Sensory Processing Disorder:

What is It?
&
What to do about it?
“The human brain is a sensory processor. Its core function is to perceive, integrate, interpret, and then facilitate the appropriate coordinated response to the visual, tactile, auditory, olfactory, and proprioceptive information present in the world around us.”

Chang et al
WHAT IS IT?

- Impaired processing of sensory information (multisensory integration) contributes to attention, learning, emotional regulation, and social dysfunction /impairment/ dysregulation
- Originator of the theory is A. Jean Ayers Ph.D., late 1960’s
  - Neurological processes that organize sensations in the body from the environment AND enables one to function within that environment
  - When the brain can not synthesize these neurological information coming in simultaneously; “It is like a traffic jam in your head…with conflicting signals quickly coming from all directions, so that your brain doesn’t know how to make sense of it all.” Nancy Peske
https://youtu.be/IcS2VUoe12M?t=55s
SYMPTOMS

- Posture: sitting / standing
- Difficulty reading/ learning
- Loud voice (outside voice)
- Fidgety (ADD/ADHD)
- Impulsive
- Enuresis
- Excess pressure with writing
- Can not tolerate tags, seams in socks
- Will only wear certain clothes
- Doesn't like hair cut/brushed
- Doesn't like baths
- Doesn't like certain texture foods "picky eater"
- Doesn't like bare feet
SYMPTOMS CONT

- Sleep issues
- Toe walkers
- Sensitive to touch, smell, light, noise
- Can't tolerate crowds ("freak out")
- Loves or hates amusement rides
- Fighting/ punch/ strike/bite etc
- Playground equipment (preferences; won't go on)
- "W" sitting
- Loves/hates: massage, big hugs
- Will they use finger paints/getting messy
- Increased/ decreased response to pain, temp etc
- Bumps into things/people; Poor balance “Clumsy"
- Car sick etc
- Fine motor / gross motor delays
SENSORY SYSTEMS

- Visual
- Vestibular
- Auditory
- Tactile
  - Proprioreceptors
- Augustatory
- Olfactory
LETS BREAK IT DOWN

- Systems & their Symptoms
  - Keep in mind that many symptoms overlap
V**I**S**U**A**L** S**Y**S**T**E**M

**TWO ASPECTS**
- Central and Peripheral which must function together simultaneously to allow us to move smoothly through space

Central
- Processed at a cortical level
- Is designed for learning about details and information
Peripheral (ambient):

- It is used to assist in the processing of movement and spatial awareness.
- Part of our primitive or “protective”, and subconscious brain, and triggers automatic responses of balance responses and arousal.
Visual System

- Movement in the periphery elicits a vestibular and arousal response in the nervous system.

- If an individual does not feel ‘safe in space” they may remain ‘tuned in’ to the periphery and pay less attention to the central visual field.

- Movement in the periphery can also cause a balance response even in adults.
Where the body is in space

System that responds to the position of the head in relation to gravity, linear movement, acceleration and deceleration.

It works most closely with our visual system to integrate neck, eye and postural adjustments in response to movement.
VISUAL/ VESTIBULAR

Symptoms:
- Reading difficulties
- Learning issues
- Toe walking (tactile)
- Photosensitivity
- Can’t tolerate crowds (auditory)
- Fighting/ punch/ strike/bite etc (tactile)
- Clumsy / Balance issues (prop /tactile)
- Loves or hates amusement rides
- Car sickness
- Playground equipment [preferences; won't go on]
- Fidgety (prop)
- Impulsive (prop)
AUDITORY

Central processing
- Cortical
- Learning

Ambient Sounds (Peripheral)
- Background noises usually do not come to cortical attention unless they exceed expected thresholds
- Typically these sounds register as a blip on our radar screen
- The split second difference between when the sound vibrations hits one eardrum versus the other allows the brain to localize the direction of the sound with amazing accuracy.
- Processed in areas of the brain that process time/space (sub cortical).
AUDITORY

Symptoms:
- Crying, covering of ears, yelling “shut-up”
- ‘Shut down’ unresponsive to certain sounds
- Poor attention
- Fidgety
- Impulsive
- Difficulty reading/ learning
- Loud voice (outside voice inside)
- Sleep issues
- “Sensitive to noise”
- Can’t tolerate crowds
- Fighting/ punch/ strike/bite etc
Tactile System/Touch

- Is the ability to interpret sensations received from the skin.
- The system of touch is instrumental in the development of mature visual perception (deep).

Two parts:
1) Light touch
- These receptors are part of our normal “protective” system. (F/F).
- Recall light touch travels on the same pathways as pain
- Over stimulation is mediated in the automatic brainstem area (Fight or flight) → eliciting a defensive response
Tactile System/Touch

2) Deep pressure touch

- Goes to the cortex and provides awareness and knowledge of what is being touched
- The visual cortex lights up with deep pressure touch a precursor of mature visual perception
  - Allowing experience and memory of the touch assisting in making sense of one's environment.
- Provides significant calming and focusing chemistry
PROPRIOCEPTION

- The perception of joint position
- Receptors in the joint capsule provide feedback to the brain to allow awareness of body position without visual input.
- Feedback from the spine plays a large role in the regulation of attention and arousal.
  - Low “postural” muscle tone not enough information about joint position in the spine
**Tactile / Proprioception**

Symptoms:
- Punch / strike / bite (visual / vestib)
- Toe walkers (vision)
- Hugs / massage
- Finger paints / “getting messy”
- Pain / Temperature response
- Clumsy (visual / vestib)
- Sleep issues
- Can't tolerate crowds

- Tickling (NOT Recommended)
Tactile / Proprioception - Continued

- Difficulty reading/ learning
- Fidgety (visual/vestib)
- Impulsive (visual/vestib)
- Excess pressure w/ writing
- Can not tolerate tags, seams in socks
- Will only wear certain clothes
- Doesn't like hair cut/brushed
- Doesn't like baths
- "picky eater" (olfactory)
- Doesn't like bare feet
- Posture (poor spinal input)
Augustory / Olfactory

- “Picky eater”
- Hyper/Hypo sensitive to taste or smell
REGISTRATION

- Over registration (Sensory Defensive)
  - Cup too little – takes a little to fill it up
  - Avoiding input
  - Example: Tactile – Sensitivity to tags

- Under registration
  - Cup too big – takes a lot to fill it up
  - Craving input (proprioception)

- Occurrence
  - One or multiple
  - Combination
POSSIBLE CAUSES

- Genetics
- Prenatal:
  - HM
  - Rx/EtOH abuse
  - Stress
- C-Section vs vaginal birth
- Premature
- Insufficient sensory stimulation after birth
- Infections (PANS)
- Long hospital stay
- Orphans/ Adopted children
What to do about it?

- Assessment
- Treatment
ASSESSMENT

Fine motor
- Writing pressure
- Grip

Gross motor
- Bilateral integration: Jumping jacks, alternate UE/LE mvmt
- Core mm: Supine flexion/extension
  - “W” sitting

- Convergence insufficiency
- GI health / malabsorption
- Zinc Tally test

- Sleep
- Cortisol levels
- HM (lead) AND other environmental toxins
- Low grade infection (PANS)
TOOLS

- Sensory Profile
- Convergence insufficiency profile
- Grasp (fine motor)
Sensory Checklist Example
From Raising a Sensory Smart Child, © Biel & Peske, 2005

TOUCH

- Being touched on some body parts, hugs and cuddles
- Certain clothing fabrics, seams, tags, waistbands, cuffs, etc.
- Clothing, shoes, or accessories that are very tight or very loose
- Getting hands, face, or other body parts “messy” with paint, glue, sand, food, lotion, etc.
- Grooming activities such as face and hair washing, brushing, cutting, and nail trimming
- Taking a bath, shower, or swimming
- Getting toweled dry
- Trying new foods
- Feeling particular food textures and temperatures inside the mouth—mushy, smooth, etc.
- Standing close to other people
- Walking barefoot

AVOIDS SEEKS MIXED NEUTRAL
**APPENDIX**

**Convergence Insufficiency - Symptom Questionnaire**

**Clinic instructions:** Read the following subject instructions and then each item exactly as written. If subject responds with "yes" - please qualify with frequency choices. Do **not** give examples.

**Subject instructions:** Please answer the following questions about how your eyes feel when reading or doing close work.

<table>
<thead>
<tr>
<th></th>
<th>Never</th>
<th>(not very often) Infrequently</th>
<th>Sometimes</th>
<th>Fairly often</th>
<th>Always</th>
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<tbody>
<tr>
<td>1. Do your eyes feel tired when reading or doing close work?</td>
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<td>2. Do your eyes feel uncomfortable when reading or doing close work?</td>
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<td>3. Do you have headaches when reading or doing close work?</td>
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<td>4. Do you feel sleepy when reading or doing close work?</td>
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<td>5. Do you lose concentration when reading or doing close work?</td>
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<td>6. Do you have trouble remembering what you have read?</td>
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<td>7. Do you have double vision when reading or doing close work?</td>
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<td>8. Do you see the words move, jump, swim or appear to float on the page when reading or doing close work?</td>
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<td>9. Do you feel like you read slowly?</td>
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<td>10. Do your eyes ever hurt when reading or doing close work?</td>
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<td>11. Do your eyes ever feel sore when reading or doing close work?</td>
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<td>12. Do you feel a &quot;pulling&quot; feeling around your eyes when reading or doing close work?</td>
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<tr>
<td>13. Do you notice the words blurring or coming in and out of focus when reading or doing close work?</td>
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<tr>
<td>14. Do you lose your place while reading or doing close work?</td>
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<tr>
<td>15. Do you have to re-read the same line of words when reading?</td>
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Total Score: __________
Pencil Grasp Development

1—1 1/2 years
Cylindrical Grasp

2—3 years
Digital Grasp

3 1/2—4 years
Modified Tripod Grasp

4 1/2—7 years
Tripod Grasp

A = radial cross palmar grasp; B = palmar supinate grasp; C = digital pronate grasp, only index finger extended; D = brush grasp, E = grasp with extended fingers; F = cross thumb grasp; G = static tripod grasp; H = four fingers grasp; I = lateral tripod grasp; J = dynamic tripod grasp.
Concomitant diagnoses—or miss diagnoses?

- ADD/ ADHD
- “Behavioral issues”
- Anxiety
- OCD
- ASD (over lay w/)
- PANS
Could an undiagnosed case of sensory processing disorder lead to Anxiety, OCD, Endocrine dysfunction?
TREATMENTS

- Support the Nervous System
- Nervines
- Adaptogens
- EFA, Vitamin A, E, C, B’s; Zn, Se, Ca, Mg, Fe etc
- Feingold Diet (Blue Book)
- Sleep strategies

- OT /PT Referral
  - Gross motor
  - Fine motor (Sensory therapy) –Typically OT
  - Feeding (ST or OT)

- ST Referral
  - Language (articulation)

- Behavioral Optometry Referral
OT/PT REFERRAL

FOR:

- General OT/PT
  - Sensory Integration Therapy  (NOT COVERED BY INSURANCE)
- Visual /Vestibular Therapy
- Berard Auditory Integration Training (AIT)
- SOS (Sequential Oral Sensory) Approach to Feeding for oral /motor defensiveness
  - http://www.sosapproach-conferences.com/
OT/PT REFERRAL

WHEN:

- Fine motor Delay
  - Writing Issues
- Gross motor delay
  - Low tone
  - Poor bilateral integration
- Tactile defensiveness /Proprioceptive seeking
- "picky eater"
- Toe walkers (tight heel cords)
- Poor balance “Clumsy"
OT/PT’s may recommend the following as treatment:

- Core strengthening
- Cozy corner
- JJ/ wall push ups
- Weighted blanket
- Obstacle course
- Mvmt activities w/ visual tracking
  - Swinging etc
- Preferential seating
- Heavy work
- Bear Hug
- Weighted vest
- Weighted blanket
- Disco Sit
- Gum
- B/C— should ONLY be done by someone who has been trained
- Astronaut protocol
A FEW OT/PT OFFICES WHICH PROVIDE SIT

- TherapyWorks Pediatrics, LLC
  - SANE Eval
  - SIT
  - Berard Auditory Integration Training (AIT)
- L &M Pediatric Rehabilitation
- SuperKids Pediatric Occupational Therapy Services (comes to your home)
- Advanced Therapy Solutions, LLC
BEHAVIORAL OPTOMETRY

FOR
- Visual Behavioral Therapy

Symptoms:
- Reading difficulties
- Learning Difficulties
- Reading comprehension issues
- Issues w/ taking computer testing
  - Convergence Insufficiency
- Fidgety/ Impulsive
- Toe walker
Behavioral Optometrist Referral List

- Dr. Juanita Collier Cromwell, CT
- Dr. Christine Semenza in Old Lyme CT
- Dr. Randy L Schulman in Norwalk
- http://www.centerforintegratedvision.com/
- Dr. Phyllis Liu in Woodbridge and New Milford
ICD-9 CODES

- 781.92 Abnormal posture
- 782.0 Disturbance of skin (parasthesia)
- 781.3 Lack of coordination (motor dyspraxia)
- 728.87 muscle weakness
- *349.9 Unspecified disorder of Nervous System
- 315.4 Gross motor delay
- 994.6 Motion sickness

- 315.32 Central Auditory processing disorder
- 315.39 Speech language disorder (articulation, delay, etc)

- 783.3 Feeding deficiency and mismanagement
- 378.83 Convergence insufficiency
GROUND BREAKING SCIENCE
**Abnormal White Matter Microstructure in Children with Sensory Processing Disorders**  
*Owen et al*  
*June 2013*

- Initial study

- Demonstrated SPD patients to have “strikingly decreased white matter microstructural integrity—especially in posterior cerebral regions. These regions are implicated in unimodal sensory procession as well as MSI (multisensory integration)”
Autism & Sensory Processing Disorders: Shared White Matter Disruption in Sensory Pathways but Divergent Connectivity in Social–Emotional Pathways

Yi-Shin Chang et al
July 30, 2014

- Small sample size:
  - 15 male ASD (10 had overlapping SPD dx)
  - 16 male SPD (3 excluded)
  - 23 TDC

- 5-16% of children in USA are reported to have SPD

- Over 1% of children in USA carry a ASD dx
  - 90% ASD have sensory “behaviors”
  - DSM-5 diagnostic criteria now includes: hyper/hypoactivity to sensory input or unusual interest in sensory aspects of the environment
Diffusion Tensor Imaging, DTI, which measures microscopic movement of H2O molecules providing information of white matter tracts & fiber tractography – “allowed for quantitative non invasive evaluation of white matter microstructure and connectivity”
SPD group alone had significantly decreased connectivity in the splenium of the corpus callosum (posterior)
- Inefficient transfer of information b/w hemispheres

SPD and ASD cohorts – both had decreased connectivity in parieto-occipital tracts (which are involved in sensory perception and multisensory integration) HOWEVER the SPD cohort had the most extensive white matter alterations (which subserve auditory, tactile and visual perception and integration)
The findings of the study demonstrate that some areas of the brain that appear to be affected in those w/ SPD are different than ASD and therefore offer a neuroanatomical distinction.
CASES
Case I
SG 7yo Female (1st Appt)

Pertinent Hx
- Birth Hx: stressful time for mother* [chemicals in cord blood/cortisol in cord bl?], vaginal birth, past due nursed w/o issue
- Skipped crawling
- Chronic OM
- Enjoys jumping on trampoline
CASE I
1ST APPT CONTINUED

**SPD sxs**
- Dislikes spinning on playground equipment
- **Car sickness (stomach aches/N)**
- Clumsy
- Sensitive to noise-crowds
- “Picky eater”
- Sensitive to smells
- Hair brushing “hurts”
- Will only wear pajama pants & no underwear during the day
Objective

- Convergence issue – asymmetry (R)
- Supine flexion – c/o sore neck and back mm post sustained flexion
- Poor extensor mm (prone extension-unable to maintain)
- After 9 jumping jacks → lost coordination and flow
- Poor UE strength
**Case I**

1st Appt Continued

**Treatment**
- Trial of MultiVitamin d/t taste issue
- Moved seat on bus to a front seat
  - Mother to assess any change in N
- Assess clumsiness post jumping on trampoline w/ visual targeting
- Implement Cozy corner (w/ wted blanket)
- Prone extension exercises daily, w/ variations
CASE I
2ND APPT

Subjective
- Trampoline w/ visual target → decreased clumsiness and increase in cognitive processing
- Mother noted increase in clumsiness post “screen time”
- Decreased N w/ change of seat on bus to front
- “Loves” wted blanket (calming)
- Multivitamin didn’t like “taste”
- Did not implement prone extension exercises

Tx:
- EFA
- Obstacle course suggestions given
- Suggested training in b/c protocol
**Case I**

**3rd Appt**

**Subjective**
- Overall decreased complaints (per pts mother)
- Loves EFA
- Prone Ext – doing more often.
  - Patient commented it is “exhausting”
- Denies initiation of obstacle course suggestions
- Clothes continue to be an issue
  - B/C protocol not initiated
**Case I**

**Overview**

Main improvements

- Car sickness/ Nausea – treated by moving seat on bus
- Clumsy → treated by daily trampoline jumping with visual targeting

- Continues to have difficulty w/ tactile hypersensitivity
  - Brushing and compression program recommended, but not implemented
**Case II**
**RP 13yo Female (1st Appt)**

**Pertinent Hx**
- Birth Hx: C-Section
- Poor sleep habits
- Fears: getting lost, demons, night, clowns, porcelain dolls
- Anxiety: Reading /public speaking
- Tickling by brothers

**SPD Sxs**
- Finger sucking → “calming”
- Likes to “snuggle”
- Issue w/ loud sounds
- “Picky eater”
CASE II
1ST APPT CONTINUED

Objective
- No eye contact
- Hat pulled down over eyes, Hair in face, shirt pulled up over mouth
- “Cloaked in black”
- Lethargic/ withdrawn
- Convergence issue (R ) eye

Treatment
- Behavioral optometrist referral
- Wted blanket
- Refrain from others tickling
- EFA
CASE II
2ND APPT

Subjective
- Called for appt w/ Behav optom
- No f/u w/ wted blanket
- Stopped taking EFA
- Tickling has stopped
- Sleep: feels room is haunted
- Poor dietary choices: Carbs/ Dairy
- Chaotic household (parents, several animals, 2 brothers, and sister in law)

Objective
- Prone on chairs in waiting room
- Lack of eye contact
- Lack of engagement in conversation
CASE II
2ND APPT CONTINUED

Tx
- 3mg Melatonin qhs
- Discussed making Wtd blanket
- Discussed Nutr plan (increased proteins)

- Mancinella 30c 3p QD
CASE II
3RD APPT

Subjective

- Behav optom appt:
  - Dr. Semenza stated that pts “eyes working independent of each other. 90% of her brain is focused on the words and the information.”
- Changed bedroom
- No change in nutr/diet
- Inconsistent w/ EFA
- Not taking Melatonin or Mancinella
- Wted blkt not using
- Wrote a play and performed at church

- Mother reported pts “self language” has improved
- Dad reported pt is more engaged and overall communication has increased
CASE II
3RD APPT CONTINUED

Objective
- Wearing Glasses (prescribed by Dr. Semenza)
- Hair out of face
- Eye contact
- Engaged /communicated
- Sitting erect in chair
Main improvements
- Convergence insufficiency being addressed by Behavioral optometry and prescribed glasses
- Improved sleep (bedroom change)
- No tickling by brothers
- Impact of Mancinella (?)

Continued Issues
- Finger sucking
  - Deep pressure (wted blanket, heavy work)
- “Picky eater”
  - Nutrition (EFA, Multi)
  - Supplements
REFERENCES

- **Journal Articles**

- **Websites**
REFERENCES

_books

- Your Essential Guide to Understanding Sensory Processing Disorder Copyright © 2011 by Angie Voss, OTR
- The Out of Sync Child Copyright © 1998 by Carol Stock Kranowitz, MA
  ISBN 0-399-52386-3
- Raising a Sensory Smart Child © 2009 by Lindsey Biel, OTR/L and Nancy Peske
  ISBN 0143115340

_courses

- The Whole Child: S.A.N.E System of Pediatric Assessment & Treatment
  Debra Dickson, PT
- Evaluation and Treatment of Sensory Processing Disorders
  Bonnie Hanschu, OT