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

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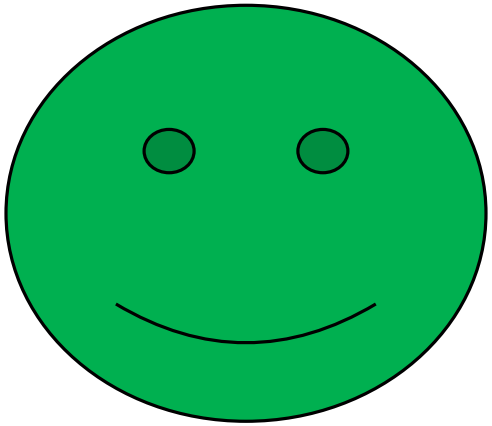
Disclosures

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[7]

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.”

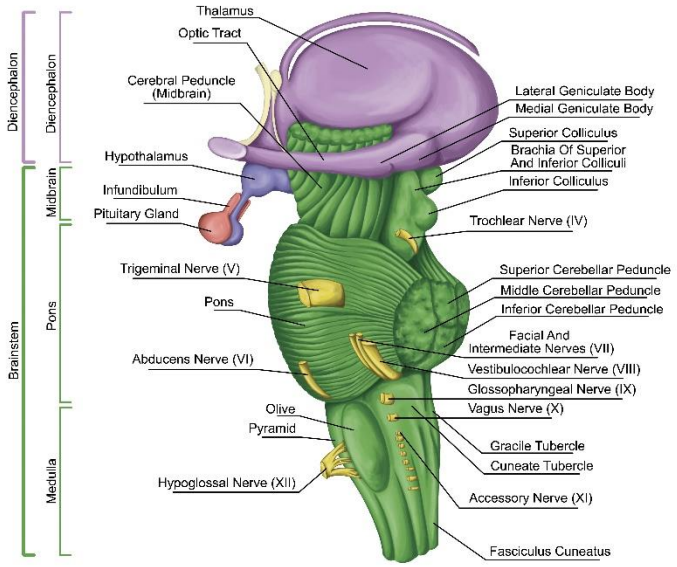
BENEFITS![7]

- 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

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

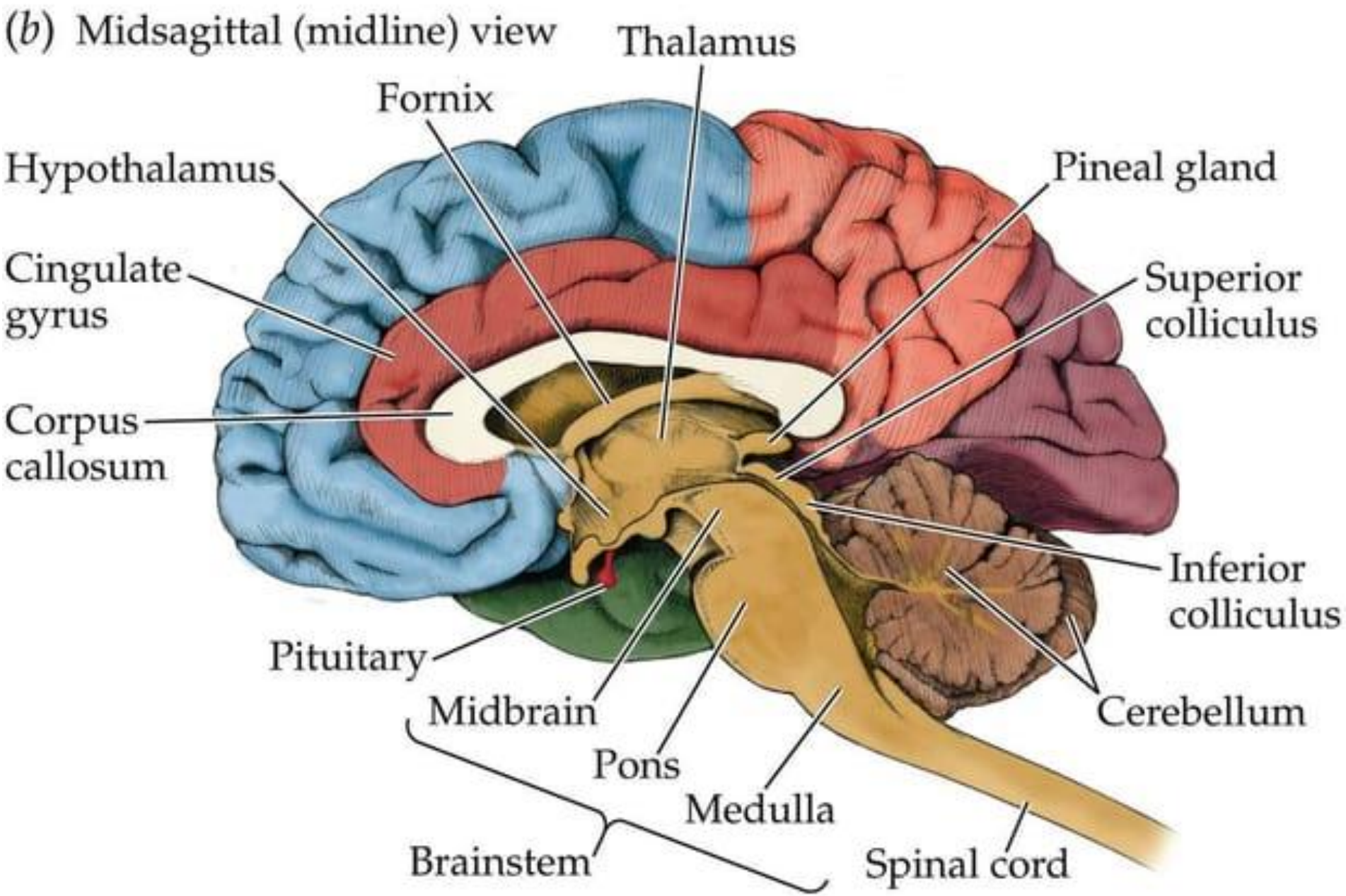
- Cortical inhibition:
  - Baby starts to explore environment
  - Movement against gravity
  - Replaced with postural reflexes that control balance, coordination and sensory motor patterns
    - Reponses differ with age and are related to CNS maturation

Motor Control – Bobaths[29]

- 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”[29]

- 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!



***Biological Psychology 6e*, Figure 2.12 (Part 2)**

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

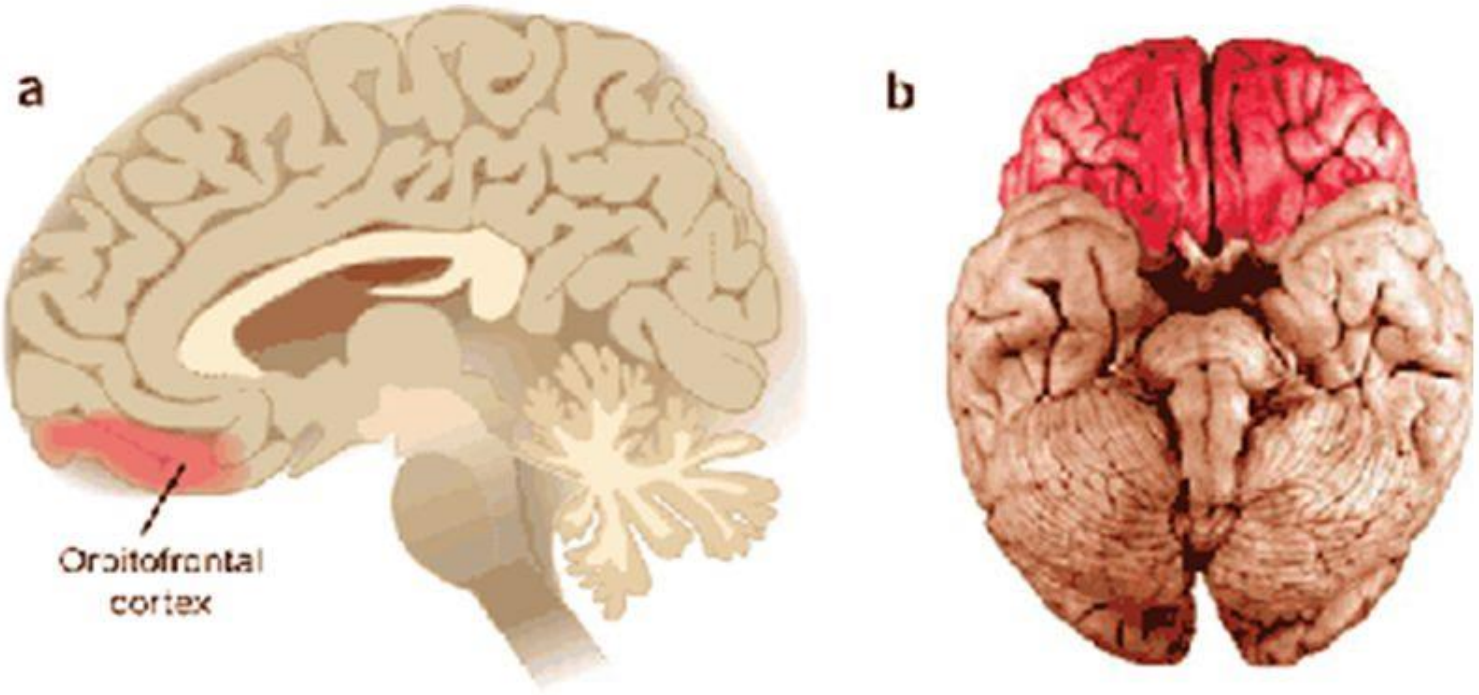
- Lead to:
  - ADHD, sensory processing disorder, autism, and learning disabilities
- Contribute to deficits with:
  - Coordination, balance, sensory perceptions, fine motor skills, hyper mobility, sleep, immunity, energy levels, impulse control, concentration, and all levels of social, emotional and intellectual learning.

The Frontal Lobe[31]

- 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

Orbitofrontal cortex



We need our orbitofrontal cortex to make intelligent choices. Its individual cells code for value.

Ann Thomson, Nature Neuroscience

More about the OFC[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).

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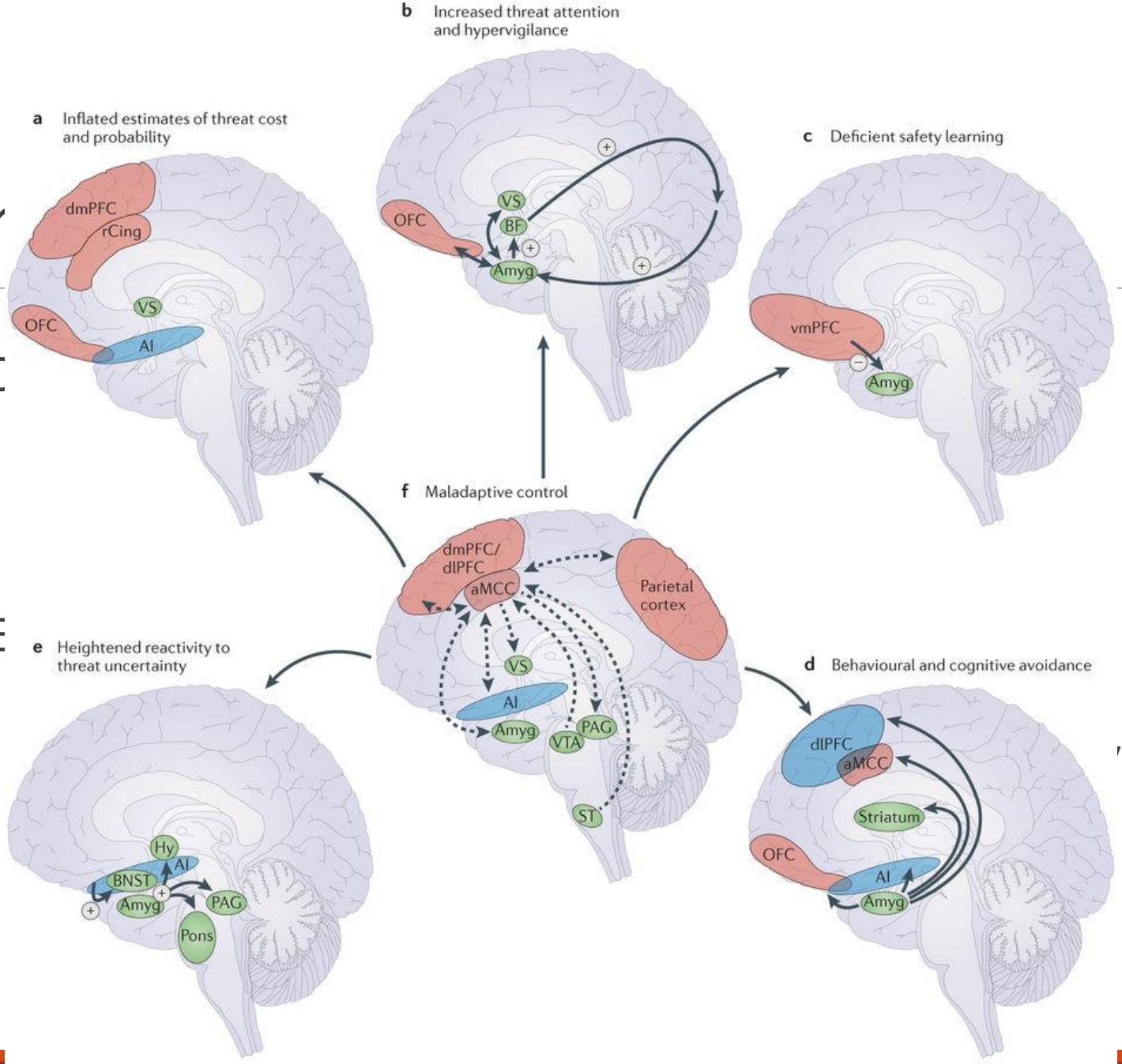
a Inflated estimates of threat cost and probability
dmPFC
rCing
OFC
VS
AI
b Increased threat attention and hypervigilance
OFC
VS
BF
Amyg
c Deficient safety learning
vmPFC
Amyg
f Maladaptive control
dmPFC/ dlPFC
aMCC
Parietal cortex
VS
AI
Amyg
PAG
VTA
ST
e Heightened reactivity to threat uncertainty
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BNST
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Pons
d Behavioural and cognitive avoidance
dlPFC
aMCC
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ing

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?[35]

- Primitive Reflex use prior in TBI
- Too low-level

Thank you to our FCOVDs!

- 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[26]
  - 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 & Attention[25,36-38]

Primitive Reflex	Purpose of Reflex	Appears	Should Integrate By:	Signs of Retention
Moro Reflex	Primitive Fight or Flight Reaction	Birth	2 to 4 Months	Hyper Sensitivity, Hyper Reactivity, Poor Impulse Control, Sensory Overload, Social & Emotional Immaturity
Rooting Reflex	Automatic Response to Turn Towards Food	Birth	3 to 4 Months	Fussing Eating, Thumb Sucking, Dribbling, Speech and Articulation Problems
Palmer Reflex	Automatic Flexing of Fingers to Grab	Birth	5 to 6 Months	Difficulty with Fine Motor Skills, Poor Manual Dexterity, Messy Handwriting
ATNR	To Assist Baby Through Birth Canal and Develop Cross Pattern Movements	Birth	6 Months	Poor Eye-Hand Coordination, Difficulty with Handwriting, Trouble Crossing Vertical Mid-line, Poor Visual Tracking for Reading and Writing
Spinal Gallant Reflex	Assist Baby with Birth Process	Birth	3 to 9 Months	Unilateral or Bilateral Postural Issues, Fidgeting, Bedwetting, Poor Concentration, Poor Short Term Memory
TLR	Basis for Head Management and Postural Stability Using Major Muscle Groups	In Utero	3 1/2 Years	Poor Muscle Tone, Tendency to Walk on Toes, Poor Balance, Motion Sickness, Spatial Orientation Issues
Landau Reflex	Assist with Posture Development	4 to 5 Months	1 Year	Poor Motor Development
STNR	Preparation for Crawling	6 to 9 Months	9 to 11 Months	Tendency to Slump While Sitting, Poor Muscle Tone, Poor Eye-Hand Coordination, Inability to Sit Still and Concentrate

Brain Balance Achievement Centers[39]

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[40]

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

Galant

Snow Angel

Jumping Jack – often held due to post concussive state

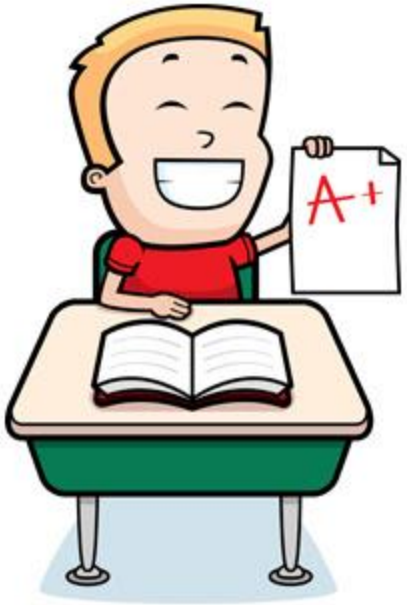
Complex Motor – L2

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!

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