Preparing your patients for the game of life and sport:
Bridging the gap between physical therapy and performance

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About Me

• 13 years in the fitness and nutrition industry
• specializing in performance enhancement and injury prevention through proper assessment and training methods.
• Physical Therapist at Kinetic Physical Therapy (www.kineticptpa.com)
• Own and operate CORE Fitness (www.corefitnessstudio.com)
• Developed CORE’s scientific training and nutrition methodology through clinical practice and successful outcomes.
Certified Strength and Conditioning Specialist (NSCA-CSCS),
Titleist Performance Institute Golf Medical Professional Level 3
Russian Kettlebell Challenge Instructor (RKC),
Functional Movement Screen (FMS)
Certified Selective Functional Movement Assessment (SMFA), and Y Balance Test.
What was my goal?

- To bring appropriate exercise prescription and performance training to the rehabilitation world
My Mission

To restore optimal health to people of all ages and abilities through proper nutrition, performance enhancement, and rehabilitation and bridge the gap between performance and physical therapy.
Special Thanks

• Gray Cook
• Mike Boyle
• Greg Rose
• Gary Gray
• Dr. Ed Thomas
• Athletes’ Performance
• Mike Clark
• Michole Dalcourt
• Pavel

• Thomas Myers
• Shirley Sarhman
• Vladmir Janda
• Kolar
• Stuart McGill
• Dr. Mark Cheng
Thank you
Evolution

- NASM
- NSCA
- Paul Check
- Athletes’ Performance
- Functional Movement Systems
- Anatomy Trains
- RKC TPI
• 2-3x more likely to get injured
• Removing the dysfunctional pattern will make you improve core stability/motor control
• Example—restricted hip mobility
Objectives

- To discuss philosophy and rationale of functional movement
- To illustrate that pain-free does not mean functional
- To identify performance indicators by integrating the FMS, SFMA, and Y Balance Test
- To suggest strategies for implementing corrective strategies
- To offer strategies to integrate quality, movement-based training
- To provide a method of bridging the gap between physical therapy and performance
- To provide a balanced and comprehensive approach to treating the whole person
Are we getting our patients pain-free?

- Pt’s and insurance companies are impairment focused!
- Need to normalize and then enhance performance (gray)
- Pain distorts motor control (Gray)
- Movement changes after injury (Gray)
- Main predictor of injury is previous injury and asymmetry
- WHAT IS PAIN? (Pain can be with functional and dysfunctional patterns)
- GRAY area: Is my patient ready for return to activity and sport?
- We are amazing compensators
- If pain exists, we develop strategies to move
  - Over input of global (increased neural drive)
  - Decreased input of local (inhibit)
What is Pain?

“A perception, not really a sensation, in the same way that vision and hearing are. It involves sensitivity to chemical changes in the tissues and then interpretation that such changes are harmful. This perception is real, whether or not harm has occurred or is occurring. Cognition is involved in the formulation of this perception. There are emotional consequences and behavioral responses to the cognitive and emotional aspects of pain”.

- Dr. Don Ranney “Anatomy of Pain”
What is Pain?

- How We Feel Pain; How The Nervous System Detects and Interprets Pain
- From Erica Jacques, former About.com Guide
- Updated July 21, 2009

- Sensory nerves
  - respond to different things
  - Produce chemical changes

- Pain receptors (Nociceptors) activate when there is injury or microtrauma
  - Triggered to fire chemical changes
  - Temp, pressure, stretching in surrounding tissues
What is Pain?

- Dorsal horn → Brain
  - Limbic System
  - Thalamus and other areas for interpretation

Affected by EVERYTHING going on in the Nervous System
- Chemical or mechanical (pg 82)

- “The message is that pain is a signal to a problem. It's not the underlying problem." - Gray Cook
Predictors of Injury:

- **Previous Injury**  
  Ekstrand et al 2006, Murphy et al 2003

- **Asymmetries**  

- **Motor Control**  

- **BMI**  
  McHugh et al 2010

- **Pain-free does not necessarily mean functional**
Or.....Are we preparing our patients to move well?
We first need to understand movement

- Nervous System
- Musculoskeletal
- Fascial
“If you can optimize the nervous system, you can optimize performance.” Z health

- Sensory feedback to
- Neuroplasticity
  - Example: Jump 3 x on heels to give afferent info to inhibit posterior chain
Musculoskeletal System
Fascial System

- Three dimensional matrix
- “Muscles are discrete, while fascia is continuous.” Tom Myers
- Ruffini nerve endings
- Pacinian Corpuscles
- Golgi tendon organs
- Muscle spindles
- Free nerve endings
- Responds to supply and demand around postural system, ETC
What is movement dysfunction?

- Poor durability
- Microtrauma
- Non-contact
- Build motor plans around physical limitations
  - Kinematic sequence (matt Yung)
Establishing a Movement Baseline

- Selective Functional Movement Assessment
- Functional Movement Screen
- Y Balance Test

- How can we assess as performance specialists if we have nothing to objectively compare to?
- Geriatric population—bike, SAQ, but what about reflex, stability, balance, timing, patterning?
- Screen foundational movements for a proactive approach to injury prevention
Neurodevelopment

- The most fundamental activities of the human body revolve around simple and basic patterns of human movements.
- There is a developmental sequence that starts at infancy and develops through childhood (rolling → crawling → walking).
Motor Milestones
At birth, a child exhibits a spine that resembles a “C.”

Increased physiological flexion is due to their position in utero.

Position of comfort.

Frequently revert to this position during illness, fatigue, sitting, sleeping, and in old age.

Where your eyes lead, your head will follow; and where your head goes, your body will follow as well.

Hence, during your training, positioning your head and eyes with proper alignment throughout the body, is critical.
Motor Milestones

- Visualize a newborn with lots of mobility.
- Mobility is defined by Lee Burton as “the ability of the neuromuscular system to allow movement through a full non-restricted, pain-free range of motion.” In essence, babies have no restrictions.
- They can put their feet in their mouth at about six months old and can assume almost any position comfortably.
Motor development occurs in the cephalocaudal direction, implying children begin to have control of their head before the rest of their body.

- Initially, newborns move their head with their eyes.
- At about three to five months, they begin to move their eyes independent of their head.
- They learn to lift their head up with control before they can initiate rolling, an optimal core milestone.
Motor development occurs in the cephalocaudal direction, implying children begin to have control of their head before the rest of their body.

Initially, newborns move their head with their eyes.

From zero to two months, babies are first able to momentarily lift their head and progress to lifting it about 45 degrees from prone (stomach) to be able to see the world. They also begin to weight bear on their forearms and hands.

At about three to five months, they begin to move their eyes independent of their head.

They learn to lift their head up with control before they can initiate rolling, an optimal core milestone.
Motor Milestones
Babies six to eight months can push themselves high onto their hands and weight shift on to one arm. This is their primary means of getting around at this age—crawling, another important milestone. Additionally, they sit upright without support. They need to have stability in sitting before they begin crawling or standing.
Motor Milestones

- Children *learn* to balance themselves through feel. Gravity begins to pull their ribs down, and their limber frames begin to develop stability through primitive, or fundamental movement patterns.

- At 10 to 12 months, children develop the “S” curve in their spine, and at 12-15 months, they stand briefly alone without support and begin walking with arms held high in the air for balance.
Motor Milestones

- A child who is months will begin throwing balls and climbing into chairs. At around 21 months, they deep squat to play and stand on one foot with support briefly.
Brain stores motor plans

Motor patterns are developed around your physical limitations. If you take away the physical limitations, you still need to work on the motor plan.

Pain distorts motor control
Motor Control

- Central Nervous System (CNS) organizes muscles and joints into coordinated functional patterns
- Sensory environment provides us feedback
Motor Learning

- Cognitive phase
- Associative phase
- Autonomous phase
Motor Learning

- A learned sequence of movements that combine to produce a smooth, efficient action in order to master a particular task
- Development of motor skill occurs in the motor cortex
- Training properly can enhance motor learning, improve performance, decrease risk of injury, and ultimately produce quality, efficient patterns
- Improper training leads to inefficient motor patterning, energy leaks, poor performance, and injury.
Tensegrity
Reflexes

- Primitive
- Postural
- Locomotor
- Sensory Neuron
- Interneuron
- Motor Neurons
Mobility and Stability

- **Mobility**: combination of muscle flexibility, joint ROM, and a body’s segment’s freedom of movement. (moving through a non-restricted, pain-free ROM)
- **Stability**: ability to maintain posture and/or control motion
  - Static and Dynamic
- Athletes often exhibit strong static stabilizers, but weak dynamic stabilizers
Functional Performance Pyramid

Skill

Performance

Movement

Paradigm Shift

Adapted by Gray Cook 2004
Joint by Joint Approach

- Ankle Mobility
- T-Spine Mobility
- Lumbar spine Stability
- Hip Mobility
- Scapulo-thoracic stability
- GH Mobility (stability)

Adapted from Mike Boyle
Regional Interdependence

- “Refers to the concept that seemingly unrelated impairments in a remote anatomical region may contribute to, or be associated with, the patient’s primary complaint.”

- Wainner et al JOSPT 2007
Functional Movement System:
- Functional Movement Screen
- Selective Functional Movement Assessment
- Y Balance Test

Screen-Checking risk, not designed to dx
Test-Measure ability
Assessment-
Selective Functional Movement Assessment

- ASSESSMENT
- Developed by Gray Cook and Kyle Kiesel
- Modified/expanded by Greg Rose and Mike Voight
- Provides clinicians road map to treating injury
- Series of 7 full body movement tests
- Assessing FN, FP, DN, DP
- Identify the MOST DN pattern
Selective Functional Movement Assessment

- Active cervical flexion
- Active cervical extension
- Cervical Rotation
- Lateral Bend
- Upper Extremity Pattern 1
- Upper Extremity Pattern 2
- Multi-Segmental Flexion
- Multi-Segmental Extension
- Multi-Segmental Rotation
- Single Leg Stance
- Dynamic Leg Swings
- Overhead Deep Squat
- Pain Provocation Tests
  - Impingement Sign
  - Horizontal Adduction
Functional Movement Screen

- Reliable and reproducible screen
- Identifies
  - Physical imbalances, limitations, and weaknesses
  - Potential cause and effect relationships of deficits and microtrauma/ chronic injuries
- Improves fundamental movement patterns with simple corrective exercises
1. Deep Squat
2. Hurdle Step
3. In-Line Lunge
4. Active-Straight Leg Raise
5. Shoulder Mobility
6. Trunk Stability Push-Up
7. Rotary Stability

(Others: Active Impingement Test, Spinal Extension and Flexion)
• Scoring
• If pain is present, stop and begin SFMA or refer
The Y Balance Test™
Star Excursion Balance Test (SEBT)

- First described by Gary Gray 1995
- Requires measurement in 8 directions (each leg)
- 6 practice trials in each direction
- 3 measurements each (include greatest reach)
- 144 reaches to test one person

Gray 1995, Hertel 2000
How the Test is Performed

- Maintain single-leg stance while reaching contralateral (reach leg) as far possible along the appropriate vector.
- Touch the farthest point on the line as lightly as possible with the most distal part of foot.
- Rt to Lft, Clockwise to Counterclockwise
Which Direction Matters?

- Performance of all 8 is Unnecessary
  - Hertel et al

- Good Reliability in 3 Directions
  - Plisky et al
Three reach tasks may be used clinically to test for functional deficits related to CAI in lieu of testing all 8 tasks (Hertel 2006)

- Quick/Efficient
- Portable
- Consistent
- Objective
- Multiple Surface Applications
- Based on extensive research and excellent reliability
Lower Quarter Y Balance Test

- Reliable
- Identifies Chronic Ankle Instability (CAI)
- Identifies ACL insufficiency
- Predictive of injury based on age, gender, sport
- Improves after training
What are we testing?

- Neuromuscular Control
- Proprioception
- ROM/Flexibility
- Strength/Stability
Y Balance Test Protocol

- 6 Trials on one leg in each of 3 directions
- Shoes off
- Video Instruction
- Stand on 1 leg on center foot plate with most distal aspect of toes just behind starting line
- While maintaining single leg stance, person reaches with the free limb in the anterior, posteromedial, and posterolateral directions in relation to stance foot
- Stands on platform, pushes the reach indicator
- 3 trials each leg
Y Balance Test Protocol

- Standard test order: R ant, L ant, R PM, L PM, R PM, L PM, R PL, L PL
- Stance foot movement is allowed
- Body movement is allowed as long as subject returns to start position under control
- Greatest successful reach used for analysis
- Lower right limb length is measured (most distal ASIS to most distal medial malleolus)
- Score analysis: Difference between right and left
Composite Score

- Total composite score compared to limb length:
  - Add three directions together
  - Divide by 3 x limb length
  - Multiply by 100
Benefits

- About 3-5 minutes including scoring (6 practice trials suggested before baseline values are recorded)
- Admin, scoring, interpretation easy
- Formal training for admin/interpretation not addressed

Functional Uses
- Post Measures for Functional Rehabilitation
- Pre-participation Physicals
- Injury Prevention Screens
- Multi-sport Application
- Return to Sport Testing
Norms

- Norms: (Plisky 2006)
  - Subjects: 235 male and female basketball players in 7 Indiana high schools (freshmen, junior varsity, and varsity)
  - *Anterior, posteromedial, and posterolateral* reach distances and limb lengths were measured in cm. bilaterally
  - After normalizing for lower limb length, each reach distance, rt/lft reach distance, a composite reach distance were examined
# Basketball Normalized Reach Distances

<table>
<thead>
<tr>
<th>Normalized Reach Distance</th>
<th>Total</th>
<th>Girls</th>
<th>Boys</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior</td>
<td>83.8 + 7.1</td>
<td>81.4 + 6.2</td>
<td>84.1 + 7.6</td>
</tr>
<tr>
<td>Posteromedial</td>
<td>113.4 + 9.7</td>
<td>110.1 + 10.00</td>
<td>116.1 + 8.5</td>
</tr>
<tr>
<td>Posterolateral</td>
<td>106.4 + 10.8</td>
<td>103.6 + 10.7</td>
<td>108.7 + 10.3</td>
</tr>
<tr>
<td>Composite</td>
<td>100.9 + 8.4</td>
<td>98.4 + 8.2</td>
<td>103.0 + 8.0</td>
</tr>
</tbody>
</table>
Good with some excellent (Plisky 2006): Subjects: 235 male and female basketball players in 7 Indiana high schools (freshmen, junior varsity, and varsity)

Intrarater Reliability
- ICC .84-.87 all directions
- ICC .99 limb length

Test-Retest
- ICC .89-.93
- Method Error 3.0-4.6% (Good measurement stability)
Reliability

• Adequate to Excellent:
  • Intertester – ALL directions, Excellent $0.99$, $p \leq 0.01$
  • Intratester = Good
    • Anterior direction
      • $0.91$, $p \leq 0.01$
    • Posteromedial direction
      • $0.86$, $p \leq 0.01$
    • Posterolateral direction
      • $0.90$, $p \leq 0.01$
Basketball (Plisky 2006):

- **Intrarater Reliability**
  - ICC .84-.87 all directions
  - ICC .99 limb length
- **Test-Retest**
  - ICC .89-.93
  - Method Error 3.0-4.6% (Good measurement stability)

Excellent (Hertel 2000):

- **Intratester reliability**
  - ICC all directions .82-.96
- **Intertester reliability**
  - ICC .81-.93
Predictive Validity:

- Greater than 4 cm right/left difference in anterior direction
- > 2.5 times more likely to be injured
- Decreased overall performance (lowest 1/3 of individual scores) on test (total of all three directions)
- Women over 6 times more likely to be injured

Plisky et al 2006
Potential Uses: Return to Sport Testing

- Greater than 4 cm right/left difference in anterior direction predictive of at risk
- Can be used to demonstrate functional symmetry

Plisky 2006
Potential Uses: Predicts Athletes at Increased Risk of LE Injury

- 4cm right/left anterior reach difference
- Bottom 1/3 of peers

Plisky 2006
Currently tested on athletic populations
Requires a great deal of strength, neuromuscular control, and coordination, therefore is may not be conducive to all populations
However, more norms need to be established for different populations
Excellent reliability

Three directions: medial, inferomedial, superomedial
Upper Quarter

- Read in centimeters to nearest half
- 3 trials
- 2 practice trials on each side
- Thumb adducted and aligned with red start line
- Feet and shoulders hip width apart
- Standard testing order: Medial, inferomedial, superolateral relative to stance arm
- All 3 are performed sequentially without touching
Maintain balance on one hand
Cannot lift or move the balance hand from platform
Return the reach hand
Maintain contact with target
Functional Uses

- R/L asymmetry of 4 cm or less
- Composite score within normal values for age, sport, occupation, activity
- Pre/post testing
- Documentation of functional strength, stability, and mobility
Composite Score

- Upper limb length: C7 spinous process to tip of longest finger with shoulder elevated to 90° in sagittal plane
- Composite Reach:
  \[(\text{Medial} + \text{inferomedial} + \text{superomedial}) \times 100\]
  \[3 \times \text{limb length}\]
Steps to Functional Exercise

- Screen, Test, Assess
- Establish mobility
- Establish Stability
- Re-screen, test, assess
Corrective Exercise

- Don’t correct the movement, correct the primitive things that came before that
- Progressions and regressions following the neuromotor developmental sequence
Corrective Exercise

1. Trigger Point Therapy (component of regeneration/recovery)
2. Active Isolated Stretching, PNF
3. Movement Patterns
Corrective Exercise

• Perfect practice makes perfect!
• It is important that the motor program is practiced CORRECTLY
• Otherwise, the info the brain is accessing is INEFFICIENT
• Example: Rotary Stability
Corrective Strategies

- Integrating into movement preparation
- Active rest
- Coupling with exercise
Self-Myofascial Release

- Improves flexibility, function, performance
- Reduces injuries
- Apply deep pressure into myofascial restrictions to influence kinetic chain
- Autogenic Inhibition of muscle spindle
- Active Release Therapy (ART)
- Search and Destroy!
Self-Myofascial Release

- Corrects muscle imbalances
- Increases joint ROM
- Decreases muscle soreness/relieves joint stress
- Decreases neuromuscular hypertonicity
- Increases extensibility of musculotendinous junction
- Increases neuromuscular efficiency
- Maintain normal functional muscular length
The regulation of occurrence, pace, or coordination to achieve a desired effect in all 3 planes
- Timing is the SEQUENCING of the actions within the global movement in all 3 planes
- Joint motions
- Timing is the REACTION to the forces in all 3 planes
- “Loads” [or turns-on] the myofascial system
- Without proper timing (joint motion), there is not optimal loading of myofascial system in all 3 planes
Tensegrity (PTA Global)

- Mathematical model
- Developed in the 1960’s
- • Used to describe synergy
- • between ‘push’ and ‘pull’
- • forces
- • Acronym for ‘Tensional’
- • Tensegrity à forces exist
- • in balance for mutual
- • benefit (increase stability at
- • a reduced energy cost) integrity’
Myofascial Lines
Assessment of Movement Quality

- Breathing
- Poor Breathing (apical)
  - Increased neural drive to global muscles
  - Inhibits local muscles
  - Adopts a high-threshold strategy
- Power breathing (pg 48 –RKC)
  - Inhale through your mouth
  - Inhale through your nose
  - Pinch off a nostril
- Fill approximately 75% of capacity
- Biomechanical breathing match
- MINDFUL Movement
- Harmony, timing, sequencing, rhythm
- Rolling: log vs segmental
- Dissasociation
Performance

- Tension: strength and power
- Relaxation: speed, endurance, and flexibility
- (sports require both)
For the patients...

- Empower them to do it on their own. If you can’t touch your toes, you can’t run
- Educate them on their active life or soon to be active life beyond PT
  - Self soft-tissue mobilization
  - Neuromuscular Activation
  - Corrective Exercise?
  - Movent Preparation
  - Performance Program
- Insprire them to continue with structured program
Performance Team

- Understand each other’s role
- Communicate
Performance Team

- Ethical responsibility
- Multidisciplinary Approach:
  - Performance Specialist
  - Registered Dietitian
  - Physical Therapists
  - Mental Health
  - Sports Professionals/Coaches
- Communication
- Performance Specialist partnering with physical therapist
- Develop a common language
- FMS
- Goal: work together for the best interest of our patient
Direction of Physical Therapy Profession

- Referral Sources
- MD’s → Performacne Specialists, coaches,
References


References


References

- Gray, GW. Wynn Marketing Inc; Adrian, MI: 1995. Lower Extremity Functional Profile.
References

References