Reversed prosthesis (RSA) - when and what are the implications for physiotherapy pre- and post op.

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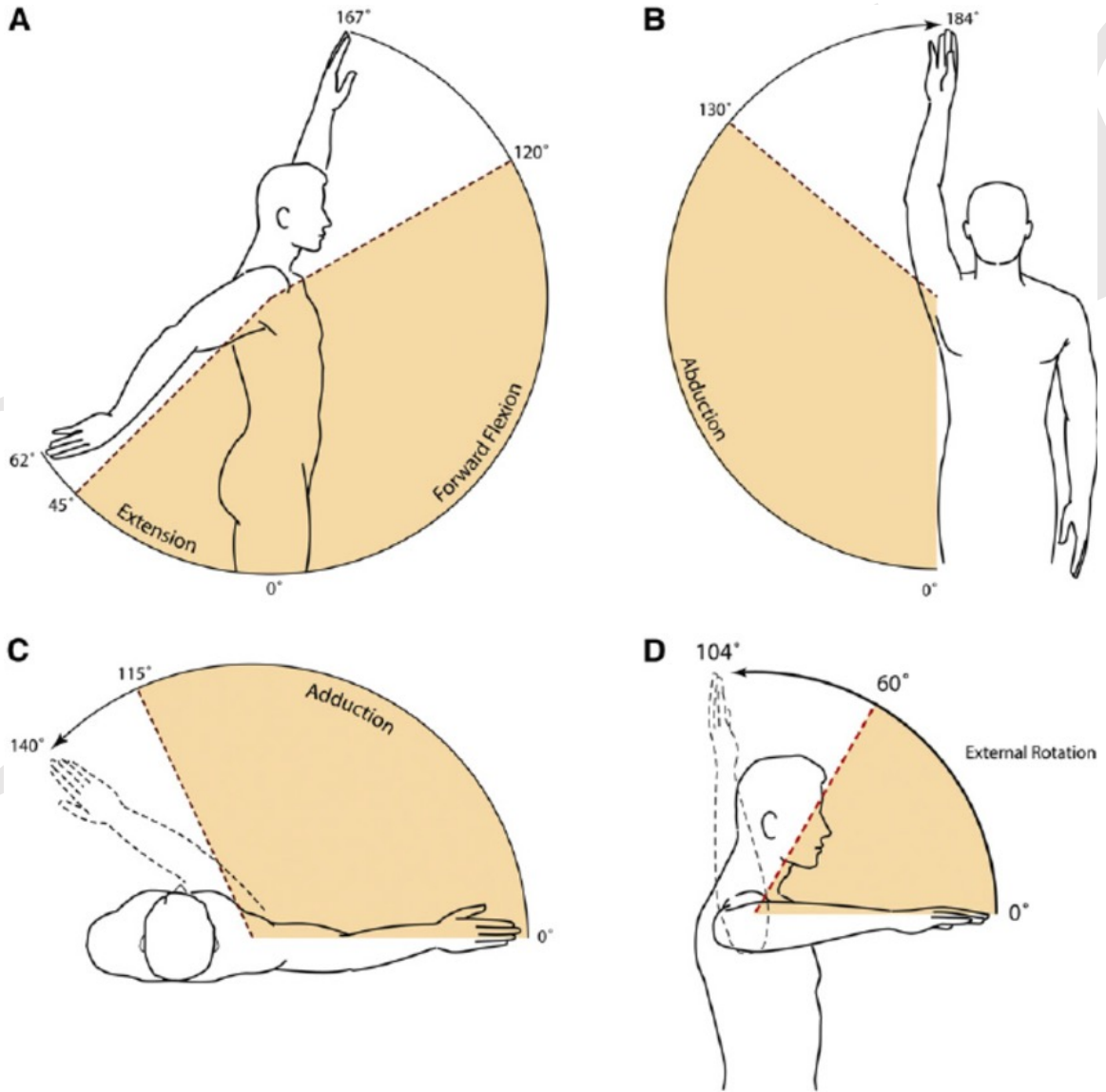
Sahlgrenska University Hospital

Gothenburg, Sweden

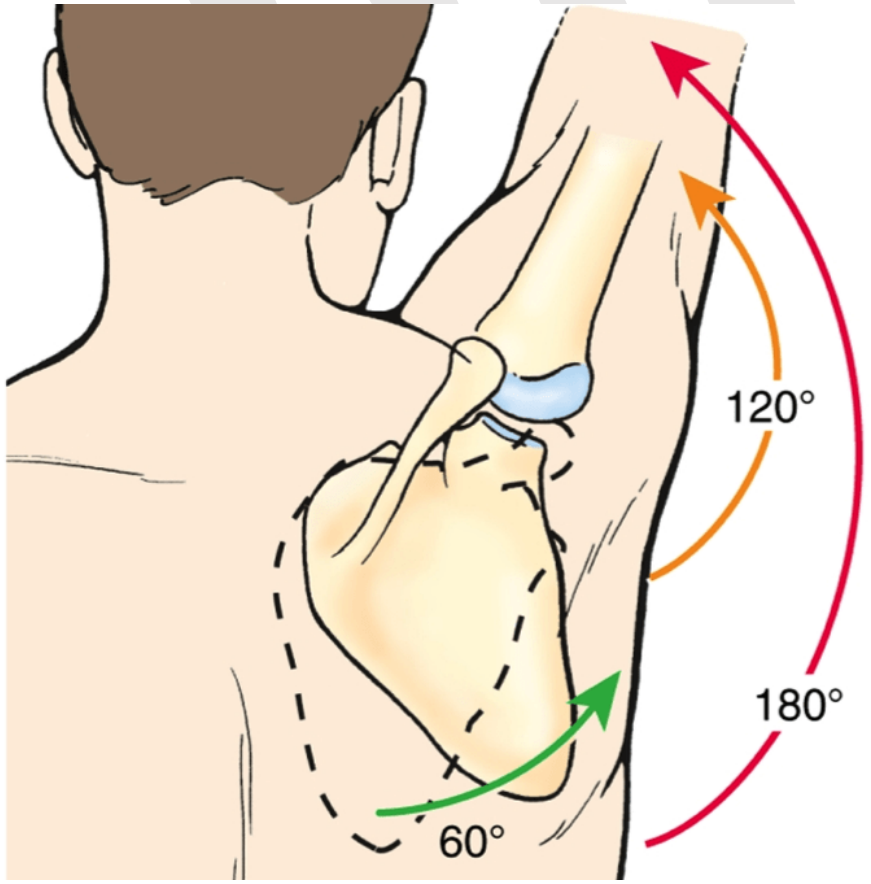
Eusser, Poznan, 2021

“Perfect compromise between stability and mobility”



Scapulohumeral rythm

- 1/3 thoracoscapular
- 2/3 glenohumeral

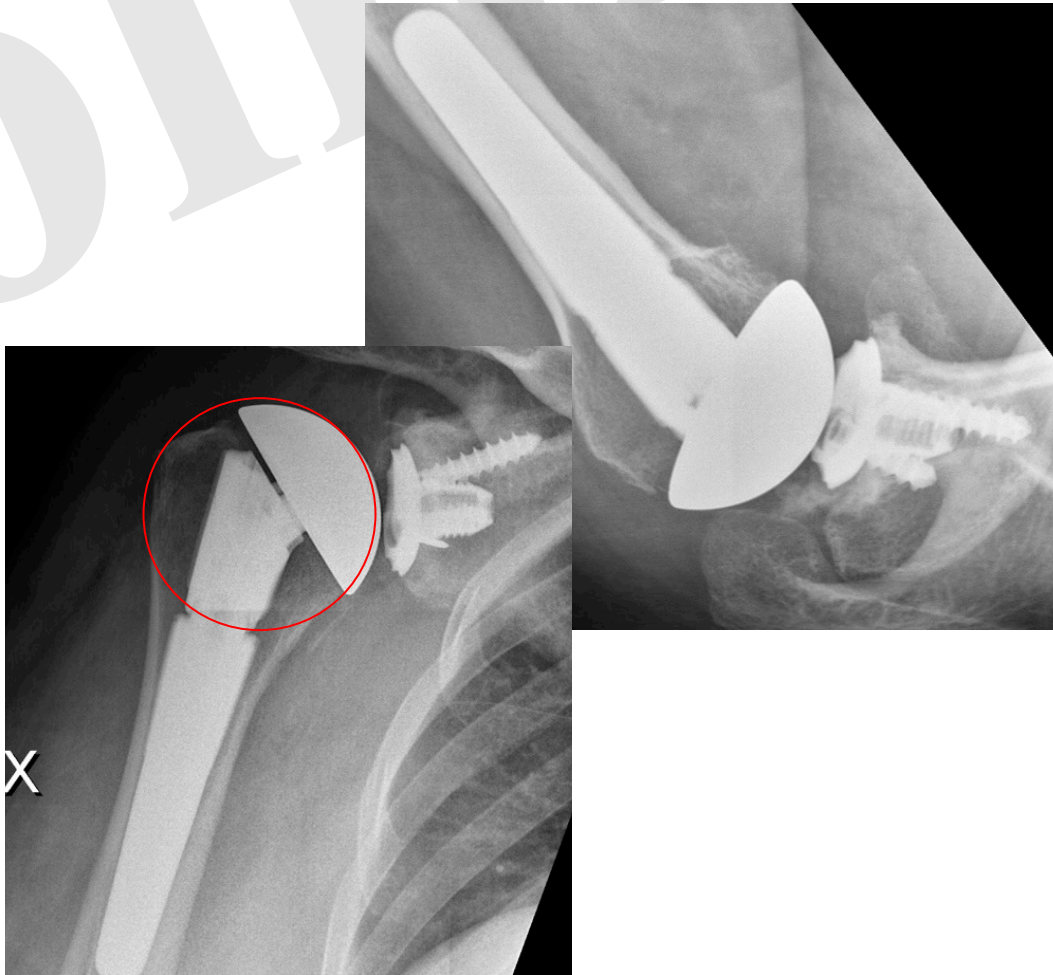


Anatomical shoulder arthroplasty

Indications:

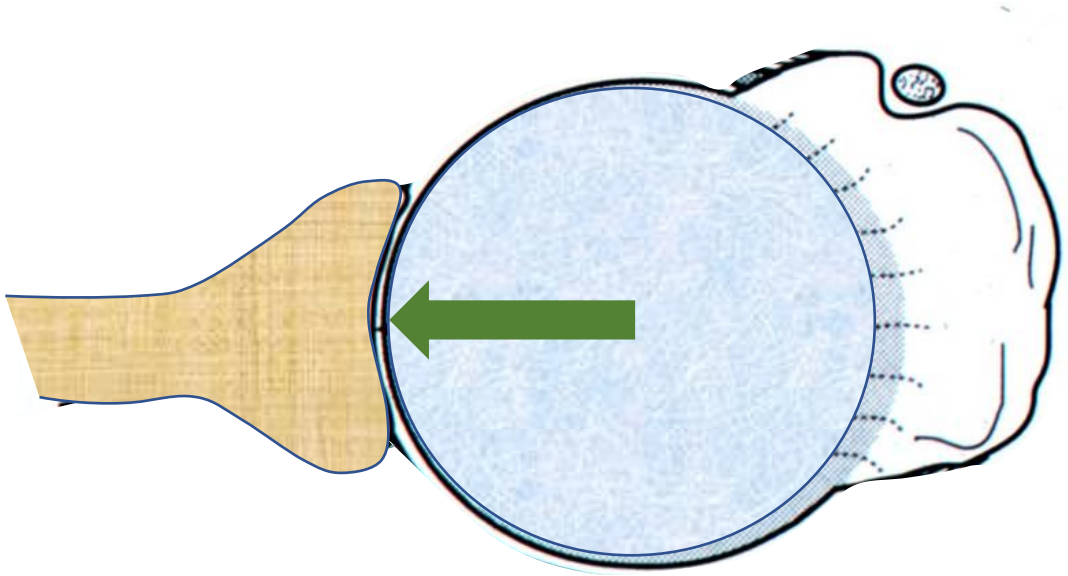
- Pain that can be treated with TSA
- Worn/injured articular surfaces

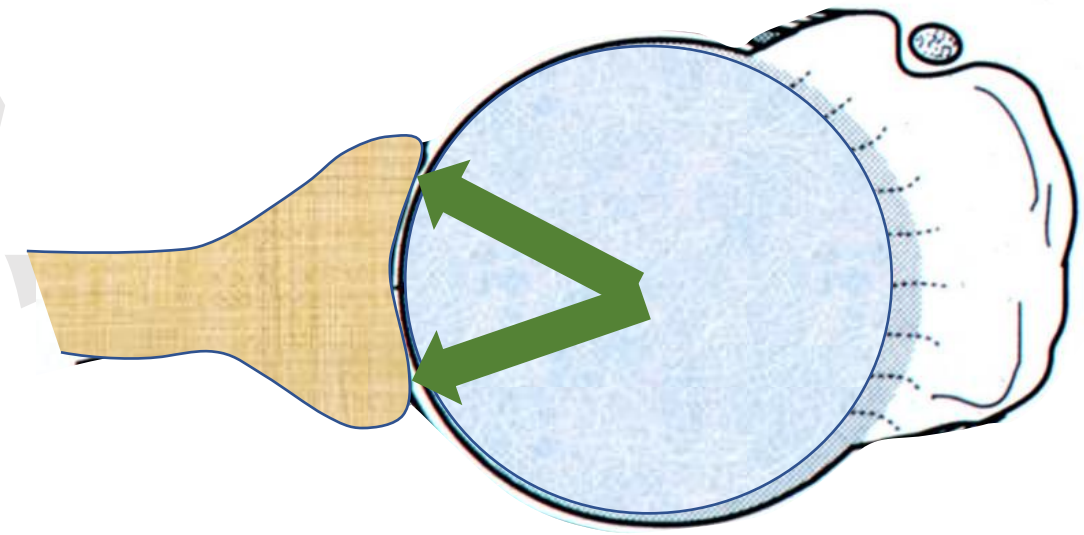
- Possible to restore anatomy
- Including stability, rotator cuff function, soft tissue balance etc



Concavity - compression

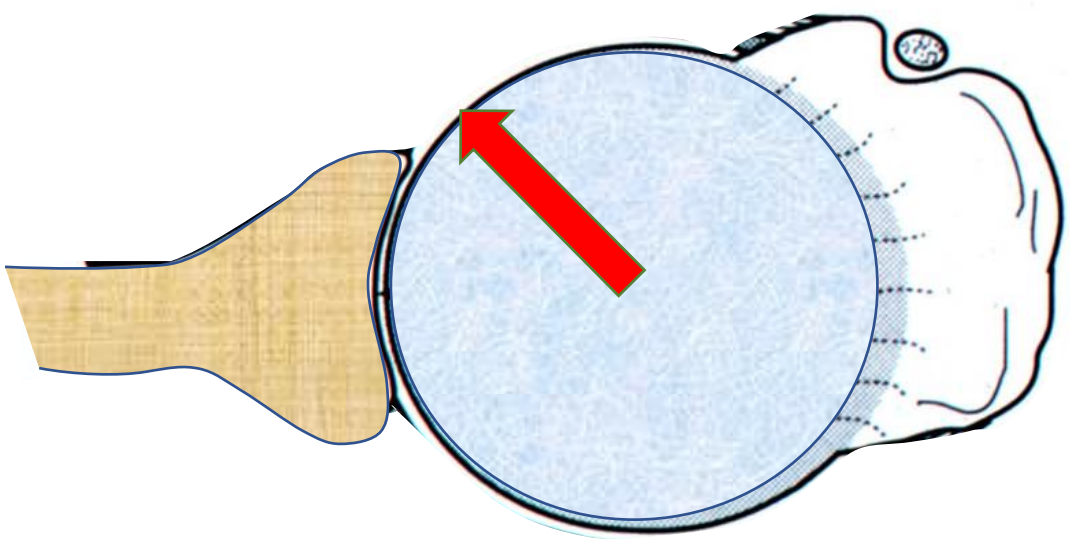
Anatomy

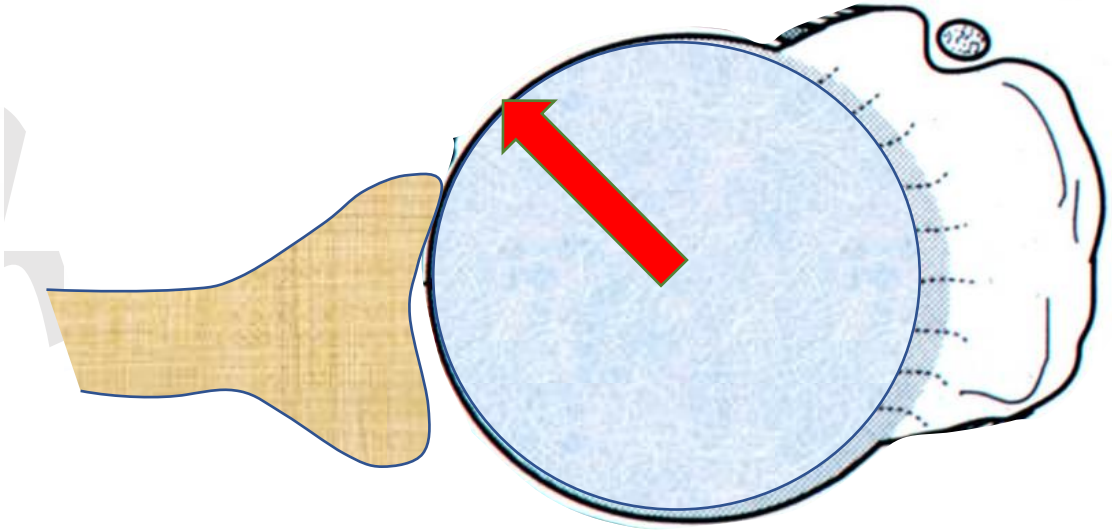




As long as the combined force vector stays within the glenoid – the shoulder is stable

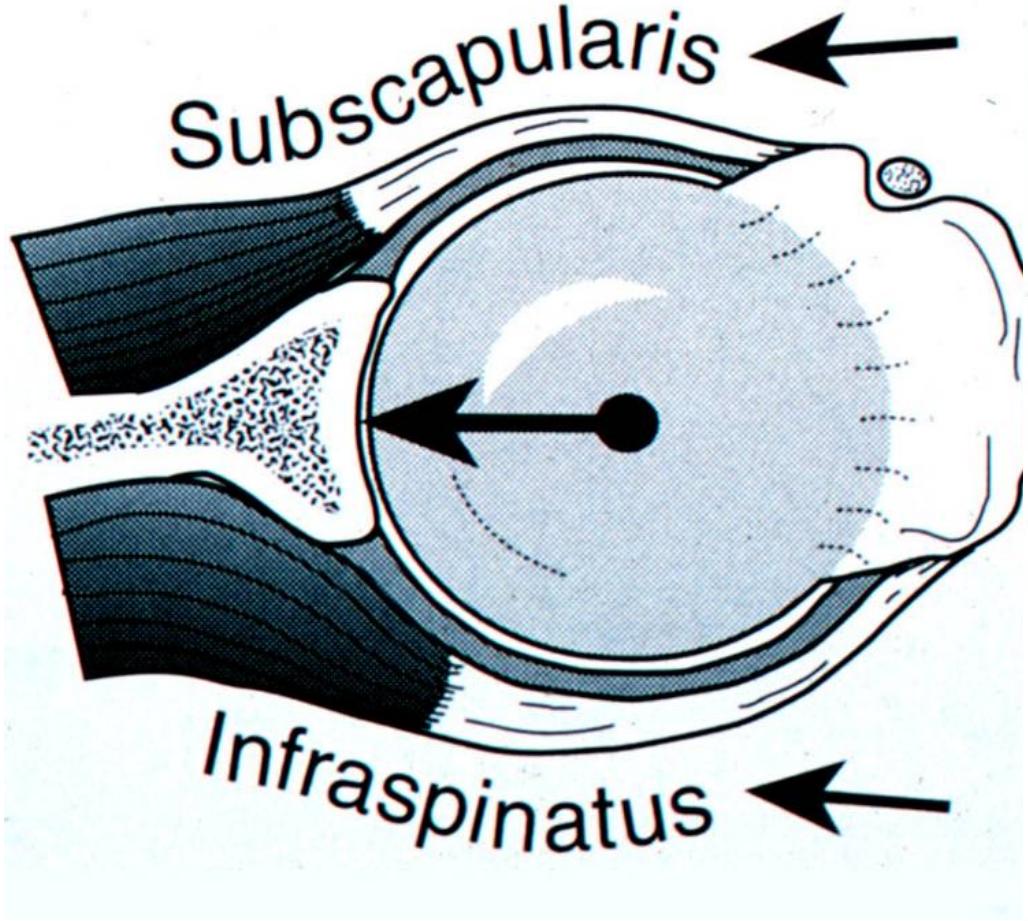
Anatomy

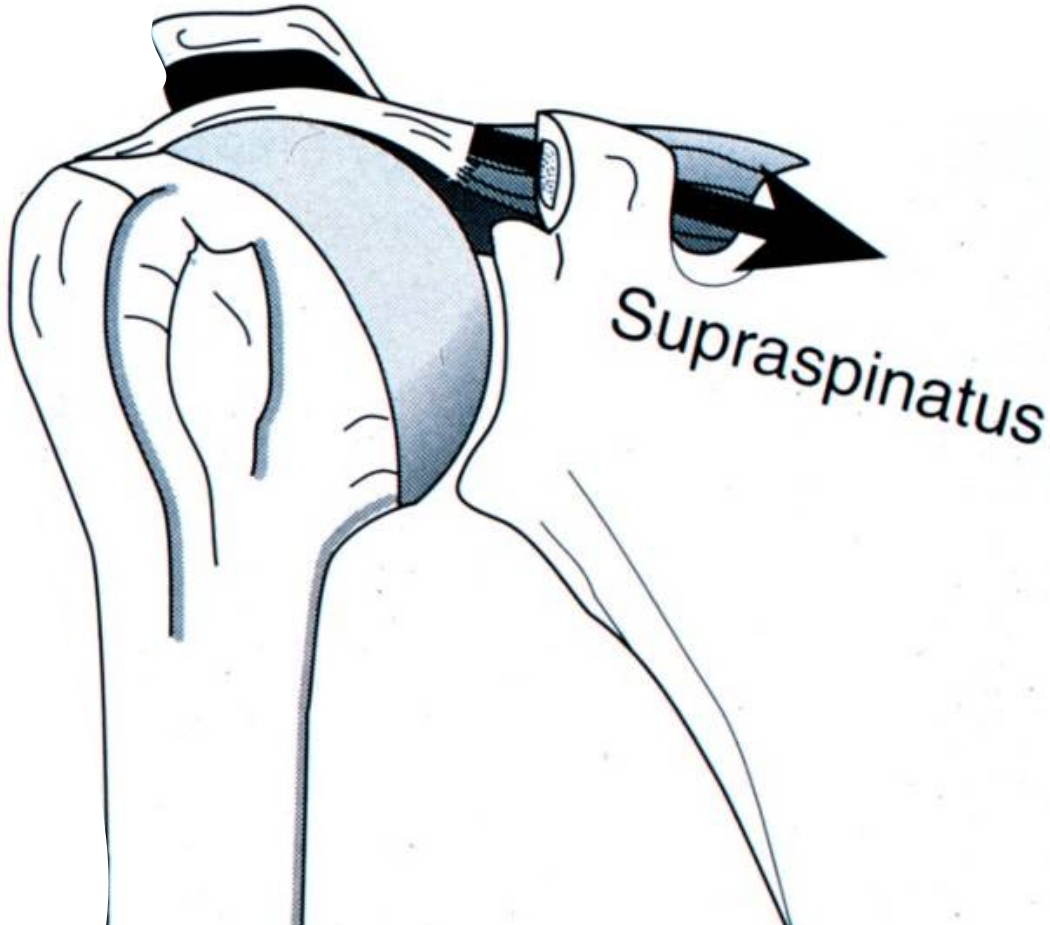




Whenever the combined force vector points outside the glenoid
- The shoulder starts its path to dislocation

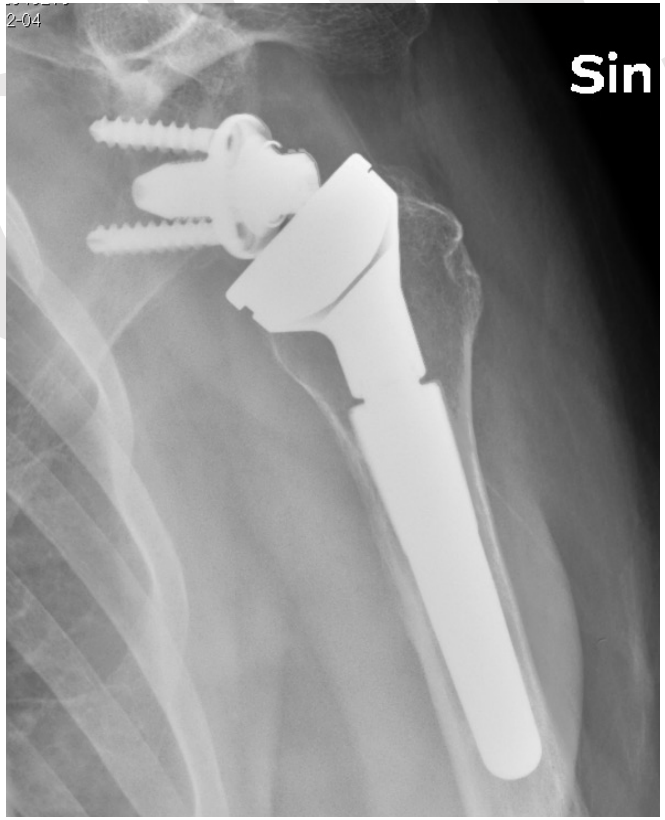
Rotator cuff – the good force



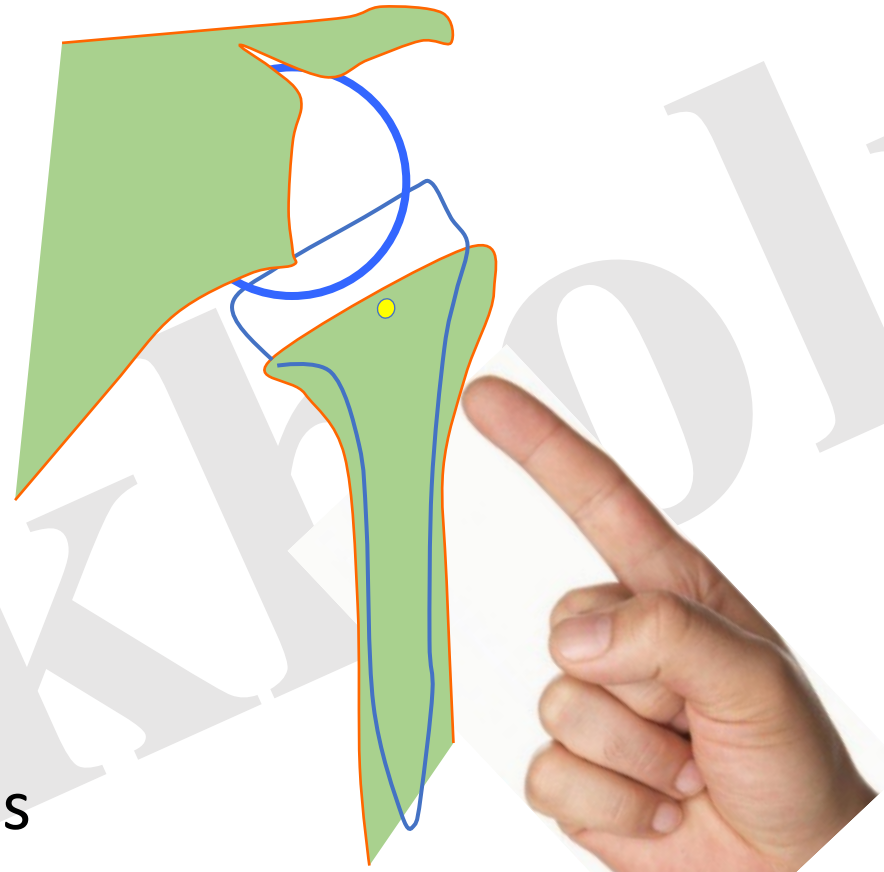


Failed cuff

Failed cuff – revised to reverse arthroplasty

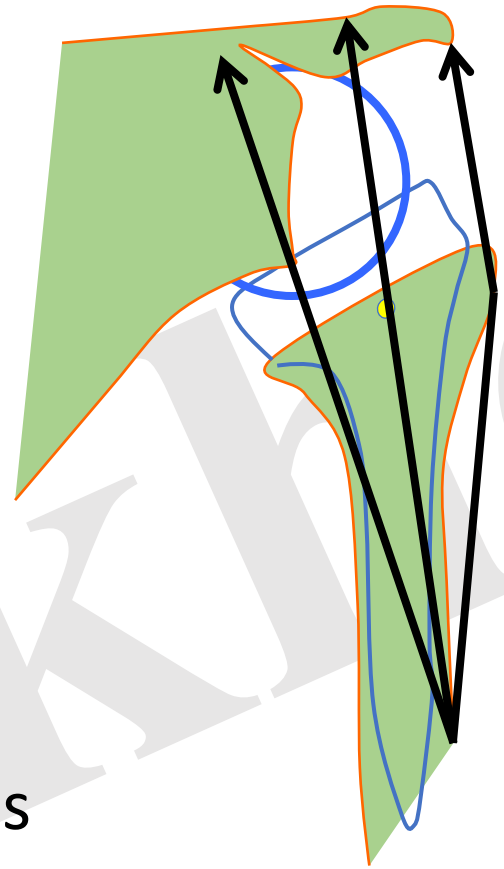


Reverse shoulder arthroplasty



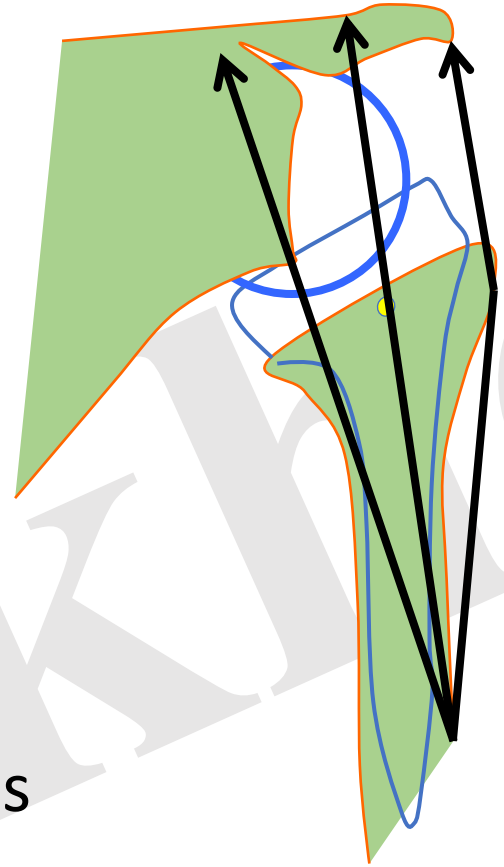
- Ball and socket joint
- Muscle tension maintains congruency

Reverse shoulder arthroplasty



- Ball and socket joint
- Muscle tension maintains congruency
- Completely deltoid dependent

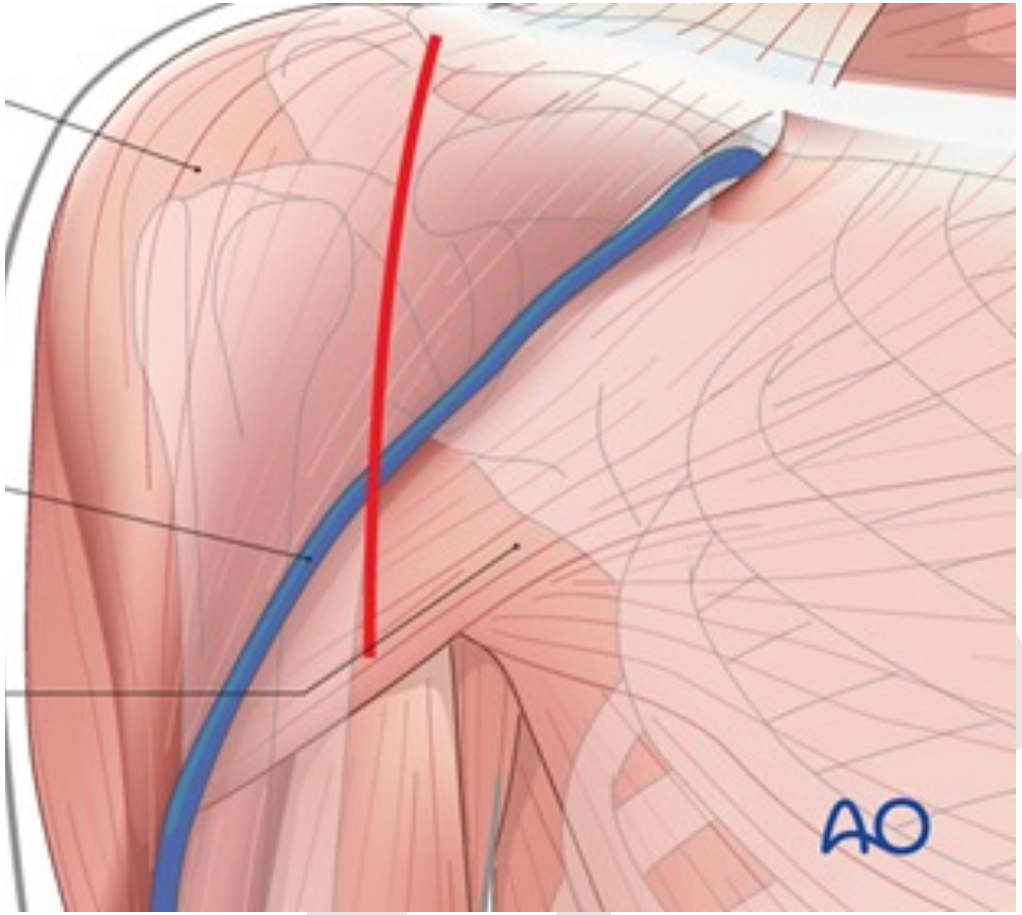
Reverse shoulder arthroplasty

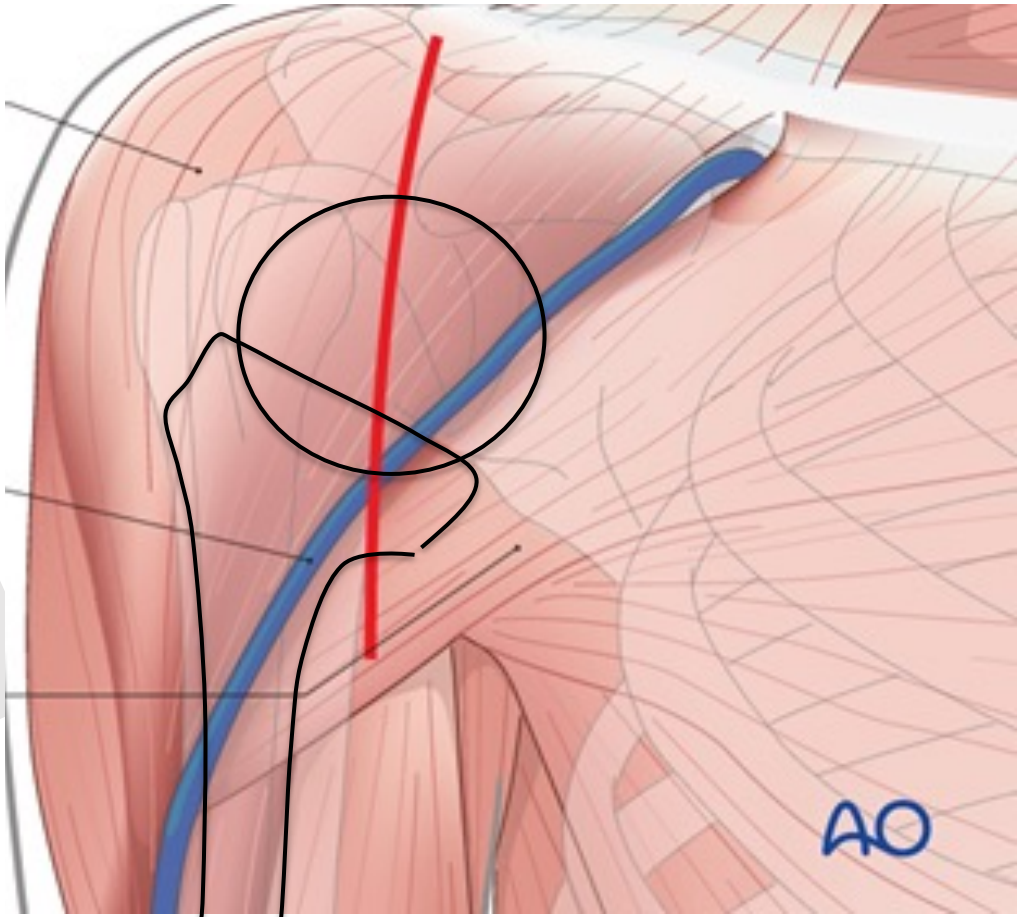


- Ball and socket joint
- Muscle tension maintains congruency
- Completely deltoid dependent

Indications:

- Failed cuff
- Instability
- Glenoid bone loss
- Multiple revisions with poor soft tissue
- Fractures



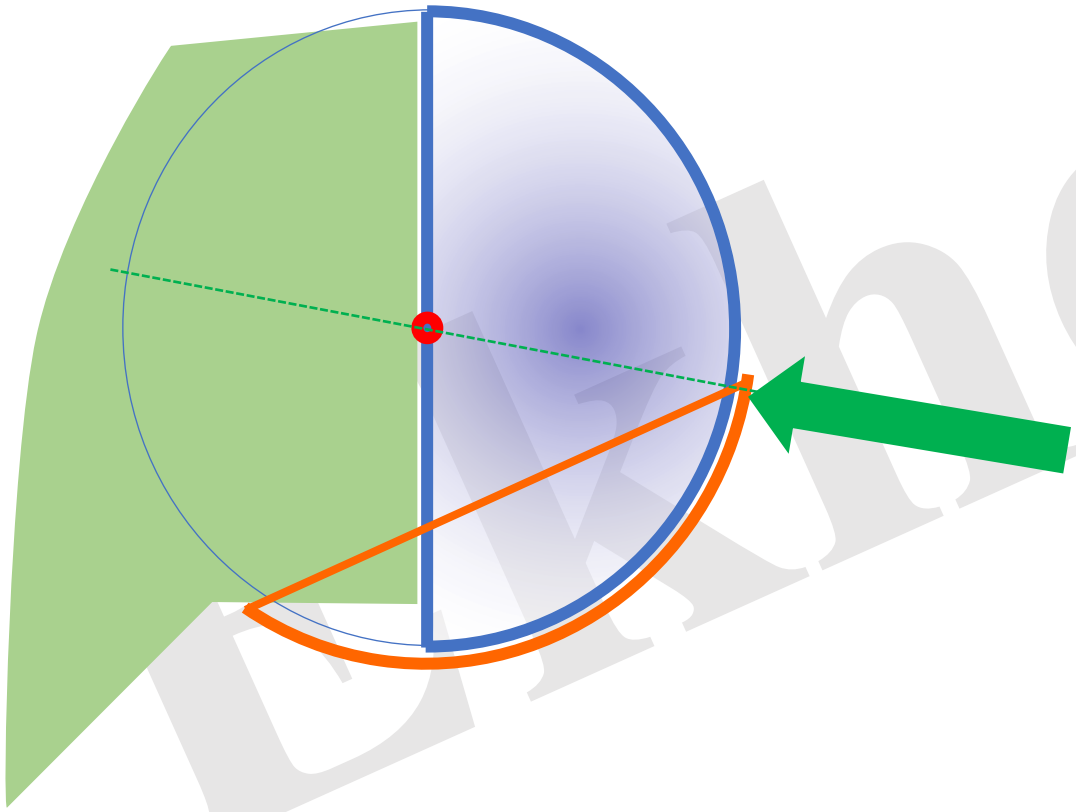


Placed in the force centre of the deltoid muscle

Deltoid dysfunction

Loss of deltoid insertion

Mechanics



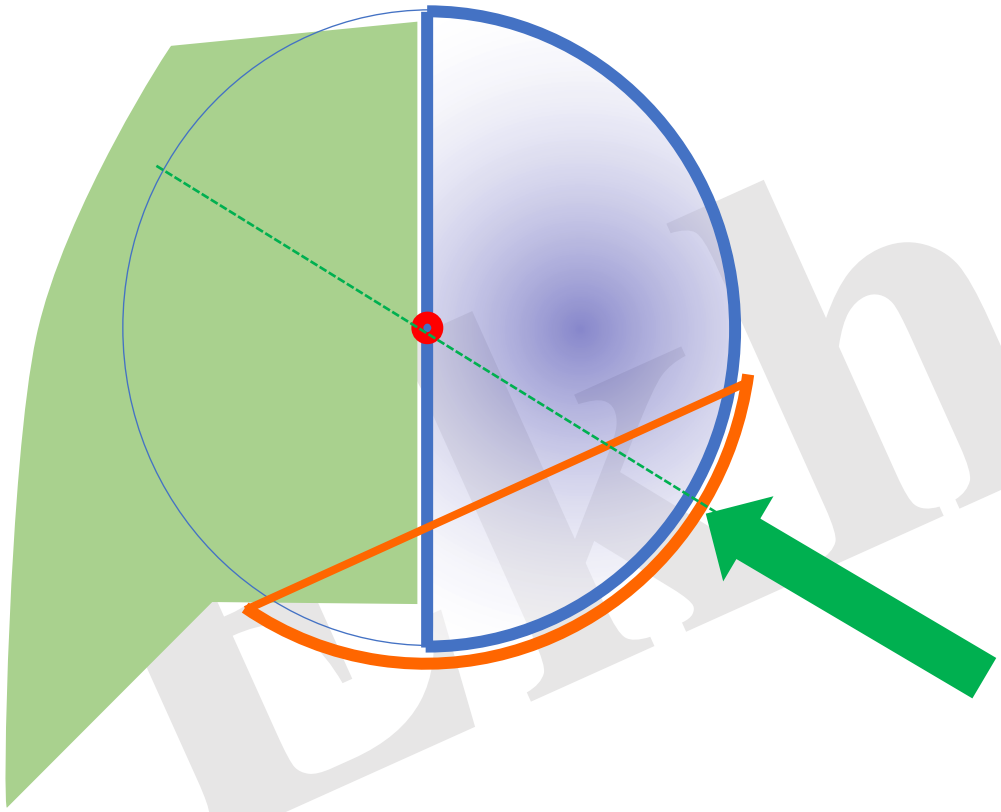
Combined forces:

- **Deltoid**
- **Cuff (ssc, isp, tm)**

- Pectoralis
- Lat dorsi
- Teres major
- Triceps
- Conjoined tendon

- Soft tissue (scar etc)

Mechanics



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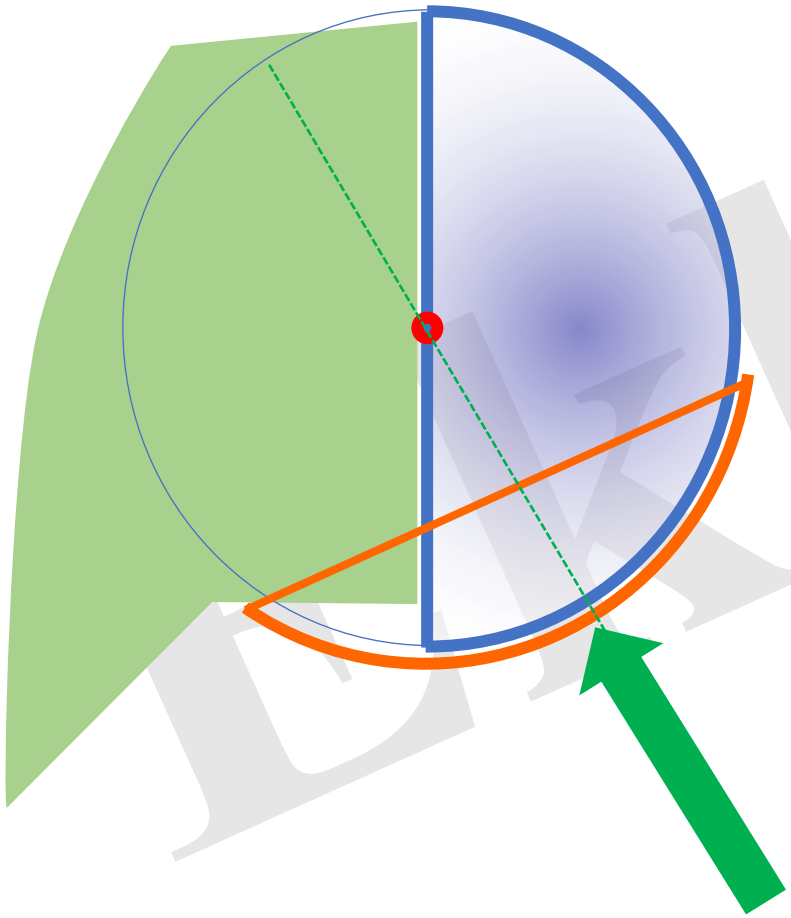

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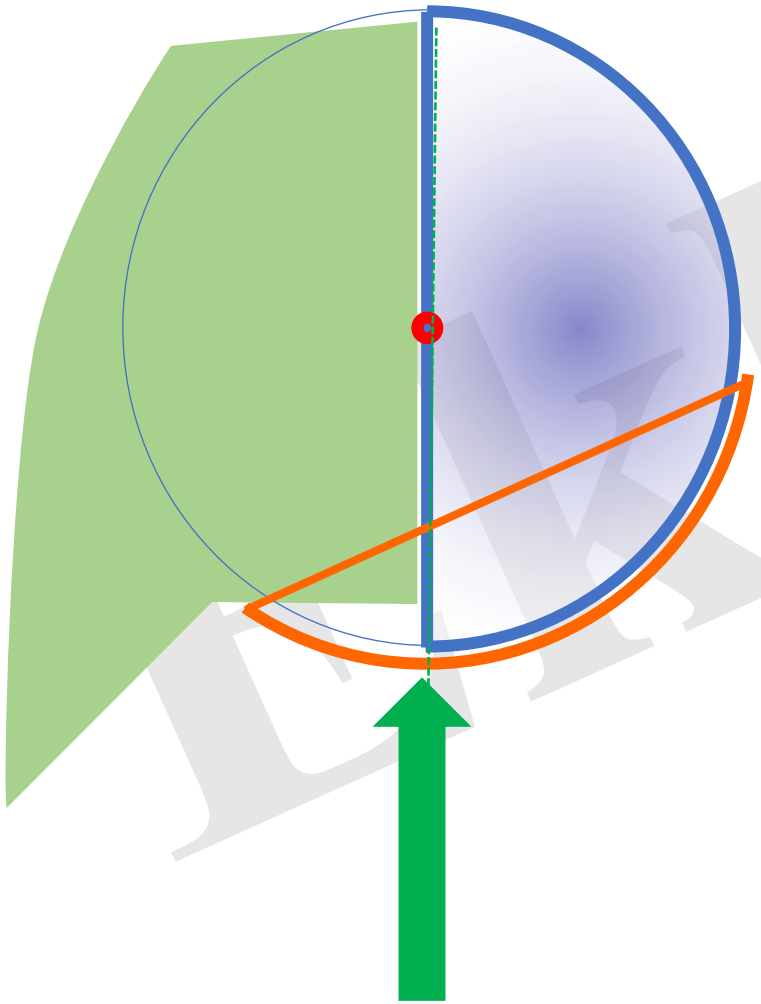

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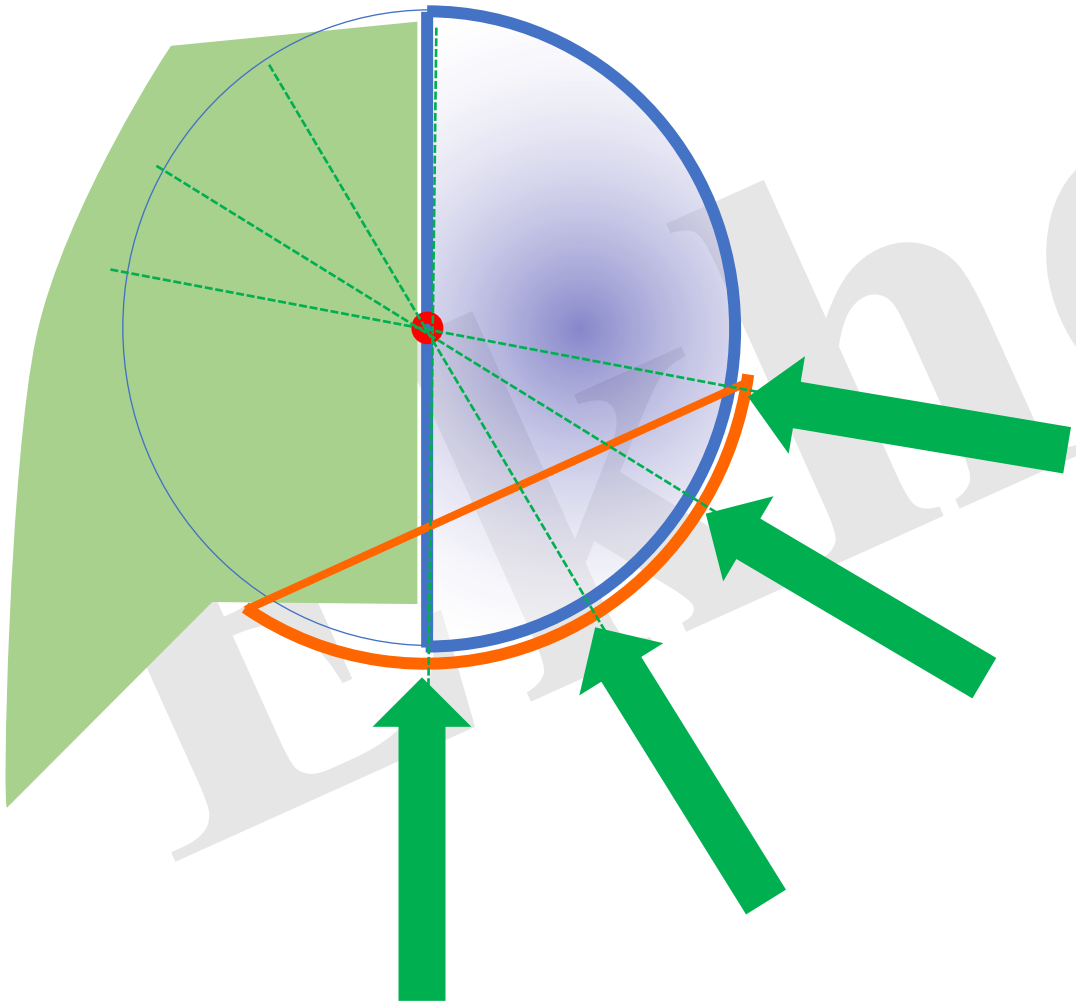

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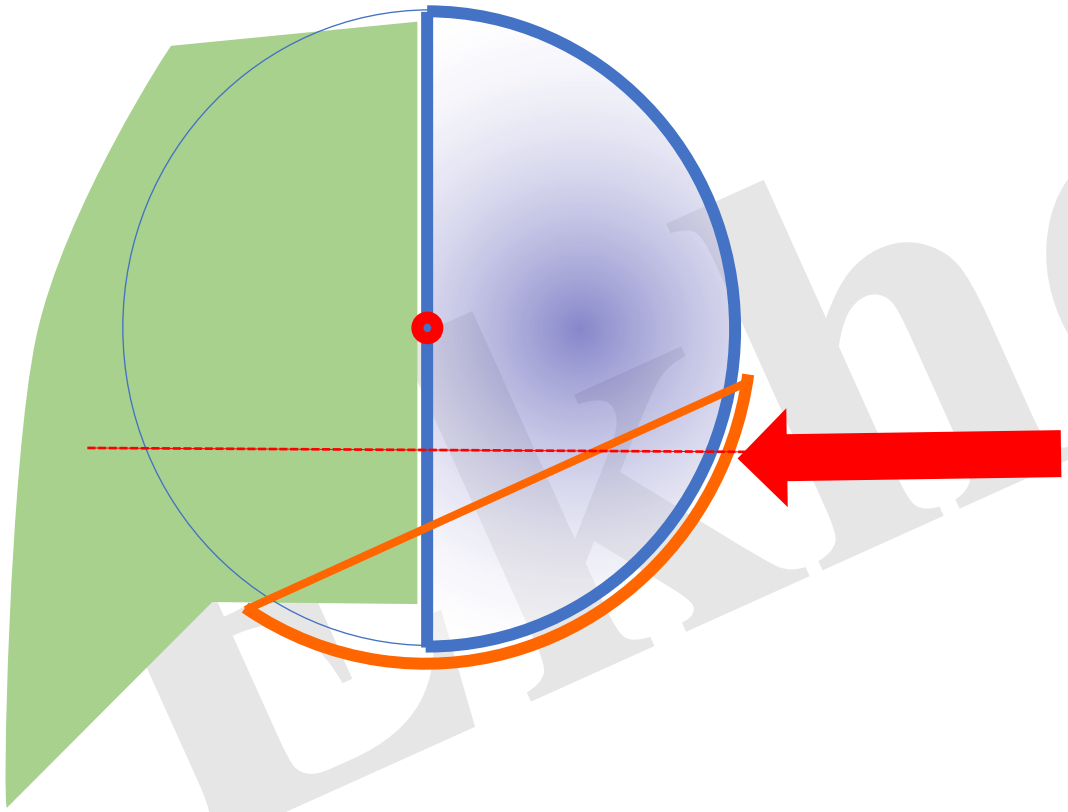

- **Combined forces:**
- Deltoid
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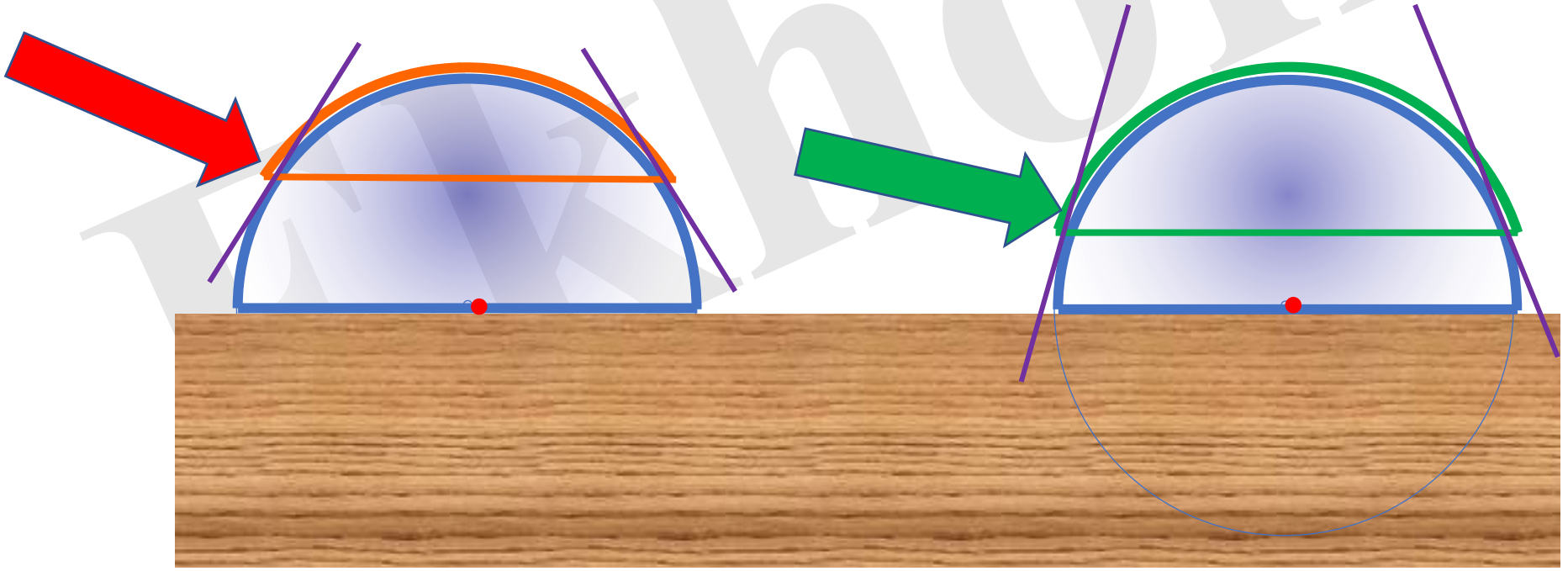
Mechanics

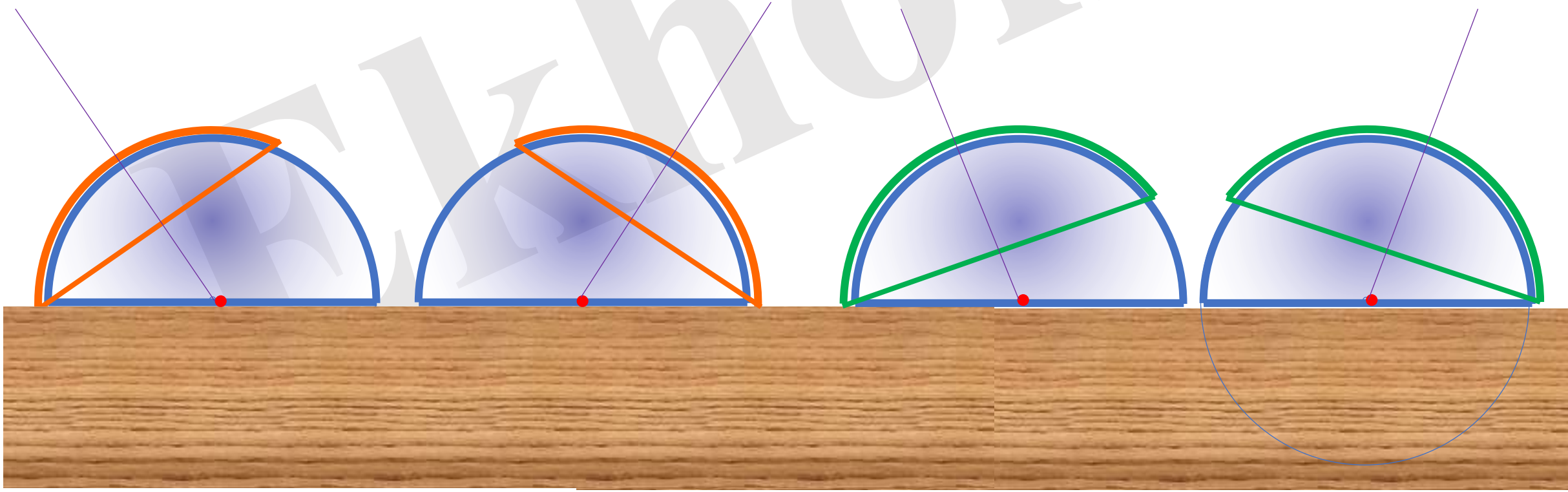
Larger cup) is obviously stable within a wider range of force directions



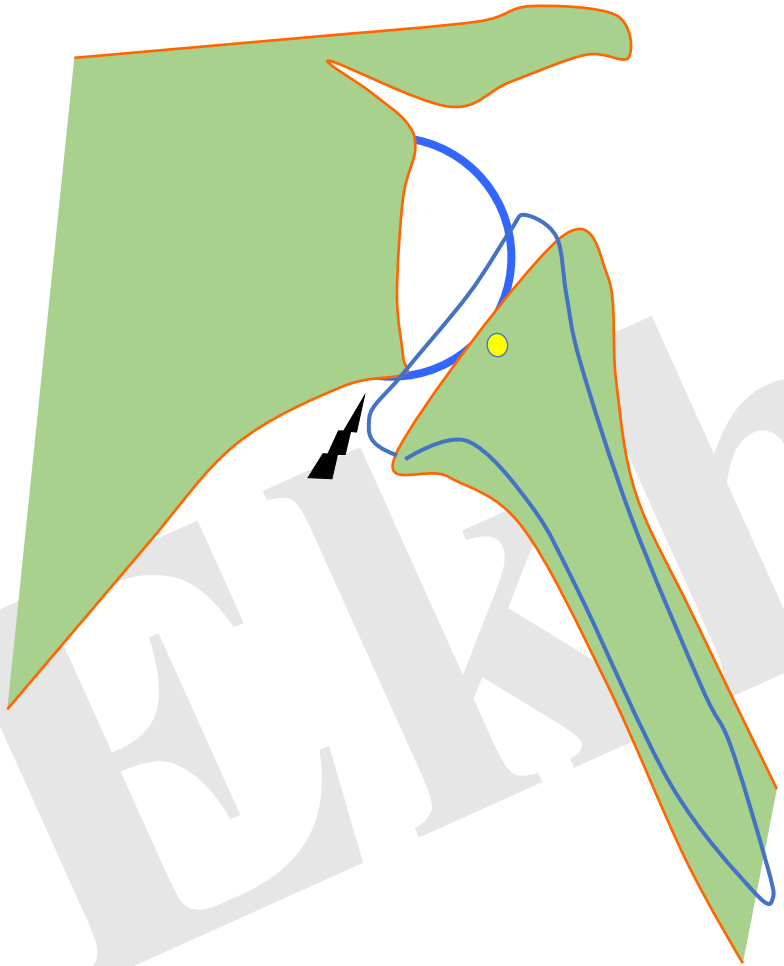
Larger cup
(retentive)

Mechanics

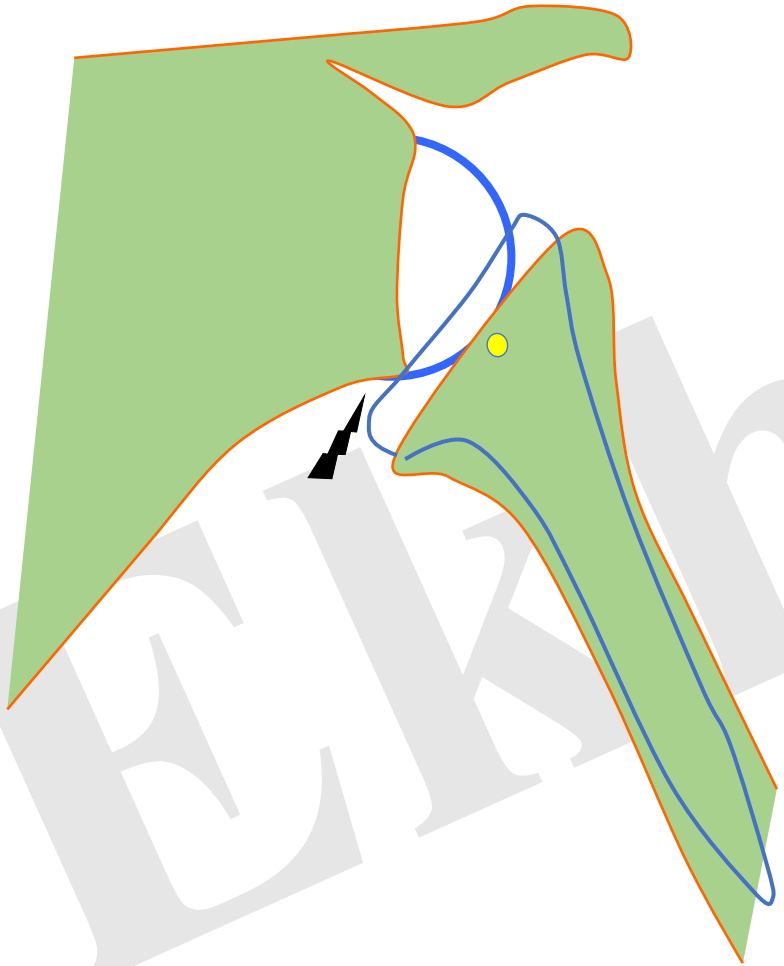
But a more retentive cup has less range of motion

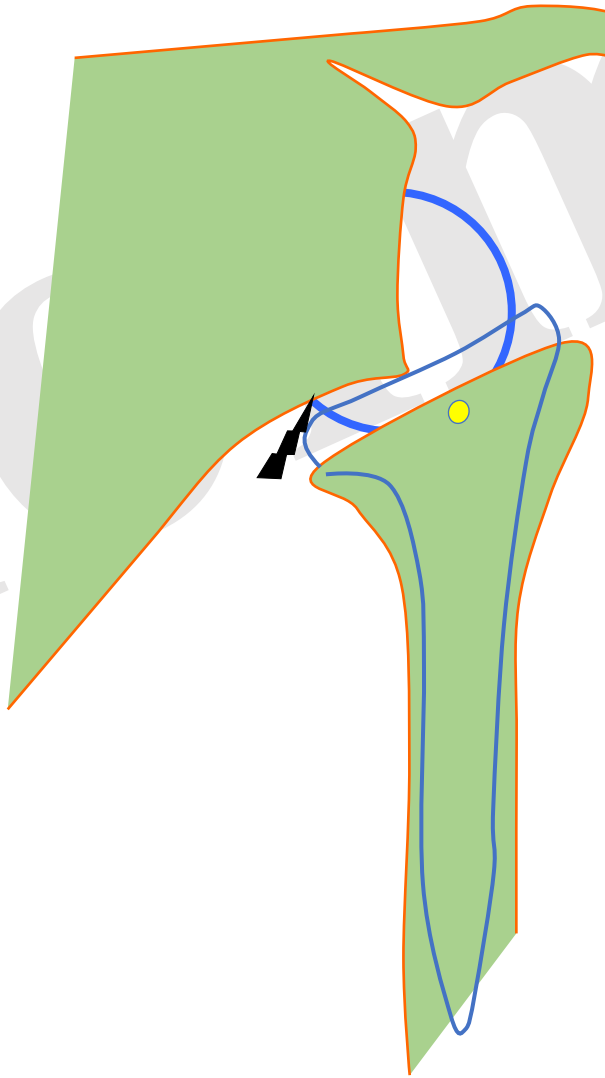


Mechanics



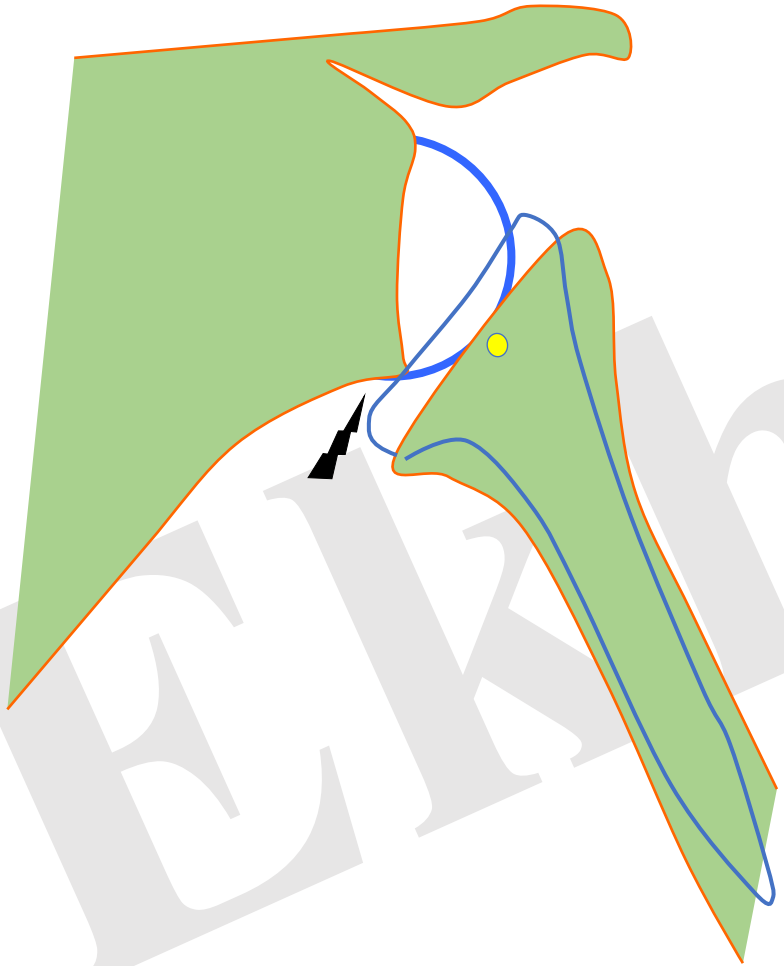
Mechanics





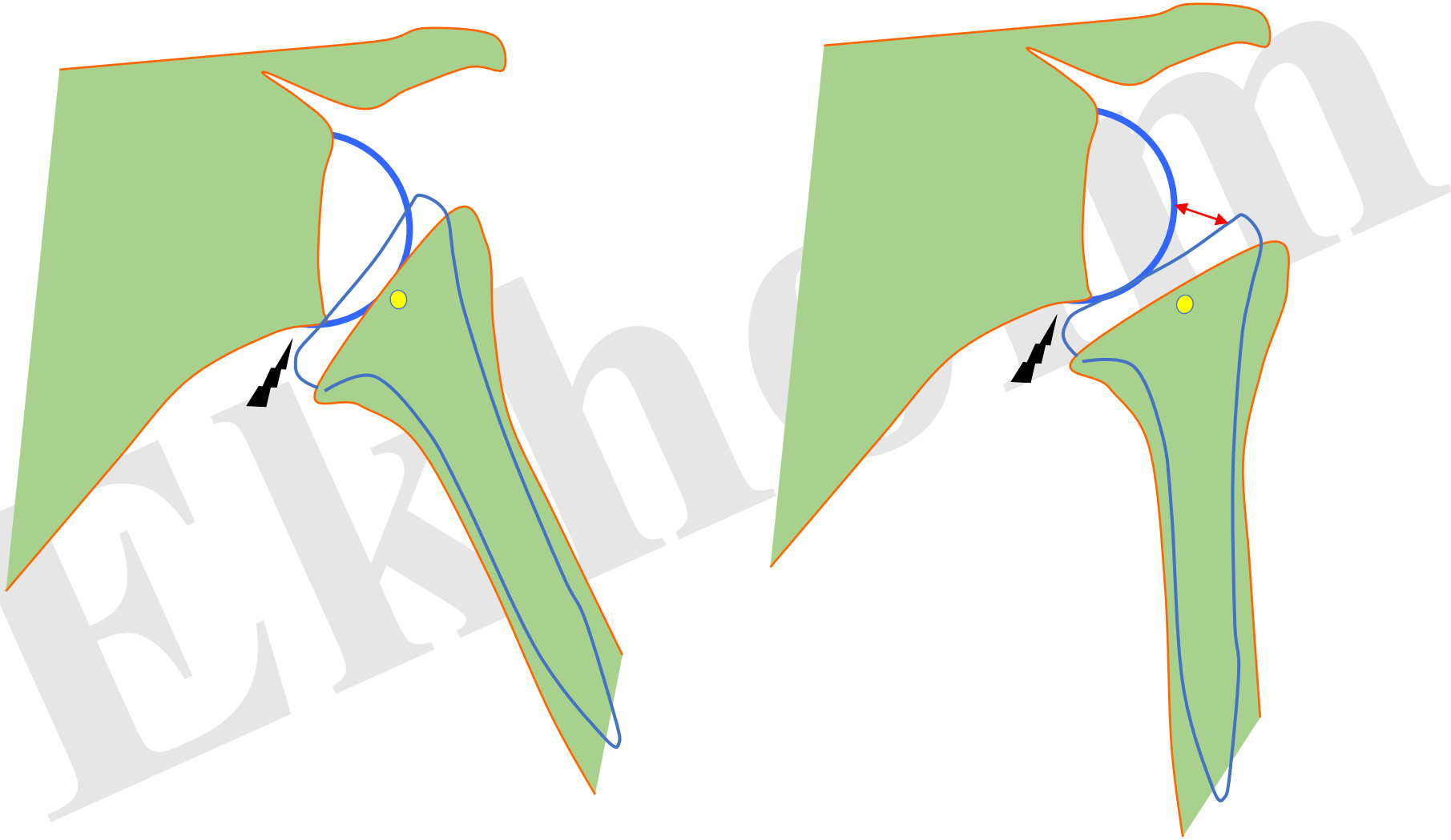
Distalised glenosphere

Mechanics



What if motion continues after impingment?

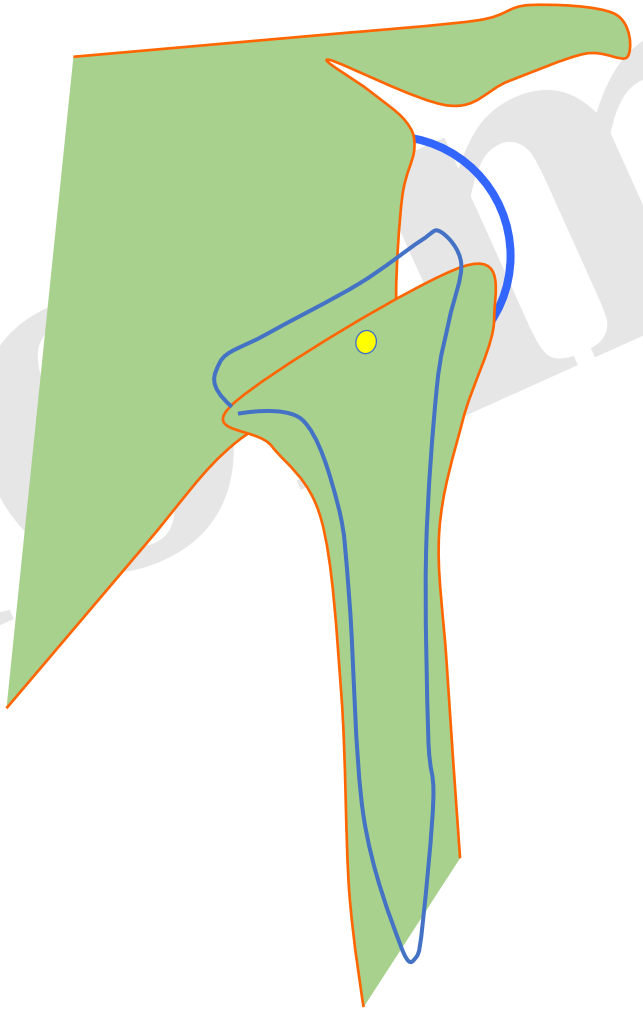
Mechanics



Forced continued motion with impingement will open joint and start dislocation

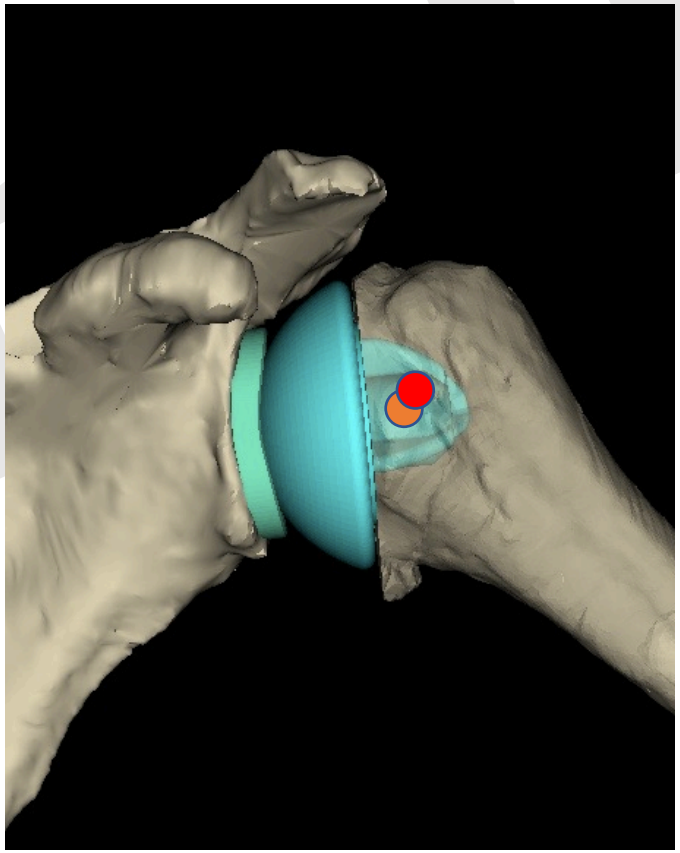
Mechanics

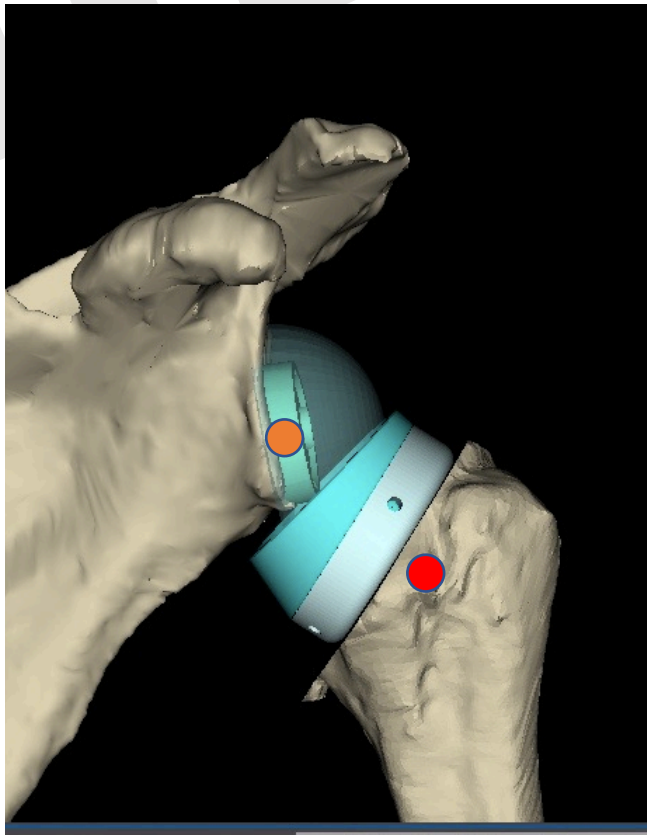
- Dislocation rate up to 8%
- Dislocations typically occur during the first month
- Dislocations often go unnoticed by the patient
- Dislocations are “always” anterior



Anatomy of RSA

- Centre humeral head
- Centre of rotation (COR)





RSA:

- COR is medialised
- Humerus is medialised
- Humerus is lateralised vs COR
- Humerus is distalised vs COR

- Humerus orbits around glenosphere - outside the joint

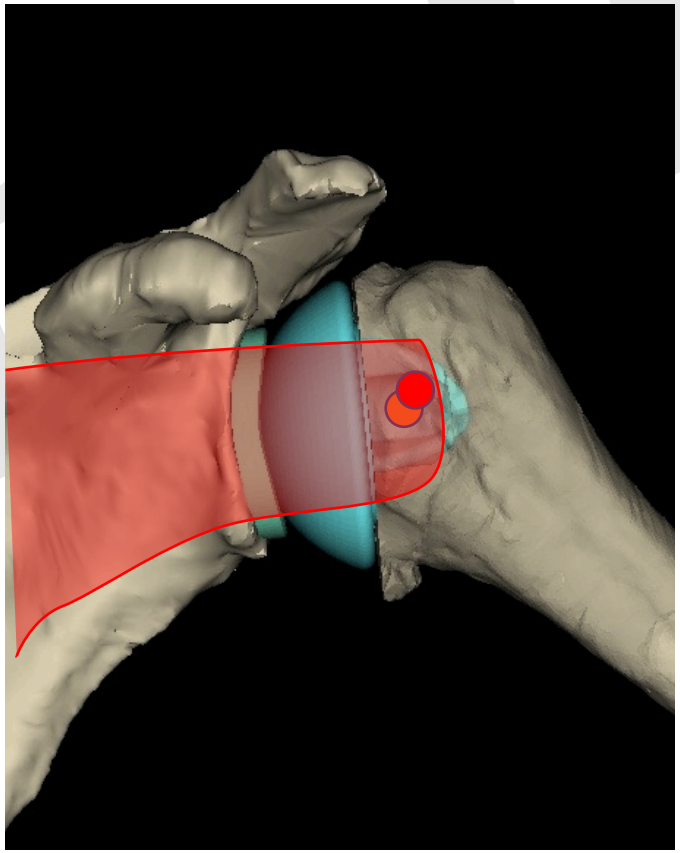
Anatomy of RSA

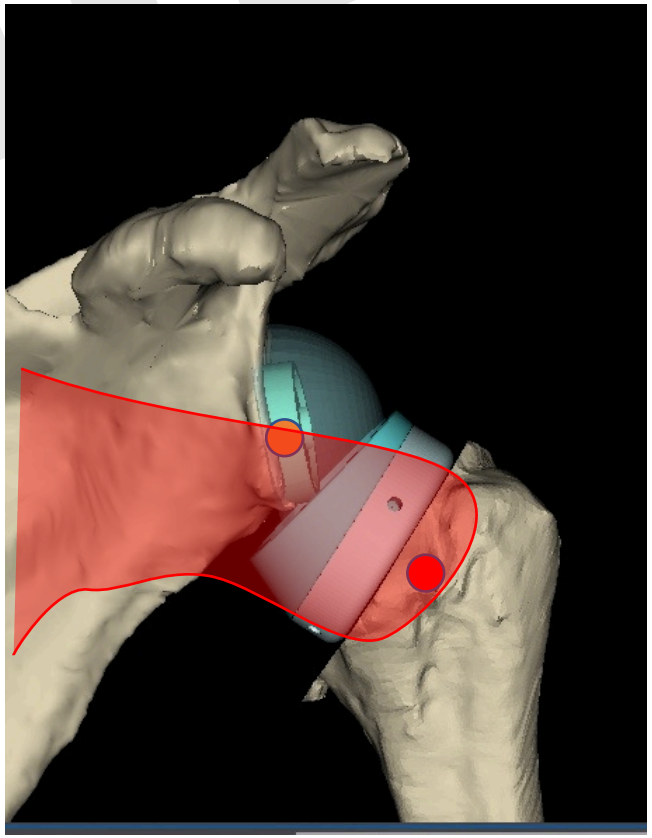
- Centre humeral head
- Centre of rotation

RSA:

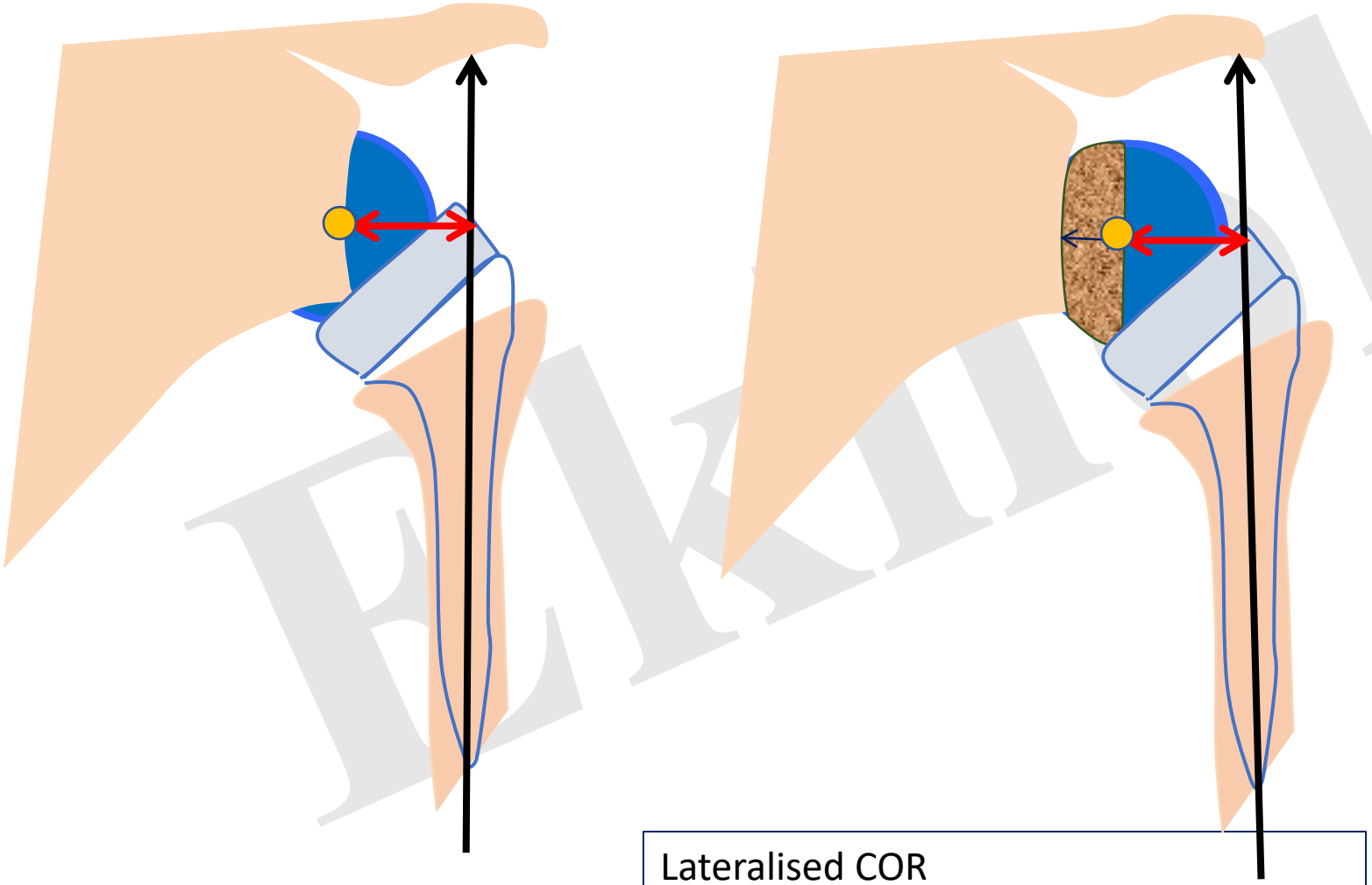
- COR is medialised
- Humerus is medialised
- Humerus is lateralised vs COR
- Humerus is distalised

- Rotator cuff distalised



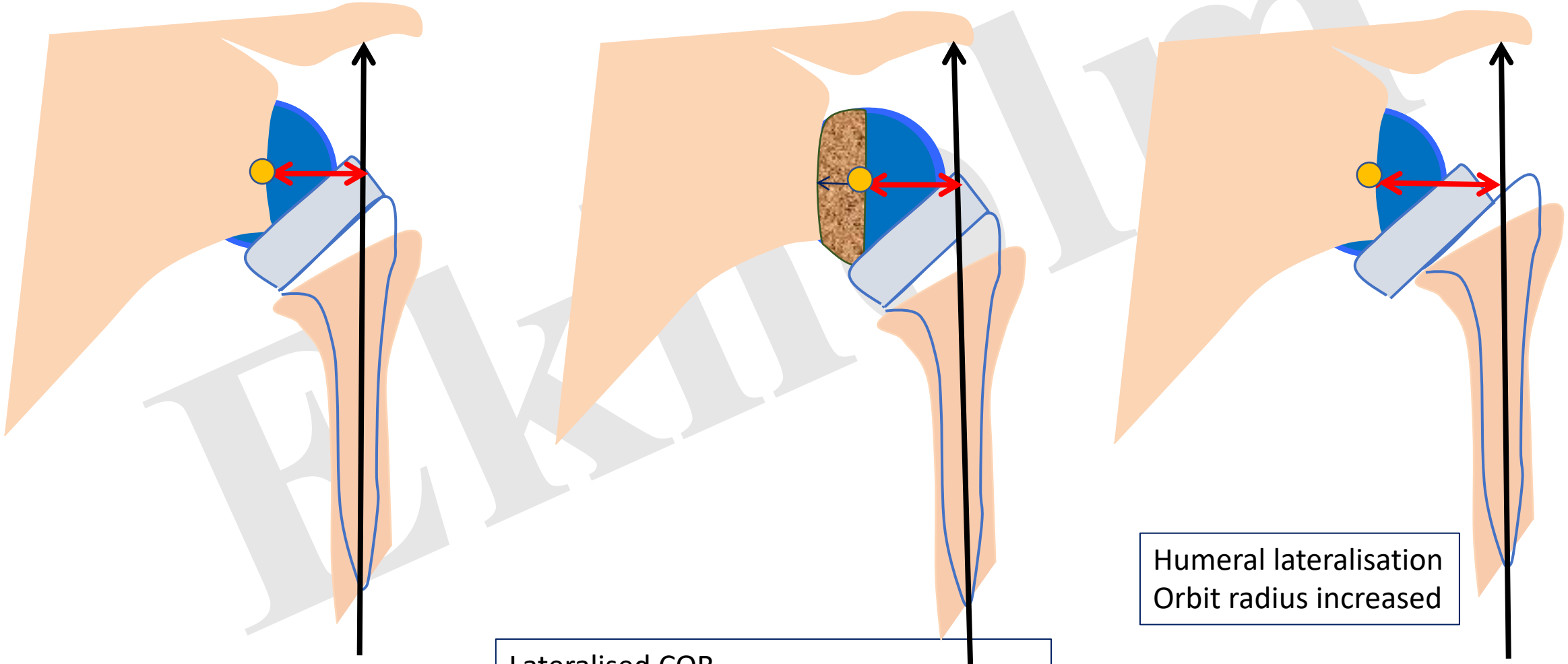


Glenoid lateralisation vs humeral lateralisation



Lateralised COR
Improved tension without distalisation

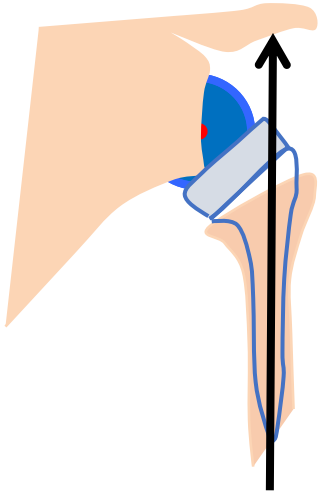
Glenoid lateralisation vs humeral lateralisation

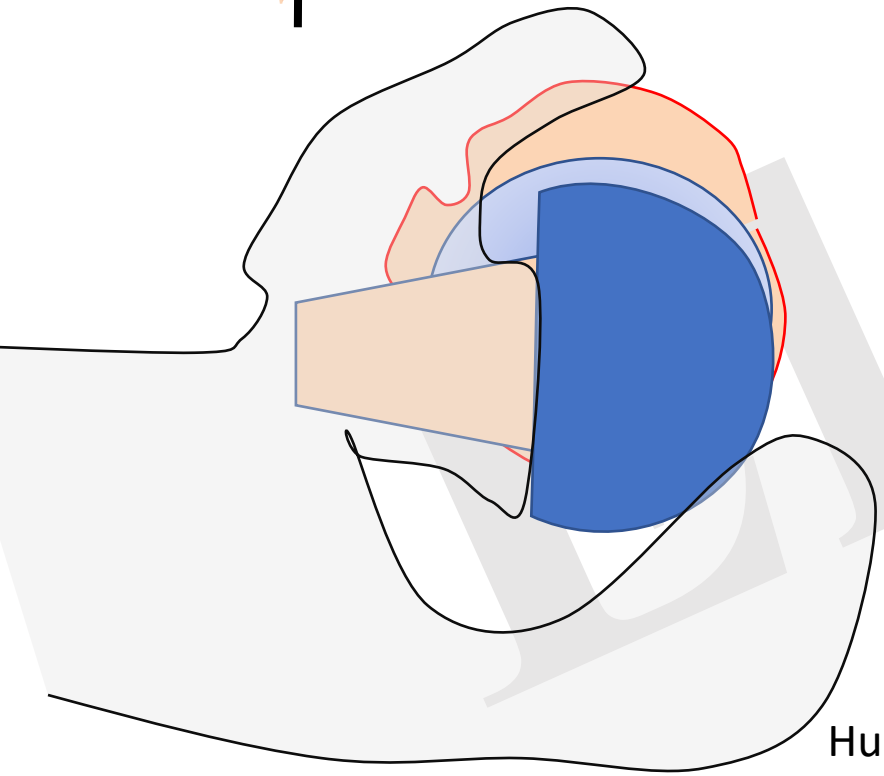


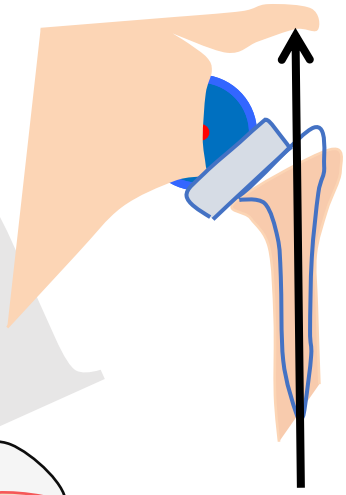
Lateralised COR
Improved tension without distalisation

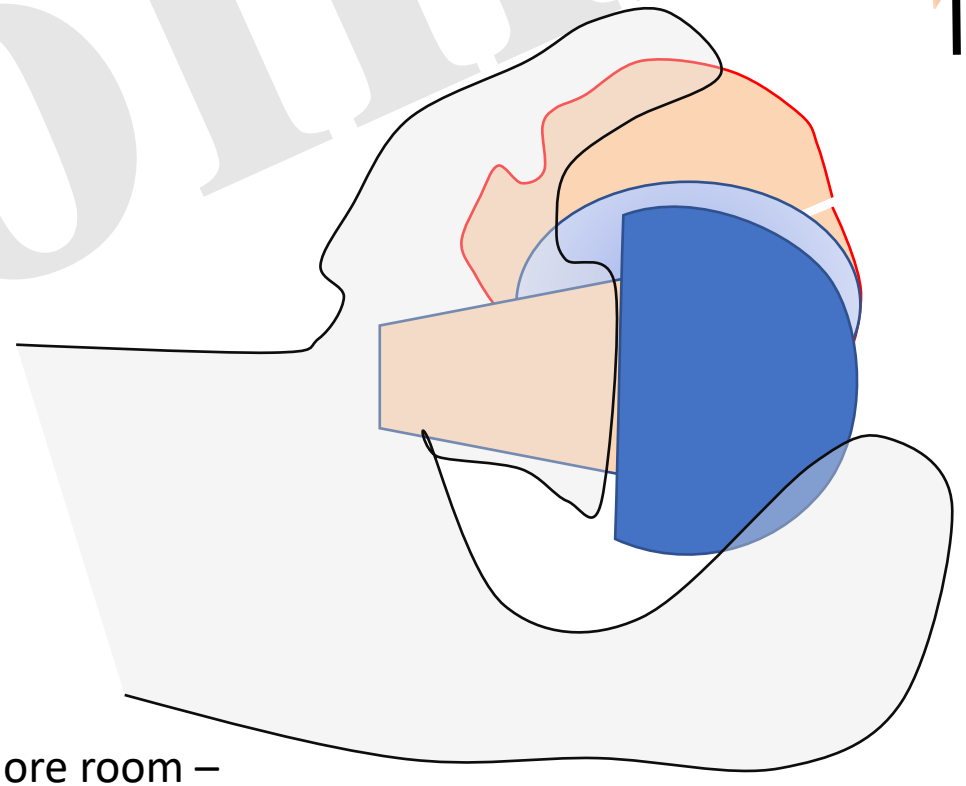
Humeral lateralisation
Orbit radius increased

Standard humerus vs lateralised



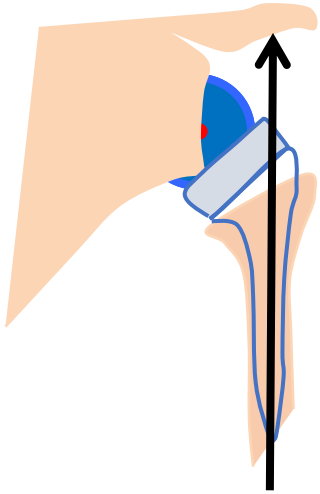


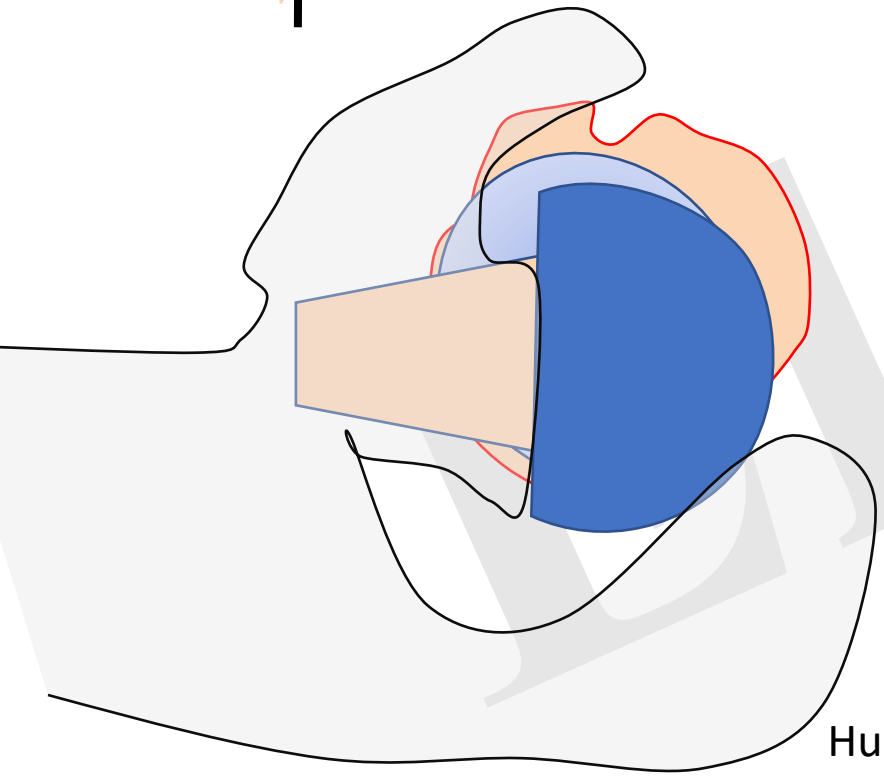


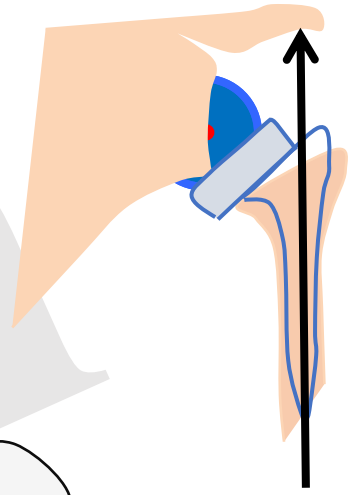


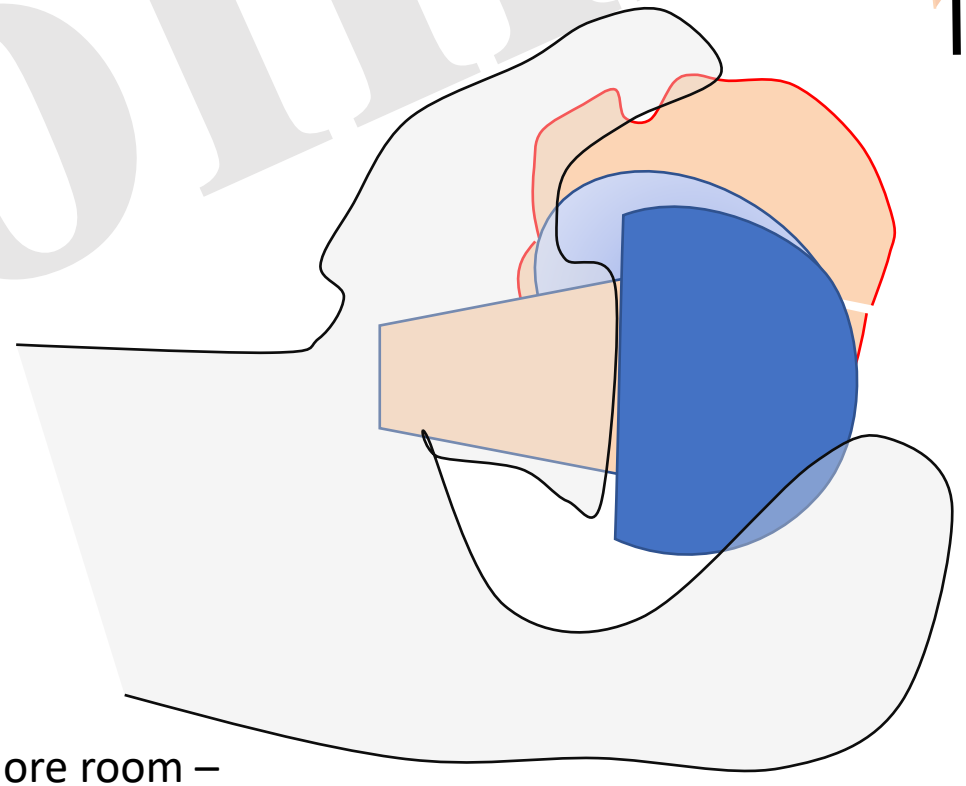
Humeral lateralisation requires more room –
risk for abutment on coracoid or acromion

Standard humerus vs lateralised









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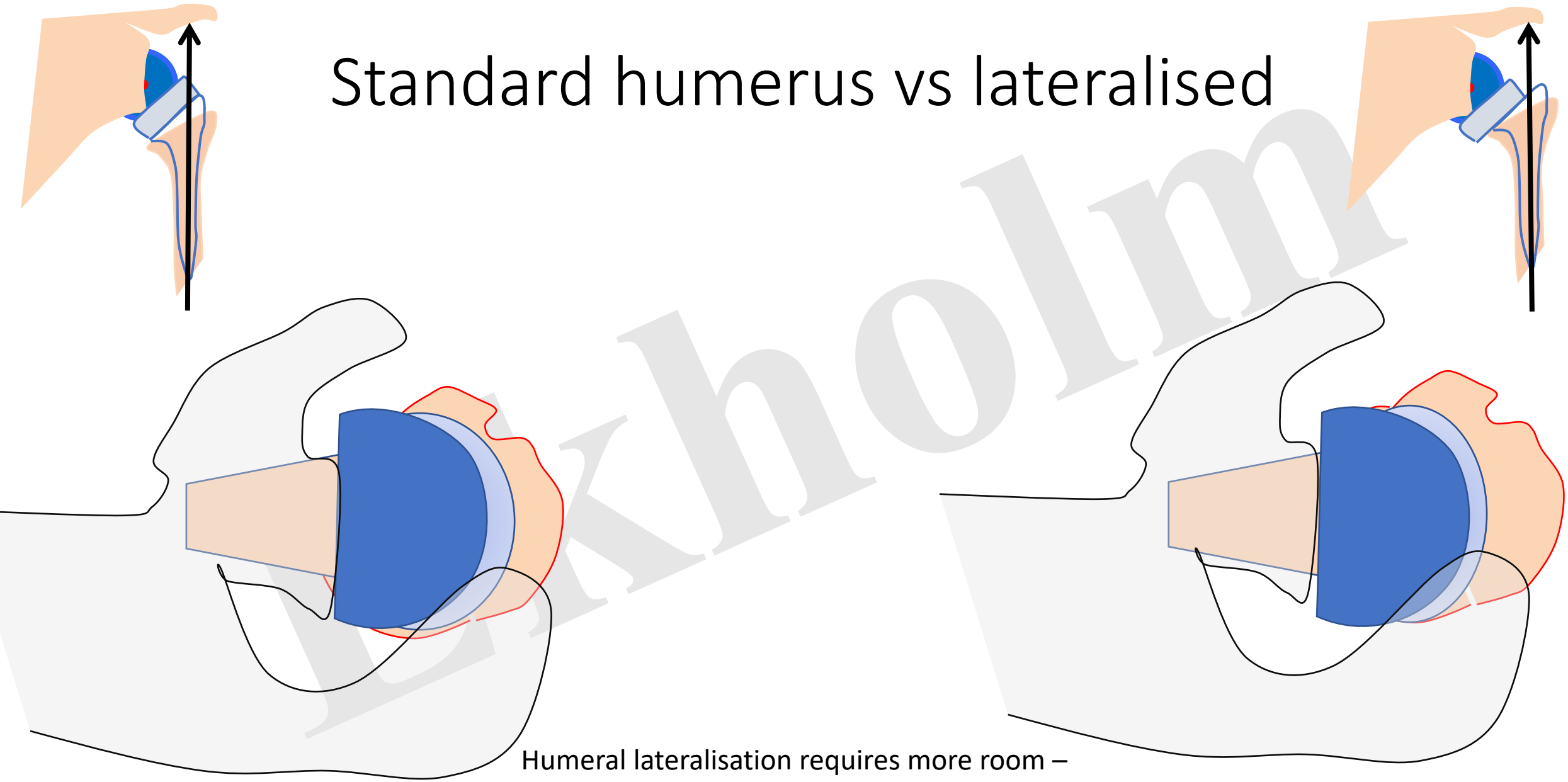

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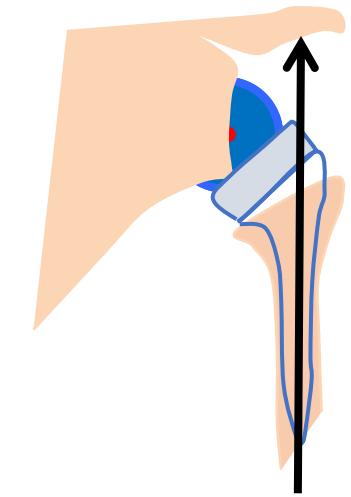

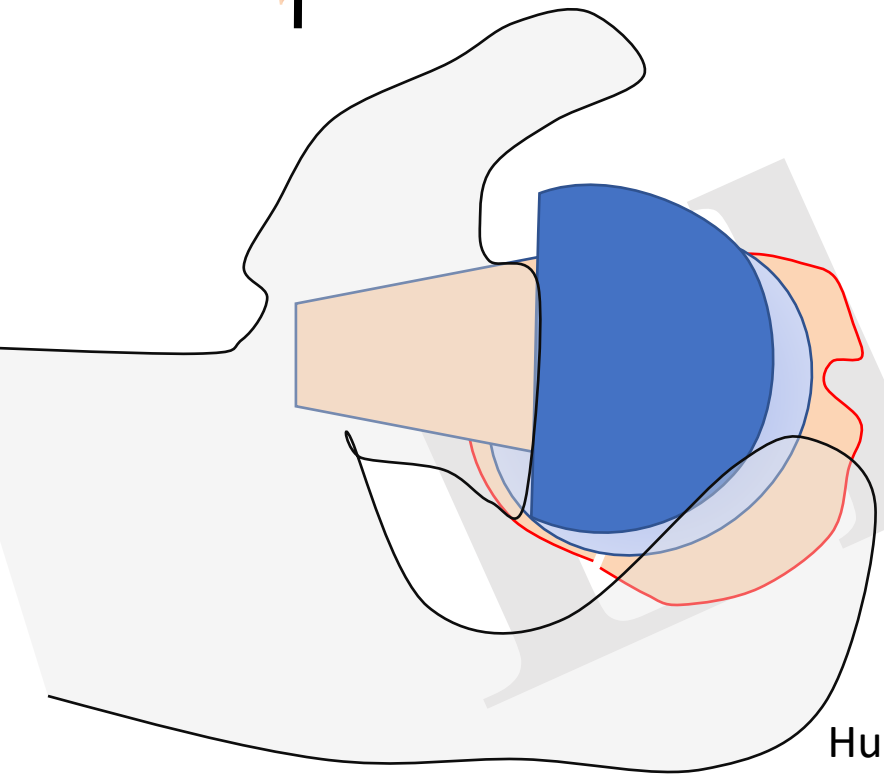

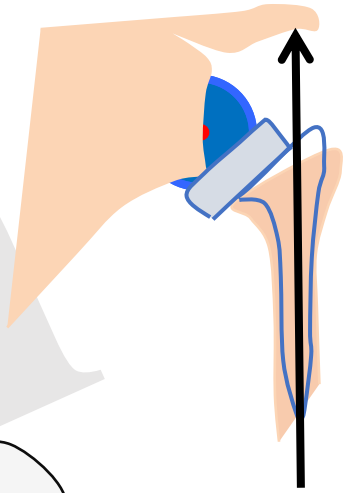

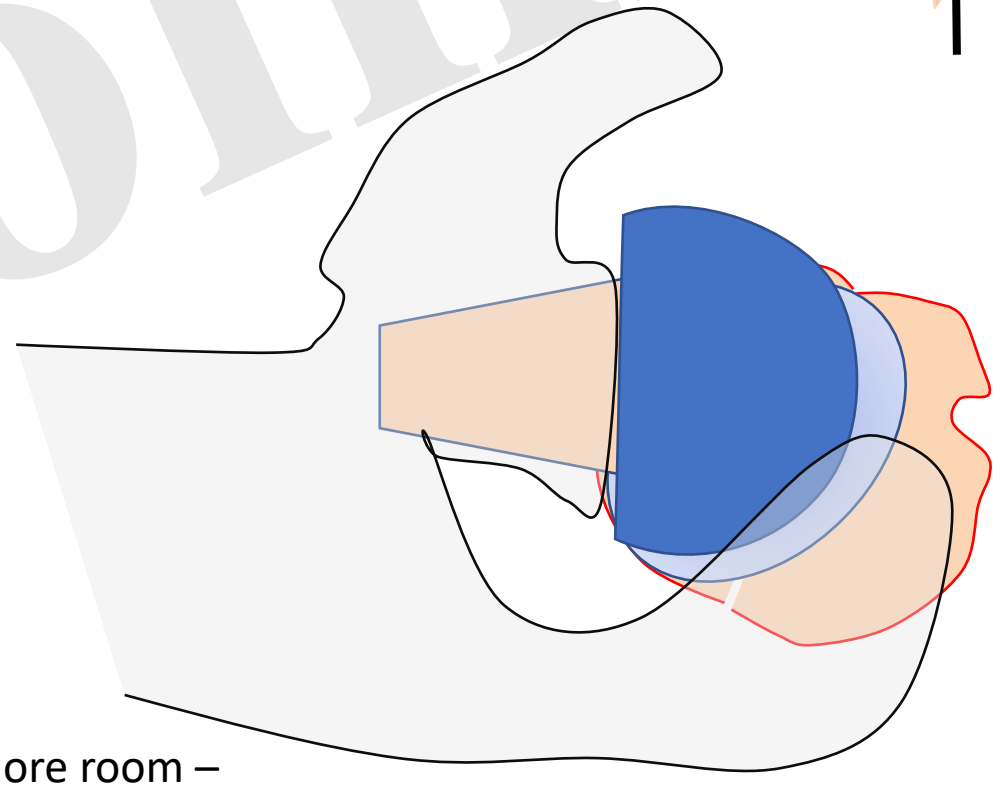

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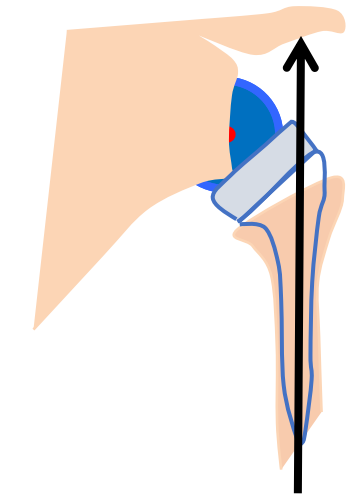

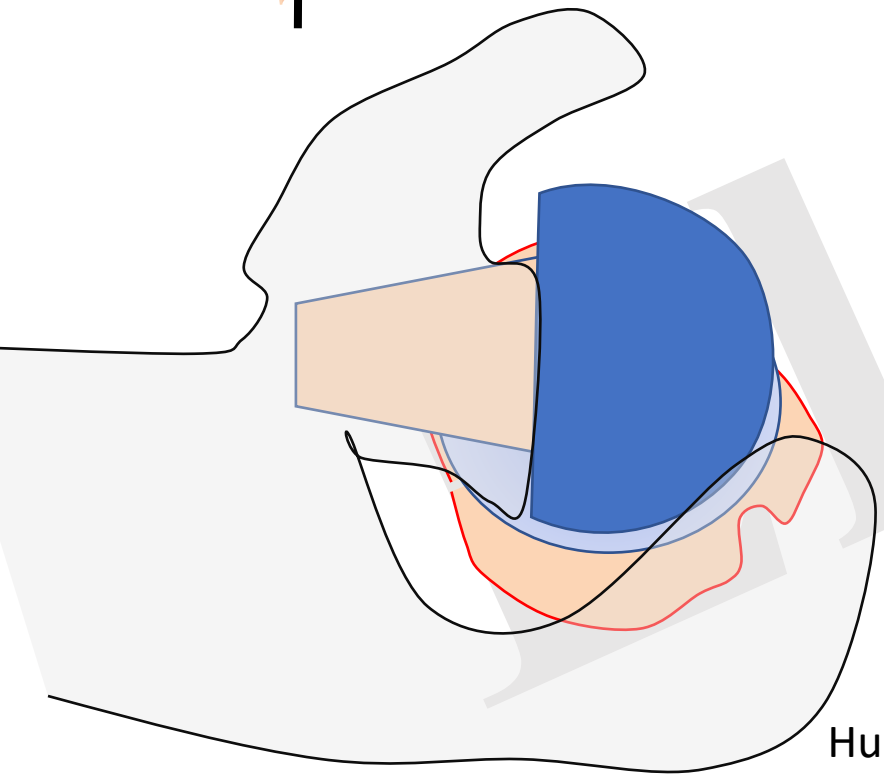

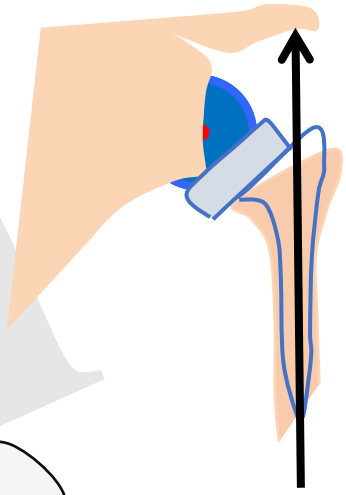

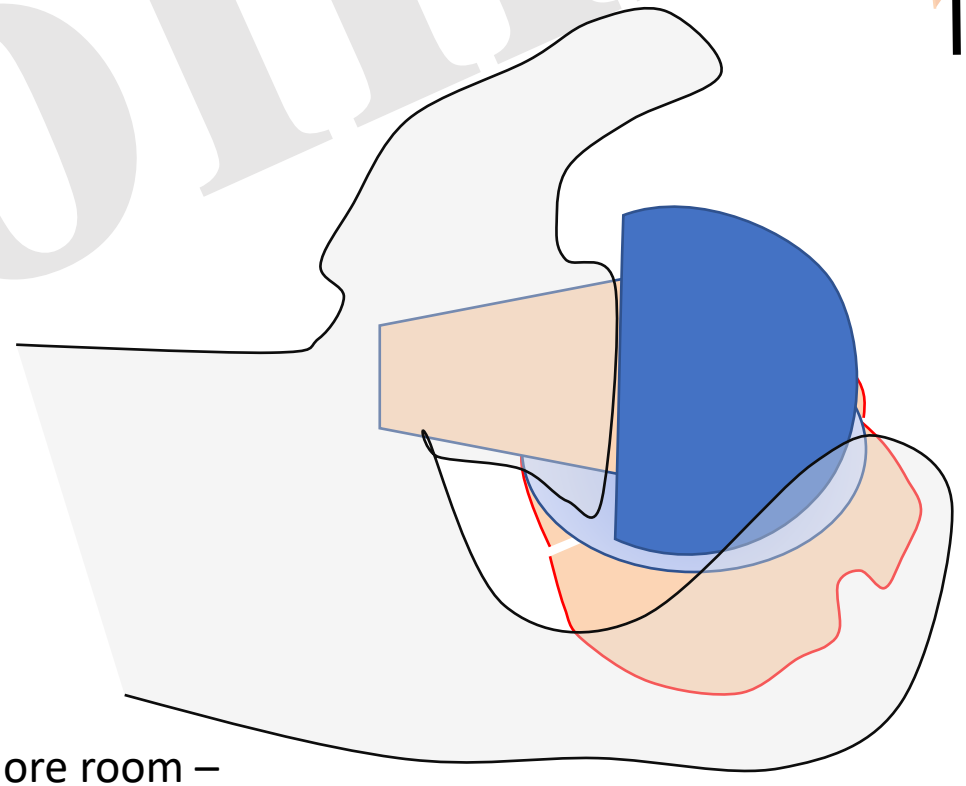

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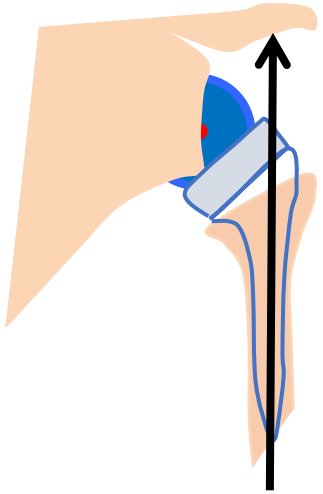
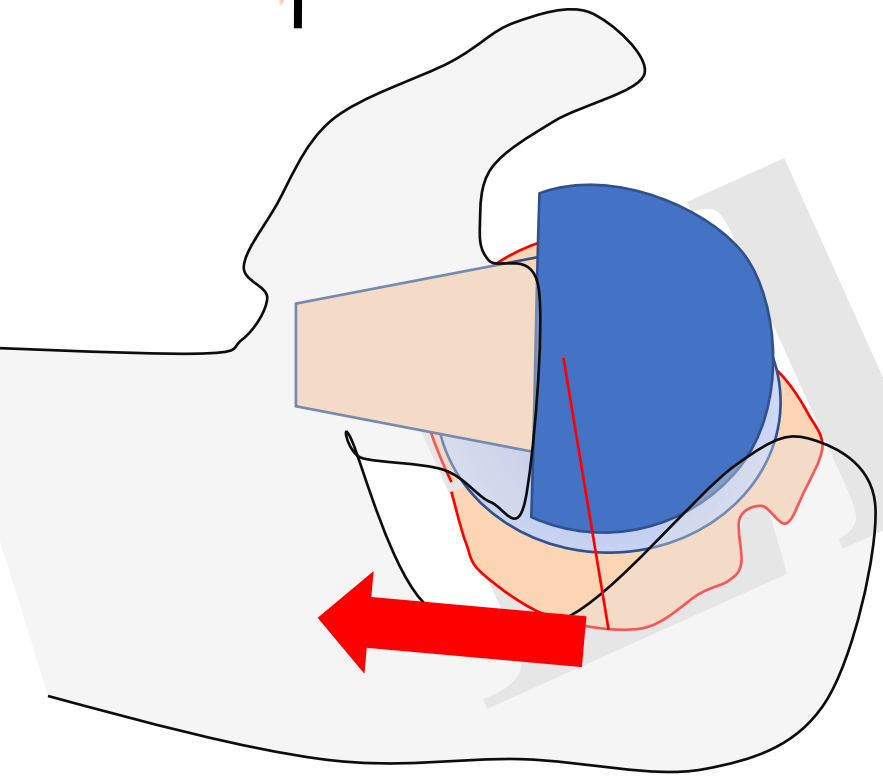
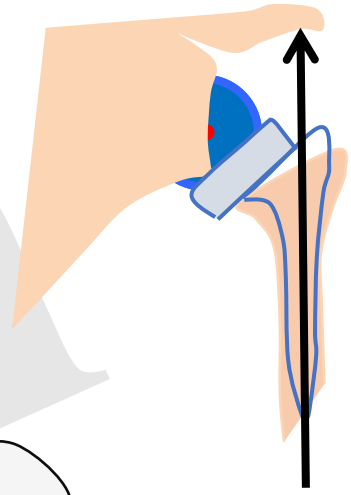
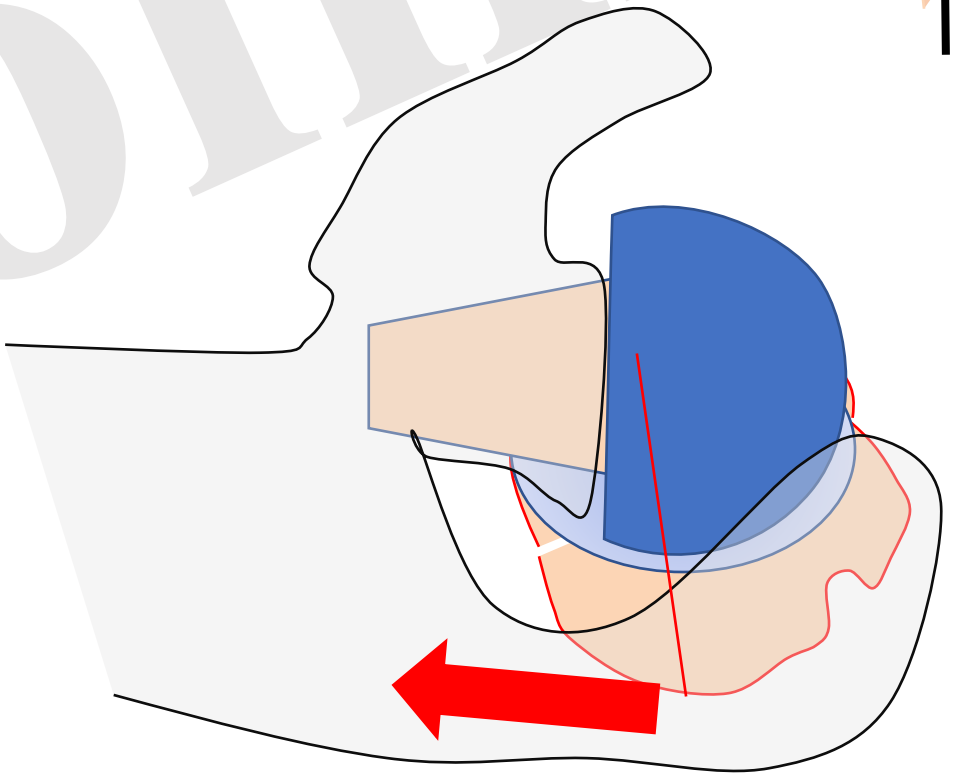
Standard humerus vs lateralised

Longer lever arm – makes ER muscles stronger

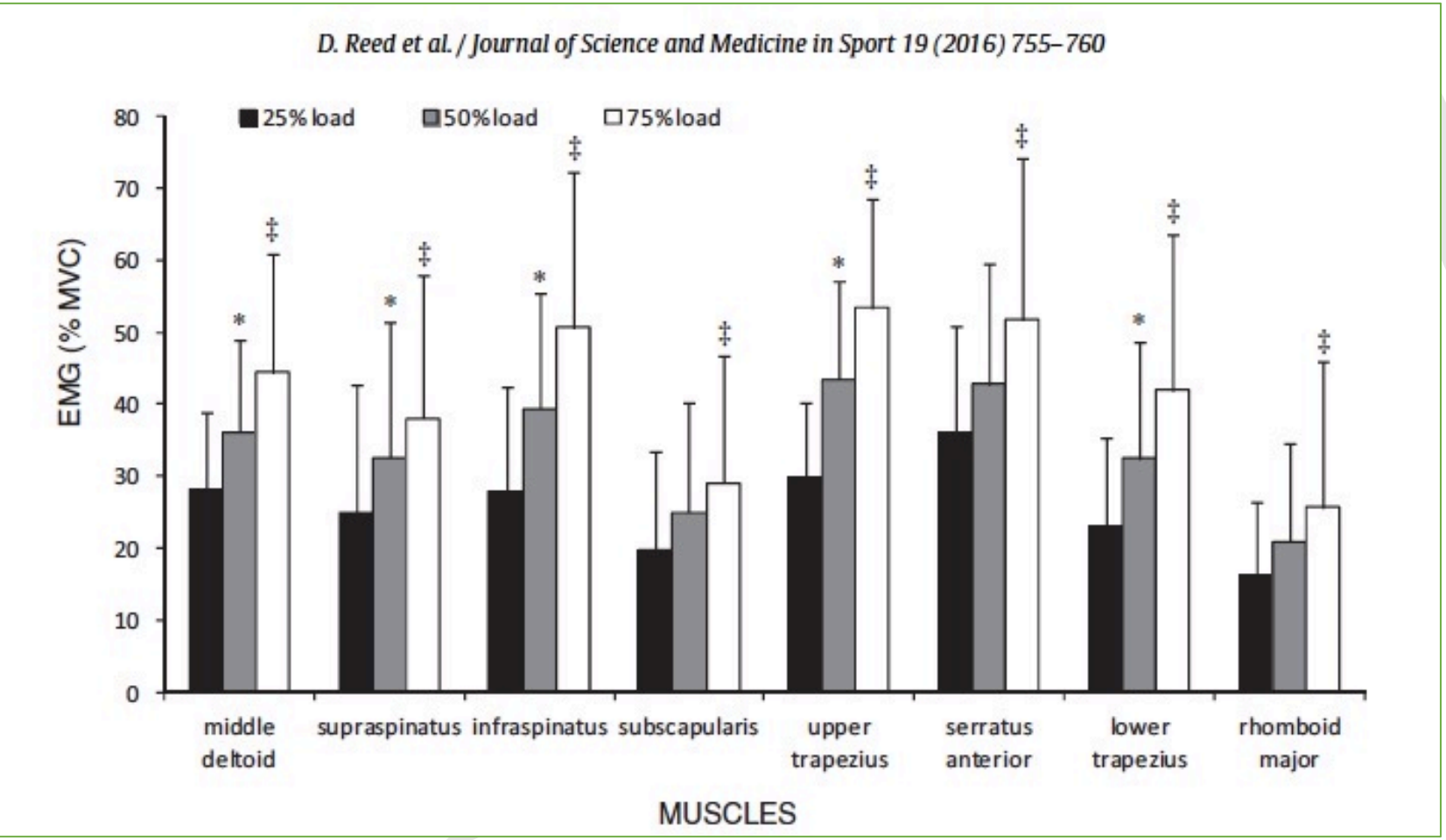








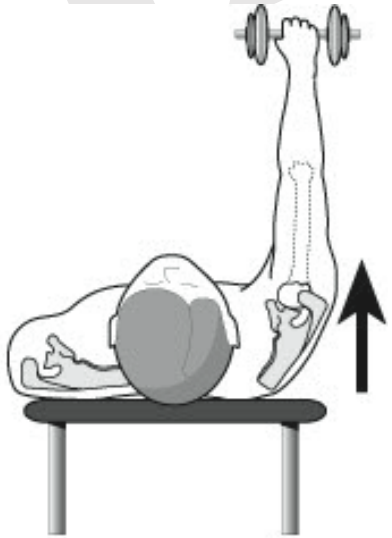
Gleno-humeral stability and motion



- Complex and beautifully orchestrated muscle symphony

Injuries, surgery, immobilisation, physio – how is the orchestra affected in rTSA?

Scapular role



RSA motion

- Functioning deltoid usually allows good flexion and abduction

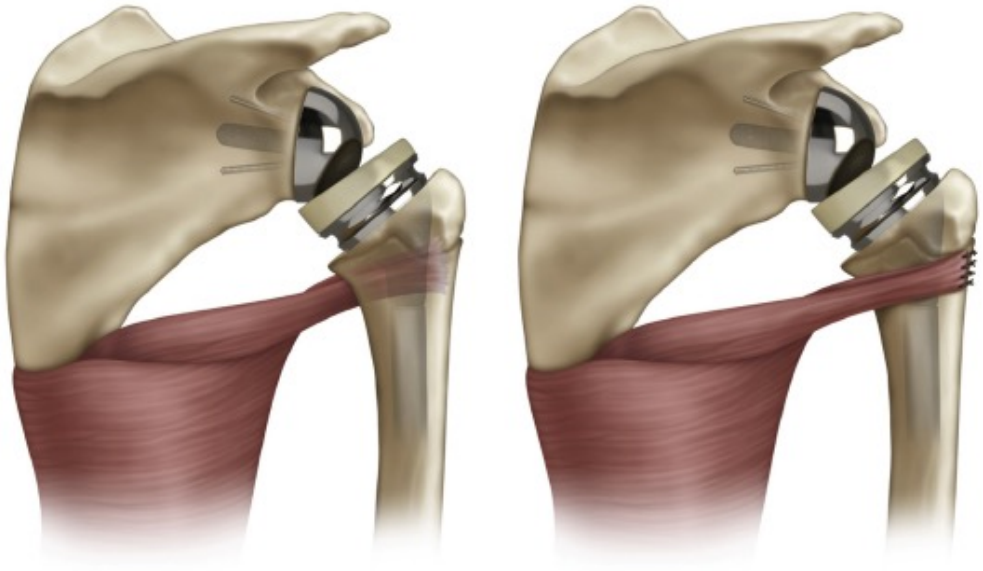
However

- Internal rotation limitations (scapular impingement)
- External rotation limitations (infraspinate, teres minor)

Reverse shoulder arthroplasty with and without latissimus and teres major transfer for patients with combined loss of elevation and external rotation: a prospective, randomized investigation

Bradley L. Young, MD[a], Patrick M. Connor, MD[b,c], Shadley C. Schiffern, MD[b], Katherine M. Roberts, MS[d], Nady Hamid, MD[b,*]

J Shoulder Elbow Surg (2020) 29, 874–881



>2y, 28 pts

Conclusion:

- No differences in the ADLER, DASH, ASES, and SST with LD-TM transfer CLEER
- Both groups showed significant improvements in all clinical outcome assessments including functional tasks that require active external rotation.
- Posterior deltoid? Teres minor tension?

Journal of Orthopaedics 21 (2020) 379–383

Preoperative external rotation deficit does not predict poor outcomes or lack of improvement after reverse total shoulder arthroplasty

Moby Parsons [a], Howard D. Routman [b], Christopher P. Roche [c], Richard J. Friedman [d,*]

Database,
72y, >3year F/U

,

314 pts >30deg ER
vs
115pts <0deg ER,

This study demonstrates that patients with <0◦ preoperative aER

- Similar putcome outcomes as preserved aER
- Can expect a degree of improvement that is actually significantly higher for range of motion, subjective function and SST.

Shoulder proprioception following reverse total shoulder arthroplasty

International Orthopaedics (2020) 44:2691–2699

Joanna Walecka[1,2] · Przemysław Lubiatowski[1,2] · Paolo Consigliere[3] · Ehud Atoun[3] · Ofer Levy[3]

29 pts, >2 years post-op
Electronic goniometer
Pts asked to place their arm in 14 different positions

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29 pts, >2 years post-op
Electronic goniometer
Pts asked to place their arm in 14 different positions

Operated shoulder more accurate than contralateral in 9 positions!

Flexion 30, 90, 120
Abduction 30, 90, 120
IR 30, 45
ER 15

Results correlate with pain, ROM, ADL scores

Three-Dimensional Scapular Kinematics in Patients with Reverse Total Shoulder Arthroplasty during Arm Motion

Kwang Won Lee, MD, Yong In Kim, MD*, Ha Yong Kim, MD, Dae Suk Yang, MD,
Gyu Sang Lee, MD, Won Sik Choy, MD

Clinics in Orthopedic Surgery 2016;8:316-324

13 pts, 72 years, >1 year post-op

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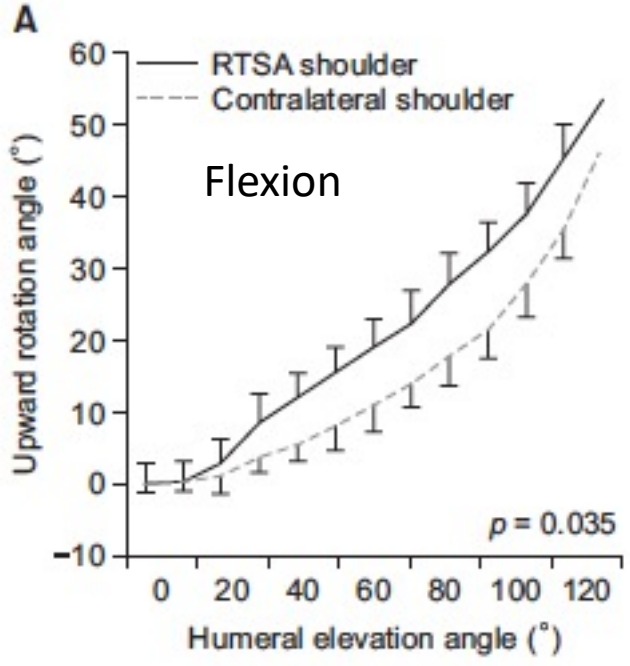

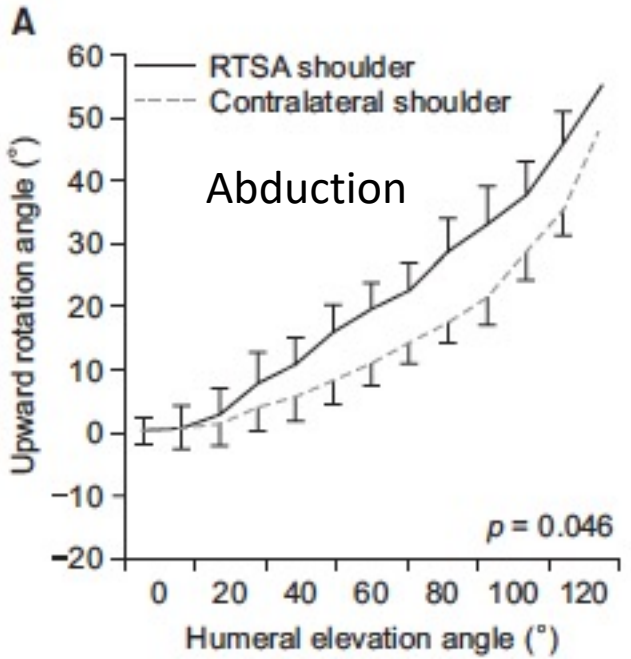

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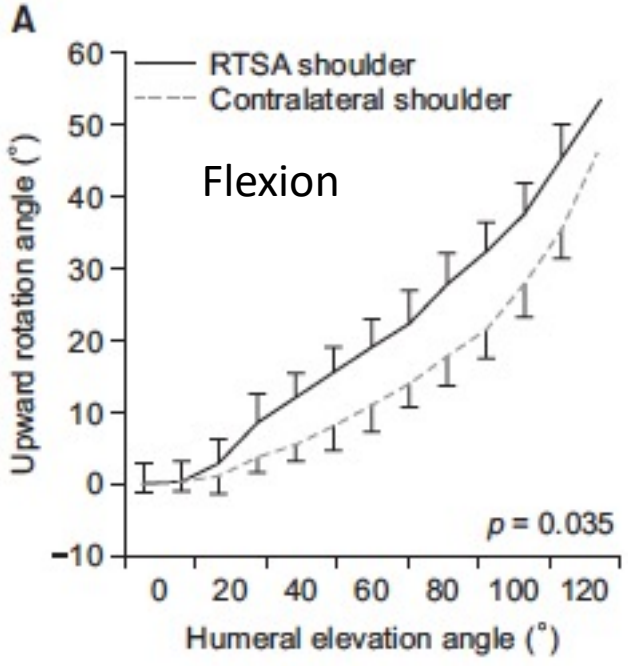
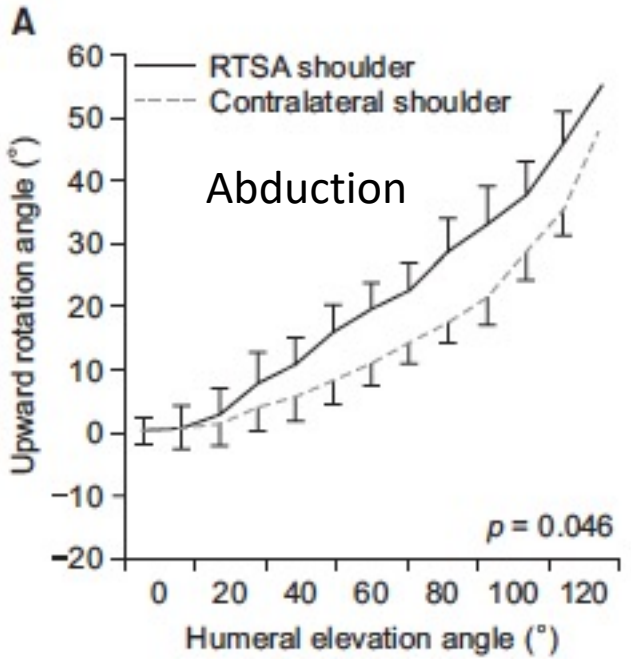
13 pts, 72 years, >1 year post-op

Conclusion

- Greater demands for scapular motion after RTSA
- Rehabilitation strategies should increasingly focus on strengthening the periscapular muscles



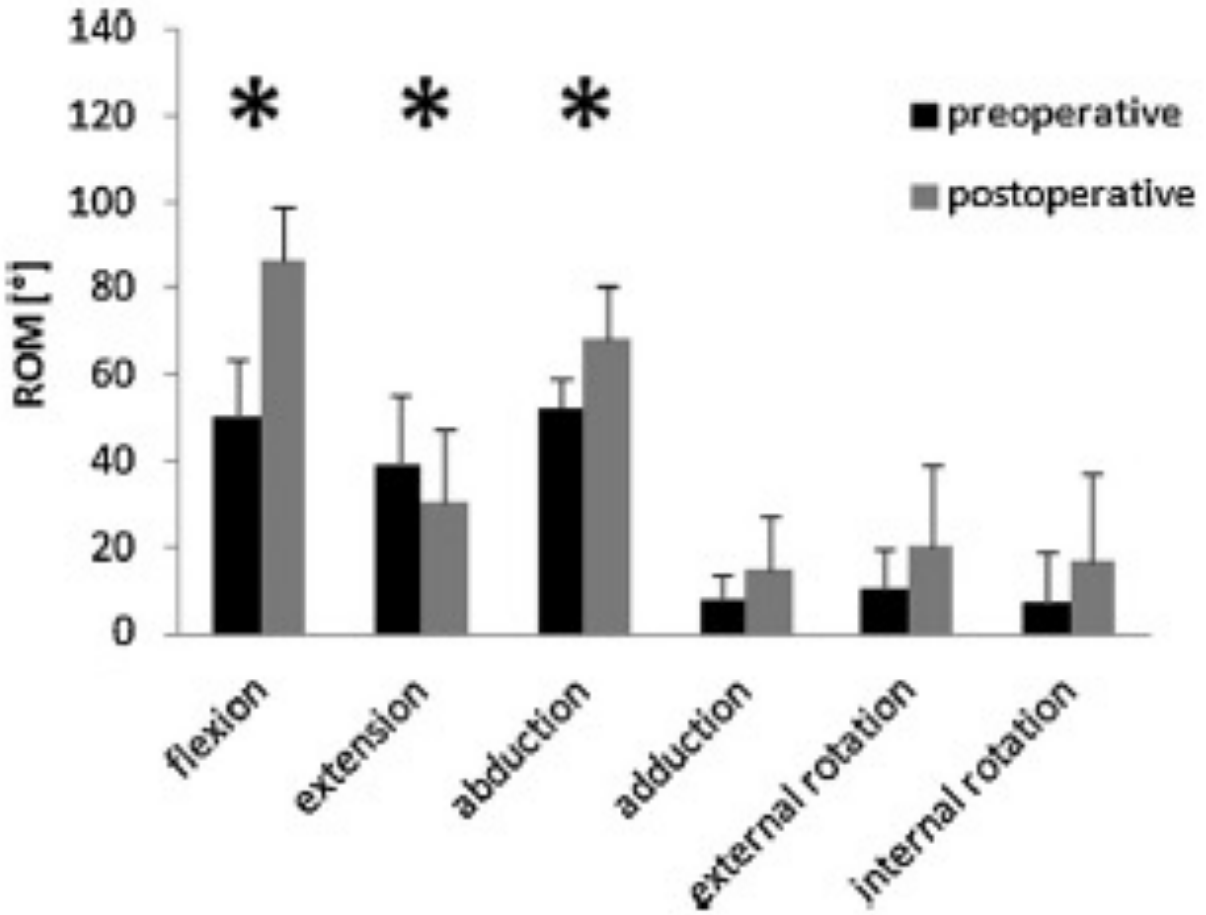


Orthopaedics & Traumatology: Surgery & Research 101 (2015) 191–196

Can reverse shoulder arthroplasty in post-traumatic revision surgery restore the ability to perform activities of daily living?

M.W. Maier[a,*], F. Zeifang[a], M. Caspers[a], T. Dreher[a], M.C. Klotz[a], O. Rettig[a], S.I. Wolf[a], P. Kasten[b]

[a] Clinic for Orthopedics and Trauma Surgery, Heidelberg University Hospital, Heidelberg, Germany
[b] Orthopedic Surgery Center (OCC) Tübingen, University Department of Orthopedic Surgery, Hoppe-Seyler-Strasse, 3, 72076 Tübingen, Germany



Improved active flexion and abduction
Decreased extension

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Improved active flexion and abduction,
Decreased extension
The improved ROM was benificial in one of four ADLs.

Table 2
Patients and the ability to completely perform the activities of daily living before and after surgery.

	comb	wash	wipe	shelf
Patient 1				
Preop	0	+	+	0
Postop	0	+	+	0
Patient 2				
Preop	0	+	+	0
Postop	0	+	+	0
Patient 3				
Preop	0	+	+	0
Postop	0	+	0	0
Patient 4				
Preop	+	+	+	0
Postop	+	+	+	0
Patient 5				
Preop	+	+	+	0
Postop	+	+	+	+
Patient 6				
Preop	0	+	0	0
Postop	+	+	+	+

Cmb: combing the hair; Wsh: washing the axilla; Wip: wiping when using the toilet; Shlf: taking a book from a shelf; +: able to perform the ADL; 0: not able to perform the ADL; preop: preoperative; postop: postoperative.

Knee Surg Sports Traumatol Arthrosc (2018) 26:100–112

Return to sport after shoulder arthroplasty: a systematic review and meta-analysis

Joseph N. Liu[1] · Michael E. Steinhaus[1] · Grant H. Garcia[1] · Brenda Chang[2] · Kara Fields[2] · David M. Dines[3] · Russell F. Warren[3] · Lawrence V. Gulotta[3]

Returned to sport:
TSA 93%
HHA 71%
rTSA 75%

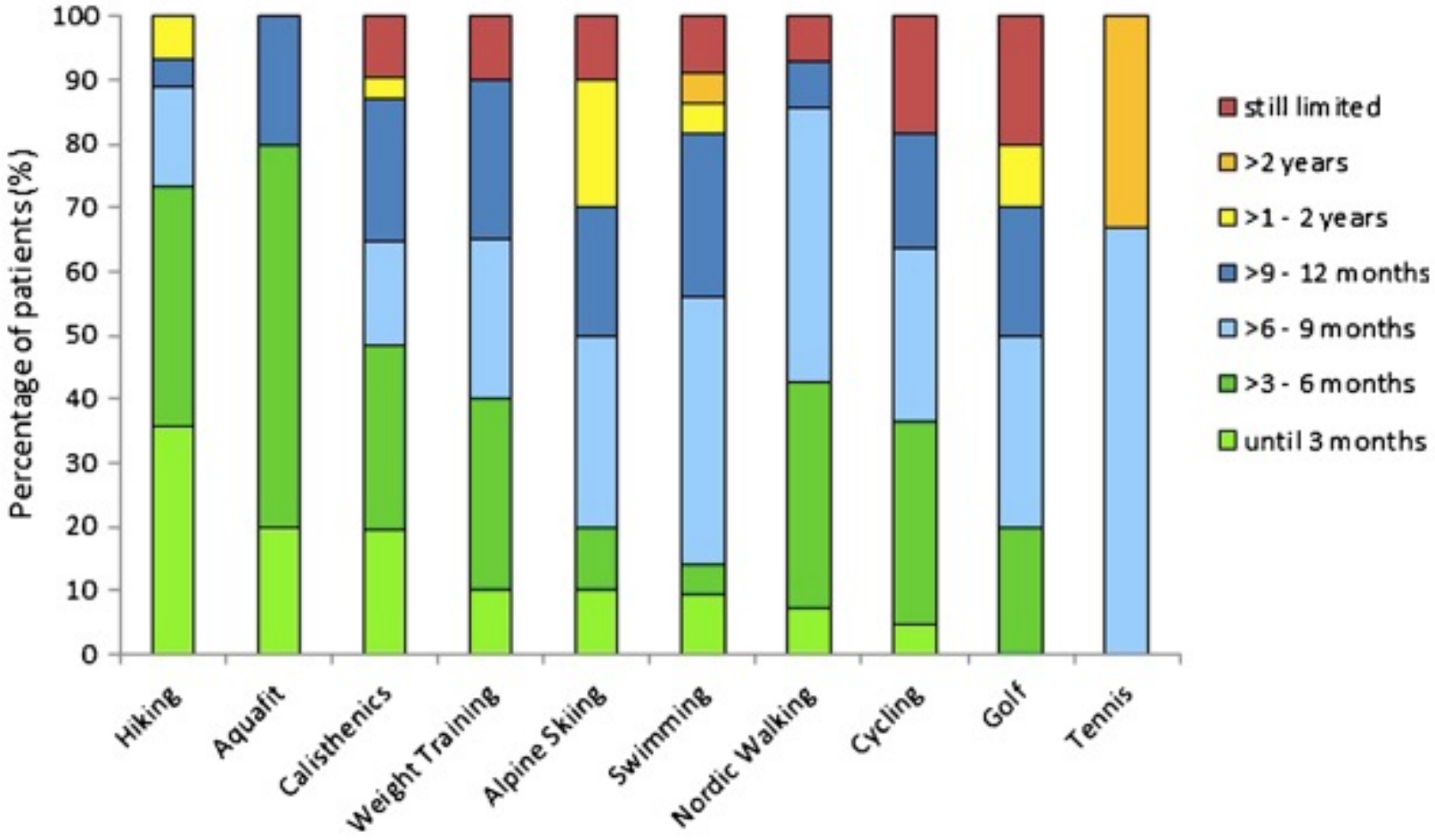
Conclusion
Most patients are able to return to one or more sports following shoulder arthroplasty, with anatomic total shoulder arthroplasty having the highest rate of return.

Return to sports after reverse shoulder arthroplasty—the Swiss perspective

Christoph Kolling [1,2] · Mirela Borovac [2,3] · Laurent Audigé [1,2] · Andreas M. Mueller [3] · Hans-Kaspar Schwyzer [1]

International Orthopaedics (2018) 42:1129–1135

305 pts, 77 years



clusions

e majority return to previous sports

tient expectations of post-operative

orts activity need to be addressed when

anning RSA

J Shoulder Elbow Surg (2011) 20, 281-289

Long-term activity restrictions after shoulder arthroplasty: an international survey of experienced shoulder surgeons

Robert A. Magnussen, MD[a,*], William J. Mallon, MD[b], W. Jaap Willems, MD, PhD[c], Claude T. Moorman III, MD[a]

Racquetball	Not allowed
High-impact aerobics	Not allowed
Singles tennis	Not allowed
Basketball	Not allowed
Football (soccer)	Not allowed
Track and field (sprinting)	Not allowed
Baseball/softball	Not allowed
Snowboarding	Not allowed
Weightlifting	Not allowed
Waterskiing	Not allowed
Volleyball	Not allowed
Track and field (throwing)	Not allowed
Martial arts	Not allowed
Lacrosse	Not allowed
Team handball	Not allowed
American football	Not allowed

Table IV Summary of reco

Activity	Reverse total shoulder arthroplasty
Jogging/running	Allowed
Walking	Allowed
Ballroom dancing	Allowed
Stationary bicycle	Allowed
Low-impact aerobics	Allowed with experience
Stairclimber	Allowed with experience
Hiking	Allowed with experience
Road cycling	Allowed with experience
Golf	Allowed with experience
Swimming	Allowed with experience
Table tennis	Allowed with experience
Pilates	Allowed with experience
Bowling	Undecided
Elliptical trainer	Allowed with experience
Cross-country skiing	Allowed with experience
Ice skating	Allowed with experience
Doubles tennis	Undecided
Downhill skiing	Undecided
Rollerblading	Undecided
Rowing	Undecided
Fencing	Undecided

A randomized single-blinded trial of early rehabilitation versus immobilization after reverse total shoulder arthroplasty

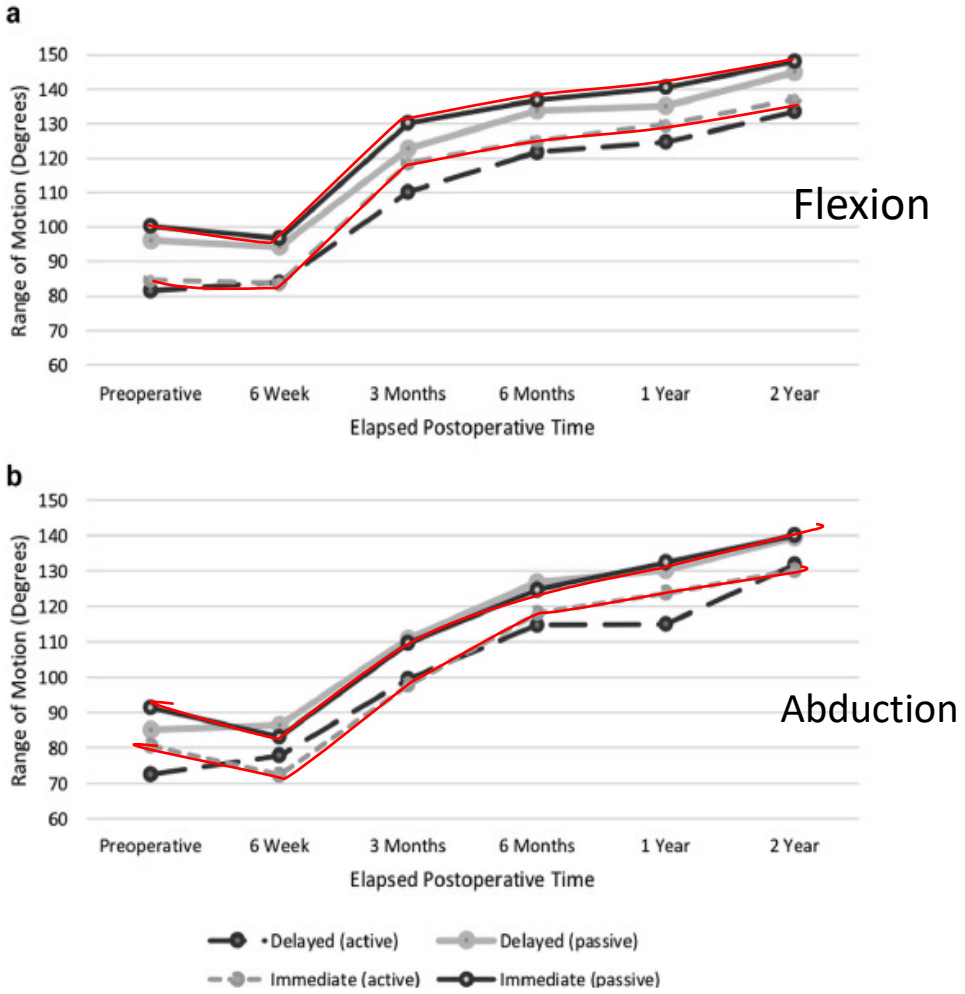
Mia S. Hagen, MD, Sachin Allahabadi, MD, Alan L. Zhang, MD, Brian T. Feeley, MD, Trevor Grace, MD, C. Benjamin Ma, MD*

J Shoulder Elbow Surg (2020) 29, 442–450

86pts, 69years, >1y F/U

(1) Delayed rehabilitation (sling for 6 weeks)

(2) immediate rehabilitation (immediate physical therapy for passive and active ROM and weaning of sling use as tolerated but no resistance training for 6 weeks)



Flexion

Abduction

A randomized single-blinded trial of early rehabilitation versus immobilization after reverse total shoulder arthroplasty

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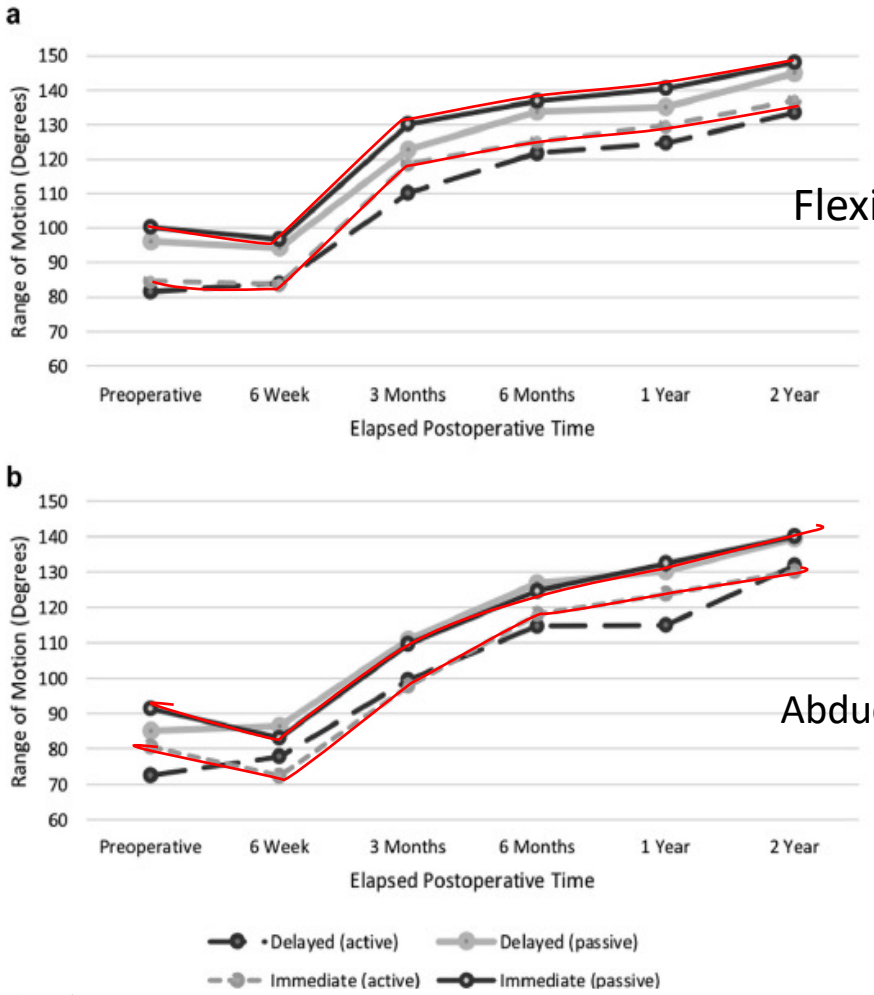


Conclusion

- These results support the safety of early postoperative rehabilitation
- Avoids the limitations of prolonged immobilization in an elderly population;

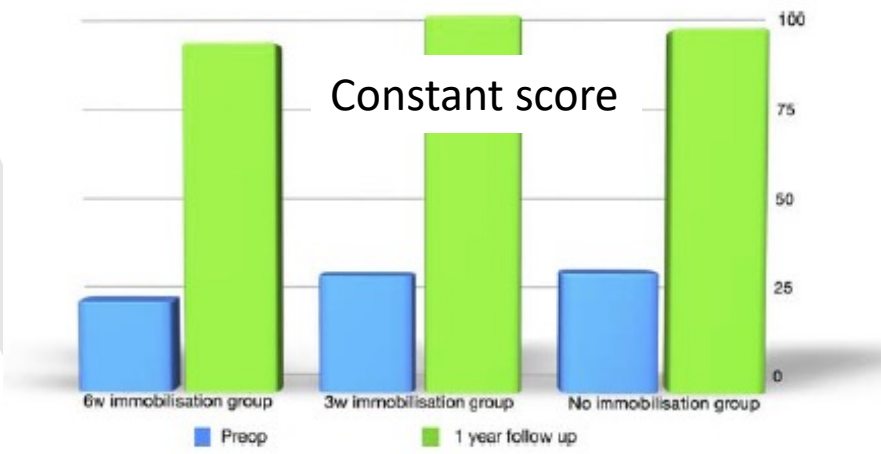
Accelerated rehabilitation following reverse total shoulder arthroplasty

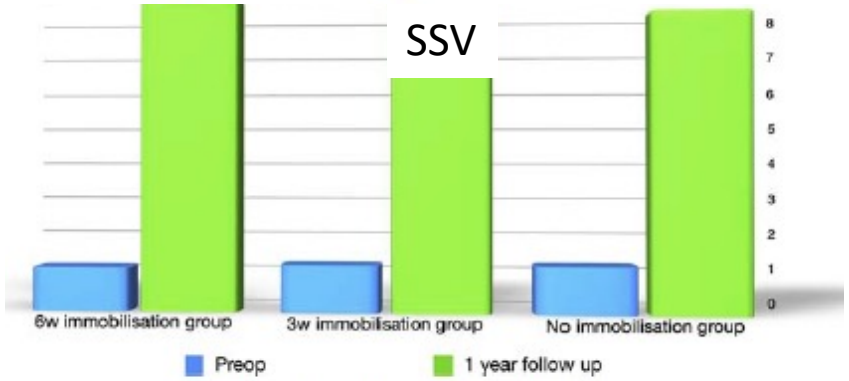
Jonathan Lee, PT[a], Paolo Consigliere, MD[a], Ernest Fawzy, FRCS(Orth)[a], Laura Mariani, MD[a], Caroline Witney-Lagen, FRCS(Orth)[a], Luis Natera, MD, PhD[a,b,c], Berta Buch, MD[b,c], Ehud Atoun, MD[d,e], Giuseppe Sforza, MD, MCh(Orth)[a], Eyal Amar, MD[f], Ofer Levy, MD, MCh(Orth), FRCS[a,d,e,*]

J Shoulder Elbow Surg (2021) 30, e545–e557

320 pts,3 groups, 1 year F/U

1. 6 weeks immobilisation
2. 3 weeks immobilisation
3. No immobilisation



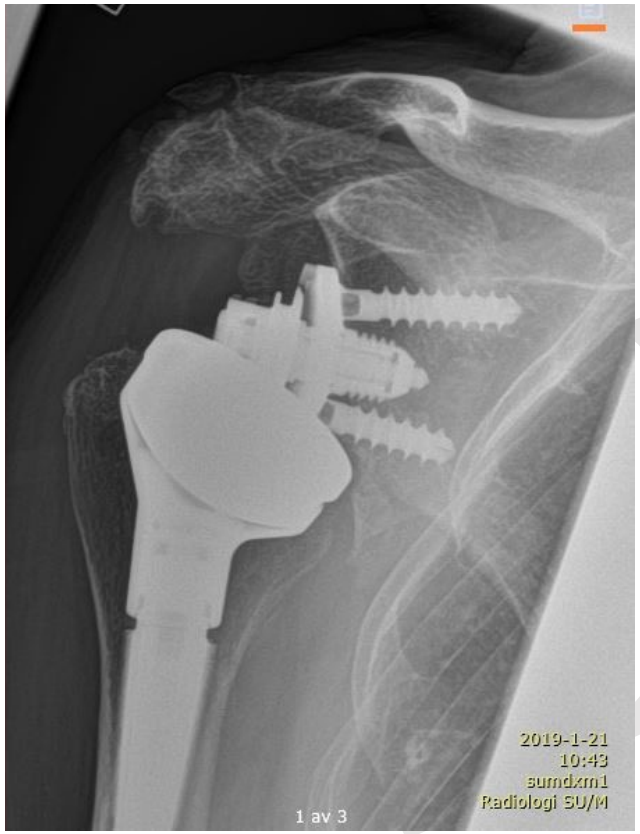


Conclusion

Accelerated rehabilitation:

- Safe and leads to reliable good clinical results
- Quick return to function.
- Psychological and emotional advantage
- Earlier return to normal function and independence

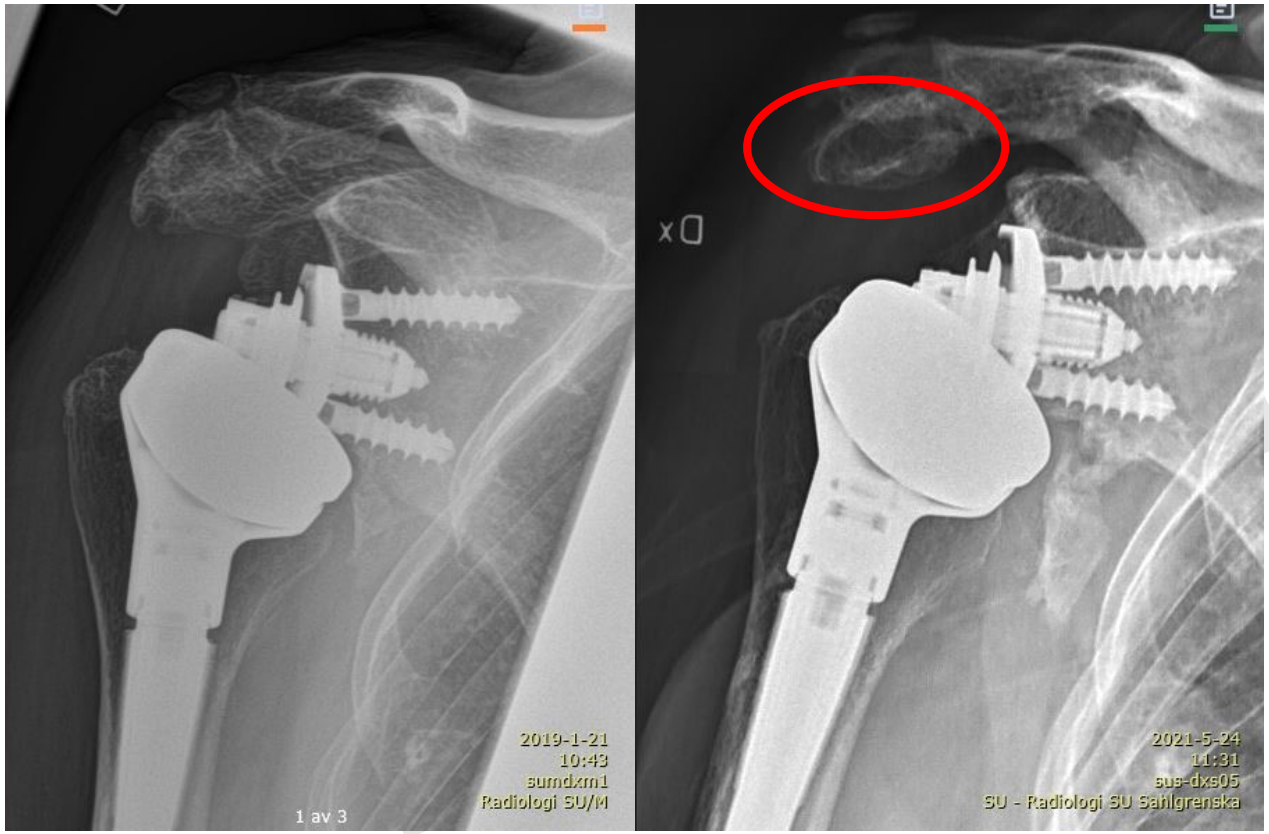
Woman, 75 y, RA

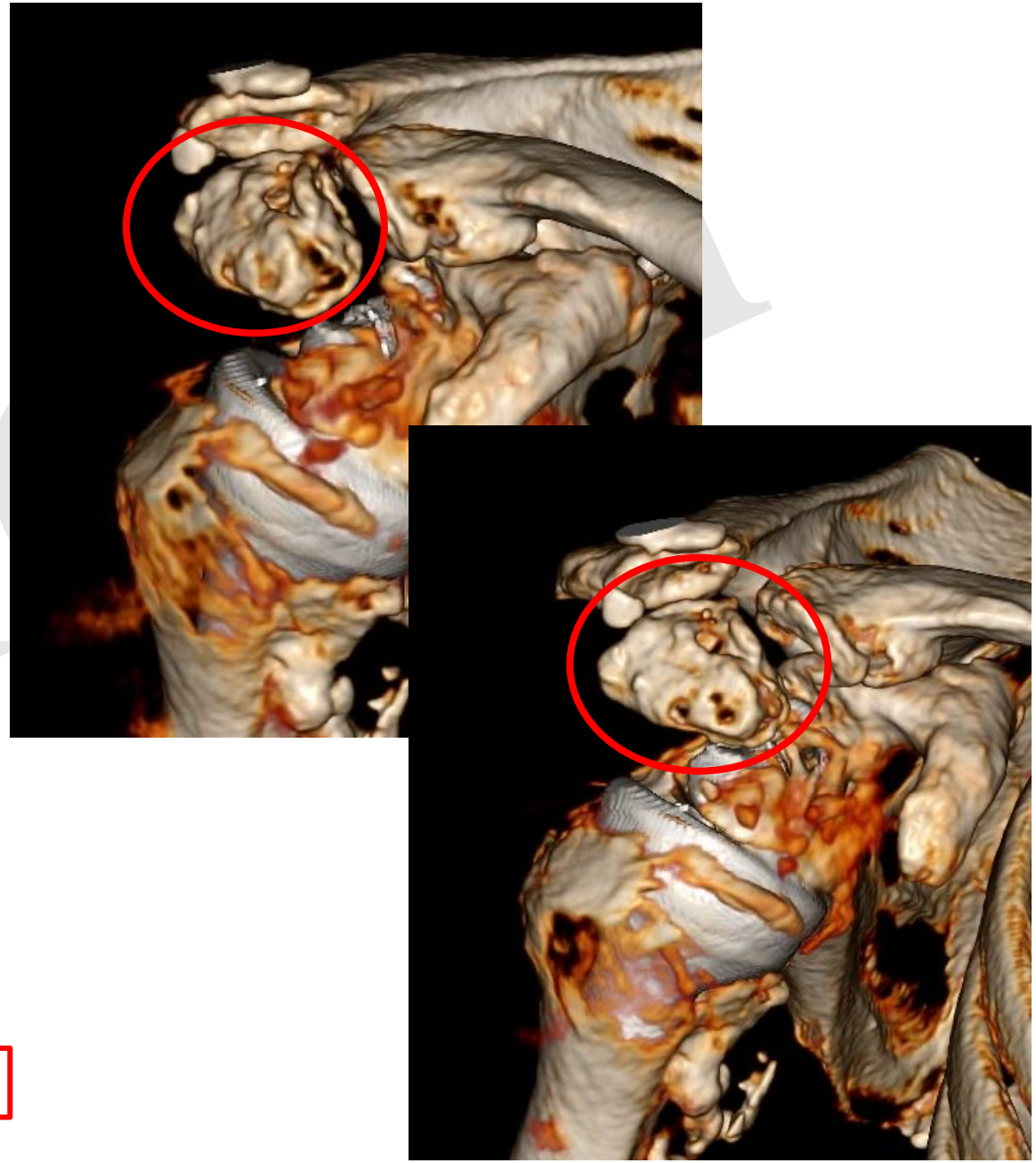


Pain free RSA with excellent ROM

1 year post-op sudden pain onset and loss of motion

Woman, 75 y, RA

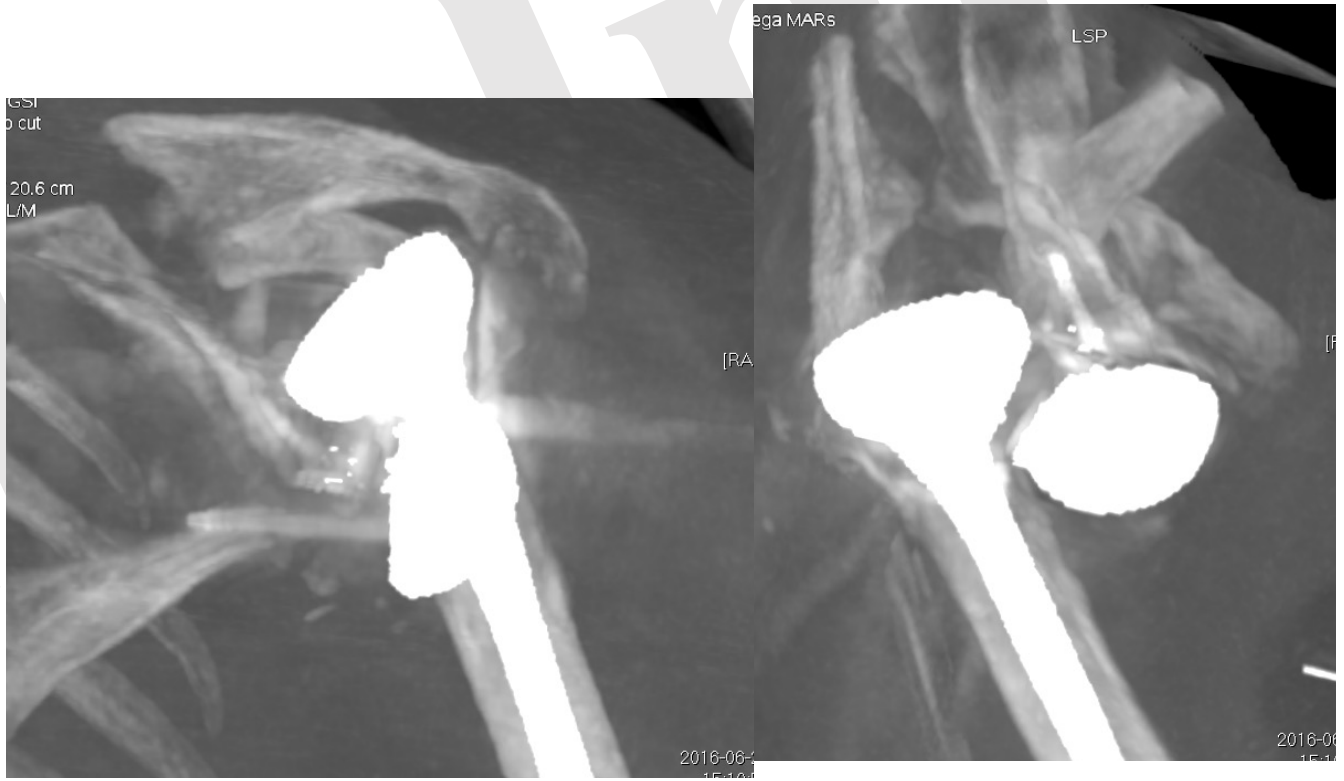




Acromion fatigue fracture

Woman, 70 y

3 months dislocation



Spine fx – posterior dislocation

Role of physiotherapist in RSA

- Early motion
- Allow time for bone fixation before large loads
- Gradual deltoid strengthening
- Some patients need holding back

- Pain at end of motion = scapular impingement?
- Unexpected stiffness and/or pain = low grade infection?
- Sudden loss of function and pain onset = acromion fracture?


Thank You