

# Therapeutic Management of the Reverse Total Shoulder

Valley Health Rehab Symposium  
Oct 2019  
Tyneshia Schermann

# Preoperative Teaching

- Obtain subjective history
  - Home set-up, social support, prior level of functioning
- Identify needs
  - Clothing
  - Medication information
- Initiate discharge discussion
  - Support
  - Environment

# Preoperative Teaching (cont)

- Environmental considerations
  - Recliner for sleeping
  - Bathroom set-up
  - Lighting
  - “Command Center” set-up

# Post Op Day 0

- Assess mobility and safety
- Provide education on restrictions and precautions to protect surgical site
- Initiate training for activities of daily living (ADLs)

# Post Op Day 1

- Continue training for ADLs
- Initiate home exercise program
- Follow up education for restrictions and precautions to protect surgical site

# Activities of Daily Living

- Upper body tasks
  - Sling management
  - Grooming
  - Bathing
  - Dressing

# Activities of Daily Living (cont)

- Lower body tasks
  - Dressing
  - Bathing
  - Toileting

# Adaptive Equipment

- Reacher
- Sock aid
- Dressing stick
- Shoe horn
- Long handled sponge



# Home Exercise Program

- Pendulum exercises
- Supine external rotation and flexion
- Scapular exercises
- Elbow, forearm, wrist and hand exercises

# Home Exercise Program (cont)

- Education and Training focus:
  - Establishing routine
  - Understanding use of ice
  - Identifying red flags

# Use of Technology

- Reminders for exercises
- Skin inspection
- Correct sling management

# References

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# Reverse Total Shoulder Arthroplasty Variations in Post Op Protocols

Anna Dennis DPT GCS OCS Cert DN

VH Rehab Symposium

October 18, 2019

# Conflict statement:

- I have no affiliation with any authors, products or research in this presentation.

# Goals

Understand about RTSA:

- Major post op concerns
- Anatomical/biomechanical principals
- Evidence for clinical rehabilitation approaches
- Variation in published post op protocols



# Factors affecting outcomes

## Factors affecting outcome

- Pre-existing pathology, implant design/placement, quality of remaining soft tissue, quality of rehab, compliance with rehab<sup>1</sup>
- Soft tissue tension which is set by the surgeon by placement of prosthesis<sup>1</sup>

## 4 Post Surgery Concerns

- Prosthesis protection from dislocation
- Acromial and scapular spine overload, stress reactions/fractures
- Comprise or tear supscap repair
- Periscapular fatigue

# Most Common Indication

Rotator cuff arthropathy<sup>2</sup>



# Great YouTube of RTSA Surgery



# RTSA Complications

- 19% to 68% <sup>2</sup>
- Acromial and scapular spine fracture, hematoma, infection, instability/dislocation, mechanical baseplate failure, neurological injury, periprosthetic fracture and scapular notching.

# Current controversies in RTSA

- Optimal baseplate positioning, humeral neck-shaft angle ( $135^{\circ}$  versus  $155^{\circ}$ ), glenosphere placement (medial, lateral or bony increased offset RTSA), polyethylene wear, and subscapularis repair<sup>2</sup>
- Post op protocol agreements

# Normal Shoulder Biomechanics

Dynamic stabilizers of shoulder<sup>1</sup>

Scapulohumeral group:

- Deltoid
- Rotator cuff: infraspinatus, supraspinatus, teres minor, subscapularis

Axioscapular group:

- Rhomboids, trapezius, serratus anterior, levator scapula,

Axiohumeral group: originate on thorax and insert on humerus

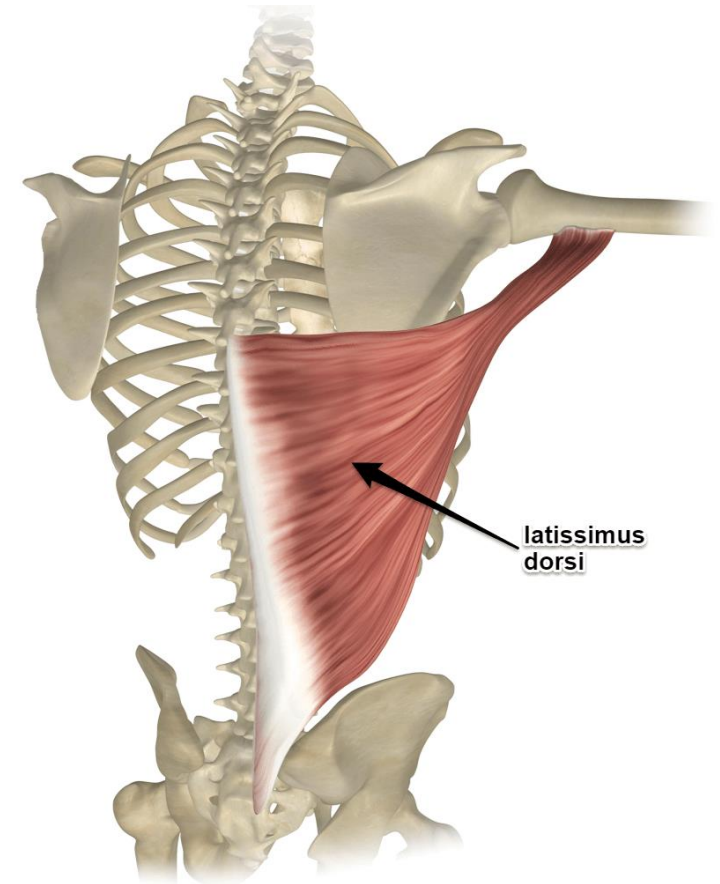
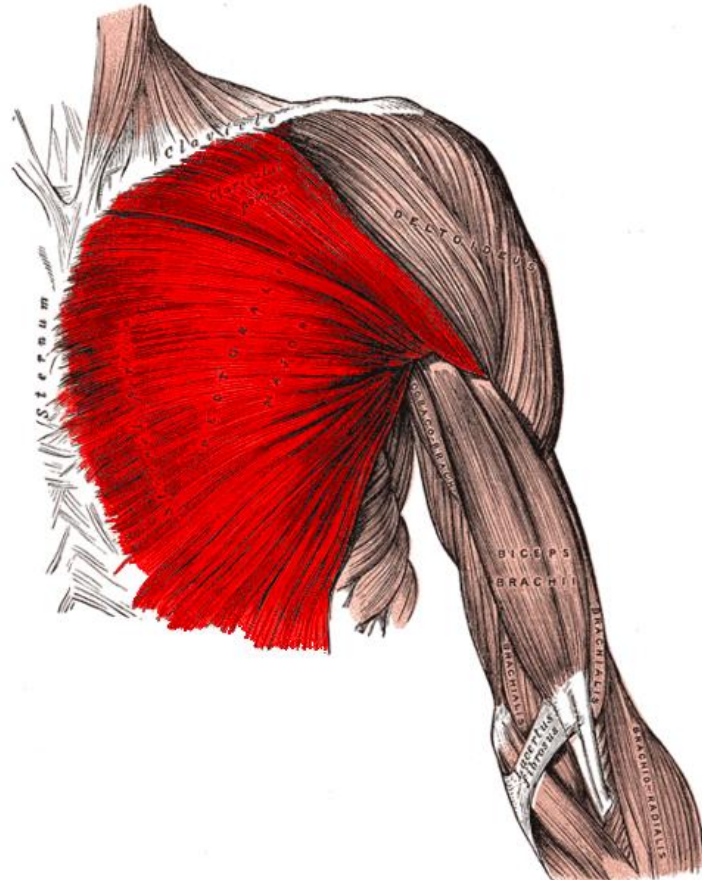
- Latissimus dorsi and pec major

# Normal shoulder biomechanics

- Deltoid muscle is the primary abductor of the arm with supraspinatus helping with initiation
- Rotator cuff muscles compress the humeral head in the glenoid fossa for stability<sup>1</sup>



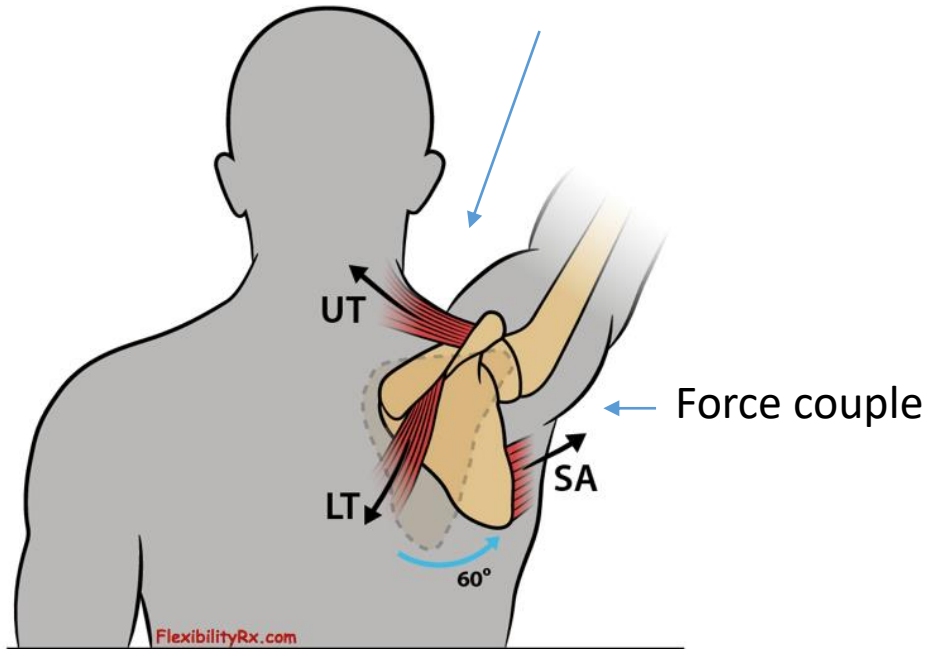
# GH Joint: Prime Movers of Humerus



Pictures taken from internet October 2019

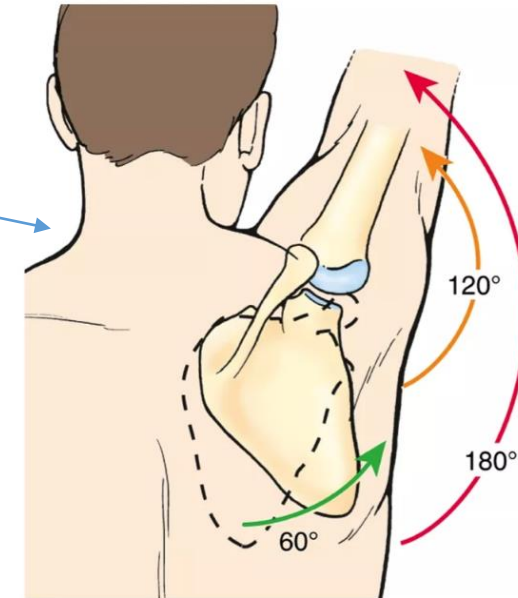
# Scapulothoracic Movers

Movers are force couples



upward rotation: (UT) Upper Trap:  
(LT) Lower Trap: (SA) Serratus Anterior

SHR



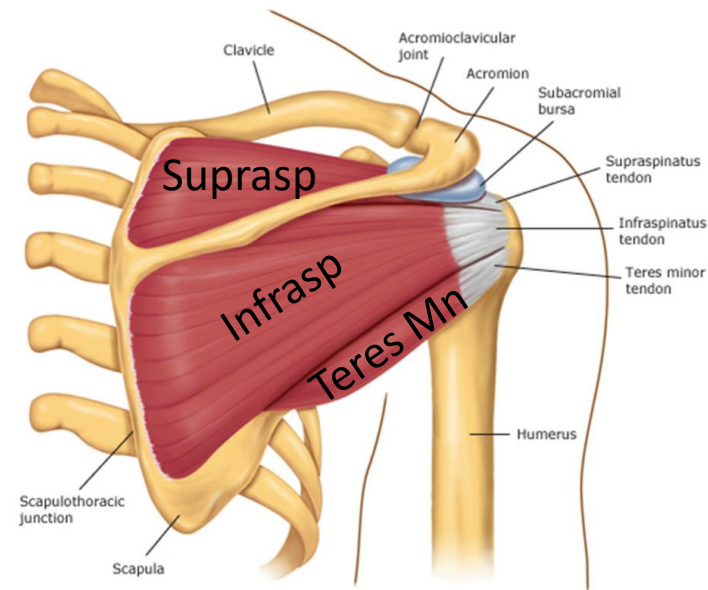
(C) Scapulo-humeral rhythm. The scapula and humerus move in 1:2 ratio. When the arm is abducted 180 degrees, 60 degrees occurs by rotation of the scapula, and 120 degrees by rotation of the humerus at the shoulder joint.

Pictures taken from internet October 2019

# Stabilizers of GH Joint: Rotator Cuff



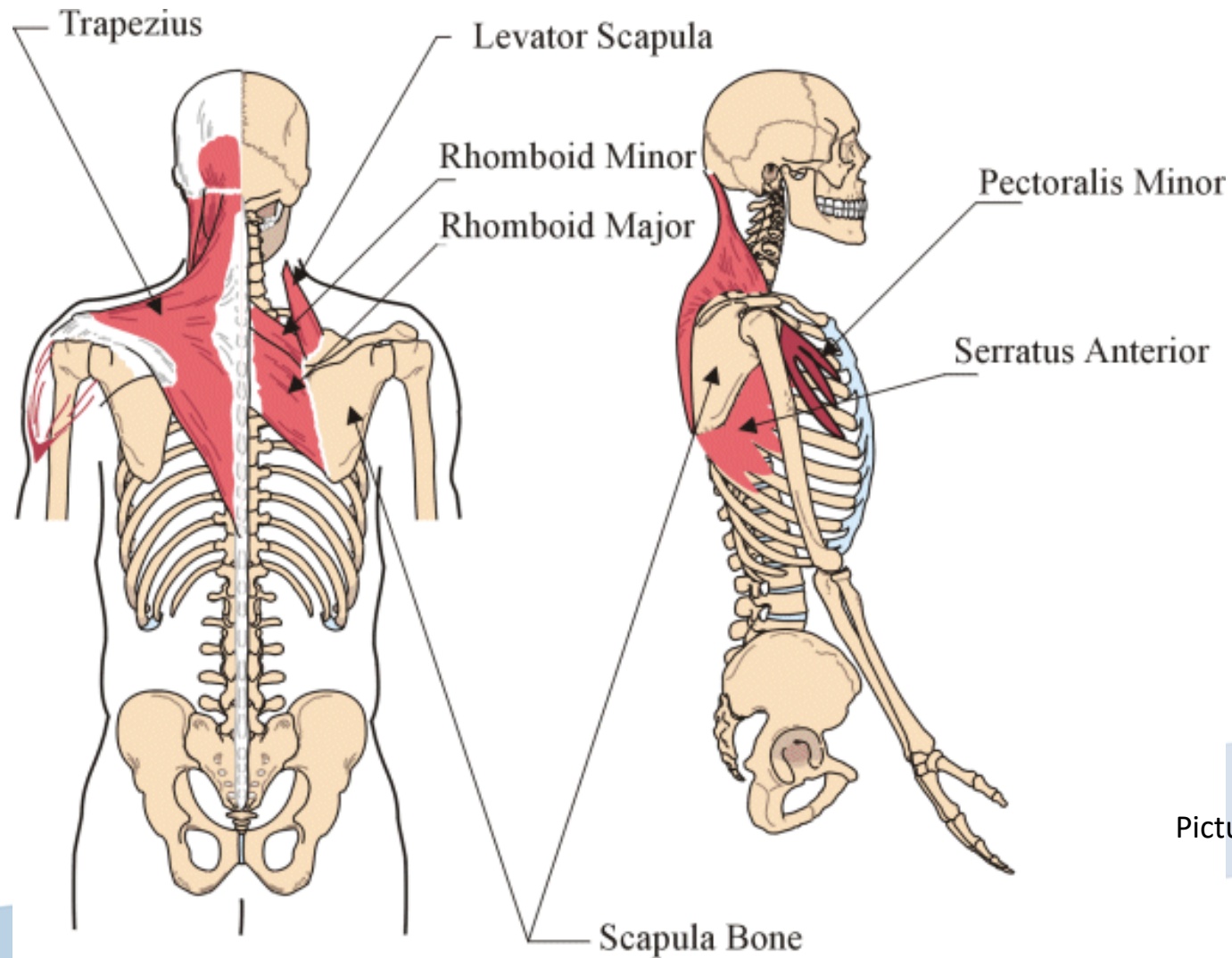
Anterior



Posterior

Pictures taken from internet October 2019

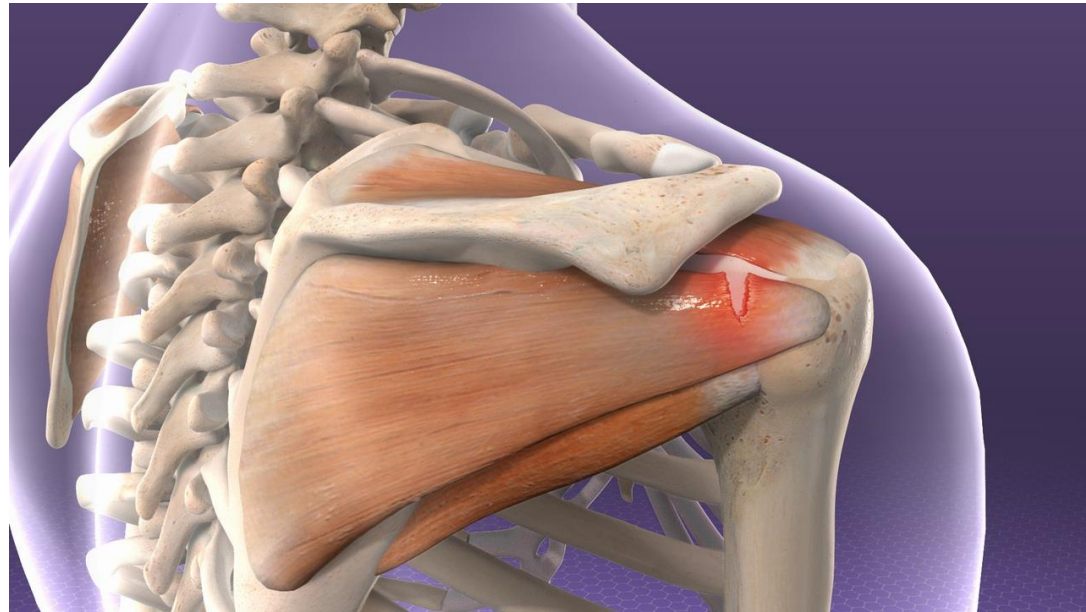
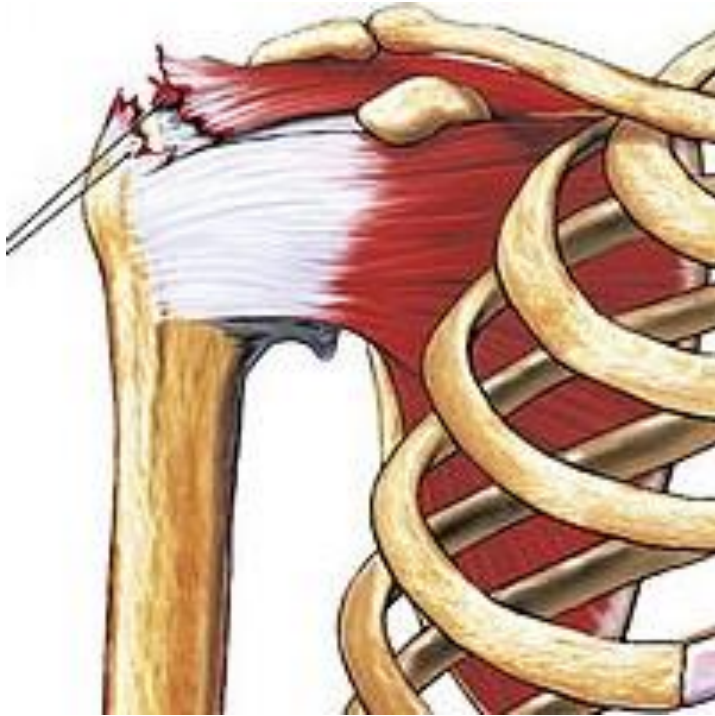
# Scapular Stabilizers



Pictures taken from internet October 2019



# Rotator Cuff Tears



Rotator Cuff Tear. Newport Orthopedic Institute. <https://www.newportortho.com/Orthopedic-Services/Shoulder/Shoulder-Injuries-Conditions/Rotator-Cuff-Tear.aspx>. Accessed October 9, 2019.

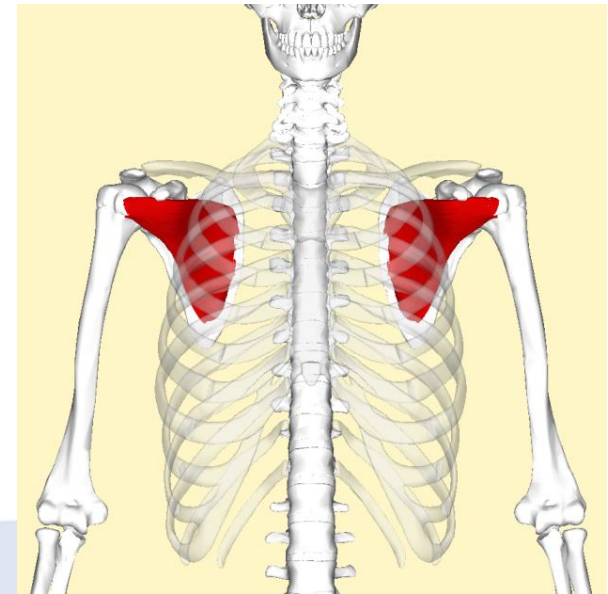
Picture taken from internet October 2019

# Subscapularis

- Largest and most powerful RC, internally rotates GH joint
- Protects from anterior translation of humeral head
- Allows you to hold items and hug



Pictures taken from internet October 2019



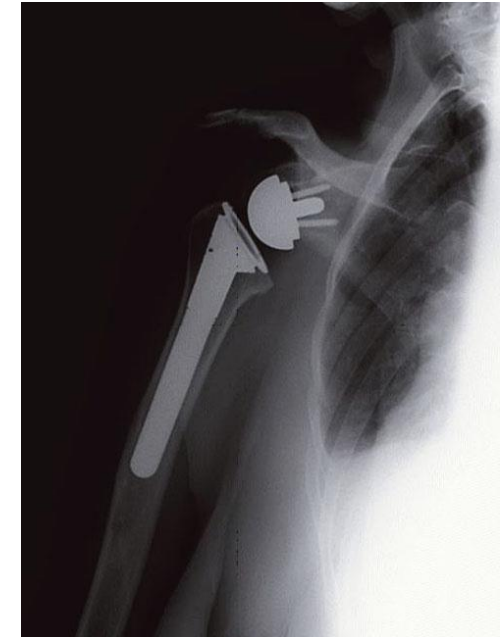
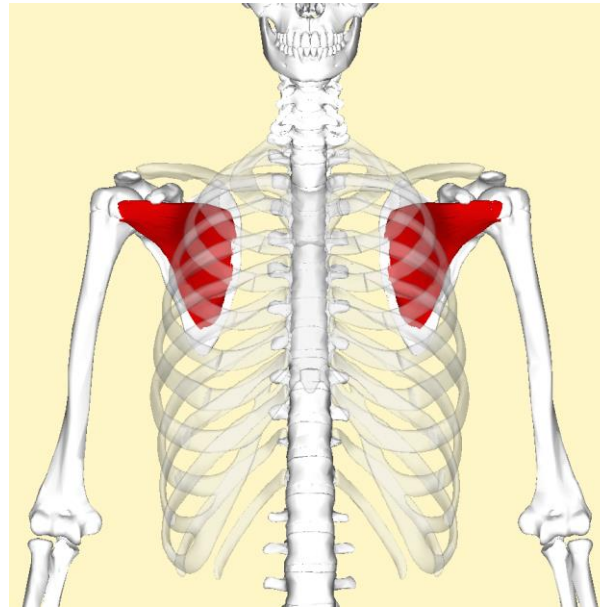
# Dislocation: Effect of Subscapularis Repair

Anatomical TSA



**Critical to stability<sup>5</sup>**

RTSA

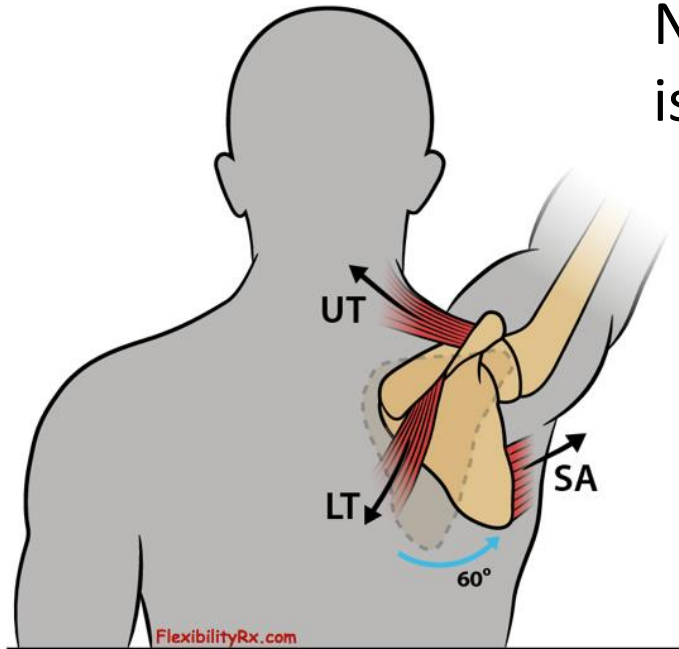


**Affect on stability is controversial: Risk<sup>6,7,8</sup> vs No Risk<sup>9</sup>**

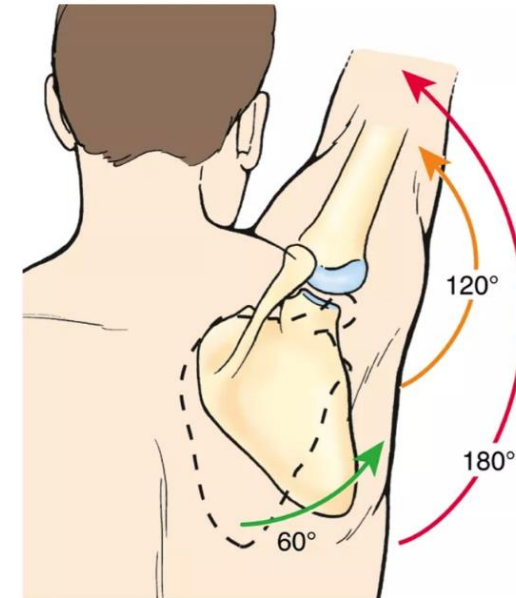


# Normal Scapulohumeral Rhythm

Normal SHR varies but is usually 2:1 to 3:1<sup>3</sup>



upward rotation: (UT) Upper Trap:  
(LT) Lower Trap: (SA) Serratus Anterior



(C) Scapulo-humeral rhythm. The scapula and humerus move in 1:2 ratio. When the arm is abducted 180 degrees, 60 degrees occurs by rotation of the scapula, and 120 degrees by rotation of the humerus at the shoulder joint.

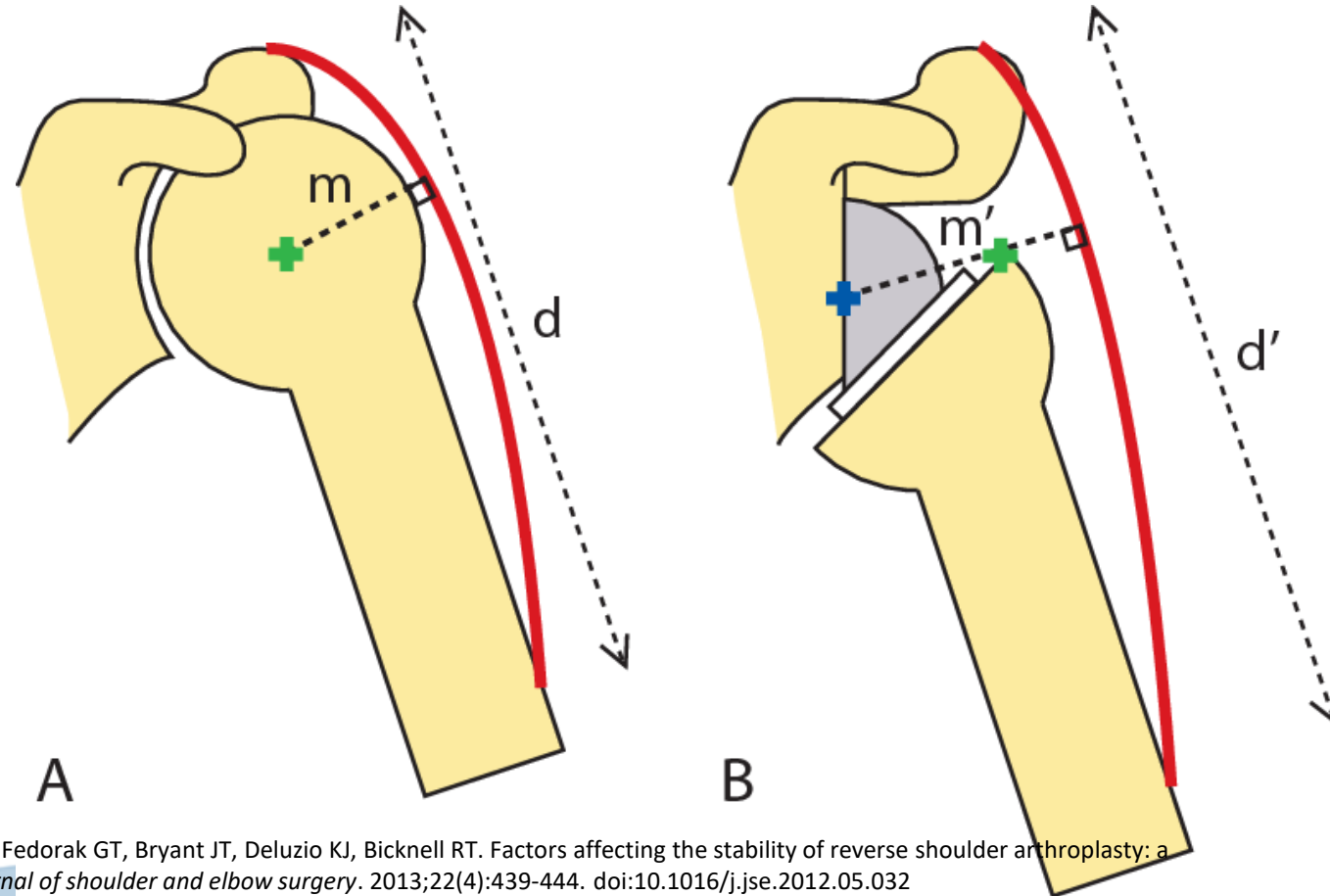
Pictures taken from internet October 2019



# RTSA Biomechanics<sup>4</sup>

- Center of rotation shifts medially
- Increases deltoid and pec major moment arms
- Increases torque
- Recruits more anterior and posterior deltoid fibers for flexion and abduction
- Deltoid can now initiate shoulder abd
- Teres minor stabilizes by counteracting deltoid shear<sup>1</sup>
- Some studies: SHR is less than normal: inc scapularthoracic contribution

# RTSA Biomechanics



Clouthier AL, Hetzler MA, Fedorak GT, Bryant JT, Deluzio KJ, Bicknell RT. Factors affecting the stability of reverse shoulder arthroplasty: a biomechanical study. *Journal of shoulder and elbow surgery*. 2013;22(4):439-444. doi:10.1016/j.jse.2012.05.032

## 4 Post Surgery Concerns

- Prosthesis protection from dislocation
- Acromial overload, stress reactions/fractures
- Comprise or tear supscap repair
- Periscapular fatigue

# Dislocation Studies

Risk factors for dislocation<sup>7,8</sup>

Between two studies: rates varied between 3 to 9.2 %

- BMI
- Male
- Subscapular insufficiency
- Revision surgery
- However, for RCA only 1%<sup>8</sup>
- Note: studies did not mention therapy/rehabilitation

# Concern: Dislocation

## Take home message:

- Conservative progression with high risks: BMI, male, revisions, subscap insufficiency
- Universal precaution of no HBB for 12 weeks
- Sling: varied from 0-4 and 0-6, one study said as needed
- Protocols vary regarding when to begin deltoid isometrics, AROM, PROM.
- Dr. Mitchell/Flatow protocol has more precautions listed (see below)

# Concern: Acromion and scap spine stress fx

- Stress fractures occurs in the acromion and scapular spine in 3.1% to 10%<sup>10</sup>
- RTSA: arm is longer by approx. 2.5 cm
- Inc the abductor moment arm in all three deltoid heads, thereby converting abduction to their primary function.



# Concern: Acromion and scap spine stress fx

## Principles of Osteoporosis Management (on Halogen)

- Fx every 20 sec, affects 55% of US population 50+ yo
- 1 of 3 woman and 1 of 5 men
- More prevalent than coronary HD, diabetes, HA, breast/uterine/ovarian CA

# Concern: Acromion and scap spine stress fx

## Principles of Osteoporosis Management (on Halogen)

- Diseases that inc risk (25 on list): hypo/hyper thyroid, eating disorders, mental illness, chronic inflammation, MS...
- Medications that inc risk (14 on list): corticosteroids, diuretics, heparin, methotrexate...
- Other risk factors: post menopausal, genetics, low wt <130#, over exerciser, sedentary, smoking, never having child, poor nutrition...



# Concern: Acromion and scap spine stress fx

- **Take home message**: know your pt's bones (osteoporosis?), pt education regarding no jerking/quick motions, progress with low wt and high reps with caution, assess signs of acrominal/scap stress and pain

# Concern: Protecting Subscapularis Repair

**\*\*Overall, no consensus on subscap protection post surgery<sup>11\*\*</sup>**

- Immediate rehabilitation vs 4 weeks (delayed PT) ↑ healing of subscap in delayed group 96% vs 81%
- Some studies recommended utilizing pulleys for AAOM. However, electromyographic studies have shown that seated pulley exercises are not truly passive
- Good agreement
  - the amount of shoulder ER ROM should be limited
  - AROM and resisted internal rotation exercises should be limited
  - Some authors suggested no ER past neutral, others to 30-40 degrees (which has shown higher rates of subscapularis complications).
- No consensus: ER ROM precautions in the first rehabilitation phase.
- No consensus: subscapularis isometrics start
- Romano et al no resisted IR until 2 months, and no PROM ER for 4 weeks.

# Concern: Protecting Subscapularis Repair

- **Take home message:**
  - Understand all surgical procedures done and shoulder history
  - Conservative if a lot of comorbidities.
  - Discuss with surgeon if concerned about given protocol
  - Talk to colleagues
  - Lots more research out there to view

# Concern: Periscapular fatigue

- SHR in RTSA increases load on periscapular musculature
- RTSA shoulders: avg 1.3:1<sup>4</sup>
- Young healthy shoulders avg 3:1 to 2.6:1<sup>3</sup>
- Causes periscap mm pain, subscap bursitis, AC joint pain, scap and acromion stress fx.
- **Take home message**: special attention to strengthening/coordination of scapularthoracic stabilizers and force couples, address trigger points and other myofascial restrictions

# A Systematic Review of Proposed Rehabilitation Guidelines Following Anatomic and Reverse Shoulder Arthroplasty<sup>11</sup> (May 2019)

- Published rehabilitation protocols, precautions, and clinical outcomes post TSA and RTSA
- Full search strategy is at [www.jospt.org](http://www.jospt.org)
- Data Extraction Two authors (J.K. and G.B.) collected and recorded data
- Risk-of-Bias Assessment Methodological risk of bias was assessed by 2 authors (J.K. and G.B.) independently. If consensus could not be reached, a third author (G.G.) arbitrated the final decision
- 6 studies were appropriate for RTSA, all were based upon expert opinion

# A Systematic Review of Proposed Rehabilitation Guidelines Following Anatomic and Reverse Shoulder Arthroplasty<sup>11</sup> (May 2019)

**TABLE 1**

**INCLUSION AND EXCLUSION CRITERIA**

<b>Key Concept</b>	<b>Inclusion Criteria</b>	<b>Exclusion Criteria</b>
Population	<ul style="list-style-type: none"> <li>• Glenohumeral joint osteoarthritis</li> <li>• Rotator cuff arthropathy</li> <li>• Rotator cuff deficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Humeral fracture</li> <li>• Osteonecrosis</li> <li>• Rheumatoid arthritis</li> <li>• Chronic dislocation</li> </ul>
Exposure	<ul style="list-style-type: none"> <li>• Primary TSA</li> <li>• Primary RTSA</li> </ul>	<ul style="list-style-type: none"> <li>• TSA revision</li> <li>• RTSA revision</li> <li>• Shoulder hemiarthroplasty</li> </ul>
Outcomes	<ul style="list-style-type: none"> <li>• Thoroughly reported rehabilitation protocols</li> <li>• Home-based therapy versus physical therapy</li> <li>• Biomechanical and tissue physiology rehabilitation concepts</li> </ul>	<ul style="list-style-type: none"> <li>• In situ or cadaveric studies</li> <li>• Biomechanical studies</li> <li>• Reported only complication</li> <li>• Reported only outcomes</li> </ul>

*Abbreviations: RTSA, reverse total shoulder arthroplasty; TSA, total shoulder arthroplasty.*

TABLE 4

## REHABILITATION GUIDELINES POST REVERSE TOTAL SHOULDER ARTHROPLASTY

Study	Slings	PROM	AROM	Resisted Exercise	Precaution
Boudreau et al <sup>7</sup>	0-4 wk	0-6 wk: elevation, 90°-120°; ER, 30° 6-12 wk: flexion and ER as tolerated 12-16 wk: all movements as tolerated	0-6 wk: elbow, wrist, and hand 6-12 wk: shoulder as tolerated • Rectangular Snip	0-6 wk: submaximal deltoid and scapular isometrics 6-12 wk: deltoid isometrics 12-16 wk: slow strength progression for deltoid and scapula 4+ mo: stretch and strengthen with maintenance programs	0-6 wk: avoid IR, adduction, and extension 6-12 wk: no adduction, IR, or extension 12-16 wk: do not exceed 1.4 kg, enforce good mechanics for elevation 4+ mo: 6.8 kg
Blacknall and Neumann <sup>3*</sup>	Comfort only	None	0-6 wk: assisted elevation to 90° and ER to 30° 6-12 wk: 0°-90° of active short level-arm flexion, inclined surface; progress to straight-arm flexion 12-16 wk: ROM as tolerated	0-3 wk: deltoid isometrics 3-6 wk: vigorous isometrics 6-12 wk: progress to isotonic as tolerated 12+ wk: progressive resistance	0-6 wk: avoid ER, IR, abduction, and extension
St Pierre and Frankle <sup>54</sup>	0-4 wk	0-6 wk: pendulums (supports for 2 wk, then unsupported) 6-12 wk: as tolerated 12-16 wk: as tolerated; add sleeper stretch	0-6 wk: elbow, wrist, and hand table slides for supported elevation and wand-assisted elevation in supine 12-16 wk: as tolerated	4-6 wk: shoulder isometrics, scapular musculature, and distal arm 6-10 wk: ER and IR 10 wk to 6 mo: weights to active exercise, wall push-ups, functional specificity	None
Romano et al <sup>46</sup> (group A) <sup>†</sup>	0-2 wk	0-12 wk: as tolerated	0-6 wk: flexion to 60°-120°, ER to 20°-30° 6+ wk: as tolerated	0-6 wk: deltoid and scapular isometrics 6-12 wk: deltoid and scapular musculature using elastic band	0-6 wk: if subscapularis repaired, then no ER PROM for 4 wk and no resisted IR for 2 mo
Romano et al <sup>46</sup> (group C) <sup>†</sup>	0-4 wk	0-12 wk: as tolerated	0-6 wk: flexion to 60°-120°, ER to 20°-30° 6+ wk: as tolerated	0-6 wk: deltoid and scapular isometrics 4 wk: begin AROM exercises 8 wk: deltoid and scapular musculature using elastic band	0-6 wk: if subscapularis repaired, then no ER PROM for 4 wk and no resisted IR for 2 mo
Wolff and Rosenzweig <sup>60</sup>	2-6 wk	0-6 wk: no PROM 6+ wk: as tolerated	Not reported	6-12 wk: deltoid and scapular strength progression: isometric to isotonic	0-6 wk: avoid IR, adduction, and extension 6-12 wk: continue avoiding adduction, IR, and extension 4+ mo: 6.8 kg

Abbreviations: AROM, active range of motion; ER, external rotation; IR, internal rotation; PROM, passive range of motion; ROM, range of motion.

\*Time frames do not apply; progression is strictly criterion dependent.

<sup>†</sup>Differentiated progression into group A (cuff tear arthropathy, primary osteoarthritis cuff deficiency with pseudoparalysis), group B (all others not in A or C), and group C (rheumatoid arthritis, fracture).

# RTSA Protocol Systematic Review

## Precautions

### Weeks 0-6

- 3 studies recommended avoiding shoulder internal rotation, adduction, and extension<sup>11</sup>
- 1 study required that individuals with a subscapularis repair limit shoulder external rotation for 4 weeks and perform no active shoulder internal rotation for 8 weeks.

### Weeks 6-12

- 2 studies continue to limit shoulder internal rotation, shoulder adduction, and extension.

### Weeks 12+

- Boudreau et al no lifting more than 1.4 kg (3 lbs)
- Two studies had lifelong precautions limiting patients to lifting no more than 6.8 kg (15 lbs) with the surgical arm



# Dr Mitchell/Dr Evan Flatow

Sling	PROM	AAROM	AROM	Resisted Ex	Precautions
<p>0-4 wk day + night</p> <p>0-6 wk day</p> <p>6+ wks wear out in crowds</p>	<p>3-6 wk supine fwd and scap elv to 120, ER in scap plane</p> <p>6-8 wk IR to &lt;50 in scap plane</p> <p>6-8 wk gentle gh, scap mobs if indicated</p>	<p>0-1 wk Pendulum, Supine ER (varies, will be specified), supine Fwd elv (varies, will be specified), scap retraction</p>	<p>6+ wk can lift coffee cup only in fwd flx, begin ADLs, possibly drive</p> <p>6-8 wk AROM (supine progress stnding) flx and scaption, IR and ER in scap plane</p>	<p>1-6 wks sub max deltoid isom in scap plane.</p> <p>3-6 wk resisted elbow, wrist, hand</p> <p>6-8 wk sub max IR/ER isometrics, supine rhythmic stabs</p> <p>8 wk isotonic deltoid, periscapular ex</p> <p>9-12 wk resisted flx/scaption w light bands start in beach chair and IR/ER in sidelying w light bands</p> <p>**bands preferred over wts due to ease of control</p>	<p>0-12 wk No sh ext past neutral and no HBB</p> <p>0-6 wk no lifting, no ADLs</p> <p>6+ wk can lift coffee cup only in fwd flx, begin ADLs, possibly drive</p> <p>12+wk no lifting &gt;5#, keep wts in front of body, no jerking motion, *DC: 80-120 elevation, ER 30, painfree AROM w proper mechanics</p>

## Other Sources of Protocols

- Surgeons are putting protocols on internet
  - Cleveland Shoulder Institute  
<https://www.youtube.com/watch?v=8y0AM9HM9qo>
  - St Pierre and Frankle promoted surgeon-directed rehabilitation for patients with exercises performed at home using web-based videos. (St Pierre P, Frankle M. Shoulder rehabilitation: is there a role for home therapy? In: Bennett JP, ed. Physical Therapy: Theory, Practices and Benefits. New York, NY: Nova Science Publishers; 2011:109-126.)

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# Reverse Total Shoulder Arthroplasty Variations in Post Op Protocols

Anna Dennis DPT GCS OCS Cert DN

VH Rehab Symposium

October 18, 2019

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# Factors affecting outcomes

## Factors affecting outcome

- Pre-existing pathology, implant design/placement, quality of remaining soft tissue, quality of rehab, compliance with rehab<sup>1</sup>
- Soft tissue tension which is set by the surgeon by placement of prosthesis<sup>1</sup>



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# Great YouTube of RTSA Surgery



Reverse Total Shoulder Arthroplasty - YouTube.  
[https://www.youtube.com/watch?v=bLI0tzWnE6o&t=2866s&has\\_verified=1](https://www.youtube.com/watch?v=bLI0tzWnE6o&t=2866s&has_verified=1). Accessed September 29, 2019.

Reverse Total Shoulder Arthroplasty

33,477 views • Mar 16, 2016

👍 211    💬 16    ➦ SHARE    ⌵ SAVE    ⋮

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- Acromial and scapular spine fracture, hematoma, infection, instability/dislocation, mechanical baseplate failure, neurological injury, periprosthetic fracture and scapular notching.

# Current controversies in RTSA

- Optimal baseplate positioning, humeral neck-shaft angle (135° versus 155°), glenosphere placement (medial, lateral or bony increased offset RTSA), polyethylene wear, and subscapularis repair<sup>2</sup>
- Post op protocol agreements

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- Rhomboids, trapezius, serratus anterior, levator scapula,

Axiohumeral group: originate on thorax and insert on humerus

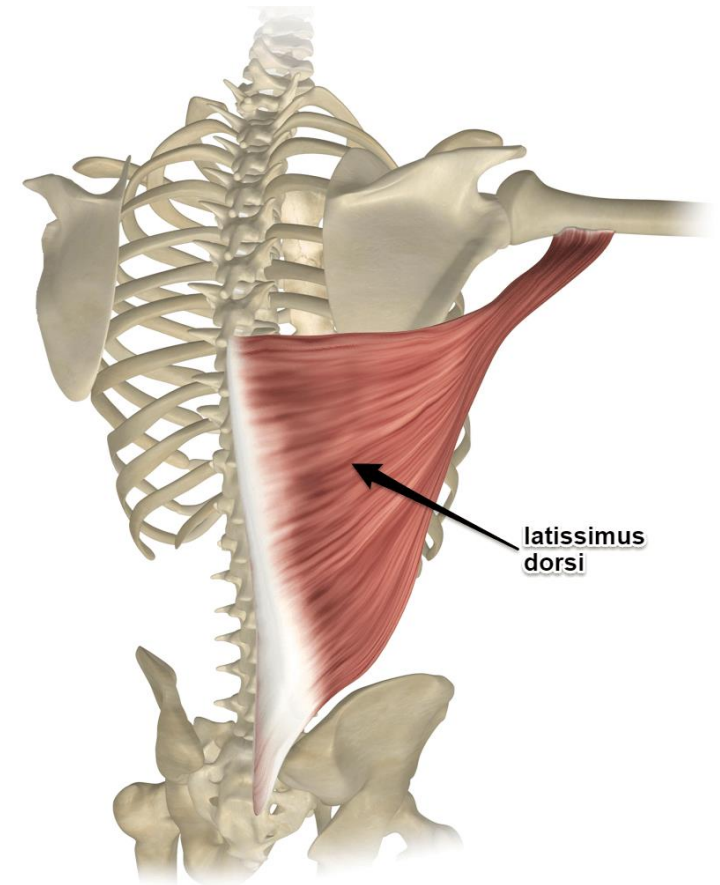
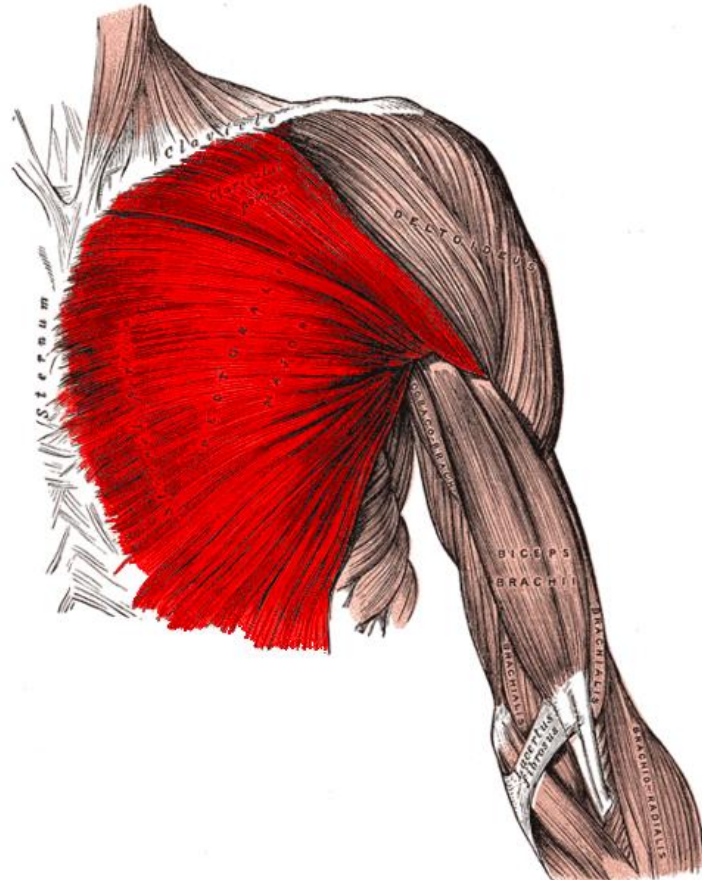
- Latissimus dorsi and pec major

# Normal shoulder biomechanics

- Deltoid muscle is the primary abductor of the arm with supraspinatus helping with initiation
- Rotator cuff muscles compress the humeral head in the glenoid fossa for stability<sup>1</sup>



# GH Joint: Prime Movers of Humerus

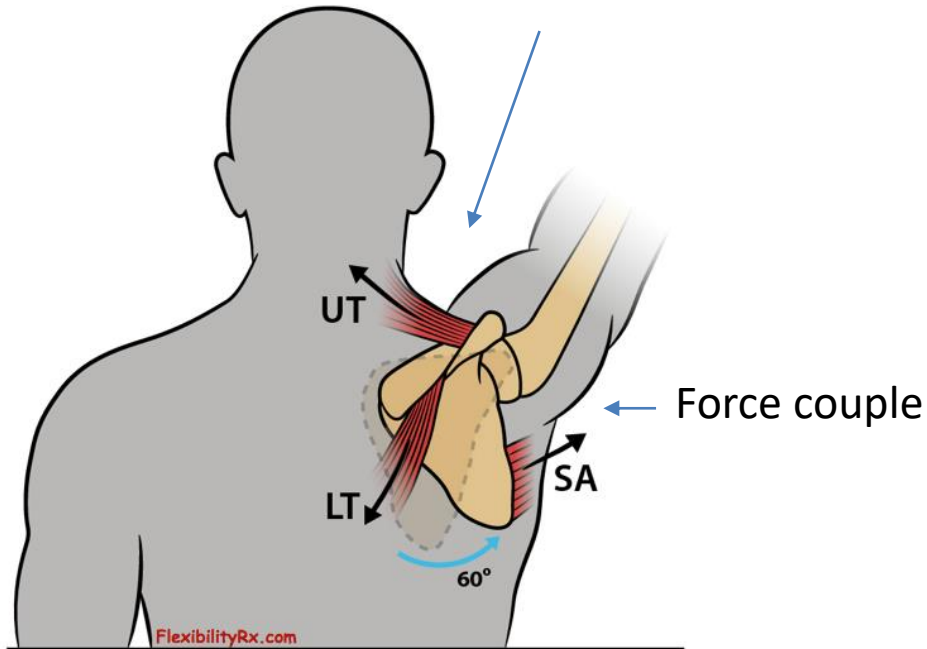


Pictures taken from internet October 2019



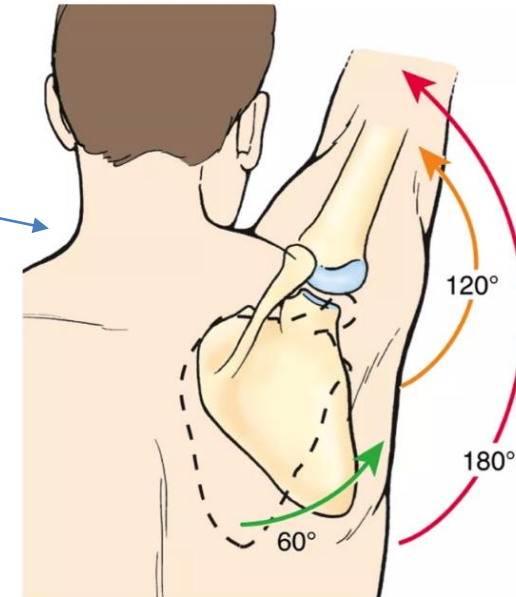
# Scapulothoracic Movers

Movers are force couples



upward rotation: (UT) Upper Trap:  
(LT) Lower Trap: (SA) Serratus Anterior

SHR



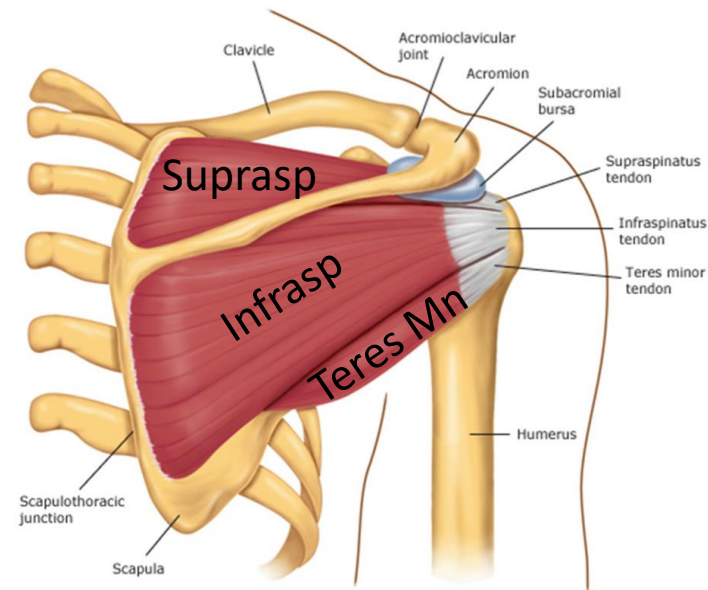
(C) Scapulo-humeral rhythm. The scapula and humerus move in 1:2 ratio. When the arm is abducted 180 degrees, 60 degrees occurs by rotation of the scapula, and 120 degrees by rotation of the humerus at the shoulder joint.

Pictures taken from internet October 2019

# Stabilizers of GH Joint: Rotator Cuff



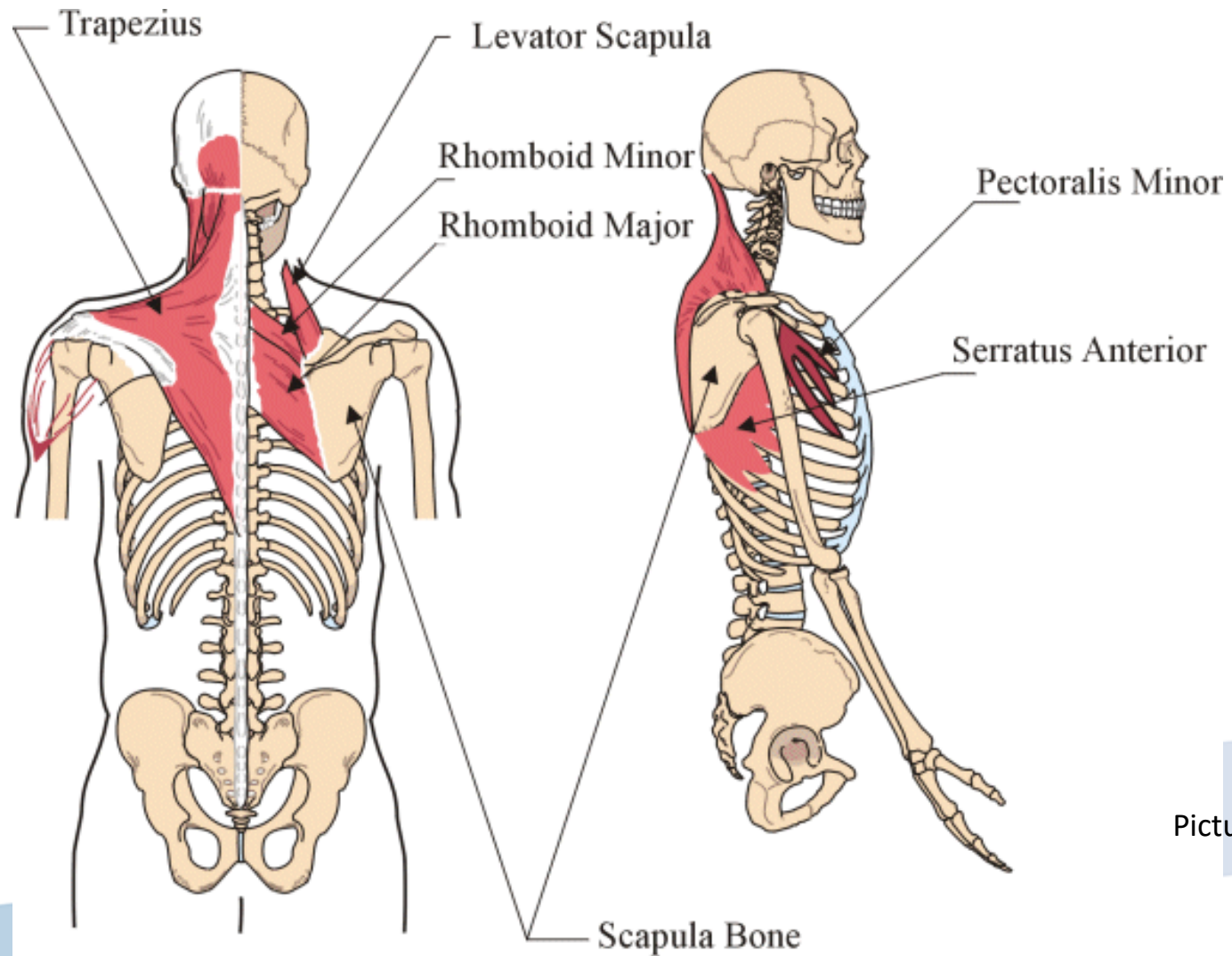
Anterior



Posterior

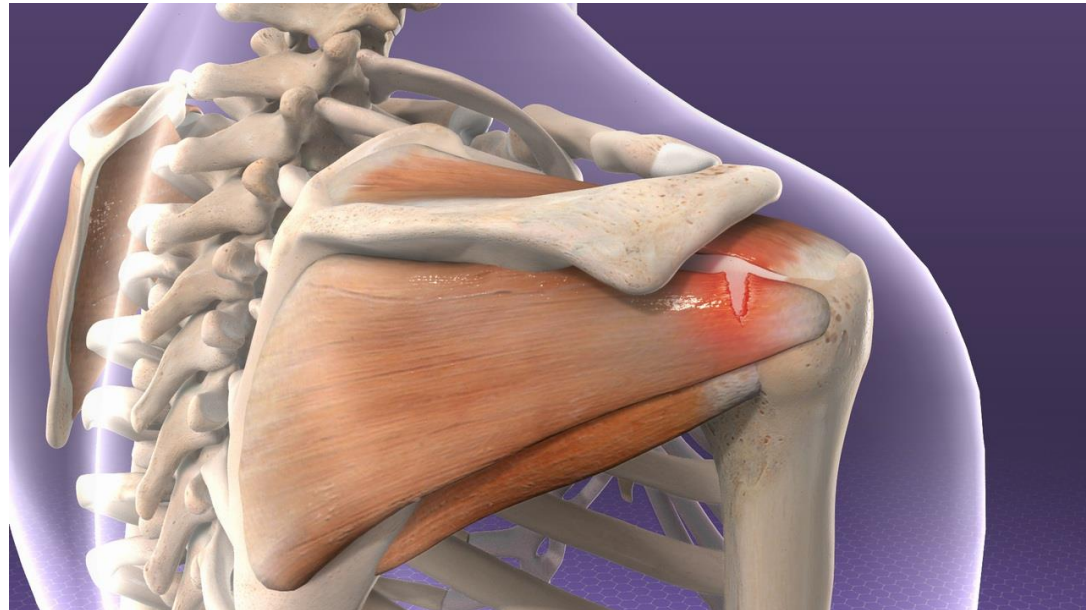
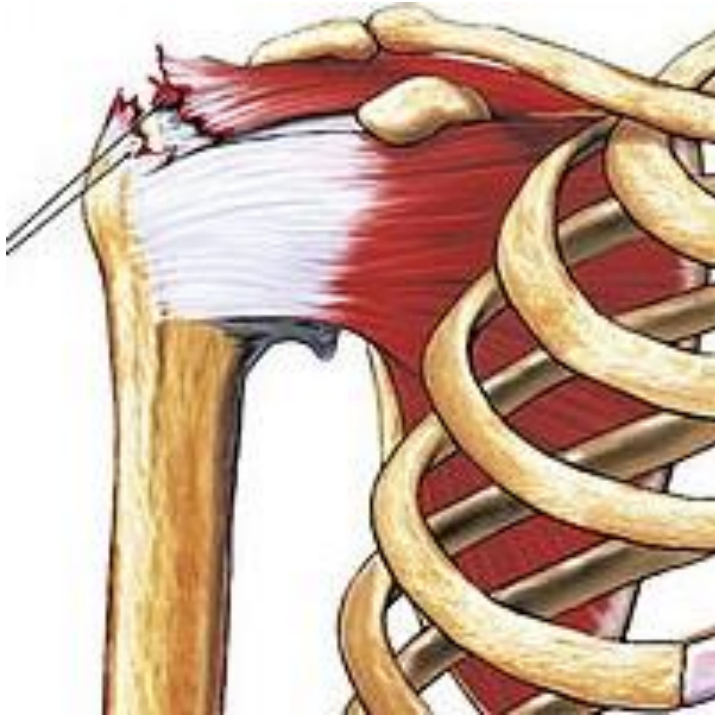
Pictures taken from internet October 2019

# Scapular Stabilizers



Pictures taken from internet October 2019

# Rotator Cuff Tears



Rotator Cuff Tear. Newport Orthopedic Institute. <https://www.newportortho.com/Orthopedic-Services/Shoulder/Shoulder-Injuries-Conditions/Rotator-Cuff-Tear.aspx>. Accessed October 9, 2019.

Picture taken from internet October 2019

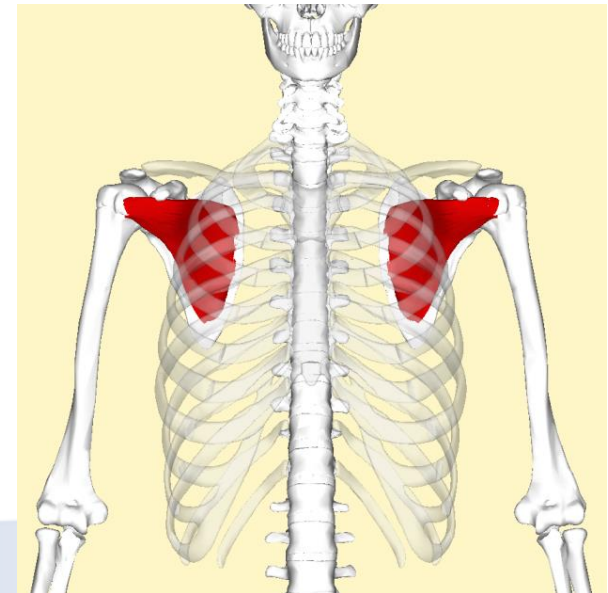


# Subscapularis

- Largest and most powerful RC, internally rotates GH joint
- Protects from anterior translation of humeral head
- Allows you to hold items and hug



Pictures taken from internet October 2019

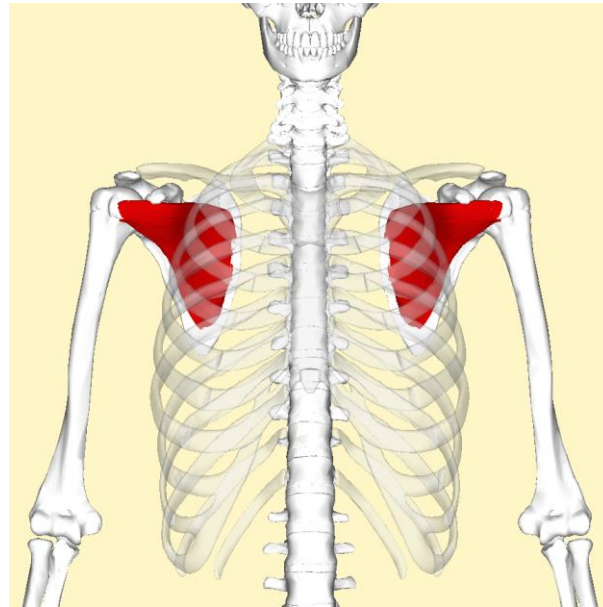


# Dislocation: Effect of Subscapularis Repair

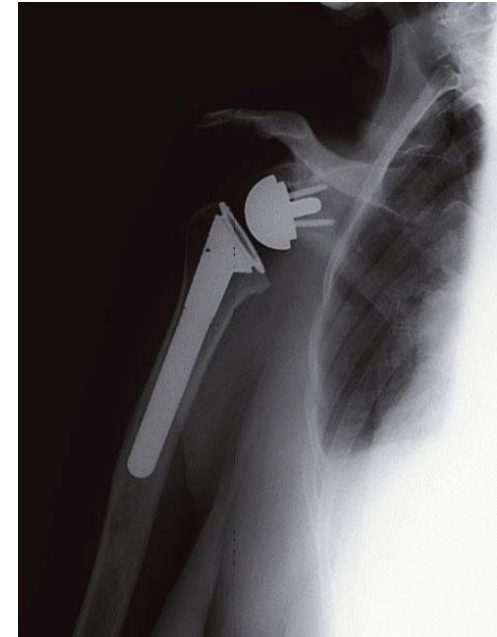
Anatomical TSA



Critical to stability<sup>5</sup>



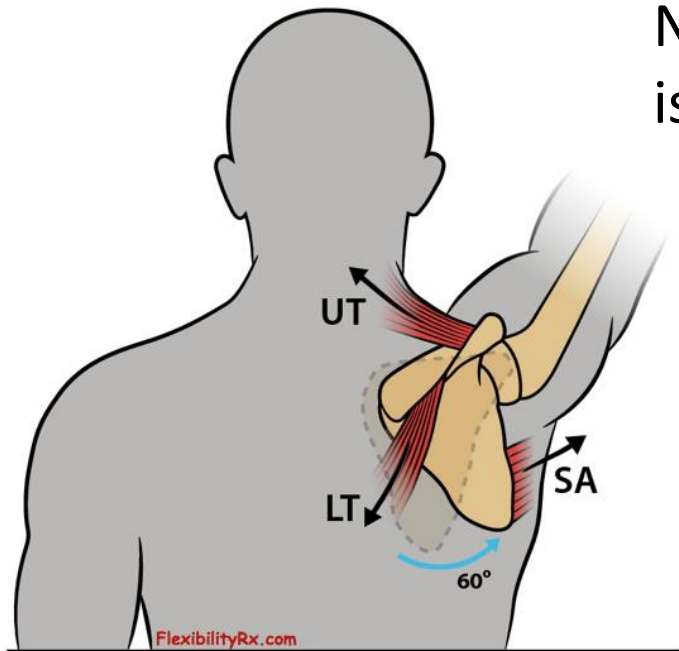
RTSA



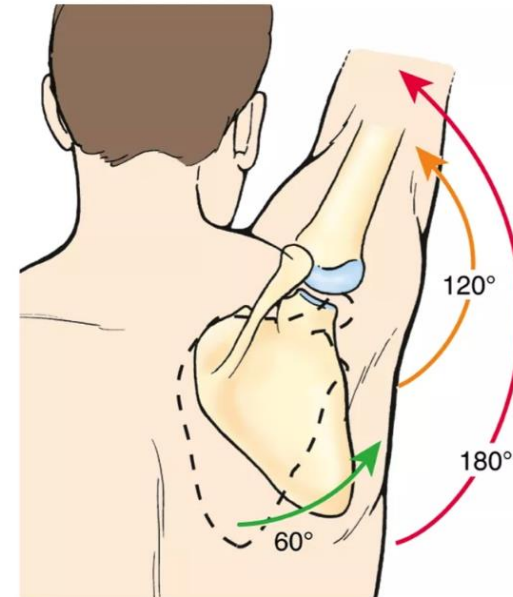
Affect on stability is controversial: Risk<sup>6,7,8</sup> vs No Risk<sup>9</sup>

# Normal Scapulohumeral Rhythm

Normal SHR varies but is usually 2:1 to 3:1<sup>3</sup>



upward rotation: (UT) Upper Trap:  
(LT) Lower Trap: (SA) Serratus Anterior



(C) Scapulo-humeral rhythm. The scapula and humerus move in 1:2 ratio. When the arm is abducted 180 degrees, 60 degrees occurs by rotation of the scapula, and 120 degrees by rotation of the humerus at the shoulder joint.

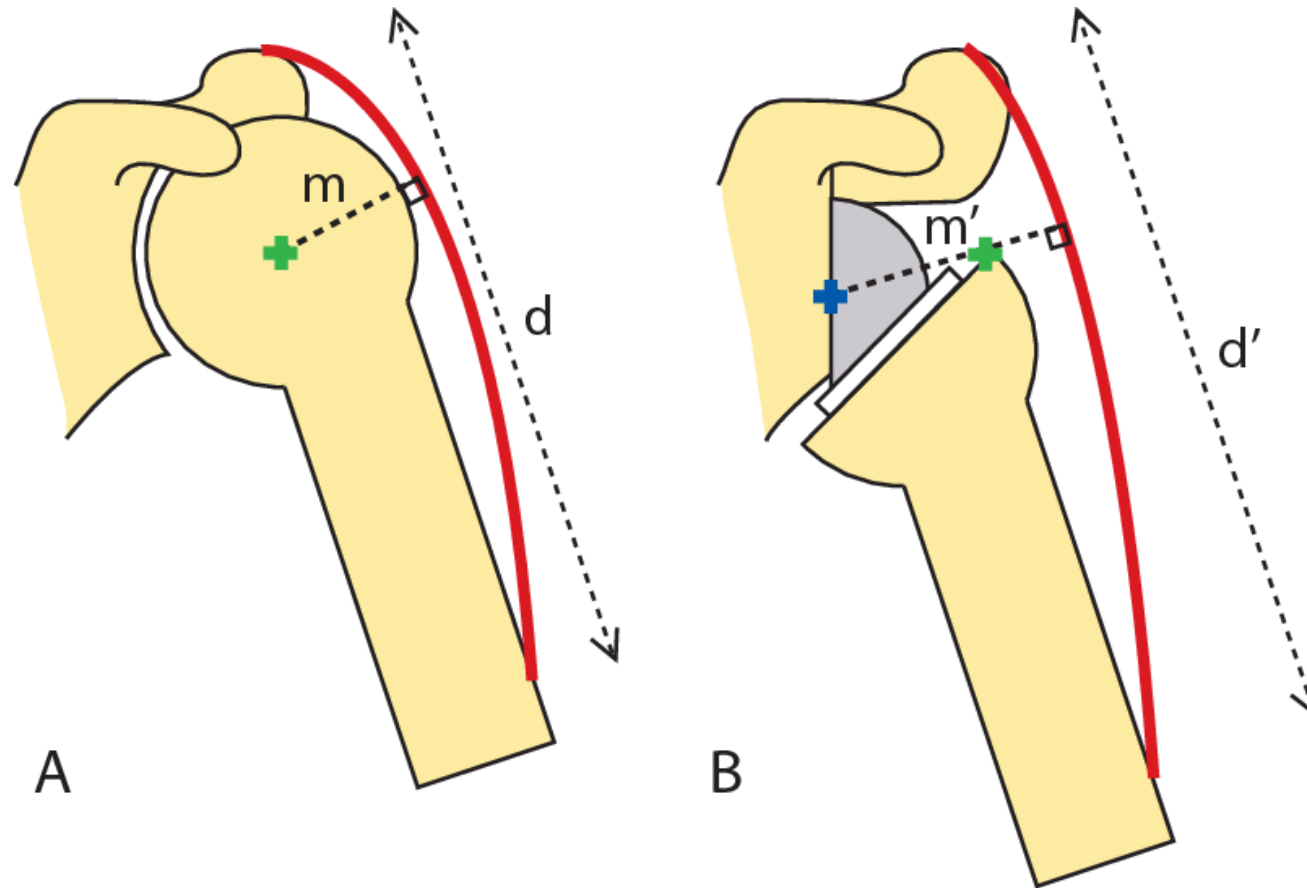
Pictures taken from internet October 2019

# RTSA Biomechanics<sup>4</sup>

- Center of rotation shifts medially
- Increases deltoid and pec major moment arms
- Increases torque
- Recruits more anterior and posterior deltoid fibers for flexion and abduction
- Deltoid can now initiate shoulder abd
- Teres minor stabilizes by counteracting deltoid shear<sup>1</sup>
- Some studies: SHR is less than normal: inc scapularthoracic contribution



# RTSA Biomechanics



Clouthier AL, Hetzler MA, Fedorak GT, Bryant JT, Deluzio KJ, Bicknell RT. Factors affecting the stability of reverse shoulder arthroplasty: a biomechanical study. *Journal of shoulder and elbow surgery*. 2013;22(4):439-444. doi:10.1016/j.jse.2012.05.032

## 4 Post Surgery Concerns

- Prosthesis protection from dislocation
- Acromial overload, stress reactions/fractures
- Comprise or tear supscap repair
- Periscapular fatigue

# Dislocation Studies

Risk factors for dislocation<sup>7,8</sup>

Between two studies: rates varied between 3 to 9.2 %

- BMI
- Male
- Subscapular insufficiency
- Revision surgery
- However, for RCA only 1%<sup>8</sup>
- Note: studies did not mention therapy/rehabilitation

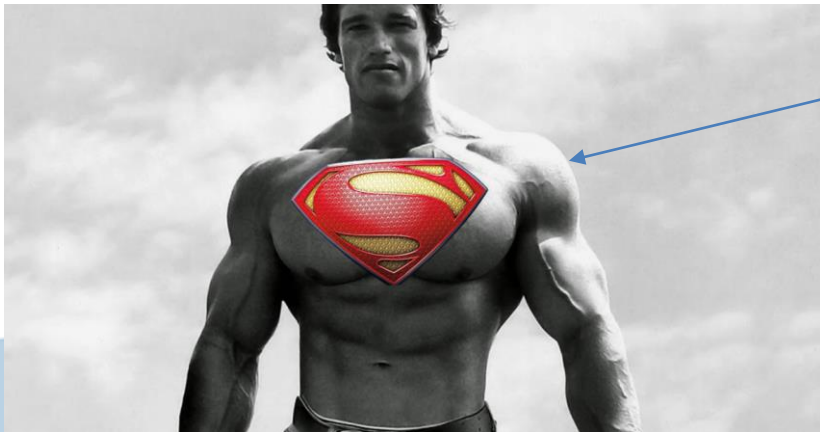
# Concern: Dislocation

## Take home message:

- Conservative progression with high risks: BMI, male, revisions, subscap insufficiency
- Universal precaution of no HBB for 12 weeks
- Sling: varied from 0-4 and 0-6, one study said as needed
- Protocols vary regarding when to begin deltoid isometrics, AROM, PROM.
- Dr. Mitchell/Flatow protocol has more precautions listed (see below)

# Concern: Acromion and scap spine stress fx

- Stress fractures occurs in the acromion and scapular spine in 3.1% to 10%<sup>10</sup>
- RTSA: arm is longer by approx. 2.5 cm
- Inc the abductor moment arm in all three deltoid heads, thereby converting abduction to their primary function.



# Concern: Acromion and scap spine stress fx

## Principles of Osteoporosis Management (on Halogen)

- Fx every 20 sec, affects 55% of US population 50+ yo
- 1 of 3 woman and 1 of 5 men
- More prevalent than coronary HD, diabetes, HA, breast/uterine/ovarian CA

# Concern: Acromion and scap spine stress fx

## Principles of Osteoporosis Management (on Halogen)

- Diseases that inc risk (25 on list): hypo/hyper thyroid, eating disorders, mental illness, chronic inflammation, MS...
- Medications that inc risk (14 on list): corticosteroids, diuretics, heparin, methotrexate...
- Other risk factors: post menopausal, genetics, low wt <130#, over exerciser, sedentary, smoking, never having child, poor nutrition...

# Concern: Acromion and scap spine stress fx

- **Take home message:** know your pt's bones (osteoporosis?), pt education regarding no jerking/quick motions, progress with low wt and high reps with caution, assess signs of acrominal/scap stress and pain



# Concern: Protecting Subscapularis Repair

**\*\*Overall, no consensus on subscap protection post surgery<sup>11\*\*</sup>**

- Immediate rehabilitation vs 4 weeks (delayed PT) ↑ healing of subscap in delayed group 96% vs 81%
- Some studies recommended utilizing pulleys for AAOM. However, electromyographic studies have shown that seated pulley exercises are not truly passive
- Good agreement
  - the amount of shoulder ER ROM should be limited
  - AROM and resisted internal rotation exercises should be limited
  - Some authors suggested no ER past neutral, others to 30-40 degrees (which has shown higher rates of subscapularis complications).
- No consensus: ER ROM precautions in the first rehabilitation phase.
- No consensus: subscapularis isometrics start
- Romano et al no resisted IR until 2 months, and no PROM ER for 4 weeks.

# Concern: Protecting Subscapularis Repair

- **Take home message:**
  - Understand all surgical procedures done and shoulder history
  - Conservative if a lot of comorbidities.
  - Discuss with surgeon if concerned about given protocol
  - Talk to colleagues
  - Lots more research out there to view

# Concern: Periscapular fatigue

- SHR in RTSA increases load on periscapular musculature
- RTSA shoulders: avg 1.3:1<sup>4</sup>
- Young healthy shoulders avg 3:1 to 2.6:1<sup>3</sup>
- Causes periscap mm pain, subscap bursitis, AC joint pain, scap and acromion stress fx.
- **Take home message**: special attention to strengthening/coordination of scapularthoracic stabilizers and force couples, address trigger points and other myofascial restrictions

# A Systematic Review of Proposed Rehabilitation Guidelines Following Anatomic and Reverse Shoulder Arthroplasty<sup>11</sup> (May 2019)

- Published rehabilitation protocols, precautions, and clinical outcomes post TSA and RTSA
- Full search strategy is at [www.jospt.org](http://www.jospt.org)
- Data Extraction Two authors (J.K. and G.B.) collected and recorded data
- Risk-of-Bias Assessment Methodological risk of bias was assessed by 2 authors (J.K. and G.B.) independently. If consensus could not be reached, a third author (G.G.) arbitrated the final decision
- 6 studies were appropriate for RTSA, all were based upon expert opinion

# A Systematic Review of Proposed Rehabilitation Guidelines Following Anatomic and Reverse Shoulder Arthroplasty<sup>11</sup> (May 2019)

**TABLE 1**

**INCLUSION AND EXCLUSION CRITERIA**

<b>Key Concept</b>	<b>Inclusion Criteria</b>	<b>Exclusion Criteria</b>
Population	<ul style="list-style-type: none"> <li>• Glenohumeral joint osteoarthritis</li> <li>• Rotator cuff arthropathy</li> <li>• Rotator cuff deficiency</li> </ul>	<ul style="list-style-type: none"> <li>• Humeral fracture</li> <li>• Osteonecrosis</li> <li>• Rheumatoid arthritis</li> <li>• Chronic dislocation</li> </ul>
Exposure	<ul style="list-style-type: none"> <li>• Primary TSA</li> <li>• Primary RTSA</li> </ul>	<ul style="list-style-type: none"> <li>• TSA revision</li> <li>• RTSA revision</li> <li>• Shoulder hemiarthroplasty</li> </ul>
Outcomes	<ul style="list-style-type: none"> <li>• Thoroughly reported rehabilitation protocols</li> <li>• Home-based therapy versus physical therapy</li> <li>• Biomechanical and tissue physiology rehabilitation concepts</li> </ul>	<ul style="list-style-type: none"> <li>• In situ or cadaveric studies</li> <li>• Biomechanical studies</li> <li>• Reported only complication</li> <li>• Reported only outcomes</li> </ul>

*Abbreviations: RTSA, reverse total shoulder arthroplasty; TSA, total shoulder arthroplasty.*

TABLE 4

## REHABILITATION GUIDELINES POST REVERSE TOTAL SHOULDER ARTHROPLASTY

Study	Slings	PROM	AROM	Resisted Exercise	Precaution
Boudreau et al <sup>7</sup>	0-4 wk	0-6 wk: elevation, 90°-120°; ER, 30° 6-12 wk: flexion and ER as tolerated 12-16 wk: all movements as tolerated	0-6 wk: elbow, wrist, and hand 6-12 wk: shoulder as tolerated ● Rectangular Snip	0-6 wk: submaximal deltoid and scapular isometrics 6-12 wk: deltoid isometrics 12-16 wk: slow strength progression for deltoid and scapula 4+ mo: stretch and strengthen with maintenance programs	0-6 wk: avoid IR, adduction, and extension 6-12 wk: no adduction, IR, or extension 12-16 wk: do not exceed 1.4 kg, enforce good mechanics for elevation 4+ mo: 6.8 kg
Blacknall and Neumann <sup>3*</sup>	Comfort only	None	0-6 wk: assisted elevation to 90° and ER to 30° 6-12 wk: 0°-90° of active short level-arm flexion, inclined surface; progress to straight-arm flexion 12-16 wk: ROM as tolerated	0-3 wk: deltoid isometrics 3-6 wk: vigorous isometrics 6-12 wk: progress to isotonic as tolerated 12+ wk: progressive resistance	0-6 wk: avoid ER, IR, abduction, and extension
St Pierre and Frankle <sup>54</sup>	0-4 wk	0-6 wk: pendulums (supports for 2 wk, then unsupported) 6-12 wk: as tolerated 12-16 wk: as tolerated; add sleeper stretch	0-6 wk: elbow, wrist, and hand table slides for supported elevation and wand-assisted elevation in supine 12-16 wk: as tolerated	4-6 wk: shoulder isometrics, scapular musculature, and distal arm 6-10 wk: ER and IR 10 wk to 6 mo: weights to active exercise, wall push-ups, functional specificity	None
Romano et al <sup>46</sup> (group A) <sup>†</sup>	0-2 wk	0-12 wk: as tolerated	0-6 wk: flexion to 60°-120°, ER to 20°-30° 6+ wk: as tolerated	0-6 wk: deltoid and scapular isometrics 6-12 wk: deltoid and scapular musculature using elastic band	0-6 wk: if subscapularis repaired, then no ER PROM for 4 wk and no resisted IR for 2 mo
Romano et al <sup>46</sup> (group C) <sup>†</sup>	0-4 wk	0-12 wk: as tolerated	0-6 wk: flexion to 60°-120°, ER to 20°-30° 6+ wk: as tolerated	0-6 wk: deltoid and scapular isometrics 4 wk: begin AROM exercises 8 wk: deltoid and scapular musculature using elastic band	0-6 wk: if subscapularis repaired, then no ER PROM for 4 wk and no resisted IR for 2 mo
Wolff and Rosenzweig <sup>60</sup>	2-6 wk	0-6 wk: no PROM 6+ wk: as tolerated	Not reported	6-12 wk: deltoid and scapular strength progression: isometric to isotonic	0-6 wk: avoid IR, adduction, and extension 6-12 wk: continue avoiding adduction, IR, and extension 4+ mo: 6.8 kg

Abbreviations: AROM, active range of motion; ER, external rotation; IR, internal rotation; PROM, passive range of motion; ROM, range of motion.

\*Time frames do not apply; progression is strictly criterion dependent.

<sup>†</sup>Differentiated progression into group A (cuff tear arthropathy, primary osteoarthritis cuff deficiency with pseudoparalysis), group B (all others not in A or C), and group C (rheumatoid arthritis, fracture).

# RTSA Protocol Systematic Review Precautions

## Weeks 0-6

- 3 studies recommended avoiding shoulder internal rotation, adduction, and extension<sup>11</sup>
- 1 study required that individuals with a subscapularis repair limit shoulder external rotation for 4 weeks and perform no active shoulder internal rotation for 8 weeks.

## Weeks 6-12

- 2 studies continue to limit shoulder internal rotation, shoulder adduction, and extension.

## Weeks 12+

- Boudreau et al no lifting more than 1.4 kg (3 lbs)
- Two studies had lifelong precautions limiting patients to lifting no more than 6.8 kg (15 lbs) with the surgical arm

# Dr Mitchell/Dr Evan Flatow

Sling	PROM	AAROM	AROM	Resisted Ex	Precautions
0-4 wk day + night 0-6 wk day 6+ wks wear out in crowds	3-6 wk supine fwd and scap elv to 120, ER in scap plane 6-8 wk IR to <50 in scap plane 6-8 wk gentle gh, scap mobs if indicated	0-1 wk Pendulum, Supine ER (varies, will be specified), supine Fwd elv (varies, will be specified), scap retraction	6+ wk can lift coffee cup only in fwd flx, begin ADLs, possibly drive 6-8 wk AROM (supine progress stnding) flx and scaption, IR and ER in scap plane	1-6 wks sub max deltoid isom in scap plane. 3-6 wk resisted elbow, wrist, hand 6-8 wk sub max IR/ER isometrics, supine rhythmic stabs 8 wk isotonic deltoid, periscapular ex 9-12 wk resisted flx/scaption w light bands start in beach chair and IR/ER in sidelying w light bands **bands preferred over wts due to ease of control	0-12 wk No sh ext past neutral and no HBB 0-6 wk no lifting, no ADLs 6+ wk can lift coffee cup only in fwd flx, begin ADLs, possibly drive 12+wk no lifting >5#, keep wts in front of body, no jerking motion, *DC: 80-120 elevation, ER 30, painfree AROM w proper mechanics



## Other Sources of Protocols

- Surgeons are putting protocols on internet
  - Cleveland Shoulder Institute  
<https://www.youtube.com/watch?v=8y0AM9HM9qo>
  - St Pierre and Frankle promoted surgeon-directed rehabilitation for patients with exercises performed at home using web-based videos. (St Pierre P, Frankle M. Shoulder rehabilitation: is there a role for home therapy? In: Bennett JP, ed. Physical Therapy: Theory, Practices and Benefits. New York, NY: Nova Science Publishers; 2011:109-126.)

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# Questions?

