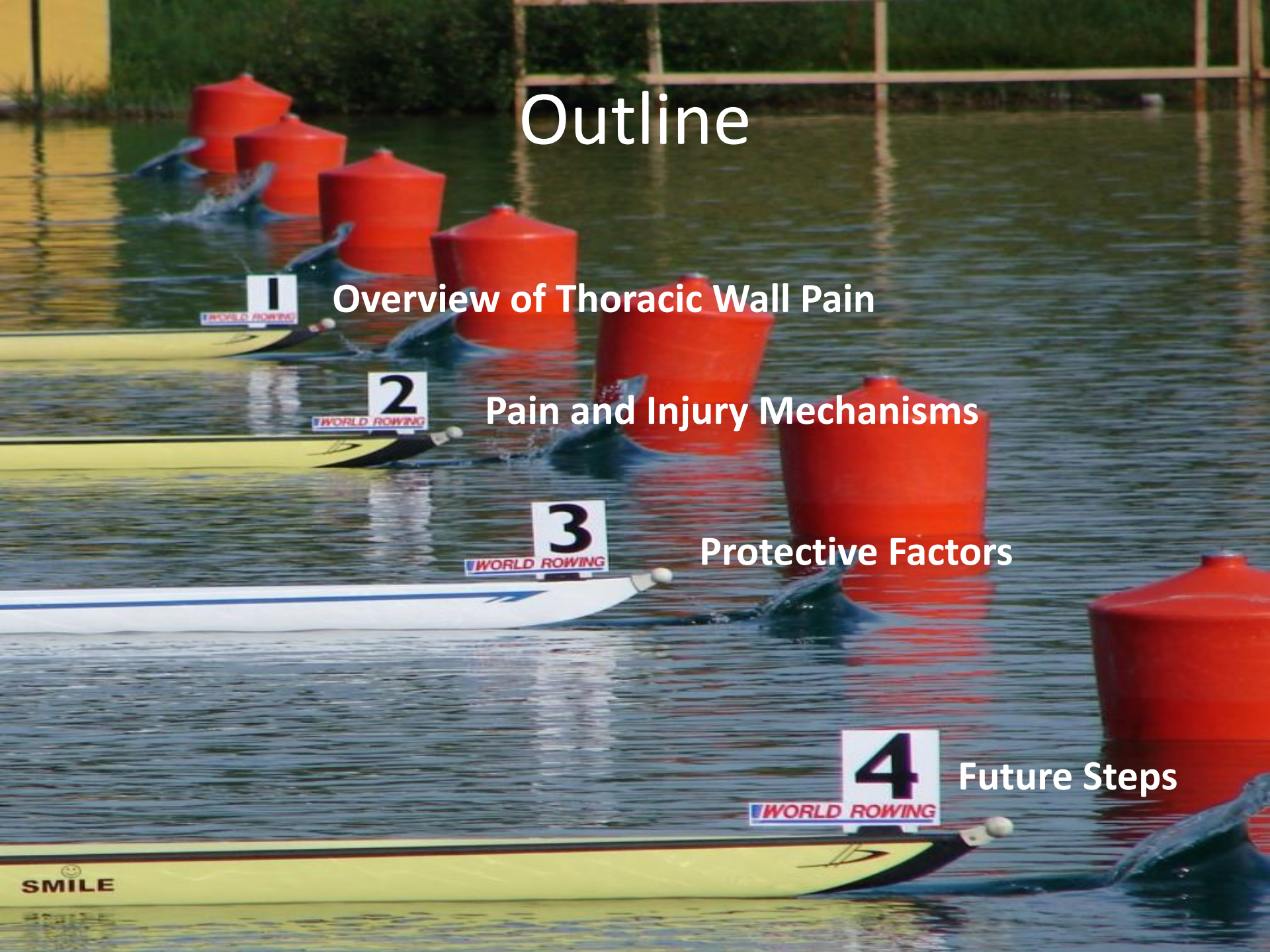
Thoracic Wall Pain in Rowers

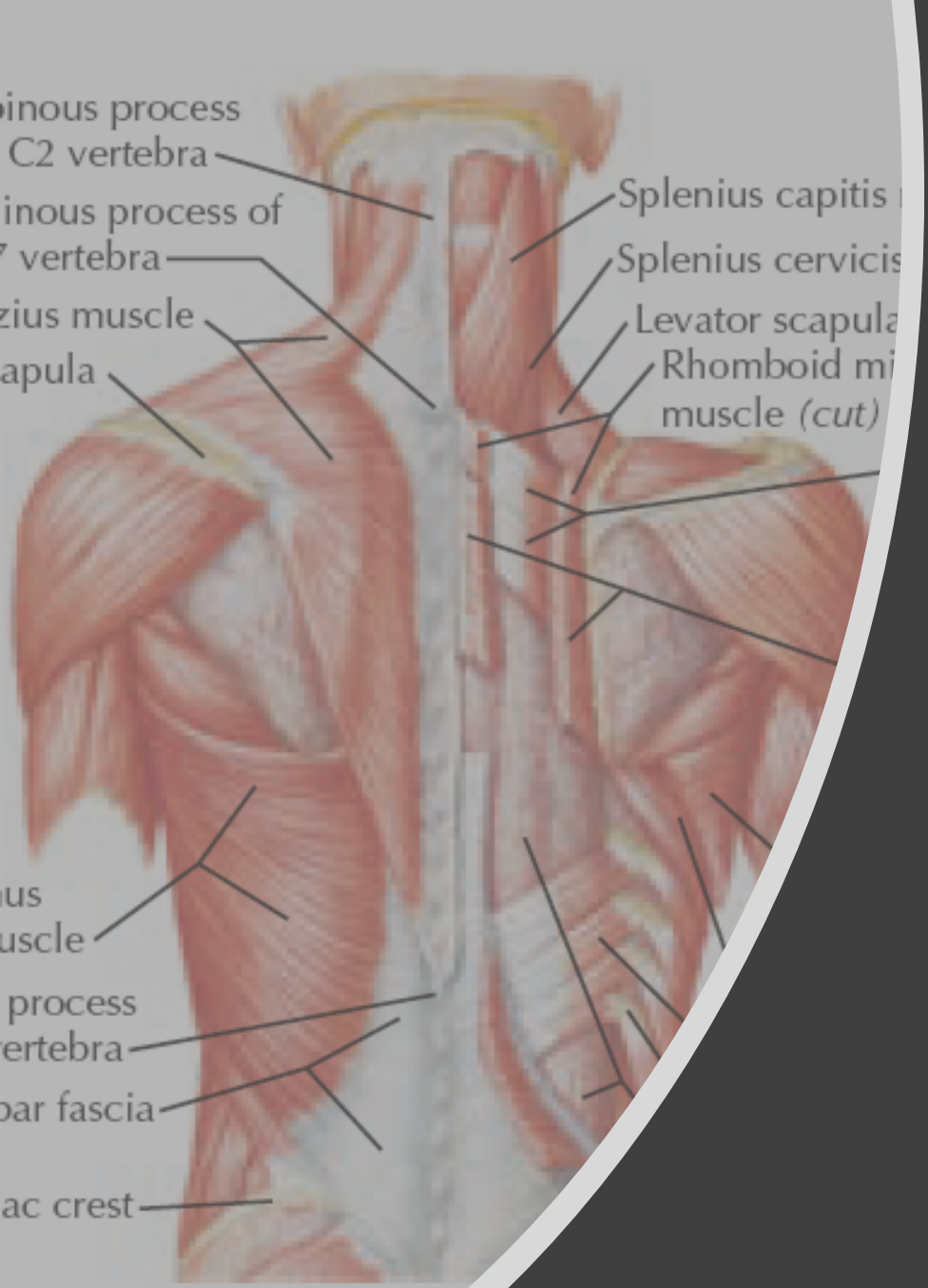
What do we know and where do we need to go?

Jane Thornton MD PhD

Outline

1. Overview of Thoracic Wall Pain
2. Pain and Injury Mechanisms
3. Protective Factors
4. Future Steps

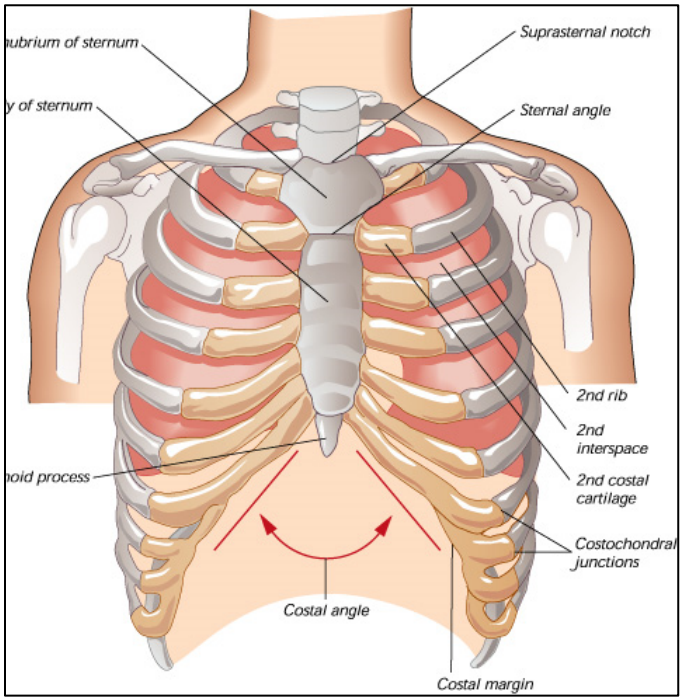




THORACIC WALL

ANATOMY

DIFFERENTIAL



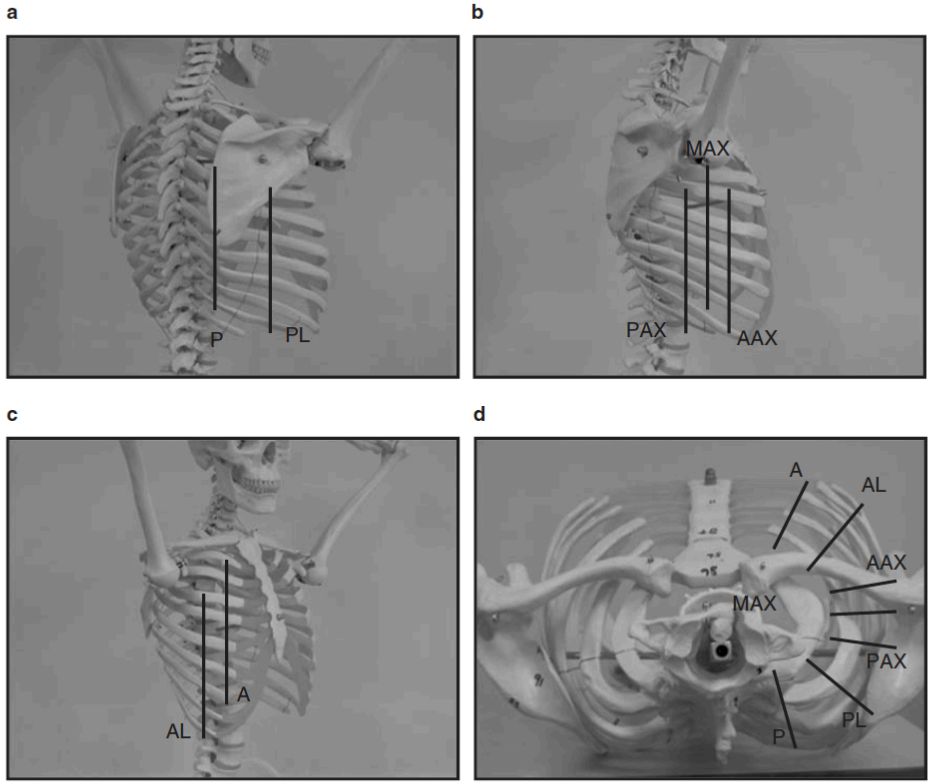


Fig. 2. Regions of the rib cage where rib stress fractures occur. (**a**) Posterolateral rib cage view; (**b**) lateral view; (**c**) anterolateral view; (**d**) transverse view. **A** = anterior; **AL** = anterolateral; **AAX** = anterior axilla; **MAX** = mid-axilla; **P** = posterior; **PL** = posterolateral; **PAX** = posterior axilla.

McDonnell, Hume, Nolte 2011

Differential

Common

- Intercostal muscle strain
- Costochondritis
- ?Costovertebral subluxation
- Rib stress injury/fracture

Less Common

- Intercostal nerve injury
- Serratus Anterior Avulsion
- Bone malignancy (e.g. Ewing's sarcoma)
- Cardiovascular/Respiratory origin and referred pain


RIB STRESS
INJURY

Rib Stress Injury: Guidelines for Diagnosis and Management

GBROWINGTEAM

Definition: Rib stress injury is the development of pain due to bone oedema caused by overload along the bone shaft

Evans and Redgrave BJSM 2016

Chest wall pain

Diagnostic features for rib stress injury (and clinical markers*)

History

- Insidious sudden onset or crescendo pain over a few days or weeks
- Pain on deep breathing*
- Pain on pushing/pulling doors*
- Difficulty rolling over in bed or sitting up from a lying position*
- Unable to sleep on affected side*
- Possible cough/sneeze pain*

Examination

- Tenderness commonly mid axillary line of chest wall
- Ribs 5-8 in particular
- Tender spot over oedema and sometimes palpable callous
- +ve spring/compression of ribcage (AP & lateral)*
- Pain with press up or resisted serratus anterior testing*
- Pain on initiating trunk flexion (sit up position including oblique bias)*

Severity of injury

Mild

- VAS score 2-3/10**
- Rib pain towards end of activity
- 'Can row through it'
- 'Tightness or soreness'
- Mild tenderness
- Compression test may be negative
- May only be stiff splinted rib cage without pain
- Often not all clinical markers* present

Moderate

- VAS score 4-6/10**
- Rib pain on movements
- Unable to complete training/racing
- Tender on palpation and compression test positive
- Most clinical markers* will be present

Severe

- VAS score 7-10/10**
- Rib pain at rest
- Painful on deep inspiration/coughing
- Pain on simple movements/lying/reaching
- Unable to train or race
- Compression test positive
- All clinical markers* likely to be present

Pain/Injury Mechanisms

INTRINSIC

EXTRINSIC

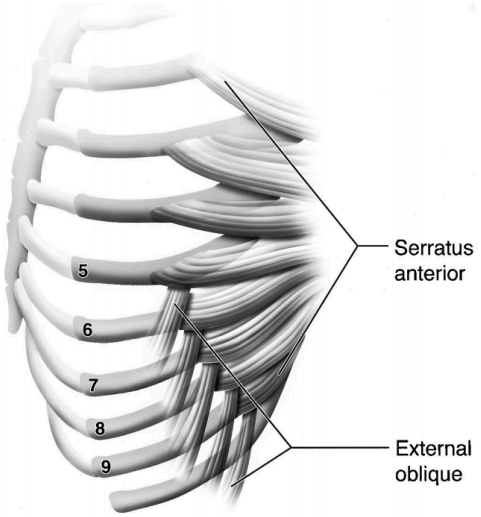


Figure 1. Anatomy of the serratus anterior and external oblique muscles at the lateral rib.

0363-5465/98/2626-0516$02.00/0
The American Journal of Sports Medicine, Vol. 26, No. 4

Rib Stress Fractures in Elite Rowers

A Case Series and Proposed Mechanism

Kristine A. Karlson,* MD

From the Department of Family Medicine, University of Michigan, Ann Arbor, Michigan

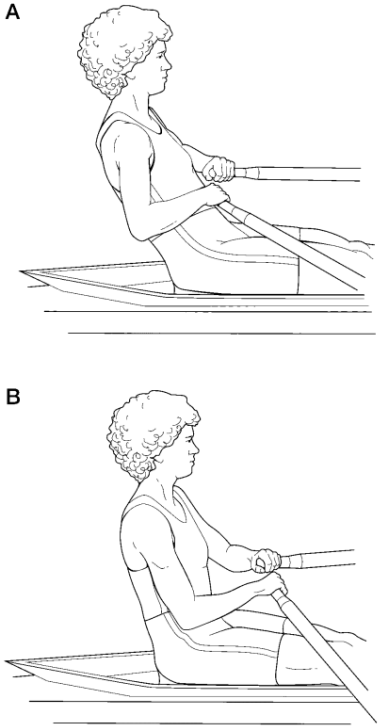
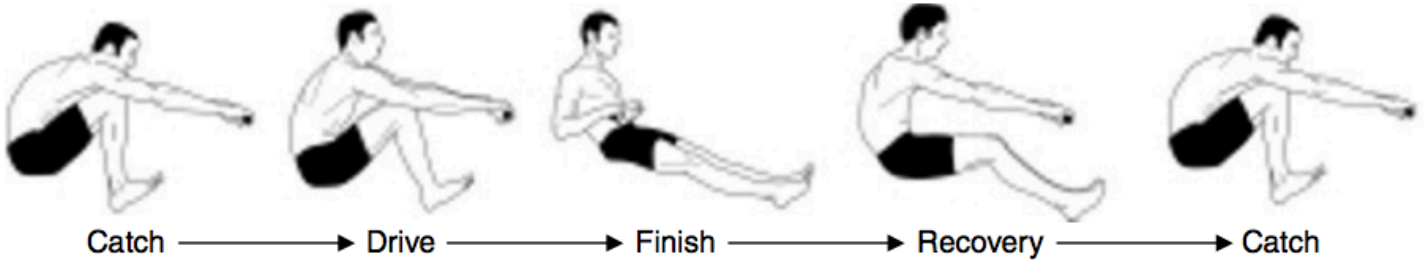


Figure 2. A, standard layback and arm position at the finish of the rowing stroke. B, modified finish position to decrease forces exerted on the rib by the serratus anterior and external oblique muscles.

Theory #1

Theory #2



Warden et al. Sports Med 2002

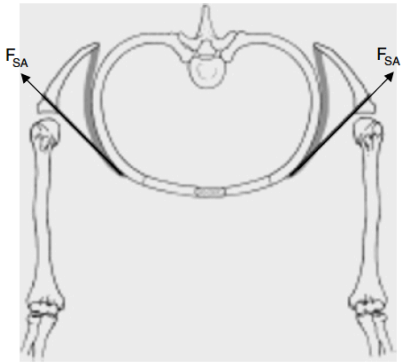


Fig. 5. Schematic of the potential protective effect of serratus anterior (SA) on rib-cage compression. F_{SA} is the postulated force vector generated by SA on its attachments to the ribs. The force vector generates a reverse bowing effect resisting rib bending.

REVIEW ARTICLE

Sports Med 2002; 32 (13): 819-836
0112-1642/02/0013-0819/$25.00/0

Aetiology of Rib Stress Fractures in Rowers

Stuart J. Warden,[1,2] *Fiona R. Gutschlag,*[2] *Henry Wajswelner*[1,2] and *Kay M. Crossley*[1]

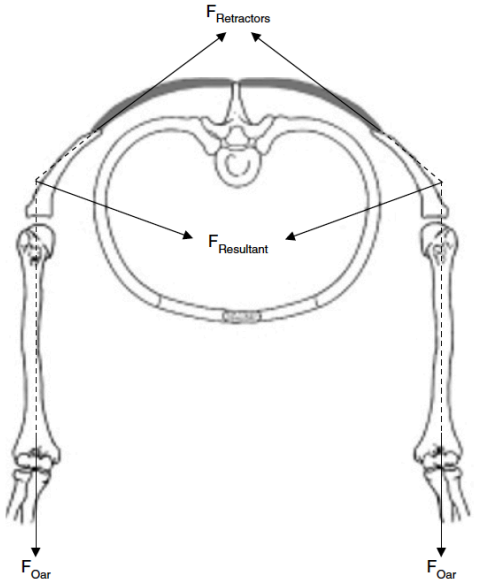
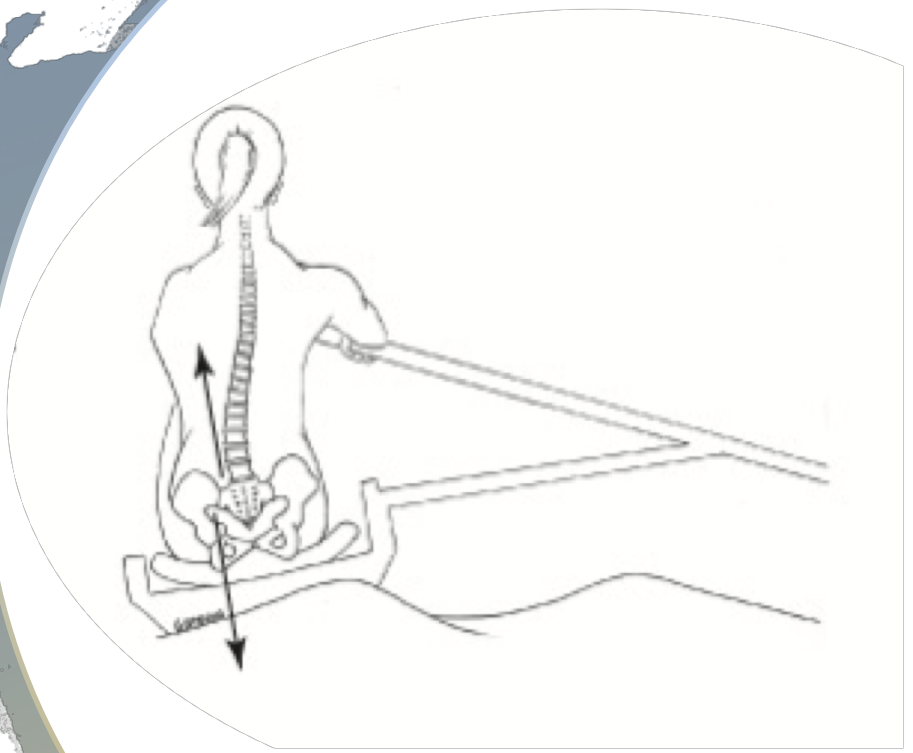


Fig. 6. Schematic of rib-cage compression generated by the combined pull of the retractors and oars during early drive. F_{Oar} is the postulated force vector generated by the pull of the oar on the upper limb. It results from leg extension and generates a scapula protraction moment. $F_{Retractors}$ is the postulated force vector generated by the pull of the retractors on the scapula. $F_{Resultant}$ is the resultant force of F_{Oar} and $F_{Retractors}$, as resolved using the parallelogram method. $F_{Resultant}$ generates a compression moment on both sides of the rib cage.

Theory #3

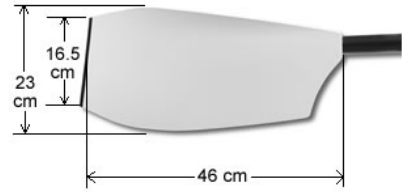
Extrinsic

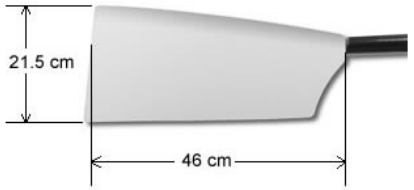
Environmental
Stroke Mechanics
Sculling vs Sweep
Training Volume/Intensity

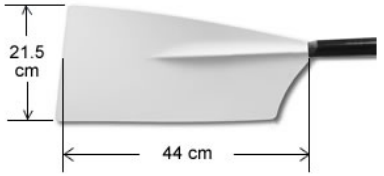


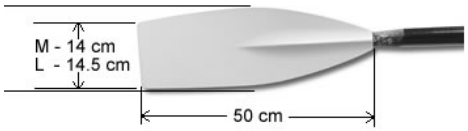
Equipment


CANADA
HUDSON

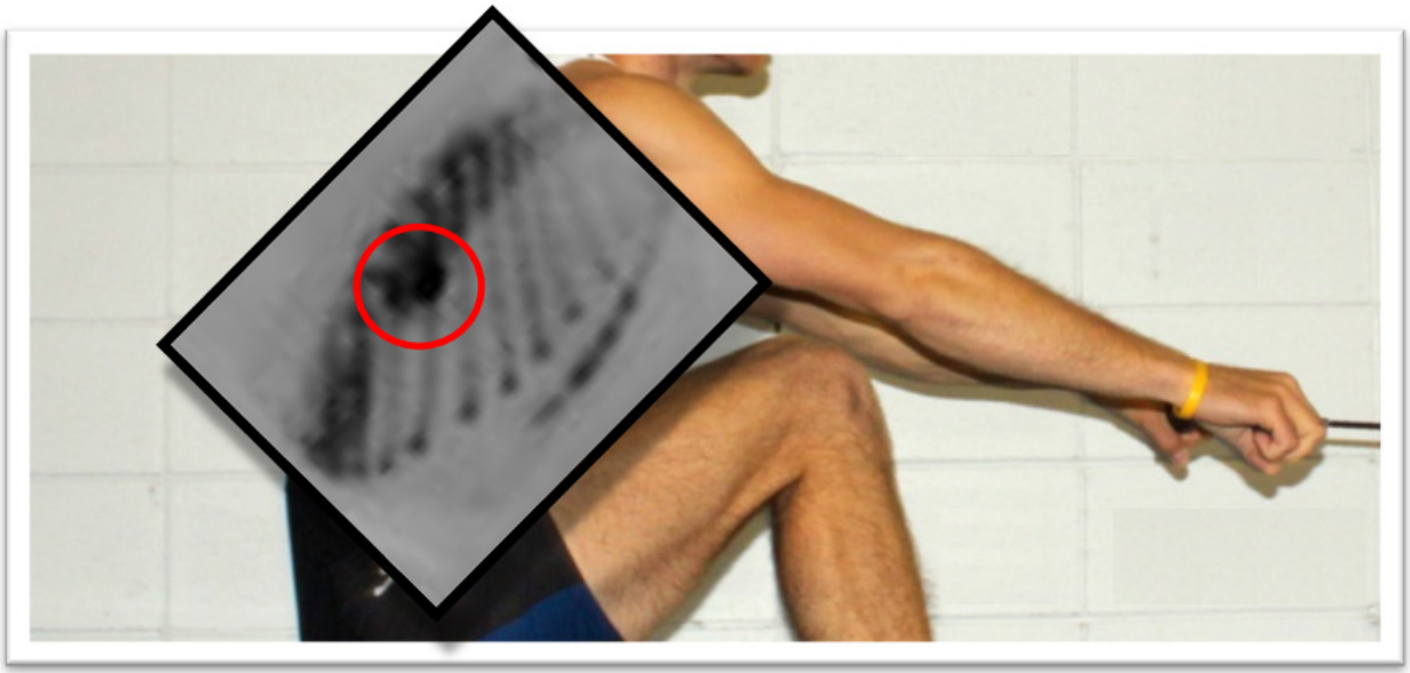

16.5 cm
23 cm
46 cm

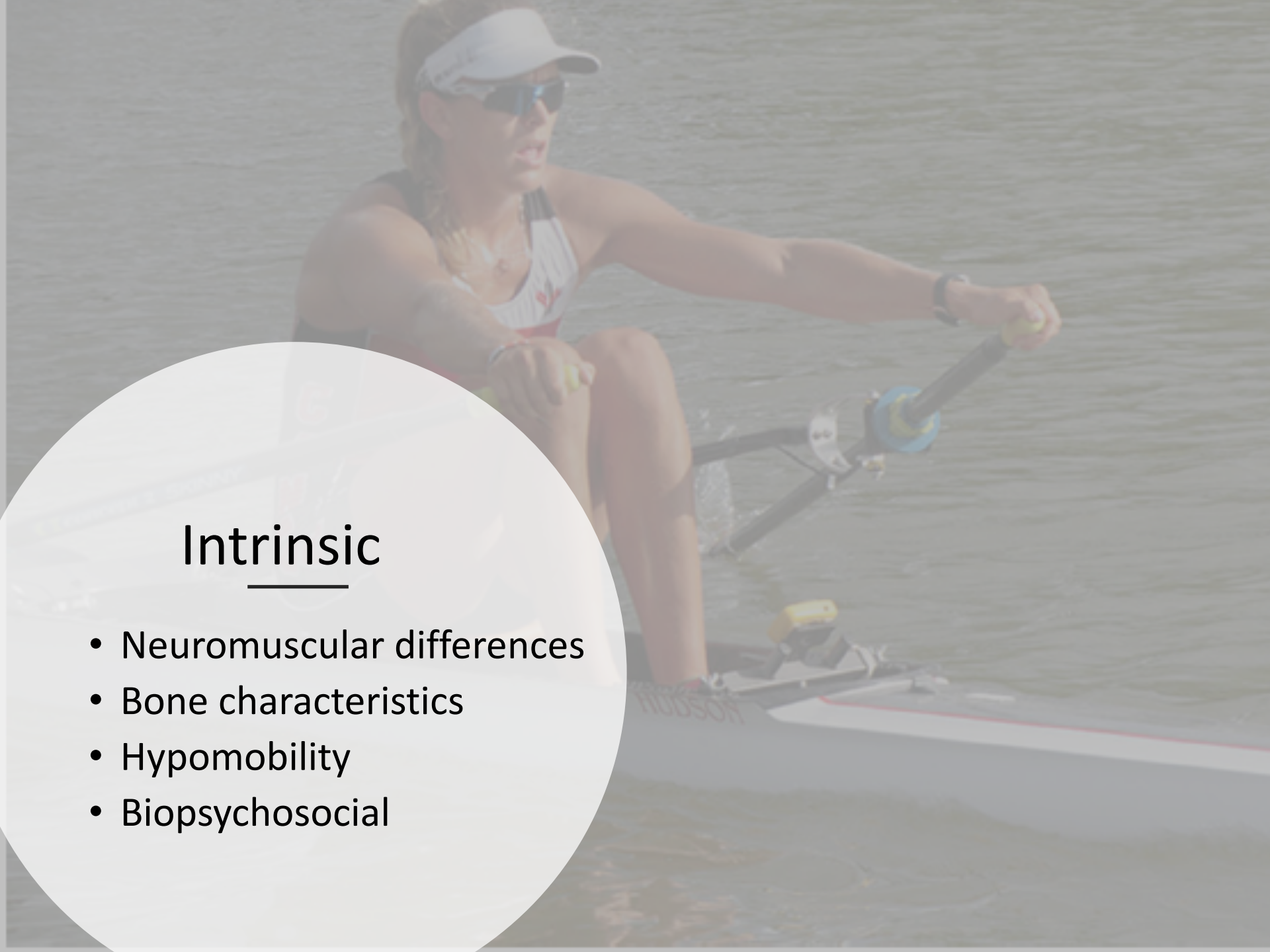

21.5 cm
46 cm


21.5 cm
44 cm


M - 14 cm
L - 14.5 cm
50 cm

Ergometers

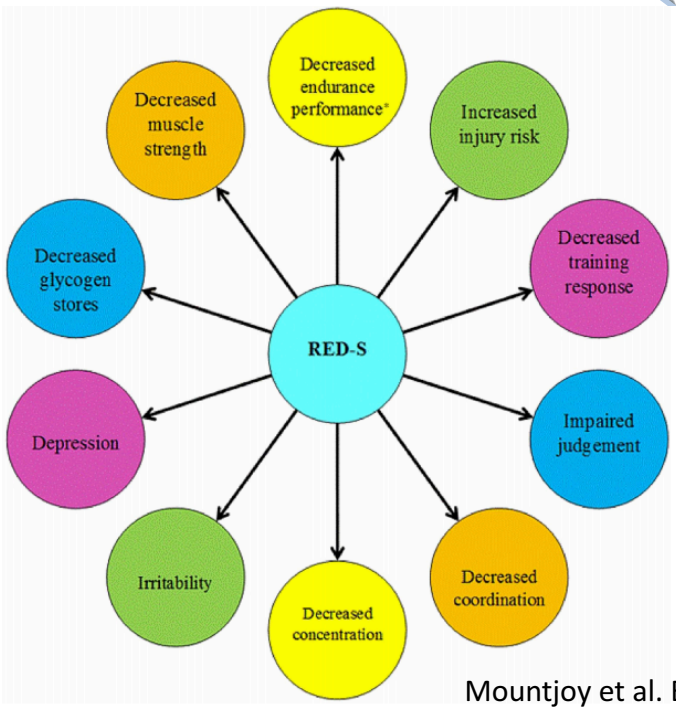




Intrinsic

- Neuromuscular differences
- Bone characteristics
- Hypomobility
- Biopsychosocial

Relative Energy Deficiency in Sport (RED-S)



Mountjoy et al. BJSM 2014

Para Rowing

Complete inclusion of adaptive rowing only 1000 m ahead

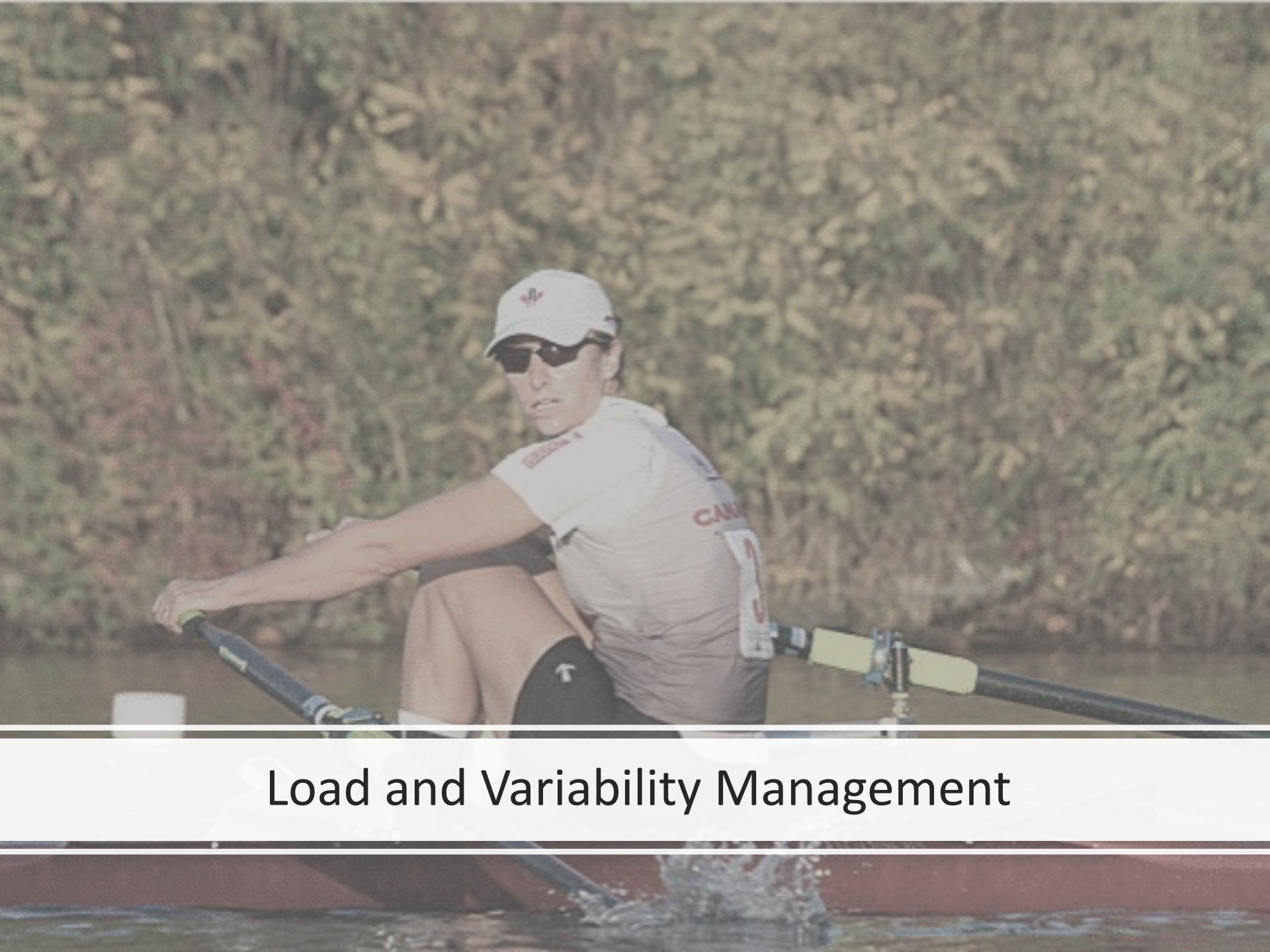
Tomislav Smoljanovic,[1] Ivan Bojanic,[1] Jo A Hannafin,[2] Axel Urhausen,[3,4] Daniel Theisen,[4] Romain Seil,[4,5] Alain Lacoste[6]

BJSM 2013

Goodey et al. 2012

Protective Factors

- LOAD and VARIABILITY MANAGEMENT
- ADDRESSING DEFICIENCIES
- SECONDARY PREVENTION



Load and Variability Management

Addressing Deficiencies

Secondary Prevention

Future Research

- Prospective surveillance studies of thoracic wall pain and dysfunction
- Clinical trials involving preventive methods
- Relationship with thoracic wall pain and RED-S in rowers
- Acute versus Chronic Workload in rowing
- Fatigue and load management studies
- On-water studies

Questions?

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