# Anatomic versus Reverse TSA

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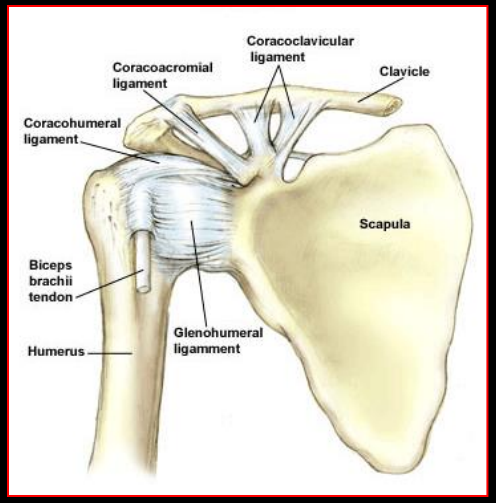
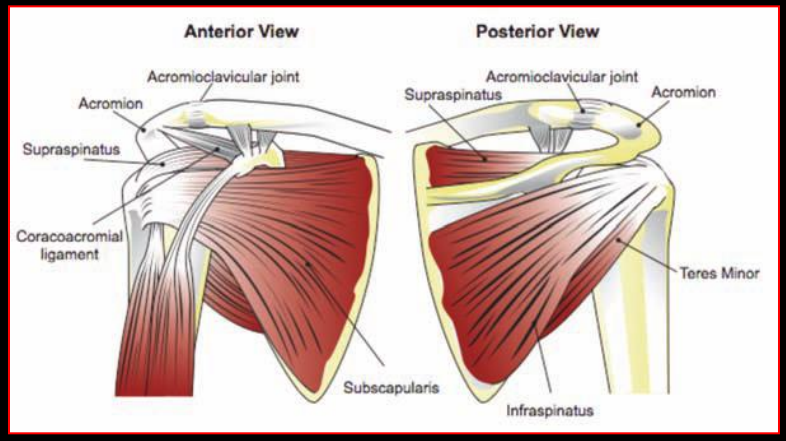
AUCKLAND BONE AND JOINT SURGERY

# The Shoulder

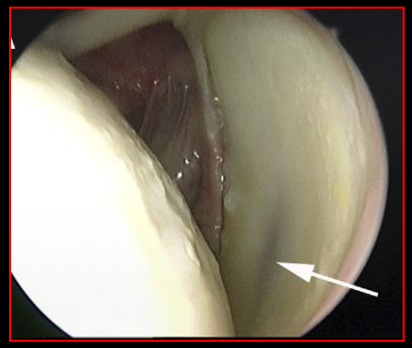



- Complex multi-articulated system that produces largest ROM of any joint in body
- Requires integrated function of 4 different articulations
- Intricate relationship exists between bony elements and surrounding soft tissues

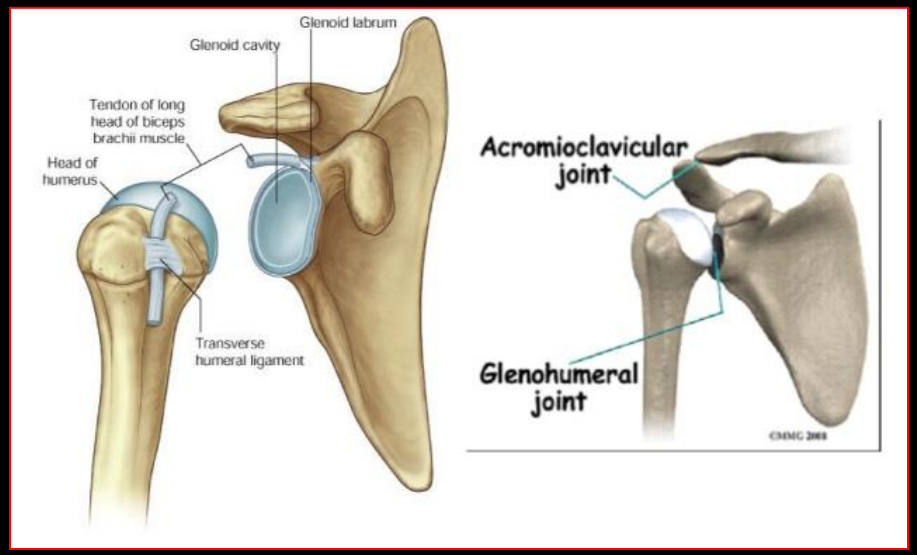


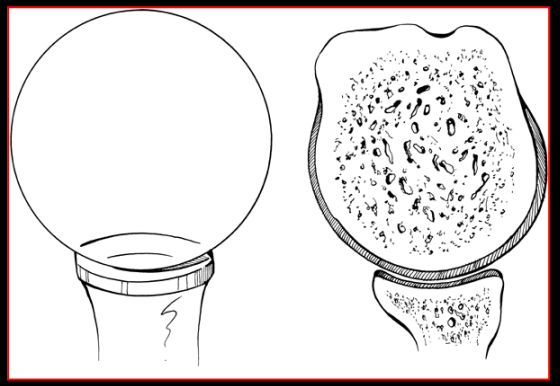

- Common source of pain and functional disability

# Bony Anatomy

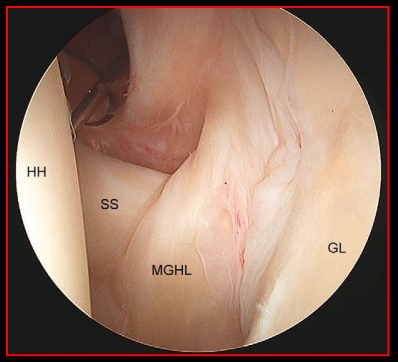


- Provides foundation for stability while allowing motion
- Stability primarily dependent on static restraints (capsule and labrum) and dynamic restraints (rotator cuff)

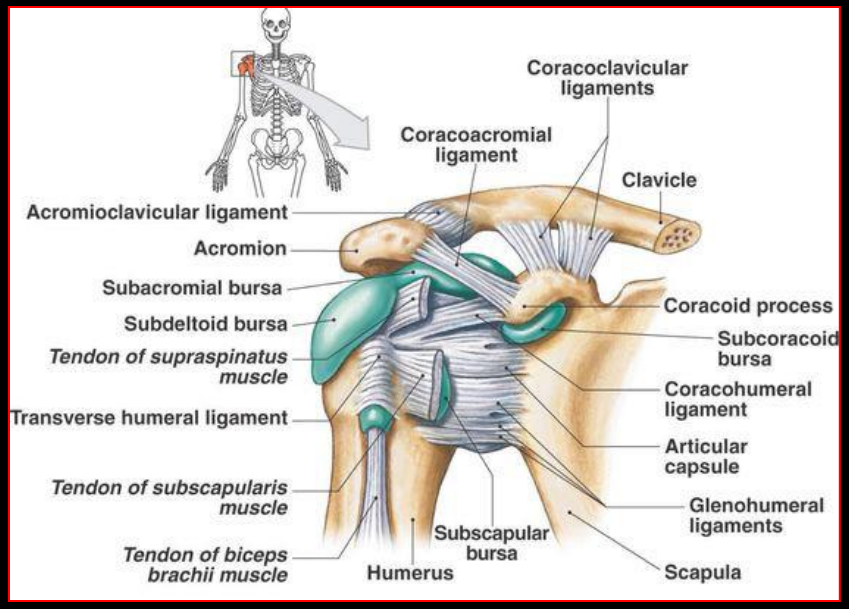


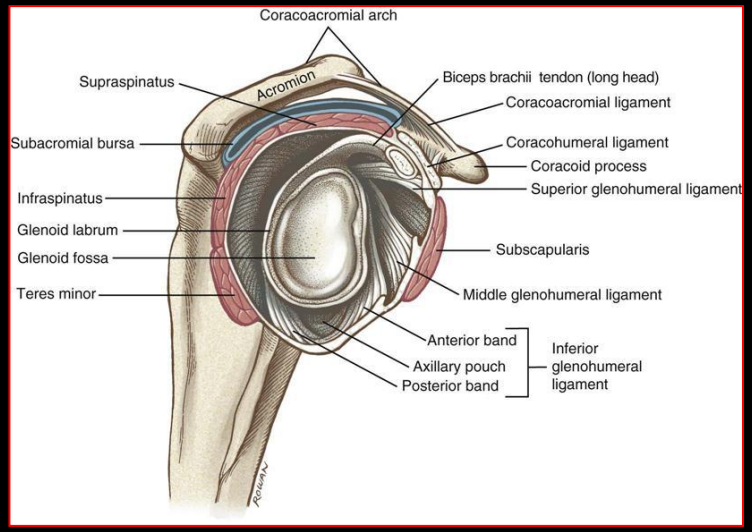



# Ligament Anatomy




- Main source of stability for the shoulder
- Ligaments are complex thickenings of the capsule that becoming tight at the end range of motion

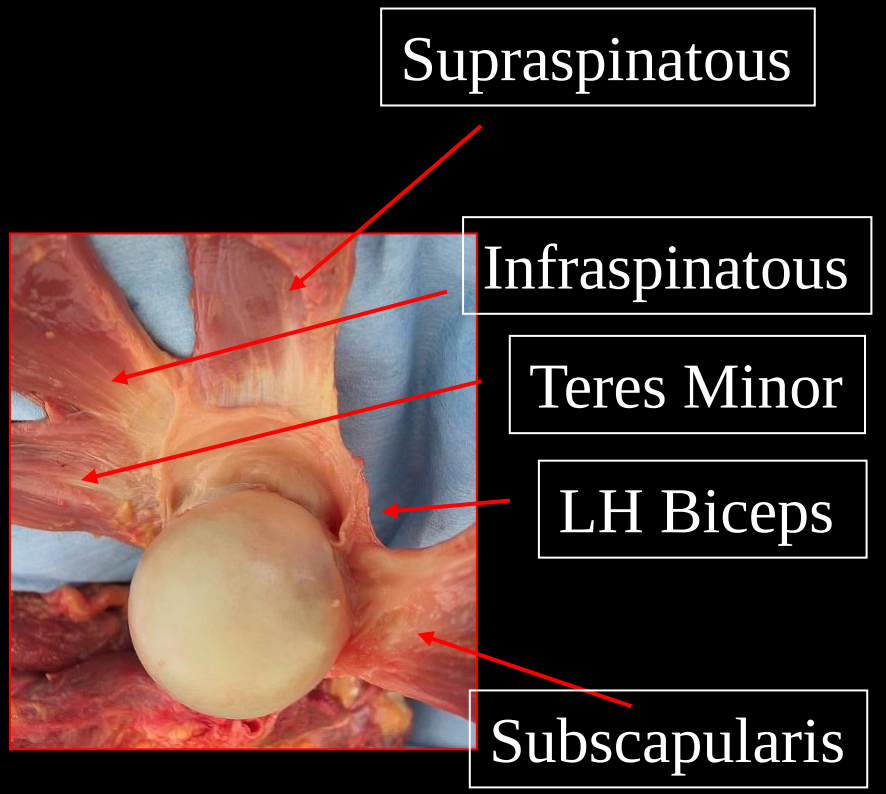


# Rotator Cuff Anatomy

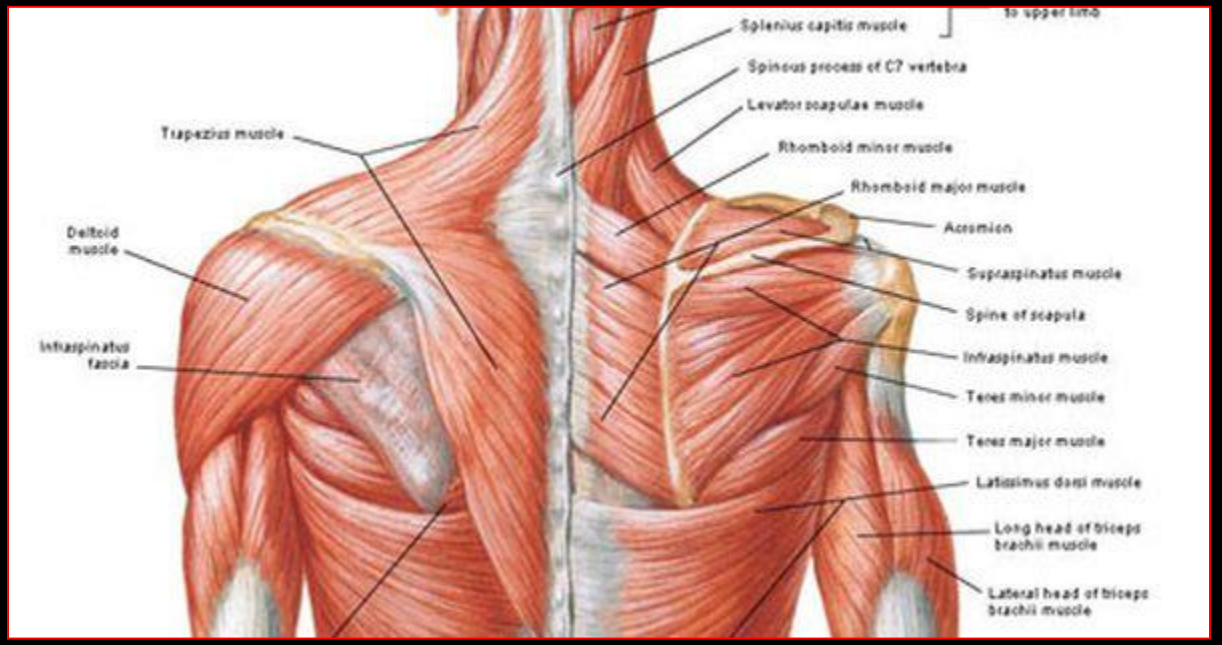
- Four muscles organized as a tendinous sleeve around the humeral head
- Divided into 2 functional parts by the biceps tendon

- Functions primarily in coordinating shoulder motion and keeping humeral head centered within the joint



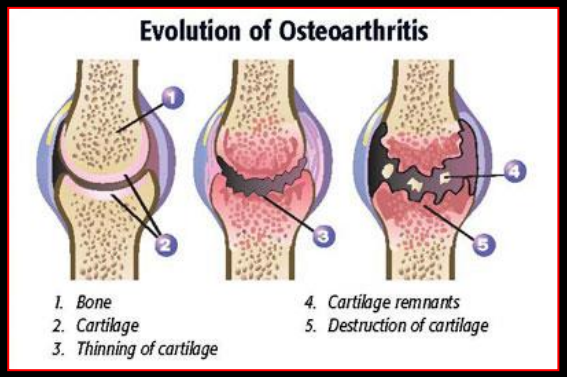
# Muscle Anatomy

- Work together to provide mobility and strength of the shoulder joint, and help to protect the underlying structures



# Shoulder Arthritis

- Humeral head and glenoid normally articulate through smooth, congruent, and well lubricated cartilage surfaces




- Arthritis results when these articular cartilage surfaces become damaged and/or worn

# Shoulder Arthritis

- Not a typical cause of shoulder pain
  - soft tissue pathology (RC) more common
- Many different types, each of which may require different treatment strategies
- Each type accompanied by varying degrees of soft tissue involvement (ligament, RC, muscle)
- Joint destruction accompanied by dysfunction of these soft tissues leads to pain, restriction of motion, and functional impairment

# Common Types of Arthritis

- Degenerative (Osteoarthritis)

- Inflammatory (Rheumatoid)

- Post-Traumatic

- Associated with Massive Rotator Cuff Tear

# Presentation

- May be noted incidentally during investigation and/or treatment of other shoulder pathologies (especially in younger patient)

<u>However</u>

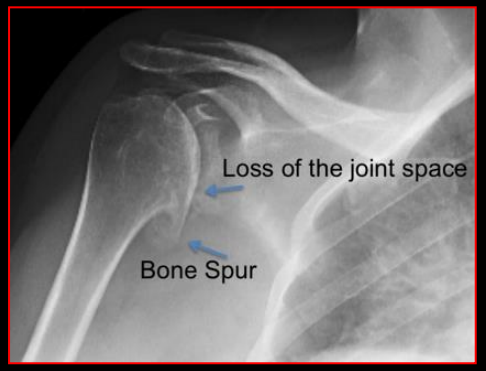
- Many will present with symptoms suggestive of arthritis, with pain and progressive loss of function (stiffness) of the shoulder
- Physical examination reveals muscle wasting, painful crepitus on joint motion, and limited range of motion (both active and passive)

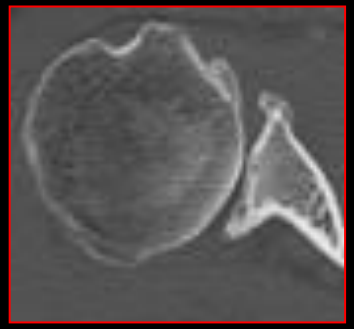
# Imaging

- Diagnosis usually determined from plain radiographs

- CT scans obtained if there is a question about amount or quality of bone available

- Soft tissue imaging obtained if there is concern about rotator cuff integrity
  - preferably MRI as USS unreliable in presence of shoulder stiffness




# Nonsurgical Treatment

- Initiated once diagnosis established
- Includes lifestyle modification, physical therapy, paracetamol, NSAID's, chondrosupplements, cortisone injections, hyaluronic acid, and biologic treatments

<u>However</u>

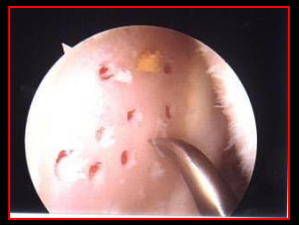
- Evidence to support nonsurgical treatments limited
- Really only of value for patients with mild symptoms in early stages of the disease

- Most patients with established arthritis respond poorly

# Surgical Treatment

- Considered for well informed and motivated patients who have failed non-operative treatment (pain is the primary indication)
- Classified into the following categories:

  - palliative
  - reparative



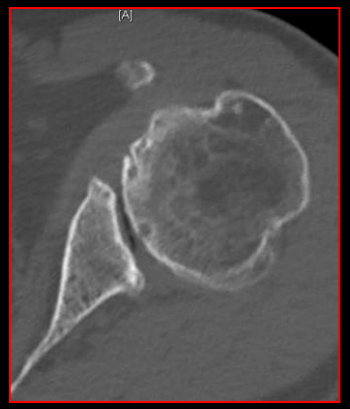
- restorative

- reconstructive

# Palliative

Arthroscopic Debridement

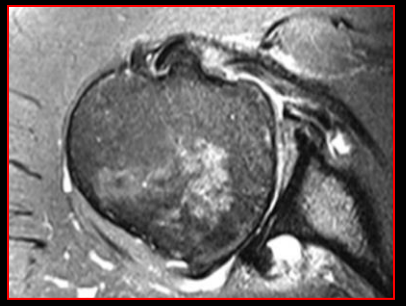
- Lavage, removal of debris, chondroplasty, removal of osteophytes, capsular release
- Predominant goal pain relief and a delay to TSA
- Level IV type evidence suggest improvements in pain relief and satisfaction in short term
- No high quality evidence to support routine use
- Poor prognostic factors bipolar lesions and joint incongruity



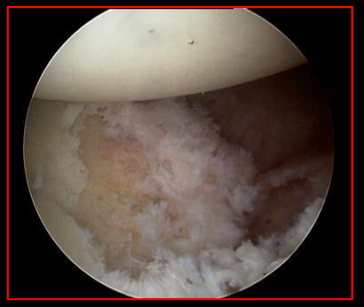
# Reparative

Microfracture

- Aim is to perforate subchondral bone plate to facilitate ingrowth of fibrocartilage to cover hyaline cartilage defect
- May be useful in short term for symptom relief, especially for isolated small full thickness lesions
- Can provide long term improved function and reduced pain in some patients, but high reoperation rates and failure
- May not alter natural history of degeneration
  - bipolar lesions, diffuse disease, glenoid wear



# Restorative

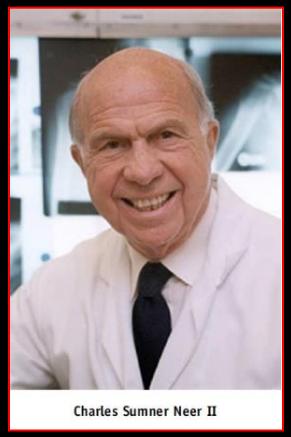


Biologic Resurfacing

- Aim to provide an interposition of soft tissue to reduce rate of bony erosion and deformity
  - capsule, fascia lata, allograft or scaffolds of allograft or xenograft ECM (eg. GraftJacket or Arthroflex)
- Undertaken either open or preferably arthroscopic
- Most reported outcomes unpredictable with high revision rates
- Recent report suggests safe option in select patients, but identification of optimal patient difficult

# Reconstructive

- From late 19th century to early 1970's surgeons tried with varying degrees of success to develop a viable TSA
- In 1973 the design of Charles S Neer II substantially improved the reliability of outcomes and modern shoulder replacement was born
- Initial indication was for proximal humerus fractures


Charles Sumner Neer II

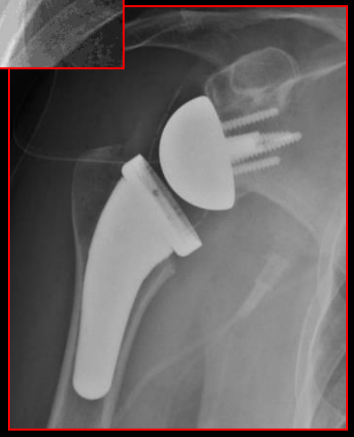
# Modern Shoulder Replacement

<u>Procedure Options</u>

- Hemiarthroplasty - replacing humeral head only

- Anatomic TSA - replacing humeral head and glenoid

- Reverse TSA - reversing the bearing surfaces



# Hemiarthroplasty

- Generally indicated when glenoid itself is uninvolved (acute fracture, AVN of humeral head) or when preference is to avoid glenoid replacement (arthritis in very young)
- Options include resurfacing, stemless, short stem, or conventional length stem




- Humeral head options include cobalt chrome, ceramic, or pyrocarbon



# Hemiarthroplasty


- Longer follow-up studies have reported good symptomatic and functional results, especially with resurfacing

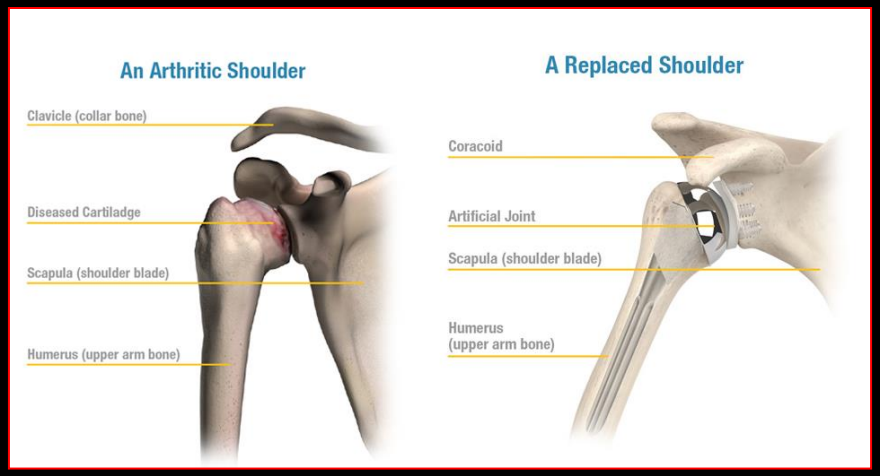
<u>However</u>

- Early failure is a major concern, with progressive joint space narrowing, glenoid erosion, and diminishing outcomes occurring over time

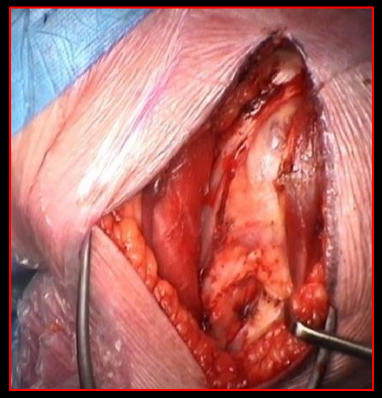
- Pain relief and functional results much better following TSA with fewer revisions

# Total Shoulder Arthroplasty

- Both anatomic and reverse TSA well established as means to relieve pain and improve ROM and function for many afflictions of the shoulder
- Goal specifically is to replace the arthritic humeral and glenoid joint surfaces with prosthetic ones
- However both are very much ‘soft tissue’ operations

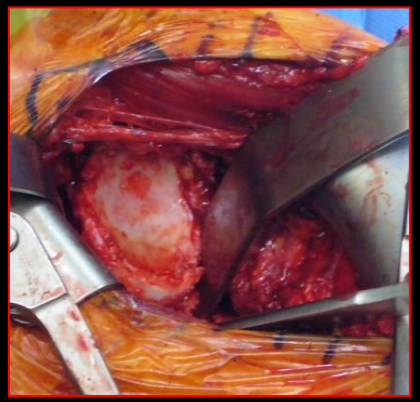


# Surgical Technique



- Good exposure of the shoulder joint and the soft tissues around it is essential to be able to address all of the structures involved (‘soft tissue’ operation)

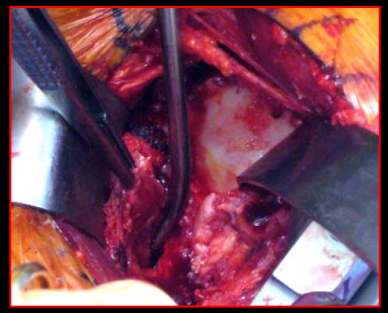
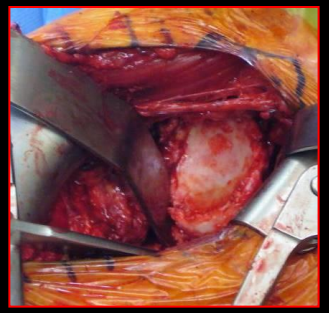
- Technically demanding surgical procedure, especially for the glenoid resurfacing portion of the operation
  - good glenoid exposure can be difficult and takes time



# Surgical Technique

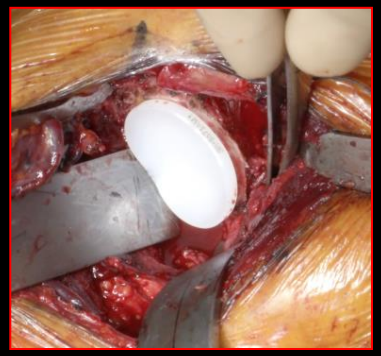
- Beach chair position with affected shoulder well off the table to facilitate humeral preparation


- Deltopectoral approach with extensive anterior and inferior capsular release to facilitate glenoid exposure

# Surgical Technique

- Once good access obtained implantation of components determined by type of prosthesis used
- Many aspects of the procedure similar for both anatomic and reverse TSA

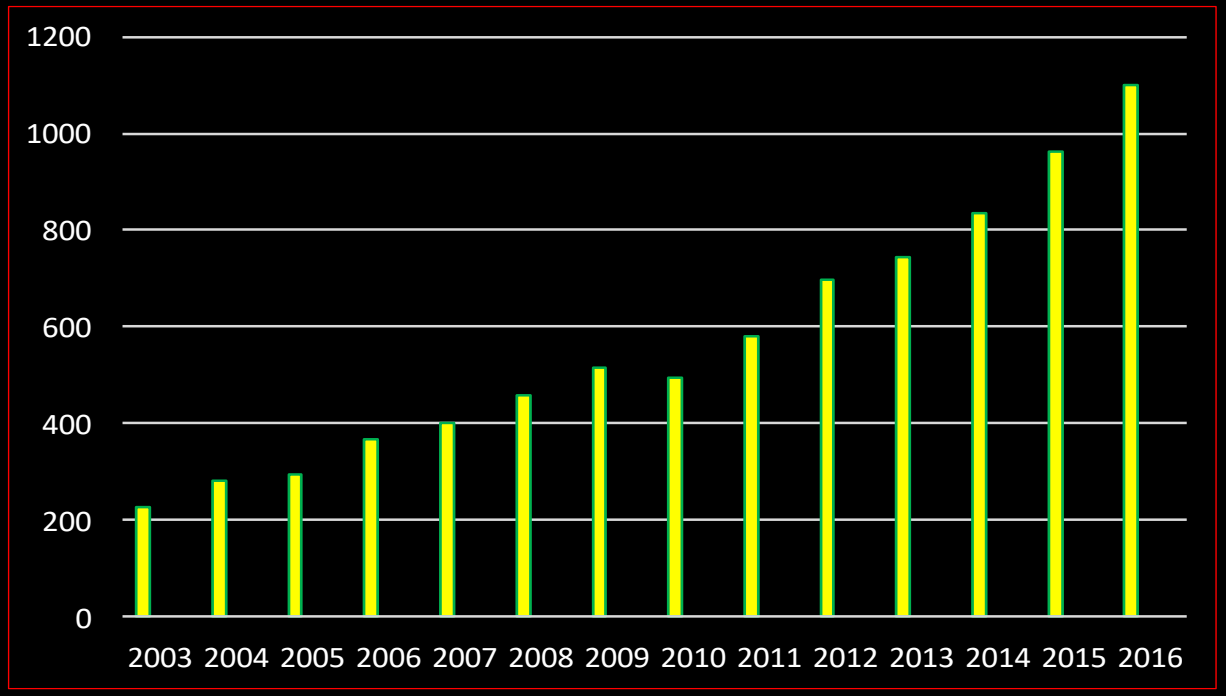


Anatomic

Reverse

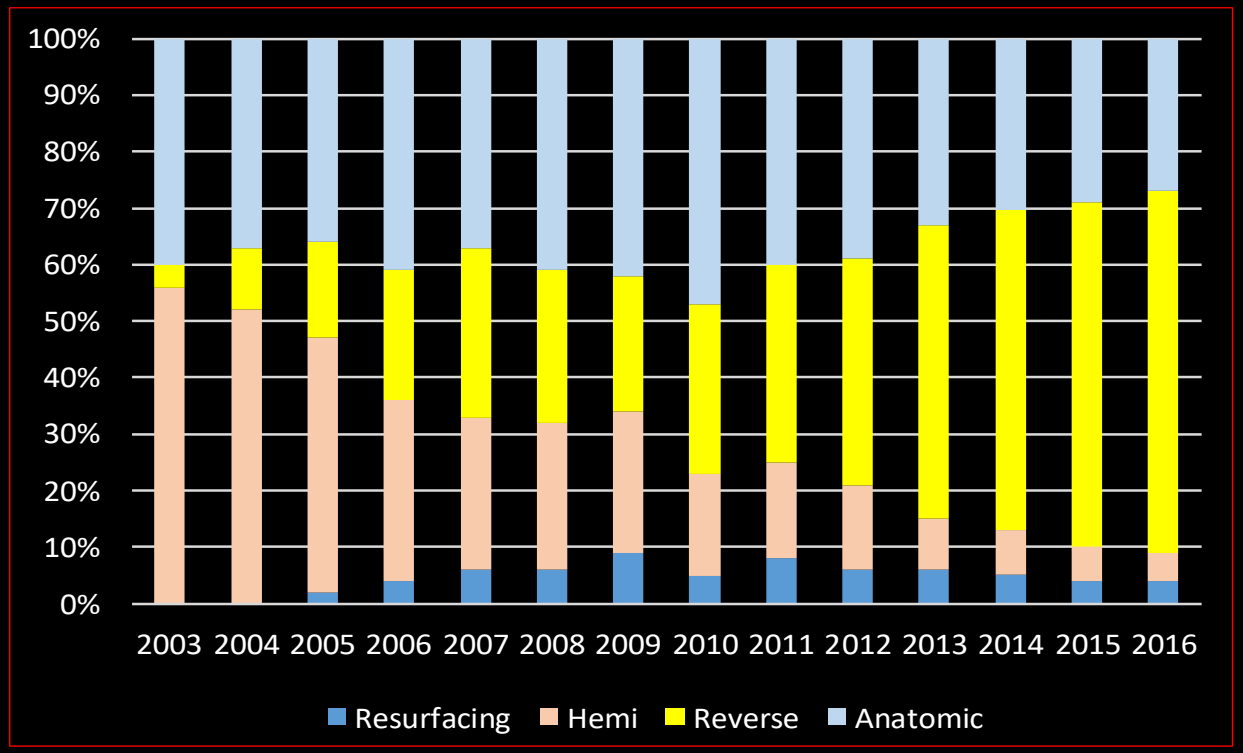
# Utilisation

- NZ Shoulder Joint Registry reveals progressive increase in utilisation of TSA over last 15 years



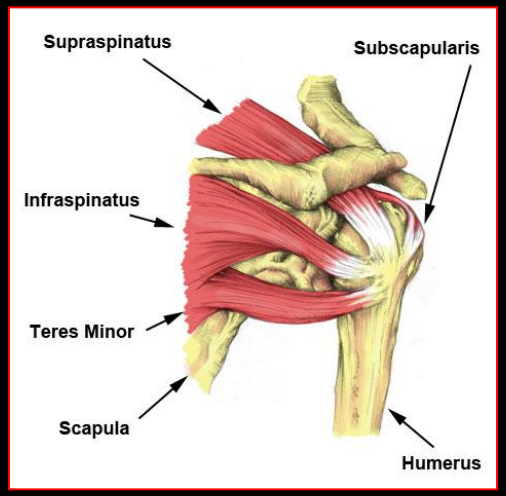
# Utilisation

- Not only progressive increase in number of TSA's performed, but type of prosthesis usage has changed dramatically



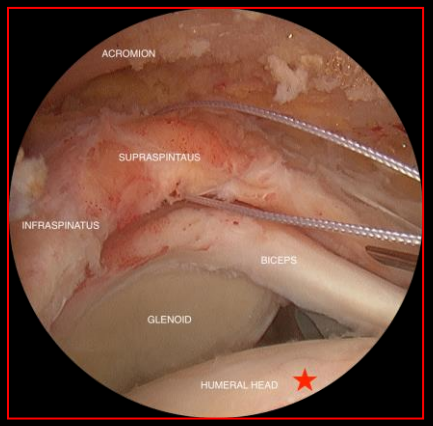
# Why???

- For anatomic TSA to be successful, ROM must be restored through the release of scar tissue and contractures, proper sizing and placement of implants, and an intact and functioning rotator cuff with sufficient strength to power the shoulder




# The Reality

- As we age our rotator cuff progressively fails, with an increasing incidence of full thickness rotator cuff tears with each decade of life

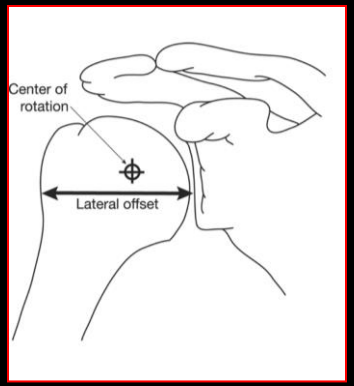



<u>In addition</u>

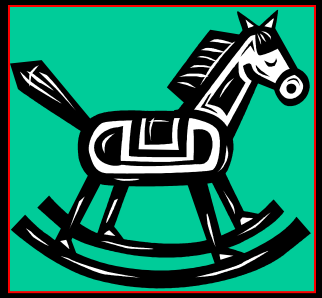
- Even when the rotator cuff is intact, the quality of the tendon tissue is often poor, and the ability to rehabilitate a contracted and weak RC can be limited, especially in the elderly

# Normal Shoulder Motion

- Very complex
- Humeral head centre of rotation remains relatively constant relative to the glenoid until end range of motion when some translation occurs (ligaments and capsule become tight)




- This requires soft tissue ‘balance’ so that implant can be moved while remaining stable
- If implant stability is compromised, asymmetric loading of implant and early failure can occur



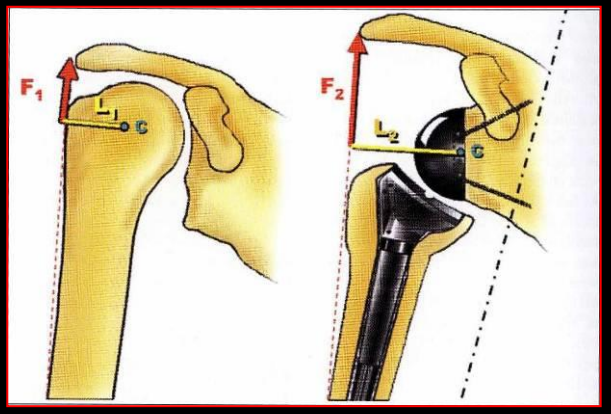
# Rotator Cuff Deficiency

- When the rotator cuff has ruptured or is non-functioning, the shoulder is deprived of one of its main stabilising elements

- Under the action of the deltoid muscle, the humeral head migrates superiorly resulting in loss of the fulcrum for arm elevation and early loosening of the glenoid component

# Reverse TSA

- The only way to restore stability and mobility in this situation is to provide new biomechanical conditions for better functioning of the deltoid, compensating for the lack of a functional RC
- Hence the rationale for a reverse ball and socket shoulder replacement
  - improves function of deltoid by medializing and distalising COR
- Many different reverse TSA designs now on the market




# In Simple Terms

- Decision on which type of TSA should be performed is based on whether the patient has an attached and functional rotator cuff

Osteoarthritis

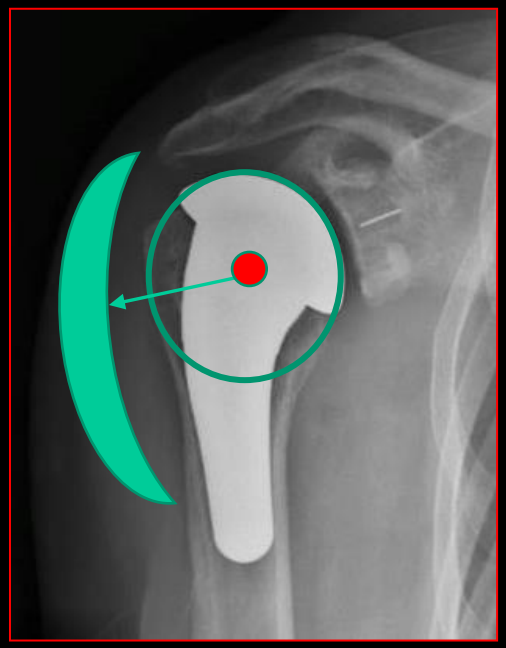
RC tear arthritis

Anatomic

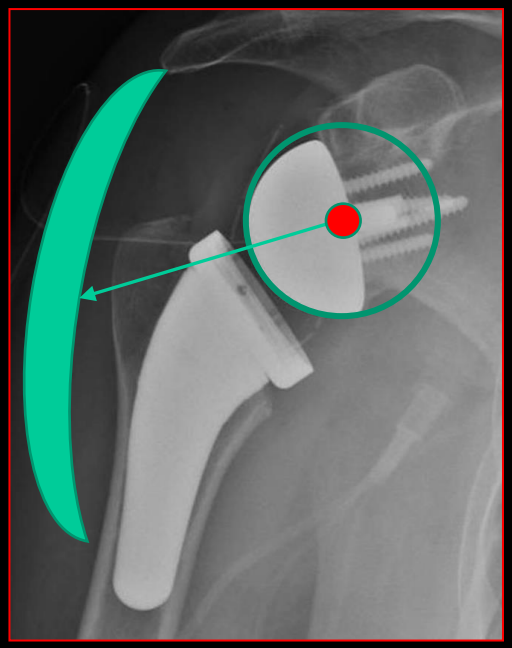
Reverse

# Reverse TSA

- Medialises and lowers the center of rotation of the joint, thereby increasing the lever arm and efficiency of the deltoid muscle



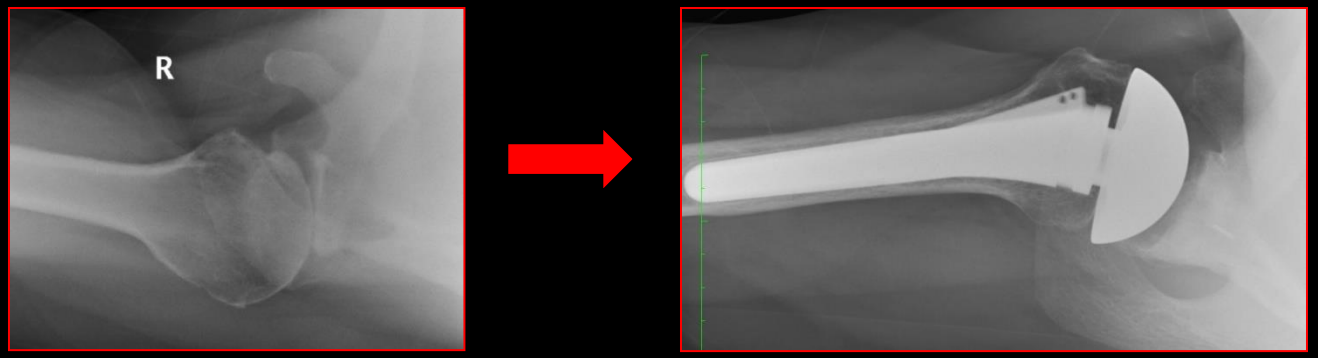
Anatomic



Reverse

# Remember

- Although improved understanding of shoulder anatomy and mechanics has led to better implants and improved ability to perform anatomic TSA …




- … functional outcome still very dependent on the release and balancing of soft tissues to serve the desired functions of stability and motion

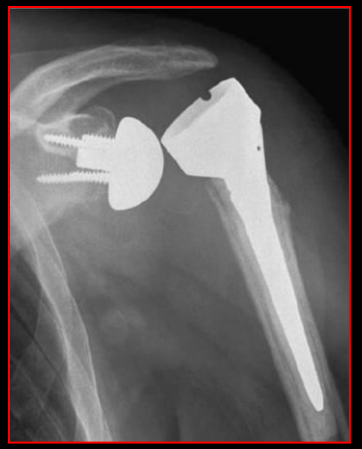
# Therefore

- Trend toward greater utilisation of reverse TSA (not reliant on a functioning RC)

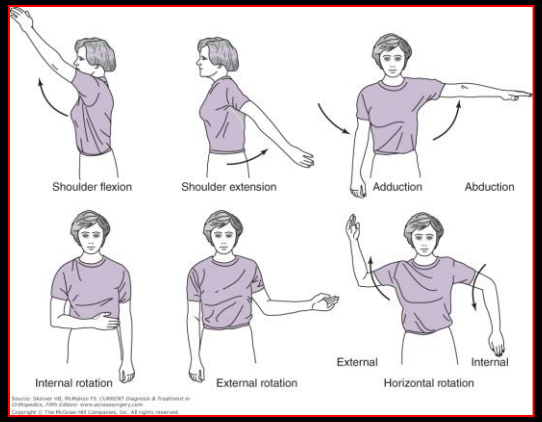
<u>However</u>

- Increasing use likely multifactorial
  - greater surgeon experience with use of reverse TSA
  - improved implant designs
  - favourable longer term outcomes
  - poor outcomes with anatomic TSA in certain patient groups
    - Glenoid bone loss
    - Older patients with OA (> 70 years)
    - Revision TSA
    - Fractures (acute and # sequelae)

# However



- Unsolved problems remain, likely related to the nonanatomic design of the implant
  - instability, acromial stress fracture, nerve injury, loss of internal rotation, scapula notching
- Recent studies have reported reverse TSA to be an independent risk factor for inpatient morbidity, mortality, and increased hospital costs
- A good primary anatomic TSA still results in better overall ROM and function compared to reverse TSA

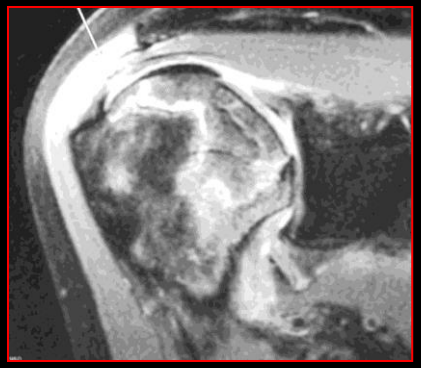


# My Approach

<u>Hemiarthroplasty</u>

- Acute non-reconstructable proximal humerus fracture in younger patient (< 70 years)

- AVN of humeral head



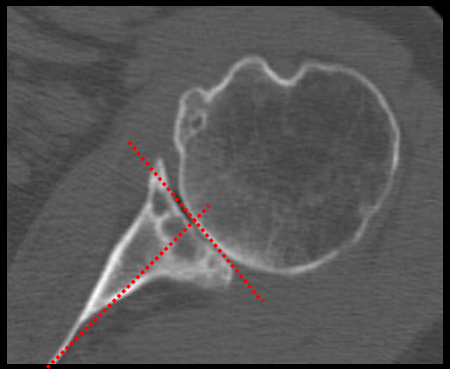
- Certain younger patients with severe arthritis

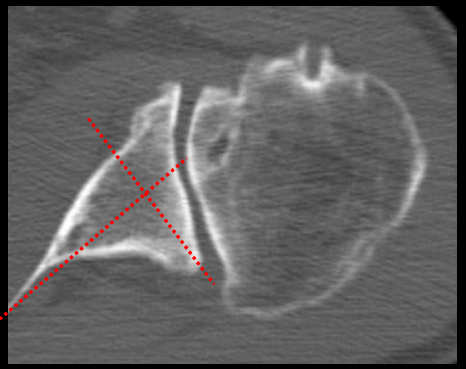
# My Approach

Anatomic TSA

- Glenohumeral arthritis from any cause, but must have
  - intact and functioning rotator cuff (caution > 70 years)
  - no significant glenoid bone loss

- Current systems cannot reliably deal with glenoid bone loss or version abnormalities > 15 degrees





# My Approach

Reverse TSA

- Basically all other indications for shoulder arthroplasty
  - rotator cuff tear arthropathy
  - massive irreparable RC tear without arthritis
  - arthritis with glenoid bone loss > 15 degrees
  - arthritis any cause > 70 years +/- RC tear
  - acute proximal humerus fracture > 70 years
  - fracture sequelae
  - revision TSA
- Which is why my practice is now 70:30 in favour of reverse TSA

# Summary

- No question that surgeons do a better job of performing shoulder arthroplasty than in preceding decades
- Often most difficult part of procedure is deciding what type of arthroplasty is most appropriate for the patient
- Still need to be precise with surgical technique and understand the limitations of the implant system in use
- If different variables in each individual case are identified and addressed a successful outcome can be anticipated

# Thank You