

Understanding Sensory Processing for Children with Autism Spectrum Disorder

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Learning Objectives

1. Examine sensory processing disorder characteristics
2. Understand neurological differences in the brains of children with ASD and how this impacts functional daily living skills
3. Recognize the importance of engagement for children with ASD and the role of the occupational therapist with facilitating engagement
4. Discuss practical sensory interventions that can be implemented into daily routines

What is Sensory Processing Disorder?

- Sensory information confusing, upsetting, not meaningful.
- Poor organization of sensory input for adaptive responses.
- Misinterprets sensation from touch, sounds, sights, scents, movement, from the environment and from the body.
- Interferes with participation in daily activities.
- Paradigm shift...Proposed nosology for diagnostic classification

Proposed New Diagnostic Taxonomy

Miller et. Al. (2007) Concept evolution in sensory integration: A proposed nosology for diagnosis AJOT, 61, 135-140.

- **Sensory Modulation Disorder**
 - 1. Overresponsivity (sensory defensiveness)
 - 2. Underresponsivity
 - 3. Sensory Seeking

- **Sensory-Based Motor Disorder**
 - 1. Dyspraxia
 - 2. Postural Disorder

- **Sensory Discrimination Disorder**
 - Visual, auditory, tactile, proprioception, taste/smell

Sensory Modulation Disorder

- Define Sensory Modulation: “The ability to regulate and organize reactions to sensory input in a graded and adaptive manner”. (Bundy et. Al. 2002 Sensory Integration Theory and Practice 2nd edition)
- Balance between Inhibition vs. Facilitation
- Effects attention & behavior

Sensory Modulation Disorder

Overresponsivity

- Sensory Overresponsivity = over-notice sensory input; Responds to sensation faster, more intensely, longer duration.
- Can occur in one or more sensory systems
- Difficulty in new environments & transitions
- Sensory Defensiveness
- Sensory overload causes a “Fight, Flight, or Freeze” reaction.
- Autonomic Nervous System (sweat glands, heart rate, digestion, blood vessels, release adrenaline & cortisol)
- Affects ADL’s dressing and eating. (examples: Restricted diets from avoiding foods with textures, seams in socks cause emotional meltdowns getting ready in the morning)
- Examples: Covers ears to moderate sound levels, withdraws from touch, behavior rigid & controlling.

Sensory Modulation Disorder: Underresponsivity

- Sensory underresponsivity = poor registration; Decreased awareness, orientation & response to sensory input
- May account for some behaviors in ASD children due to causing problems related to attention
- Requires intense sensory input to notice
- Appear sedentary, lethargic, apathetic
- Mislabeled “lazy” or “unmotivated”
- May fail to take action.
- Appears to lack inner drive for socializing
- Takes longer to respond

Research

- Children with ASD fall into both overresponsivity and underresponsivity in multiple sensory systems.
- Tomcheck, Dunn (2007) Sensory processing in children with and without autism: A comparative study using the short sensory profile AJOT, 57

Sensory Modulation Disorder: Sensory Seeking

- Sensory Seeking = Prefer intense & extreme sensory input.
- Constantly moving, careless, restless, unsafe
- Impulsive, intense, highly energetic
- High pain tolerance
- Viewed as “Dare Devils”
- Displays attention-seeking behavior
- Explosive, aggressive
- SS disrupts attention profoundly – compromises learning and completion of daily tasks
- Examples: Makes vocal sounds to stimulate auditory system, plays roughly with toys, prefers spicy food, spins or rocks self, fidgets with objects, “on the go”.

Sensory Processing and Classroom Emotional, Behavioral, and Educational Outcomes in Children With Autism Spectrum Disorder

(Ashburner, J., Ziviani, J., & Rodger, S. (AJOT Sept./Oct. 2008))

- Method: 28 ASD children (average IQ), compared with 51 age and gender-matched peers
- Results: Short Sensory Profile scores for ASD children Underresponsive/Seeks Sensation & Auditory Filtering explained 47% variance in academic performance. Negative correlations were found b/w:
 - Auditory filtering & inattention to cognitive tasks
 - Tactile hypersensitivity/hyperactivity and inattention
 - Movement sensitivity and oppositional behavior
- Conclusion: Children who have difficulty processing verbal instructions in noisy environments, and who often focus on sensory seeking behaviors appear more likely to underachieve academically.

Sensory-Based Motor Disorder: Dyspraxia

- Praxis=(Motor Planning) Conscious attention to task while relying on stored sensory info from sensory systems
- Dyspraxia=Difficulty executing unfamiliar motor actions affecting oral, fine gross motor
- Poor body awareness in space
- Signs & Symptoms: Bumps into people or objects, poor articulation, illegible handwriting
- Need excessive repetition to learn a new motor skill
- Benefits from multi-sensory teaching styles

Dyspraxia in autism: association with motor, social, and communicative deficits

Dziuk et. al. (2007) *Developmental Medicine & Child Neurology*

- 47 high fx children w/ASD
- Control 47 typically developing children
- Physical and Neurological Assessment of Subtle Signs – test for motor skills
- Praxis exam – gestures to command & imitation
- Results
 - ASD group significantly poorer praxis
 - Praxis performance strong predictor of autism (measured using Autism Diagnostic Observation Schedule)
 - Dyspraxia in autism cannot be entirely accounted for by motor skill impairments suggesting additional contributing factors
 - Praxis in children w/ASD correlates with social, communicative and behavioral impairments that define the disorder...suggesting that dyspraxia may be a core feature of autism or a marker of the neurological abnormalities underlying the disorder

Motor Planning Strategies



- 5 repetitions – Feed Forward
- Keep classroom arrangement consistent
- Break task into small steps and practice
- Use pictures to sequence students through task
- Give child checklist to i.d. task/schedule
- Let other children go first to model action
- Practice skill repeatedly

Sensory-Based Motor Disorder: Postural Disorder

- Define: “Difficulty stabilizing the body during movement or at rest to meet the demands of the environment or of a given motor task.” (Miller et. Al. 2007)
- Difficulty with movements against gravity.
- Signs & Symptoms: Slumping at desk, falling out of chair, difficulty with fitness skills in P.E.

Sensory Discrimination Disorder

- Define: Difficulty perceiving details of sensation for differences or similarities.
- Can occur in one or more sensory system
- Requires additional time to process information
- Impacts learning, self-esteem, behavior.
- Poor visual or auditory discrimination = Learning or language disability.
- Somatic senses: Poor tactile, proprioceptive, vestibular discrimination affects body awareness in space & smooth, graded motor coordination.

ASD Definition

- “ASD’s are developmental disabilities that are defined by considerable impairments in social interaction and communication and the presence of unusual behaviors and interests. ASD’s include autism, PDD, and Asperger syndrome.” (Center for Disease Control Press Release)

Epidemiology

- 1 in 150 U.S. 8 yr.-old children have ASD
- UK study found 1 in 60 children have ASD
- Equal male/female ratio
- ASD same prevalence across ethnic groups and countries



Early Indicators of ASD

- Physical risk markers of ASD; accelerated head growth in first 3 years of life, thinner bone structure, low birth weight (<5.5 lbs.), low muscle tone.
- Motor and sensory characteristics in toddlers later diagnosed with autism were good predictors of the diagnosis along with social skills. (Baranek, 1999)
- Children later diagnosed with ASD often mouth things excessively, react aversively to touch, demonstrate atypical eye contact, don't imitate similarly as typical children.
- Behavioral indicators; lack of joint attention, lack of pretend play, not responding to their name.

Red Flags of ASD in the 2nd Year of Life

Amy Wetherby, PhD, CCC-SLP, and Julian Woods
Florida State University

- Lack of coordination of non-verbal communication
- Lack of sharing interest of enjoyment
- Repetitive movements with objects
- Lack of appropriate gaze
- Lack of response to name
- Lack of communicative vocalizations with consonants
- Lack of warm, joyful expressions
- Unusual prosody (Rhythm, intonation, stress on words. Speech sounds chopped, monotone, robotic, sing-song)
- Repetitive movements or posturing of body
- Lack of pointing
- Lack of playing with a variety of toys
- Lack of response to contextual cues

Possible Causes of ASD

- Genetics
 - Inherited: Several genes coming together
 - Twins 90%-95% of cases
- Biological
 - Increased risk higher for first born to older mothers (>35) & fathers (>40)
- Environment (Risk Factors)
 - Toxins: Food, water, cleaners
- Atypical Brain Development

Anatomy of an Autistic Brain

Time Magazine May 15, 2006 “Inside the Autistic Mind”

- Frontal Lobes – Higher reasoning: Enlarged
- Corpus Callosum – Links left/right hemispheres: Undersized
- Amygdala – Plays role in emotion & social behavior: Enlarged
- Hippocampus – Memory: 10% larger
- Cerebellum - Coordination: Overloaded white matter
- Too many local connections

Mirror Neurons in the Mind

Scientific American Journal November 2006

Mirror neurons provide a direct internal experience, and therefore understanding, of another person's act, intention or emotion.

They may underlie the ability to imitate another's actions, and thereby learn.

Mirror Neurons & Autism

Scientific American Journal November 2006

- Studies of people with autism show lack of mirror neuron activity in several regions of the brain.
- Mirror neurons are involved with social interaction; dysfunction could explain symptoms of autism including isolation and absence of empathy.
- A complementary hypothesis, the salience landscape theory, may account for secondary symptoms of autism including hypersensitivity.

Autism Spectrum Disorder

- 50%-90% of children with ASD have problems with motor coordination...
- Balance, bilateral coordination, motor planning, body scheme, and fine motor skills.
- Affects activities: Handwriting, shoe tying, cutting, riding a bicycle, jumping rope, skipping, playing ball, and extracurricular sports.

Autism Spectrum Disorder

- 40% of children with ASD have sensory sensitivity to touch, sound, taste, light, and smell...
- ...and sensory Under-Responsiveness to vestibular, proprioceptive and tactile input.
- = Poor MODULATION, Regulation, and Processing.

OT's Role with Autism

- Evaluate & determine developmentally appropriate skills
- Suggest accommodations/modifications
- Integrate service delivery in natural environments and routines for daily living activities
- Provide interventions: Developmental activities, self-care, sensory integration/processing
- Facilitate play activities for social interactions
- Devise transition strategies
- Collaborate with family & community
- Assist with engagement in meaningful tasks the increase quality of life

ASD & Engagement

adapted from
Tomcheck NATTAP conference 2007

- Engagement is...Performance in occupations or activities as the result of:
 - Self-choice
 - Motivation
 - Meaning
 - Purposeful
- Four Elements of Engagement
 - 1. The ability to choose
 - 2. Intrinsic motivation to engage
 - 3. The individual's experience of meaning
 - 4. Performance skills and patterns

ASD & Engagement

adapted from
Tomcheck NATTAP conference 2007

- Sensory Processing and Engagement
 - Effective SP is critical for receiving, interpreting, and utilizing sensory information for functional performance.
 - Effective SP provides a foundation for adaptive behavior.
 - Initiation and maintenance of engagement involves organization, regulation, motivation and skill.

ASD & Engagement

adapted from
Tomcheck NATTAP conference 2007

- Research findings indicate children with ASD have sensory modulation disorder (Tomcheck & Dunn 2007)
- Poor sensory modulation is theorized to impair a child with autism's ability to sustain active engagement with people or activities.
- Active engagement is identified as the “key component to all intervention programs for children with ASD” (National Research Council 2001)

ASD & Engagement

adapted from
Tomcheck NATTAP conference 2007

- Educating Students with Autism
 - Sustained attention to an activity or person
 - Ability to attend and respond to the environment
 - Sensorimotor Intervention:
 - Modulation and controlling arousal
 - Direct and share control during treatment
 - Provide concrete meaningful materials
 - Graded introduction of tasks
 - Support for combination of sensory & behavioral interventions
- With a better understanding of engagement we can better support participation!

OT's Role with Autism

- Intervention helps children improve **FUNCTIONAL ENGAGEMENT** and **PARTICIPATION** in every day life.
- Intervention helps children with ASD physically, emotionally, and socially through sensory integration intervention, sensory diets, and environmental strategies...

OT's Role with Autism

- ...which helps children:
- modulate their nervous systems to “just right”
- improve motor coordination
- increase self-esteem through success
- acquire social skills, prevocational skills, academic skills and play skills.

Efficacy of OT-SI with Children with Autism

AOTA Annual Conference St. Louis, MO 2007; AOTA Evidence-Based

Practice Literature Review of OT for Children with SPD/SID

- OT-SI was effective in improving play skills, social interaction, adult interaction, approach to motor tasks, and decreasing sensory sensitivities. No changes were found in peer interactions. (Baranak, 2002)

Research: Autism & Asperger

AOTA Annual Conference St. Louis, MO 2007; AOTA Evidence-Based Practice Literature Review of OT for Children with SPD/SID

- Embedded figures and detecting objects in visual search task are strengths, but when attention is required visual search becomes deficient. (Jarrod, et. al. 2005)
- Rely on visual input to maintain balance –may suggest difficulty with vestibular and somatosensory or proprioceptive systems (Minshe, et al., 2004; Malloy et. al. 2003)
- A relationship b/w sensory hypersensitivity and anxiety; relationship b/w hpyosensitivity and depression (Pfeiffer, et. al., 2005)

Touch therapy reduces symptoms in preschool children with autism

Field et al (1997) Brief report: Autistic children's attentiveness and responsivity improve after touch therapy. *Journal of Autism and Developmental Disorders*, 27, 333-338.

- Touch Therapy involved “moderate pressure and smooth stroking movement on each of the following areas: head/neck, arms, hands, torso, and legs/feet”. (p334)
- 22 children (12 boys & 10 girls) Age 4.5
- 15 min. a day/2 days a week/4 weeks
- Touch aversion & off task behavior significantly decreased in both groups
- Orientation to irrelevant sounds & stereotypic behaviors decreased significantly more in therapy group
- Touch therapy group significant improvement on Autism Behavior Checklist sensory scale, relating scale, total scale, no significant changes with control group
- Touch therapy group significant changes on Early Social Communication Scale, no significant changes with control group

Animal-Assisted Therapy

- Research – *Occupational Therapy Incorporating Animals for Children With Autism: A Pilot Investigation*
Sams et. al. AJOT 2006
- Results: Significantly greater use of language and social interaction in sessions incorporating animals.
- Single case study-5 yr old child w/ASD & dog named Henry
- Results: Child spoke his first sentence, began to make social interactions with therapists, became more aware of others needs
Jennifer Barol graduate student New Mexico Highland University School of Social Work (2007)
- *Tools for Pets* Diana Henry
www.ateachabout.com

Identifying SPD in ASD

- Observation
- Teacher/Parent interview
- SPD Checklist www.SPDCconnection.com
- Occupational Therapy Evaluation
- Sensory Processing Measure (SPM)
- Sensory Profile

OT Direct Intervention for ASD

Autism: A Comprehensive Occupational Therapy Approach

Chapter 10 Sensory Integration

Mailloux & Roley

- Use structured sensory environment with emphasis on proprioceptive, vestibular, and tactile input
- Increase intrinsic motivation, purposeful play
- Delivery of intervention in context of play
- “Artful Vigilance” from therapist
- Child Centered Approach
- Elicitation of adaptive responses
- “Just-Right level of challenge”
- Active vs. passive participation

Intervention for ASD

- **ABA:** Applied Behavioral Analysis; produces positive gains IQ and academic, but smaller effect on behavior
- **TEACCH** Treatment & Education of Autistic & Related Communication Handicapped Children; Enables children to generalize learning to other environments
- **DIR:** Developmental Individual-difference Relationship; Floortime – enter the child’s world
- **Social Stories (Gray);** Visual cues to anticipate events
- Environmental modifications
- Structured developmental play
- Child centered
- Positive behavioral supports have moderate to strong effect on improving behavior
- ASD with SPD benefit from sensory-based interventions
- Sensory Diet

Sensory Diet

Patricia Wilbarger, PhD, OTR

- Sensory strategies & accommodations that a child engages in and uses throughout daily routines as “food” for the nervous system.
- Used intermittently to help a child maintain a “just right” alertness for focusing and emotional well-being.

Alerting Sensory Strategies

- Sit on Ball chair
- Sit on Air-filled cushions (Movin' Sit, Disc O' Sit, inflatable camping pillow (www.rei.com), tennis balls, beach ball “chair”)
- Allow child to have movement breaks (exp. Office errand, stand at desk- Mayo Clinic studies)
- Incorporate movement activities in teacher lesson plans
- Listen to lively, fast-paced music

Alerting Sensory Strategies

- Smell Peppermint/Citrus scents
- Taste sour food/candy (lemon, pickle, WarHeads)
- Look at bright colors, light-up toys
- Use highlighter to draw attention to text
- Use hand fidgets (velcro inside desk, tangle, fidgetz, paperclips)

Modulating Sensory Strategies

- WEIGHTED VEST (www.OTvest.com)
- Neoprene pressure vest
- Weighted lap bag (fish tank rocks – washable)
- Beanbag chair
- Naturally occurring “Heavy work”
- Therapy band/Bungee rope wrapped around chair legs
- Weighted blanket
- Lycra under clothes (Under Armour, Benik – compression vest/shorts, Spio pressure garment)
- Weighted wrist band for f.m. tasks

“Weigh” Cool Bracelet

www.Abilitations.com

www.Integrationscatalog.com

Modulating Sensory Strategies

- Extracurricular activities: Swimming, Martial Arts, Yoga
- Playground - climbing monkey bars
- Chew GUM
- Suck thick liquids through a straw
- Oral motor fidgets (Chewlery, toothpick, straw)
- Chores - Cleaning wiping off table, carry groceries & laundry basket, vacuum
- Visual picture schedule Q-Charms
- Smell cinnamon, coffee beans, cloves
- Listen to classical music - Example: Mozart
(60 beats per min.=heart organizing to NS)

www.QCHARM.com

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www.spioworks.com



Calming Sensory Strategies

- Pet an animal
- Deep Breathing
- Slow rocking in a rocking chair
- Keep to a routine as often as possible
- Allow child to stand in front or back of line
- Wear tag-less clothing, seem-less socks

Calming Sensory Strategies

- Provide quiet retreat area
- Incorporate environmental sounds/white noise machine
- Decrease wall decorations in classroom (exp. Use flip chart)
- Adjust lights/Cozy shades (www.integrationscatalog.com)
- Tools for the eyes; oil & water, lava lamp, fish tank
- Smell Vanilla/Chamomile scents
- Taste warm bland foods (mashed potatoes, baked breads)

Strategies for Promoting Auditory Skills in ASD Children

Catherine Schneider, OTR

- Be aware of competing background noises
- Name & describe sensory components of objects
- Talk about same and different qualities of objects size, shape, form, smell, texture
- Describe steps you are doing in an activity as you are doing them
- Have child listen & i.d. (recorded) sounds
- Reinforce positional concepts

Auditory Strategies

- Headphones (www.coopersafety.com) PelterH7/earplugs
- Simplify language, slower rate
- Give one direction at a time
- Pair directions with physical/visual prompts
- Allow longer response time
- Stand close to child when speaking
- Seating preference away from doors/windows
- www.route2greatness.com

www.route2greatness.com

[Cafeteria](#)

Activities of Daily Living for ASD: Sleeping Environmental Variables

- 1. Assess room temperature
 - Too hot/cold?
- 2. Tactile sensitivities
 - Bedding; cotton sheets & heavy blankets
 - Pajamas; fabric, elastic, socks, tight/loose fit?
- 3. Consider noises your child hears
 - Running water, barking dog,
 - Use white noise
- 4. Visual Input
 - Does your child prefer dark or nightlight?

Activities of Daily Living for ASD: Sleeping Bedtime Routines

- 1. Stick with a set bedtime
- 2. Provide a visual picture schedule of the bedtime routine (4-6 steps)
- 3. Implement selected sensory strategies that are calming to your child
- 4. Select relaxing activities prior to bedtime
 - Looking at the same story book every night
 - Saying goodnight to favorite objects
 - Singing a favorite quiet song
 - Listening to calming music
 - Hugging and kissing family members

Activities of Daily Living for ASD: Bath time



- Use a foam visor to keep water out of eyes
- Draw with soap crayons
- Keep to a routine; use a visual pictures for bath time sequence
- Consider a shower instead of bath

Activities of Daily Living for ASD: Brushing Teeth

- Use a vibrating toothbrush
- Try variety of toothpaste flavors
- Play games with ‘Crocodile Dentist®’
- Read a book about teeth, such as *Hooray for Teeth* by Gena Shaw
- Sing a song “If you’re happy and you know it show your teeth” then smile in a mirror
- Ask for x-ray vest at dentist



Activities of Daily Living for ASD: Oral Motor/Feeding

- *Improving Speech and Eating Skills in Children with Autism Spectrum Disorders* (AAPC 2008) Maureen A. Flanagan, MA, CCC-SCP
- 1. Have child apply lotion to feet, legs, arms, etc.
- 2. Have child provide tactile stimulation to lips
- 3. Ask child “Get your chew tube”
- 4. Instruct child to “put chew tube away and get your Nuk Brush” (normalizes oral sensitivity & encourages tongue movement independent of jaw movement)
 - Push down on tongue 10-30 times (adult counts out loud)
 - Brush both sides of the tongue, front 3rd top of mouth

Activities of Daily Living for ASD: Oral Motor/Feeding

- Provide an oral motor time as part of the child's daily routine; Before or between meals
- Use variety of sensory items
 - Toothbrushes, Nuk
 - Vibrating massager
 - Flavored lip balm
 - Blowing bubbles
 - Chew tubes
 - Flavor sprays
 - Lollipop, gummy bears, jellybeans
 - Whistles

Activities of Daily Living for ASD: Oral Motor/Feeding



- Foods that improve jaw stability; 1. Crunchy foods carrots, pretzels, chips, apples 2. Chewy foods dried fruit, jerky, taffy, meat
- Foods that improve tongue & lip control 1. Sour/spicy foods lemons, pickles, salsa 2. Sucking thick liquids, frozen juice bars
- Avoid foods that combine 2 different textures, foods that stick to teeth (peanut butter), popcorn

Activities of Daily Living for ASD: Playing

- **Research:** *Out of School Participation in Children With High-Functioning ASD* Hilton, Crouch, & Israel AJOT Sept./Oct. 2008
- **Results:** Significant differences in participation between typical and HFASD groups in number of activities, number of individual's with whom they participate, and variety of environments
- **Conclusion:** Findings suggest social impairment impacts participation. Addressing social skills in intervention could increase participation.

Activities of Daily Living for ASD: Playing

- *Participation in Sports for Children on the Autism Spectrum* Stacey Reynolds, OT Practice 2006
- Benefits: ↑ cardiovascular, enhanced muscle tone, maintenance of healthy weight, stress release, sensory modulation, socialization, sense of belonging, developing new skill, accepting rules/consequences, honoring commitments, improved self-esteem for accomplishments.
- OT's role: encourage community opportunities, support participation, consult with coaches/recreation program directors, suggest modifications and behavioral strategies, attend a game or practice to observe (alt. view video tape)

Activities of Daily Living for ASD: Playing

- *Participation in Sports for Children on the Autism Spectrum* Stacey Reynolds, OT Practice 2006
- Coaching strategies for ASD
 - Repeat directions, visual modeling
 - Give choices (exp. “Do you want to get in the game, keep score, get water for players?”)
 - Do not yell; instead wait until child is off field/court then give new directions/pointers, speak slowly & clearly, always mention what was done well
 - Pair ASD child with typical peer pal during practice drills
 - Review practice schedule prior to beginning, give warnings with any change in routine
 - Ask parents to have their child practice putting safety equipment on before the first day of practice (motor planning)
 - Consider Under Armour® under uniform tactile sensitivity

Activities of Daily Living for ASD: Playing

- Choose sports that are simple & encourage more active participation:
(Swimming, martial arts, bicycling, gymnastics)
- Organized sports:
(baseball, soccer, football, basketball) sometimes too much standing around and too many rules to follow
- Provide roles in organized sports such as team manager
- ‘Just Right Fit’

It Takes a Whole Village to Raise a Child!

- We need to work together!
- School staff
- Administrators
- Therapists
- Families
- Community members



