Global Assessment and Sensorimotor Disintegration Correction

Language, Logic, and Assessment Method for Clinical Management

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Buona sera!
“The process of discovery is seeing what others have seen before and thinking something new.”

Albert Einstein
It is what we think we know that keeps us from learning
Claude Bernard

The only thing that interferes with my learning is my education.
Albert Einstein
What is the point of being alive if you don’t at least try to do something remarkable.

John Green
Plan for our time together

- Introduce the terms of our discussion
- Introduce the research underlying sensorimotor disintegration
- Introduce the theory of a global deficit
- Demonstrate the assessment
- Discuss the implications
- Q&A
Glossary

- PFLM – Performance for Life Method
- GMA – Global Mechanical Assessment
- GPD – Global Proprioceptive Deficit
- RLS – Reciprocal Limb Syndrome
- FFA – Feed Forward Activation
- FB – Feed Back
- APAs – anticipatory postural adjustments
- CPAs – compensatory postural adjustments
- SAID-specific adaptation to imposed demand
Exploring the Neuromodulatory Effects of the Vertebral Subluxation and Chiropractic Care

- Haavik, Holt, Murphy 2010
Figure 1: Vertebral Subluxation may lead to altered sensorimotor integration
Figure 2: Chiropractic adjustments may normalise afferent input and therefore promote appropriate sensorimotor integration.
Cervical spine manipulation alters sensorimotor integration: A somatosensory evoked potential study

Haavik Murphy 2006
Cortical responses to adjustment

• N 2O / N 30 excitation
• Lasts for 20+ minutes post adjustment
• Possible window of opportunity for neural integration and increased plasticity
The role of spinal manipulation in addressing disordered sensorimotor integration and altered motor control

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\textsuperscript{b} Faculty of Health Sciences, University of Ontario Institute of Technology, 2000 Simcoe St North, Oshawa, Ontario, Canada L1H 7K4
(b) Normal afferent input → Appropriate Somatosensory Filtering & processing → Appropriate sensorimotor integration → Accurate motor control → Good function → Spinal manipulation → Appropriate Joint movement
How do we know?

• What is your criteria for determining sensorimotor disordered integration? (effects of the subluxation)
• What is your weighted confidence?
• What is your explanation?
• What is your monitoring strategy?
Presumption(s)

- An intact nervous system free of pathology or injury performs as a neutral conduit of signals.
- The mechanical indicators of techniques are a direct indicator of change in the nervous system.
- The changes in the horizontal stay changed in the vertical
Components of movement

- Neurology
- Soft tissue
- Joint movement
- Neuromechanics – the combining of neurology and biomechanics
Components of Neuromechanics

- **Feedforward**
  - 100 ms prior – 50+ms post
- **Feedback**
  - 75-100 ms post
- **Neural Plasticity**
  - Axonal and Cortical
- **Task Specificity**
  - Function, training, rehabilitation
  - What am I going to do?
  - How am I going to do it?
System of Movement – NMS

- Core – anchors everything
- Lower extremity – contacts the environment, GRF, Shock absorption, adaptation to surface change, footwear design, long lever mechanical actions
- Upper extremity – almost everything except ambulation. Reach to ... touch, grasp, lift, hit ... long lever muscle coupling actions
Process of GMA

- Use the extremities as long levers to challenge the CNS to properly anchor and operate.
- Compare sides via isometric mirror image tasks.
- Observe quality of anchoring and operation.
- Determine if reciprocal limb coupling inefficiency is involved. RLS
Where did this come from?

- Clinical observation that seemingly minor injuries were persistent despite quality care by ATCs, DCs, PTs, MDs.
- Noting that asymmetrical dorsiflexion was prevalent in many cases.
- Testing with extremities prior to adjusting the spine indicated a tendency towards a pattern of contralateral dysfunction of UE and LE.
Starting Point
• Do mirror image isometric test
• Check for response- how does cerebellum respond?
• Is pain involved?
• “Hold this right here”
• Don’t think about the test
  ➢ Watch what the body does/core/extremities/face
  ➢ Everything before test is feedforward, APA
Abduction LE / LLNC
Abduction LE / LLNC Oblique
Adduction LE / LLNC Oblique
Adduction UE / LLNC Oblique
Scapular SLNC
Flexion UE / LLNC
## Prevalence of GPD

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<th>GPD Number</th>
<th>GPD Percentage</th>
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Theory of GPD

- Because it has nothing to do with pain the patient is not aware of its’ presence.
- Because it appears to change the efficiencies within the NMS instantaneously the potential for injury may increase or decrease without perception.
- If you don’t check for it pre and post you don’t really know if a change has occurred.
Cycle of Injury – Lephart, Fu, Scott

Ligamentous injury 1

Structural Instability 2

Proprioceptive Deficit

Decreased Neuromuscular Control

Functional Instability 3

Reinjury 4

Mechanical Model

Neuromechanical Model
Cycle of Injury – Chiropractic / Neuromechanical Model

Potential for Injury / Reinjury

Ligamentous injury

Structural Instability

Proprioceptive Deficit

Decreased Neuromuscular Control

Subluxation – Corrupted Signal

Mechanical Model

Neuromechanical Model

Downes 2002
Panjabi’s article / implications

Efficient Performance

From Panjabi 2006

- Intact Mechanoreceptors
  - Normal Transducer Signals
    - Feedback
  - Neuromuscular Control Unit
    - Normal Response
      - Feedback
  - Normal Muscle Response Pattern
    - Coordination of Individual muscle activation

No Adverse Consequences
Subfailure Injury of Ligaments in the Spine

From Panjabi 2006
Global Proprioceptive Deficit Model – Downes 2000

- Interference
  - Proprioceptive Deficit
    - Corrupted Signal
    - Feedforward deficit

- Functional Instability
  - Adverse Consequences
- Feedback
  - SAID
- Decreased Neuromuscular Control
  - Corrupted Muscle Response Pattern

- Global Compensatory Effect
  - Altered Coupling patterns
  - Reciprocal Limb Syndrome
  - Feedforward alterations
  - Functional Inefficiencies
  - Altered Movement Patterns
  - Layering of CMRP
So what does it mean?

- If you find apparent inequality in the mirror image isometric tests … the patient has a neurological deficit.
- If you find that there is a contralateral upper or lower extremity demonstrating a similar inequality … the patient has reciprocal limb syndrome RLS.
- If you don’t find anything then there is no ‘global’ imbalance … maybe …
Proprioceptive Feedback and Preferred Patterns of Human Movement  

- **A** Metabolic Cost Feedback
- **B** Sense of Effort Feedback
- **C** Proprioceptive Feedback

- Metabotropic receptors
- Central chemoreceptors
- Metabolic Energy Demand

- Central Processing
- Descending Command
- Reflexive Effects

- Muscle Activation
- Muscle Forces

- System Mechanics
- Body Movement

- Task Performance
- Muscle spindles

- Golgi tendon organs
The relevance of central command for the neural cardiovascular control of exercise

J. W. Williamson

Figure 1. Schematic diagram to show the potential interactions between central command and perception of effort or exertion
Patterns of GPD

- Complaint patterns, right LB / left shoulder – neck
- Lower extremity and contralateral upper extremity
- Layering – starts with all one side, then after adjusting a different pattern is seen, then after adjusting another pattern appears.
- Proper approach to management with a different sequencing of tools.
Correlate spinal problems with extremity dysfunction

- Extremity imbalances will place the most consistent stress on the spine to adapt and create balance. (Twisted Torso Syndrome)
- Obvious muscle imbalances, tight erector spinae on one side and tight upper trap and posterior cervical muscular on the opposite.
- Spinal ‘instability’ that does not resolve or actually worsens with adjusting.
“Core”

- Multifidus
- Sacrum
- Transversus abdominis
- Pubic symphysis
<table>
<thead>
<tr>
<th>Muscles of the Inner Core of the Spine</th>
<th>Muscles of the Outer Core of the Spine</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Spinal extensors (multifidus) muscles</td>
<td>1. External Olique</td>
</tr>
</tbody>
</table>
| 2. Deep neck flexors  
(longus capitas, longus colli) | 2. Rectus abdominis |
| 3. Abdominal wall  
(transverse abdominis) | 3. Erector Spinae |
| 4. Diaphragm | 4. Lattissimus Dorsi |
| 5. Pelvic floor | |
An Investigation of Neck Muscle Activity in Asymptomatic Participants who show different lumbar spine motion patterns during prone hip extension

Bruno Murphy 2011
- Specific
- Adaptation to
- Imposed
- Demand

- What demand do you put on pt to create a specific adaptation?
- Remove interference w/o \( \Delta \) of SAID?
- Musculoskeletal vs. visceral?
- Biochemical or psychosocial
Shoulder Injuries

- Multifactorial
- Primary impingement (compressive tendinitis)
- Primary tensile overload (tensile tendinitis)
- Others
Complex Force Coupling
“You cannot solve the problems you now have at the same level of thinking you used to create them.”

Albert Einstein
Thank you for your attention!
Arrivederci!

A dopo!