Sensory Processing: Implications for Physical Therapists

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Presented by: Niamh Tunney, PT, DPT, MS; Alyssa LaForme Fiss, PT, PhD, PCS

Session Description: This course will provide a general overview of examination and intervention strategies to address sensory processing impairments across the lifespan. The four main types of sensory processing disorders will be described including problems with sensory modulation, sensory discrimination and perception, vestibular processing and dyspraxia. The subcategories of sensory modulation and the typical presentation of these subcategories will be emphasized (sensory seeking, sensory hyporesponsivity, sensory hyperresponsivity, and sensory avoiding), and participants will self-assess their own sensory modulation using the Adolescent and Adult Sensory Profile. Basic intervention strategies to address various sensory modulation disorders will be presented. Case examples will be discussed in small group settings to integrate examination and intervention techniques for use in the clinic environment.

By the conclusion of this course, participants will be able to:

1. Identify and describe the four main categories of sensory processing disorder
2. Compare and contrast the four subcategories of sensory modulation
3. Understand the administration and scoring of the Sensory Profile
4. Discuss the available research on sensory processing interventions
5. Identify the appropriate use of various sensory interventions
6. Apply examination and intervention knowledge to patient case examples

Presenter Bio(s):

Niamh Tunney PT, DPT, MS is a Clinical Assistant Professor in the Department of Physical Therapy at Mercer University, Atlanta Georgia. Dr. Tunney completed her Master of Science degree at Georgia State University, her Doctor of Physical Therapy at MGH Institute of Health Professions, and she qualified as a physiotherapist at Trinity College Dublin, Ireland. She practiced full time in neuro-rehabilitation for 17 years. Her teaching focus is in the area of neurorehabilitation and neuroscience.
Alyssa LaForme Fiss, PT, PhD, PCS is an Associate Professor and the Interim Department Chair at Mercer University, where she teaches courses in research and pediatric physical therapy. She completed her Bachelor and Master degrees in Physical Therapy at The Ohio State University. She completed her PhD in Rehabilitation Science from the University of Kentucky. Dr. Fiss is board certified as a Pediatric Clinical Specialist and continues to provide services for children with disabilities.
Sensory Processing: Implications for Physical Therapists

Pre/Post tests

1. A patient with poor tactile and proprioceptive processing, difficulty with fine motor and manipulation skills, difficulty grading force of movements, and decreased body awareness and motor planning may be displaying:
   a. Dyspraxia*
   b. Vestibular discrimination disorder
   c. Postural-ocular movement disorder
   d. Sensory modulation disorder

2. Which strategy may be most beneficial to facilitate engagement of a person who demonstrates sensory hypo-responsiveness in intervention activities?
   a. Use headphones to modulate noise
   b. Use slow, smooth, rhythmical swinging prior to intervention for calming
   c. All of the above
   d. None of the above*

3. The PT treats a child with sensory integration dysfunction. His mom notes that the child does not like to get messy, is a picky eater, and will only wear shirts without tags. While observing this same child on the playground, the PT notices the child spinning repeatedly in circles until they fall over. The PT determines this child may have:
   a. Over-responsive tactile and vestibular systems
   b. An over-responsive tactile system and under-responsive vestibular input*
   c. Under-responsive tactile and vestibular systems
   d. An under-responsive tactile system and over-responsive vestibular system.

4. A patient presents with the following behaviors: hyperactivity/ constant movement impulsivity/ risk-taking behavior/ seeking of touch or pressure, enjoyment of LOUD sounds/ busy environments and enjoyment of spicy, hot or sour foods/ chewing/ crunchy foods
   This person is most likely:
   a. Sensory seeking*
   b. Hypersensitive to sensory input
   c. Sensory avoidant
   d. Dyspraxic

5. Research supports that sensory processing disorders experienced by adults are similar to those experienced by children
   a. True*
   b. False
Sensory Processing: Implications for PT
Alyssa LaForme Fiss, PT, PhD, PCS
Niamh Tunney, PT, DPT, MS
September 30th 2016

Sensory Processing
“Neurological process that organizes sensation from one’s own body & the environment & makes it possible to use the body effectively within the environment” (Ayres, 1989)

Sensory Processing Disorders
“denote(s) the diagnosis of difficulty in processing sensory input in an efficient & accurate manner, & includes the accompanying behavioral, attentional, motoric, & functional manifestations”

Miller, Cermak, Lane, Anzalone, & Koomar, 2004
SENSORY SYSTEMS

Sensory Systems
1. Sight
2. Smell
3. Taste
4. Sound
5. Touch
6. Vestibular
7. Proprioceptive

SENSORY INTEGRATION

Role of the Central Nervous System
• Take in/process sensory stimuli
• Filter out irrelevant information
• Prioritize
• Adapt to change
• Regulate arousal levels
• Produce a behavioral response

SENSORY PROCESSING DISORDERS

1. Sensory Discrimination Disorder
2. Postural-Ocular Disorder
3. Dyspraxia
4. Sensory Modulation Disorder
Sensory Discrimination Disorder

Difficulty differentiating & interpreting differences or similarities in qualities of stimuli
– Tactile discrimination & perception problems
– Proprioceptive problems
– Visual perceptual problems

Postural-Ocular Disorder

Problem with control of posture or quality of movements seen in low muscle tone or joint instability and/or poor functional use of vision.

Often seen with vestibular and proprioceptive problems

Dyspraxia

Problem with planning, sequencing & executing novel motor activities

Decreased body awareness & motor planning
Behavior

Disclaimer:
Not all behaviors have an underlying sensory cause!

Need for observation to differentiate!

Sensory Modulation

Ability of CNS to appropriately grade and generate responses to incoming sensory stimuli.

Continuum

Dunn’s Model of Sensory Processing

Neurological Threshold: Amount of stimuli required to produce behavioral response.

Behavioral Response: Anchored by acting passively and actively in relation to one’s threshold.
Dunn’s Model of Sensory Processing

Sensory Seeking

- Under responsive to sensory stimulation
- Actively seeks sensory information

Behaviors

- Hyperactivity/ constant movement
- Impulsive/ risk-taking behavior
- Seeking of touch or pressure
- Difficulty understanding personal space
- Enjoy LOUD sounds/ busy environments
- Enjoys spicy, hot or sour foods/ chewing/ crunchy foods
- Enjoy sensory experiences
Sensory Hyporesponsiveness
(Low Registration)

- Delayed responses to sensory information
- May demonstrate low muscle tone
- High sensory thresholds & passive self regulation

Behaviors

- Passive/ Low energy/ Slow/ Lethargic
- Miss cues that might guide their behaviors
- Hard to motivate/ Uninterested in surroundings
- High pain/ pressure thresh hold
- MAY be easier to focus in a distracting environment
- Does not notice when clothing twisted or uncomfortable limb/ body positions

Sensory Hyperresponsivity

- Sensory sensitivity
- Passive strategies
Behaviors

- Distractible
- High level of awareness of environment & tendency to attend to detail
- Prefers quiet or predictable activities
- Prefers routine and structure
- Over stimulated easily

Sensory Avoiders

- Sensory avoidance or sensory defensiveness
- Fight or flight response
- Active response to sensation

Behaviors

- Actively avoids sensory stimulation
- Avoids hugs/kisses/light touch
- Particular with clothing
- Hair washing/bathing difficult
- Cautious/unwilling to try new things
- Over reacts to small movements
- Strong dislike of crowded or loud environments
- Picky eaters
- Aggression
Blogger Experience

- Account of own experience as an adult with SMD and its impact on her life
- Sound and sight turned way up and touch and proprioception turned way down.


RESEARCH

- Sensory processing disorders experienced by adults are similar to those experienced by children (Brown et al 2000).
- Lower levels of participation in all important areas of life for children with SMD (Tamar Bar-Shalita et al 2008)
• Adults who are over-responsive to environmental stimuli have very different daily life experiences to other adults. (MKennealey et al 2011)

TBI and SMD

• Sensory deficits may underlie behavior changes in adults post TBI
• TBI results in changes in how people process sensory information, therefore it is possible that the sensory changes are related to the behavioral changes (DS Alwis et al 2013)

Assessing Sensory Modulation
Assessment of Sensory Modulation

Clinical Observation
Caregiver/ Team Report
Standardized Testing

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Purposes of Sensory Profiles

Provide information on how individual processing sensory information

Enable more informed intervention planning

Found to be valid & reliable & can be applied clinically when designing interventions (Brown, et al, 2000)

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Directions

Answer 60 statements on the following scale:

- Almost never (1)
- Seldom (2)
- Occasionally (3)
- Frequently (4)
- Almost always (5)
Directions

Transfer raw item scores into corresponding item numbers in each Quadrant on page 5.
Add values to obtain Quadrant Raw Score Totals
Transfer Quadrant Raw Score Totals to the correct Summary Chart on page 6.
Plot scores in the appropriate classification column

Directions

Circle the symbol that matches classification information for that quadrant on page 7.
Can then use these descriptions to assess sensory modulation & help design interventions.

Profiles

Quadrant Scores
Joe obtained scores indicating performance similar to most people in:
- Sensory Sensitivity
  - Sensation Avoiding

Joe scored in the Less Than Most People range in these quadrant(s) which indicates the possible need for further assessment in these areas:
- Sensation Seeking

Joe scored in the More Than Most People range in these quadrant(s) which indicates the possible need for further assessment in these areas:
- Low Registration

Individuals with Low Registration tend to miss signals unless they respond to stimuli that others notice. In general, they may have trouble reacting to rapidly presented low-intensity stimuli. They may not detect a smell that bothers everyone else in the room, or be the last one in the room to understand a joke. On the other hand, such individuals may suffer to focus on tasks of interest in distracting environments.
Sensory Profile

Reproducible charts provide an intervention matrix across the quadrants and six sensory processing categories

- taste/smell processing
- movement processing
- visual processing
- touch processing
- activity level
- auditory processing

Administration with Individuals with Severe Disabilities

May adapt administration procedures to allow a caregiver to answer the questions.

Cannot use classification system based on comparative results using standardized procedures.

Can use clinical judgment to assist in understanding of the sensory processing patterns and design intervention strategies

Sensory Modulation Adult Checklist

- Not a valid reliable measure, but an informal checklist. Not an outcome tool.
- Very long – 138 items to check
- Only check those that apply to you
- Headings:
  - Sensory modulation
  - Sensory discrimination
  - Sensory based motor skills
  - Social/Emotional
  - Internal Regulation
INTERVENTION

• SI intervention shows improvement in some measures but not others compared to activity intervention and no intervention (Miller et al 2007)

• Systematic review for children with CP indicated that SI intervention was ineffective and that sensory processing intervention was weak (Novak et al 2013)

Sensory integration therapy and Autism - systematic review

• “The current evidence-base does not support the use of SIT in the education and treatment of children with autism spectrum disorders (ASD)”.

• It should not be used in an evidence based program

• The studies included serious methodological flaws

Lang R et al. 2012
SIT and self-injurious behavior - a case report

- Behavioral therapy v. SIT in a 9 year old exhibiting self-injurious behavior
- Behavioral therapy superior
- SIT ineffective

American Academy of Pediatrics policy statement relating to SIT (2012)

“Occupational therapy with the use of sensory-based therapies may be acceptable as one of the components of a comprehensive treatment plan. However, parents should be informed that the amount of research regarding the effectiveness of sensory integration therapy is limited and inconclusive. Important roles for pediatricians and other clinicians may include discussing these limitations with parents, talking with families about a trial period of sensory integration therapy, and teaching families how to evaluate the effectiveness of a therapy”.

General Strategies

- Provide the sensory experience the person needs following appropriate assessment - compensation
- Expose the person gradually to more challenging sensory environments to promote healthy adaptation – remediation
- Teach self-regulation (caregiver regulation)
General Strategies

Maintain appropriate arousal levels
Know intensity of input
Know types of input
Age appropriate activity
Functional activity

What is a sensory diet?

Provides appropriate sensory stimuli to help effectively filter, integrate & organize sensory information

<table>
<thead>
<tr>
<th>Chart 1</th>
<th>ENVIRONMENTAL EFFECTS ON LEVEL OF AROUSAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occasion</td>
<td><strong>Activating</strong></td>
</tr>
<tr>
<td>Noise Level</td>
<td>Loud sudden noises or voices</td>
</tr>
<tr>
<td>Visual Stimuli</td>
<td>Bright colors, excessive background stimuli</td>
</tr>
<tr>
<td>Lighting</td>
<td>Bright or fluorescent lights</td>
</tr>
<tr>
<td>Room Organization</td>
<td>Cluttered rooms</td>
</tr>
<tr>
<td>Vestibular/Movement</td>
<td>Unpredictable fast movements with sudden position changes</td>
</tr>
<tr>
<td>Tactile/Proprioception</td>
<td>Light touch, tickling, unexpected touch</td>
</tr>
<tr>
<td>Odors</td>
<td>Strong or noxious odors (i.e., perfume, paint)</td>
</tr>
<tr>
<td>Temperature</td>
<td>Sudden temperature changes, temperature extremes</td>
</tr>
<tr>
<td>Routine/Structure</td>
<td>Novel events</td>
</tr>
</tbody>
</table>
Temperature

Routine

Organization

• Simplify (supplies)
• Organize space
• Create areas

Breath
THE MOTOR PIECE

Bimanual activities

Hand eye coordination
Motor Learning

Attention!

- Sensory seekers having difficulty focusing.
- Allow changes dependent on sensory need

Therapy Specific Techniques

- Incorporating SIT into routine therapy activities
Let’s PLAY

CASES

- Rancho level V TBI tactile and vestibular seeker and visual and auditory seeker
- Rancho level VII TBI seek tactile, sensitive to vestibular, visual, and auditory
- Low level CVA tactile avoider, visual sensitive

Questions
References

Case Studies

For the following cases identify the sensory profile of the patient and develop intervention strategies to incorporate into your planned mobility activities and strategies to provide the sensory experience the patient needs for maximum participation in therapy.

**Case 1: Rancho level V TBI**

Your patient is a 19 year old college student s/p TBI sustained when cliff diving into the Chattahoochee - currently exhibiting confused, appropriate behaviors.

He presents with right hemiplegia UE > LE. Minimal stereotypical movement of the RUE with mild flexor spasticity; poorly controlled movement against gravity in the RLE.

Fair sitting balance; poor standing balance.

Requires mod assist for bed mobility, transfers and min assist for gait X 90 feet once upright using a straight cane.

He is very restless when immobile and rock the w/c back and forth all the time. He is constantly trying to leave the area in the w/c. and self-propels fast in the hallways whenever he escapes. He frequently tries to get up from w/c.

He routinely reaches out to touch the therapists, other patients and visitors with his left hand despite frequent cues not to; he fidgets with the brakes of his wheelchair, pulls at his clothes, chews on the neck of his t-shirts.

You are working on transfer training using a squat and pivot transfer from w/c to mat.

Select activities that would prepare him for the transfer taking his sensory needs into consideration.

Select transfer training method that takes his sensory needs into consideration.
Case 2: TBI Case Study Rancho Level VII

Patient is a 26 year-old who sustained a TBI in an MVA. CT scan revealed multiple contusions, right temporal-parietal hemorrhage, and diffuse edema. It is 12 weeks post injury, and patient is in an acute rehabilitation facility with a TBI program, for intensive rehab. Currently at Rancho Level VII, with bilateral neurological deficits R > L.

PMHx: previously healthy, no relevant medical or surgical history

Meds: dilantin, baclofen, acetaminophen

Occupation: computer analyst. Was very physically active and enjoyed recreational seasonal sports; coached a high school freshman lacrosse team.

Physical Exam:

Cognition, Communication/behavior: Follows 1 step directions, forgets instructions if too complicated, or too long a delay between instruction and action. Pt is alert and oriented X 4. Demo poor safety and impulsive behavior occasionally. Able to attend to task briefly, but wanders off task. Is able to talk and answer questions. Has word finding problems from time to time and gets frustrated by it. Observed touching items and people, stroking items accessible to him, fidgeting with items on his lap-tray. His wife reports that he likes to chew ice, and has always loved hot spicy foods. Observed distress with activities involving quick turns, obstacle courses, sudden perturbations during balance training, and with repeated bed mobility activities. He performs better in the quiet room than in the gym and startles very easily with an exaggerated response to loud noises in the gym and in the hallways and in the cafeteria.

Posture in chair –restless, and leans to right. Uses RUE naturally for movement and balance.

Sensation: Cutaneous sensation is intact but requires pressure to respond to touch testing. Is confused about the directions for kinesthetic testing.

Motor: generally ataxic movement, transitions and gait.

A/PROM: Functional AROM is available at all joints. No abnormalities of tone detected.

Strength: LUE: 2/5 range. LLE: generally in 3+/5 range approx. L ankle DF 2/5. R limbs are 5/5.

Coordination: presents with dysmetria L > R, dysdiadochokinesia and dyssnergia L>R. Able to tap left foot in small ranges and slowly. Accuracy decreases with speed of movement

Functional activities:

Bed Mobility: independent with all bed mobility. Responds poorly to side-lying transition.

Sitting: can sit with supervision without using UE support, can reach in all directions easily, can maintain against resistance. Sitting posture is normal – relaxed. Scoots independently. Is impulsive and attempts to get up from the mat spontaneously. Sit to stand and the reverse with CGA

Standing: balance in standing is impaired. Stand with CGA and wide base of support, lean a little to the right. Requires min assist for reaching, stepping activities, and to pick item up from floor. Requires min assist for mini-squat. Is able to stand on RLE X 15 seconds; LLE X 5 seconds and stumble.

Transfers: independent in both directions for a squat and pivot transfer.

Ambulation: can ambulate 100 feet with a lofstrand crutch and min assist. Gait is ataxic and balance is a significant limiting factor for ambulation.

Stairs: min assist using 1 rail. Need cueing to safe stepping sequence and for safe foot placement
Case 3: R CVA tactile avoider, visual sensitive

30 year old with a diagnosis of R CVA with L hemiplegia. Medically stable and was discharged home following 2 weeks of rehab on the acute inpatient rehab unit as benefits have run out. Is referred for outpatient therapies.

PMHx: Hypertension, seizure disorder since childhood, smokes 1 pack of cigarettes a day.

History/interview


Observed: resists manual cues for upright posture, manual facilitation for mobility training, and manually resisted exercise activities, hates the gait belt, and pulls away from you when you use it for alignment during gait. Fidgeting with clothes regularly. Covers eyes when lying on the mat, wears sunglasses even when cloudy outside. Is obviously uncomfortable when working on computer. Wife reports that he hates going to the mall, to the gardening center, and had to leave when they took the kids to Malibu racing track.

Cognition: alert and oriented X 4 – answer basic questions accurately


Physical Exam

Left visual field cut, impaired sensation left side of you face and poor tongue movement to left.

Sensation/perception: Diminished kinesthesia on the left in general. Accurate for pain, but reports less intense sense on the left. Left neglect is evident during functional activities.

AROM: normal R side; weak movements LUE in the 2/5 range and LLE generally in 3-/5 range.

PROM: There is no resistance to passive movement of the left limbs and functional ROM is available at all joints.

Strength: R side is 5/5. MMT is N/A on left.

Functional activities: - uses mainly the right side for all activities. Responds to verbal cueing to include left side. You can generally be approx min assist for bed mobility; mod assist for transfers and gait.

Sitting: close SBA using RUE support. Leans to the right, and reaches in small ranges to the right.

Standing: stands with min assist leaning over to the right. LLE is hyperextended. Leans to the right and is unable to maintain midline.

Ambulation: ambulates 50 feet with LBQC and typical hemiplegic gait deviations.
Sensory Processing: Implications for Physical Therapists

Pre/Post tests

1. A patient with poor tactile and proprioceptive processing, difficulty with fine motor and manipulation skills, difficulty grading force of movements, and decreased body awareness and motor planning may be displaying:
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   c. Postural-ocular movement disorder
   d. Sensory modulation disorder

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4. A patient presents with the following behaviors: hyperactivity/constant movement impulsive/risk-taking behavior/seeking of touch or pressure, enjoyment of LOUD sounds/busy environments and enjoyment of spicy, hot or sour foods/chewing/crunchy foods This person is most likely:
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5. Research supports that sensory processing disorders experienced by adults are similar to those experienced by children
   a. True*
   b. False