Primitive Reflex Integration for Concussion –
A New Use for an Old Technique

Lauren Ziaks, PT, DPT, ATC, AIB-VR
Co-founder, PhoenixConcussionRecovery.com
Concussion Specialist, Intermountain Healthcare, Park City, UT
Chelsea Brown, PT, DPT
Concussion Specialist, Boston Sports Medicine, Watertown, MA
Disclosures

Speaker Lauren Ziaks is a co-owner of the website PhoenixConcussionRecovery.com and an employee of Intermountain Healthcare.

Speaker Chelsea Brown is a full-time employee of Boston Sports Medicine.
Learning Objectives

- Understand what primitive reflexes are and their role in the concussed population
- Demonstrate a functional understanding of vertical integration and the impact disruption can cause
- Demonstrate high level understanding of the Primitive Reflex Screen
- Understand the general progression of PRI exercises
Neuroplasticity is “the ability for neuronal circuits to make adaptive changes on both a structural and functional level, ranging from molecular, synaptic, and cellular changes to more global network changes.”
**BENEFITS!**

- Adult brain *continues* to be adaptable!
  - Provide new stimuli
  - Compensatory mechanisms with therapy

- “Window of opportunity” for recovery
  - When provided the appropriate targeted therapies.
Primitive Reflexes
What IS a Primitive Reflex?²⁵,²⁶

- Developed 25-40 weeks of gestation

- Automatic Movement Pattern:
  - Brainstem-mediated
  - Crucial to early development
  - Should integrate in the 1st year of life except TLR
Some are present forever and this is normal!

- Blinking Reflex – blink with bright light or touch
- Cough Reflex – cough to clear the airway
- Gag Reflex – gagging when the back of throat is stimulated
- Sneeze Reflex – clearing the nasal passages
- Yawn Reflex – increases oxygen
Overview

- **Survival:**
  - Rooting – stroking cheek → baby turns for feeding
  - Snout, Suck – tap lips at midline → ms contract.
  - Palmar – object pressed into palm → fingers flex
  - Landau – questionable – not present at birth, address with TLR and STNR in our protocol

- **Will discuss later:**
  - Moro, ATNR, STNR, galant
  - TLR – questionable – not present at birth, widely accepted as a PR
Normal Integration

- Cortical inhibition:
  - Baby starts to explore environment
  - Movement against gravity
  - Replaced with postural reflexes that control balance, coordination and sensory motor patterns

- Responses differ with age and are related to CNS maturation
Motor Control – Bobaths

- CNS serve to organize all information allowing us to perform skilled activities while balanced.

- 4 levels of integration for motor function:
  - Spinal level
  - Brainstem level
  - Midbrain level
  - Cortex

- ANY level can inhibit/suppress activity
  - *However,* the higher the level – the more intricate the influence becomes
“Normal Postural Reflex Mechanism”

- 3 components to perform skilled movement
  - Normal postural tone
  - Intact reciprocal innervations
  - Normal patterns of coordination – automatic postural reactions.

- Requires inhibition of all unwanted activities to work properly!
Vertical Integration

- Levels: Mesencephalic (midbrain), diencephalic (thalamus/hippocampus), telencephalic (cortex).

Hierarchic Integration Principles:
- Jacksonian Hierarchic Integration
- Encephalization

Are we modifying information from the more primal parts of our brain or replacing these areas?
Summary – Functional Needs

- As the Primitive Reflexes “go away” the postural reflexes, VOR, and visual processing systems are able to form and then integrate!

- In the 1st year the brainstem level reflexes are inhibited in sequential order and replaced by more mature movement patterns for balance, coordination and sensory development!
Abnormal

- Lead to:
  - ADHD, sensory processing disorder, autism, and learning disabilities

- Contribute to deficits with:
  - Coordination, balance, sensory perceptions, fine motor skills, hyper mobility, sleep, immunity, energy levels, impulse control, concentration, and all levels of social, emotional and intellectual learning.
The Frontal Lobe

- Why is the frontal lobe important?

- Characteristic of frontal lobe disorders
  - “Re-emergence of motor acts that were appropriate at developmentally earlier stages – suppressed by maturation of frontal lobes – reappear with dysfunction”
  - Grasp and suck 2 most prominent in frontal lobe disorders
We need our orbitofrontal cortex to make intelligent choices. Its individual cells code for value.

Ann Thomson, Nature Neuroscience
More about the OFC\textsuperscript{32,33}

- Creates reinforcement patterns in our brain based on pleasant and painful experiences.

- Input comes from all senses:
  - olfactory (smell pasta think of grandma), gustatory, auditory (emotions from music), visual, and somatosensory (touch).
Emotional Overflow

- Responds to internal and external stimuli
- Deals with emotional regulation.
- Most of these connections are reciprocal

**Emotional Overflow**

- **IMPORTANT FOR PRI** – not all patients experience but WARN all
  - Needed to understand due to severe reactions patients were having initially
What We Know - Retention

- Stress of mother or baby during pregnancy
  - Birth trauma, breech birth, Cesarean birth, induced birth
- Lack of movement in utero
- Extended time spend in car seat/carrier, jumpers and walkers restricting normal movement patterns to develop
- Illness, trauma, injury, chronic stress
Why Haven’t PR Been Promising Before? 

- Primitive Reflex use prior in TBI
- Too low-level
Thank you to our FCQVDs!

- PRs have been used to treat developmental delays in children
  - Cerebral Palsy
  - Behavior disorders- ADD/ADHD
  - Reading and writing difficulties
  - Vision therapy
Impact on Visual System

- Individuals with abnormal reflexes but normal acuity have been shown to have difficulties with oculomotor and visual-perceptual skills
  - 80% of our vision comes from the neural pathways including visual processing, eye tracking, accommodation and focusing
Relating to Brain Injury

- Using research associated with reflex integration in children and re-emerging reflexes in adults with frontal lobe damage

- Due to changes to the central nervous system rostral to the spinal cord\(^2\)\(^6\)
  - Most common in neuro-degenerative diseases with frontal lobe damage- Parkinson’s and Alzheimer's
  - Can occur due to injury, trauma, toxins or stress
Reflexes for Vision & Attention²⁵,³⁶-³⁸
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<th>Appears</th>
<th>Should Integrate By:</th>
<th>Signs of Retention</th>
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<td>Birth</td>
<td>2 to 4 Months</td>
<td>Hyper Sensitivity, Hyper Reactivity, Poor Impulse Control, Sensory Overload, Social &amp; Emotional Immaturity</td>
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<td>Rooting Reflex</td>
<td>Automatic Response to Turn Towards Food</td>
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<td>Spinal Gallant Reflex</td>
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<td>3 to 9 Months</td>
<td>Unilateral or Bilateral Postural Issues, Fidgeting, Bedwetting, Poor Concentration, Poor Short Term Memory</td>
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<tr>
<td>TLR</td>
<td>Basis for Head Management and Postural Stability Using Major Muscle Groups</td>
<td>In Utero</td>
<td>3 1/2 Years</td>
<td>Poor Muscle Tone, Tendency to Walk on Toes, Poor Balance, Motion Sickness, Spatial Orientation Issues</td>
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<td>Preparation for Crawling</td>
<td>6 to 9 Months</td>
<td>9 to 11 Months</td>
<td>Tendency to Slump While Sitting, Poor Muscle Tone, Poor Eye-Hand Coordination, Inability to Sit Still and Concentrate</td>
</tr>
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Brain Balance Achievement Centers

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Functional Understanding

- **Moro:**
  - Motion sickness, clumsy kid – poor balance/coordination – frequently stubs toes etc. Mood swings and distractible.

- **Galant:**
  - Postural difficulties, attention deficits, sitting still in class, associated with bedwetting

- **STNR:**
  - Muscle tension – neck pain, stiffness. Kids who can’t sit still in class, constantly moving/rocking or fidgeting.
ATNR and TLR

ATNR & TLR

Hinder functional activities
- Rolling, hands to midline, hands to mouth (exploring!)
- 50% kids with ATNR dx or display sx of dyslexia**

Can → structural deformity:
- ATNR and scoliosis
- Both – subluxation of femoral head – dislocation – seen functionally as W sit?

ATNR

Limited in more mature motor mvts – crossing midline (kick ball across body to opp side), coordination, eye tracking and hand-eye coordination

Discrepancy with oral and written performance

Conflict with reading and writing abilities if present >6-7months**
Moro Reflex: Signs of Retention

- Poor balance and coordination
- Difficulty with vision, reading or writing
- Easily fatigued
- Hypersensitivity
- Hyper-activity
- Poor impulse control
- Sensory overload
- Social and emotional immaturity
- Difficulty sleeping
ATNR: Signs of Retention

- Poor concentration
- Balance deficits
- Difficulty crossing vertical midline
- Visual tracking issues
- Difficulty with hand-eye coordination
- Messy handwriting
- Poor sense of direction
STNR: Signs of Retention

- Headaches related to increased muscle tension
- Poor hand-eye coordination
- Difficulty with concentration
- Vision disorders
- Slumping, poor posture
- Inability to sit still and concentrate
- W sitting
TLR: Signs of Retention

- Difficulty with balance
- Visual deficits with tracking and convergence
- Visual perceptual difficulty
- Motion sickness
- Poor sequencing
- Poor sense of time
- Decreased muscle tone
- Toe walking
Spinal Galant Reflex: Signs of Retention

- Unilateral or bilateral posture issues
- Poor concentration
- Poor short term memory
- Fatigue
- Fidgeting/ inability to sit still
- Sensitivity to clothing touching the skin
- Bedwetting
- Irritable Bowel Syndrome
Primitive Reflex Screen: Moro

- **Bridge:**
  - Patient in hooklying, press palms together in “prayer” position: complete glute bridge exercise maintain inward pressure on hands. Repeat with arms crossed lightly over chest to compare.
  - **Positive test** = unable to maintain inward pressure with palms, hips deviate laterally, lift toes. *Mild – pt describes increased difficulty in prayer vs control position of arms crossed over chest.*
Primitive Reflex Screen: ATNR

- **Quadruped**
  - Passively rotate head to one side holding for 5 seconds, repeat contralat.
  - **Positive test** = bending elbows of arm opposite rotation or WS posteriorly

- **Standing (Schilder Test)**
  - Feet together, arms straight in front with wrists relaxed - passively rotate head with eyes closed
  - **Positive Test** = arms rotating ipsilat or 1 arm dropping in elevation.
Primitive Reflex Screen: STNR

- Quadruped
  - Passively flex neck holding for 5 seconds, then passively extend neck and hold for 5 seconds - repeat x 3
  - **Positive test** = WS posteriorly, arching back, bending arms, PF of feet
Primitive Reflex Screen: Spinal Galant

- Quadruped:
  - Stroke one side of the lumbar spine towards sacrum - this should be completed on the skin for most accurate results
  - **Positive test** = arching the back or move/ WS away from side that is stroked
Primitive Reflex Screen: TLR

- Superman
  - Prone, arms at side with palms facing up; raise arms and legs simultaneously (superman position), repeat with cue to keep head down.
  - **Positive test** = unable to keep legs or arms straight, inability to raise both extremities at the same time
How to Fix Disinhibited Reflexes??
Keys to Integration Exercises

- Daily exercise with most at 2x10
  - Instructed to decrease repetitions or complete in sections if severe increase symptoms.
  - Goal is to **FATIGUE** the reflex!

- Slow and purposeful
  - Have someone watch them at home!
  - Quality over quantity

- Exercises must be done **exactly** as prescribed

- Progress to Level 2 as tolerated
Findings

- 2-6 week average for integration
  - **Outliers:**
    - Non-compliant (#1)
    - Severe TBI
    - Children with retained reflexes with increase post concussion
      - Often require increased rehabilitation to fully integrate
      - Incorporate postural reflex positions to vision and vestibular ex
Time for Exercises!

For access to our handouts:
PhoenixConcussionRecovery.com
→ “Provider Portal”
→ “Conference”

Password_________

Please respect copyright on these unique documents
Exercise Protocol

LEVEL 1
Bridge
Superman, swimmer
Cat/camel, Bird Dog
Snow angel
Marching Zombie

LEVEL 2
Pigeon, duck
Deadbug
Starfish
Slap tap
Archer
Robot
Level 1 – Moro

Bridge – as seen in screen
  • Progress – ADD squeeze
Advanced Moro Exercises

Duck on a bike
Pigeon carrying a pizza – Generally Harder
Level 1 STNR

Cat / Camel

Bird Dog
STNR – L2

- Deadbug
  - Squat press
  - Lunge + Overhead Press
Level 1 – ATNR

Zombie
Level 2 – ATNR

Archer

Robot
TLR

Superman

Swimmer
Jumping Jack – often held due to post concussive state
Complex Motor – L2

Slap Tap
Complex Motor – L2

Starfish
Back to your seats!
Combination – retention vs disinhibition?

- **Level 3?**

- **Play in postural reflex positions**
  - Board games, blocks, coloring, reading

- **Vision exercise in postural reflex positions**
  - Scanning, figure ground, saccades, accommodation exercises

- **Cognitive load**
  - Add to balance, crawling, bear crawling, postural control exercises
Prone on PB – extensor tone vs gravity
½ kneeling for postural support
Seated on PB for postural stability
Add Cognitive Load!
Give it a try at home!

- Try any of these postural positions at home tonight!
  - Cook dinner in half kneeling or high kneeling
  - Do your paperwork in side sitting
  - Sit on a physioball – it is good for you anyway!
  - Lay over a pillow, cushion, or physioball for extensors.

- If any of these are hard for you WORK ON IT!
Administration

- Documentation
  - + Reflex presentation
  - Integration date
  - Write areas of improvement needed as any other exercise – “pt continues to dem sig WS to R with bird dog” or “pt dem full integration of L1 PRI ex today.”

- Patient Education
  - We give a handout with overview of reflexes with their + reflexes indicated. All ther ex programs given with photos and written instructions to improve compliance
Billing

- Used as our ther ex portion of cspine visits or integrated during our normal vision and vestibular visits.
  - ICD-10 Codes
    - R29.2 Abnormal Reflex – never use as first code!
  - CPT Codes
    - 97110 – therapeutic exercise x 2
    - 97112 – neuro re-education
    - 97530 – therapeutic activities
The Future

- Go out and start testing patients!
- Use our handouts – please respect our copyright protection
- Get patients exercising!
- Team up for future research for this exciting new treatment paradigm for the concussed population!
Questions?
Thank you!

Ziaks.L@gmail.com
Cbrown@bostonsportsmed.com
Twitter: @LZConcussion
Phoenixconcussionrecovery.com
References:


