NEURO-OPTOMETRIC REHABILITATION ASSOCIATION

The VISION Development Team

Resiliency Through Reconnections - Reflex Integration Following Brain Injury

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Focusing on The Re-Emergence of Primitive Reflexes Following Acquired Brain Injuries

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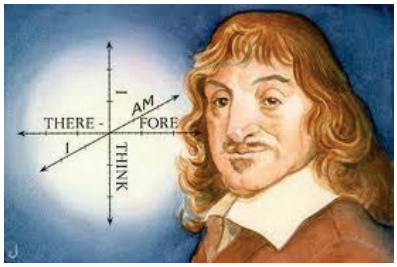
Objectives – Advanced Course

- Detail what primitive reflexes (PR) are
- Why they re-emerge following a brain injury
- How they affect sensory-motor integration
- How integration techniques can be used in the treatment of brain injuries

Objectives

- Learn how to effectively screen for the presence of PRs
- Learn how to reintegrate these reflexes to improve patient outcomes
- Current research regarding PR integration and brain injuries will be highlighted
- Cases will be presented

Pioneers to Present Day Leaders



Descartes (1596-1650)

Getting Back to Life After Brain Injury (BI)

What is Vision?

- Vision writes spatial equations for muscles to solve
- The quality of visual input is directly related to the quality of motor output
- We are visual beings, 70% of brain real estate is vision related

Neuro-Optometric Testing

- Neuro-Optometrists use a variety of tests
  - Refraction
  - Ocular Health
  - Binocularity
  - Accomodation
  - Balance (Balance Tracking Systems)
  - Eye Movements (RightEye)
  - Functional Visual Fields
  - Neuro-Sensory Motor Disruptions: Reflex Testing

Why Do We Care About PRs and BI?

- Gives us another way to monitor the injured brain.
- Is another tool in our Vision Training toolbox (vision is commonly affected in ABI but so are PRs)
- A big goal in BI is preventing further injury

Primitive Reflexes & Brain Injuries

- "The effects of TBI are broad-reaching and often affect not only cognitive and physical aspects of functioning, but also the emotional, behavioral, relational and even spiritual components of a client's life."

  -Larry Maucieri, Ph.D."

TBI vs ABI

- Traumatic Brain Injury (TBI) is caused by an external force , such as a blow to the head. The force abruptly pushes the brain to move inside the skull causing injury to the brain tissue and in some cases the skull. Concussions are an example of a TBI. Falls, sports injuries, and car accidents are common causes of TBI.

TBI vs ABI

- Acquired Brain Injury (ABI) occurs at the cellular level. It is most often associated with inflammation or pressure on the brain. Increased pressure could be a result of neurological illness, such as a stroke, a lack of oxygen or a tumor. Cerebral Palsy is a type of ABI.

NORA BLOG: August 15, 2019

What others can learn from my career-ending concussions

"I want health care providers to understand that rehabilitation after a TBI is not a one-size-fits-all solution. Every concussion is different. I also want doctors to understand that athletes are uniquely vulnerable. As young people who define themselves by the sport they play, they are very likely to be in denial about the severity of their head injury. They are generally unreliable in assessing their own concussion-related deficits because their drive to return to play is so strong."- Alecko Eskandarian
Major League Soccer (MLS)

Primitive Reflexes & Brain Injuries

- Brain injuries and brain impairment can be caused by physical, emotional, psychological trauma or a consequence of the aging process.
- These injuries and impairments can trigger the brain to revert back to a primitive stage of development, reactivating primitive reflex activity.

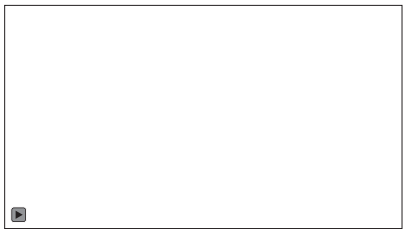
What is A Reflex?

- An automatic response to neurological signal, resulting from a stimulus, that is sensed by sensory neurons, and then is automatically converted into an action, through a series of sequential synapses.
- They are involuntary reactions that occur almost instantaneously following a perceived or non-perceived stimulus.

Reflexes and Human Performance

- Our neurology is the "life-wire" that sustains the physical body
- Reflexes are a component of that life-wire
- There are an unknown number of reflexes in the human body:
  - Some are innate or inborn reflexes primitive reflexes (PR)
  - Some are developed throughout our lives. These are acquired reflexes.

What is A Primitive Reflex?



- Automatic, repetitive specific movement patterns
- Initiated and controlled by the brainstem
- Emerge in utero - integrated within 1st year of life
- Inhibited by higher brain areas and then integrated within the nervous system
- Our first sensory motor experiences
- Retained with atypical neurology, poorly developed motor systems
- Reappear with trauma, dementia, or brain injury

Primitive Reflexes Have Purposes

- **Assist in birth:** work with mother's reflexes for vaginal birth
- **Survival:** Automatic subconscious responses to changes or stimuli within or outside our bodies
  - Maintain homeostasis: heart rate, breathing, digestion
  - Automatic actions: swallowing, sneezing, coughing, and vomiting
- **Serve as early motor experiences**
  - On course to become refined and complex

Survival is a Key Purpose for BI

- Brain Injuries threaten survival; stimulating release of PRs
  - If any part of the person feels threatened, then recovery is compromised
  - Reflexes will fail to reintegrate if the CNS feels that they need to be active to maintain life
  - A sense of safety must be achieved for primitive functions to subside their activity
    - More to come: Polyvagal Theory

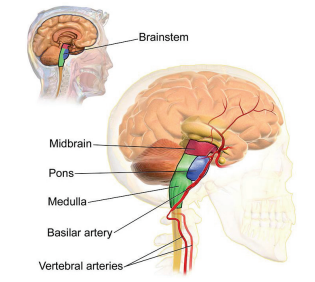
Developmental Model Related to Reflexes

- As a child reaches their developmental milestones, neurological information is sent to the brain to inhibit primitive brain activity.
- PRs become "stored neurological codes" once their purpose has been fulfilled, and higher brain centers are formed and myelinated.
- Postural Reflexes are added to the capacities of the CNS as the brain matures.

Postural Reflexes

- Reflexes that help us to support our posture against gravity so that we can sit, stand, and move without falling over
- Mediated by midbrain
- Through childhood and into adulthood, we rely on these reflexes to maintain balance

Postural Reflexes



https://qbi.uq.edu.au/brain/brain-anatomy/midbrain

Developmental Model Related to Reflexes

- These postural reflexes remain active in our CNS throughout our lifetime and help us with daily motor movements
- Primitive reflex activity in any person older than the age of integration, can significantly compromise functions of daily life.

Reflexes and Human Performance

- Reflexes are part of our "neurological code"
- Utilizing reflexes reinforce the code and act to write more advance codes
- As primitive reflexes mature, the brain evolves to cortically control complex skills
- Coordination, posture, emotional wellbeing, sensory processing, social engagement, critical thinking, and functional vision skills all evolved from the neurological foundations of our primitive nervous system

PRs and BI

- PRs can re-emerge with brain trauma and neurodegeneration
- Especially with damage to the CNS rostral (anterior) to the spinal cord
- The parts of the CNS that regulate vital functions form first
  - What is required most for survival forms first (sequential CNS maturation)
  - Because these pathways are laid down first, they are located in the midline of the CNS and ventral parts of the brain - therefore are most protected
  - These pathways are not dependent on sensory input for their development

PRs and BI

- Primitive Reflexes are always firing
  - PRs fire rostrally to help push the development of the brain
  - As the brain develops, higher level brain centers fire back down to the brainstem to inhibit the PRs
  - As these higher-level brain centers fail due to trauma or neurodegeneration, the PRs are recruited. As they re-emerge from the brainstem, they are activated to sustain life. (survival)

Frontal Release Signs

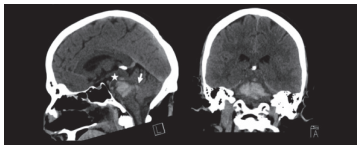
- Based on the theory that primitive reflexes become inhibited once frontal lobes become myelinated; when the frontal lobes degenerate, become diseased or are injured, these infantile reflexes then become "released."
- A return of primitive reflex activity is considered to be a sign of disorders that affect the frontal lobes; However the affected area is not necessarily confined to the frontal lobes.

Frontal Release Signs

- Theory: Primitive reflexes are held "in check" by the frontal lobe. After a brain injury, the frontal lobe is unable to inhibit their activity and they are released.
- Common Frontal Release signs include suck, grasp, snout, and groping reflexes, and abnormal gaze.
- Destruction of the frontal eye fields (FEF) can cause deviation of the eyes to the ipsilateral side
- PRs are released from inhibition by cerebral damage, typically frontal

New Soft Signs May Warrant Further Imaging

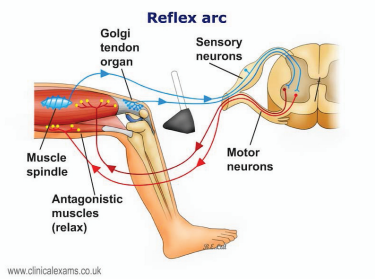
- The development of grasp responses or other PR's in a patient known to have a frontal lobe tumor or infarct, may be a soft sign indicating the extension of that lesion.
- Reimaging is warranted if lesion extends.



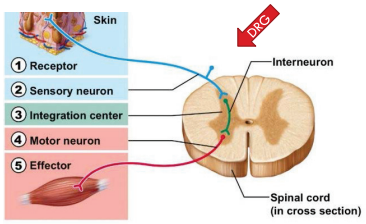
Neuro-Anatomy of a Reflex Arc

Simplified Overview

Neuro-Anatomy of a Reflex Arc



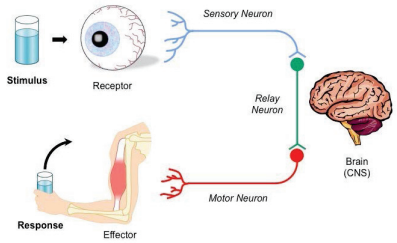
Neuro-Anatomy of a Reflex Arc



https://onlinesciencenotes.com/reflex-action-and-its-conduction/

- Sensory Receptors detect a physical or chemical stimulus and turns it into electrical impulses.
- Dorsal root ganglion (cell body of the afferent neuron)
- Interneuron - a neuron connecting an afferent and efferent neuron.
- Motor neuron (efferent)
- Effector organ: muscle or gland

Neuro-Anatomy of a Reflex Arc



https://ib.bioninja.com.au/standard-level/topic-6-human-physiology/65-neurons-and-synapses/stimulus-response.html

Classifying Reflexes

There are several ways of classifying reflexes.

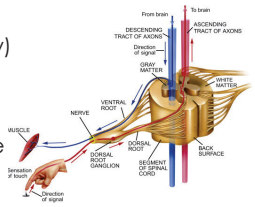
- In terms of the number of neurons or synapses between the primary afferent neuron and the motor neuron.
- In terms of the systems that receive the stimulus and give the response.
- In terms of various levels of the nervous system.
- Path of activity
- In terms of function

Classifying Reflexes - Number of Neurons

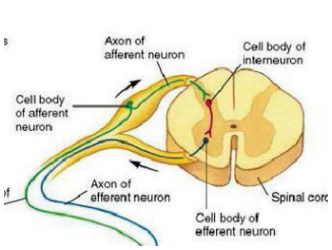
- **Monosynaptic Reflex:** One synapse
- **Multisynaptic Reflex:** More than one synapse is involved
- **Polysynaptic Reflex**: The pathway is of variable length, some parts disynaptic, some trisynaptic, etc.

Monosynaptic Reflex Arcs

- Have one synapse between two neurons, (sensory and a motor neuron)
- Efferent (Motor) neuron receives input directly from the afferent neurons (sensory)
- Rapid messaging allows for Rapid Response
- Examples:
  - Stretch reflex, myotatic reflex or muscle spindle reflex
  - Patellar reflex
  - Achilles reflex



Classifying Reflexes - Number of Neurons



- Most reflex arcs are multisynaptic & polysynaptic
- They have one or more interneurons that interface between the sensory and motor neurons along the reflex pathway.

Classifying Reflexes - Systems that receive stimuli

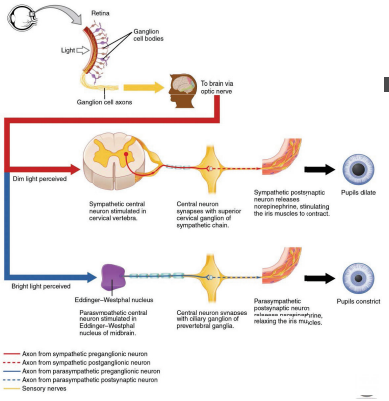
- **Visceral Reflexes:** Reflexes where at least one part of the reflex arc is an autonomic nerve
  - Pupillary reflex, carotid sinus reflex
- **Viscero-visceral reflexes:** originates in the viscera and ends in a viscera.
  - Gastric distension results in intestinal peristalsis
  - Decrease in heart rate following distention of the carotid sinus
- **Viscero-somatic reflexes:** originates int the viscera and ends in a soma
  - Abdominal cramping that accompanies rupture of the appendix

Classifying Reflexes- Systems that receive stimuli

- **Somatovisceral reflexes**
  - Vasoconstriction that results from cooling the skin
- **Somato-somatic reflexes:** Somatic stimuli produce patterns of reflex activity in segmentally related somatic structures.
  - Knee jerk that follows tapping the patellar tendon.
  - Withdraw

Classifying Reflexes

Ganglionic Reflex: The reflex originates in a peripheral organ, synapses in an autonomic ganglion and terminates in a peripheral effector.



https://courses.lumenlearning.com/epcc-austincc-ap1-2/chapter/autonomic-reflexes-and-homeostasis/

Classifying Reflexes - Levels of NS

- **Intra-segmental Reflex:** Central reflex activity occurs within a single spinal cord segment
  - Dorsal root ganglion afferent enters C7, synapses with an interneuron in C7, which synapses with a motor neuron within C7, and the axon exits C7.
- **Inter-segmental Reflex:** The central reflex activity involves more than one spinal cord segment.

Classifying Reflexes - Path of activity

- **Axonal Reflexes:** Sensory activity moves along a single branch of a peripheral nerve to a bifurcation, then passes back to the same tissue, causing a neuroeffector response- without entering the spinal cord.
  - Touching the skin can cause vasodilation
- **Ipsilateral Reflex:** The central activity remains on the same side of the spinal cord.
- **Contralateral Reflex:** Afferent input enters the court on one side and the motor output exits the cord on the opposite side.

Classifying Reflexes - Path of activity

Reciprocal Innervation

- Neuronal circuits that allow inhibition (reciprocal inhibition) or facilitation (reciprocal excitation) of neurons either opposing or aiding the rifle response.
- Ex: when straightening your arm, the excitation of the biceps will produce reciprocal relaxation or inhibition of the tricep muscles.
- Allows for smooth coordinated movements

Classifying Reflexes - Path/Function

Crossed Extensor Reflex

- Part of the flexor reflex
- Contraction of the extensor muscles of the contralateral limb to support weight.
- Contraction outlast stimulus.

Classifying Reflexes - Function

- Extensor Thrust Reflex
  - Help maintain balance
  - Tactile stimulus applied to foot
- Scratch Reflex
  - Triggers scratching away irritant
  - Stimulus – irritation of skin

Classifying Reflexes- Function

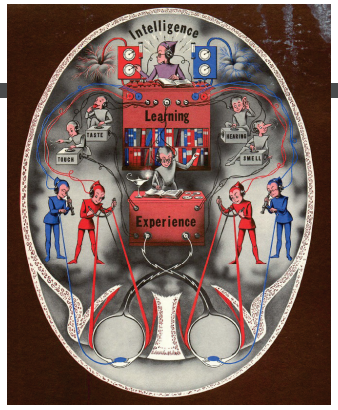
Primitive Reflexes

Postural Reflexes

ETC…. There are more reflexes than this lecture covers.

Hang in there….

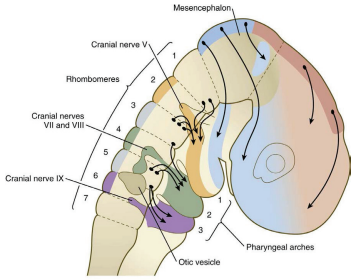
Our advance course covers a little more basic Neuro-anatomy!



Brain Stem

- **Key Points**
- In vertebrate anatomy, the brainstem is the posterior part of the brain, adjoining and structurally continuous with the spinal cord.
- Though small, the brainstem is an extremely important part of the brain, as the nerve connections from the motor and sensory systems of the cortex pass through it to communicate with the peripheral nervous system.
- The brainstem also plays an important role in the regulation of cardiac and respiratory function, consciousness, and the sleep cycle.
- The brainstem consists of the medulla oblongata, pons, and midbrain.

Differentiation: Major Subdivisions of the Brain



Human Embryology and Developmental Biology 5th edition, by Bruce M. Carlson

Brain Stem

- **Pons**: Contains nuclei that relay signals from the forebrain to the cerebellum, along with nuclei that deal primarily with sleep, respiration, swallowing, bladder control, hearing, equilibrium, taste, eye movement, facial expressions, facial sensation, and posture.
- **Midbrain**: Associated with vision, hearing, motor control, sleep and wake cycles, alertness, and temperature regulation.
- **Medulla**: The lower half of the brainstem that contains the cardiac, respiratory, vomiting, and vasomotor centers and regulates autonomic, involuntary functions such as breathing, heart rate, and blood pressure.

Consequences of BI

"The literature documents the effects of TBI on a range of domains including behavior, cognition, and personality."

-Larry Maucieri, Ph.D."

Visual & Cognitive Consequences of PR Post Injury


Sensorimotor and Physiological Indicators of Impairment in Mild Traumatic Brain Injury: A Meta-Analysis

- A recent study looked at the persistence of sensorimotor and physiological impairments post mild traumatic brain injury (mTBI).
  - Galea, Olivia A., et al. "Sensorimotor and Physiological Indicators of Impairment in Mild Traumatic Brain Injury: A Meta-Analysis."

Visual & Cognitive Consequences of PR Post Injury

- The findings demonstrate that sensorimotor and physiological changes persist at least 4 weeks to 6 months beyond the expected recovery times following subacute mTBI in an adult population.
- Overall, significant group differences in 36 sensorimotor and physiological variables (eg, balance, gait velocity and motion analysis outcomes, various oculomotor tasks, as well as heart rate variability frequency domains) were identified.
- These findings have implications for post-injury assessment and management.

-Galea, Olivia A., et al.

Primitive Reflexes & Brain Injuries

"After a TBI a client may manifest changes in mood (usually as depression), as well as anxiety, impulsivity, reduced personal insight and social judgment, degraded motivation, changes in sleep, poor memory, and inattention."

- Larry Maucieri, Ph.D.

NORA Weekly Digest

The Physicians Weekly reported in a study, for child and adolescent participants evaluated within 10 days of concussion incident, "abnormal performance on the Romberg test was independently associated with a longer duration of symptoms during recovery." While "headache severity and frequency, confusion, forgetfulness, attention difficulties, trouble remembering, getting tired often and easily, and dizziness were also associated with longer duration of symptoms, only abnormal performance on the Romberg test kept this association upon using a multivariate Cox proportional hazards model." The study was published in Neurosurgery.

Primitive Reflexes & Brain Decline

- A recent study found that Primitive reflexes were exhibited by 33.1% of aging subjects. Subjects with active PR demonstrated decreased performance on tests evaluating global cognition, executive functions, attention, and language.
- The Snout reflex was the most common PR, followed by glabellar tap and palmomental reflex. -Camarda, C.

Primitive Reflexes & Brain Injuries

Those working with this population need to "understand the impact of a head injury on cognition and thinking. The person recovering from either an open or closed head injury may have difficulty with many realms of cognition such as memory, attention and concentration, learning, memory, reasoning, planning, executive functioning and problem solving."

-Shaughnessy, M. F

Primitive Reflexes & Brain Decline

- The Snout reflex: Lightly tapping on the upper lip, just under the nose, causes pouting or pursing of the lips.
- Glabellar Tap: A person continues to blink when tapped more than 5 times lightly between the eyebrows.
- Palmomental reflex: Stimulation of the thenar eminence can cause an involuntary contraction of the mentalis muscle of the chin.

Lifetime Experience of Mild TBI

- Military with mild TBI: show lifetime consequences with Subtle Deficits in Sensory Reactivity and Sensory Integration During Static Balance testing.
- A custom-designed and validated virtual reality-based computerized posturography device was used to assess postural stability, whereas emotional reactivity was assessed using the acoustic startle response (ASR), and neurocognitive performance was assessed using the defense-automated neurobehavioral assessment (DANA).

-Wright, W Geoffrey, et al.

Lifetime Experience of Mild TBI

- A significant effect of number of mTBI was found in the postural assessment ($p = 0.002$)
- Lifetime mTBI was associated with suppressed ASR magnitude ($p = 0.03$) but did not affect neurocognitive performance

-Wright, W Geoffrey, et al..

Primitive Reflexes & Brain Injuries

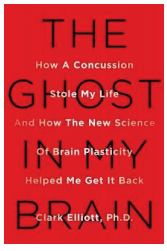
Another recent study found that the palmomental reflex (PMR) could be elicited in 46% of ALS patients.

-Taiello A, C

Beyond Brain

How a Concussion Stole My Life and How the New Science of Brain Plasticity Helped Me Get It Back

BI, not only affects the physical being, but has an impact on the soul's connection to the body!



VT reaches the soul!

"I was, at last, and once again, *human!*"

Clark Elliott
after Vision Therapy

Traditional Medical Model

- Traditional Medical Model – good at acute care- saving lives and preventing a serious condition from spiraling out of control…..but what happens when patient returns home?
- Neurologists know about primitive reflexes but only when they are severe
  - Coma/semi-coma
  - CP
- Few Neurologists know about successful therapeutic interventions to reorganize the primitive reflexes- Let's change this!

Primitive Reflexes & Brain Injuries

- Optometrists, therapists, and interdisciplinary teams can identify active primitive reflexes and provide therapeutic interventions to improve functional vision skills that impact motor control and cognitive deficits.

How can you help?

- You can use primitive reflex integration techniques to regain visual functions, connect sensory systems with vision processes, and improve motor coordination, with vision leading!

Defining Reflex Patterns

Fear Paralysis Reflex *Emerge: 5 GW Integrate: 9-12 GW*

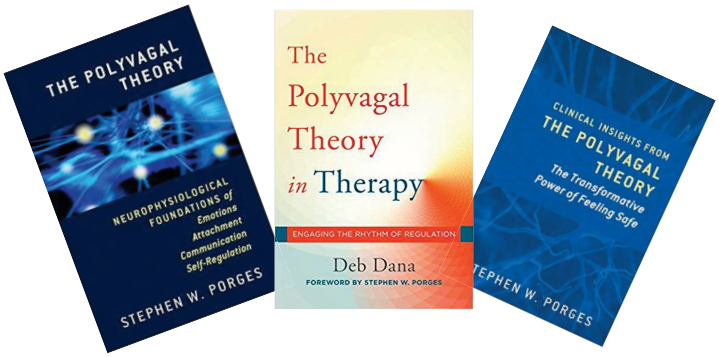
- A withdrawal reflex
- The embryo reacts to stress and stimulation by withdrawing and freezing
- As the fetus' tactile awareness develops, withdrawal upon contact gradually lessens

Consequences of Activation

Fear paralysis reflex:

Panic Attacks, Freeze, irregular breathing, severe avoidance

Polyvagal Theory: Fight, Freeze, or Engage



Polyvagal Theory

- "Three neural circuits form a phylogenically ordered response hierarchy that regulates behavioral and physiological adaptation to safe, dangerous and life-threatening environments." –Stephen Porges
  - Sympathetic
  - Parasympathetic
  - Social Engagement

Polyvagal Theory

- Parasympathetic (most ancient) "A primitive passive feeding and reproduction system creating a metabolic baseline of operation to manage oxygen and nourishment via the blood."
- Sympathetic (newer) "A more sophisticated set of responses enabling mobility for feeding, defense and reproduction via limbs & muscles."
- Social Engagement (most modern) "A sophisticated set of responses supporting massive cortical development– enabling maternal bonding (extended protection of vulnerable immature cortex processors) and social cooperation (language and social structures) via facial functions."

Polyvagal Theory

- Parasympathetic: For the torso, CN X (Vagus Nerve– Dorsal Branch); For the pelvis, the Sacral Plexus; For the head, Cranial Nerves III, VII, IX. These nerves operate baseline survival functions including heart/ lungs, digestion and reproduction. Sympathetic:
- Sympathetic Trunk plus Cervical, Celiac and Mesenteric Ganglia. These nerves go to all organs and operate smooth muscles during daytime alertness and mobilization, and fight/flight responses.
- Social: Special Efferent pathways within Cranial Nerves V, VII, IX, X (Vagus Nerve– Ventral Branch), XI; Corticobulbar Tract; also afferent pathways in Vagus. These nerves operate involuntary actions of the face, voice, hearing and related functions. Ventral Vagus also affects the heart.

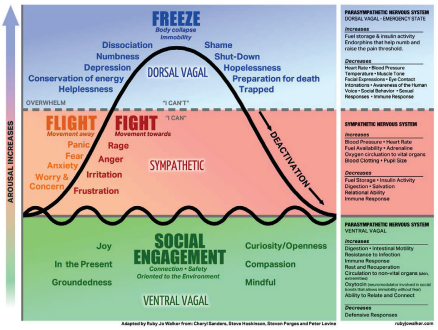
Polyvagal Theory

- Our NS continuously evaluates risk in the environment. Through, neuroception. (Porges, 2004).
- This ability to sense danger is hardwired into our NS and reflects adaptive strategies associated with our phylogenetic history.
- The way we react to the specific acoustic frequency bands that constitute music is determined by the same neural circuits that evaluate risk in our environment.
- For example, low frequency sounds elicit a sense of danger associated with approaching predator.

Polyvagal Theory

- Specific acoustic frequency bands in the environment elicit different emotional experiences, which are paralleled by adaptive physiological states.
- Each of these physiological states is functionally an adaptive state that influences affect regulation, social engagement behaviors, and our ability to communicate. We experience these states with feelings of safety, danger, or ultimate demise (i.e., life threat).
- Therapeutic interventions that can involve facial muscles, middle ear, and visual relaxation have been shown to reduce stress within the nervous system and improve social engagement.

Polyvagal Theory: Fight, Freeze, or Engage



"The limbic system "grabs" the sympathetic NS to turn on defense systems including the fight or flight mobilization system and the freeze immobilize system. But the freeze response is totally different; where fight and flight are mobilization, freeze is immobilization, and immobilization is potentially lethal for mammals."

-Dr. Stephen Porges

Therapeutic Interventions

Fear Paralysis Reflex:
Tapping - Emotional Freedom Technique, or EFT, a psychological acupressure technique

- Light therapy
- Meditation
- Breathing exercises

Defining Reflex Patterns

Snout Reflex Integrate: 12 m PN

- Tapping the upper lip lightly near the midline, causes contraction of the muscles of the mouth to resemble a "Pout" or snout.
- One of several reflexes associated with developing facial muscle tone needed for nourishment, articulation and social engagement.

Consequences of Activation

Snout Reflex:
Soft sign of bilateral cerebral damage, associated with pseudobulbar palsy

- Affects social engagement
- Facial expression
- Expressive language

Therapeutic Interventions

Snout Reflex:

- Tapping- Emotional Freedom Technique, or EFT, a psychological acupressure technique
- Light therapy
- Breathing programs
- Visual tactile Mirror work
- Vibration around mouth

Defining Reflex Patterns

Rooting Reaction Emerge: 28GW Integrate: 3 m PN

- Needed to search for food
- A tactile stimulus to cheek causes infant to turn head and eyes to stimulus
- One of several reflexes associated with nourishment and articulation

Consequences of Activation

Rooting Reaction:

- Poor articulation
- Difficulty swallowing
- Difficulty reading out loud
- Difficulty saying what is seen

Therapeutic Interventions

Rooting Reaction:

- Visual-tactile stimulation in mirror
- Vision led tongue movement games with vibration/singing toothbrush
- Refer to SLP or other appropriate professional

Defining Reflex Patterns

Glabellar Tap Reflex Integrate: 4 m PN

- Glabellar reflex (also known as the "glabellar tap sign") repetitive tapping on the forehead causes the eyes to blink in response to the first several taps.
- Afferent signals travel via the trigeminal nerve, synapsing with efferent signals via the facial nerve that cause the orbicularis oculi muscle to contract (blinking).

Consequences of Activation

Glabellar Tap Reflex:

- Persistent eye closure
- Blepharospasm (eyelid twitch)
- Common with Parkinson's, Alzheimer's, frontal lobe infarctions, brain tumors

Therapeutic Interventions

Glabellar Tap Reflex:

- Visual-tactile stimulation in mirror
- Emotional Freedom Technique

Defining Reflex Patterns

Moro Reflex: *Emerge: 9-12 GW Integrate: 4 m PN*

Whole body response to sensory or vestibular stimuli

- Stimulated by vestibular change, tactile, auditory, visual, olfactory, emotional, or memory
- The reflex has a extension phase and an embrace phase
- A fight or flight response that stimulates the first "breath of life"

Consequences of Activation

Moro Reflex:

- Problems with regulation of sympathetic nervous system
- Vestibular problems
- Hypersensitivity to sensory stimuli
- Oculomotor dysfunction and visual perceptual delays, significant anxiety
- Emotional regulation disturbances
- Stuck in a battle between fight or flight

Therapeutic Interventions

Moro Reflex: Vision Related Therapeutic Interventions

- Sensory integration techniques for specific sensory triggers: vision therapy, auditory therapy, tactile integration therapy, proprioception training, etc.
- Therapeutic breathing - meditation
- Visually guided massage
- Syntonics

Defining Reflex Patterns

Babkin Palmomental: *Emerge: 9 GW Integrate: 3 m PN*

- Links the hands with head/neck (eyes) & mouth
- When hands are stimulated:
  - Head moves toward chest
  - Mouth opens
  - Tongue moves

Consequences of Activation

Babkin Palmomental:

- Moving mouth when writing
- Sticks tongue out when catching ball
- Often fists hands
- Person is tense

Therapeutic Interventions

Babkin Palmomental:

- Squeezing fists on slow inhale, opening hands on exhale while breathing out tensions
- Closing eyes while squeezing fists and feeling reactions of head and mouth
- Mirror box activities
- Ball taps – with breathing and awareness

Defining Reflex Patterns

Palmar Reflex: *Emerge: 10 GW Integrate: 3 m PN*

- A grasping reflex
- Tactile stimulus to palm causes fingers to move
- Builds tone in the hands
- When integrated allows differentiation of finger movements needed for fine motor tasks such as writing, zipping zippers, and typing

Consequences of Activation

Palmar Reflex: Residual effects

- Poor pencil grip
- Tactile hypersensitivity
- Poor thumb and finger opposition
- Poor finger dexterity
- Difficulty writing, typing, or playing musical instruments

Therapeutic Interventions

Palmar Reflex: Beneficial Exercises

- Crawling with flat hands
- Hide objects in playdough with eyes closed
- Hand massage
- Finger isolation games

Defining Reflex Patterns

Tonic Labyrinthine Reflex (TLR) *Emerge: 12 GW Integrate: 9 m PN*

- Helps to establish balanced flexor and extensor tone
- Flexion of the head causes flexion of the limbs
- Extension of the head causes extension of the limbs

Consequences of Activation

TLR:

- Postural instability through transverse plane
- Balance problems
- Hyper or hypotonicity
- Poor head righting reactions
- Oculomotor dysfunction
- Orientation difficulties
- Poor proprioception
- Skeletal and muscular asymmetries
- Poor rhythm

Therapeutic Interventions

TLR:

- Endurance of full body extension followed by full body flexion
- Head rotations while standing on forward/backward tilt boards
- Infinity walk with head lowered and raised

Defining Reflex Patterns

Asymmetrical Tonic Neck Reflex (ATNR) Emerge: 13 GW Integrate: 6 m PN

- Stimulates homolateral movement
- Turning the head causes:
  - extremities on the individual's face side to extend
  - extremities on the individual's occipital side to flex

Consequences of Activation

ATNR:

- Instability through the sagittal plane
- Unbalanced standing posture
- Skeletal and muscular asymmetries
- Poor saccades and pursuits
- Difficulty with bilateral integration
- Poor handwriting
- Difficulty reading
- Poor cross pattern movements when walking
- Difficulty with crossing midline
- Poor awareness of both sides of the body
- Inaccurate sense of midline

Therapeutic Interventions

ATNR:

- Wall leans with pursuits
- Walking rail and Marsden ball
- Supine eye control
- Saccades, pursuits
- Tactile/proprioceptive input laterally
- Phys dip for midline
- Brock string/ fusion tasks & walking rail

Defining Reflex Patterns

Spinal Galant Emerge: 15 GW Integrate: 9 m PN

- Assists in the birth process and contributes to auditory processing, urinary control, and intestinal functioning
- A stimulus to the side of the lumbar spine towards the sacrum causes hip flexion

Consequences of Activation

Spinal Galant

- Inability to sit still
- Tactile hypersensitivity - tags, clothing, and belts are a source of discomfort
- Poor concentration
- Auditory processing disorders
- Poor visual fixation
- Incontinence

Therapeutic Interventions

Spinal Galant

- Angels in snow
- Back scoots
- Auditory stimulation with bone conduction
- Writing on back
- Vibration on back

Defining Reflex Patterns

Babinski Reflex Emerge: 1 wk PN Integrate: 9 m PN

- Important for assisting with the commando crawl, toe differentiation, and balance
- A stimulus to the lateral portion of the foot causes toes to flare

Babinski

- ***"Pathological reflexes"***
- The best known (and most important) of the so-called "pathological reflexes" is the Babinski response (upgoing toe; extensor response).
- The full expression of this reflex includes extension of the great toe and fanning of the other toes.
- This is actually a superficial reflex that is elicited in the same manner as the plantar response (i.e., scratching along the lateral aspect of the sole of the foot and then across the ball of the foot toward the great toe).

Babinski

- This is a primitive withdrawal type response that is normal for the first few months of life and is suppressed by supraspinal activity sometime before 6 months of age.
- Damage to the descending tracts from the brain (either above the foramen magnum or in the spinal cord) promotes a return of this primitive protective reflex, while at the same time abolishing the normal plantar response.
- The appearance of this reflex suggests the presence of an upper motor neuron lesion.

https://www.dartmouth.edu/~dons/part_1/chapter_8.html

Consequences of Activity

Babinski Reflex

- Poor balance
- Can't stand still
- Agitated when having to stand and wait
- Abnormal gait
- Increase risk of falls

Therapeutic Interventions

***Babinski Reflex*:**

- Tapping ball with foot-pointing and flexing toes
- Squeezing and then spreading out toes
- Jumping on a trampoline
- Foot massages

Defining Reflex Patterns

Symmetrical Tonic Neck Reflex (STNR) Emerge: 6 m PN
Integrate: 11 m PN

- Helps the infant defy gravity,
- Further refines head control,
- Builds strength in upper extremities and hips,
- Stimulates focusing of visual system and development of binocularity

Defining Reflex Patterns

STNR

- When prone and the head is flexed, the arms bend and the legs extend shifting the center of gravity to the upper core
- When sitting on feet, extending the head causes the arms to extend and the legs to flex shifting the center of gravity towards the lower core

Consequences of Activation

STNR

- Loss of balance when walking
- Increase risk of falls
- Difficulty focusing eyes and mind

Therapeutic Interventions

STNR

- Moving in and out of supine to sphinx to quadruped
- Standing forward facing head tilts
- Hart chart while in quadraped
- Vertical eye tracking (floor to ceiling)
- Accommodative lens exercises

Defining Reflex Patterns

Segmental Rolling "automatic" rolling Emerge: 6 m -10 m PN

- Initiated movement of hips or shoulders causes segmental rolling
- Rolling from front to back occurs before back to front
- Demonstrates the ability to shift weight, cross midline, and coordinate movements of the extremities and the core.
- Occurs through orchestration of several muscle groups and reflexes to achieve righting of the body when movement is initiated by hips or shoulders

Consequences of Activation

Segmental Rolling

- Poor tone and motor coordination of
  - Back Extensors
  - Hip Flexor/Extensors
  - Obliques
  - Abdominals
- Decreased ability to coordinate head, neck, and shoulders

Consequences of Activation

Segmental Rolling

- Difficulty sequencing
- Lack of fluid motion in hips and shoulders when walking
- Difficulty balancing trunk freely while walking - rigidity
- Difficulty shifting center of gravity
- Leans to one side
- Awkward movements

Therapeutic Interventions

Segmental Rolling

- Standing wall touches: With back against wall slowly turn and touch the wall while reaching across your chest.
- Slow sequential rolling on floor: Tootsie Roll (Binovi App)

Defining Reflex Patterns

Tilting Reactions while Standing Emerge:12-21 m PN

- Allows a person to regain balance when body is put slightly out of balance
- Helps to maintain balance while moving

Consequences of Activation

Tilting Reactions - Standing

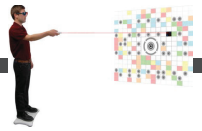
- Increase incidence of falling
- Distortions in balance
- Poor vestibular functions

NORA Weekly Digest

July 17, 2019

- LEADING THE NEWS
- Romberg Test Able To Predict Concussion Recovery Duration, Study Shows

Therapeutic Interventions



Tilting Reactions -Standing

- Developing JND of weight shifts
- Use of 2 digital scales / Balance Tracking Systems
- Balance board activities with head movements
- Attending to weight shift with yoked prisms (BL, BR, BU, BD)
- Use of balance mat/foam board

"Postural Stability Assessment Following Concussion: One Piece of the Puzzle"

- It appears that postural stability testing provides a useful tool for objectively assessing the motor domain of neurologic functioning and should be considered a reliable and valid adjunct to the assessment of athletes suffering from concussion.

  -Guskiewicz, Kevin M. PhD

- Clinical Journal of Sport Medicine: July 2001 - Volume 11 - Issue 3 - p 182-189

Here's what you need to know to get started…

- It's common for primitive reflexes to return in reverse order
- You need to test the reflexes to find out which reflexes are active and to what extent they are active
- Learn the associations between the reflexes and vision skills
- Be sure your patient understands how the reflex impacts their daily life

Here's what you need to know to get started…

- Follow an integrative systematic approach
- Remember reflexes occur as a result of sensory and motor neurons making a connection
- Therefore when working with reflexes in vision training, think about how you can connect vision with other sensory systems
- Take it slow
- Celebrate small changes - they are building up to regaining life!

Protocol for Re-integration

- Treatment still begins with foundational reflexes
- Start with breathing exercises
- Use small tolerable amounts of sensory information
  - You want neurons to fire together so that vision is neurologically wired to our other senses
  - Touch, taste, sound, proprioception, and internal awareness
  - Be careful not to overstimulate

Protocol for Re-integration

- Use Optometric power tools: Only as prescribed by overseeing eye doctor
- Do NOT work outside your lane without professional collaboration - per individual patient

Why Does Vision Rehabilitation Work?

- **Neuroplasticity:** Neurons are able to increase their connections with other neurons based on stimulation, learning, and experience.
- **Dendrogenesis:** Formation of NEW connections/neuronal pathways! Can occur in 30 seconds or less.
- **Neurogenesis:** New neurons are formed from neural stem cells. This can occur at ANY age.
  - Environmental complexity stimulates Neurogenesis of the visual cortex (Trends in Neuroscience 2001)

Why Does Vision Rehabilitation Work?

"To change the wiring in one skill, you must engage in some activity that is unfamiliar, novel to you but related to that skill, because simply repeating the same activity only maintains already established connections...our brains are wonderfully plastic throughout adulthood, and the brain has a tremendous ability to compensate and rewire with practice."

John Ratey MD, 'The User's Guide to the Brain"

Remember The Tower

Tilting Reactions Standing Emerge:12-21 m PN
Symmetrical Tonic Neck Reflex (STNR) Emerge: 6 m PN Integrate: 11 m PN
Segmental Rolling Emerge: 6 m PN supine to prone 10 m PN prone to supine
Amphibian Reflex Emerge: 4-6 m PN in prone, followed in supine
Oculo-Head Righting Reflex (OHRR) &
Labyrinthine Head Righting Reflex (LHRR) Emerge: 2-3 m PN
Landau Emerge: 3 - 10 wks PN Integrate: 3.5 yrs.
Babinski Reflex Emerge: 1 wk PN Integrate: 9 m PN
Plantar Grasp Emerge: 28 GW Integrate: 9 m P
Flexor withdraw Emerge: 28 GW Integrate: 4 m PN
Rooting Reaction Emerge: 28GW Integrate: 3 m PN
Traction Response Emerge: 28GW Integrate: 2-5 m PN
Suck Swallow Emerge: 28GW Integrate: 2-5 m PN
Crossed Extension Emerge: 28 GW Integrate: 1-2 m PN
Spinal Galant Emerge: 15 GW Integrate: 9 m PN
Asymmetrical Tonic Neck Reflex (ATNR) Emerge: 13 GW Integrate: 6 m PN
Tonic Labyrinthine Reflex (TLR) Emerge: 12 GW Integrate: 9 m PN
Palmar Reflex Emerge: 10 GW Integrate: 3 m PN
Moro Reflex Emerge: 9-12 GW Integrate: 4 m PN
Babkin Palmomental Reflex Emerge: 9 GW Integrate: 3 m PN
Fear paralysis reflex Emerge: 5 GW Integrate: 9-12 GW

Understand The Consequences of Abnormal Activity

Reflexes Foundations to Functional Skills

Reflexes affect human performance

Activities of Daily Living:

- Bathing
- Dressing
- Grooming
- Mouth Care
- Toileting
- Transferring bed/chair
- Walking
- Climbing stairs
- Eating

Instrumental Activities of Daily Living:

- Shopping
- Cooking
- Managing Medications
- Using the phone and looking up numbers
- Doing housework Doing laundry
- Driving or using public transportation
- Managing finances

Neuro- Optometric Testing

Accommodation: Ability to focus the eyes can be affected by active:

- Fear Paralysis Reflex (FPR) may be associated with Streff Syndrome
- Tonic Labyrinthine Reflex (TLR) - Balanced muscle tone of the ciliary muscles that surround the lens.
- Symmetrical Tonic Neck Reflex (STNR) - associated through developmental purpose of STNR - Early rocking on hands and knees with head extension and LE flexion, and shifting of center of gravity, stimulates focus

Tips

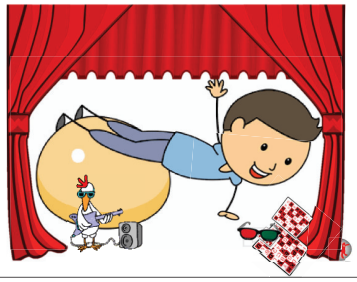
- Begin your treatment with the earliest abnormal reflex. For example, the Moro reflex precedes STNR. If both are present work with the Moro first.
- Why? Because MR will send them into fight or flight and interfere with your techniques to resolve focusing, neuro-fatigue, and attention.

Tips

- If a person has balance issues and an active TLR, the person will make gains faster if they reintegrate the TLR before expecting balance to return.
- Why? Because when the TLR is active, muscle tone is unbalanced and fatigue sets in quickly. When the person bends their head, their knees feel like collapsing. This will interfere with your balance work.

Integration of Motor Systems with Sensory Systems

- Set the stage for discovery
- Provide opportunities for the sensory systems to interconnect
- Refining growing perceptions
- Connect, Impact and Inspire!



Regardless of cause or type of brain injury people desperately need your help!

Thank You!!

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