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Interoception: The Hidden Sensory System

Rondalyn V. Whitney, PhD, OTR/L, FAOTA
Learning Outcomes

- 1) Describe key concepts related to the interoceptive system
- 2) Recognize the function-dysfunction continuum within the interoceptive system
- 3) Articulate intervention strategies to improve sensory processing and integration of the interoceptive sensory system

Review of Ayre’s Sensory Integration Theory

- Postulates that adequate processing and integration of sensory information is an important foundation for adaptive behavior.

- In sensory integrative dysfunction the brain does not process or organize the flow of sensory impulses in a way that gives the individual precise information about him/herself and the world.

- Somatosensory refers to the body and the senses together and can be used synonymously with sensory motor or sensorimotor.
The Five Senses + Three

The five senses
  Seeing (vision)
  Hearing (auditory)
  Touching (tactile)
  Smelling (olfactory)
  Tasting (gustatory)

Plus three
  Proprioception (position orientation)
  Vestibular (spatial orientation)
  Interoception (internal organs)

[Need to mention: Praxis/Kinesthetic(movement orientation)]
For example:

- Vestibular, proprioceptive, and tactile all contribute to body awareness
- Body awareness is necessary for concentration, organization, self-esteem, etc.
- Performance skills: sensory-perceptual, emotional, cognitive, communication/social

AND interoception

Integrate (inputs come together)

For the end products: Performance (resilience) and social engagement
The drive to engage in occupation is the mechanism through which children develop skills and competencies.

Core Elements of Sensory Integration Intervention Process (fidelity measures)

- Therapist’s Behavior and Attitude
- Provide just-right challenges
- Collaborate on activity choice
- Guide self-organization
- Support optimal arousal
- Create play context
- Maximize child’s success
- Ensure physical safety
- Arrange room to engage child
- Foster therapeutic alliance

Why Sensation is Important for Learning

The brain learns best when aroused to attend to the learning opportunity.

If an internal sensation is demanding priority, we are not available to shift (move on from our internal need) to the external demand being placed upon us and so we miss out on the teaching.

Postulates of Sensory Integration Theoretical Base

1. An optimal state of arousal is a prerequisite for adaptive responses to occur.
2. Sensory integration occurs during adaptive responses.
3. Multiple sensory systems may be needed to facilitate an optimal state of arousal.
4. Adaptive responses must be directed toward child’s current developmental level.
5. Activities that reflect “just right challenge” produce growth and development.
6. Problems with sensory modulation or in foundational abilities contribute to deficits in end product abilities.
Postulates of Sensory Integration Theoretical Base (cont.)

7. Child needs to be self-directed, with therapist guidance, for sensory integration to occur.

8. Adaptive responses are elicited through activities that facilitate sensory modulation, discrimination, and integration resulting in improved postural control, praxis/ bilateral integration, and participation.

9. Intervention is directed to underlying deficits in sensory modulation, discrimination, integration, and/or foundational abilities and not toward training in specific skills or behaviors.

10. As child achieves increasingly complex adaptive responses in therapy, changes will be evident in outcome abilities such as self-regulation, self-esteem, social participation, academic performance, and participation in daily life routines and activities.

Atypical sensory processing may present as

- Poor sleepers
- Poor eaters
- Hard to soothe
- Unresponsive to others

Or by

- Using less than optimal strategies in an attempt to regulate their arousal state (hand flapping, rocking, head banging)
### Function-Dysfunction Continuum

<table>
<thead>
<tr>
<th>Function</th>
<th>Dysfunction</th>
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</thead>
<tbody>
<tr>
<td>1. Optimal state of arousal</td>
<td>1. State of arousal not optimal to support adaptive response</td>
</tr>
<tr>
<td>3. Multiple sensory systems working together</td>
<td>3. One or more sensory system out of sync with the others= non-optimal state</td>
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<tr>
<td>4. Adaptive response at child’s current developmental level</td>
<td>4. Immature adaptive responses</td>
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<tr>
<td>5. Able to tolerate frustration when given age appropriate tasks</td>
<td>5. Poor frustration tolerance, avoidance strategies</td>
</tr>
<tr>
<td>6. Adaptive sensory modulation, age appropriate end product skills</td>
<td>6. Maladaptive sensory modulation, delays in age expected end product skills</td>
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</tbody>
</table>

7. Child self-directed
8. Participates in sensory activities
9. Age appropriate development
10. Tolerates increasingly complex challenges

7. Delays in independence
8. Avoids sensory based play
9. Developmental delays (underlying sensory-motor)
10. Maladaptive responses to daily life routines and activities
Case: Winnie

Winnie is a 9-year-old girl with challenges in sensory processing and sensory integration that affect her participation in daily occupations and limit her social opportunities.

An occupational therapy evaluation identified difficulties in the area of self-care, sensory processing, and social interactions. Winnie’s mother describes her as high strung and says that she can be snobbish. She has only one friend. Her mother states that Winnie grows extremely anxious when her routine is interrupted and she has difficulty recovering – she says she ‘can’t breathe’ and her heart is so loud it hurts her ears. When overwhelmed, Winnie is diagnosed with encopresis and has occasional ‘accidents’, wetting her pants. Asthma has been ruled out. Mother and father are very concerned about Winnie’s behavior (avoidance, tantrums) and lack of interest in activities outside the house. She is overly avoidant of novel experiences. She has poor frustration tolerance and will become anxious to the point that she will cry or tantrum. As a child she refused to nap, and even now, transitioning to sleep can result in tears and tantrums.

Function – dysfunction

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<tbody>
<tr>
<td>X</td>
<td>Optimal state of arousal</td>
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<td>X</td>
<td>Adaptive response to sensation</td>
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</table>
Thinking about Interoception

Interoception is the sense that helps you understand your 'internal state', what's going on inside your body.

Interoceptive system is the sensory system of the internal organs (e.g., heart rate, hunger, digestion, state of arousal, mood, etc.). That's where the receptors are

When there is dysfunction in this system, a person has trouble knowing when they feel hungry, full, hot, cold, have a full bowel/bladder or thirsty.

Goal: Homeostasis

Feel

Act

Regulate
Emotional awareness...

Activities to build an emotional Vocabulary

- Label your own emotions
- Label your child’s emotions
  (tie these to the body’s sensations)
- Put emotions on a continuum
**Zones of Regulation**

- **Blue**: Calm, happy, comfortable, ready to learn.
- **Green**: Good, positive, doing a good job, feeling okay.
- **Yellow**: I need help with this, I am anxious, I am having trouble.
- **Red**: I am feeling very angry, I am mad, I need to cool down.

**Feelings Word List**

- Happy
- Sad
- Scared
- Surprised
- Angry
- Surprised
- Confused
- Tired
- Bored
- Frustrated
- Hungry
- Sleepy
- Curious
- Amazed

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**When I feel.... My body...**

- **Angry**: My cheeks get hot, I grit my teeth, my stomach hurts...
- **Lonely**: My shoulders roll forward, my head tips forward, my breathing is long and slow

**Emotional awareness** → **Lack of awareness of body signs**

**Body Scans: Check your body!**
Breath

Spider Races
Sensory strategies to help with sleep/Interoceptive system

1. Use the dark to create sleep/wake rhythms
2. Make bedtime a routine (use external cues to compensate for the lack of internal cues)
3. Overt relaxation to compensate for lack of internal capacity (Rainbow relaxation).
4. Use sensory strategies (proprioception/deep tactile)
5. Reduce anxiety (monster spray, routine, etc.)

https://www.aota.org/~media/Corporate/Files/AboutOT/Professionals/WhatsOT/HH/Facts/Sleep-fact-sheet.pdf
All learning occurs through the senses

- Input ===> Learning ===> application
  - Sensory in ===> motor out
  - Faulty input in (distortion in sensory input)
  - Faulty motor out (demonstration of learning / work product)
Remember:
Types of sensory patterns (profiles)

- Atypical sensory processing in interoceptive system
- **Over-responsivity** to your heart beat, thirst, temperature, bladder/bowel sensations
- **Under-responsivity** to your heart beat, thirst, temperature, bladder/bowel sensations
- **Poor modulation** such as being unable to respond to sensation (your heart beat, thirst, temperature, bladder/bowel sensations) with behaviors that are consistent with the intensity of the input.

Sensory modulation of Interoception

- Individual’s ability to respond adaptively to sensation over a broad range of intensity and duration
- Supports optimal arousal, attention, and activity level to meet the demands of the environment
Sensory discrimination of interoception

- Individual’s ability to interpret and differentiate between the spatial and temporal aspects of sensory information
  - Where is it?
  - What is it?
  - When did it occur?

Postulates Regarding Change for Sensory Modulation

- Intervention must be directed towards facilitating an adaptive response.
- Opportunities for AR’s in one sensory system will likely lead to AR’s in other sensory systems.
- When sensory modulation is brought to an optimal level, problems in other areas can be better addressed.
- Understanding of the sensory modulation issues allows life activities and routines to be structured to support optimal arousal.
- Support of the child’s engagement in play that modulates sensory input will help develop self-regulation.
HOW?
Start with what you know

- Proprioception and deep pressure are organizing
- Input to the cells but impact (organization) is at the neuro-physiological (brain to body) level
- Modulation aka homeostasis aka regulation aka resilience aka recovery aka ‘bounce back-ability’ aka adaptive coping

Case

Mary is 6 years old, she has no diagnosis but she has yet to achieve independence with toileting, frequently wetting or soiling herself at school. She says she just ‘doesn’t realize’ when she has to go. She also has difficulty falling asleep at night and will not nap at school. Mary is a quiet child, and often seems somewhat ‘tuned out’.

Using a sensory approach, specifically the interoceptive system, discuss what might be happening?

So how do we treat bowel and bladder?
Sleep dysregulation?
Continued

Intervention must be directed towards facilitating an adaptive response

- Listening to your body
- 5 point breathing (Breath in/ out…)

Continued

Opportunities for adaptive response in one sensory system will likely lead to AR’s in other sensory systems

- Proprioception
- Deep Pressure
- Vestibular
- Tactile
- Auditory
- Visual
When sensory modulation is brought to an optimal level, problems in other areas can be better addressed.

Understanding of the sensory modulation issues allows life activities and routines to be structured to support optimal arousal.
Support of the child’s engagement in play that modulates sensory input will help develop self-regulation.

It’s important to develop organizing routines and positive habits. Because at the end of the day, development is in fact, child’s play.
References:

Questions?

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