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Reflexes and Evidence-Based Practice

Introduction

Over the years, there have been many ‘hot topics’ in the therapy world. Most often these involve topics influenced by current events or new developments in clinical areas that the occupational therapy field has not yet taken a stance on. Reflex integration therapy is one such area that has remained a hot topic for some time. The main reason for this is because its level of acceptance varies based on the age group and population it is used to treat. Integrating reflexes is an important aspect of pediatric therapy, since the presence of certain primitive reflexes can lead to impairments in motor control and development. However, it can be a controversial treatment method when used with any population for a variety of reasons, which this course will detail.

Section 1: Background of Reflexes

1,2,3,4,5

From a biological standpoint, reflexes are defined as involuntary, unplanned actions that are the result of a certain stimulus. These automatic responses originate from reflex arcs found within neural pathways in the nervous system. Since they are automatic, they do not use a person’s cognitive energy in the way that most bodily functions do. There are two types of reflexes. Autonomic reflexes (from autonomic reflex arcs) are those that impact internal organs and somatic reflexes (from somatic reflex arcs) are those that affect muscles. Autonomic reflexes are usually sent from the hypothalamus, or brain stem, which are part of the autonomic nervous system. Autonomic reflexes may also be controlled by the spinal cord, which is an extension of the central nervous system. Somatic reflexes, on the other hand, more often come from motor centers in the brain or what is known as the somatic nervous system, which is a division of the peripheral nervous system. Since somatic reflexes come from the brain, they are considered voluntary and under our conscious control. Autonomic reflexes are regulated in

part by the autonomic nervous system, which controls bodily functions such as breathing rate, heart rate, sweating, metabolic activity, and blood pressure. Somatic reflexes are governed by proprioceptors, or sensory receptors that keep tabs on the position of our body parts within its environment. Proprioceptors also monitor body movements and exertion or strain that our musculoskeletal system experiences. These receptors are located within skeletal muscle throughout the body.

Both autonomic and somatic reflexes contain afferent and efferent neurons. Afferent neurons control sensory information while efferent neurons control motor information, which is why both neurons are an important part of each type of reflex. Afferent neurons bring information from sensory receptors throughout the body (in the muscles, peripheral organs, and elsewhere) to the central nervous system to generate a motor response. Efferent neurons are then used to transport the processed motor information from the central nervous system to the muscles, glands, and other body parts to carry out the motor response. It is common for a reflex to have several synapses for various neurons within its reflex arc. In addition to the sensory and motor neurons, reflex arcs also contain a relay that serves as a go-between.

A reflex arc consists of several basic steps. In reference to protective reflexes, for example, the first step is that pain receptors in the skin identify important stimuli and create multiple nervous impulses pertaining to that stimulus. Afterwards, those same pain receptors use sensory neurons to transport the impulses to a relay neuron (also called an interneuron) located in the spinal cord. From there, the relay neuron sends the impulse information to the motor neuron located in the part of the body that first experienced the painful stimulus. This motor neuron serves as an effector for the stimulus, since it causes the muscle in that body part to contract and act in reaction to the pain it just experienced. This action is referred to as a response, or a motor response.

All reflexes typically occur instantaneously, have a localized effect, and are involuntary. The short sequence of steps involved in a reflex arc, which we detailed above, is what makes the execution of reflexes so fast. Reflexes are protective, in that they prevent someone from being injured. Some examples of those reflexes include moving your hand away from a hot item after touching it, blinking when a foreign object gets into your eyes, and putting your hands in front of your face when a flying object is coming at you. Similarly, bodily functions such as sneezing and coughing are considered reflexes since they are in response to irritation in the nasal cavity and throat. Most reflexes bypass the cerebral cortex to save mental capacity for more complex processes. However, there are times when certain reflexes override this tendency and are sent to the brain for a distinct purpose. A good example of this is when you are carrying a hot plate and want to keep a firm grasp on it until you reach your destination.

Categories of Reflexes

There are three main categories of reflexes. The first is superficial reflexes, which are triggered by stroking the mucous membrane or the skin. After testing, an abnormal superficial reflex will be absent or diminished. Some examples of superficial skin reflexes include the gluteal reflex, anal reflex, upper and lower abdominal reflexes, cremasteric reflex, plantar reflex, and interscapular reflex. Someone can elicit these reflexes by stroking the skin in the outlined areas, which results in nearby muscle contractions. The mucous membrane reflexes are the corneal reflex (which leads someone to blink), the gag reflex, the uvular reflex, and the sneeze reflex.

Deep tendon reflexes (also known as muscle stretch reflexes, stretch reflexes, or myotatic reflexes) are bodily responses to passive stretches. By testing deep tendon reflexes, someone can evaluate the status of the afferent nerves and related motor pathways. People with lower motor neuron lesions may demonstrate hypoactive or entirely absent deep tendon reflexes while individuals

with upper motor neuron lesions typically experience exaggerated deep tendon reflexes. In order to test a deep tendon reflex, a therapist should tap a tendon (which radiates to the muscle it connects to). This sends a message to the spinal cord that the muscle has been stretched, so the spinal cord quickly sends a message back to the muscle to trigger a contraction. This leads to an obvious motor response. Some examples of deep tendon reflexes include the biceps, distal finger flexors, quadriceps knee jerk, radial brachialis, triceps, ankle jerk, and jaw jerk reflexes.

Pathological reflexes (also known as primitive or neonatal reflexes) are the type of reflexes that are often heavily debated. They are considered typical in newborns and are involuntary. They help increase an infant's chances of survival. As children grow and their nervous system develops, the reflexes should integrate and ideally will no longer be present by around the age of 2.

In particular, the frontal lobe is the area that inhibits these reflexes in typically developing children and adults and replaces them with voluntary, normalized movement patterns. However, these reflexes may reappear or persist in adults who experience neurological injuries or disorders. When this happens, the reflex is referred to as a sustained reflex. If this category of reflexes presents in adults, it is typically an indication of disinhibition in the cortex. There are several categories of pathological reflexes, which are divided based on the level of the nervous system that controls them.

Equilibrium Reflexes

Cortical or equilibrium reflexes are a category of reflexes that provide higher level bodily adjustment when a person's center of gravity experiences a disruption. Equilibrium reflexes are governed by the cerebellum. These retained reflexes develop at around 6 months of age and are first apparent when a child begins moving from laying down to standing or sitting. They help a person maintain their

balance by shifting their base of support. Equilibrium reactions arise in response to:

- External movement changes, such as when a person is pushing an object that weighs less than they thought, which requires them to walk and push faster
- Internal movement changes, including when someone shifts their weight from one leg to the other
- External forces on the body, such as when an athlete who is running gets hit by another athlete but continues to move toward their desired location

Equilibrium reflexes are the next level of bodily responses after righting reflexes, as equilibrium reflexes are more mature in that they help move the trunk and extremities in the direction opposite of the force that is acting on the body.

Reflexes Appearing in Utero or Between 0 and 6 months

Asymmetric tonic neck reflex (ATNR) - This reflex develops as early as 18 weeks gestation and integrates when a child is between 4 and 7 months old; in order to test this reflex, a child should be laying in supine position while someone turns their head to one side; the typical response is for the child to extend their arm and leg on the side their head has been turned to while flexing the other arm and leg; the ATNR can also be tested by having a child stand with their arms straight in front of them while looking forward; the therapist should then ask the child to slowly move their head from left to right while keeping their arms in the same position; the appropriate response is to keep the arms straight out in front of the body while the head moves from side to side; therapists can also test the ATNR in quadruped by asking a child to get on their hands and knees on the ground while turning their head slowly from left to right; the appropriate response to this test is keeping the elbows and shoulders straight while moving the head; the ATNR helps

children develop normalized muscle tone, hand-eye coordination, and consistent movements on one side of their body; this reflex is produced by the brainstem

Babinski reflex - This reflex should be present at birth and typically integrates between 12 and 24 months of age; to test this reflex, someone should firmly stroke the sole of the foot; the appropriate response is the big toe moving upward and the remaining toes fanning outward; this reflex is meant to draw attention to stimulus on the bottom of the foot, which can potentially be harmful if unattended

Babkin reflex - This reflex first develops around 9 weeks gestation and should integrate by around 4 months of age; to test this reflex, you can place light pressure on both of a baby's palms; this should cause the baby to open their mouth and lean their head forward or to one side; while it may not appear so at first, this reflex helps a baby in early feeding by allowing them to learn the motions necessary to place pressure on the breast to stimulate the flow of milk while actively feeding; similar to the plantar reflex, the babkin reflex also allows babies to flex their fingers, which helps with grasp and manipulation

Crossed extensor reflex - This reflex is typically present at birth and integrates by around 2 months of age; this reflex works synergistically with the flexor withdrawal reflex to protect someone and prevent a loss of balance after they experience a painful stimulus; in the presence of something painful on the left lower extremity, for example, the crossed extensor reflex should cause someone's right lower extremity to extend; in turn, this allows the left leg to flex to bring attention to the painful stimulus, which is an example of the flexor withdrawal reflex; this reflex is produced by the spinal cord

Cry reflex - This reflex typically develops at birth, yet there is no specific time when it integrates; the cry reflex is triggered in response to stimulus such as hunger, pain, or other forms of discomfort; it is common for premature infants to lack a cry reflex, which is why they should be closely observed for signs of discomfort

Diving reflex - This reflex appears at birth and can be tested by submerging a baby underwater; the expected response is for a baby to hold their breath and open their eyes; this reflex also causes a decrease in heart rate, blood pressure, and other vital signs in order to conserve energy and maintain organ function to avoid injury; in combination with the swimming reflex, this reflex helps protect babies when they are placed in water they may not yet be able to get out of

Extensor thrust reflex - This reflex is typically present at birth and should be integrated by around 2 months of age; this reflex can be elicited by stroking the sole of the foot, which will cause the leg to extend; this reflex is intended to signal the lower extremities to provide more support in response to stimulus; while the extensor thrust reflex integrates very young, a more mature version of it (called the stretch reflex) persists and helps with actions such as walking and running; this reflex is produced by the spinal cord

Flexor withdrawal reflex - This reflex is typically present at birth and integrates by around 2 months of age; the flexor withdrawal reflex works synergistically with the crossed extensor reflex to protect someone and prevent a loss of balance after they experience a painful stimulus; in the presence of something painful on the left lower extremity, for example, the flexor withdrawal reflex should allow the left leg to flex in response to the discomfort; to complement this, the crossed extensor reflex should cause someone's right lower extremity to extend so they don't lose their balance; this reflex is produced by the spinal cord

Glabellar tap reflex - This reflex is present from birth; it is unclear specifically when this reflex should integrate, but its presence in adults is considered abnormal; some sources suggest that its presence in adults may be suggestive of Parkinson's disease, but this testing is not a consistent diagnostic measure for the condition; to test the glabellar reflex, a therapist should use one finger to tap the space on the forehead that is between the eyebrows and just above the nose (called the glabella); the expected response is for someone to blink several times and then stop despite the continuation of tapping

Landau reflex - This reflex appears around 3 months of age and should be integrated by between 12 and 24 months old; to test this reflex, a therapist should hold an infant in the air while prone; if a child were to demonstrate a normal response, they would raise their head up against gravity and slightly flex their legs behind them; this reflex is important because it helps motor coordination between the upper body and lower body

Limb placement reflex - This reflex is present at birth and should integrate by 3-4 months of age; to elicit this reflex, a therapist should hold a baby just over the edge of a table; when the baby's lower leg or lower arm comes in contact with the table, the typical response is to lift the limb so that it clears the table; the limb placement reflex is intended to assist with the development of anticipatory reactions based on a person's surroundings

Moro reflex - This reflex first appears around 3 months of age and should be integrated by 6 months; this reflex can be elicited in a few ways, either by suddenly dropping the baby's head by a few inches or suddenly lowering the entire baby by a few inches; these are the most common methods of stimulation, but a therapist can also elicit the same response by introducing a painful stimulus to the upper abdomen; a normal response to these actions is crying along with abduction and extension of the arms along with finger extension and slight extension of the spine and neck; after this initial response, a baby should adduct their arms, place their hands at the front of the body, and then place their arms at their sides; this is yet another protective reflex that helps shield a baby from injury

Palmar grasp reflex - This reflex is typically present at birth and integrates between 4 and 5 months of age; the palmar grasp reflex causes babies to flex their fingers (with the exception of the thumb) in response to light touch on the palmar surface; in addition, this reflex also causes a baby's fingers to cling due to traction on the tendons of the four digits; this reflex is produced by the spinal cord

Rooting reflex - This reflex first develops around 32 weeks gestation, is not fully mature until 36 weeks gestation, and is usually integrated between 3 and 6

months of age; when someone strokes a baby's mouth, cheek, or other nearby parts of the face, they turn their head toward the source of the stimulus; this reflex assists with feeding and helps a baby find food that is crucial to survive; this reflex is produced by the spinal cord

Snout reflex - This reflex is usually present at birth and integrates by 12 months old; therapists can elicit this reflex by lightly tapping the upper lip; the expected response is tightened, puckered, protruding lips, which appears somewhat like a snout; this reflex is often grouped in with the sucking and palmomental reflexes because it helps with the development of facial structures that assist with feeding

Spinal galant reflex (trunk incurvation reflex) - This reflex appears when a baby is at 20 weeks gestation and integrates between 3 and 9 months old; to elicit the spinal galant reflex, a therapist should stroke one side of the spine while a baby is in prone; the expected response should be lateral flexion of the spine in the direction of the stimulus; this reflex begins developing in utero because it helps a baby move down the birth canal during delivery; after birth, a baby continues to benefit from this reflex because it encourages greater hip range of motion, a stronger spine, and the development of balance/equilibrium through maturation of structures in the inner ear; each of these functions prepares a baby for creeping, crawling, and walking; the spinal galant reflex further assists with hearing development as it helps transmit vibrations from the skin to the ear through bone and skin conduction

Startle reflex - This reflex begins developing around 25 weeks gestation and should integrate between 2 and 4 months of age; to elicit this reflex, a therapist can make a sudden, loud noise to which the typical response is crying; this reflex is often confused with the Moro reflex, which has a similar reaction but is not triggered by any auditory stimulus

Sucking reflex - Similar to the rooting reflex, the sucking reflex first develops around 32 weeks gestation and matures by 36 weeks gestation; this reflex integrates between 3 and 6 months and works in conjunction with the rooting

reflex to help a baby properly feed; in addition, the sucking reflex helps babies self-soothe so this reflex also works with those that aid in hand-eye coordination once babies begin sucking their thumbs for comfort; this reflex is produced by the spinal cord

Swimming reflex - This reflex is present at birth and should integrate by around 6 months of age; to test this reflex, a therapist should submerge a baby in water in the prone position; the typical response to this is a baby kicking their legs and waving their arms; while these motions are not actually indicative of a baby knowing how to swim, it mimics swimming behavior in an attempt to protect the baby; this is also an indicator of how babies are innately programmed to know what to do in water, which is what makes them able to learn actual swimming at such a young age

Tonic labyrinthine reflex (static labyrinthine reflex) - This reflex appears at around 2 weeks old and is not retained, as it should integrate by 2 years of age; the tonic labyrinthine reflex causes a baby to flex their arms, legs, and neck when they are placed in prone; this reflex produces the opposite response when a baby is in supine, which is extension of the arms, legs, and neck; this reflex serves to help a baby adjust to the force of gravity and helps them develop muscle tone in the extremities, torso, and neck; this reflex is produced by the midbrain

Walking reflex (stepping reflex) - This reflex is present at birth and should integrate by 2 months of age; when an infant is held upright by their arms with their legs flat on a solid surface, their legs appear to walk or even dance; this reflex helps prepare a baby for walking by generating movements that are similar to what they will be executing when their lower limbs come in contact with ground surfaces; this reflex is produced by the spinal cord

Reflexes Appearing Between 6 Months and 3 Years

Plantar grasp reflex - This reflex is usually present at birth or shortly afterwards and should be integrated between 6 and 12 months old; the plantar grasp reflex can be tested by stroking the sole of the foot gently or by pressing the thumb into the sole of the foot just below the toes; the expected response to these actions is bending of the lateral surface of the foot along with flexion and adduction of the toes in a way that simulates grasping; this reflex is produced by the spinal cord

Symmetric tonic neck reflex (STNR) - This reflex appears between 6 and 9 months of age and should be integrated between 9 and 11 months old; someone can test the STNR on a child by passively moving their head up and down; when a child's head is passively flexed, their upper extremities should be flexed while their lower limbs should be extended; when a child's head is passively extended, their upper limbs should be extended and their lower limbs should be flexed; this reflex helps prepare a child for crawling, which usually occurs around this time; when thinking of its long-term benefit, it's integral for a child's postural, eye-hand coordination, and even visual focus during certain strenuous activities; this reflex is produced by the brainstem

Lifelong Reflexes

Amphibian reflex - A retained postural reflex that a child first develops between 4 and 6 months of age; when the hip is elevated, this reflex allows a child to gain more flexion in the knee, hip, and arm on the same side; this type of movement not only helps prepare a child for rolling, creeping, crawling, and walking, but it also readies them for movements that cross midline; this reflex is produced by the midbrain

Blink reflex - This retained reflex is present at birth and will cause someone to blink or squint when the eyes or touched, when debris gets inside of them, or when they are exposed to sudden and bright light; this is a protective reflex that

exists and remains throughout the lifespan to prevent injury to the fragile structures of the eye

Body righting acting on body (body-on-body righting reflex) - This retained postural reflex appears between 7 and 12 months of age and intends to keep the body in contact with the surface it's on regardless of how the head is positioned; this prepares a child for seated and quadruped positions; this reflex is produced by the midbrain

Body righting acting on head/neck (neck-on-body righting reflex) - This retained postural reflex also appears between 7 and 12 months of age and allows the body to be in alignment with the position of the head; for example, when a baby is lying in supine and their head is turned to one side, their whole body will follow until it is aligned properly; this reflex is produced by the midbrain

Doll's eye reflex (oculocephalic reflex) - This retained reflex first appears at around 3 months of age; since this is a type of vestibular-ocular reflex, it involves the coordination of head and eye movements; to test this reflex, a therapist should quickly rotate the head to each side while watching the eye (in most cases, therapists must hold the eyelids open to get the best image of the eyes); the proper response is the eyes moving in the opposite direction as the head

Gag reflex - This retained reflex is present from birth and serves to prevent choking by preventing foreign objects from entering the throat

Negative supporting reactions - This retained reflex triggers inhibition of extensor muscles along with increased mobility of the joints, which allows for additional flexion of the limb; this reflex is produced by the brainstem

Optical righting reflex (oculo-head righting reflex) - This retained reflex appears when a child is between 2 and 3 months old; the optical righting reflex causes a child to keep their head upright and focus their eyesight when their body is held vertically and tilted to one side; this helps someone attend to visual information in

their surroundings while also maintaining their sense of orientation as their body moves; this reflex is produced by the midbrain

Palmomental reflex - This retained reflex is present at birth; to test this reflex, a therapist should brisky and firmly stroke the thenar eminence just below the thumb from proximal to distal; a typical response is an observable twitch of the mentalis muscle in the chin on the same side as the hand that was stroked

Parachute reflex - This retained reflex is one of the last primitive reflexes to appear; it may present itself as early as 5 months old but the norm is between 8 and 9 months; when a child is suspended in prone with their head tipped downward, the parachute reflex causes them to extend their arms and digits; this reflex helps them protect their head, which is in a vulnerable position, and understandably helps them avoid serious injury; this reflex is produced by the midbrain

Positive supporting reactions - This retained reflex causes muscular contractions throughout the body, which help support the torso in response to the force of gravity; this reflex can first be seen between 3 and 4 months old; this reflex is produced by the brainstem

Protective extension reflex - This retained reflex develops between 5 and 7 months of age; when in unsupported sitting, someone presenting with a protective extension reflex will extend their arm when the opposite side of their body is nudged; this reflex also helps protect someone from injury; this reflex is produced by the midbrain

Pupillary reflex - This retained reflex first appears around 35 weeks gestation; to elicit this reflex, a therapist should shine a small light in a person's eye at which point the expected response is constriction of the pupil; this reflex exists to moderate the amount of light that reaches the retina and protect sensitive structures called photoreceptors from bright light that could potentially overwhelm it

Withdrawal reflex - This retained reflex is present at birth and serves to protect a person from noxious, painful stimuli

Causes and Presentation of Retained Reflexes

There are a range of potential causes that can lead an individual to retain these primitive reflexes. Some of these causes include being exposed to harmful toxins, receiving anesthesia for surgery at a young age, not getting enough tummy time as an infant, walking much earlier than one's peers, experiencing subluxation of the neck, taking certain prescription medications, suffering from chronic ear infections, and sustaining a fall that resulted in trauma such as a head injury. Children may also demonstrate retained reflexes if they go through a period where they do not crawl after first meeting the crawling milestone. It's also possible for children to retain reflexes if they experienced trauma during or shortly after the birthing process. Some examples of this are having a cesarean section delivery, undergoing a prolonged delivery process, being delivered in the breech position, doctors using forceps, suction, or other tools during the birth, and premature births.

When a child or adult has retained the Moro reflex, it is common for them to demonstrate oversensitivity to one or more types of sensory input (most commonly auditory input), vestibular concerns such as balance impairments and motion sickness, a limited pupillary reaction in response to light, a poor immune response and allergies, adverse reactions to most medications, poor endurance and overall low energy, difficulty adapting to new situations, and reactive hypoglycemia. It is common for people who have Attention Deficit/Hyperactivity Disorder (ADHD) and Autism Spectrum Disorder (ASD) to also have a retained Moro reflex. Individuals who have retained this reflex may also experience adrenal fatigue, food and drug allergies, and asthma.

It is common for those with a retained rooting reflex to experience chewing and swallowing difficulties, an anterior tongue tie, poor oral expression and verbal

articulation, defensiveness to oral input, and still suck their thumb. Children and adults with a retained rooting reflex may have conditions such as autoimmune diseases, hormone imbalances, and thyroid conditions. Those who have a retained palmar grasp reflex are often diagnosed with dysgraphia. As a result, their concerns may include tactile defensiveness, poor proprioceptive regulation, impaired visual coordination, poor posture when writing or completing other seated tasks that involve fine motor skills, and hand movements that correspond with speech. People with a retained palmar grasp reflex typically also demonstrate decreased manual dexterity that often causes pencil grasp and illegible handwriting.

If the ATNR is not integrated, children and adults may develop autoimmune diseases, thyroid conditions, and hormone imbalances. Impairments present in individuals with this reflex include impaired coordination (specifically impacting gait), poor balance, difficulty with subjects such as mathematics and reading, difficulty crossing midline during functional tasks, poor visual motor skills and visual tracking, illegible handwriting, and poor hand-eye coordination. Individuals who have a retained spinal galant reflex commonly experience incidents of bedwetting even after being fully potty trained along with major postural concerns (including misaligned pelvis, pelvic rotation, and scoliosis), inattention and hyperactivity, lower back pain, low physical endurance, chronic gastrointestinal concerns, poor coordination in the lower extremities, and overall muscle tension leading to chronic pain in the legs.

Individuals who have a retained TLR reflex often toe walk and experience decreased spatial awareness, hypermobile joints, poor posture, vestibular concerns such as motion sickness, difficulty with climbing and similar strenuous gross motor tasks, generalized muscle weakness, poor balance, and unusual head positioning at rest (either laterally or forward-facing). When the landau reflex is not integrated, children and adults are likely to experience poor coordination specifically pertaining to reciprocal movements among the upper and lower extremities (this leads to difficulty with many complex gross motor tasks such as

somersaults and others that involve movement of the upper and lower body in equal parts), delays in hitting motor milestones, poor postural control, and limited muscle tone.

If someone has a retained STNR reflex, they are likely to demonstrate poor seated and standing posture, low muscle tone, poor hand-eye coordination leading to messy eating and difficulty with other functional fine motor tasks, and they walk with an unusual arm positioning and swing that is slightly abducted away from their torso, which mimics walking like an ape. Individuals who have a retained STNR reflex will also commonly tend toward W-sitting due to the lax joints and low muscle tone they possess.

Section 1 Personal Reflection

What are some other ways each of the above retained reflexes could impact functional performance for an adult or a child?

Section 1 Key Words

Base of support - The area below an object that allows that object to make contact with supporting surfaces; for example, an adult's base of support usually consists of their feet, a young child's base of support may primarily include their hands as they crawl, and a person with a lower body injury may use crutches or a wheelchair as their base of support

Integrated reflex - An automatic, involuntary response from the spinal cord that is present for the first 2 years of life and shortly after matures into voluntary and more complex movements that serve a better purpose for protecting someone

Midbrain reflex - A reflex that stems from a part of the brain called the midbrain, which is located just above the brainstem; a midbrain reflex is what people often

think of as traditional reflexes that protect the body because they give a person motor control that allows them to respond to potentially dangerous situations

Retained reflex - An automatic, involuntary response from the spinal cord that should have matured into voluntary, complex protective mechanisms after a certain point but remained present and has the potential to impact someone's functional participation

Section 2: Reflex Integration Therapy: Its Basis of Evidence and Intersection with Occupational Therapy

7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30

Reflex integration therapy is defined as a non-invasive sequence of treatments intended to remediate developmental delays and improve the function of the central nervous system. In the traditional sense, reflex integration therapy is most appropriate for children who have developmental disabilities, but some professionals believe this treatment can also help adults with nervous system disorders. Since reflex integration therapy is not a discipline and rather a treatment method, it may be performed by occupational therapists, physical therapists, chiropractors, and other healthcare or alternative healthcare professionals with a background in developmental therapy.

There isn't much research to support the purported benefits of integrating reflexes through treatments such as reflex integration therapy. However, there is evidence that demonstrates the negative impact retained reflexes can have on the function of a child or adult who possesses them. As a result, the American Occupational Therapy Association (AOTA) has spoken out on the topic as part of their Choosing Wisely initiative, which helps prevent therapists from using any interventions without a strong basis of evidence. While the recommendations under this initiative are widespread and cover a range of practice areas, reflex integration therapy was mentioned under advice that pertains to pediatric

therapy. AOTA specifically notes that reflex integration therapy programs should not be used with individuals who have primary motor reflex delays unless there are clearly delineated connections to occupational outcomes. While most occupational therapists understand the need for a strong emphasis on function in all of their treatments, it can be cumbersome to put into practice with reflex integration therapy as the focus. Many therapists have difficulty finding evidence that supports the benefits of reflex integration therapy, but they also typically report trouble locating specific guidance for creating treatment sessions that remediate these concerns. When mentioning the topic, AOTA also notes that they support therapists using strategies that address ADL function in children whose signs of reflex retention negatively impact their performance as opposed to therapists utilizing interventions that solely focus on integrating specific reflexes. AOTA further details this topic in a level 5 publication (an expert opinion piece) emphasizing the importance of shared decision making as a way to minimize the use of low-value occupational therapy interventions.

As was mentioned earlier, there is a range of evidence (with varying levels of reliability) that supports how retained reflexes can negatively impact function and development. A level 2b study conducted by Pecuch et al. showed that preschool children who demonstrate a high number of retained reflexes are more likely to experience disruptions in sensory-motor development as well as educational, social, and motor deficits. The children with a higher level of retained reflexes also experienced postural disorders, dyspraxia, and sensory-vestibular disorders. A level 1b study by Melillo et al. found children and young adults between the ages of 3 and 22 who have ADHD and retained reflexes responded well to a metronome-based motor program. Participants experienced significantly less retained reflexes and major improvements in cognitive and motor measures by the end of a 12-week program. In addition, their mathematical problem-solving and listening comprehension improved. Researchers posited that these results are likely to lead to an increase in academic performance due to the cognitive and motor improvements. Gieysztor, Choińska, et al. also performed a level 1b study

that yielded improvements in psychomotor skills and overall academic performance after preschoolers' retained reflexes were integrated. The results of this study also indicated that 65% of preschool children exhibited retained primitive reflexes that placed them at at least some risk of functional concerns. A total of 9% of the children demonstrated altered development and 29% of the children were considered developmentally delayed. Researchers also found that the more severe the retained reflexes were, the less efficient the child's motor skills were.

Similar research cites a connection between retained primitive reflexes and developmental concerns including impaired coordination, limited attention, and learning difficulties such as dyslexia that may lead to poor performance in writing, reading, and mathematics. Children between the ages of 4 and 6 who demonstrated a retained STNR, ATNR, and/or TLR also exhibited decreased motor efficiency. Researchers also determined the older children in the sample whose retained reflexes were not quite as significant demonstrated improved motor skills over time. This solidifies the need for early screening efforts so that providers can address any functional deficits that are related to retained reflexes.

A level 3b study from Gieysztor, Kowal, et al. aimed to find a connection between the presence of primitive reflexes and the gait patterns and function of preschool children. All participants demonstrated trace primitive reflexes and took part in gait analysis testing. Results showed that reflex activity impacted the duration of the gait cycle, step length on the left lower extremity, the left double support phase, the right double support phase, and the right single phase. Further analysis showed that children who had a retained grasp reflex and those who had trouble mimicking a certain crawling pattern had the most difficulty with gait cadence compared to other children. Children with a retained symmetrical tonic neck reflex were found to have difficulty with right single support in gait.

Gieysztor, Sadowska, et al. performed a level 2b study that viewed the impact of retained reflexes on other specific aspects of motor function, such as trunk

rotation. A study looking at the angle of trunk rotation in the spines of school-aged children aimed to not only prevent scoliosis, but determine if these childrens' postural concerns may be attributed to retained primitive reflexes. The study tested children for the presence of the spinal Galant reflex, ATNR, and STNR. Around half of the children who demonstrated trunk rotation favored the right side. Most of the children who tested positive for trunk rotation and asymmetry also had a retained spinal Galant reflex present on the same side as the rotation. Trunk asymmetry was more common in female participants rather than male participants. This study showed there is the potential for retained reflexes to impact whether or not a child develops conditions such as scoliosis. While reflex integration therapy may not always be the appropriate solution for children with scoliosis, it should be looked into as a possibility for children with this condition who also demonstrate functional impairments.

Kalemba et al. conducted a level 3b study that took a closer look at the impact of retained reflexes on certain academic abilities of elementary school children between the ages of 5 and 11. Results showed that children with one or more retained reflexes (ATNR, STNR, TLR, spinal galant, and palmar grasp reflex) had more difficulty reading an analog clock and calculating time that had passed than peers without retained reflexes. In particular, there was the strongest relationship between the retained STNR, retained ATNR, and difficulty with telling time on an analog clock. Researchers also found a connection between these reflexes, lower neuromotor maturity, and difficulties with balance and proprioception. The STNR, ATNR, and TLR were also at the forefront of analysis in a level 2b study by Richards et al. Portions of this research team are occupational therapists, who looked at the impact of retained reflexes on children's handwriting. 85% of children who exhibited difficulty with legible writing of letters or words also had retained reflexes. 71% of the same sample size also had vision concerns. In accordance with the consensus in the field of occupational therapy, this study emphasized the importance of providing reflex integration as a part of occupation-based intervention for the best results.

Sigafoos et al. carried out a level 3b study exploring the connection between retained primitive reflexes and conditions such as ASD. These experts posit that certain delays in brain development may cause a spike in maturation of the cortex and other brain networks. This combination of processes has the potential to cause developmental asynchrony, which can result in disparities between certain functional abilities and deficits. While this particular study did not speak to the specifics of reflex integration therapy, many researchers believe there is a close link between cognitive function, motor function, and retained primitive reflexes, specifically as it pertains to ASD. This link is integral in supporting the ideology that inhibiting retained primitive reflexes can instill positive functional changes in individuals with ASD and similar conditions.

Additional studies have aimed to explore a possible connection between retained reflexes and other behavioral health conditions. For example, a level 3b study performed by Bob et al. explored the link between a retained STNR, retained ATNR, and an ADHD diagnosis in elementary students. Several studies found gender played a big part in the link between these variables. Results showed that the presence of a retained ATNR was connected with increased ADHD symptoms and balance impairments in girls. However, greater ADHD symptoms and balance deficits were linked with a retained STNR in boys. This lends even more support to the benefit of integrating certain primitive reflexes to directly improve a child's function and better manage symptoms of ADHD.

A phenomenological study led by Grigg et al. analyzed the experiences of multiple families after they assisted their children with motor interventions to help integrate retained primitive reflexes. This study took a look at the impact of rhythmic movement training (RMT) on children between the ages of 7 and 12 who have retained reflexes. Families had adopted the training on their own through a home use program and reported on their perception of the treatment. When clinicians completed interviews with the families, they found that the majority of participants believed the program was affordable and easy to incorporate into their family's daily routine. They also found it to be an overall low-impact

intervention that positively influenced their child's functional performance and motor skills.

While much of the research on retained primitive reflexes is performed on children, there are some studies that explore their effect on adults. A level 3b study by Plutino et al. looked at older adults who were admitted to an inpatient hospital for cognitive limitations. These patients were evaluated by neurologists who completed reflex testing. This study found that the most common retained reflex in the sample was the palmomental reflex, but participants also demonstrated retained grasp, snout, and glabellar tap reflexes. This study also viewed the interrater reliability of the testing and discovered that the grasp reflex had the strongest reliability out of all reflexes evaluated. Other research suggests that retained reflexes are not only connected to cognitive impairments, but several neurological conditions such as Parkinson disease, dementia, stroke, frontal lobe diseases such as frontotemporal dementia, and amyotrophic lateral sclerosis (ALS). One example is a level 3b study published by Taiello et al. that identified a connection between the primitive palmomental reflex in individuals who have been diagnosed with ALS.

James et al. performed a level 3b study focused on the impact of retained reflexes on grip strength of adults between the ages of 18 and 25. This study tested participants' grip strength while their head was in neutral, actively rotated to the right, and actively rotated to the left. Results showed that participants' right-handed grip strength was greater when the head was rotated to the left. This increase in dominant hand strength in the presence of opposite side head rotation suggests that many participants demonstrated a retained ATNR, which led to more flexor tone. While this was a small study and there are a variety of factors that play a role in hand strength, this shows that retained reflexes may partially contribute to some fine motor strength deficits in adults.

Masgutova Neurosensorimotor Reflex Intervention (MNRI) is another reflex-based intervention that has been studied for its impact on individuals with anxiety

disorders, obsessive compulsive disorder (OCD), developmental disorders, posttraumatic stress disorder (PTSD), epilepsy, ADHD, and ASD. A level 1b study by Tatarinova et al. intended to determine the impact of this modality on a person's neurodevelopment, resiliency, and capacity for learning. Participants in this study must have reported symptoms associated with one or more of the above neurological deficits as well as impaired cognition, social skills, immunity, adaptation to stress, and quality of life. Results showed that individuals experienced more normalized function of their neurological and immune systems as a result of MNRI. On a cellular level, MNRI helped individuals feel more calmness, less hypervigilance, greater resilience in the face of stress, enhanced behavior management and emotion regulation, better control over cognitive functions, and an overall more positive emotional state. While this study was somewhat nontraditional in that its sample consisted of adults with diagnoses in addition to developmental delays, MNRI still demonstrates some promise as a way to remediate the effects of retained primitive reflexes. Although, there are some aspects of the MNRI method that do not coincide with best practice for occupational therapy. For example, the founder of MNRI states that the method should be used on children whose reflexes were integrated but then resurfaced, children whose reflexes never integrated, and children who never demonstrated certain primitive reflexes at all. There is no mention of identifying concerns related to a child's function, so it's important that therapists who utilize reflex integration therapy techniques such as MNRI make modifications to the assessment process to determine the true functional need for this therapy. Traditional MNRI consists of sensory motor pairing, which involves matching the expected sensory response to the expected motor response and providing modeling so the body can appropriately adjust its stimulus response. This process takes place for the basic elements of the reflex in question and then for the more varied elements of the same reflex. MNRI also requires children to participate in integrating exercises that focus on working alongside the basic reflex pattern, working against that same reflex pattern, and then working with and against variations of the reflex. As with traditional motor learning theories, repetition plays a key role in the

implementation of this method. The next step is for the provider who performs MNRI to re-evaluate the reflex state to monitor progress.

While certain intervention methods may have their own tailored evaluations, occupational therapists are trained with their own standardized assessments to help monitor progress and keep patients consistently working toward their outcomes. The next section will be dedicated to functional, developmental, and client-centered assessments that can be used to determine a baseline for patients who are experiencing functional concerns as a result of retained reflexes.

Section 2 Personal Reflection

What are some ways occupational therapists can do a critical appraisal of the evidence surrounding retained reflexes?

Section 2 Key Words

Critical appraisal - The systematic inspection of research studies and evidence, which is intended to evaluate the material's reliability, pertinence, and overall value for certain purposes

Developmental asynchrony - When a child has varied levels of emotional, cognitive, and physical development; this term is typically used to describe the abilities of gifted individuals

Double support phase - A part of the gait cycle during which both feet are in contact with the ground; this happens for 10% of the beginning of the stance phase and for 10% of the end of the stance phase (a total of 20% of the overall gait cycle)

Low-impact intervention - An evidence-based treatment that does not require the assistance of trained experts or specialists and can often be implemented through guided tutorials, self-help guides, and similar tools; this type of intervention is also

considered brief, easy to follow, and comes with modifications to make it more customized

Single support - A phase of gait where only one of the lower extremities is in contact with the ground; it is more common to see 'right' or 'left' added to the title since this is the more descriptive term

Section 3: Occupational Therapy Assessments for Individuals with Retained Reflexes

Evaluations are a crucial aspect of the occupational therapy process. They allow therapists to determine where an individual's deficits lie and help providers formulate appropriate, person-centered goals that are prioritized by the patient and relevant parties such as their family and caregivers.

There are developmental assessments that can help therapists determine the evolving or present reflexes of pediatric or adult patients. While developmental tests can give therapists insight into a patient's potential developmental problems, they should not be the primary assessment used to discern the need for occupational therapy. It is best when developmental assessments are utilized in conjunction with functional assessments, as practical evaluations allow therapists to adhere to the standards set forth by the AOTA. Some standardized assessments that can benefit therapists evaluating individuals with retained reflexes include:

- Alberta Infant Motor Scale (AIMS)
- Assessment of Motor & Process Skills (AMPS)
- Bayley Scales of Infant Development
- Beery-Buktenica Developmental Test of Visual-Motor Integration (Beery VMI)
- Behavior Rating Inventory of Executive Function (BRIEF)

- Bruininks-Oseretsky Test of Motor Proficiency (BOT)
- Children's Assessment of Participation and Enjoyment (CAPE)
- Comprehensive Observation of Motor Postural Skills (COMPS)
- Denver Developmental Screening Test-II
- Developmental Assessment of Young Children (DAYC)
- Developmental Test of Visual Perception
- Dynamic Occupational Therapy Cognitive Assessment for Children (DOTCA-Ch)
- Evaluation Tool of Children's Handwriting (ETCH)
- Goal Oriented Assessment Life Skills (GOAL)
- Gross Motor Function Measure (GMFM)
- Handwriting Without Tears (HWT) Print Tool
- Hawaii Early Learning Profile (HELP)
- Infant/Toddler Sensory Profile
- Jordan Left/Right Reversal Test
- Knox Preschool Play Scale
- Miller Assessment for Preschoolers (MAP)
- Miller Function and Participation Scales (M-FUN)
- Minnesota Handwriting AssessmentPediatric Functional Independence Measure II (WeeFIM II)
- Motor-Free Visual Perception Test (MVPT)
- Motor Planning Maze Assessment (MPMA)

- Movement Assessment Battery for Children
- Peabody Developmental Motor Scale (PDMS)
- Pediatric Evaluation of Disability Inventory (PEDI)
- Role Evaluation of Activities of Life (REAL)
- School Function Assessment (SFA)
- Sensory Integration and Praxis Tests (SIPT)
- Sensory Processing Measure (SPM)
- So Cal Ordinal Scales of Development (SCOSD)
- Test of Handwriting Skills
- The Sensory Profile 2
- Vineland Adaptive Behavior Scales
- Wide Range Assessment of Visual Motor Abilities (WRAVMA)

In order to ensure therapists are focusing on targeted functional concerns, an occupational profile is also an integral part of the evaluation process. This will allow family members, caregivers, and others to identify priority areas that may be impacted by retained reflexes. Therapists may be asked to screen or evaluate individuals with reflex integration therapy as the specific reason for referral, at which point they must take timing and medical necessity into consideration. For example, a child may present to an outpatient clinic with an occupational therapy order from a doctor who wishes for the patient to receive reflex integration therapy. After completing the evaluation process (including performing functional testing, speaking with the child's teachers and family, and administering standardized assessments), the therapist may determine the child demonstrates no functional concerns that are able to be addressed through an occupational

therapist's scope of practice. If this is the case, therapists should be able to succinctly convey the evaluation results to the referring doctor, the family, and other professionals involved in the child's care. At times, this may include giving an overview of the current evidence that states there is no medical need for reflex integration therapy in any individual who is not functionally impaired. In such instances, the evaluation process may stand alone. Yet, the evaluation process should still cover the basic areas such as gross motor strength, fine motor strength, range of motion, coordination, balance, tone, edema, self-care skills, IADL function, cognitive function, adaptive skills, and social function.

Therapists should be sure not to make any clinical judgments or assumptions that are not backed up by standardized testing, functional observation, or other forms of evaluation. If a therapist initially believes a child would not qualify for or benefit from reflex integration therapy based on their functional performance, they should not provide them with treatment in order to comply with the occupational therapy code of ethics. In addition, if any therapist feels that a patient could potentially benefit from reflex integration therapy but they do not have the additional training or experience needed to offer that therapy, it is also part of the profession's code of ethics to make a referral to a qualified professional.

If therapists complete standard occupational therapy assessments and determine there is a functional need for therapy, they can then transition into specific reflex-based assessments if they have been trained to do so.

Section 3 Personal Reflection

How might therapists structure a handwritten evaluation report for a child who has functional limitations as a result of retained reflexes?

Section 3 Key Words

Medical need - Any healthcare or related services, supplies, or procedures that are required to adequately and effectively diagnose or treat an injury, disease, or illness; this includes any reasonable measures taken to identify or treat associated symptoms along with the root cause of a condition, injury, or illness; certain governing bodies (such as Medicare) and various states may have slightly different criteria for medical need, which is also known as medical necessity

Section 4: Occupational Therapy Interventions for Retained Reflexes

13,14,15,16,17,18,19,20,21,22

Therapeutic exercises are a large part of reflex integration therapy. As with any type of exercise, therapists should be sure to educate patients on the importance of slow and purposeful movements. However, this is especially important for reflex integration exercises. There are several reasons for this, one of which is that this speed will help patients maintain the proper body position while carrying out exercises. If a patient doesn't follow the proper movements, they will not be getting the full benefit from the exercises and are likely to still struggle with certain functional tasks as a result of the retained reflex. Another reason for slow, intentional execution is to assist a person in forming a new motor plan for the exercise. If someone has become accustomed to moving a certain way, they will need to devote more mental focus to such tasks if they want to change the way they move. This is the case for all individuals, regardless of their age. By moving slowly and thinking about each movement as it is completed, patients will see that certain actions become automatic and can more easily integrate into their daily lives.

There is no particular order in which therapists should address retained reflexes, since there is no reflex continuum. Yet, when working with patients who have

functional concerns related to more than one retained reflex, it is helpful for therapists to begin integration exercises according to the reflex integration timeline. For example, if a patient demonstrates functional deficits that stem from a retained STNR and ATNR, therapists should begin by attempting to integrate the ATNR. This is because the ATNR should ideally be integrated between 4 and 7 months old while the STNR does not traditionally integrate until 9 to 11 months of age. This timeline can be helpful in structuring treatment sessions according to the source of a patient's functional concerns.

Moro Reflex Integration

Individuals with a retained Moro reflex would benefit from certain therapeutic exercises followed by activities focused on functional interventions. One example of an exercise that can help strengthen children and adults who have a retained Moro reflex is the starfish. In order to complete this exercise, the patient should be instructed to sit in a chair and abduct their arms and legs so their body forms an 'X.' From there, the patient should count to five while moving slowly to the next position, which involves crossing the right arm over the left arm on top of the chest and crossing the right leg over the left leg at the ankle. The patient should move slowly and count to five again while reassuming the first position with both arms and legs abducted. The last step is to move slowly while crossing the left arm over the right arm on top of the chest and crossing the left leg over the right leg at the ankle. Ideally, patients should complete this sequence 10-20 times on each side of the body. Therapists should also ensure they instruct patients to extend their neck when their extremities are abducted and flex their neck when their extremities are crossed. Providers must also emphasize slowness of movement as patients progress through this sequence, since reflex integration exercises require purposeful, controlled motions. Some functional activities that pair well with reflex integration therapy exercises for the Moro reflex may include donning and doffing a pullover, hugging, cleaning overhead, and washing one's hair. Upgraded

therapeutic activities to help with integrating the Moro reflex include jumping jacks and various yoga poses.

Rooting Reflex Integration

Individuals who demonstrate a retained rooting reflex that is impacting their functional performance should practice facial exercises with the help of another person, if needed. One of the chief therapeutic exercises for the rooting reflex is similar to how someone would test for the rooting reflex. In order to facilitate this, a therapist should instruct the patient to use light pressure and stroke their cheek horizontally from the ear to the mouth. They should do this three times, going 1/2 inch lower each time. The next step involves using light pressure to stroke vertically on the cheek from the nose to the chin. They should do this three times, going 1/2 inch lower each time. For the best results, patients should perform three vertical and horizontal strokes on each side of the face five times each day.

Palmar Reflex Integration

If a patient has a retained palmar reflex, they can benefit from exercises focused on fine motor strength. Therapists can instruct patients to use play-doh, therapy putty, a resistance ball, or similar materials to strengthen their fingers. The type of material the patient uses may be dependent on their sensory abilities, but any of the above will work. The presence of an object helps the patient separate the palmar input from the movement of their fingers. They should start by placing their material of choice in the palm of their hand and firmly grasping it with all fingers at the same time. Then they can extend their fingers to relax before repeating the same sequence using digit opposition. The patient should start by bringing the index finger down to attempt to touch the thumb with the material still in their palm. After extending the fingers fully again, they will oppose the middle finger and the thumb followed by the ring finger and the thumb and, lastly,

the pinky and the thumb. For the best results, patients should complete the entire sequence of the palmar reflex integration exercise 10-20 times each day.

ATNR Integration

Individuals whose functional capacity is limited by a retained ATNR may practice two exercises. The first involves a patient lying prone with their head turned to the right side. Therapists should then direct the patient to move their right extremities into the shape of an L, which requires them to keep their left arm adducted while abducting their right arm and flexing the elbow. Patients should mimic the same positioning in their lower bodies by keeping their left leg adducted while abducting the right leg at the hip and flexing the knee. The next step is to keep their body in the L shape while turning their head to the left side. After this, patients should adduct all of their extremities to bring their body back to the center. They should then move their left extremities into the same L shape by adducting the right arm while abducting the left arm and flexing the elbow. The patient should reflect the same position in their lower body by adducting the right leg while abducting the left leg and flexing the knee. After the patient has achieved the L shape on the left side of their body, therapists should instruct them to turn their head to the right side before adducting all extremities. For the best results, therapists often instruct patients to complete this variation of the ATNR integration exercise between 20 and 30 times each day.

Another ATNR integration exercise that therapists can educate their patients on takes place in standing. The initial position involves placing the arms straight out in front of the body at a 90 degree angle with both palms down. The patient should then turn their head to one side and run in place with a particular emphasis on getting their knees as high as they can. They will do this for 10 seconds before turning their head to the opposite side and immediately repeating the same sequence. It’s recommended that patients practice this exercise three times on each side each day.

Galant Reflex Integration

A retained spinal galant reflex may impact several aspects of a patient's functional performance. For this reason, starfish exercises are effective in helping integrate this reflex. The starting position for spinal galant integration exercises is lying supine with straight legs and both arms adducted at the side of the body. Therapists should then instruct patients to slowly move their arms and legs up and out at the same time so their body forms a large X. Once the patient achieves the X position, they should bring both arms and legs back toward the body and reassume the starting position. Patients performing starfish exercises should be sure to focus on slow and purposeful movements. Therapists can encourage this type of movement by teaching patients to count to 15 as they spread their arms and legs and count to 15 as they bring their extremities back together. For the best results, patients should perform this exercise 10 times daily.

TLR Integration

Individuals who demonstrate functional concerns stemming from a retained TLR could benefit from several exercises to assist with integration. The first involves the patient lying prone with their legs extended on the floor behind them and their arms straight in front of them supporting their upper body. This is known as the superman pose. Once a patient assumes this position, therapists should instruct them to lift their arms and legs off the floor and hold for 15 seconds. Therapists often recommend this exercise be performed 10 times each day.

Another exercise to assist individuals with a retained TLR involves having someone lay on the ground in supine. The patient should slowly bring their knees in toward their chest with their arms wrapped around their legs. They should also tuck their chin in toward their legs, close their eyes, and slowly lower their legs until they are flat on the ground. Therapists should pay close attention to the patient's posture in this exercise, since it's important for the patient's elbows to face out to each side when their arms are holding their legs. It's also common for children to

struggle holding their head off the ground when tucking their chin, so this is often an area to work on. Patients should practice this exercise continually until they are able to hold their legs in toward their chest for 15 seconds before lowering them to the ground. As with the first TLR exercise, it's best for patients to practice this sequence 10 times each day.

Finally, a graded prone-on-elbows position can also help individuals with a retained TLR. Therapists can have individuals lie prone with their upper body propped up by their elbows. Therapists can have patients start by holding this position for 30 seconds and eventually work their way up to 3 minutes per day. Therapists should also ensure that patients are not contracting the muscles in the lower body, including the legs and gluteus, since this will benefit the upper body the most. This position can easily be incorporated into OT sessions, as therapists can have patients complete a variety of fine motor, visual motor, and other relevant activities in this position. Patients who particularly struggle with this posture may need to use a bolster, cushion, or other support and then therapists can upgrade the exercise to eliminate these materials.

STNR Integration

In order to address functional concerns related to a retained STNR, therapists should guide patients through exercises that are similar to the cat and cow poses in yoga. The starting position is the cat position, which involves a patient in quadruped with their back arched, head down, and chin tucked in toward their chest. From there, therapists should guide patients to reverse that position and assume the cow pose. The cow position involves remaining in quadruped, but curving their back the opposite direction so their stomach gets closer to the floor while their head comes up and back. Some people may find it difficult to respond to multiple commands when switching positions during the STNR exercises. For this reason, it's recommended that therapists give combined directions. For the cat pose, this might involve saying, "Make your chin touch your chest while you

look at your belly button" and for the cow pose, this might mean telling the patient to look up toward the sky.

Important Considerations

Home programs are an essential aspect of any plan of care, and reflex integration therapy is no exception. However, therapists should wait a few weeks before instructing patients to complete these exercises at home. Therapists can easily train caregivers, parents, and other involved parties to implement these exercises outside of sessions, but it's crucial that patients first have a good foundation of correctly completing them during sessions. As we mentioned earlier, body mechanics and pacing are key to successful completion and will help patients reap the full benefits of the exercises. Patients, caregivers, and anyone else assisting patients with exercises should understand the importance of discontinuing the exercises if they experience any pain or discomfort. They should report this outcome back to their therapist, who can investigate further and inform them of the next steps.

Therapists also often wonder if it's appropriate to provide tactile cueing or hand-over-hand assistance as patients complete the exercises, since this is typical for some patients' therapy sessions. Because of how important it is for patients to get the sensory input from proper movements, hand-over-hand assistance is helpful for patients who cannot independently initiate a reflex integration exercise on their own. This is acceptable to a certain point, but therapists should write goals for patients that encourage them to complete the exercises without direct physical input, since that will be the most beneficial for patients. In addition to completing the exercises independently, another indication of patient progress is being able to pass the reflex test without signs of retention. This means that therapists should observe a patient's ability to attain the position correctly, hold it for a certain period of time (which is intended to increase over the plan of care), and complete the reflex testing without any concerns. Therapists can preface

reflex integration exercises with any techniques that help the patient learn better. For example, if a therapist has identified that a patient is more of a visual learner, the therapist can utilize videos, pictures, mirrors, and in-person demonstrations to teach them the exercises. Similarly, therapists can take advantage of multi-modal strategies that are catered to the individual person and their needs.

In terms of documentation, therapists should be familiar with the idea of justifying all activities in relation to their functional impact. The same ideology applies to reflex integration therapy, so therapists must emphasize function each step of the way when they are writing any type of documentation. Therapists must start by outlining the connection between a patient's functional deficits and their retained reflexes in the evaluation as well as the patient's goals. In addition, therapists should include the clinical reasoning for exercises and their connection to functional activities in all session notes. In order to assert the need for continued treatment, therapists must document progress in functional outcome measures when they reevaluate patients. Each of these steps outlines the gains that patients are making while also securing reimbursement from third party payors. In addition, accurate and relevant documentation helps support the distinct role of occupational therapy in assisting patients with functionally significant retained reflexes.

Section 4 Personal Reflection

What type of terminology should therapists include in documentation to convey a patient's progress in the area of reflex integration?

Section 4 Key Words

Continuum - An ongoing sequence of events or other objects that are interrelated and blend together

Digit opposition - A movement that involves touching the tip of the thumb to the tip of another finger

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