Clinical reasoning to inform the choice of exercises for patients with shoulder dysfunction

Evidence & application

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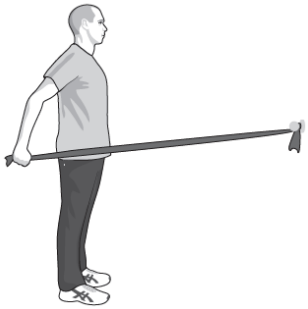
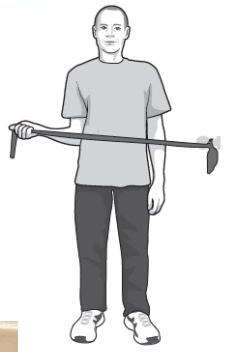
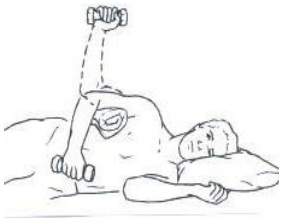


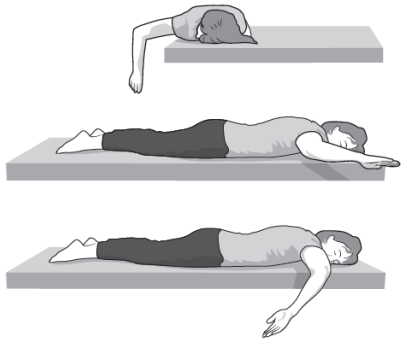








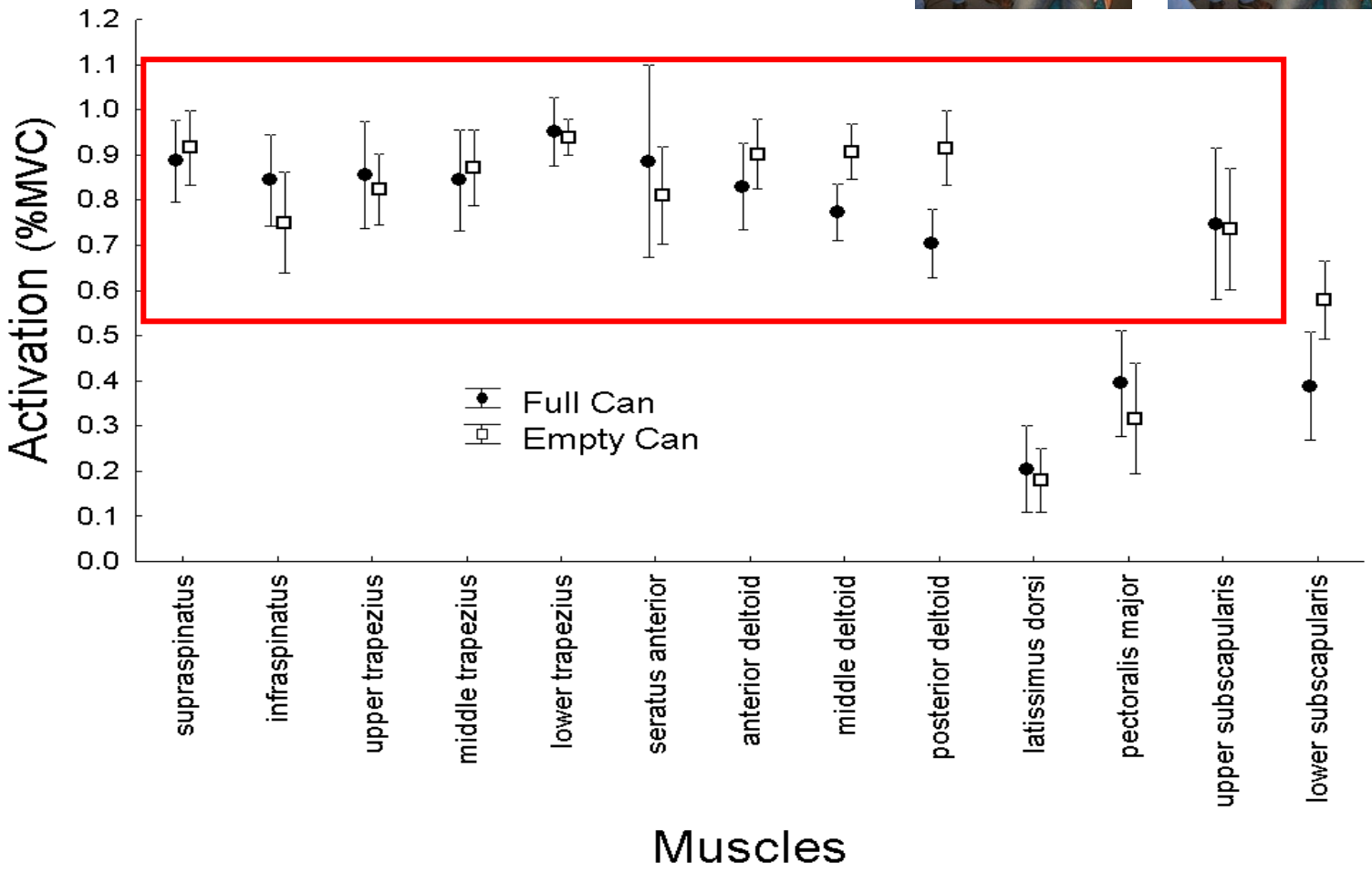


Functional anatomy of the shoulder
scapulohumeral rhythm

- shoulder abduction
  - mover muscles required
    - humerus abductors and externally rotators
    - scapula lateral (upward) rotators
- shoulder flexion
  - mover muscles required
    - humerus flexors and externally rotators
    - scapula lateral (upward) rotators
- hand-behind-back
  - mover muscles required
    - humerus extensors, adductors and internal rotators
    - scapula medial (downward) rotators

Isometric manual muscle tests

Boettcher et al 2009

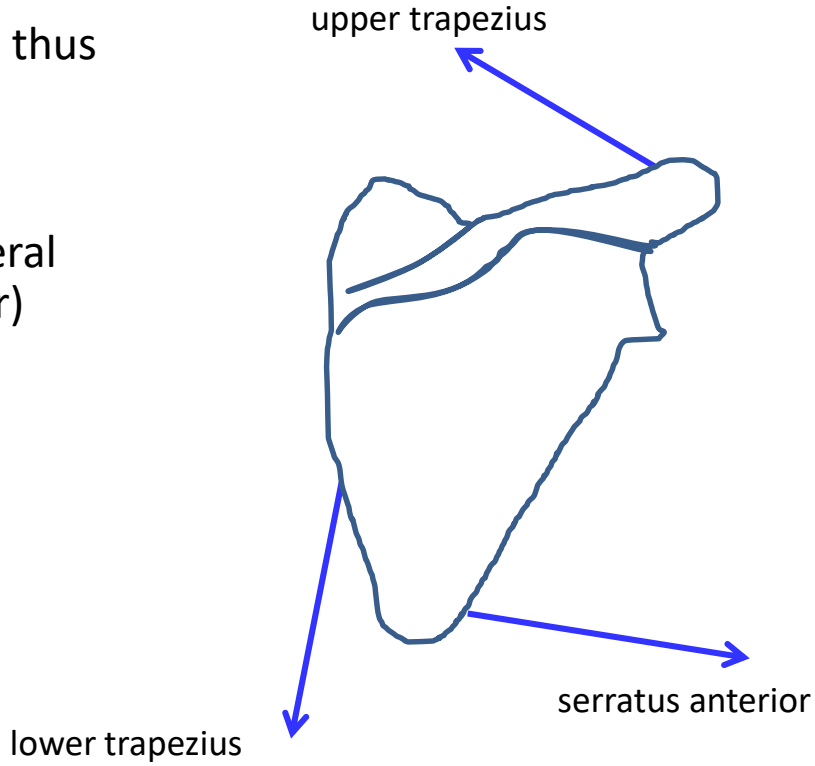


Axioscapular muscle function
rotator role

scapular rotation occurs to "serve" the shoulder joint by:

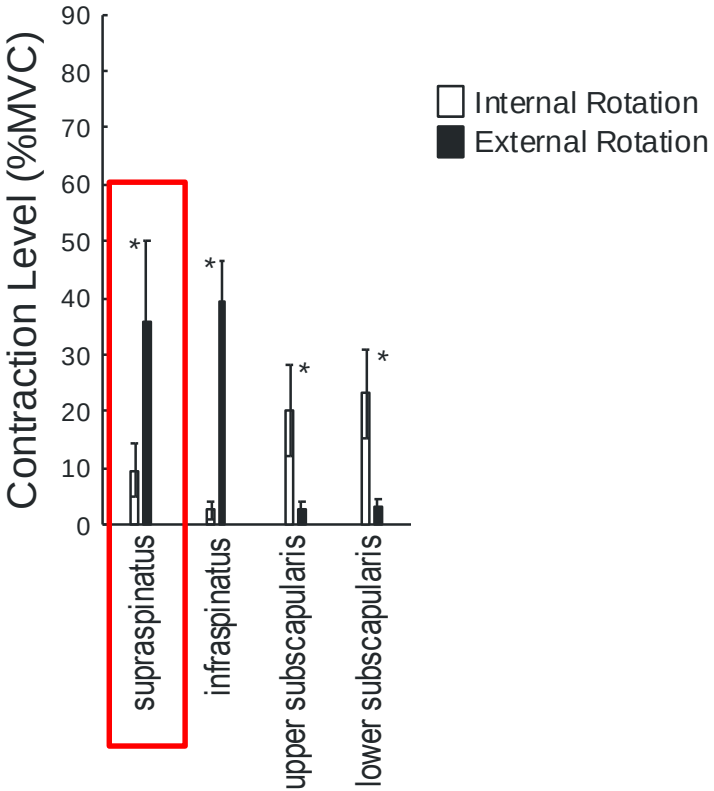
- repositioning the glenoid fossa thus increasing the available range of movement at the shoulder joint

- repositioning the scapulohumeral (rotator cuff, deltoid, teres major) muscles to maintain optimal mechanical alignment through shoulder joint range of motion



Actions of rotator cuff (RC) muscles

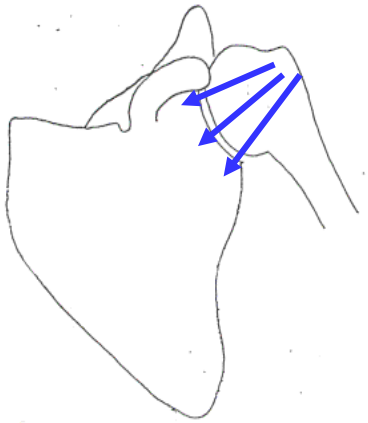
- internal rotation
  - subscapularis (anterior RC)
- external rotation
  - infraspinatus, teres minor & supraspinatus (posterior RC)



Boettcher et al 2010

Function of RC muscles

- function
  - to provide dynamic stability at the shoulder joint by:
    - providing a medial force to the humeral head to accurately position it in the centre of the glenoid fossa during shoulder movement

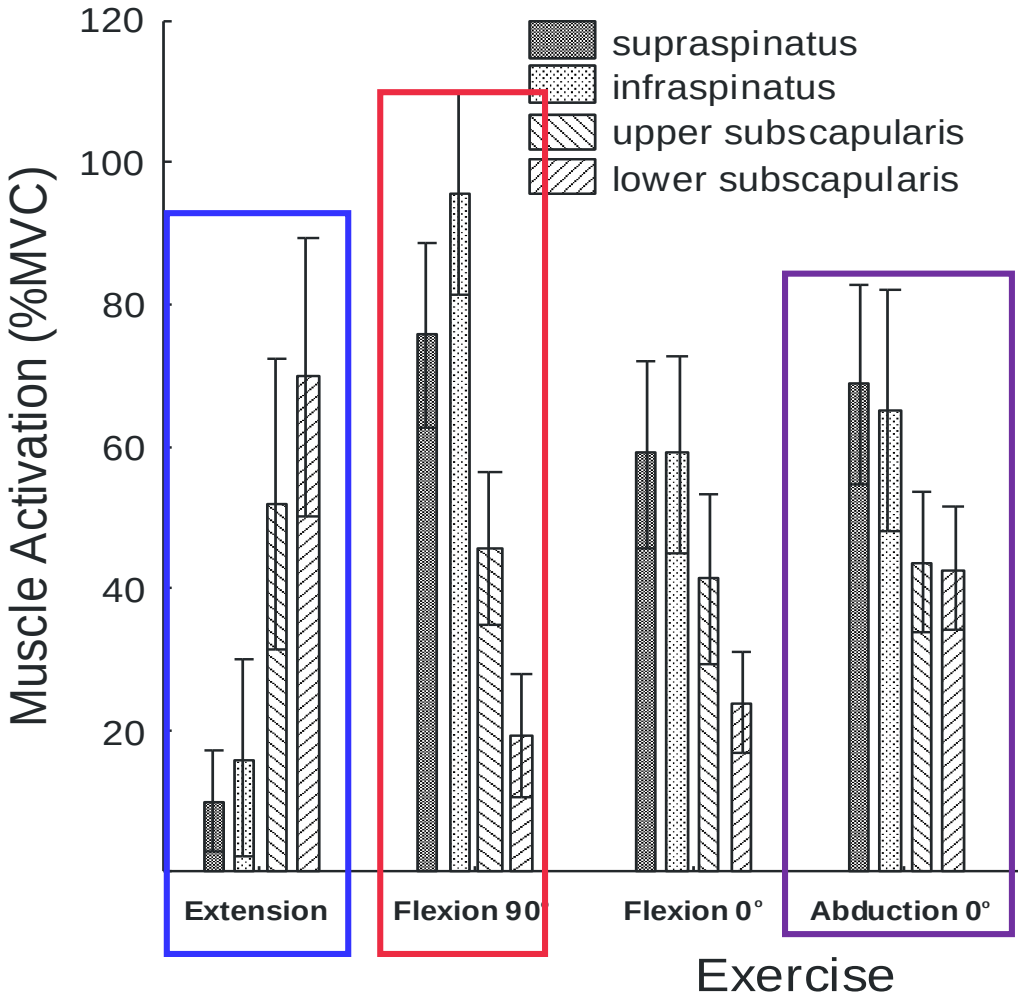


    - counterbalance translation of the humeral head caused by muscles which abduct, flex & extend the humerus

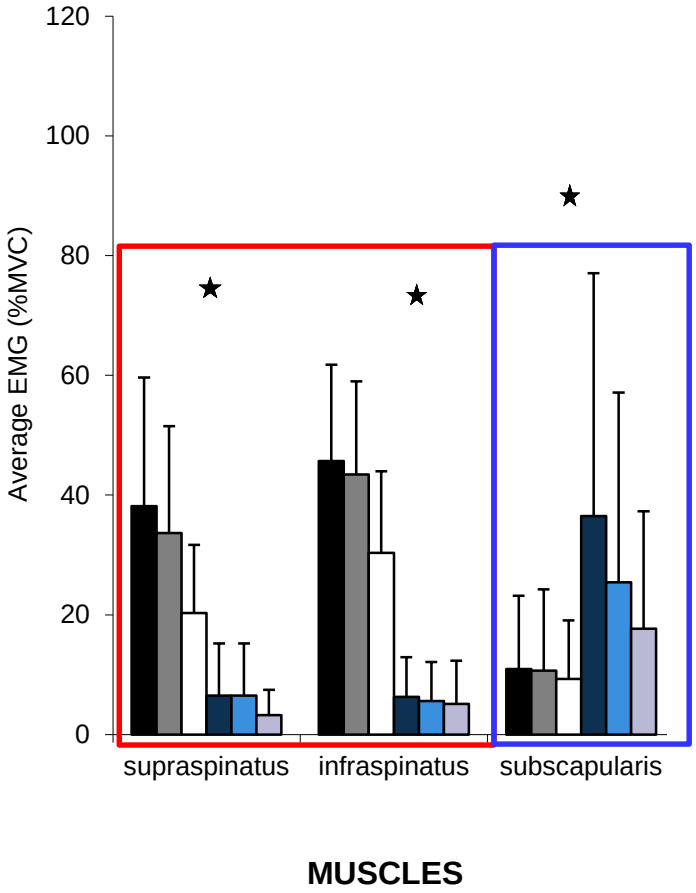
Wattanaprakornkul et al 2011, Rathi et al 2016

Function of RC muscles

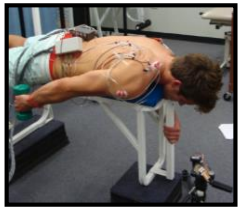
isometric flexion, extension & abduction



Function of RC muscles



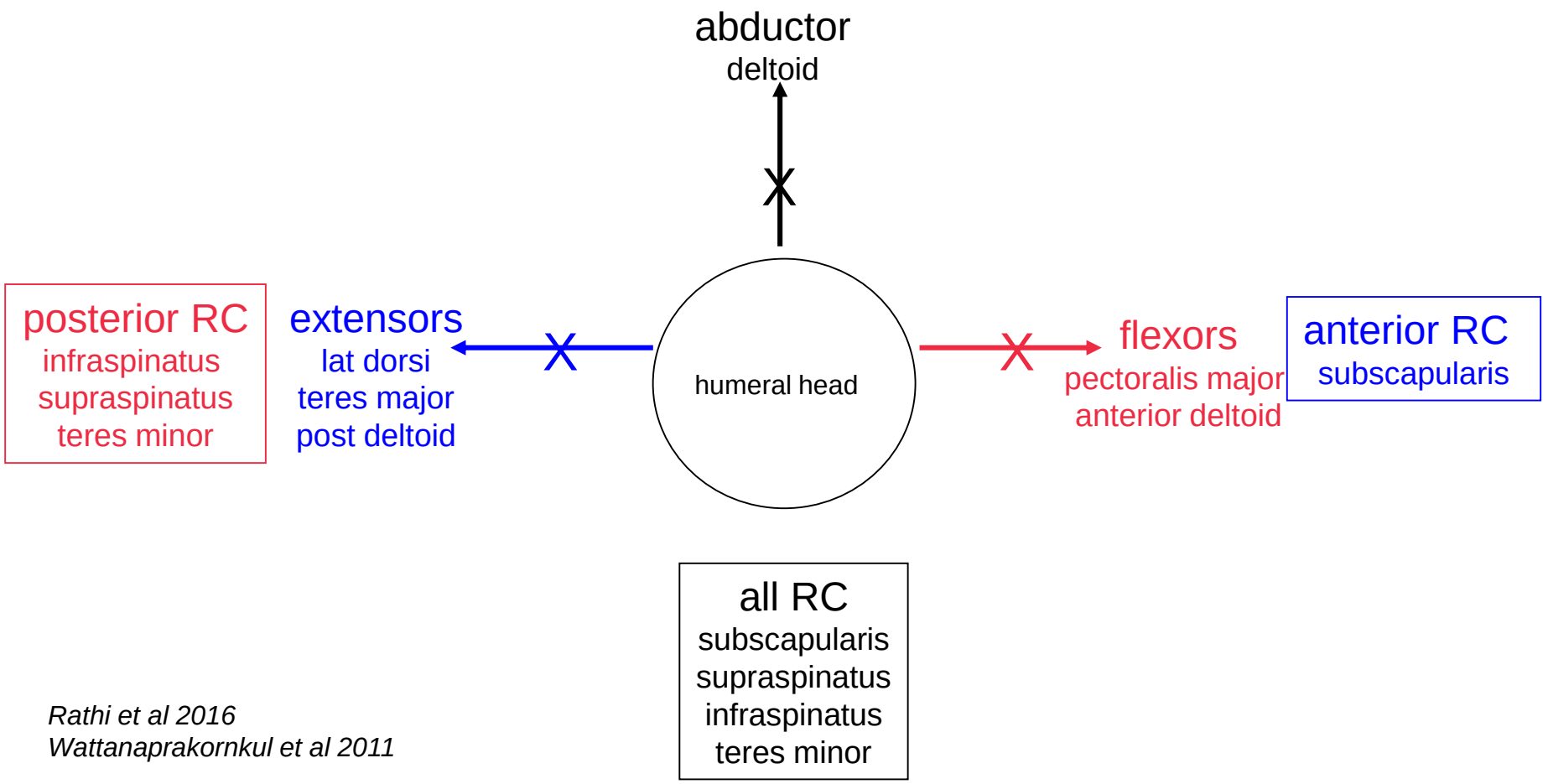
dynamic flexion & extension



Wattanaprakornkul et al 2011

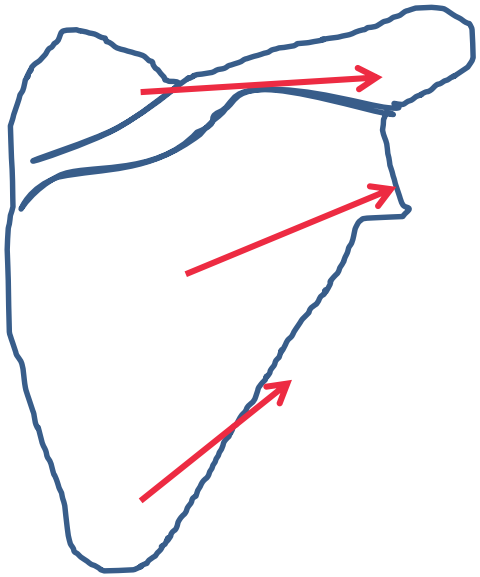
Shoulder joint stability model

balanced muscle forces



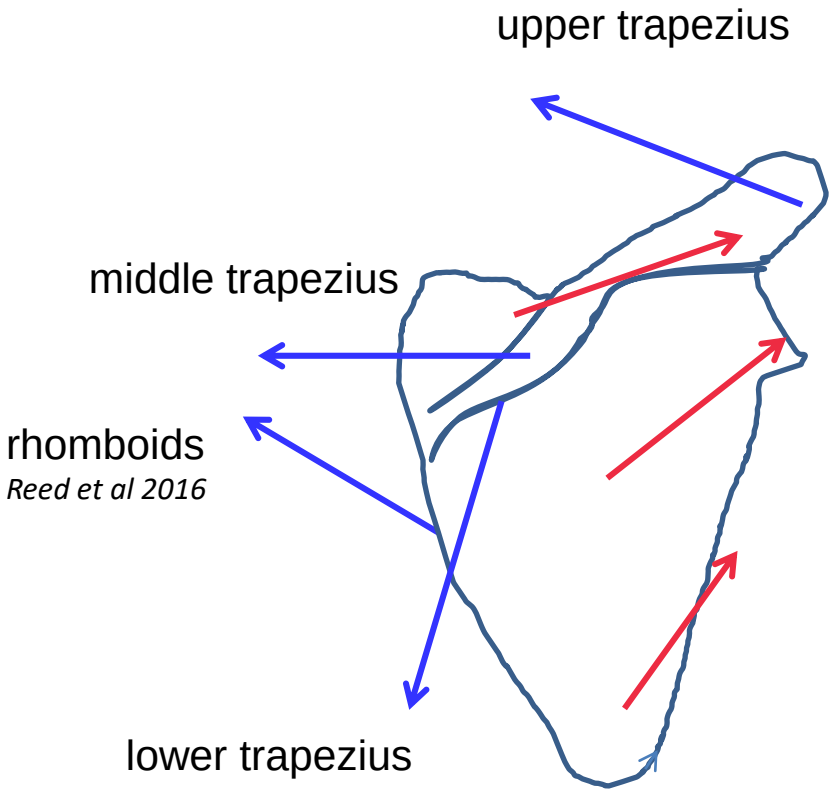
Rathi et al 2016
Wattanaprakornkul et al 2011

Axioscapular muscle function
stabiliser role



scapulohumeral muscles
deltoid
rotator cuff
teres major

Axioscapular muscle function
stabiliser role



scapulohumeral muscles
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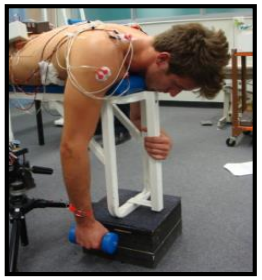
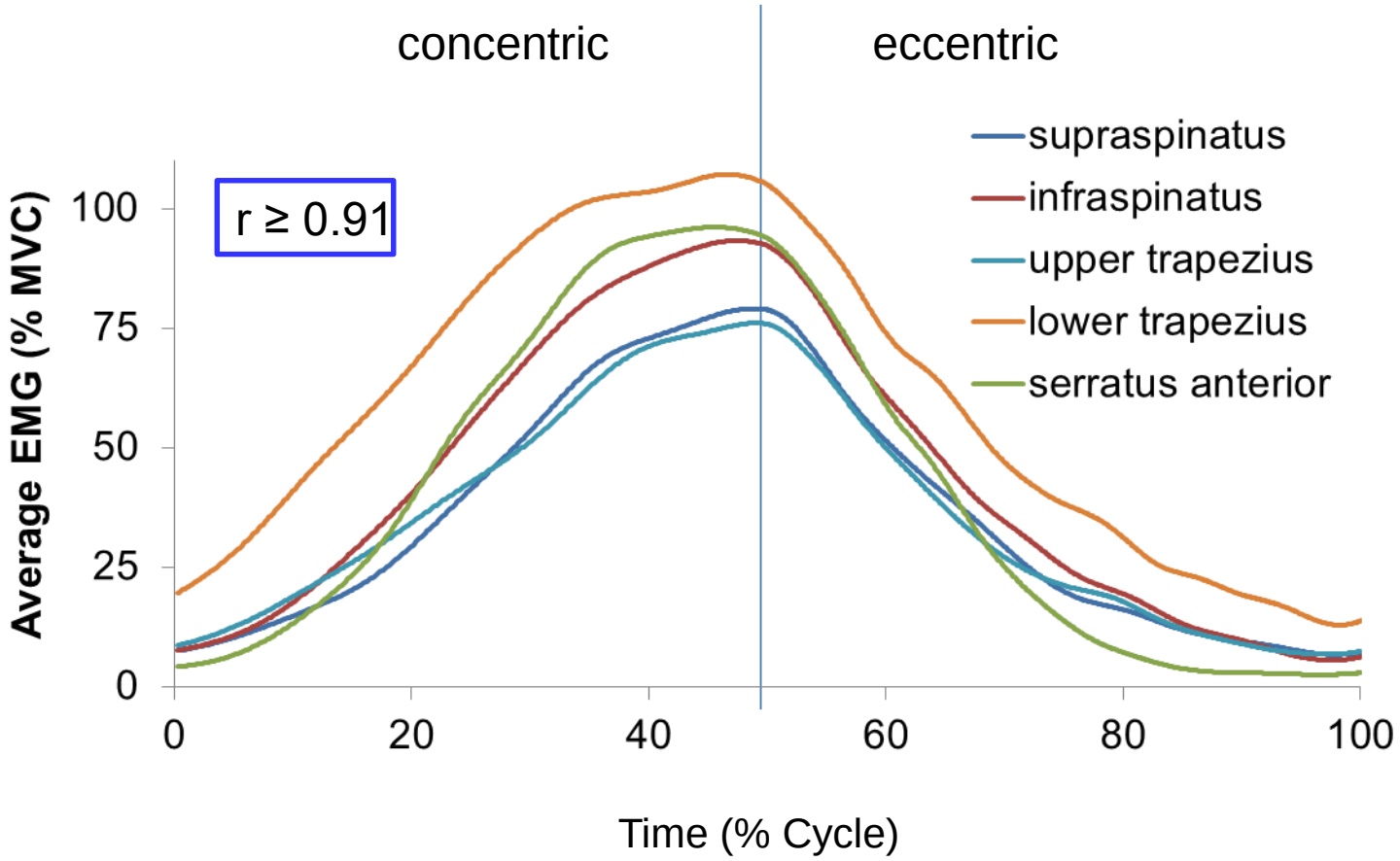
Axioscapular muscle function
stabiliser role



Wattanaprakornkul et al 2011

Axioscapular muscle function
stabiliser role

70% maximum load



Shoulder exercises

- MUST recruit muscles moving the humerus, rotator cuff & axioscapular muscles simultaneously
- reflects scapulohumeral rhythm & dynamic stability requirements of shoulder joint & scapula
  - axioscapular muscles are recruited to position the scapula to serve the shoulder joint
  - muscles moving the humerus at the shoulder also glide the humeral head
  - RC muscles are recruited to prevent humeral head translation
  - axioscapular muscles are recruited to prevent RC (& deltoid & teres major) muscles from translating the scapula

Clinical reasoning case study

Interview summary:

- Your patient is a 65 year old woman who has had unilateral, dominant-side shoulder pain for 4 months. She has been diagnosed with sub-acromial impingement syndrome & has not had any treatment.
  - no uniformity in defining diagnostic labels
  - no generally accepted explanation for the aetiology & pathogenesis of the majority of cases of shoulder pain
  - at best only moderate diagnostic agreement between clinicians

    Bamji et al 1996, Liesdek et 1997, de Winter et al 1999

- The pain has been gradually increasing & she cannot identify any precipitating factor as the cause of her pain. She has not experienced this pain before.
  - no trauma

- Recently she has been experiencing pain at night when she lies on her affected shoulder which is interfering with her sleep.
  - common finding in most painful shoulders

Clinical reasoning case study

Interview summary:

- The pain is over the point of her right shoulder & into her proximal upper arm & is not associated with paraesthesia. MRI scans report a partial thickness tear in her supraspinatus measuring 1 cm in length.
  - → posterior RC
  - common finding in this age group regardless of symptoms
  - no clear relationship between structural damage & shoulder pain & functional limitation

    Unruh et al 2014, Miniaci et al 2002, Frost et al 1999, Milgrom et al 1995, Sher et al 1995

- Her shoulder pain is increased with the following activities of daily living
  - reaching into higher shelves
  - pulling clothing over her head
  - putting on jacket.
  - painful flexion → posterior RC - scapular upward rotators
  - painful abduction → all RC - scapular upward rotators

- Reaching backwards & doing up her bra do **not** cause pain.
  - extension/HBB **not** painful → posterior RC - scapular downward rotators

Clinical reasoning case study

Physical examination findings:

In standing:

- positive Hawkins-Kennedy impingement test
  - →no information regarding specific muscle dysfunction

- active abduction
  - pain between 100° & full range with pain increasing as range increases
  - →posterior RC muscles - rotator role - shortened length
  - increased scapular elevation at the end of range & facilitating scapular upward rotation decreases the painful range of motion
  - → axioscapular muscles - scapular upward rotator role - shortened length

Clinical reasoning case study

Physical examination findings:

In standing:

- active flexion in the sagittal plane
  - pain between 120° & full range with pain increasing as range increases
    - → posterior RC muscles - rotator role - shortened length
  - normal scapulohumeral rhythm
    - → axioscapular muscles - upward rotator role OK
- active hand-behind-back
  - range = non-dominant (painfree) side & is painfree
    - → normal anterior RC muscles

Clinical reasoning case study

Physical examination findings:

In supine lying:

- palpation findings:
  - tender over anterior glenohumeral joint line
    - →posterior RC - stabiliser role

- external rotation strength tests:
  - mid length - some decrease in strength with slight pain
  - shortened - **significant decrease in strength with severe pain**
  - lengthened - some decrease in strength with slight pain
    - → posterior RC – rotator role - shortened range
    - → axioscapular muscles - stabiliser role

- internal rotation strength tests:
  - normal strength & painfree throughout rotation range
    - → anterior RC normal

Clinical reasoning case study

Summary of assessment findings

predominant shoulder muscle dysfunction

("functional diagnosis")

↓

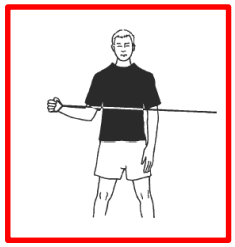
posterior RC - rotator role - shortened length

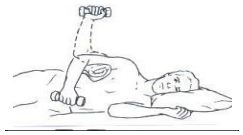
axioscapular muscles - stabiliser role

Clinical reasoning case study

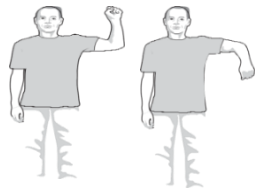
Exercise treatment choice

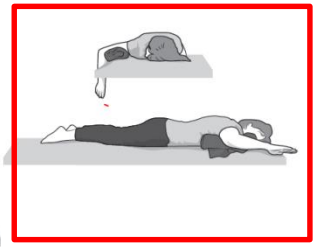
progress by increasing complexity of muscle function



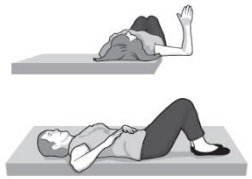


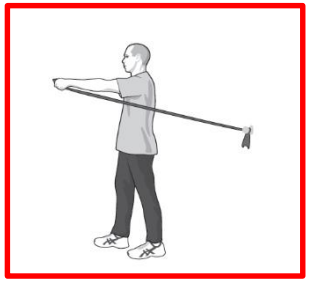
- posterior RC - rotator role
- axioscapular muscles - stabiliser role



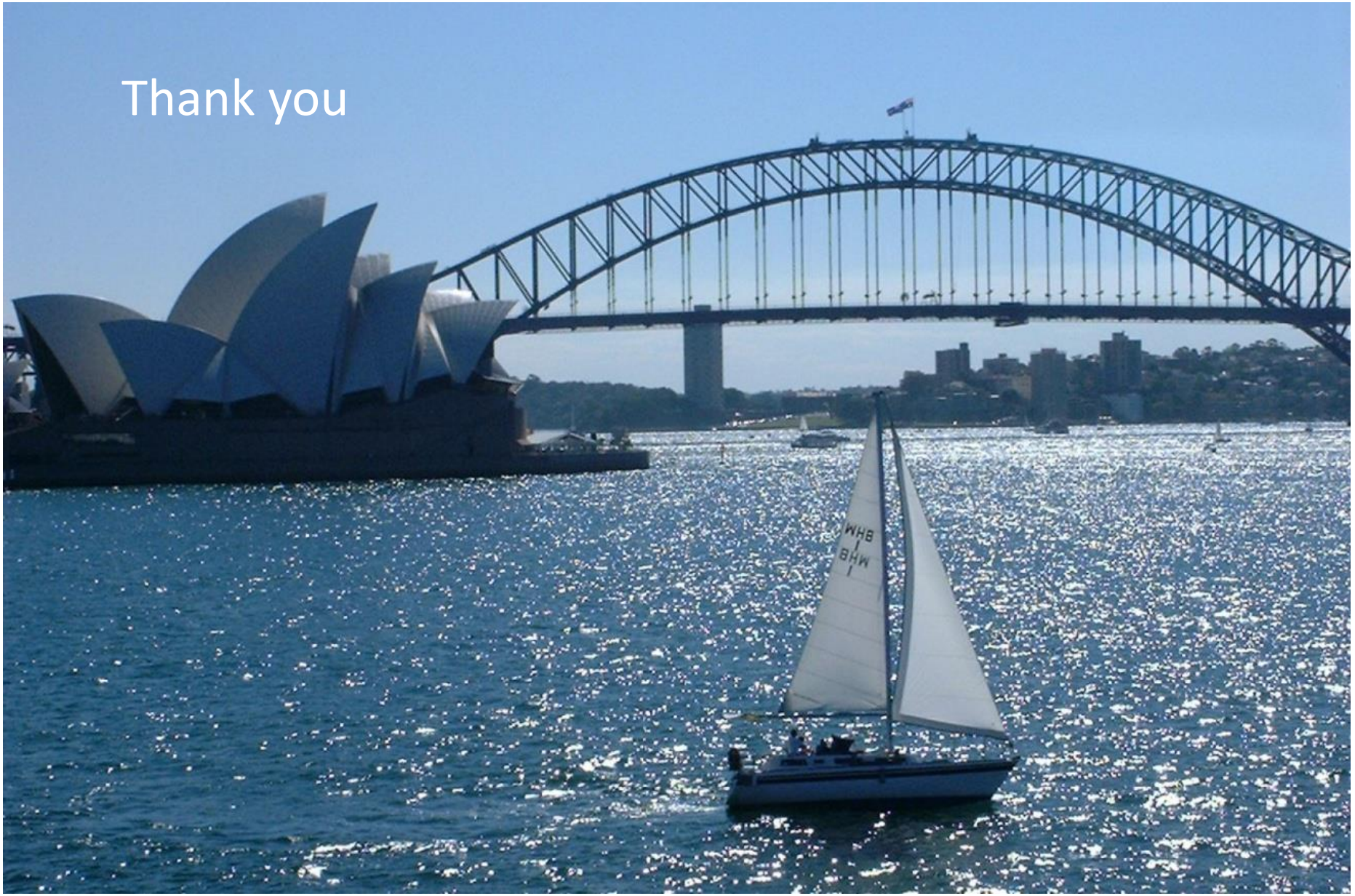


- posterior RC - rotator role
- axioscapular muscles – stabiliser & rotator roles





- posterior RC - rotator & stabiliser roles
- axioscapular muscles - stabiliser & rotator roles


Thank you