Musculoskeletal dysfunctions associated with swimmer's shoulder

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Review

Musculoskeletal dysfunctions associated with swimmers' shoulder

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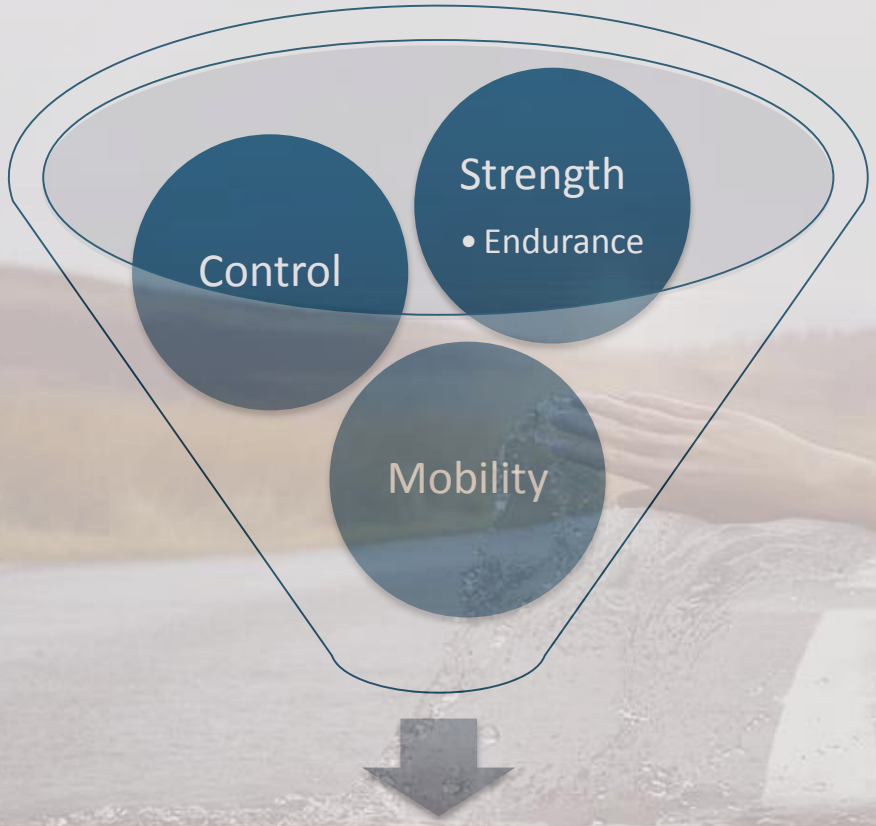
University of Antwerp

SURPRISING?



Greater risk for injury

Elite swimmers: 14km/day
2500 shoulder revolution/day
16 000 shoulder revolutions/week
…
Shoulder pain is the most frequent Orthopaedic injury in swimmers

Epidemiology

- **40-91% prevalence of shoulder pain among elite and non elite swimmers** (McMaster and Troup , 1993, Merrick et al, 2002, Sein et al, 2010, Tate et al, 2012)
- **Depends on level of competition,…**

- **Yearly Injury rates** (Merrick et al 2002)
- 66% elite swimmers
- 57% professional baseball players
- 44% college volleyball players
- 7% professional golfers

** *Occasionally*=less than 1 time per month; *Sometimes*=1-3 times per month; *Regularly*=1 or more times per week

FIGURE 2. Pain medication usage frequency.

"Swimmers believe that shoulder pain is a normal part of swimming and that they should train with their shoulder pain to complete necessary practice yardage and to be successful in the sport."

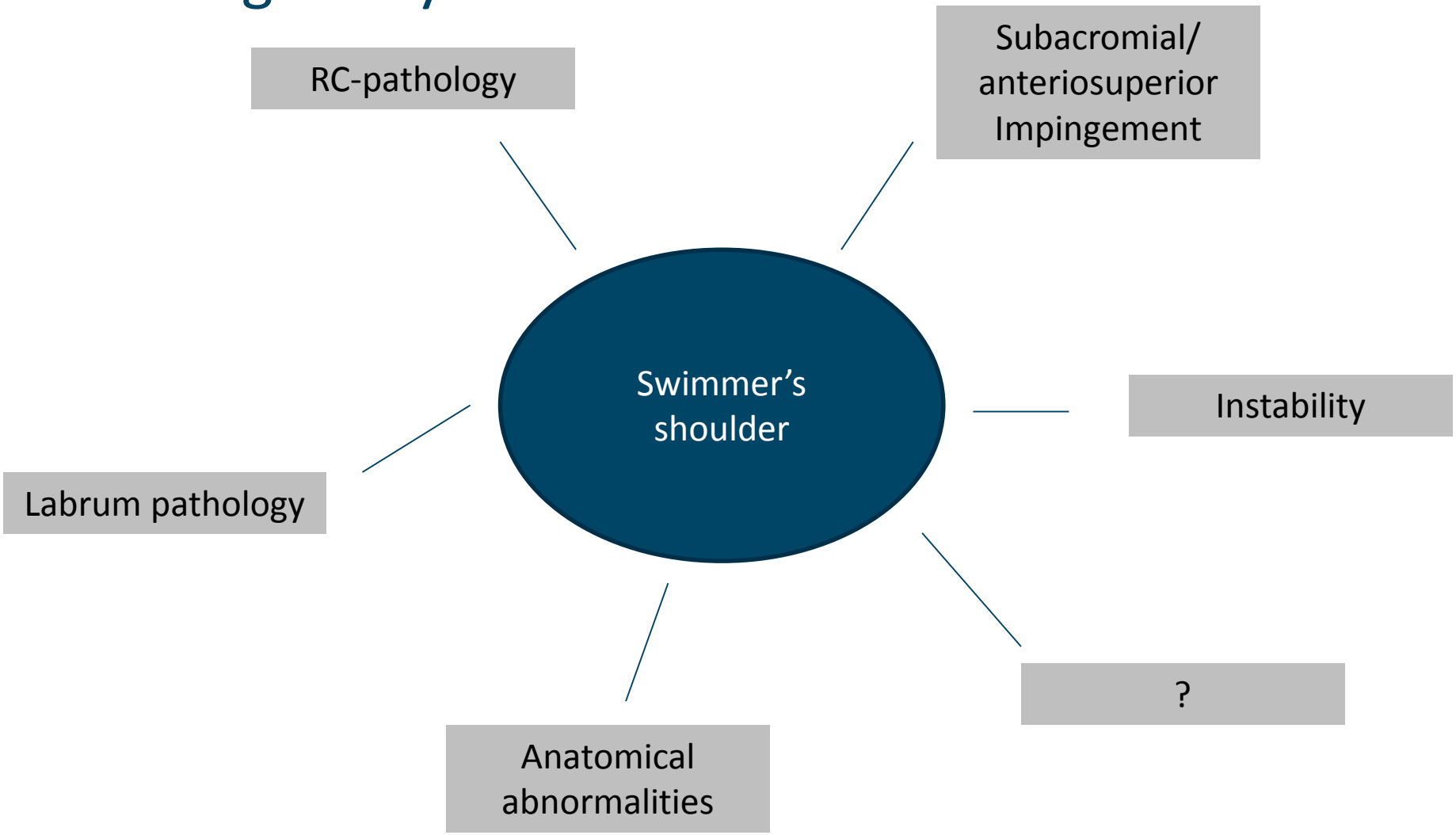
Hibberd & Myers, 2013

"syndrome with anterior shoulder pain induced by repetitive impingement of the rotator cuff under the coraco-acromial arch"

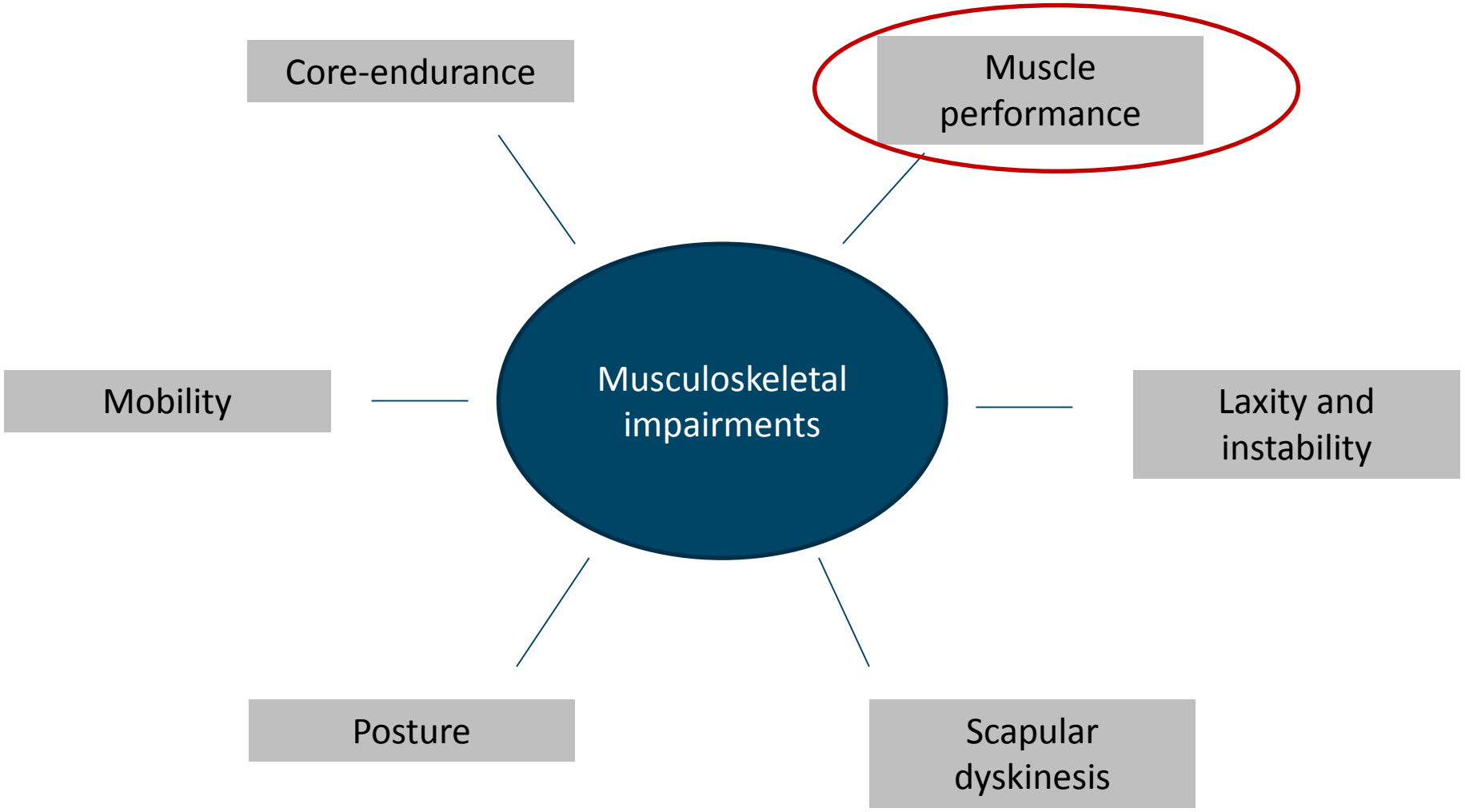
… Subacromial impingement?

…or an anteriosuperior internal impingemt

Heterogeneity of the swimmer's shoulder



Physical characteristics



Muscle performance (**activity)**

	Rhomboidei	Upper trapezius	anterior deltoid	middle deltoid	Serratus Anterior	subscapularis	Infraspinatus	teres minor	Supraspinatus
hand entry	PS<PFS (1)	PS<PFS (1)	PS<PFS (1)	PS<PFS (1)					
pulling phase	PS>PFS (1)				PS<PFS (1)	PS>PFS (2)		PS<PFS (2)	
hand exit			PS<PFS (1)	PS<PFS (1)			PS>PFS (1)		
mid-recovery		PS<PFS (2)		PS<PFS (2)		PS<PFS (1)	PS>PFS (2)		PS<PFS (2)

PS= painful shoulder
PFS= painfree shoulder

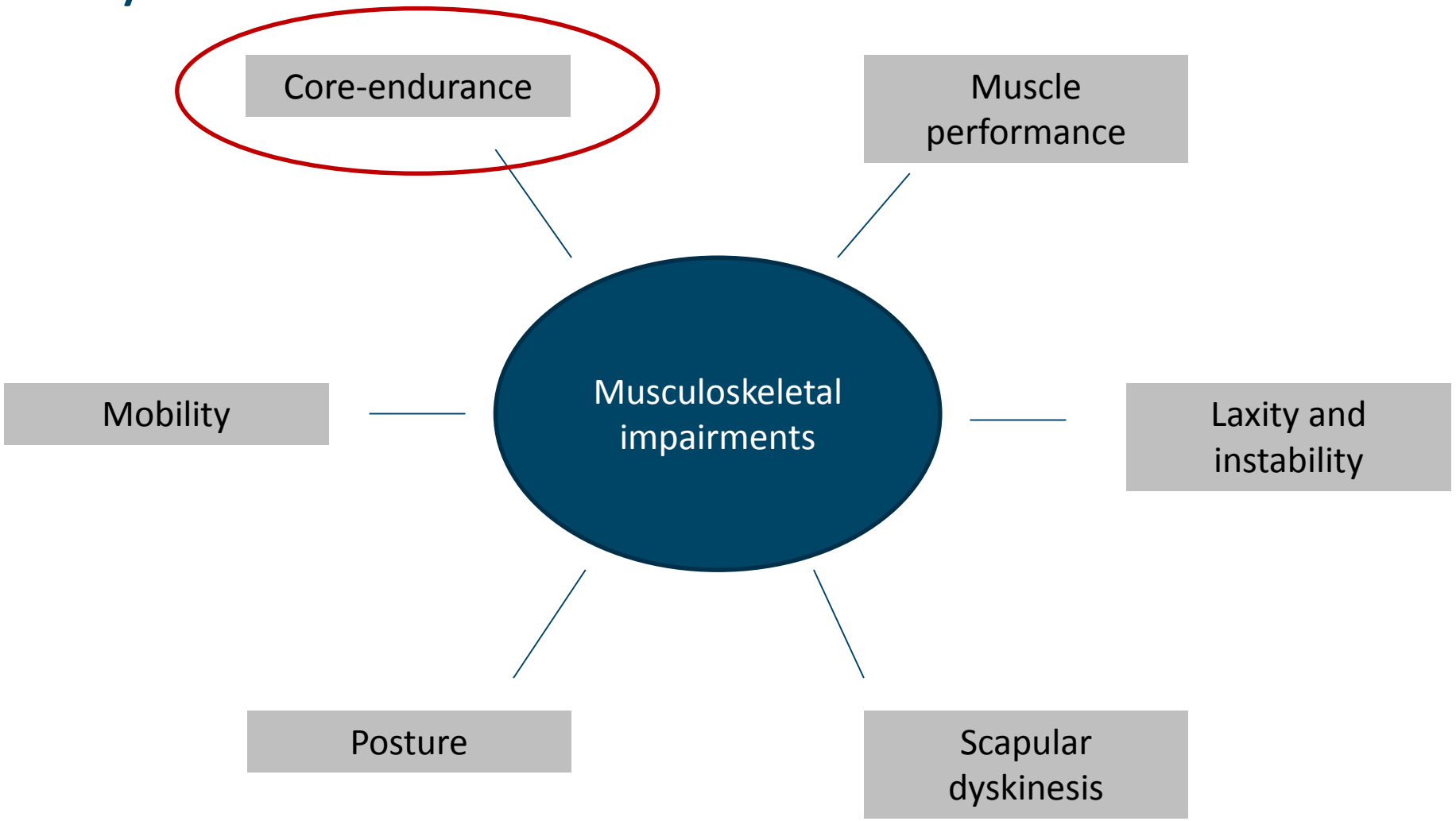
Scovazzo et al. 1991 (1); Ruwe et al. 1994 (2); Tate et al. 2012

Muscle ratio / imbalance?

- ✓ Controls: lower ER:IR ratio due to higher IR strength
- ✓ Shoulder pain: no change in ratio

"Insufficient evidence for difference in ER:IR ratio"

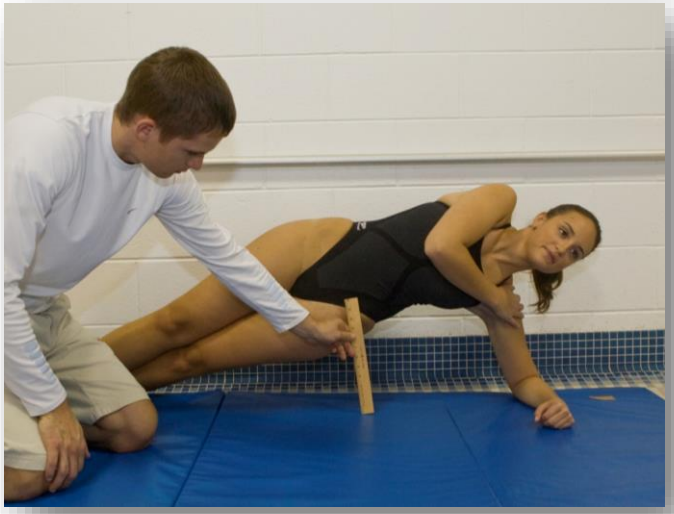
Physical characteristics



Core endurance

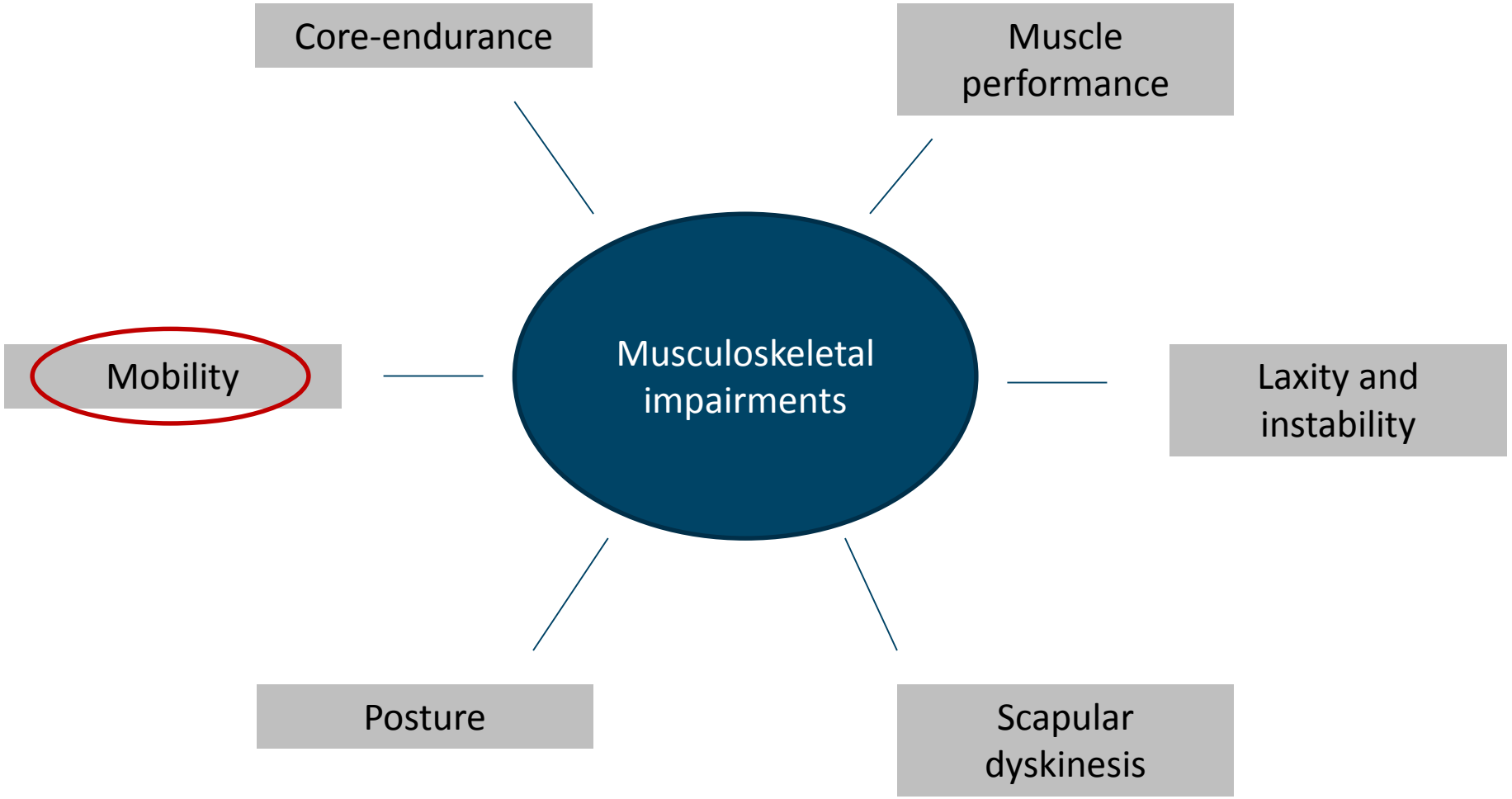
Shoulder endurance for abduction & ER: “Shoulder endurance negatively correlated with shoulder pain” Beach et al. 1992

Reduced core endurance (side brigde) for the 12-14 years group with shoulder pain (n=236 swimmers) Tate et al. 2012



Tate et al. 2012; McGill et al,1999, Schellenberg et al, 2007

Physical characteristics

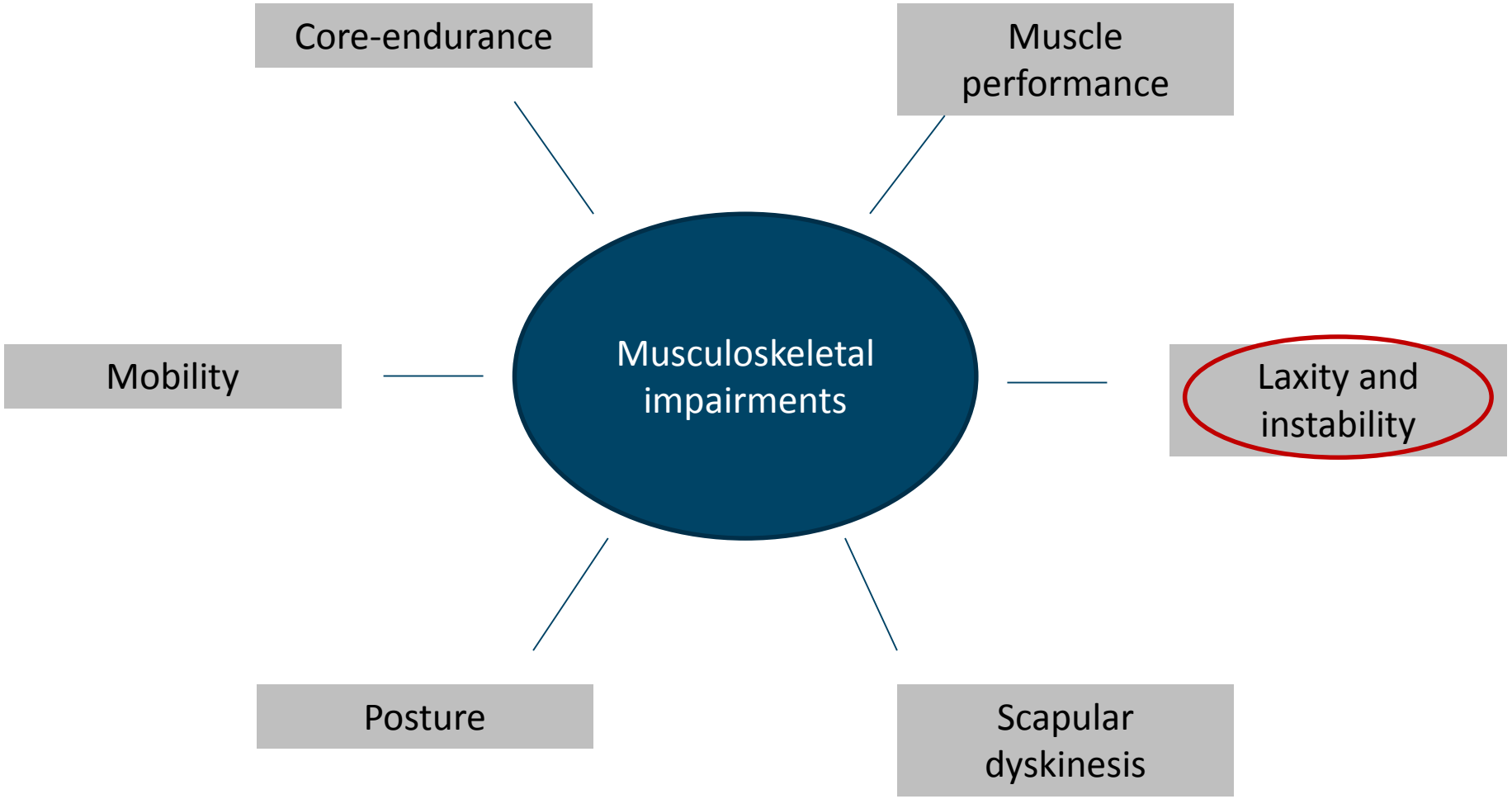


Shoulder range of motion

“Some evidence for reduced IR ROM and increased or decreased ER ROM to be risk factors for shoulder pain in swimmers”

Walker et al. 2012, Tate et al. 2012

Physical characteristics

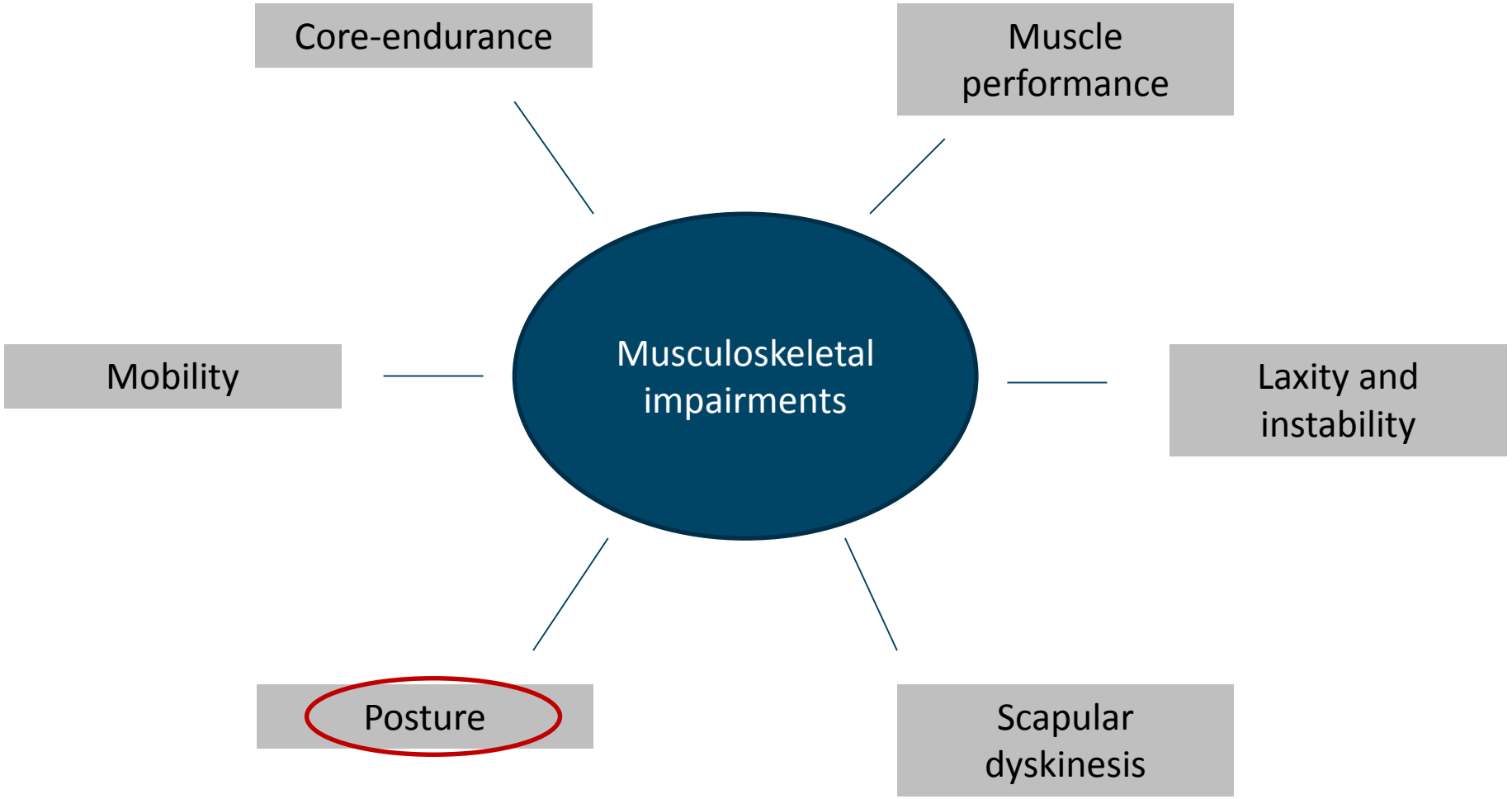


Glenohumeral laxity and instability

Greater laxity in competitive swimmers compared to other athletes

Study	Population	Laxity/instability tests	Conclusion
McMaster, 1998	40 high level competitive swimmers (35% with pain)	Sulcus sign, Anterior/posterior drawer test	+ correlation Laxity ~ Shoulder pain
Rupp, 1995	22 competitive swimmers vs non-overhead athletes	Apprehension test	46% shoulder pain & 50% + apprehension test
Bak & Fauno, 1997	36 competitive swimmers (68% with pain)	Sulcus sign, anterior drawer, apprehension test	No clear statistical significance
Sein, 2010	80 competitive swimmers (54% with pain)	Sulcus sign, anterior/posterior drawer tests	+ correlation Laxity ~ Shoulder pain

Physical characteristics



Shoulder posture

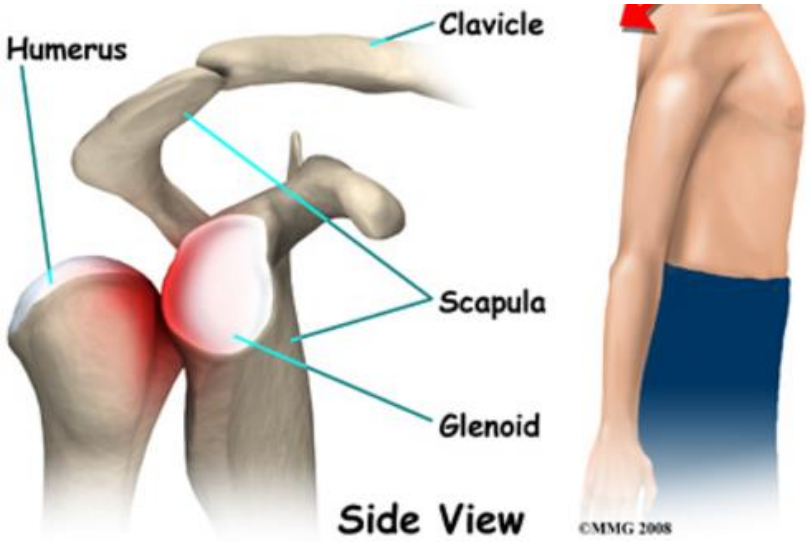
= general shoulder position

= specific humeral head position

- ✓ McKenna (2012): humeral head position predictive for shoulder pain?

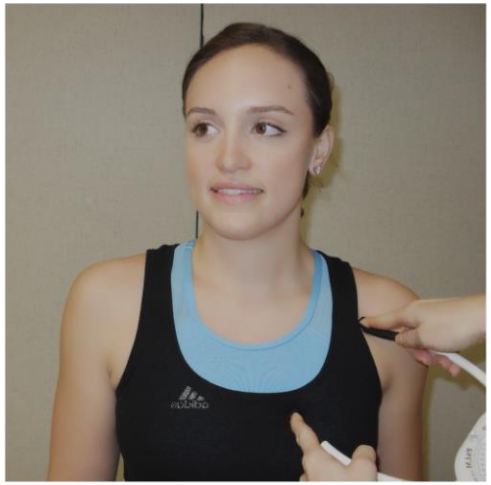
  46 adolescent swimmers

  greater posterior position → higher risk shoulder pain



Pectoralis minor muscle length

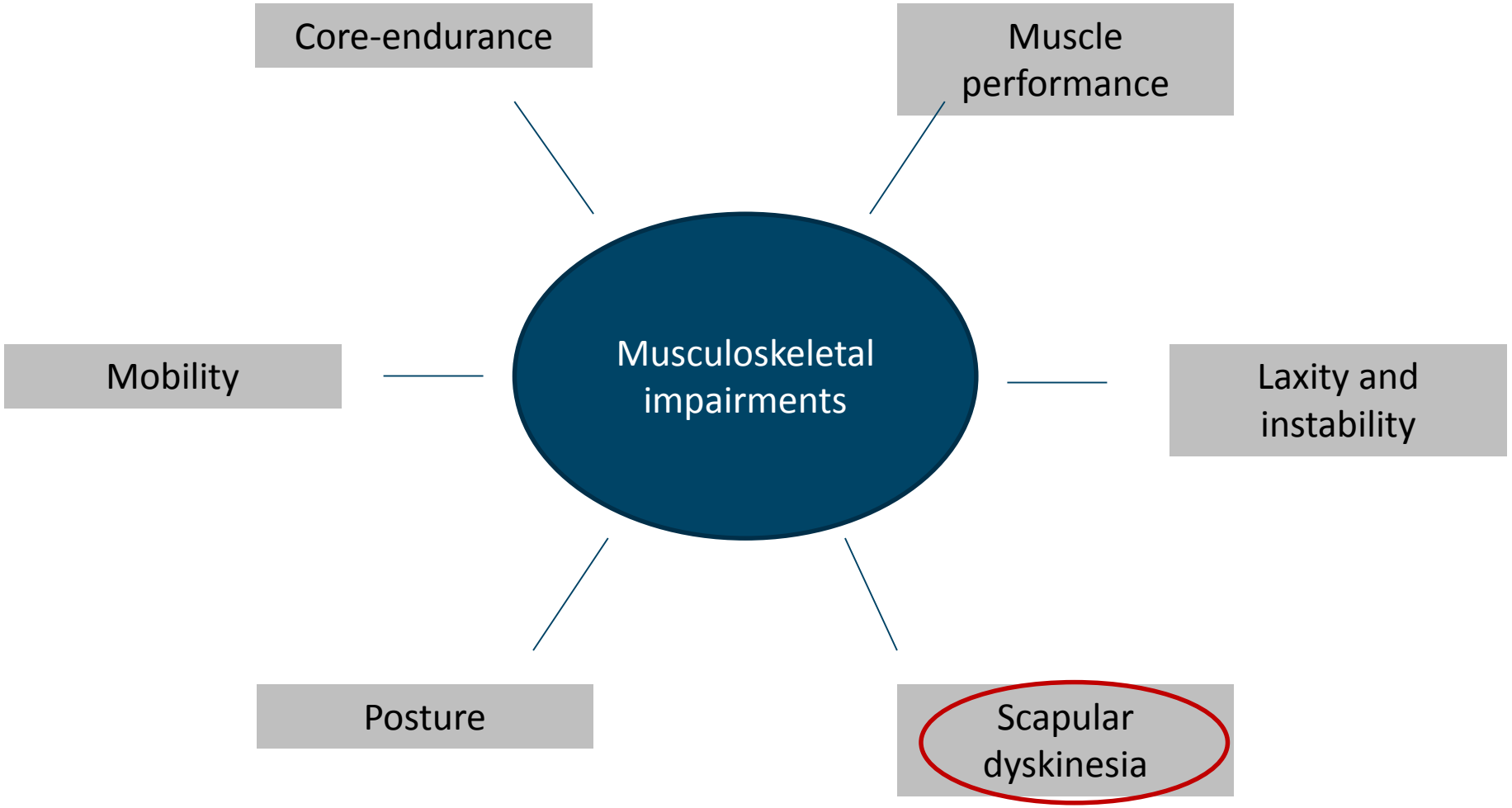
decrease in the pectoralis minor (PM) muscle length ($p<0.05$ on the dominant arm; in swimmers with shoulder pain)



"potentially shortened pectoralis minor muscle may play a predisposing role in the development of shoulder pain in swimmers"

Harrington et al. 2013; Tate et al. 2012, Borstad 2008

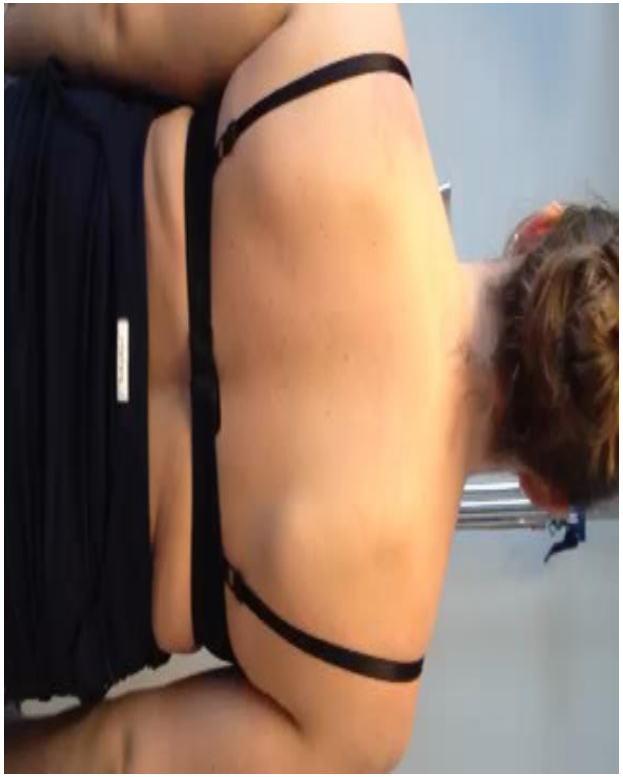
Physical characteristics



What is scapular dyskinesis (SD)?

"The scapula demonstrates premature or excessive elevation or protraction, nonsmooth or stuttering motion during arm elevation or lowering, or rapid downward rotation during arm lowering" (**Dysrhythmia**)

"The medial border and/or inferior angle of the scapula are posteriorly displaced away from the posterior thorax." (**Winging)**



McClure et al. 2009; Struyf et al. 2014

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SD = normal feature

- potentially needed for max performance
- protective against injury

SD = movement disorder

- identifies athlete at risk for injury
- preventive intervention needed

Risk Factors Associated With Shoulder Pain and Disability Across the Lifespan of Competitive Swimmers

Angela Tate, PhD, PT, Cert MDT*; Gregory N. Turner, DPT, PT, ATC†; Sarah E. Knab, DPT, PT, ATC‡; Colbie Jorgensen, DPT, PT*; Andrew Strittmatter, SPT*; Lori A. Michener, PhD, PT, ATC, SCS§

*Arcadia University, Glenside, PA; †Drayer Physical Therapy, Lancaster, PA; ‡Nazareth Hospital, Philadelphia, PA; §Virginia Commonwealth University, Richmond

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Routledge

→ No relevant differences in scapular dyskinesia between swimmers with and without shoulder pain

Can scapular and humeral head position predict shoulder pain in adolescent swimmers and non-swimmers?

LEANDA McKENNA, LEON STRAKER, & ANNE SMITH

Curtin Health Innovation Research Institute, Curtin University of Technology, School of Physiotherapy, Perth, Australia

→ Altered scapular position predictive for development of shoulder pain in swimmers

Scapular Rotation in Swimmers with and without Impingement Syndrome: Practice Effects

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[1]Programs in Rehabilitation Sciences, [2]Family, Community, & Preventive Medicine, Drexel University, Philadelphia, PA; [3]Department of Physical Therapy, University of the Sciences in Philadelphia, Philadelphia, PA; and [4]Department of Human Physiology, University of Oregon, Eugene, OR

→ decrease in scapular upward rotation in those with shoulder impingement after practice

"Swimming may alter scapular position, but it is unclear if these changes are related to the development of shoulder pain"

Is SD predictive for shoulder pain?

	Kawasaki 2012	Myers 2013	Clarsen 2014	Struyf 2014	Shitara 2015	Andersson 2017
Gender?	100% male	100% male	100% male	50-50	100% male	50-50
Type overhead sports?	Rugby	Baseball	Handball	Volleyball, tennis, baseball, handball, batminton	Baseball	Handball
Classificatio of scapular dyskinesis?	Visual observation	Visual observation	Visual observation	Visual observation	Visual observation	Visual observation
Sports level?	Top-league	High school players	Elite level	Recreation al level	High school players	Elite level

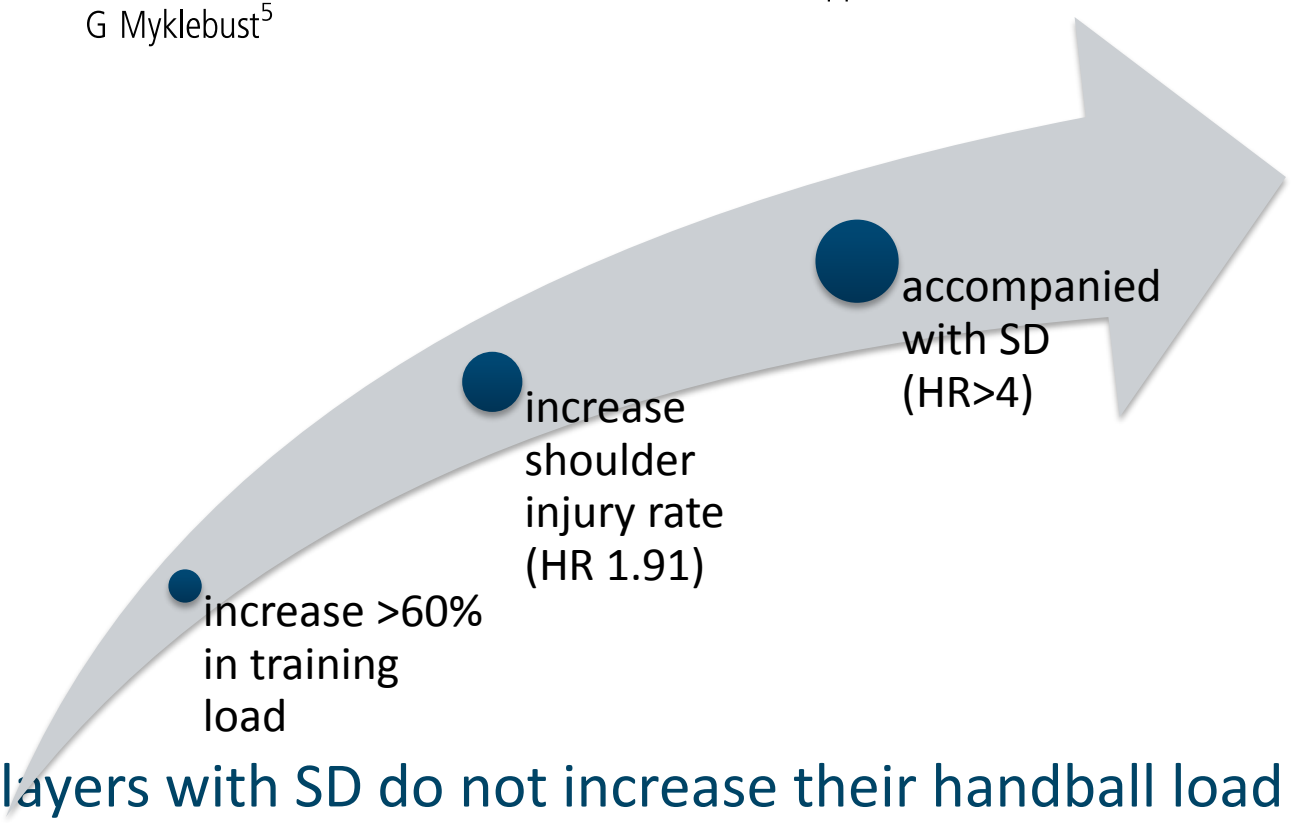
OR 3.6

OR 8.4

What about training load? Møller et al. 2017

Handball load and shoulder injury rate: a 31-week cohort study of 679 elite youth handball players

M Møller,[1] R O Nielsen,[1] J Attermann,[2] N Wedderkopp,[3] M Lind,[4] H Sørensen,[1] G Myklebust[5]



if players with SD do not increase their handball load by more than 20%, they are not more predisposed to shoulder injury compared with players with normal characteristics.

SD may not be a large risk factor on its own

Could play a role in case of excessive increase in load (Moller et al. 2017)

= interactive risk factor

Limitations of this review

Non-systematic

Mostly retrospective paper

clear lack of well-powered longitudinal prospective studies

stroke technique?

breathing pattern?

swim yardage?

body composition?

Summary of MSK ”dysfunctions” in swimmers with shoulder pain vs unimpaired swimmers

Table 1 Differences in musculoskeletal function in swimmers with shoulder pain versus unimpaired swimmers

Shoulder muscle performance	
Muscle activity during freestyle swimming	Less activity of UT, R, AD, MD (hand entry); less activity of SA; higher activity of R (pulling phase); less activity of AD and MD; higher activity of IS (hand exit); less activity SSc (mid-recovery)
Muscle activity during breaststroke swimming	Less activity of Tmi; higher activity of SSc (pulling phase); less activity of MD, UT, SSp; higher activity of IS (mid-recovery)
Muscle strength	Tendency of reduced IR strength[18]
Muscle endurance at the shoulder	Less AB and ER endurance[9]
Core endurance	Less core endurance[6]
Shoulder range of motion	Higher (≥100°) or lower (<93°) ER ROM[20] ; reduced shoulder flexion and IR ROM[6]
Laxity and instability	Greater GH laxity and instability[1 17 21 22]
Shoulder posture	Greater posterior humeral head position[7] ; shorter PM[6 19]
Scapular dyskinesis	Tendency to greater incidence of SD[7] ; decreased scapular upward rotation after swim practice[29]

AB, abduction; AD, anterior deltoid; ER, External Rotation; GH, glenohumeral; IR, internal rotation; IS, Infraspinatus; MD, middle deltoid; PM, pectoralis minor; R, Rhomboids; ROM, Range of motion; SA, Serratus Anterior; SD, scapular dyskinesis; SSc, subscapularis; SSp, Supraspinatus; Tmi, Teres Minor; UT,Upper Trapezius.

Future directions for research => longitudinal prospective designs

Injuries in swimmers: not always the shoulder!

37 yrs, 2 children

Extremely athletic

No history of Sh-pain

Demonstration: “how to dive” to his daughter

Nose #

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THANKS

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