Challenges with Sensory Processing in Children with ASD

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Sensory Integration Dysfunction versus Sensory Processing Disorder

- Sensory Integration is an evolving theory
- There is ongoing research to guide terminology
- AOTA recommends that we describe the problem rather than name a disorder
- "Children with difficulty processing and integrating sensory information"

The Process

- Reception: dependent on level of Arousal, Orienting response
  - Modulation: balancing excitatory and inhibitory inputs
  - Discrimination: Cognitive process that enables us to distinguish differences
- Integration of that information with prior experience, attach meaning
- Adaptive response – response appropriate to stimulus
- Praxis - Cognitively remembering the adaptive or motor response for future use
- Organization of behavior

Dysfunction in Sensory Modulation

- Difficulty achieving and maintaining a developmentally appropriate range of emotional, attentional, and motoric responses to sensory stimuli, resulting in difficulty adapting to challenges encountered in daily life (James, et al. 2011)
- One or more of the 7 sensory systems may be involved
- Symptoms: overresponsivity, underresponsivity, sensory seeking or a combination
- Overresponsive - classical stress response – fight, flight, freeze
- Severity: mild to severe

Sensory gating

- A neurological processes of filtering out redundant or unnecessary stimuli in the brain from all possible environmental stimuli
- Prevents an overload of irrelevant information in the higher cortical centers of the brain.
- Largely automatic, also occurs within the context of attention processes.

Habituation

- A form of learning in which an organism decreases or ceases to respond to a stimulus after repeated presentations.
- Essentially, the organism learns to stop responding to a stimulus which is no longer biologically relevant.
- For example, may habituate to repeated sudden loud noises when they learn these have no consequences.
- Desensitization Protocols

Dunn's Model of Sensory Processing

- Threshold = point along neurological continuum most likely to generate a response

Neurological threshold continuum	Behaviour response continuum	
	Brain acts in accordance with threshold	Brain counteracts threshold
	PASSIVE	ACTIVE
HIGH	Low Registration	Sensory Seeking
LOW	Sensory Sensitive	Sensory Avoiding

Figure 1: Adapted representation of Dunn's Model of Sensory Processing (from Adolescent/Adult Sensory Profile User Manual[14])

Low/ Poor Registration

- High threshold/passive response
- Notice less sensory stimuli, oblivious
- Self absorbed, uninterested, flat emotionally
- Most sensory input in daily life doesn't provide enough intensity to reach threshold
- Can mask as poor discrimination
- Interventions – increase intensity to improve chances for noticing and responding

Sensory Seeking

- High threshold/active response
- Enjoys, needs and seeks input from environment
- Active, excitable
- Problem when seeking behaviors interfere with fully participating or completing an activity.
- Intervention - Provide appropriate opportunities for input

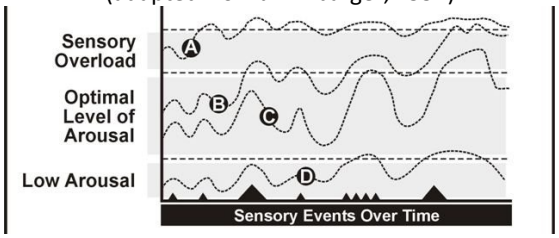
Sensory Sensitive

- Low threshold/passive response
- Detect more input that others
- Can be highly distractible, hyperactive
- Auditory, Visual, Tactile, Vestibular
- Defensive response rather that orienting response
- Large increase in heart rate, respiration, vasodilation.
- Increased sensitivity to all other sensory stimuli
- Interventions – provide more structured input

Sensory Avoiding

- Low Threshold/active response
- Can be rule bound, ritual driven, uncooperative
- Unfamiliar input is difficult to understand and organize
- May tune out to avoid, seem uninterested
- May be hyper alert but still
- Interventions – make input less available, graded, organized, predictable exposure

Model for Understanding Sensory Modulation (adapted from J. Wilbarger, 1991)



Context/Environment

- Behavior is influenced by context
- Not only sensory processing patterns but also contextual factors
- Sensory processing: universal and context-specific qualities
  - Universal: sensory avoiding - cover ears at home and
  - Context: sensory seeking – singing at home (ok) vs school (disruptive)
- Teachers/parents responses differ: unique view
- Home/school variables differ = need contextually designed assessments, different interventions, and different goals

(Brown, N.B., & Dunn W. 2010)

Sensory Profile & School Companion (Dunn)

- Sensory profile across a variety of settings
- Co-regulation = feed off state of regulation of those around
- Home
- Community
- School
  - Classroom
  - Cafeteria
  - Playground
  - Media center/Library
  - Halls
  - Bathroom

Research on Sensory Processing and ASD

- most common comorbid symptom (Silva & Schalock, 2012)
- 69% - some type of sensory symptom (Baranek, et al., 2006)
- inversely related: mental age increases, sensory symptoms decrease (Baranek, et al., 2006)
- low mental age produces hyporesponsivness in social and nonsocial contexts; higher mental age produces more responsiveness (Baranek, et al., in press)
- more severe symptoms in social-communication = more likely to be hyporesponsive; higher language abilities = fewer hyporesponsive or seeking behaviors (Watson et al., 2011)
- most pronounced for under-responsivity, followed by over-responsivity, and sensory seeking; 6-9 year-olds: over-responsivity and seeking (Ben-Sasson et al., 2009)
- more taste/smell sensitivity and sensory underresponsivity (Schoen et al., 2009)

Research (continued)

- abnormal auditory, visual, touch, and oral sensory processing; improved with age except low threshold to touch (Kern et al., 2006)
- correlation between sensory processing and repetitive behaviors (stereotypies and compulsions) (Boyd et al., 2010)
- tactile sensory impairment - hypersensitivity to noninjurious stimuli and hyposensitivity to injurious stimuli (Silva & Schalock , 2012)
- emotionally reactive and poor sensory registration on Sensory Profile (Watling, Deitz, & White, 2001)
- relationship between sensory hypersensitivity (sensory sensitivity and avoiding) and anxiety; hyporesponsiveness and depression (Pfeiffer, Kinnealey, Reed, & Herzberg, 2005)
- academic underachievement and tactile processing, auditory filtering, and underresponsiveness or sensory seeking (Ashburner, Ziviani, and Rodger, 2008)

A Word on Attention

- Common problem
- Types (Patten & Watson, 2011)
  - Orienting attention – initial physical orientation to a stimulus, person, or event
  - Sustained attention – ability to maintain the regard of an object or event
  - Shifting attention – disengaging attention from one stimulus/ reorienting toward another
  - Social attention – naturally occurring; orientation to social stimuli (voices, faces)
  - Joint attention – shared attention; between two or more people and an object/event

A Word on Attention (CONT.)

- All are challenging ***except sustained attention***
- Difficulty modulating sensory information in environment = difficulty attending to the stimuli relevant for learning

Principles for Using Sensory-Based Activities

(Patricia and Julia Wilbarger –"Sensory Diet")

- tactile and vestibular- early developing, very important
- light, random, or unexpected touch; high frequency noises, some kinds of movement – can be disorganizing
- movement, deep pressure touch, joint compression or traction, and heavy work - most powerful, long-lasting
- visual, auditory, olfactory, and oral/respiratory inputs - "state changers" or "mood makers"
- fidget toys and vibration - can be calming and organizing.

Interventions

- Self – Inside out/Outside in
- Inside
  - Desensitization Protocol
  - In preparation for anticipated event
    - Cognitive rehearsal
  - Ongoing
    - Drop the baseline
    - Make certain less challenged systems are "calmer than calm"
- Outside
  - Fidgets, headphones, clothing
- Environment

Deep Pressure Touch

- Firm touch or activities that put pressure on the skin like massage, being squeezed under a therapy ball, rolling on a firm surface
- Input lasts about 90-120 minutes
  - Wilbarger Therapressure Program
  - Under Armour
  - Swimming
  - Wrestling
  - Massages
  - Horseback riding
  - Contact sports

Vestibular

- Movement such as swinging, rocking, jumping, tumbling, etc.
- Rhythmic movement can be calming.
- Has the longest lasting effect (4-8 hours)
- Very powerful = requires the most care in applying
  - Suspension equipment
  - Astronaut Program
  - Swimming
  - Horseback riding
  - Yoga

Proprioception and Heavy Work

Proprioception

- Compression or traction to the joints and muscle action
- Lasts about 90 min to 2 hours

Heavy Muscle Action

- Muscles work against resistance
- Includes both whole body, hands or mouth
  - run errands for teachers – routine or with a peer
  - classroom jobs (water plants, feed pets, pass out supplies)
  - bungee cord strung between legs of chair
  - standing desk
  - second desk or work area to allow for movement breaks
  - clothes, boots, backpacks

Oral Motor Input and Respiration

- Sucking, blowing, biting, chewing, or breathing activities
- Considered "sensory snacks"
  - lunch or snack items that can be sucked through a straw (e.g. pudding, pureed fruit, smoothies, pureed soups, yogurt); crunchy foods
  - Blowing activities – lightweight objects (cotton balls, toilet tissue tubes, wadded up plastic wrap, Ping-Pong balls, feathers) progressing up to heavier items and more challenging tasks (blowing up balloons, whistles
  - Chewing gum
  - Deep Breathing with tongue placement
  - Singing – join a choral group

Auditory

- Music or background sounds can be used to influence general arousal or affective states
  - Role of vibration
- The use of specialized listening or sound programs may reduce defensive behaviors (Therapeutic Listening, The Listening Program, iLs, etc.)
- Sound therapy also effective to lower overall level of arousal
- Calming music on a hand-held device with headphones (not ear buds)
- Advanced warning before fire drills
- Desensitization program
- Singing

Olfactory and Gustatory

Olfactory

- scents (e.g. aromatherapy) can influence general arousal and affective states; questionable effectiveness with sensory defensive
- experiment with smells to determine which are calming (lavender, cinnamon, chamomile, vanilla, and patchouli) and which are alerting (;lemon, basil, juniper, grapefruit, ginger, peppermint)
- kids in overload might use strong tastes to "feel" something

Taste

- Using sweet, sour, bitter, and flavors to influence general arousal and affective states
- Cooking groups, use of perfumes, hair gels, body powders, scented lip gloss

Neutral Warmth

- Warmth that just maintains body temperature without being too hot or cold; is usually calming
- Only lasts as long as you keep the individual involved

Supplementary Aids, Services, Program Modifications, and Supports (IEP)

- Provide frequent changes in activities or opportunities for movement
- Preferential seating
- Encourage/reinforce appropriate behaviors in academic and non-academic settings
- Break down assignments into smaller units
- Frequent and/or immediate feedback
- Have student repeat and/or paraphrase directions
- Strategies to initiate and sustain attention

Other:

- Give directions in short phrases
- Sensory activities to promote listening and focusing
- Advanced warning for transitions
- Frequent eye contact/proximity control

Study on changing the environment

Classroom modification - attention and engagement (Kinnealey, et al., 2012)

- Universal Design for Learners (UDL)
- auditory sensitivities; avoidant behaviors
- high-quality lighting in schools: improved mood, behavior, concentration
- fluorescent lights: bright, low level buzz, stress, repetitive behaviors (ASD)
- Methods: Halogen lights and sound-absorbing walls and ceiling
- Results:
  - reduction in the frequency of non-attending behaviors (student specific)
  - increased stability of attending
  - self-assessment of improved classroom performance
  - spontaneous, repeated initiation of social interaction

Studies on Exercise

Stereotypic behaviors, on-task time, academic performance (Oriel, K.N. et al. 2011)

- stereotypic behaviors decreased following vigorous jogging for 15 minutes - mildly strenuous, increased breathing rate and/or flushed face (Kern et al., 1984)
- similar results; jogging 8-10 minutes (Watters & Watters, 1980)
- stereotypic behaviors decreased after 15 minutes of jogging; carryover 90 minutes post intervention (Levinson and Reid,1993)
- only exercise programs involving *jogging* (vs. walking or ball playing) - decrease in stereotypic behaviors (Celiberti et al.,1997, Kern et al., 1982, Kern et al.,1984)
- Mixed results for on-task time and academic performance: only exercise involving *jogging for approximately 15 minutes* with enough exertion (Kern, 1982)

Study on Yoga

- Get Ready to Learn (GRTL) yoga program (Koenig, et al., 2012)
- classroom-based; yoga postures, breathing, and relaxing exercises (Buckley-Reen, 2009)
- Study: 24 students intervention/22 control; ages 5-12 years
- Aberrant Behavior Checklist (ABC)- assess challenging behavior
- 16 weeks, every morning; DVD with OT modeling
- Results:
  - significantly less irritable behavior
  - changes in lethargy/social withdrawal, hyperactivity/noncompliance.
  - No significant changes in stereotypic behavior and inappropriate speech

Study on Ball Chairs

Limited research

- 6 boys; ball with ring stabilizer; 9 days during circle time; 5 days of free choice (Bagatell, et al., 2010)
- Mixed results:
  - In-seat behavior – unique to child
  - Engagement – unique to child
  - Teacher perception – not beneficial
  - Child preference – variable from 2-5 days
- Different sensory processing profiles
- Impact of poor postural control
- May be more appropriate for children who seek vestibular-proprioceptive input
- Engagement is difficult to define and quantify

Zones of Regulation

- Developed by a school-based OT, Leah Kuypers
- emotional regulation and impulse control impact success
- recognize emotions while still in control; access tools that don't disrupt class; think about others/social expectations
- 3 neurological components for self-regulation: sensory processing, executive functioning, emotional regulation
- Four colored zones (states of alertness and emotions_:
  - ❖Blue: low states of alertness
  - ❖Green: regulated
  - ❖Yellow: heightened state of alertness
  - ❖Red: extremely heightened states of alertness or very intense feelings
- Expected vs. unexpected
- Use strategies to move into expected

Sensory Friendly Clothing
www.friendshipcircle.org/blog/2013

Soft: www.softclothing.net Made from organic cotton, non-toxic dyes, tagless labels, and flat seams

Smart Knit Kids: www.smartknitkids.com Seamless socks, underwear, and t-shirts

Kozie Clothes: www.kozieclothes.com Soft and tactile pleasing fabrics, no tags, inverted seams; also offers weighted clothing, compression clothing, and weighted vests

Therapro: www.therapro.com Sensory smart vests, shirts, socks, and pants that are seamless, soft cottons; compression shirts and clothing with weighted options

Sensory Friendly Clothing (CONT.)

Fun and Function: www.funandfunction.com Soft, seamless, tag less dresses, pants, tees, and socks; compression vest section with various graphics printed on them

Kickee Pants: www.kickypants.com Not designed specifically for special needs; made from soft bamboo cotton; fashionable styles

World's Softest: www.worldssoftest.com Over 40 different soft and comfortable socks for men and women

No Netz: www.nonetz.com Bathing suits for men and boys with no lining or net