NSCA 2016 TACTICAL STRENGTH AND CONDITIONING ANNUAL TRAINING

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Rehabilitation and Reconditioning: It’s more than just traditional conditioning

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BLUF

• There is a need to understand how the integrated systems of the body are impacted on by injury...

• ... and how the systems must be considered in developing reconditioning / rehabilitation programs
Outcomes

• Explain the three components that provide stability and protection of the body during movement – The integrated system
• Describe how the Neuromusculo-skeletal systems interact during movement
• Identify which of the Neuromusculo-skeletal systems require rehabilitation and reconditioning for optimal performance.
Scenario

• Police officer complains of back pain.
  – What exercises do you prescribe?
Scenario

• Train the core?
  – Research suggests that the problem is not one of strength or endurance but of motor control (Jull, et al., 1999)
  – TrA thickness does not change above 20-30% MVC (Himes et al., 2012)

Scenario

• What if it was a ZAP Joint dysfunction?
  – Joint trauma
  – → muscle spasm
  – → inhibition? of deep muscles?
The Integrated System

- Active system
- Passive system
- Neural System
- Neutral Zone
The Integrated System

The impact of injury

Control System

Passive System ↔ Active System
The Integrated System & Dysfunction

Scenario 1: Passive System Dysfunction

Control System

Passive System

Active System
The Integrated System & Dysfunction

Scenario 1: Passive System Dysfunction

– Joint does not move properly

• Acute cause
  – e.g. ACL tear

• Altered mechanics of movement
  – e.g. Increased laxity of the joint (Brukner & Khan, 2012)

Joint does not move properly

- Chronic cause
  - e.g. Ankle DF ROM following an ankle sprain (Pope, et al., 1998)
- Altered mechanics of movement
  - e.g. Stepping down, squatting
Scenario 1: Passive System Dysfunction

- Pain
  - Acute cause
    - e.g. ZAP joint injury
  - Altered mechanics of movement
    - e.g. Change in movement patterns and inhibition (Brugger, 1984; Ebenbichler, et al., 2001)
Scenario 1: Passive System Dysfunction

**Excessive Load**
- Ligamentous damage
- Skeletal damage

**Inhibition**
- Decreased / delayed muscle activation

**Active System**
- Excessive Load
  - Muscle damage
  - Tendon damage

**Passive System**

- Dysfunctional movement
- Pain
The Integrated System & Dysfunction

Scenario 2: Control System Dysfunction
Scenario 2: Control System Dysfunction

– Faulty Joint Position Sense

• Chronic cause

  – e.g. Recurrent ankle sprains (Hartsel, 2000)/ whiplash (Oddsdottir, & Kristjansson, 2012)

• Altered accuracy of movement
The Integrated System & Dysfunction

Scenario 2: Control System Dysfunction

– Fatigue

- Overload to the system / poor recovery
- Neural input arrives too late
Scenario 2: Control System Dysfunction

– Faulty motor control
  • Incorrect movement pattern
  • Incorrect muscle activation
    – E.g. Glutes vs hamstrings / TFL vs HF
    – Global vs local
Scenario 2: Control System Dysfunction

– Neurological injury / Neuropathy

  • Brachial plexus palsy
    – e.g. load carriage (Orr et al., 2013)
  • Weakness / Altered function
    – Scapula dysfunction
Scenario 2: Control System Dysfunction

- **Excessive Load**
  - Ligamentous damage
  - Skeletal damage

- **Delayed / Slow Commands**
  - Faulty Joint Position Sense
  - Fatigue
  - Faulty Motor Control
  - Neurological injury

- **Control System**
  - Reinforce faulty motor patterns & poor JPS

- **Passive System**
- **Active System**

- **Excessive Load**
  - Muscle damage
  - Tendon damage
Scenario 3: Active System Dysfunction

The Integrated System & Dysfunction

Control System

Passive System

Active System
Scenario 3: Active System Dysfunction

– Muscle weakness
  • Absolute weakness
    – Weaker than external requirements
  • Typically load is too much
    – E.g. load carriage
The Integrated System & Dysfunction

Scenario 3: Active System Dysfunction

– Muscle weakness
  • Relative weakness
    – E.g. Weaker than opposing muscles
  • Upper/Lower Cross Syndromes


T I M E L I M E  N E W S  A T  N S C A 2 0 1 6

T A C T I C A L  S T R E N G T H  &  C O N D I T I O N I N G  A N N U A L  T R A I N I N G

A P R I L  2 5 – 2 8 , 2 0 1 6  |  S A N  D I E G O ,  C A  |  S A N  D I E G O  M A R R I O T T  M I S S I O N  V A L L E Y
Scenario 3: Active System Dysfunction

- Muscle weakness
  - Previous injury
    - E.g. Incomplete recovery
  - Re-injure weakened structure
    - E.g. Load carriage (Orr, et al., 2016)

Orr, R. M., Coyle, J., Johnston, V., & Pope, R. (2016). Self-reported load carriage injuries of military soldiers. *International journal of injury control and safety promotion*, Fig 1, pg 4
The Integrated System & Dysfunction

Scenario 3: Active System Dysfunction
– Muscle weakness
  • Fatigue
    – E.g. Excessive work/insufficient rest
  • Overload once capable structure
    – E.g. Jump landing (Orr, 2007)
The Integrated System & Dysfunction

Scenario 3: Active System Dysfunction

- Excessive Load
  - Ligamentous damage
  - Skeletal damage

- Inhibition
  - Decreased / delayed muscle activation
  - Faulty motor patterns

- Excessive Load
  - Muscle damage
  - Tendon damage

- Muscles too weak to overcome force
  - Weakness – Absolute or Relative
  - Previous injury
  - Fatigue
The Integrated System & Dysfunction

So what?
So What?

• Member comes in post back pain
  – You give them core strengthening...but what if....
    • Poor motor timing (abdominals firing late)
    • Poor motor pattern (caused by poor technique)
    • Poor muscle activation (Gluteals not firing)
    • Faulty JPS (think they are in the right position)
    • Joint dysfunction (loss of joint ROM)

• ...means that you can't just give an exercise (e.g. core for lower back) and hope for the best...
The Integrated System & Performance

Considering this Integrated system and how it relates to performance
The Length-Tension Curve

– A muscle fibres will develop most tension at between 90-110° of resting length
– Joint position will influence which muscle takes up the most tension and receives the most stimulus.

http://4.bp.blogspot.com/-FhLuv77O5nI/U6XBzYCiO2I/AAAAAAA9o/PqLcW1uO1HA/s1600/Force-Length-Graph-2.bmp
The Integrated System & Performance

The Length-Tension Curve

- It effects optimal loading for a muscle.


http://www.bodybuilding.com/exercises/exerciseimages/sequences/255/Male/I/255_1.jpg
The Integrated System & Performance

The Length-Tension Curve

- It effects optimal position for muscle stretching.

The Integrated System & Performance

The Length-Tension Curve

- It can be used to compensate for weaker muscles
The Integrated System & Performance

Muscle activation and compensations
The Integrated System & Performance

OCK v CKC

- Both OCK and CKC are important
- The question is when to use them as part of reconditioning

http://i.telegraph.co.uk/multimedia/archive/03138/sydney-police-run_3138160c.jpg
Complex Synergies – Shifts

- In a **countercurrent** movement, the biarticular muscle is an agonist at both joints simultaneously.
The Integrated System & Performance

Complex Synergies – Shifts

• In a **concurrent** movement, the biarticular muscle is an agonist at one joint and an antagonist at another simultaneously.
Segmental Summation of Velocity

- Optimal coordinated sequence of movement that allows for optimal velocity development
- Each segment begins to move the instant the previous segment begins to slow down

Elliott, B.C. Biomechanics in Sport in eds. Pyke, FS. Better Coaching, Australian Sports Commission, Figure 7-13, p.107

http://www.netfit.co.uk/public/images/assets/160.jpg
Segmental Summation of Velocity

Monfort-Panego, et al., 2009

• When Sitting Up
  – Initial phase of the exercise during dorsolumbar spine flexion the RA is activated then decreases when Lx is around 30*-45* HF activation increases
Considerations for Programming

• Is the Passive System Involved?
  – Mechanism of injury
  – Measure Joint Range (Goniometry) / Muscle stretch and retest (TDT)
    • Also applies with technique
  – Neuromuscular system treatments not having an effect.
Considerations for Programming

• Considerations for the Active System?
  – Check / Train strength / endurance
    • Through the required range and movement pattern
  – Check opposing movement strength / endurance
  – Watch loading
    • Too soon / long
  – Focus on full recovery (foundation then performance)
Considerations for Programming

• Considerations for the Control System?
  – Integrate the movement
  – Train the muscle to fire at the correct speed
  – Ensure correct muscles are active (no compensations)
    • Where do you feel it?
  – Check for faulty JPS (or refer) / Retrain
  – Check technique with required load/speed
Rehabilitation and Reconditioning

• The integrated systems need to be considered in terms of...
  – Downstream effects
  – Reconditioning / rehabilitation exercise and training dose selection

• Reconditioning / rehabilitation programs need to be well informed and well considered – it is more than just giving a known exercise

• One size fits no-one
References

• Brugger, A. Neurological and morphological basis of so-called rheumatic pain: a contribution to the understanding of musculoskeletal diseases. (Neurologische und morphologische Grundlagen der sogenannten rheumatischen Schmerzen - ein Beitrag zum Verständnis der Funktionskrankheiten.) In: Schmerzstudien 6, Schmerz und Bewegungssystem, M. Berger, F. Gerstenbrand., K. Lewit (Eds.). Stuttgart: Fischer, 1984, pp. 56–79


References

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