Fifteen Minutes To A Better Relationship with Impact and Gravity, Part Two

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Goal For The Next Hour

- Combine multiple discipline languages and conceptual approaches explaining movement and motor control
- Come to a common understanding of why and how to do the following exercises

Athleticism

- Having enough mobility to move to and through positions that optimize length tension relationships in muscles, then being able to subconsciously find co-contraction to remove muscle slack so that power and motor control may be expressed.
  - Randy Sullivan, PT

To Build a Better Athlete:

- Help them have sufficient mobility, proper movement patterns, and enough strength to move athletically and handle higher loads

The Challenge:

- Find what each athlete is doing well and where they need improvement

- Individualization

We Need To Improve Transfer Of Training

Keep doing what you are doing if it is working

Are the athletes working the hardest improving and performing the best?

Foundational Concepts

- Motor Control
  - Computational theory
  - Dynamic systems theory
- Six Degrees of Freedom: 3D movement
- How Do Muscles Work
- Muscle pumps and Tendon elasticity

Motor Control

Computation Theory

- Top down
- How to fire
- One way

Dynamic Systems Theory

- Bottom up
- How do I create stability to achieve the goal
- Multiple competing and cooperative strategies to create stability and achieve the goal

Biotensegrity

- Tensegrity systems are stabilized by continuous tension, with discontinuous compression
- As opposed to structures and systems held together by gravitational compressive forces

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We Have A Degrees Of Freedom Problem

- We have too many joints and too many degrees of freedom
- We try to balance this problem with a degrees of constraint solution
- Maladaptive constraints can lead to diminished athletic performance or injury

Six Degrees of Freedom

- Up/Down: Sagittal plane
- Left/Right Sidebending: Frontal Plane
- Left/Right Rotation: Transverse Plane

- Movement of a joint in one plane diminishes available motion in other planes

Solutions

- Muscles cooperate to couple joints through intermuscular constraints
- Musculotendinous connections and ligaments link the stability and instability of joints
  - Locking an ankle can lock the knee can lock the hip
- Force sharing around joints minimizes shear forces and reduces degrees of freedom

Avoiding Disconnection

- Connection: Body parts working together in proper timing, sequencing, and synergy
- Disconnection: When a body segment acts out of proper timing, sequencing, and synergy.
  - Hitch in the giddy up

Why do we disconnect?

- Taught wrong
- Physical limitation prevents getting in position
- Looking for energy in wrong places
- Protective alteration of movement due to pain or injury
- Compensation for inefficient structures

We improve connection by removing muscular slack

- Synergistic isometric contraction of all muscles around a joint or limb

To improve and elicit co-contractions:

- Time Pressure
- Perturbations
- Pre-Tension

Aquabags, balls, and vests

- Top down instability to create perturbations
- Monitor for faulty strategies to create stability at joints

How do Muscles Work?

- Concentric
- Eccentric
- Isometric

How do muscles work?

- Eccentric action of the agonists
- Isometric action of the agonists
- Concentric action of the antagonists
- Isometric action of the antagonists
- Isometric action of certain stabilizers of the relevant joint or nearby joints
- Concentric action of other stabilizers of the relevant joint or nearby joints
- Eccentric action of other stabilizers of the relevant joint or nearby joints
- Passive tensioning of connective tissue
- Passive harmonic damping by connective tissue of nearby joints
  - Basmajian, 1978

Understanding Pronation and Supination

- Pronation of the foot and ankle
  - Calcaneal eversion, dorsiflexion, abduction.
  - Unlocking of ankle for shock absorption
  - Shock absorption ideally by soft tissues
- Supination of the foot and ankle
  - Calcaneal inversion, plantarflexion, and adduction
  - Locking of ankle for rigid lever for push off
  - Allow for application of force

Two Muscular Functions:

- Pump
  - Muscle
- Elastically
  - Isometric Muscle
  - Tendon loading and deformation

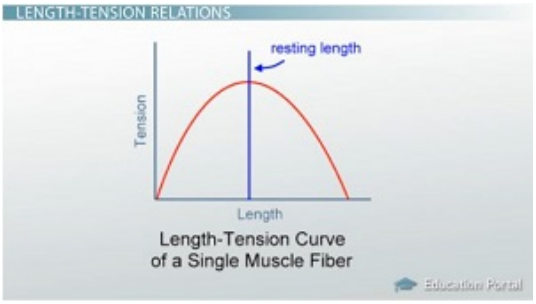
Pumping Phase

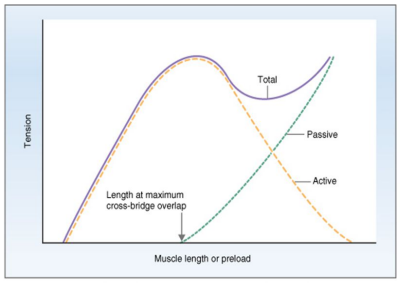
- Larger amplitude movements with greater muscular length:tension movement

Elastic

- Smaller amplitude movements and greater tendon lengthening

Length: Tension Curve





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- **Length-tension relationship in skeletal muscle.** Maximal active tension occurs at muscle lengths where there is maximal overlap of thick and thin filaments.

High loads can lead to isometric muscular function

Need To Build Both

- Muscular Strength
- Tendon Elasticity

Need:

- Control of movement through full excursion
- Optimal strength at key positions

Goals:

- Control the foot and ankle
- Control the hip
- Control the ankle, knee, and hip together
- Control the ankle, knee, hip, pelvis, and lumbar spine together
- Control ankle, knee, hip, pelvis, spine, and shoulders together

The Exercises

Pronation/Supination

Lower Extremity Internal/External Rotation

Lateral Step Down Progression

Tendon Neuroplastic Training by Ebonie Rio

- Five 45 second Isometrc holds
- 4x8 3 sec concentric and 4 second eccentric with a metronome at 60 beats per minute
- No Bounce
- Heavy load and long duration
- 70-85% MVIC
- Improved Accelerator
- Improved Brake

Ankle Isometrics

Knee Isometrics

Spanish Squats

Inside Reach Progression

Bosch Hip Locks

Hip Hinge to
Bosch Snatching Lunge

Bear Crawl and
Ball Crawl Progression

Rear Leg Elevated
Split Squats