

# Athlete Movement System: Upper Half



# Schedule

## Morning

8am - 9am: Posture and Movement

9am - 10:30am: Muscle Performance

10:30am - 11:30am: Mobility

11:30am - 12pm: Sport-Specific Cases

## Afternoon

1pm - 2pm: Educate, Unload

2pm - 3pm Increase Mobility, Use the New Range

3pm - 4pm: Align and Centrate

4pm - 5pm: Improve Muscle Performance, Use the Kinetic Chain

5pm - 6pm: Wrap-up



## Morning

### Posture and Movement

- Symptom Modification Procedure (SMP)

### Muscle Performance

- Qualitative and Quantitative

### Mobility

- Relative Stiffness
- Directional Susceptibility to Movement (DSM)



## Afternoon

### A Rehabilitation Framework

- Educate
- Unload
- Increase Mobility
- Use the New Range
- Align and Centrate
- Improve Muscle Performance
- Use the Kinetic Chain
- Train Movement



# Posture and Movement

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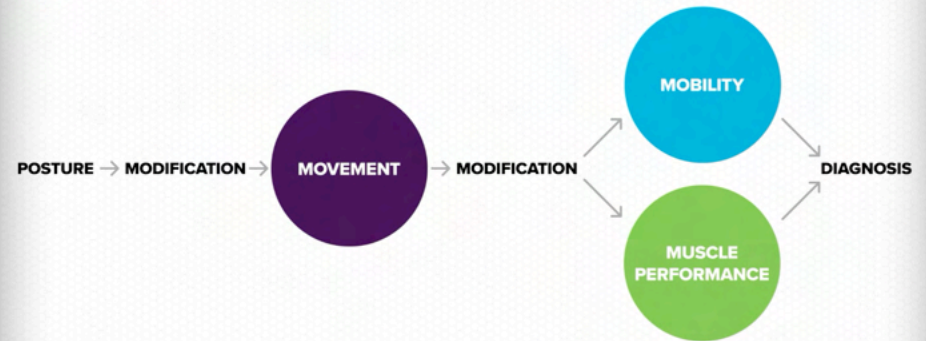
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## The Movement System



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## MSI Syndromes

### Cervical Syndromes

- Cervical extension
- Cervical extension-rotation
- Cervical flexion
- Cervical flexion-rotation
- Cervical rotation

### Thoracic Syndromes

- Thoracic rotation-flexion
- Thoracic flexion
- Thoracic rotation-extension
- Thoracic rotation
- Thoracic extension

### Humeral Syndromes

- Humeral anterior glide
- Humeral superior glide
- Shoulder medial rotation
- Glenohumeral hypomobility

### Scapular Syndromes

- Scapular insufficient upward rotation
- Scapular internal rotation
- Scapular depression
- Scapular abduction
- Scapular adduction
- Scapular winging and tilting

### Elbow

- Wrist extension with forearm pronation
- Elbow hypomobility
- Elbow flexion
- Elbow valgus
- Elbow extension
- Wrist flexion with forearm pronation
- Elbow impairment

## Symptom Modification Procedure

- An alternative method of treatment based clinical examination
- Mechanical symptom alleviating techniques that are applied during symptomatic postures or movements
- Can be performed passively (clinician applies) or active (patient modifies movement)

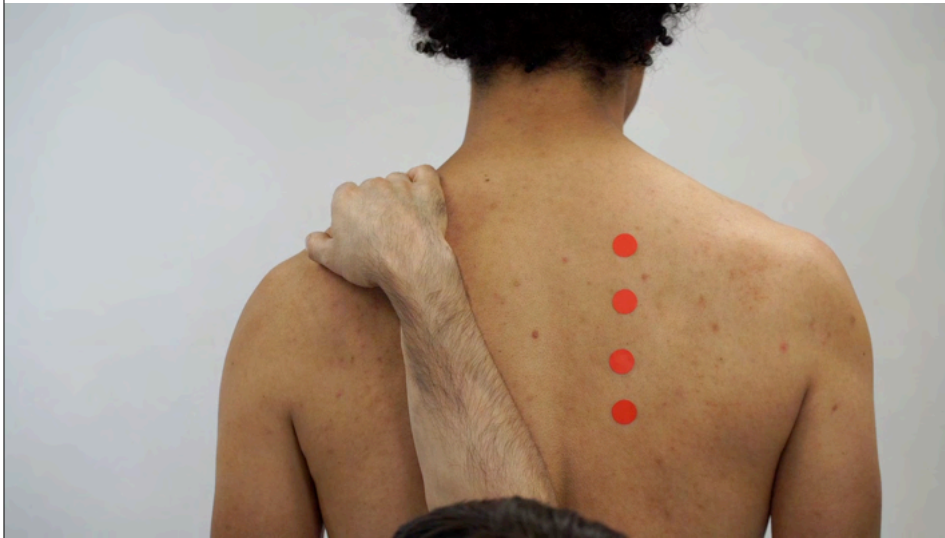


Sahrmann, S., Azevedo, D. C., & Van Dillen, L. (2017). Diagnosis and treatment of movement system impairment syndromes. Brazilian journal of physical therapy, 21(6), 391-399.



Lewis, J. S., McCreesh, K., Barratt, E., Hegedus, E. J., & Sim, J. (2016). Inter-rater reliability of the Shoulder Symptom Modification Procedure in people with shoulder pain. BMJ open sport & exercise medicine, 2(1), e000181.

## SMP Posture Example: Scapular IR



## SMP Posture Example: Scapular IR

MOVEMENT

- Excessive scapular internal rotation

MOBILITY

MUSCLE  
PERFORMANCE

## SMP Movement: Humeral Anterior Glide



## SMP Posture Example: Anterior Translation

MOVEMENT

- Excessive humeral anterior translation

MOBILITY

MUSCLE  
PERFORMANCE

## Movement Case 1



21-year-old male basketball player who reports neck pain every time he raises his arms the air to catch a pass and every time he shoots the ball.

- Which MSI Syndrome
- Which passive/active SMP
- Hypothesize mobility and muscle performance deficits

## Excessive Cervical Extension/Rotation



## Excessive Cervical Extension/Rotation

Posture Observation	Fulcrum in the cervical spine
Posture SMP	Craniocervical flexion
Movement Observation	Excessive segmental mobility with cervical extension Excessive cervical extension or rotation with shoulder flexion
Movement SMP	Craniocervical flexion with neck extension Craniocervical flexion with shoulder flexion
Mobility	Upper thoracic accessory mobility Upper and lower cervical accessory mobility Levator Scapula Upper Trapezius
Muscle Performance	Craniocervical Flexors (Longus capitis and Longus colli)

## Movement Case 2



34-year-old female accountant who attends fitness classes and has posterior shoulder pain during the mid range of a row

- Which MSI Syndrome
- Which passive/active SMP
- Hypothesize mobility and muscle performance deficits

## Excessive Humeral Anterior Glide



## Excessive Humeral Anterior Glide

Posture Observation	Excessive humeral anterior translation
Posture SMP	Posterior glide standing
Movement Observation	Excessive humeral anterior translation with shoulder flexion, abduction and medial rotation
Movement SMP	Posterior glide standing during flexion/abduction Posterior glide supine during medial rotation
Mobility	Posterior glenohumeral joint capsule Posterior Rotator Cuff
Muscle Performance	Posterior Rotator Cuff Subscapularis

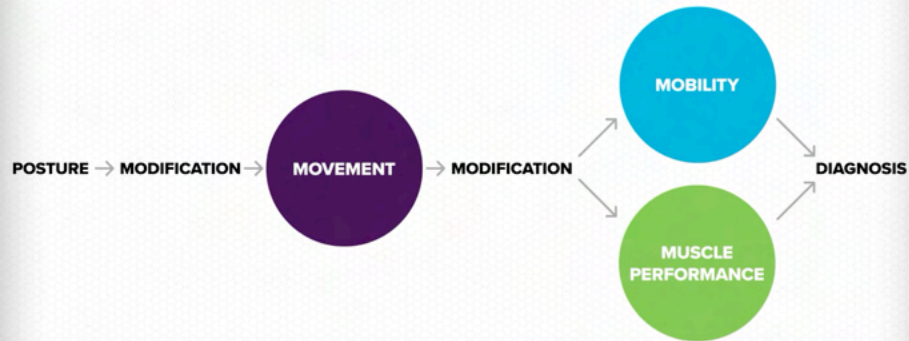
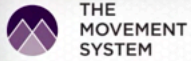
## Activity

- Find a partner and perform a posture and movement analysis of the upper half
- Classify your partner into the most prevalent MSI syndrome
- Based on pain or suboptimal movement patterns, apply a both a passive and an active symptom modification procedure
- Hypothesize and discuss with your partner the mobility and muscle performance deficits
- Be prepared to share your findings with the group

## Muscle Performance

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# The Movement System Model



# Dynamometry Options

## Tension Dynamometers

Tindeq

Gstength

## Compression Dynamometers

ActivForce

Lafayette



## Testing Variation

Tension versus Compression  
Makeshift Methods  
Isometric versus Concentric versus Eccentric  
Make Test versus Break Test  
Rate of Force Development



# Tension Versus Compression

## Tension Dynamometry



## Compression Dynamometry

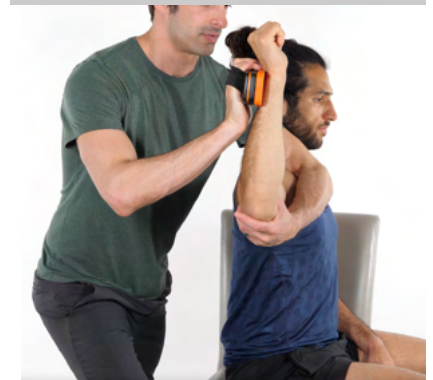


# Tension Versus Compression

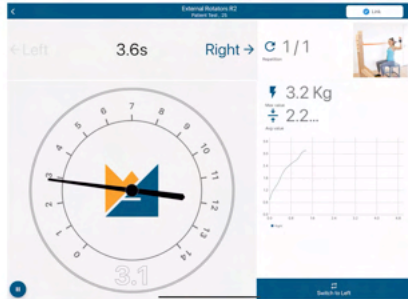
## Tension Dynamometry



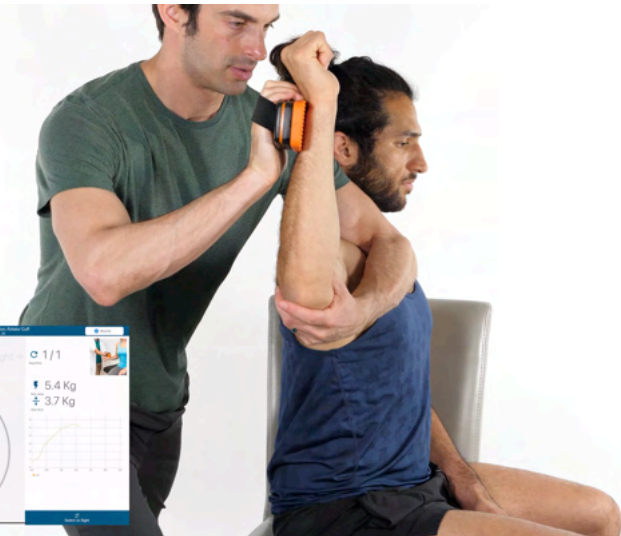
## Compression Dynamometry



## Tension



## Compression



## Makeshift Methods

Bathroom Scale

Luggage Scale

Hand Held Dynamometer

Crane Scale



## Bathroom Scale



## Crane Scale



## Make Versus Break Test

### Make Test

The athlete flexes the muscles, but is stabilized by an examiner

The reliability (both intra-rater and inter-rater) of the make-test is higher than that of a break-test.

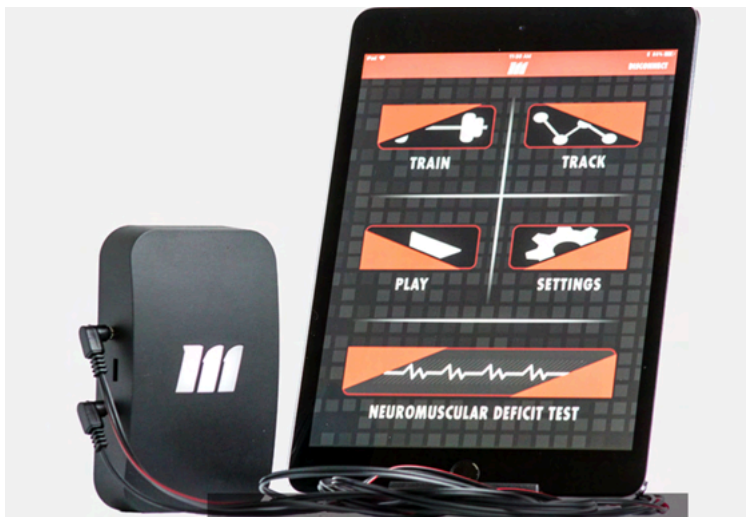
### Break Test

The examiner pushes the dynamometer against the athlete's limb until the joint gives way

The force produced by a break-test tends to be higher than that of a make-test.



## EMG Discussion



## Lecture and Lab Demonstration

- **Lecture**
  - Entralpi, Tindeg, Activforce, Kinvent
- **Lab (10 groups 1-5 A and B) Rotate clockwise**
  - Classic Manual Muscle Test Middle Trapezius
  - Tension Based Make Test Middle Trapezius (Crane Scale)
  - Compression Based Break Test Middle Trapezius (Kforce)
  - Manual muscle test with EMG

## Muscle Performance Case 1

28-year-old baseball player with shoulder pain and a suspected rotator cuff muscle performance deficit.

Perform the following:

- Classic Manual Muscle Test
- Tension Based Make Test
- Compression Based Break Test
- Functional Test (Compression or Tension)



## Muscle Performance Case 2

27-year-old volleyball player with shoulder pain and a suspected middle trapezius muscle performance deficit.

Perform the following:

- Classic Manual Muscle Test
- Tension Based Make Test
- Compression Based Break Test
- Functional Test (Compression or Tension)



## Muscle Performance Case 3

19-year-old tennis player with shoulder pain and a suspected serratus anterior muscle performance deficit.

Perform the following:

- Classic Manual Muscle Test
- Tension Based Make Test
- Compression Based Make Test
- Functional Test (Compression or Tension)



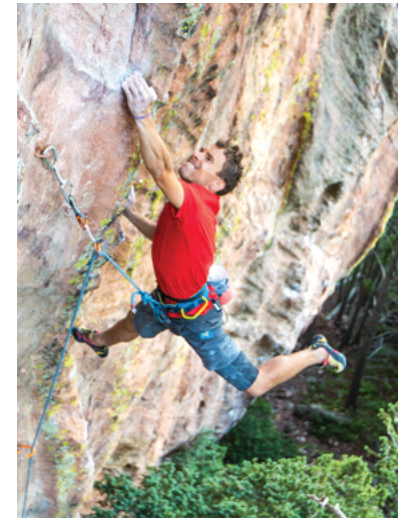
## Muscle Performance Case 4

35-year-old rock climber with finger pain and a suspected FDS tendon strain finger.

Perform the following:

- Classic Manual Muscle Test
- Tension Based Make Test
- Compression Based Make Test
- Force Plate Test Finger Profile

Note: The grip position tested must be the same as in the photo



## Muscle Performance Case 5

24-year-old swimmer with cervical spine pain every time she flexes her shoulder to end range. When palpating the spinous processes there is aberrant motion at C5 during end range shoulder flexion.

- Classic Manual Muscle Test
- Tension Based Make Test
- Compression Based Break Test
- Functional Test (Compression or Tension)



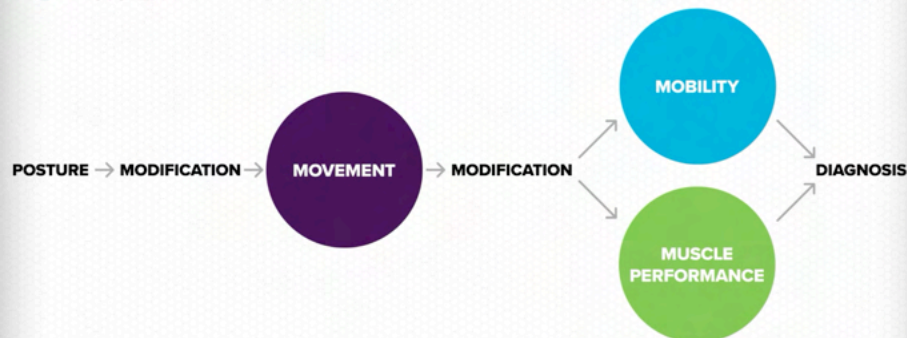
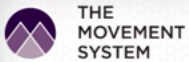
## Mobility

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## The Movement System Model



## Relative Stiffness



Black on Black  
Knot stays centered



Black on Yellow  
Knot shifts right



Yellow on Yellow  
Knot stays centered



## Mobility Case 1

Low back pain during yoga poses that require hands overhead



- What do you hypothesize are the black bands?
- What do you hypothesize are the yellow bands?
- What would be your intervention?



## Mobility Case 2

Posterior scapular region pain during gymnastics maneuvers that involve cross body reaching and internal rotation under load.



- What do you hypothesize are the black bands?
- What do you hypothesize are the yellow bands?
- What would be your intervention?



## Activity

- Find a partner and perform a posture and movement analysis of the upper half
- Make a hypothesis of a muscle(s) that has a mobility deficit
- Test whether the (s) is black/black, black/yellow, yellow/yellow
- Hypothesize and discuss with your partner other contributing factors to their posture or movement impairment
- Be prepared to share your findings with the group



## Putting it all Together

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## Sport Specific Case 1

Based on the clip observed of the rock climbing attempting a high step maneuver, what intervention could improve his ability to contact the climbing hold without falling?

- a. Left hip flexion mobility
- b. Right hip flexion mobility
- c. Right ankle dorsiflexion mobility
- d. Right ankle plantarflexion mobility



## Sport Specific Case 2

This patient reports low back pain spiking the ball. What intervention can be improve the performance of the task?

- a. Improve abdominal muscle performance and latissimus dorsi mobility
- b. Improve lumbar extensor muscle performance and teres minor mobility
- c. Improve rectus femoris muscle performance and serratus anterior mobility
- d. Improve triceps longhead muscle performance and lumbar segmental mobility



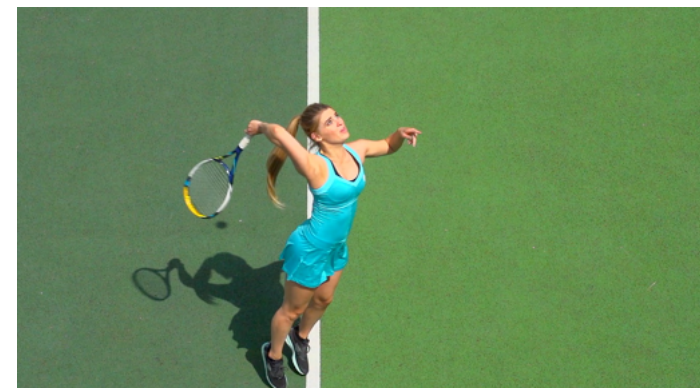
## Sport Specific Case 3

The pitcher in the clip observed reports right shoulder pain when pitching the ball. If you were to change one component of his pitch to decrease the stress on his shoulder, what would it be and why?



## Sport Specific Case 4

The tennis player in the clip observed reports right elbow pain when serving the tennis ball. If you were to change one component of her serve to decrease the stress on her elbow, what would it be and why?



## Sport Specific Case 5

The swimmer on the right side of the clip observed reports neck pain during the freestyle stroke. If you were to change one component of her stroke to decrease the stress on her neck, what would it be and why?



# Afternoon

## Schedule

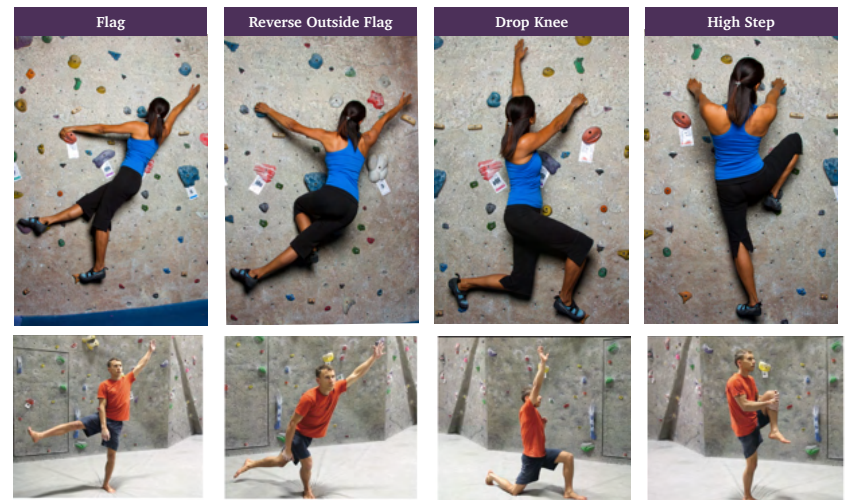
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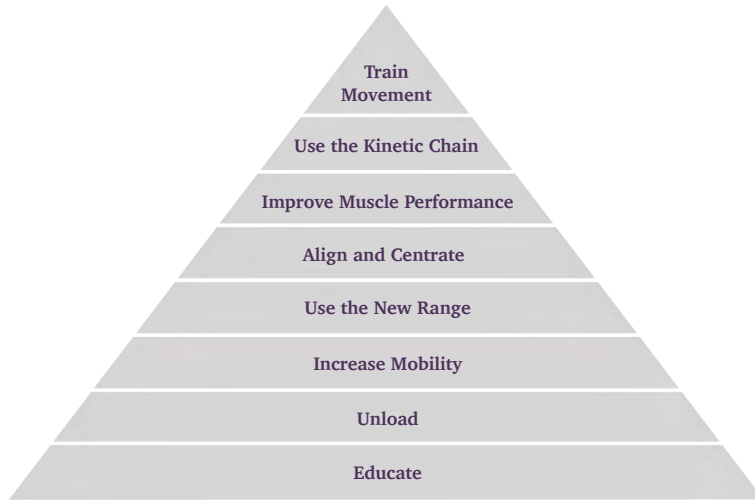
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## Climbing Warm-up



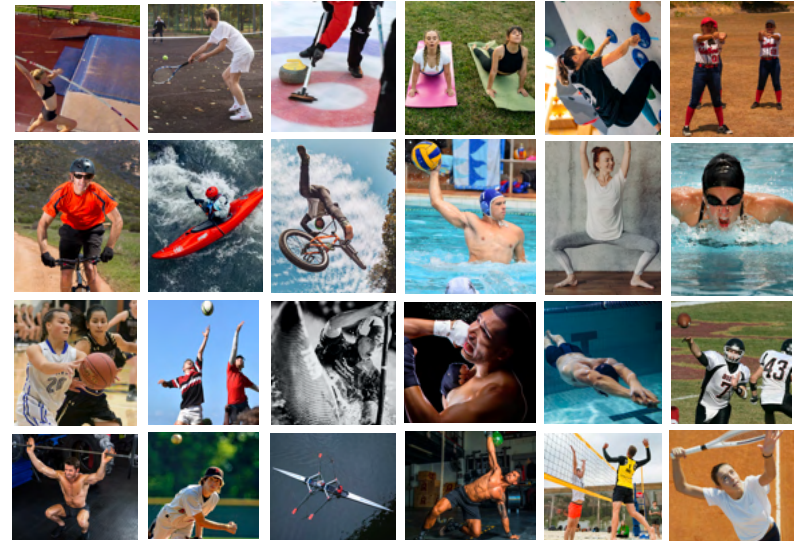
# The Treatment Pyramid



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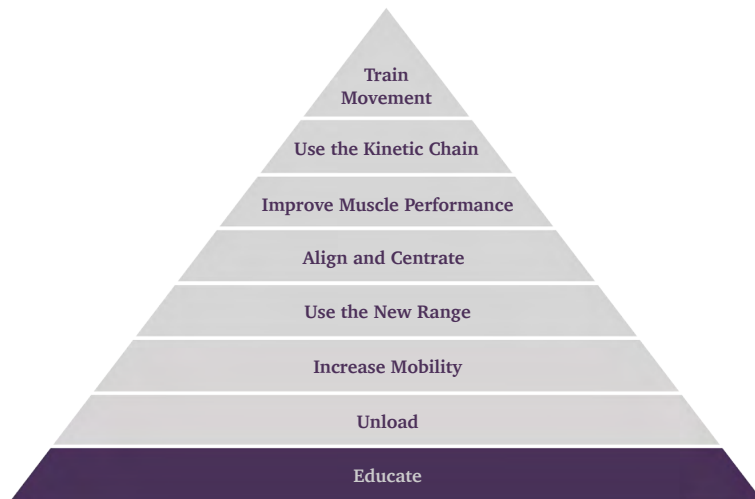
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# Apply to Athletes



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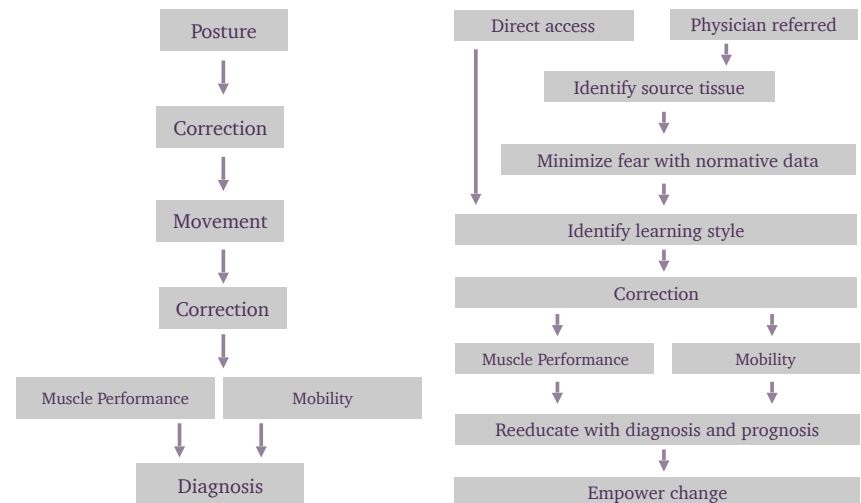
# Educate



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# VAK and Patient Education



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## The VAK Model

### Visual

Images and graphics

### Auditory

Verbal presentations

### Kinesthetic

Physical or hands-on

- Learning modalities are the sensory channels or pathways through which individuals give, receive, and store information
- The modalities or senses include visual, auditory, tactile/kinesthetic, smell, and taste



## Laddered Questions and Answer Planting

Ask laddered questions to plant the answer in their head and make the idea theirs.

Poor Athlete Education	Good Athlete Education
You need to tighten your stomach muscles when you throw the Javelin to decrease your shoulder pain.	<b>Question 1:</b> Which phase of throwing aggravates your shoulder when you throw?
	<b>Answer 1:</b> The acceleration phase.
	<b>Question 2:</b> See this video, I put your arm in that same phase a few minutes ago with a javelin and resistance band. What did you feel?
	<b>Answer 2:</b> Pain in my shoulder.
	<b>Question 3:</b> I then had you tighten your stomach muscles in that same position. Let's try that again. What happened?
	<b>Answer 3:</b> I had no pain.
	<b>Question 4:</b> What do you think will help you get rid of your pain?
	<b>Answer 4:</b> I need to tighten my stomach muscles when I throw.



## Visual and Kinesthetic



### Video Review



### Video Realtime



### Video Realtime



## Case 1: Educate

32-year-old recreational lacrosse player. Neck pain with overhead motion.

**Mobility:** Levator scapula mobility deficit

**Muscle Performance:** Impaired craniocervical flexors

**Movement:** Cervical fulcrum at C5, cervical extension and creasing with quad rock back, cervical segmental hyper mobility with shoulder flexion Sp moves contralateral

**Apply the VAK model with laddered questions and answer planting to get your patient to tell YOU why they have neck pain.**



## Case 2: Educate

21-year-old swimmer with shoulder pain during the early entry phase of freestyle stroke.

**Mobility:** Rhomboid mobility deficit

**Muscle Performance:** Serratus anterior deficit

**Movement:** Pain with shoulder flexion reduced with scapular upward rotation

**Apply the VAK model with ladder questions and answer planting to get your patient to tell YOU why they have shoulder pain.**



## Unload

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## Case: Unload



38-year-old rock climber with lateral elbow pain that radiates down the forearm

**Mobility:** Decreased pronation range of motion

**Muscle Performance:** Impaired middle trapezius strength

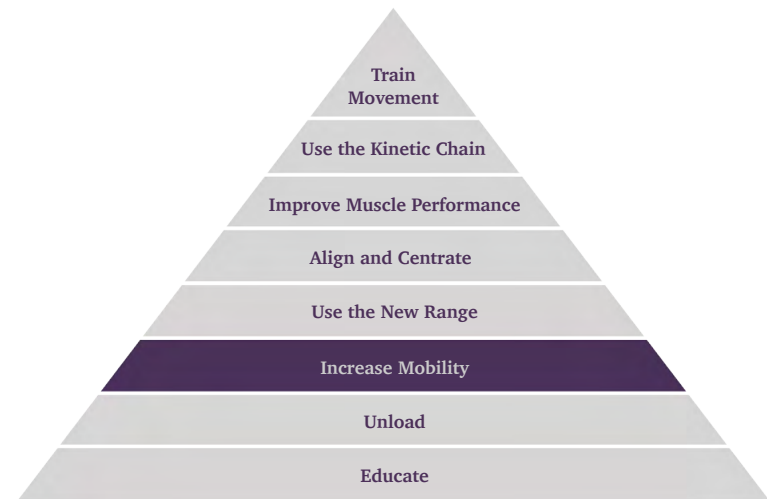
**Movement:** Excessive wrist extension while gripping

**Special tests:** Positive upper limb tension test tenderness to palpation over supinator and pec minor

**Utilize 3 unloading techniques to address the patient's symptoms**

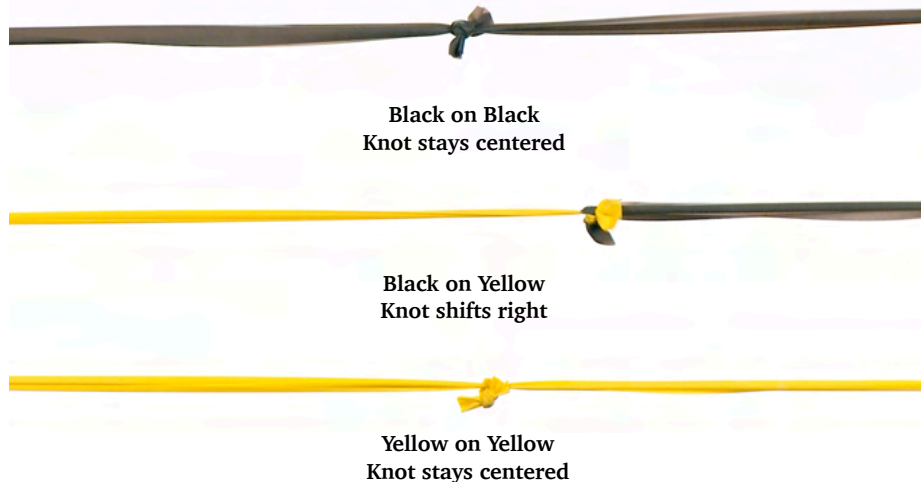


## Increase Mobility



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## Relative Stiffness



## Ways to Address Relative Flexibility

- 1. Increase Muscle/Tendon ROM** - Pull less (short term) or lengthen black band (long term)
  - Soft Tissue Mobilization (manual or instrument assisted)
  - Stretching (static or dynamic)
  - Eccentric training (agonist contract for antagonist length or agonist eccentric)
- 2. Decrease Intramuscular Stiffness** - Make the black band yellow
  - Post Isometric Relaxation (or various manual trigger point techniques)
  - Dry Needling (local stimulation)
  - Gravity Induced Inhibition (CNS driven)
- 3. Increase Intramuscular Stiffness** - Make the yellow band black
  - Stabilize the less stiff region while moving the stiffer region (active or passive)
- 4. Improve Joint Mobility** - Loosen the knot
  - Joint Mobilization (oscillatory or sustained)
  - Movement with Mobilization (controlled or functional position)

## Case 1: Increase Mobility

- **Report**
  - A competitive canoe slalom racer reports pain in their top shoulder during the paddle stroke.
- **Movement fault**
  - Short latisimus dorsi and teres major muscles (black on black)
- **Intervention**
  - Increase Muscle/Tendon ROM of the latisimus dorsi and teres major.

## Case 1: Increase Mobility



## Assessment



## Increase Muscle/Tendon ROM

**What techniques do you frequently use to improve range of motion?**

For example, decrease latissimus dorsi mobility (black/black)

## Ways to Address Relative Flexibility



**1. Increase Muscle/Tendon ROM** - Pull less (short term) or lengthen black band (long term)

- Soft Tissue Mobilization (manual or instrument assisted)
- Stretching (static or dynamic)
- Eccentric training (agonist contract for antagonist length or agonist eccentric)

**2. Decrease Intramuscular Stiffness** - Make the black band yellow

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- Stabilize the less stiff region while moving the stiffer region (active or passive)

**4. Improve Joint Mobility** - Loosen the knot

- Joint Mobilization (oscillatory or sustained)
- Movement with Mobilization (controlled or functional position)

## Case 2: Increase Mobility

• **Report**

- A swimmer reports shoulder pain during the early pull-through phase of the freestyle stroke.

• **Movement fault**

- Inadequate shoulder flexion during late recovery into the early pull-through phase of the freestyle stroke. (black on yellow)

• **Intervention**

- Decrease intramuscular stiffness of the latissimus dorsi.

## Compare and Contrast



## Assessment



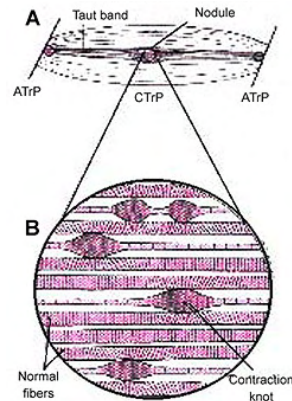
## Post Isometric Relaxation (PIR)

### When to use:

- Hypertonicity and increased tissue tension in a muscle

### What it does:

- The theory is that by using minimal resistance, specific fibers are activated and then inhibited. This is not a stretch.



## PIR of Latissimus Dorsi

### • How to perform:

- Slowly lengthen a muscle to first barrier.
- Patient pushes against you gently (10-20%).
- Patient hold contraction for 3-5 seconds.
- Take up slack to new barrier upon exhalation.
- Repeat 3-5 times.



**Assess your partners lat muscle length and relative stiffness**

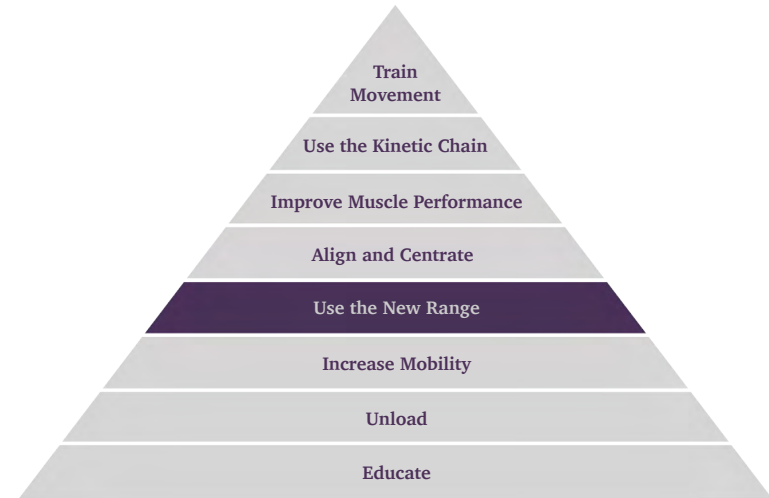
**Perform PIR**

**Reassess**

## PIR of Latissimus Dorsi



## Use the New Range



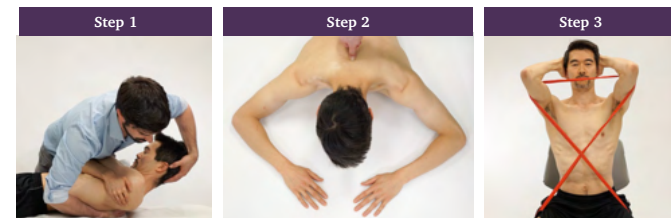
## Case: Use the New Range



51-year-old male volleyball player who reports neck pain when he spikes the volleyball.

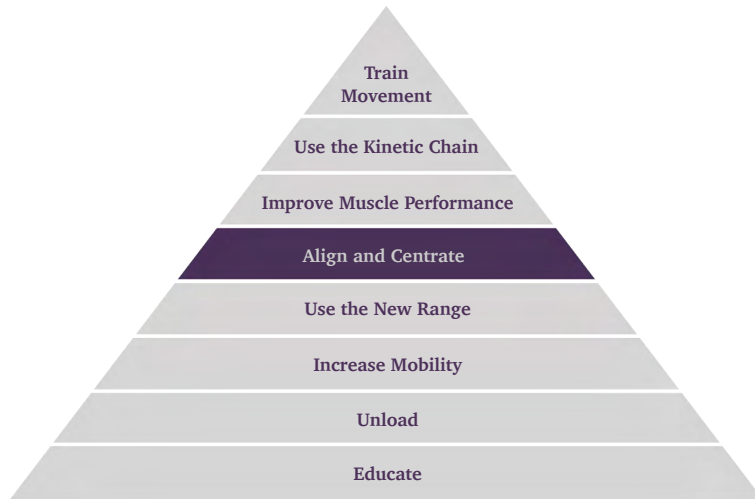
- Step 1: Direct mobilization of the thoracic spine
- Step 2: Relative motion mobilization the thoracic spine
- Step 3: Use the range just gained with resistance
- Step 4: Make it functional

## Case: Use the New Range



- Step 1: Direct mobilization of the thoracic spine
- Step 2: Relative motion mobilization the thoracic spine
- Step 3: Use the range just gained with resistance

## Align and Centrate



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## Case: Align and Centrate



22-year-old male reports left shoulder pain while shooting and passing the ball during water polo tournaments

- 25% decreased muscle performance of left trunk rotators versus right (dynamometer tall kneeling isometric)
- Anterior humeral laxity
- Decreased right shoulder external rotation muscle performance (15%) compared to right
- **What intervention can improve left trunk rotation muscle performance and promote joint stability during the acceleration of a throw?**



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## Intervention

22-year-old male reports right shoulder pain while shooting and passing the ball during water polo tournaments

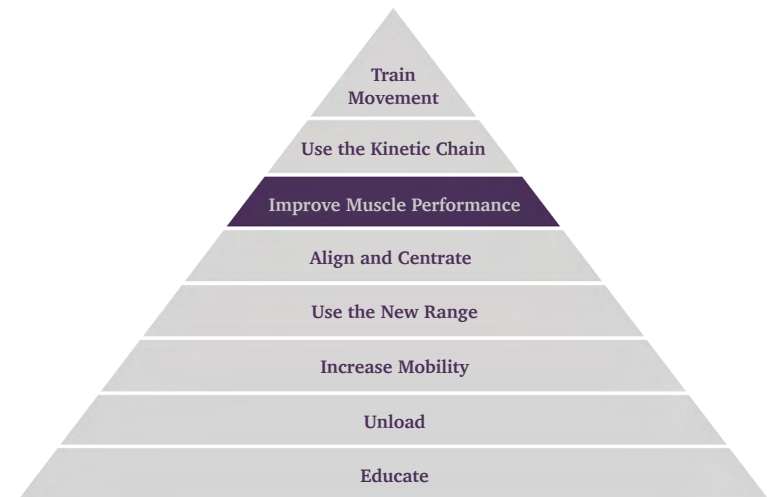
- **What intervention can you perform to improve trunk left rotation power and promote joint centration during the acceleration of a throw?**



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## Improve Muscle Performance



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## Case: Improve Muscle Performance



22-year-old pitcher reports right shoulder pain during the acceleration phase of the pitch

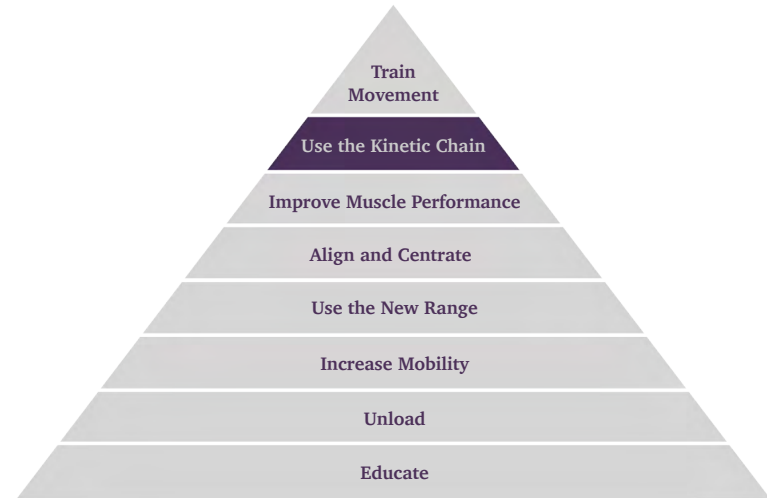
**Movement:** Humeral anterior glide during shoulder IR at 90 degrees

**Muscle performance:** Decreased humeral ER and middle trapezius strength

**Mobility:** Anterior glenohumeral joint laxity, hypomobile posterior glide

- Use one vector of assistance
- Use one vector of resistance
- Use two vectors at one time
- Use three vectors?

## Use the Kinetic Chain



## Case 1: Use the Kinetic Chain

Tennis player reports shoulder pain during the serve

**Movement:** Excessive femoral adduction during loading and inadequate humeral external rotation during cocking

**Muscle performance:** Decreased humeral ER and middle trapezius strength

**Mobility:** No mobility deficits

- Use standing phasic upper extremity exercise
- Use standing phasic upper and lower extremity exercise
- Use supine phasic upper extremity exercise
- Use supine phasic upper and lower extremity exercise
- Make it functional?

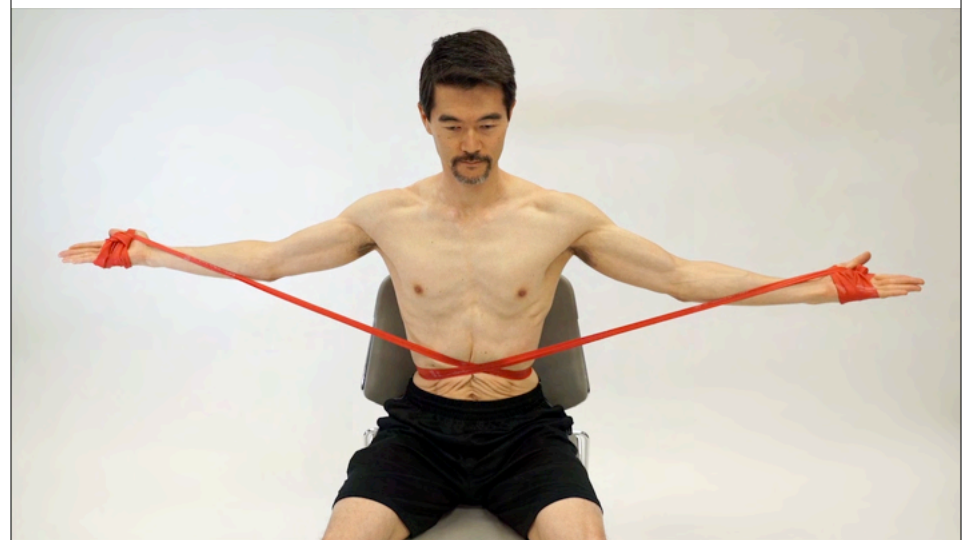
## Case 1: Use the Kinetic Chain



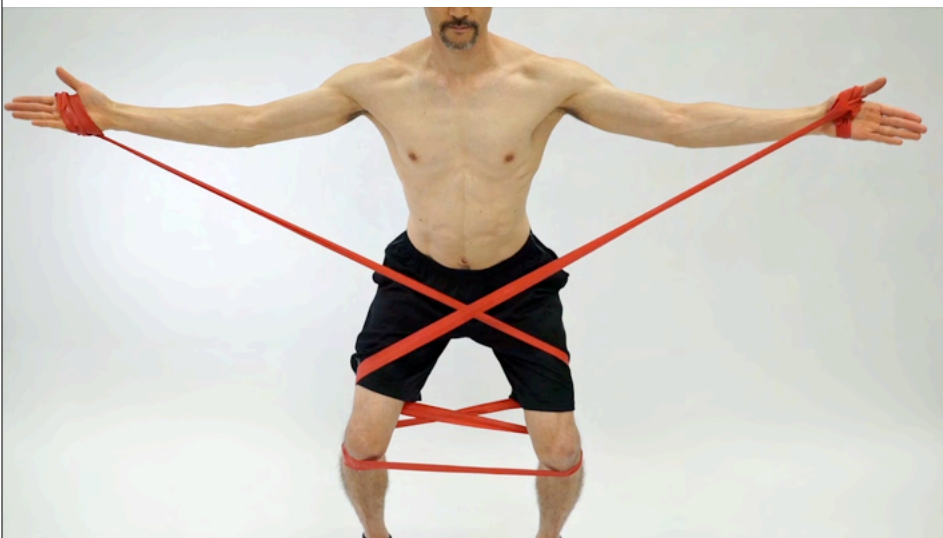
## Phasic Quadruped



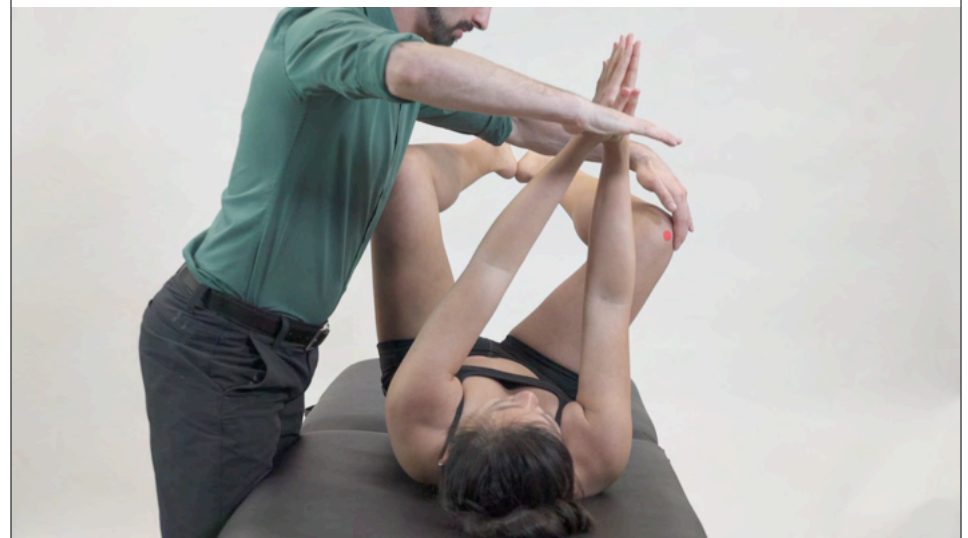
## Phasic Seated



## Phasic Standing



## Assisted Phasic Trunk Activation



## Self Phasic Trunk Activation



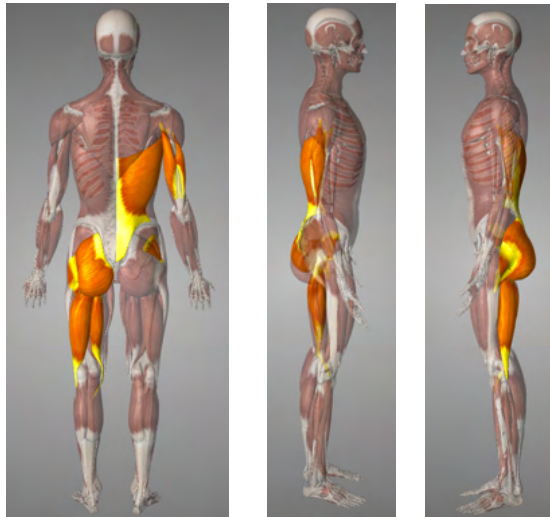
## Case 2: Use the Kinetic Chain



24-year-old 110 meter hurdler reports that they are having decreased power when exploding out of the blocks. They would like to improve their acceleration.

- Integrate a sling (anterior trunk, poster trunk or spiral) into a functional intervention to improve acceleration

## Posterior Trunk Sling



- Ipsilateral triceps and latissimus dorsi
- Contralateral thoracolumbar fascia, gluteus maximus and hamstrings

## Posterior Trunk Sling



# Summary

- Integrate key concepts from the MSI model into an ICF-based treatment model that incorporates movement coordination dysfunction with mobility and muscle performance deficits
- Combine posture and movement analysis with symptom modification procedures to determine movement classifications and inform clinical decision-making
- Demonstrate and select appropriate movement assessments and treatments for the upper half of an athlete
- Provide interventions based on faulty movement patterns and observed and relate to key impairments obtained from the objective exam and integrate into a systematic framework