

AQUATIC SENSORY PROCESSING

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All species on this earth respond or react to sensory input. Mammals use vision, hearing, smell, taste, touch and movement to negotiate the world and identify friend from foe, safety from danger, and rest from stress. Mammals communicate a variety of emotions through sounds which communicate or seek information, body postures, eye movements, facial expression and body temperature to name a few. Sensory is the foundation of all the higher skills that any species can attain. And sensory dysfunction disrupts any potential of acquiring higher level skills.

We often think that sensory processing (the ability to take sensory information into the brain, process and analyze it, and produce an adapted response) is a concern for children, especially in the early years of development. However, sensory processing is a lifelong activity and can be disrupted at any point in time. For example, sensory input begins while a child is in the womb. Movement of the mother provides stimulation to the child, the fetus changes head positions by twisting and turning which facilitates the vestibular system. As the fetus grows, the proprioceptive receptors are stimulated as the child pushes with its hands, feet, head and body against the mother's body. The child receives sounds from the outside world, feels the emotions of the mother, feels temperature differences, and is developing the touch receptors necessary for protection or discrimination.

Through the early years of life, children develop the sensory systems which directly affect the development of all other domains (motor, language, social, cognitive, behavioral). Atypical development of sensory skills (sensory overload) is often seen in children with Attention Deficit Hyperactivity Disorder, Sensory Integration dysfunction, Cerebral Palsy, Autism, general anxiety disorders, spinal cord injuries and Post Traumatic Shock Syndrome to name a few.

Throughout the lifespan, our ability to process sensory input varies depending upon our home and work environments, our emotional state, our health and wellness to name a few. We modulate input on a daily basis to be able to cope with changes in our daily lives. As we age, we see changes in how we process information due to the natural aging process, or more significantly, changes to our health. Diabetes, Parkinson's Disease, Fibromyalgia, PTSD, Chronic Pain and Strokes are examples of conditions that may cause our vestibular, proprioceptive, tactile, auditory, gustatory, and visual processing to change ... or may be the outcome of sensory issues.

Water Properties and Outcomes

When developing aquatic plans for individuals, knowing the effects of the water on the sensory system, regardless of age, is an important aspect of service delivery. Hydrostatic pressure, viscosity, buoyancy, turbulence as well as environmental stimuli all affect the outcome of treatment.

Hydrostatic pressure applies force on a submerged body. It surrounds the body in all directions. This pressure provides a calming effect when a body is at rest. Deep pressure decreases the effects of tactile hypersensitivity. Combined with movement (resistance), it facilitates proprioceptive input, increasing awareness of position in space and efficient graded movement. Hydrostatic pressure assists in decreasing edema, increases work of inhalation by providing resistance to the chest, increases blood flow, helps dull pain when tactile nerve endings have been assaulted.

Buoyancy is the upward force that is exerted on an object. The ability to float is strongly influenced by buoyancy, depending upon the person's muscle mass/density, ability to activate muscles to maintain position. Buoyancy challenges postural control and allows for more active range of motion. Because of offloading weight through the lower extremities, joints are subjected to less force which assists in decreasing pain. However, with the reduction of weight bearing, the individual may be challenged to maintain proper alignment or control due to decreased proprioceptive and vestibular input through the feet.

Resistance is a force produced against another force. Moving in the water is resisted by buoyancy. Resistance is changed by the speed of movement and positional changes. Resistance builds strength, provides proprioceptive input to the joints, assists with postural control. (Resistance bands can be used in the water to assist with muscle control, graded movement and strengthening.) Water viscosity is a form of resistance providing proprioceptive input which assists with increased trunk stability and postural control. One challenge of resistance is the increase of input to the vestibular and visual systems. As the water moves faster, visual distortion (refraction and reflection) occurs. This in turn can confuse the vestibular system and compromise a person's position in space and postural security.

Viscosity provides resistance to movement and can be altered by the amount of frontal surface being used. For example, a hand slicing through the water will offer less resistance than an open hand moving in the same direction and speed. By creating a larger surface area, proprioceptive input can be increased and produce an adapted response. Less surface area to move through the water may benefit individuals who lack strength.

Temperature of the water can affect the parasympathetic and sympathetic systems. Warmer temperature:

- promotes muscle relaxation
- decreases tactile defensiveness
- increases blood flow
- decreases pain
- decreases spasticity and
- increases flexibility

Sensory Activities Using Water Principles

Hydrostatic pressure

- Using gel filled balls (neutrally buoyant weighted balls). Hold ball with 2 hands and push it to another person (tactile, proprioceptive). Catch the ball when it is pushed back to you (visual).
- Play soccer: Kick a weighted ball from one foot to the other or to another person (proprioception, balance, position in space)
- Hold a ball or Frisbee in right, sweep the ball or Frisbee across the body to the left hand, catch with the left hand (proprioception, tactile). Sweep back to the starting point. Inhale before initiating movement, exhale as equipment moves from one side to the other to strengthen respirations, provide additional postural control. Repeat from one side to the other.
- Go underwater and pick up diving toys (tactile, proprioception, visual, decreased auditory)

Buoyancy

- Float in stillness on back (vestibular input, vision partially occluded when looking up, auditory input decreased with ears submerged. Can be challenging for individuals with gravitational insecurity)
- Float on stomach in stillness (vestibular input, vision partially occluded if face in water). If head is in face forward position, legs will sink. May use flotation assist to increase awareness and tactile input.
- Have relay races when riding noodles or holding kickboards: Change ways to travel: bicycle, kick, paddle arms, blow bubbles (you choose).
- Tuck your legs and hold as long as you can (count the seconds).
- “Jump the log” exercise (jump forward and backward).

Resistance

- Try different hand positions and equipment (slicing hands, fisted, open palm, gloves, exercise equipment)
- Wear fins to extend the length of the lever / and the participant has good plantar and dorsiflexion (proprioception)
- Bubble making: Push arms firmly down through the water, watch the bubbles come up (Proprioception, visual, tactile, auditory)
- Use resistance bands for strengthening (proprioception). For young children or individuals with limited strength, braided sponges work well.
- Kickboard challenge: 2 people, 1 kickboard. Each person holds one long side of the kickboard, facing each other. On “go”, kick as fast/hard as possible to try to stay in place (proprioceptive, tactile, vestibular)

Viscosity

- Walk forward, backward, or sideways keeping an upright posture (proprioception).
- Push and pull the water , keeping hands under the surface.
- Change speeds and frontal surface to change work (Tactile, proprioceptive)

Environmental...

Temperature

- If pool is cool, use neoprene jacket or vest to keep warm.
- If water is too warm, include water breaks, moving into shallower water to access cooler air.

Sound (vestibular,auditory system)

- Try to keep noise and ambient sound to a minimum to allow for auditory focus on practitioners
- Encourage deck shoes to decrease tactile input when on deck
- Use a whistle to gain attention of participants (will help with auditory desensitization, auditory localization)
- Use picture cards or schedules as needed to increase visual focus

The water provides all types of sensory experiences and promotes a sense of well being for anyone of any age who may experience sensory disruptions. Awareness of how any activity is influenced by the principles of water will add value to activities.

Resources

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