

# Patient Guide to Reverse Shoulder Replacement

## AVATAR

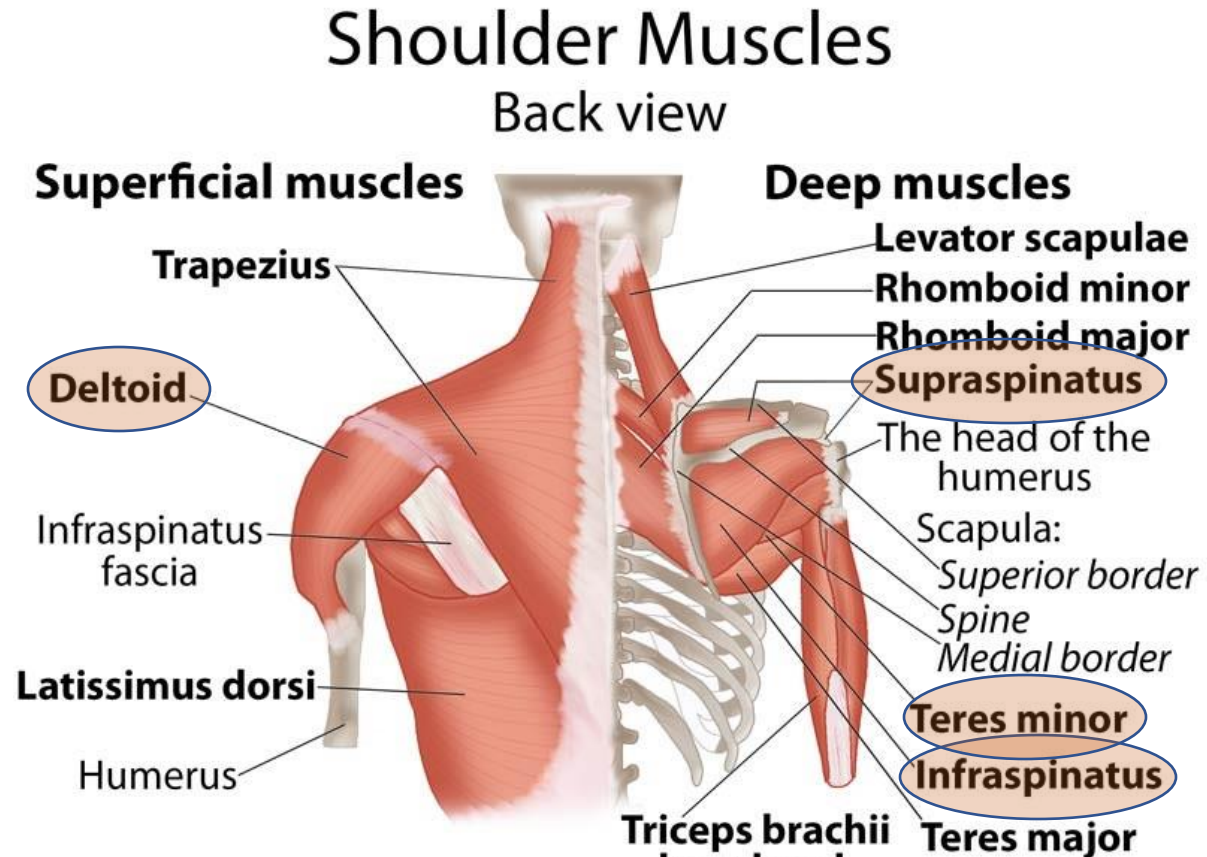
*Same Day Joint Replacement Surgery*



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# The Muscles of the Shoulder



- The rotator cuff acts to stabilize the humeral head in the glenoid concavity and to power internal and external rotation of the arm
- The deltoid is the prime mover in elevation of the arm
- Optimal deltoid function relies on a functioning rotator cuff to keep the head centered in the socket during arm elevation

# Basic Shoulder Mechanics

- The deltoid has both an **abductor** moment ( $F_R$ ) and a superior **translation** force ( $F_T$ )
- The rotator cuff neutralizes  $F_T$  by compressing the ball into the socket
- In a normal shoulder this prevents upward translation of the ball and allows for pure rotation of the joint

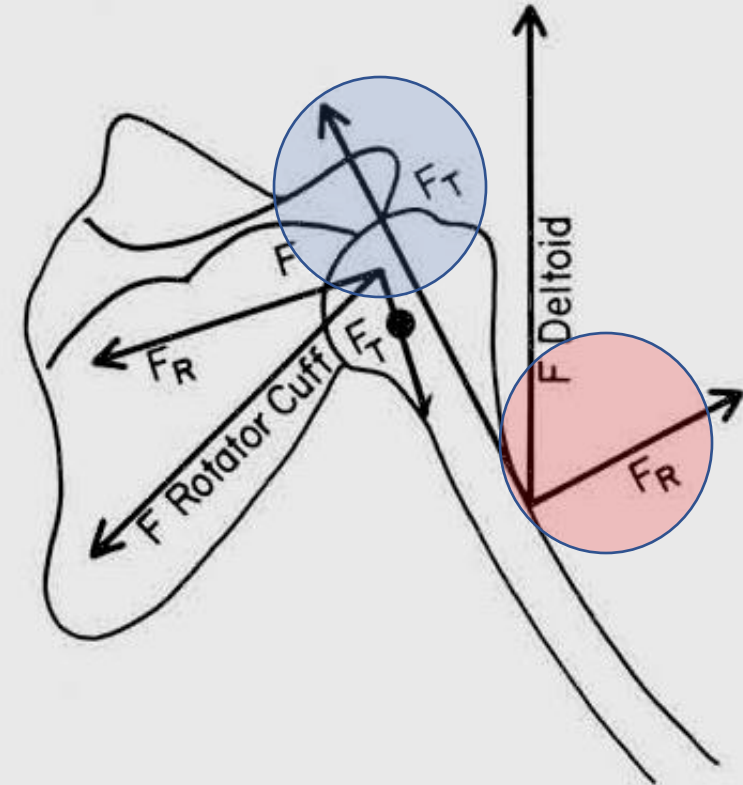
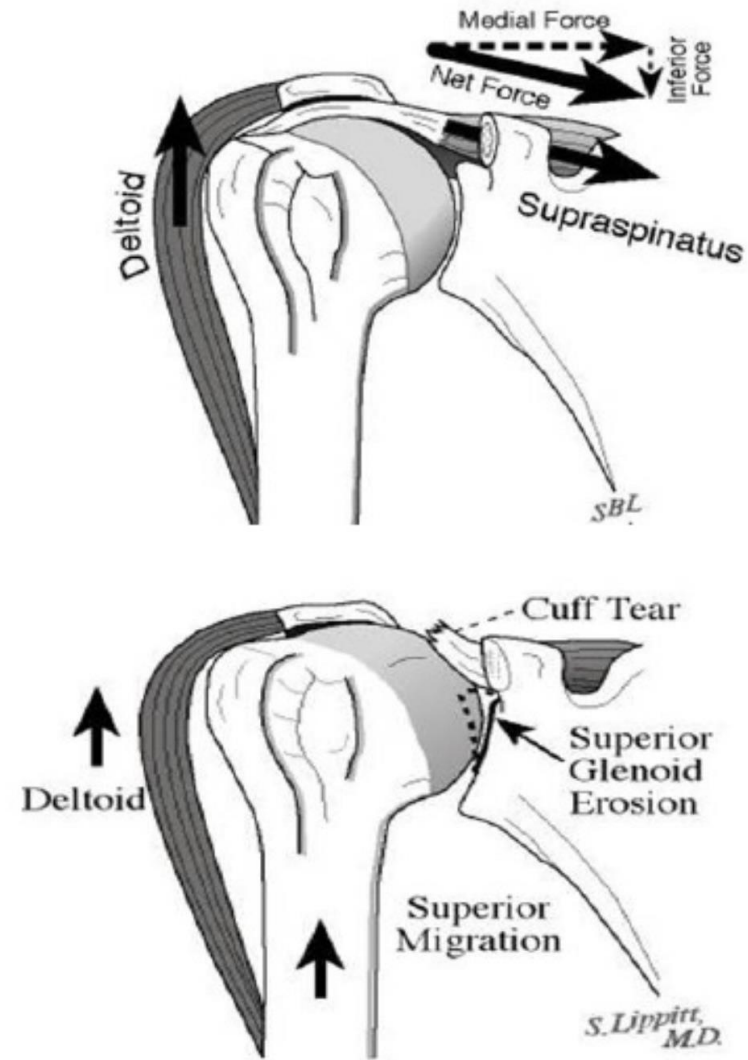


Fig. 3. Force couple of deltoid and rotator cuff muscles. The rotatory forces, acting on opposite sides of the axis of motion, combine to produce upward rotation. The translatory forces cancel each other out.  $F_R$ , rotary force;  $F_T$ , translatory force.

# The Impact of a Large Cuff Tear

- The net force generated by the rotator cuff can no longer neutralize the superior translation force (FT) of the deltoid
- This force causes the ball to migrate upward when the deltoid contracts
- Instead of rotating the arm overhead, this results in a shrugging motion with limited elevation





# Pseudoparalysis

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- When the rotator cuff cannot provide a stable fulcrum for the deltoid force to rotate the arm overhead, patients cannot raise the weight of their arm against gravity
- This term is called pseudoparalysis because the arm appears paralyzed even though it is neurologically normal





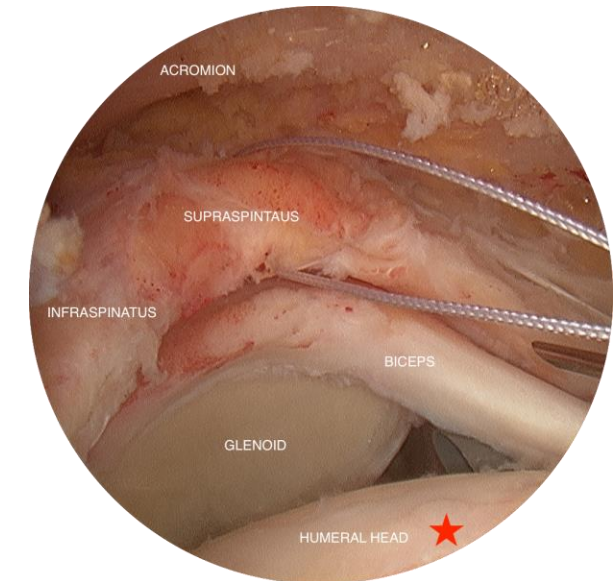
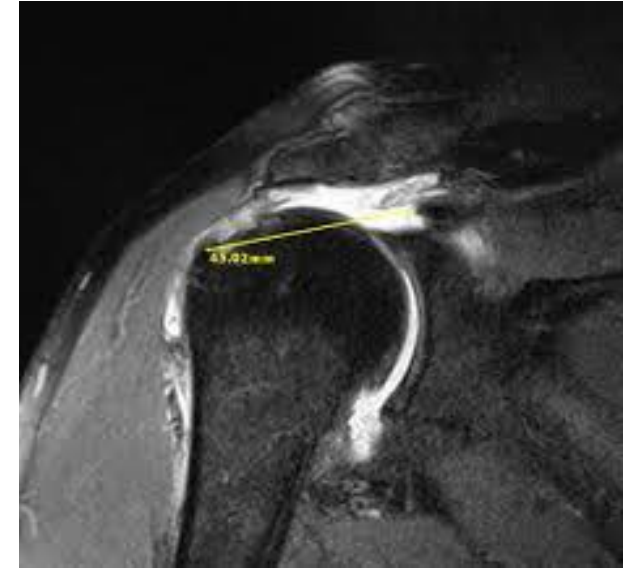
# The Clinical Problem

- Much of the work the deltoid can generate is lost to translation rather than rotation resulting in weakness with arm elevation
- To find a solution to the arthritic shoulder with a dysfunctional and irreparable rotator cuff that can provide both pain relief and restored strength and function



# Rotator Cuff Tear Challenges

- With large tears the tendon retracts away from its insertion
- With time the tendon and muscle atrophy and scar down
- Mobilization of the tendon back to its insertion may not be possible
- Weak tendon does not heal and repairs have a very high chance of retearing



# The Challenge

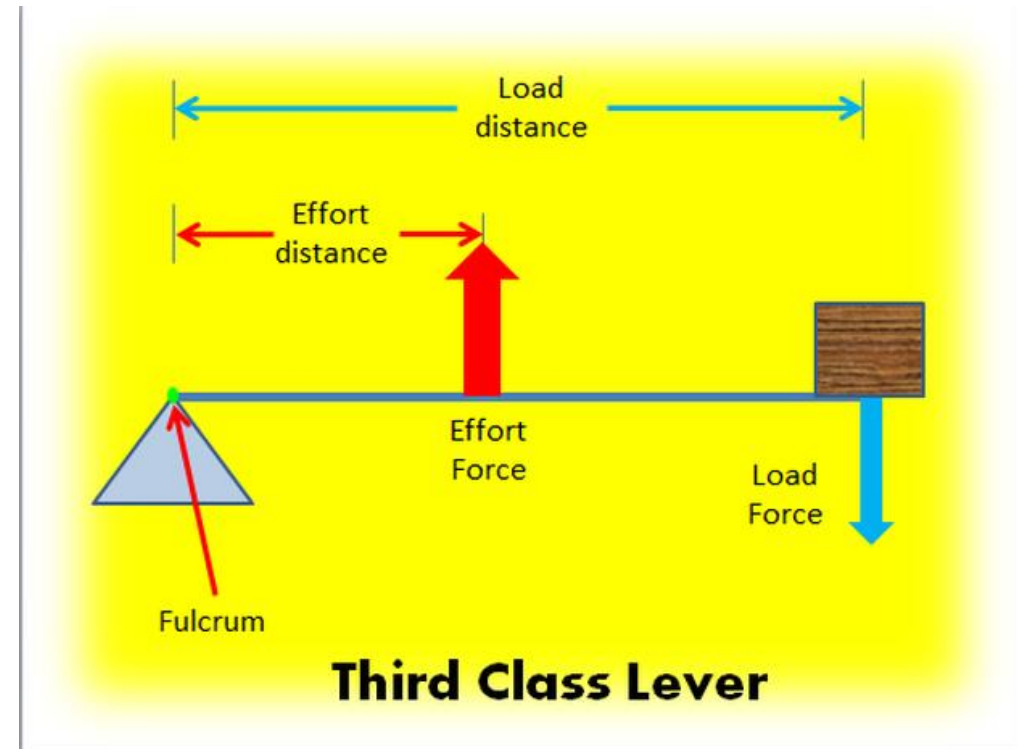
- Rotator cuff repair is not an option for these shoulders with advanced disease
- Conventional hemiarthroplasty cannot restore a stable fulcrum for rotation
- To find a compromise between mobility, stability, mechanical efficiency and resistance to loosening/failure





# Why the Reverse works

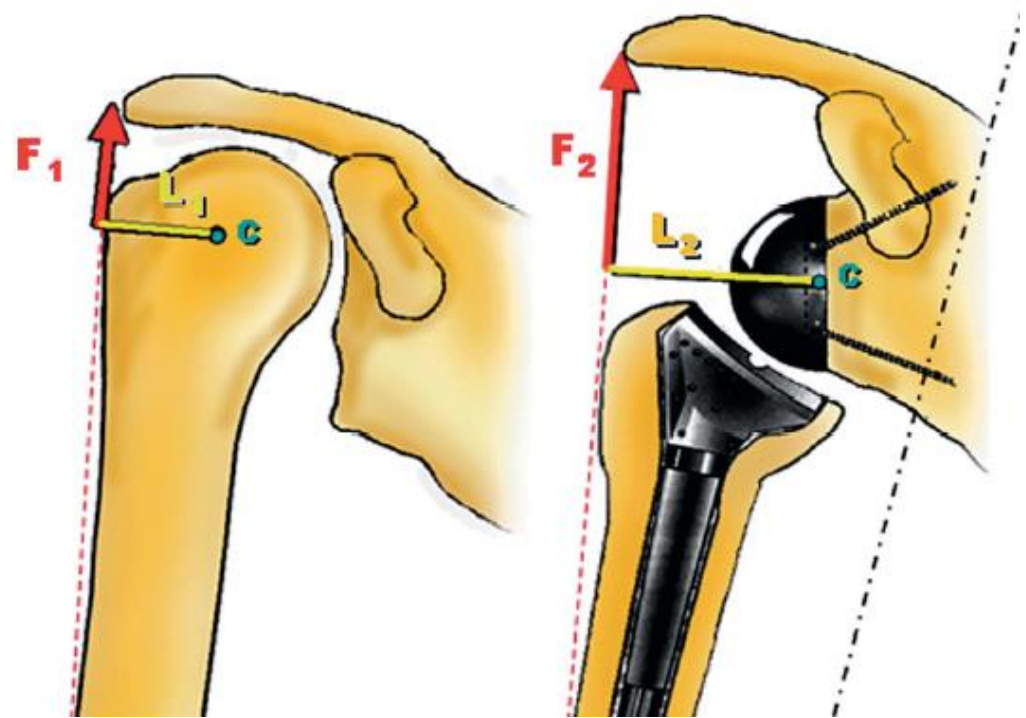
- A longer effort distance means the deltoid requires less effort force to balance or move the weight of the arm (load force)
- The reverse shoulder implant lengthen's the deltoids effort distance by shifting the center of rotation of the joint inward toward the socket



# Why the Reverse Works

- The reverse shoulder moves the center of rotation **C** from the center of the ball to the face of the socket.
- This increases the effort distance **L** as shown in the previous slide
- This means the same deltoid effort **F** can do more work to move the arm

$$W = F \times D$$



# History of the Reverse Shoulder



- Paul Grammont, a French shoulder pioneer redesigned the reverse shoulder in the early 1980s
- He achieve more favorable results leading to more widespread adoption of the reverse shoulder



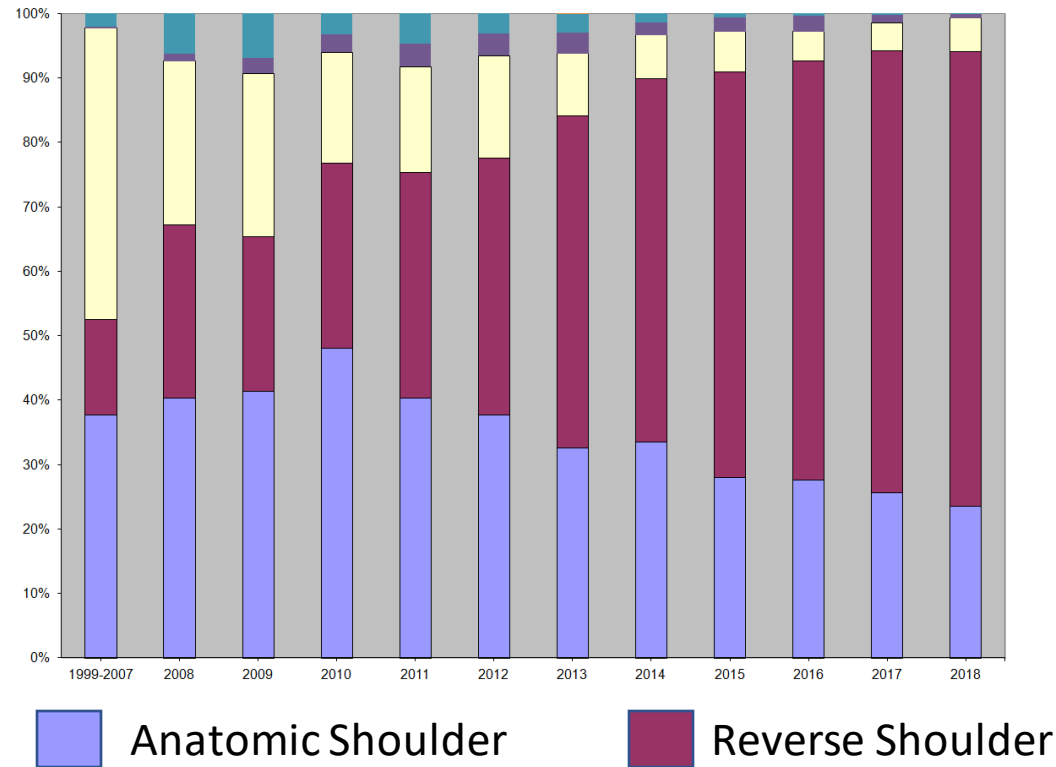
# History of the Reverse Shoulder

- First FDA approved in the United States in 2004 for treatment of rotator cuff tear arthropathy
- Progressive design iteration has led to improvement in function and long-term outcomes
- Time has led to a better understanding of indications, limitations, complications etc...

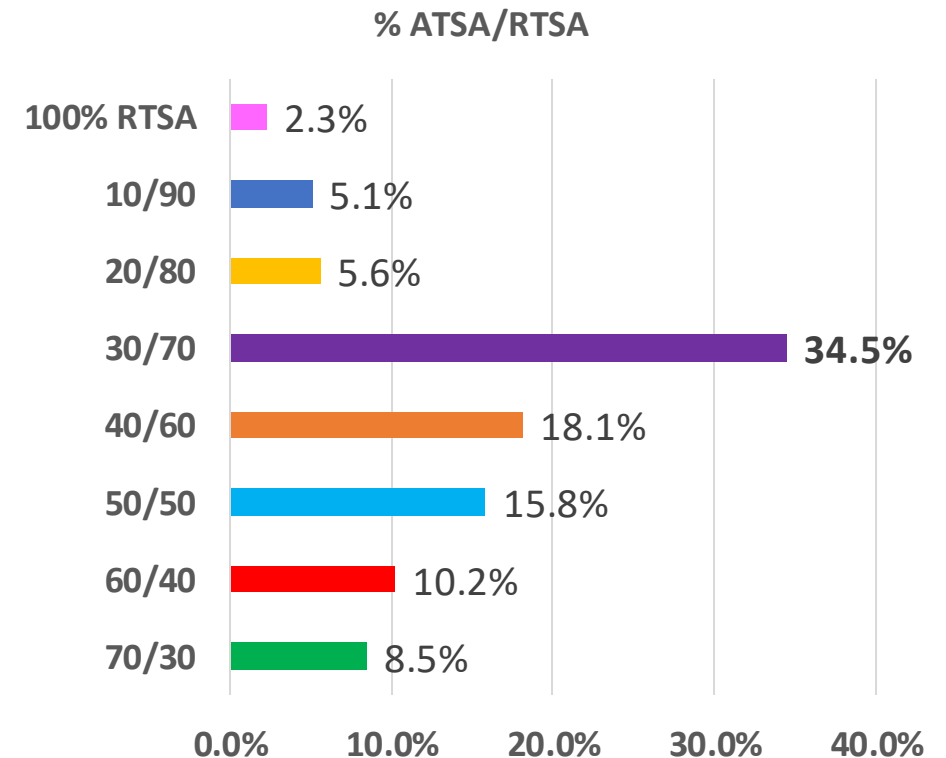


# Epidemiology of Reverse Shoulder Replacement

New Zealand Joint Replacement Registry



ASES Survey of Shoulder Arthroplasty



**Implication: RTSA now accounts for a growing majority of a growing market**



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# Expanding Indications for Reverse Shoulder

## • Indications 2004

- Severe cuff tear arthropathy
- Inability to raise the arm against gravity
- Age > 70



## • Indications 2020

- Cuff tear arthropathy
- Irreparable cuff tear
- Severe osteoarthritis
- Proximal humerus fractures
- Fracture malunion
- Chronic dislocations
- Failed shoulder replacement
- Tumor reconstruction
- Inflammatory arthritis



# Different Clinical Scenarios

- Pathology, residual cuff status, prior surgery can all affect soft tissue tension after RTSA



Cuff Tear Arthropathy



Cuff-deficient Arthritis



Cuff-intact Arthritis



Irreparable Cuff Tear



Fracture Sequelae



# Same Common Goals

- Restore strength and stability to the shoulder
- Improve function
- Provide pain relief from arthritis and rotator cuff pathology



# Variety of Design Decisions



**Versa  
Reverse**



**Biomet  
Comprehensive**



**Zimmer TM  
Reverse**



**Zimmer  
Inverse FX**



**Zimmer  
Anatomical  
Inverse**



**Tornier Reverse**



**DJO RSP**



**Smith & Nephew  
Promos**



**Lima SMR**



**Biomet  
TESS**

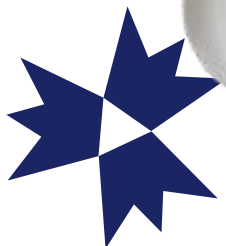


**Versa  
Reverse**



# CT-Based Planning

- More accurate than x-rays in determining glenoid morphology
- Minimizing bone loss
- Correcting retroversion
- Maximizing backside contact
- Preventing peg perforation



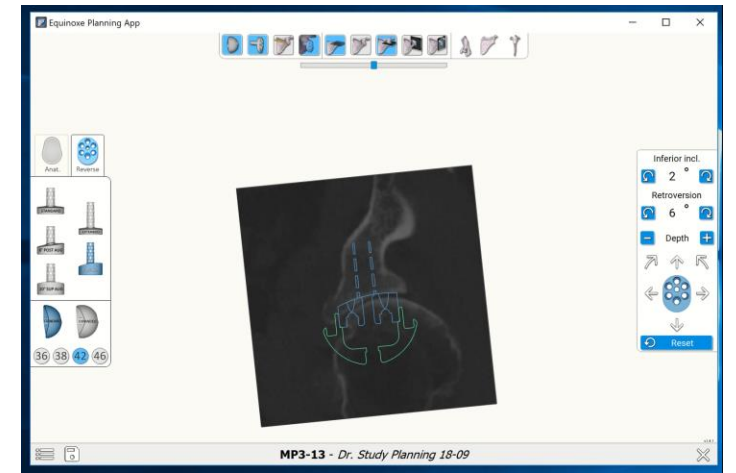
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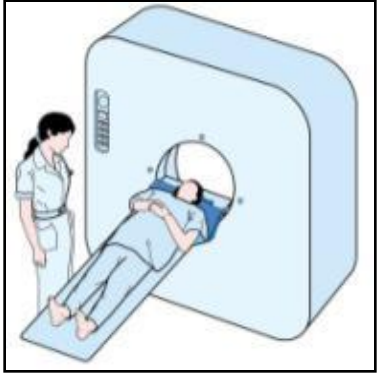
# How to choose implant configuration

- Preoperative planning from a CT scan allows precise placement of the implant and customized sizing relative to each individual's anatomy
- Intelligent instruments allow us to replicate our plan using surgical navigation



# What is GPS?

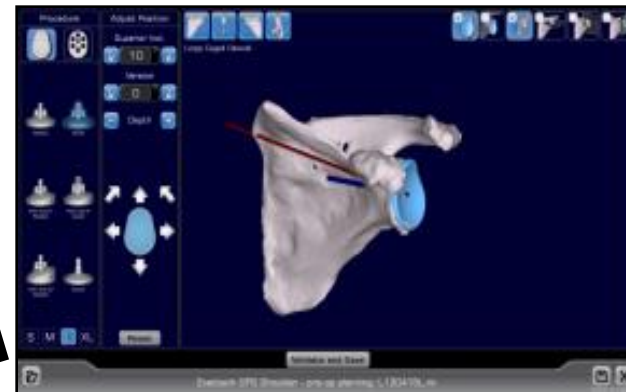
## 1. CT data collection (1mm)



## 2. CT Segmentation → Blue Ortho



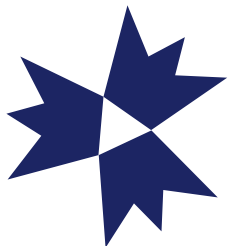
## 3. Planning



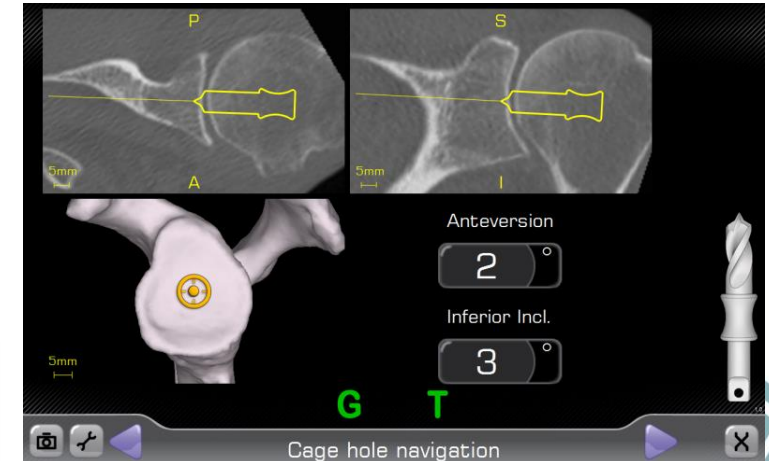
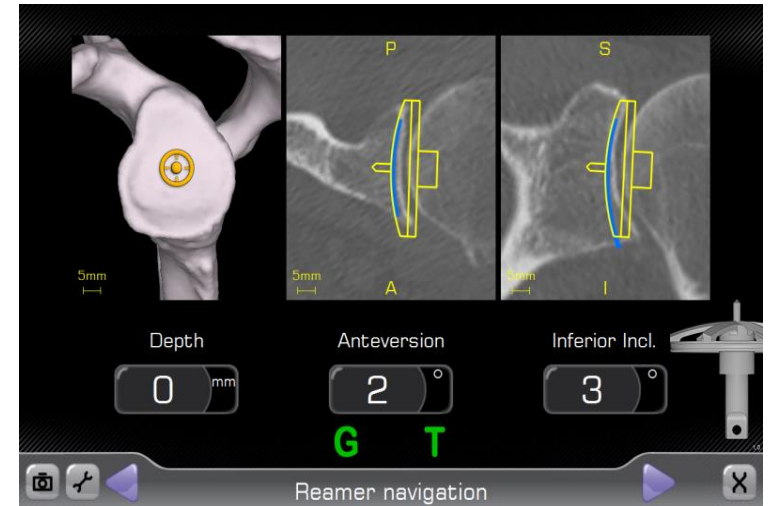
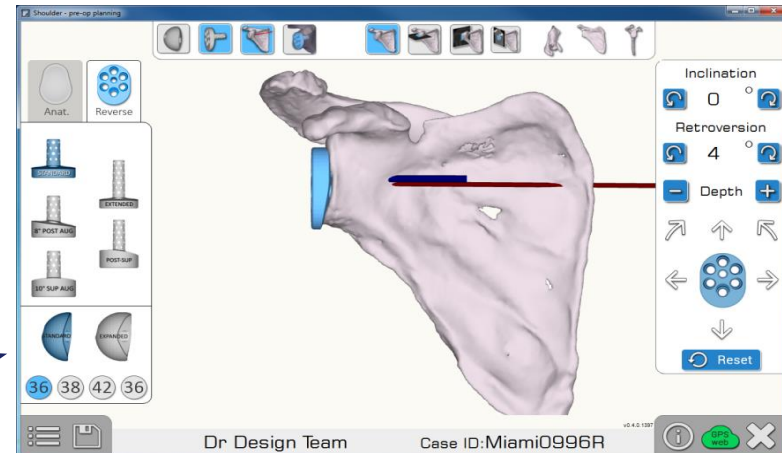
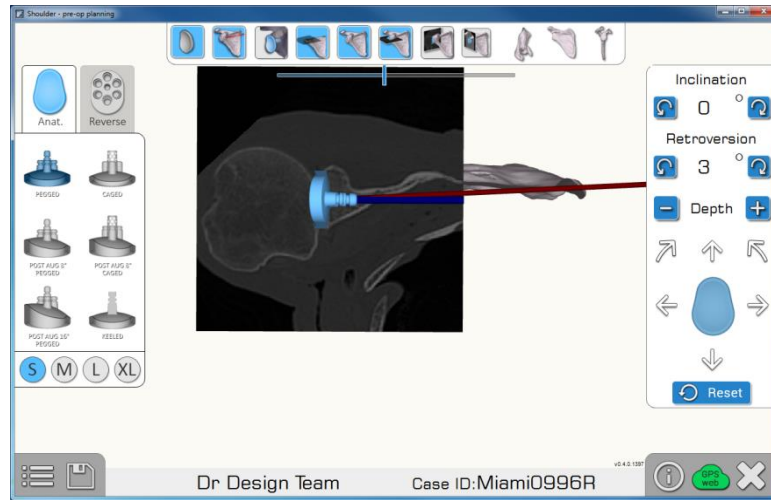
## 4. Navigation



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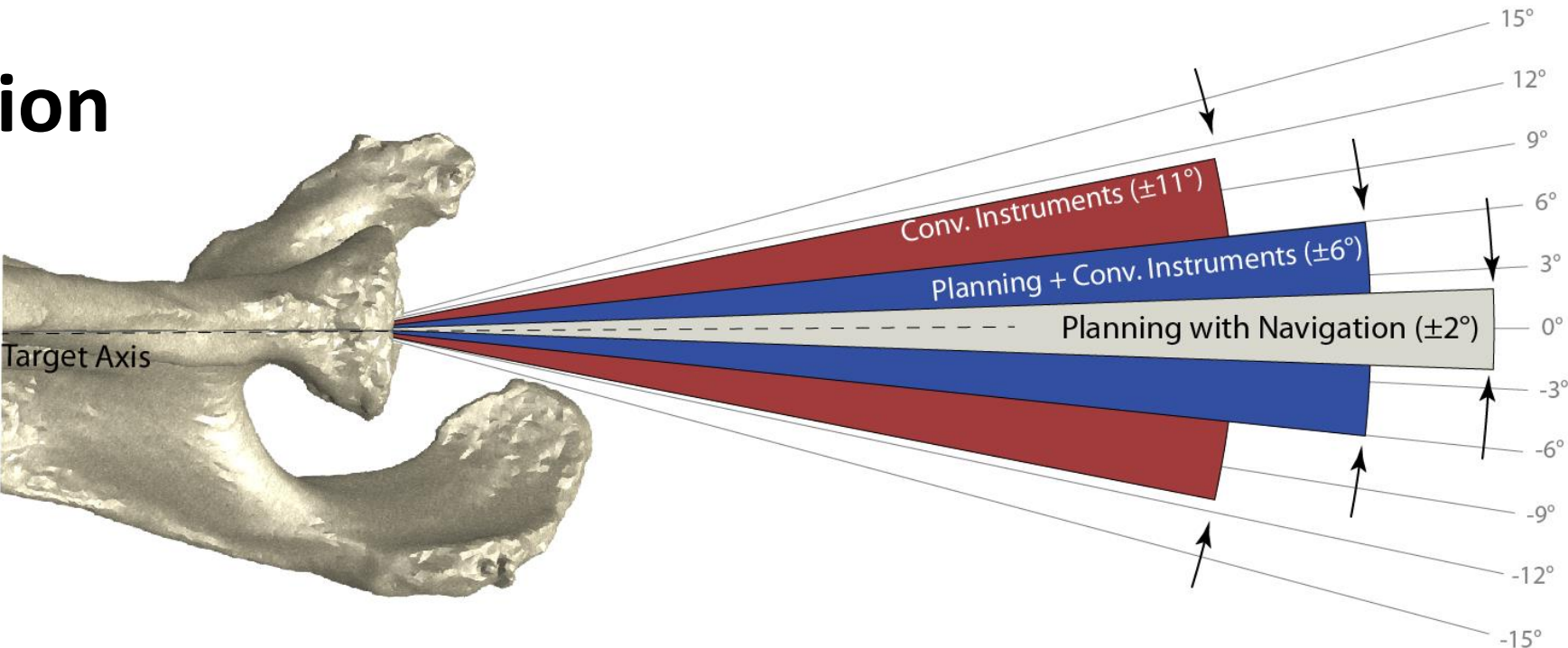


# GPS allows intraoperative plan execution

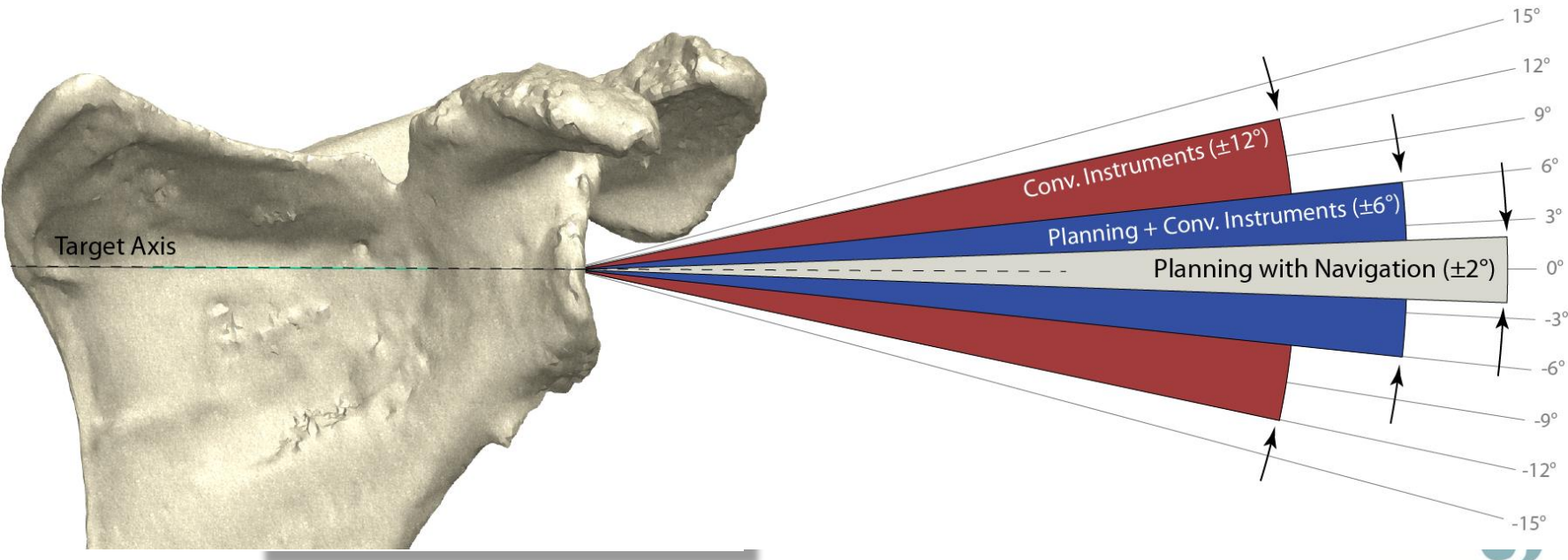


# Navigation Precision

Version



Inclination





# Recovery Goals

- Restore range of motion
- Protect any soft tissue repair that is part of the surgery
- Strengthen the deltoid and any remaining external rotator muscles that are still intact at the time of surgery





# Bruising and swelling

- This is very common after shoulder surgery and is normal
- Bruising most commonly occurs on the inside part of the upper arm and breast area
- It may sometimes also appear in the flank region below the arm pit
- Swelling can be both around the shoulder but also into the forearm and hand
- Elevation and ice are the best way to address swelling



This shows an extreme case as can occur with blood thinner medications

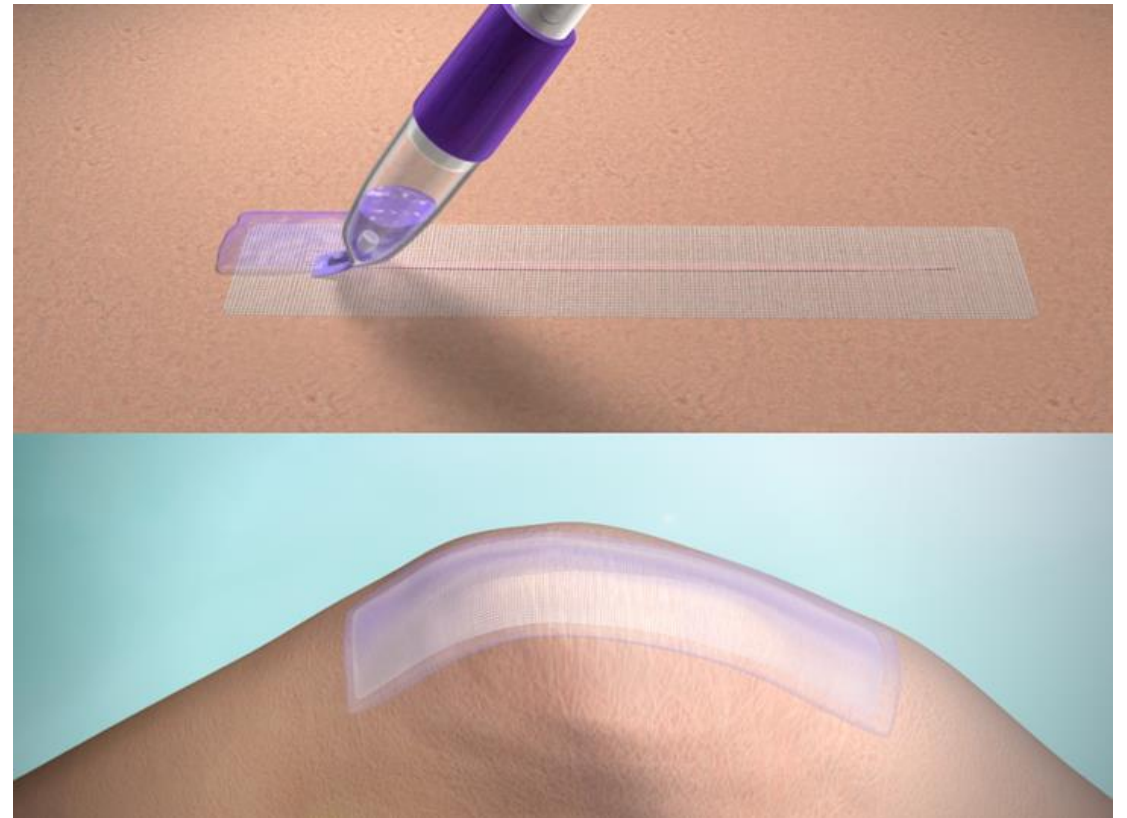
# Sling

- We recommend wearing a sling for about 4 weeks after surgery to avoid overdoing it with the new shoulder
- This allows the shoulder to adapt to the new configuration without stressing the tissue
- The sling may be removed when you are sitting comfortably but should be worn when up and about.
- We also recommend sleeping with the sling for this period of time



# Wound Care

- We close our incisions with absorbable stitches and skin glue so nothing needs to be taken out
- We generally use water resistant dressings that can stay in place for a full week after surgery
- Provided the surgical dressing stays in place during this time there is no wound care
- We typically remove the dressing at our first office visit and at that point the incision can be left open to air



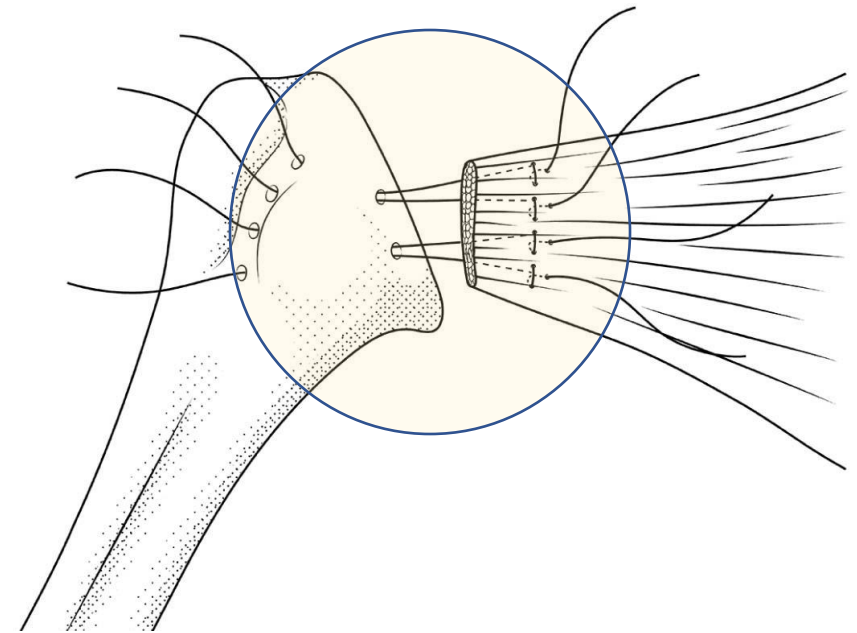
# Wound Management

- We do not use staples as they can cause irritation and pain
- We use an absorbable closure that does not require anything to be taken out
- We place a waterproof occlusive dressing that can stay on for a week



# Protecting any soft tissue repair

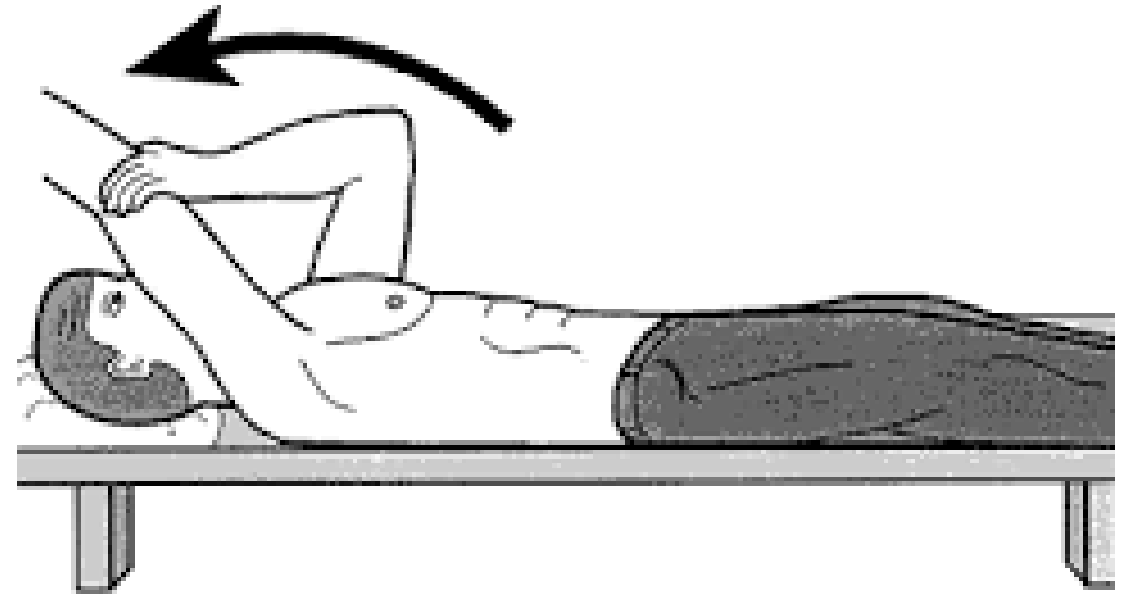
- The subscapularis tendon has to be divided to gain access to the shoulder
- If the quality of this tendon is still robust, we usually repair it at the conclusion of the case to improve internal rotation strength
- This tendon repair needs to be protected for 12 weeks after surgery to ensure healing
- This involves avoiding lifting, pushing, pulling and any other strenuous activity



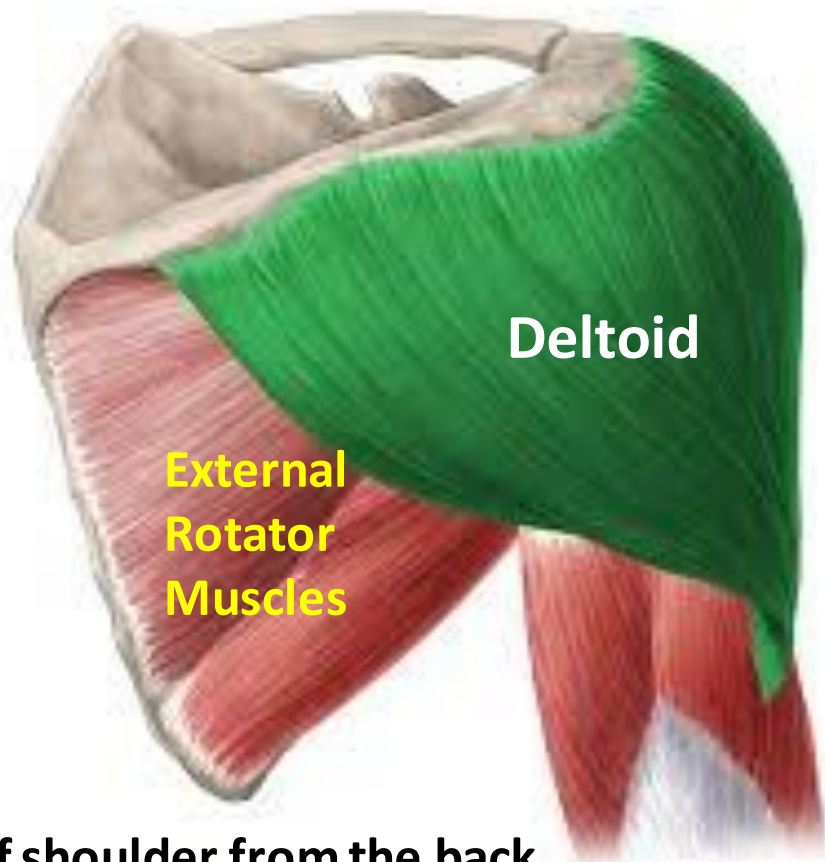


# Restoring range of motion

- Immediate range of motion exercises are essential prevent stiffness after surgery.
- Postoperative stiffness is a cause of dissatisfaction
- We recommend having a visiting therapist come to the home for the first few days
- We strongly recommend transition to outpatient therapy within a week of surgery
- Home exercises a few times a day are essential to maintain and recover range of motion



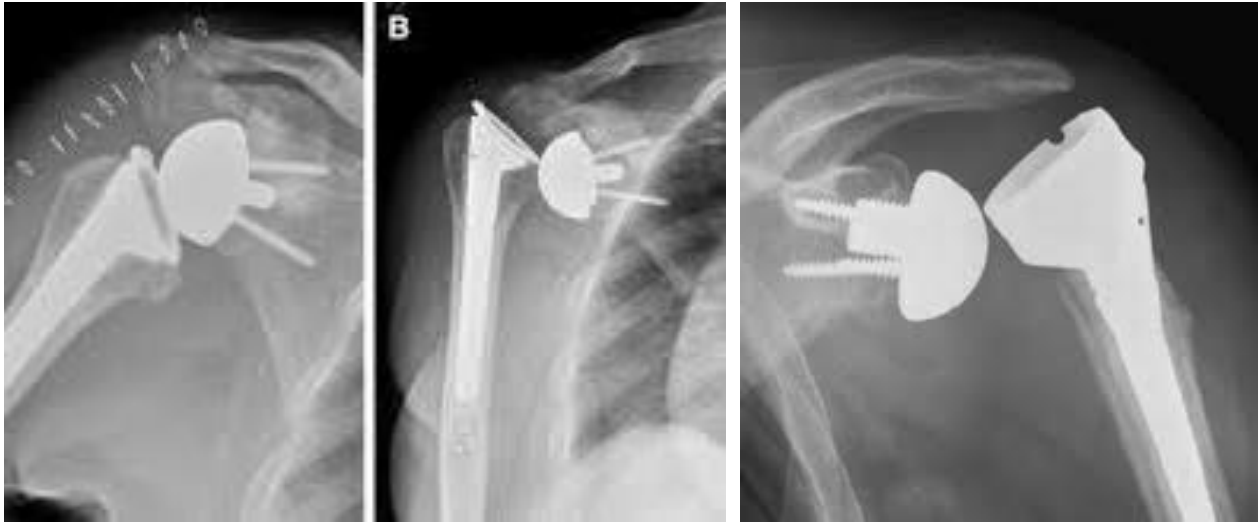
# Building Strength



- The deltoid is the prime mover of the reverse shoulder and needs to be strengthened, particularly for patients who are unable to raise their arm before surgery
- The external rotator muscles also need to be strengthened. Sometimes these muscles are part of the rotator cuff tear and full strength may not be possible to achieve despite therapy.

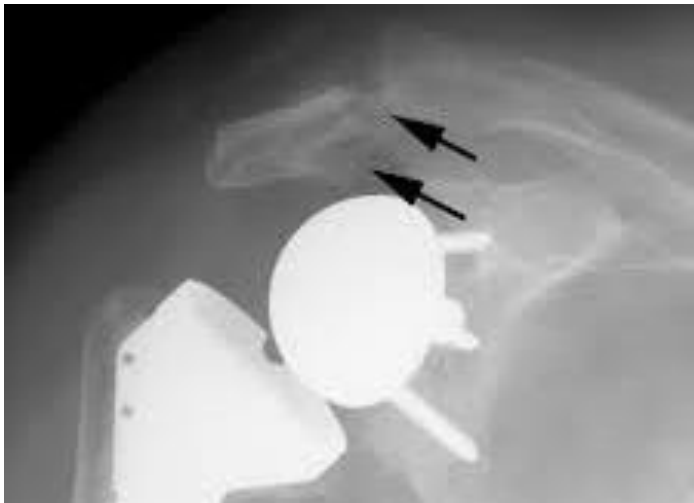
View of shoulder from the back

# Complications: Dislocation



- 2-5% of cases
- Usually happen early
- May be a problem of inadequate tissue tension
- More common in revision situations
- Generally require another surgery to increase the soft tissue tension between the implants

# Complications: Stress Fractures



- 3-8% depending on series
- May be related to preoperative bone quality
- Generally occur within first 3 months
- May be related to overly aggressive early recovery
- Usually treated nonoperatively
- May negatively impact final outcome

# Improvement

- Improvement after reverse shoulder replacement can progress for a full year and beyond.
- Recovering lost strength takes time and effort and does not come automatically
- Continued improvement requires that patients persist in their exercises well beyond the conclusion of physical therapy



# A◦V◦A◦T◦A◦R

- **Alignment of Vital Assets To Accelerate Recovery**
  - Patient education and preparation
  - Tissue sparing surgical techniques
  - Advanced pain management techniques
  - Customized therapy programs
  - Navigation through the surgery and recovery





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## Same Day Surgery

- Proven safe and effective for shoulder replacement
- Allows recovery in the comfort of home
- Keeps patients out of the hospital where there is a higher concentration of bad bacteria
- A growing paradigm that will become the new norm

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# Ingredients for Same Day Surgery Success

- Proper patient selection
- General health optimization
- Patient education
- Effective pain management
- Home support team
- Visiting nursing/PT
- Navigation

The screenshot displays the website for The Knee Hip Shoulder Center, which is part of the Orthopaedic Surgeons in New Hampshire. The website features a navigation menu with links to ABOUT, SERVICES, AVATAR PROGRAM, PATIENT INFORMATION, BLOG, and CONTACT. A prominent timeline illustrates the six steps of the AVATAR program: Step 1: Preparing your body, Step 2: Prehabilitation, Step 3: Preparing your home, Step 4: Infection prevention, Step 5: Pain Management, and Step 6: Final Preparation. Below the timeline, there are three sections for KNEE REPLACEMENT, HIP REPLACEMENT, and SHOULDER REPLACEMENT, each with a 'Click To Learn More' link. The bottom portion of the screenshot shows a video player for a video titled 'AVATAR Customized Rapid Recovery After Joint Replacement'. The video content includes the text 'Avoid an overnight stay in the hospital!' and lists two bullet points: 'Our AVATAR program allows 70% of patients to return to the comfort of home just hours after surgery' and 'We are leaders in New England in same-day joint replacement with experienced'. The video is from the STRATHAM AMBULATORY SURGERY CENTER.



Eliud Kipchoge: 2:01:39 Berlin 2018

# Surgical Preparation

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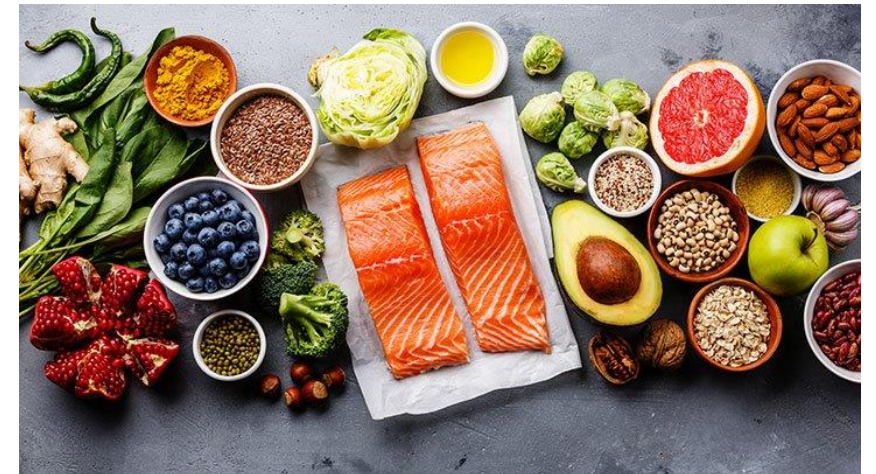
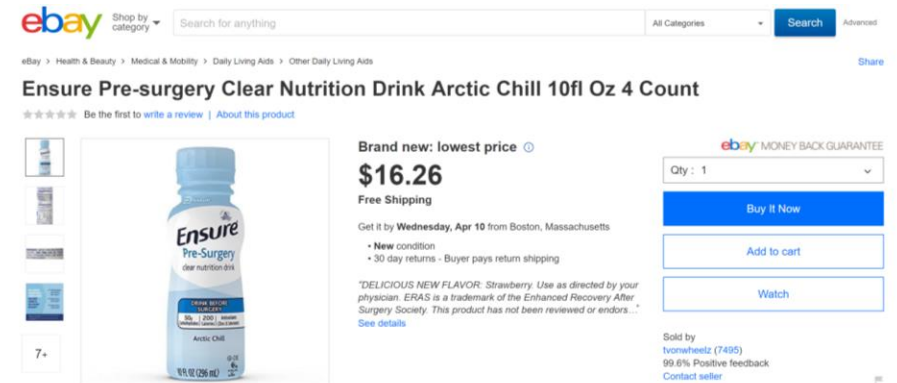
- You shouldn't have surgery without getting ready
- Own your outcomes by getting involved in the entire process

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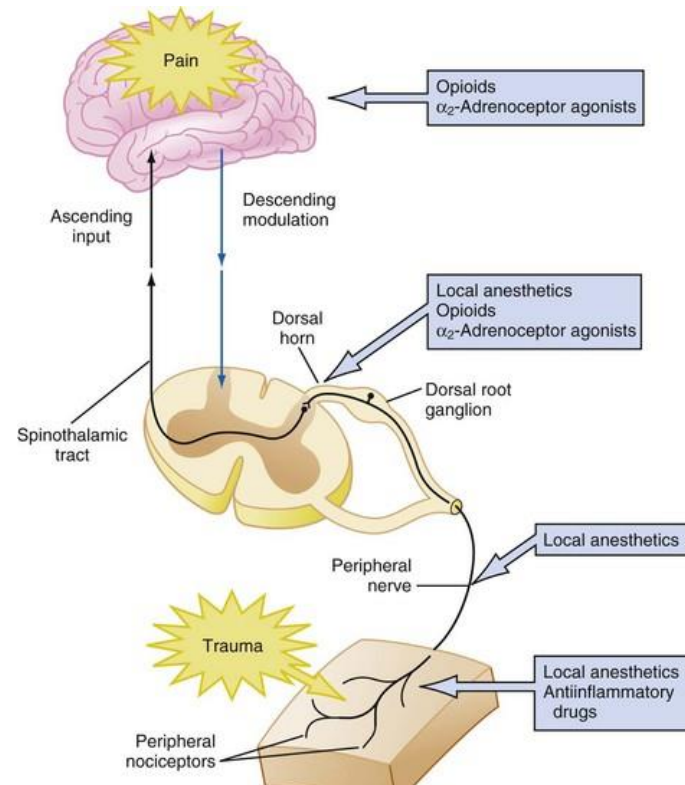


# Surgical Optimization

- We encourage better nutrition with Omega 3s and antioxidants
- We encourage certain minerals and vitamins in advance to boost immunity and healing
- Reduce alcohol intake
- Exercise
- Good hydration leading into surgery



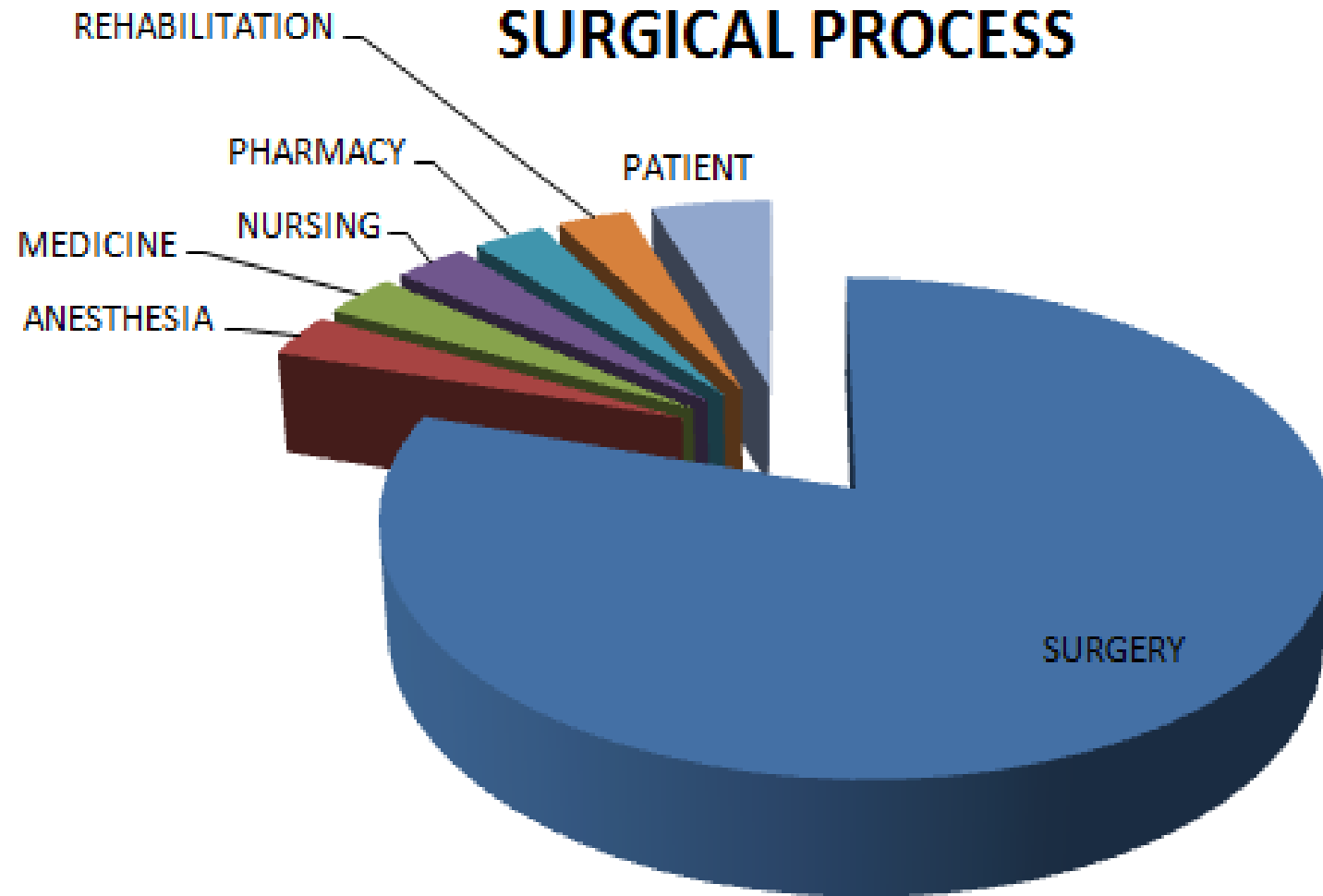
# Multimodal Pain Control



- This refers to using a combination of different medications that address pain at multiple points along the pathway
- The combination is synergistic
- Staying on a fixed schedule optimizes pain control
- This allows patients to minimize use of opioid medications

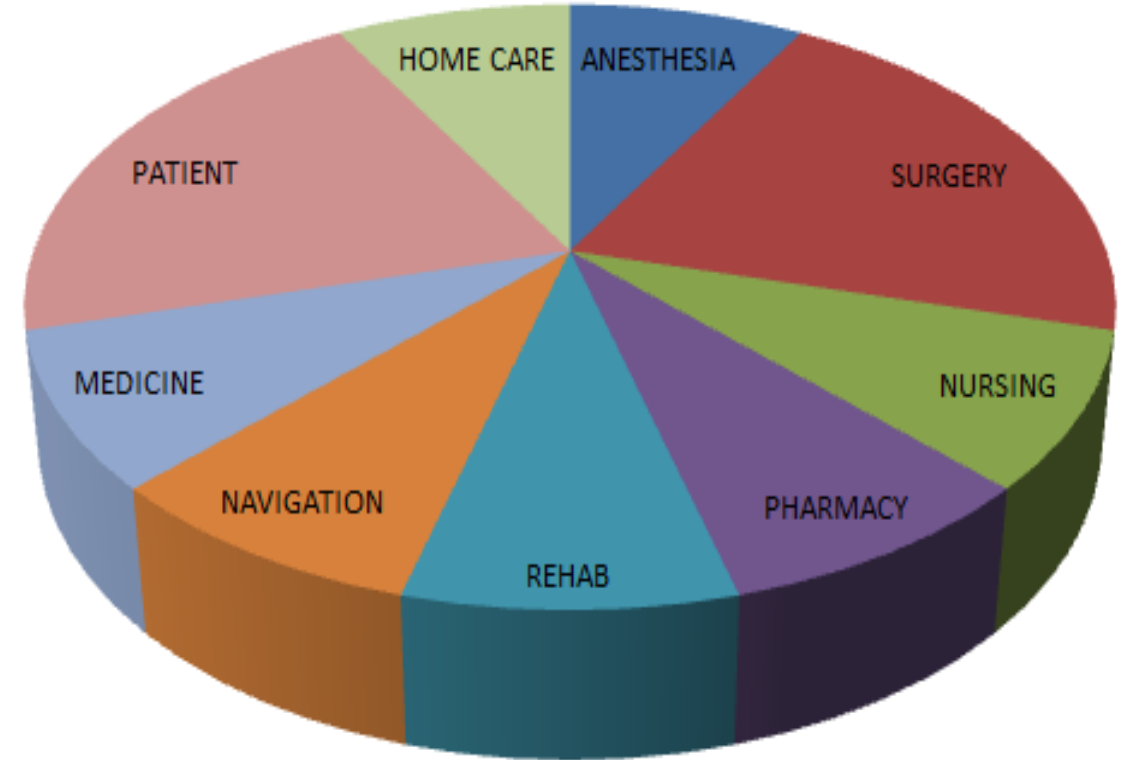
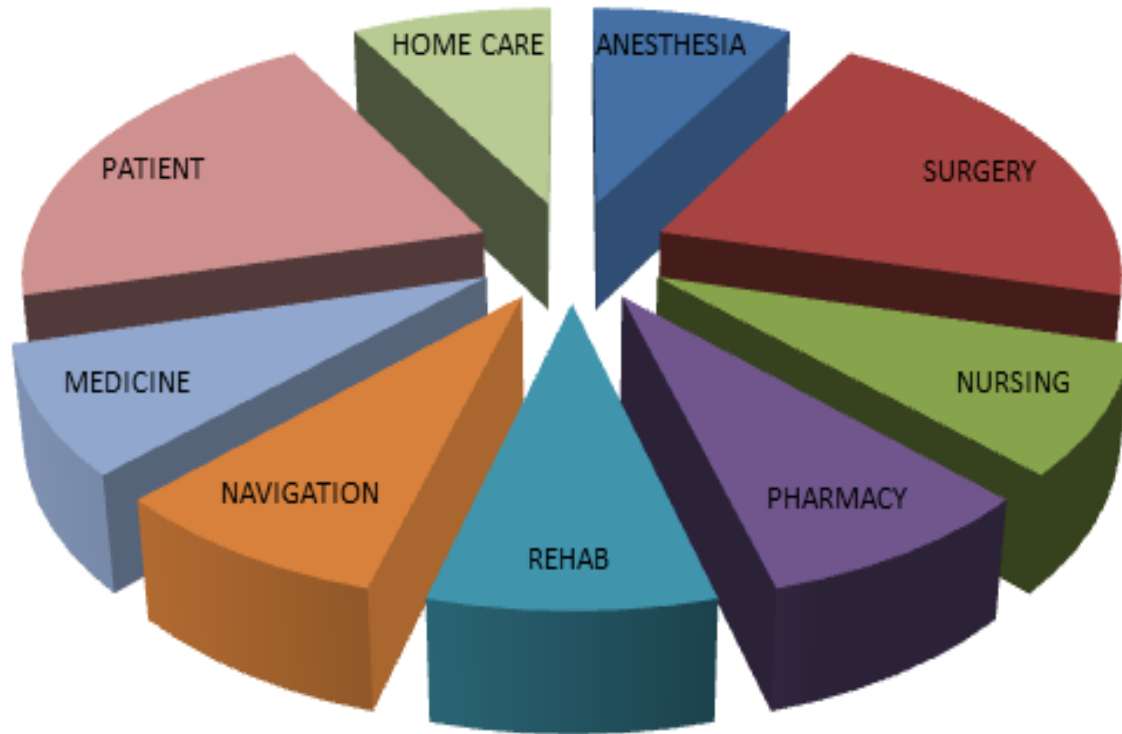


# The Historical Paradigm of Joint Replacement





# The Modern Paradigm of Joint Replacement



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# Navigation

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- We provide concierge service providing patients multiple points of contact with our staff throughout the perioperative period
- Our goal is to make sure that nothing falls through the cracks.

## Accessibility

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