

# Feed Forwards Trunk Control and its Role in Functional Force Production

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# Goal

To believe/understand the below statement:

**The absolute goal for core stability: To attain subconscious feed forwards automatic core stability and control with optimized breathing patterns under systemic/ local tissue stress and fatigue.**

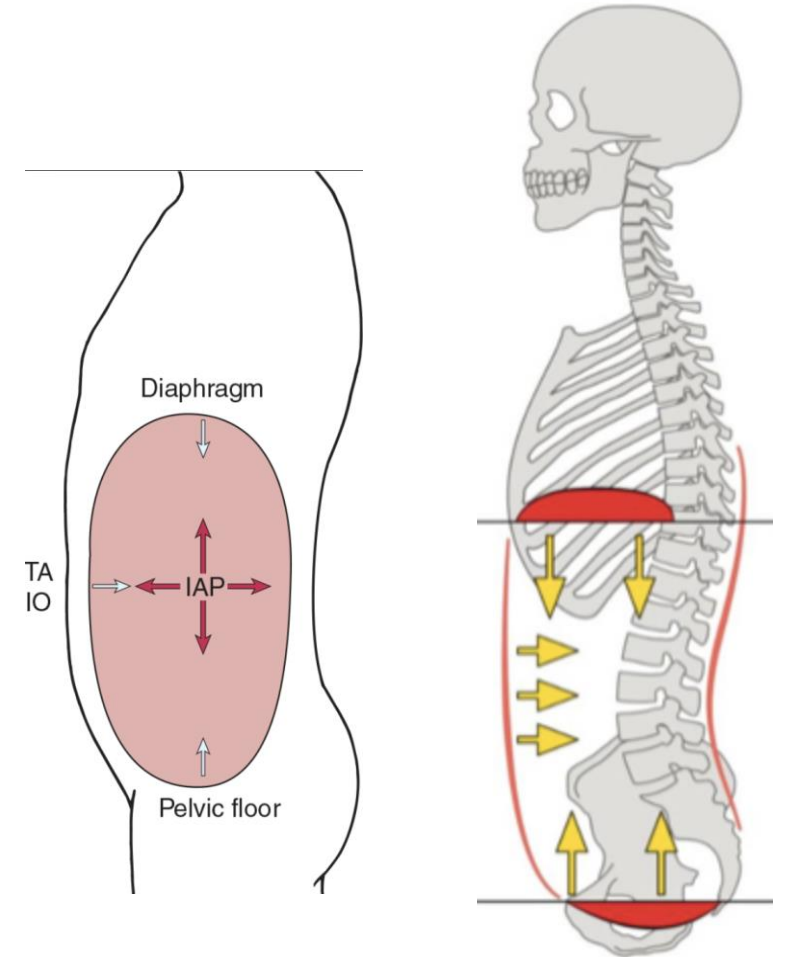
# Anthropomorphic Anatomy

**Core Stability:** The ability to control the position and motion of the trunk over the pelvis to allow optimum production, transfer and control of force and motion to the terminal segment in integrated athletic activities.

**Core Stability:** Pivotal for efficient biomechanical function to maximise force generation and minimise joint loads in all types of activities ranging from rolling in bed to running. - Kibler et al. 2006

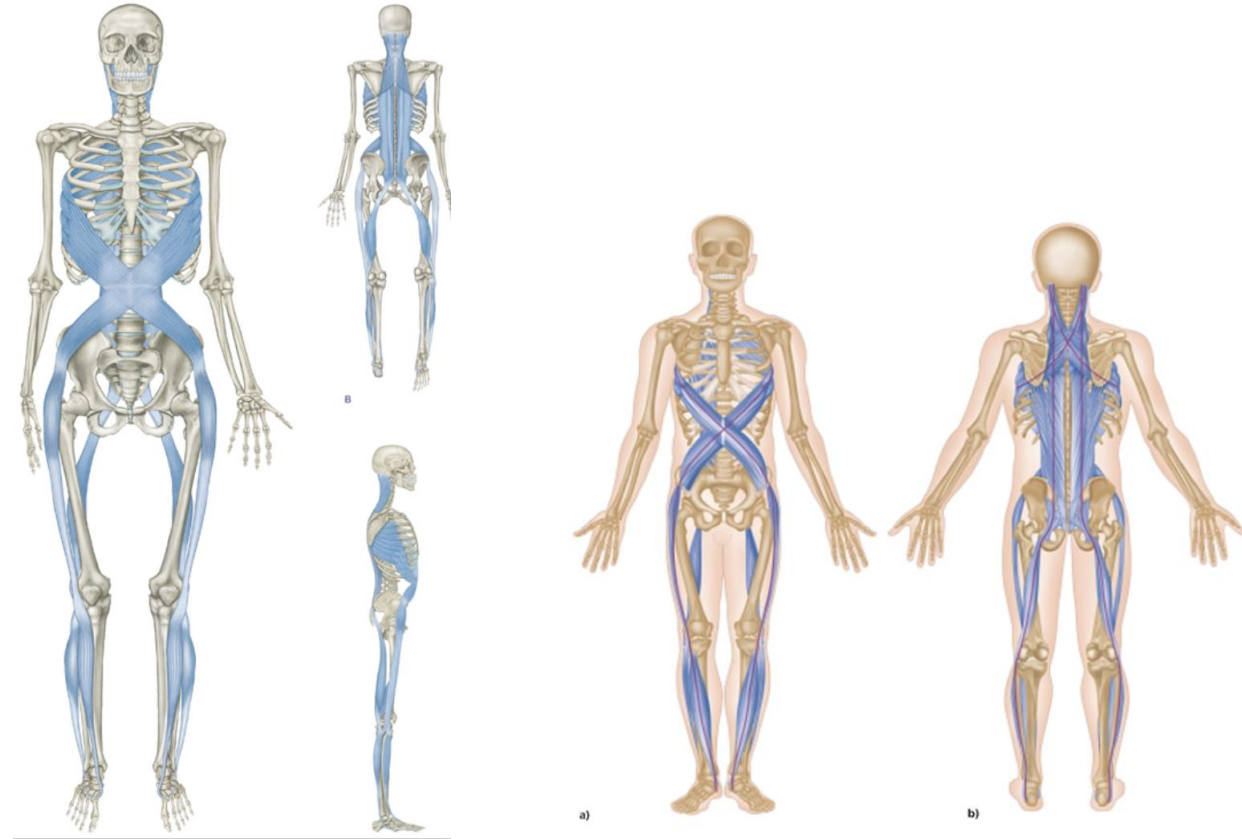
Are they **set in a position that can allow for proper BRACING and BREATHING** of the trunk

**Core muscles work in synergy with Respiratory muscles**



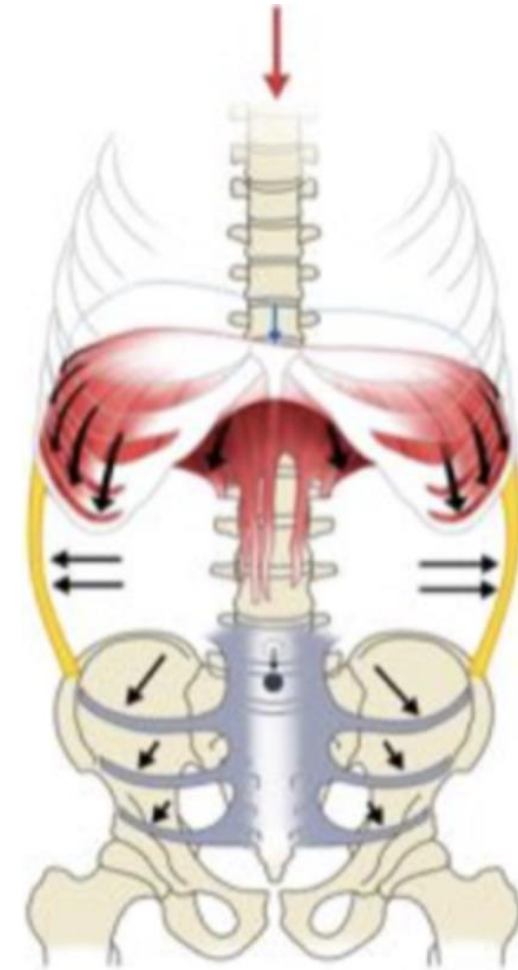
# Directional Muscle Anatomy

- Core musculature: Muscles of the trunk and pelvis that are responsible for the maintenance of stability of the spine and pelvis and help in the generation and transfer of energy from large to small body parts during many sports activities
- Respiratory and core muscles work synergistically and are most important for what can be referred to as feedforwards subconscious automatic stabilization.



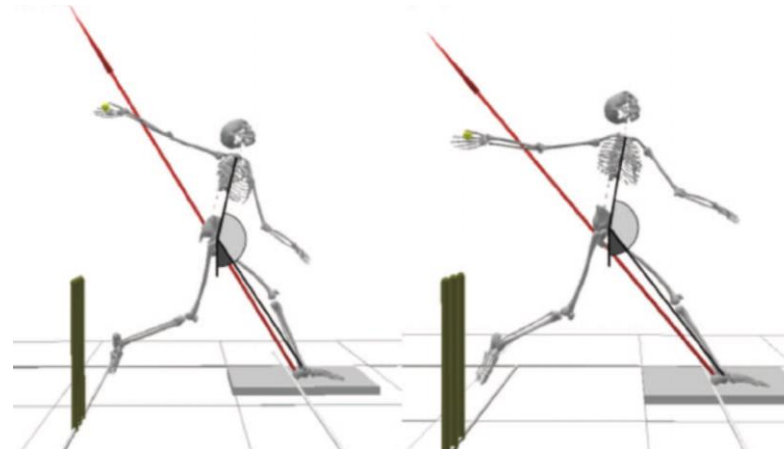
# Breathing is Bracing

- Breathing >= Core Stability (Runners/ Running Back/ cross-country skiing)
- Respiratory muscles work synergistically with the core muscles or even function as both
- The diaphragm and pelvic floor: Needed to attain true trunk stability
- Breathing function will supersede need to brace and support body for activity specific strength -Janda
- **Internal Oblique:** Increase the rib angle (rib angle appears horizontal) / increase costal angle, can pull the ribs in an anterior to posterior direction + inferior and lateral direction or slight anterior pelvic tilt due to its line of pull
- **The External Oblique:** Decrease the rib angle (rib angle appears vertical) / decrease costal angle, can pull the ribs in an anterior to posterior direction + inferior and medial direction or slight posterior pelvic tilt due to its line of pull
- **Rectus Abdominis:** Pull the ribs medially and inferiorly or slight posterior pelvic tilt due to its line of pull



# Force Transmission

- Energy transfer is needed for all of life's functions movements and the body uses the core to transmit this energy.
- All Purposeful motions should start with feed forwards proximal stability in order to transmit force across the whole body. – Hodges 1997 (Proximal stability before and during distal segmental mobility)
- If this force cannot be transmitted up the chain and the same speed and velocity is to be maintained then small peripheral joints must work harder to make up for the lost kinetic force.
- Just core leads to increased sport specific UE function: Workouts 4x weekly for 10 weeks, 7 core strength exercises + normal workout group Vs. normal workout only group, Core training group showed throwing velocity increased **4.5% average and Control group -.04%** -Manchado et al. Journal of Human Kinetics 2017



# Timing Vs. Absolute Strength

Timing and Activation Patterns > Strength:

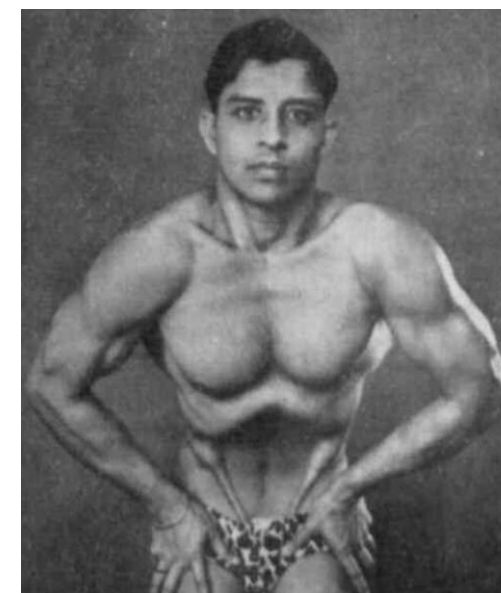
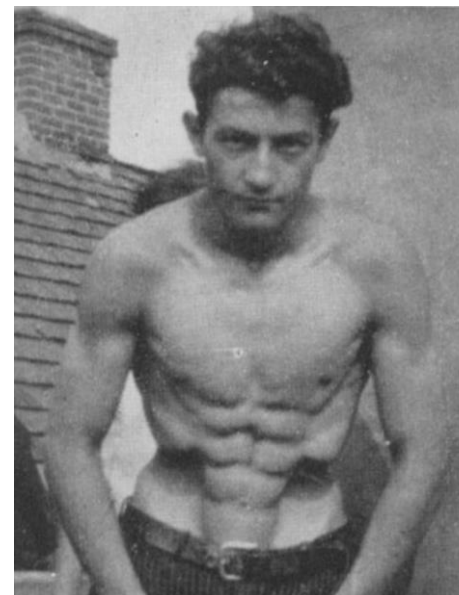
Only need around **1-10% MVIC** of the trunk muscles in order to provide joint stiffness in lumbar spine or to transmit force up the chain.

**TrA** only functions with Diaphragm + IO/EO not in isolation for > 1-2% MVIC

Impaired core activation timing seen in low back pain patients

The **diaphragm and transverse abdominis muscles** in healthy adults both fire synergistically prior to isolated lower extremity, upper extremity and trunk movements in order to stabilize trunk independent of the breathing cycle phases

-Hodges 1997 "Contraction of the Human Diaphragm during Rapid Postural Adjustments",  
"Contraction of the abdominal muscles associated with movement of the lower limb"



# Core with Respiration and Fatigue

- **Fatigue:** Decreased sensorimotor systems with a diminish in position sense/ proprioception of central and peripheral joints leading to increased tissue overload and damage.
- **Fatigue:** “Reduction in feedback from the muscle spindle, thus affects proprioception and posture”  
– Janda
- Shown that under local muscle fatigue overhead throwing athlete’s have decreased proprioception and joint centration around the Glenohumeral axis- Tripp et al 2007, Lee et al. 2007/2013
- It can also be postulated that not only peripheral but central joints have improved stability due to proprioceptive function and feedforwards control these joints are supported by the trunk.– Page 2010 (Janda approach)

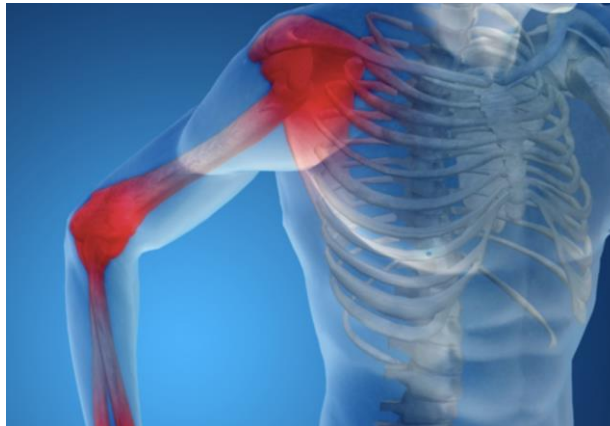


# Injury

- **Regional Interdependence:** Theory that states that seemingly unrelated impairments in remote anatomical regions of the body may contribute to and be associated with a patient's primary report of symptoms

– Wainner 2007

- If this force cannot be transmitted up the chain and the same speed and velocity is to be maintained then small peripheral joints must work harder to make up for the lost kinetic force.
- In summation, patients need correct respiratory function and core stability for efficient biomechanical function in order to maximize force generation and minimize joint loads in all sports and one cannot efficiently take place without the other



# Evidence Based Testing

- Sorensen's, Side plank (full or Knees), Abdominal sit up
- TEST UNDER SYSTEMIC FATIGUE !!!!



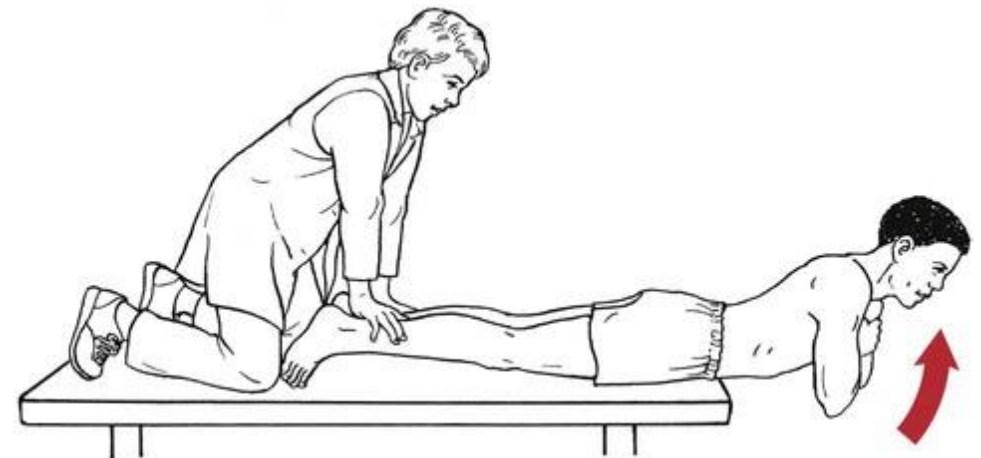
**Side bridge test**



**Extensor  
endurance test**



**Flexor  
endurance test**



# Treatment

That's what the Fellowship year is for.....



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