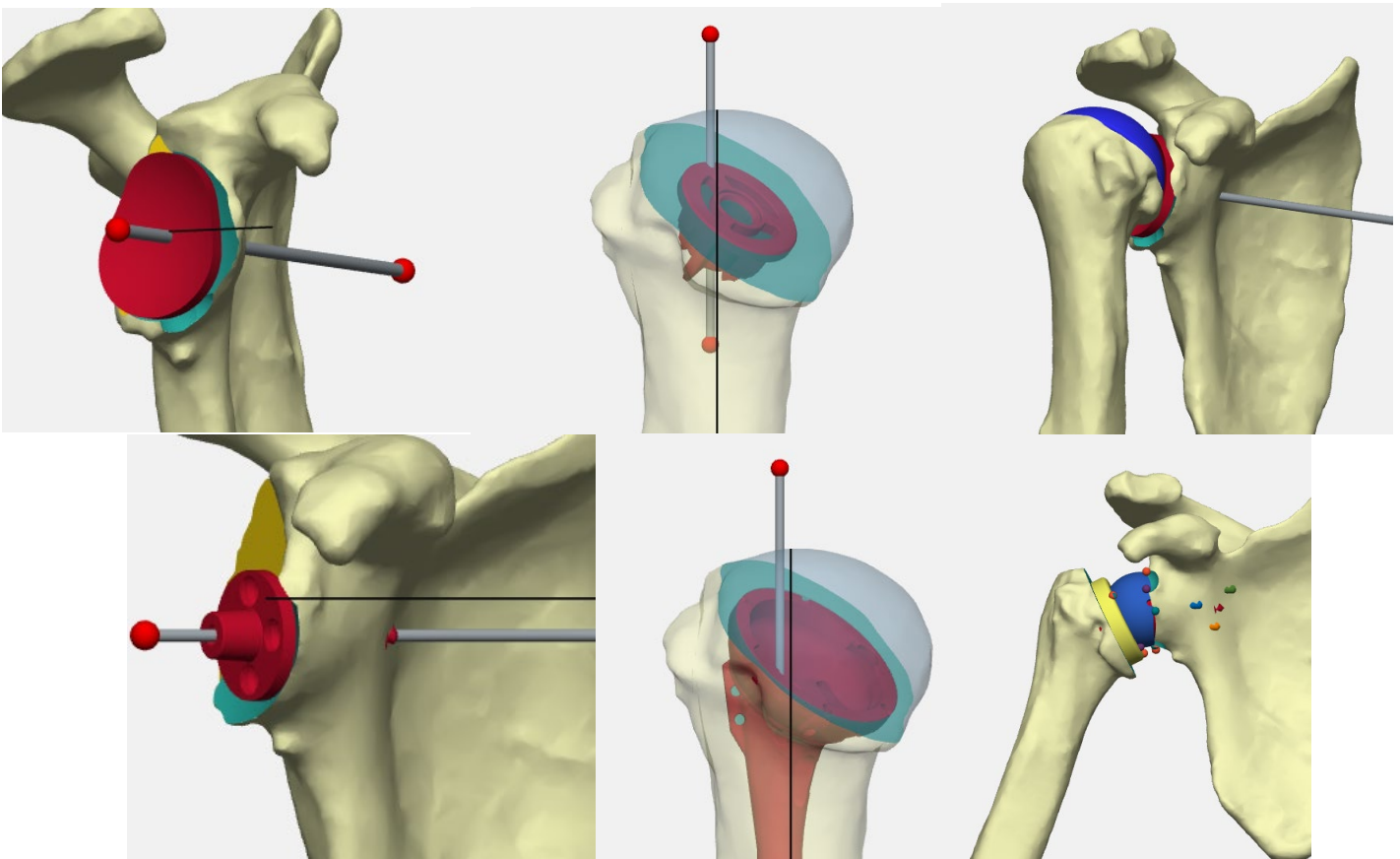
4. Identification of Subtle Pathologies, Rotator Cuff Assessment

- CT scans can reveal subtle joint abnormalities that may not be visible on plain radiographs, such as bone spurs, cysts in the bone, or atypical wear patterns.
- The integrity of the rotator cuff (RC) tendon and muscle quality can also be assessed, which is very important when considering which type of TSA would be best
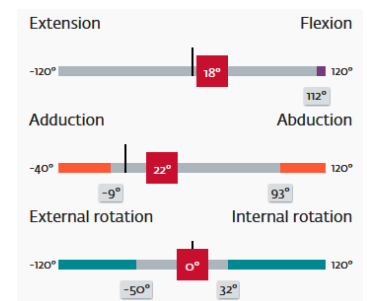
5. Reducing Intraoperative Challenges

- By providing a comprehensive map of the shoulder anatomy, CT imaging minimizes surprises during surgery.
- Surgeons can use the information to develop a step-by-step plan for addressing deformities, ensuring adequate exposure, and selecting the most appropriate implant and fixation techniques.

6. Optimizing Patient Outcomes

- Accurate implant placement, informed by CT imaging, leads to improved function, reduced stress on the implant-bone interface, and longer implant longevity.
- CT-guided planning enhances the likelihood of achieving the best possible outcome for the patient.

When CT Imaging is Especially Critical

- **Severe Glenoid Deformity**: In cases of significant glenoid wear or deformity, CT is absolutely necessary for planning corrective measures.
- **Revision Surgeries**: For patients with previous shoulder procedures, CT scans provide critical information on residual bone stock, altered anatomy, and future implant position.
- **Complex Anatomies**: In conditions such as dysplasia (abnormal bone development) or post-traumatic arthritis, CT imaging helps navigate the anatomic variations.
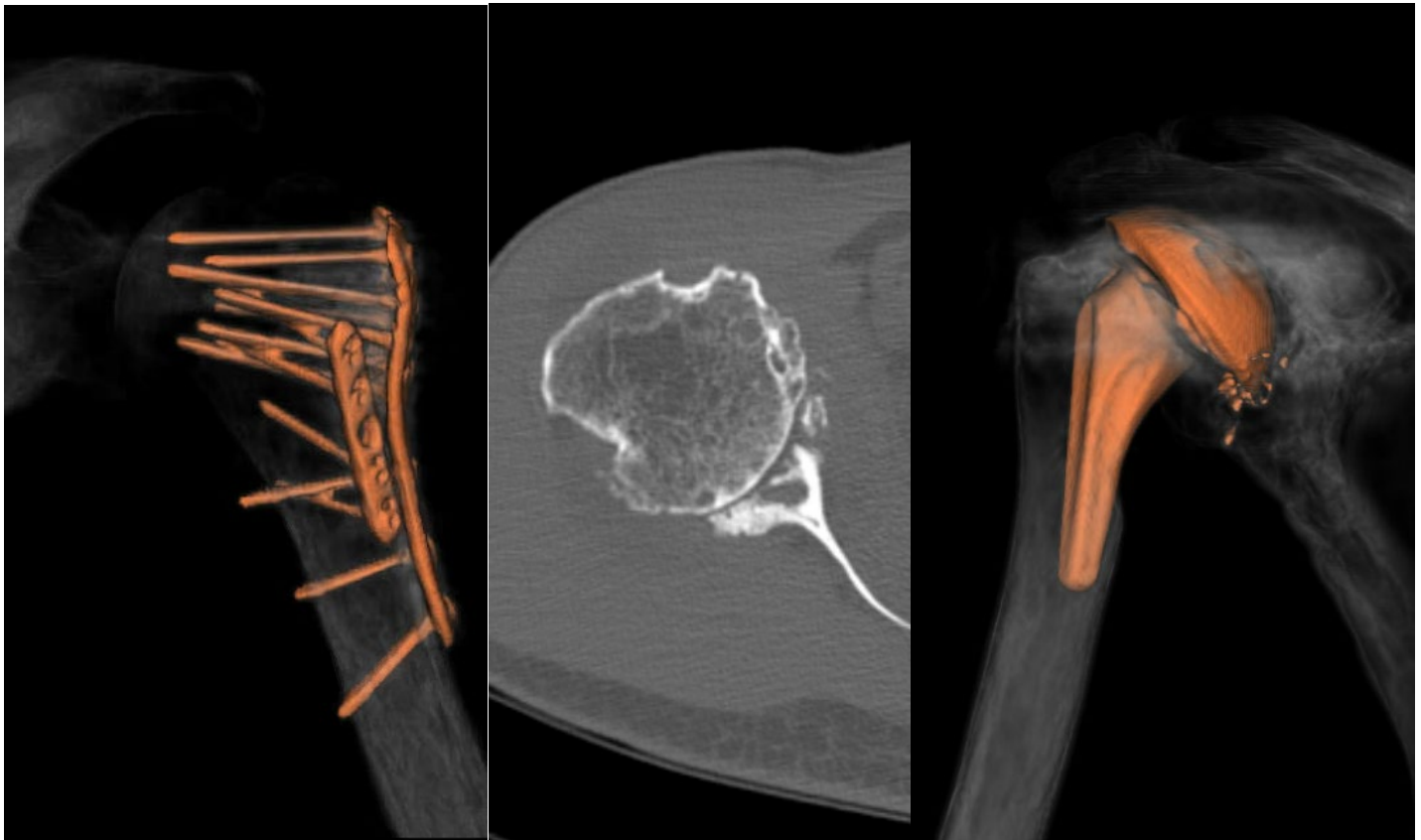
| Post-traumatic arthritis with prior hardware, altered anatomy | Severe medial wear with compromised glenoid bone | Revision surgery – prior hardware that is loose |