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Efficacy of a Sound-based Intervention with a Child with an Autism Spectrum Disorder and Auditory Sensory Over-responsivity

By

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• “Occupational therapists use music as preparation for therapeutic activities on the basis of the belief that sensory input through the auditory and vestibular systems can be calming and organizing to children (Ayres, 1979; Frick & Hacker, 2001).”

• Ayres (1972, 1979) suggested that auditory input contributes to:
  – arousal, self-regulation, & emotions

Objectives

• Discuss the complexity of auditory sensory over-responsivity in children with an Autism Spectrum Disorder.

• Discuss the current best evidence of sound-based interventions with children who demonstrate difficulty with auditory sensory over-responsivity.

• Demonstrate a the ability to identify the role of sound-based interventions in children struggling with auditory sensory over-responsivity.
Prevalence of Sensory Processing Disorder with Autism Spectrum Disorder

- 95% of children with Autism Spectrum Disorder (ASD) had some level of sensory processing difficulty.
  - 77% showed differences on the auditory filtering section on the Short Sensory Profile.
    » Dunn and Tomcheck (2007)
- 56% of children with ASD showed extreme Sensory Over-Responsiveness
  » Baranek (2002)
- 100% of 200 participants with ASD reported having difficulty with response to auditory stimuli.
  » Greenspan & Weider (1997)

The Classification of Sensory Processing Difficulties

Sensory Processing Disorder

- Sensory Over-Responsivity
- Sensory Under-Responsivity
- Sensory Seeking/Craving
- Dyspraxia
- Postural Disorders

Sensory Based Motor Disorder

- Visual Disorders
  - Auditory
  - Tactile
  - Vestibular
  - Proprioception
  - Taste/Smell
• Estimates place the prevalence of comorbidity of ASD and SPD at 69–95% (Baranek et al, 2006; Tomcheck and Dunn, 2007). Auditory SOR appears to be common among children diagnosed with ASD.

• In a retrospective study, Greenspan and Wieder (1997) reported that 100% of children (n=281) with ASD presented with disturbances in auditory processing. These auditory processing disturbances specifically related to receptive language and resulted in

#### DSM-V Criteria

• Must meet criteria A, B, C, and D:
  
  A. Persistent deficits in social communication and social interaction across contexts, not accounted for by general developmental delays.
  
  B. Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least two of the following:
    
    4. Hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of environment; (such as apparent indifference to pain/heat/cold, adverse response to specific sounds or textures, excessive smelling or touching of objects, fascination with lights or spinning objects).
  
  C. Symptoms must be present in early childhood (but may not become fully manifest until social demands exceed limited capacities)
  
  D. Symptoms together limit and impair everyday functioning.
Sensory Over-Responsiveness

• Sensory Over-Responsiveness (SOR)
  – Sensory Modulation Disorder
  – degree, intensity and nature of a person’s response to sensory stimuli
  – may cause problems with functioning in every day life.
• Auditory SOR has been defined consistently as:
  – “Consistently exaggerated or inappropriate responses to sounds that are neither threatening nor uncomfortably loud to a typical person”.

Auditory SOR

• 56% of children with ASD, from ages 2 to 7 years showed extreme, more than 1 standard deviation above norms, sensory over-responsiveness (Baranek et. al, 2006).

• 50.9% of children responded negatively to unexpected loud noises and 45.6% reported children holding their hands over their ears to protect them from sound (Dunn & Tomcheck, 2007)

• Occupational Therapists are currently addressing Auditory SOR is through sound based interventions.

• Limited body of evidence indicating the effectiveness of SBI for children with ASD and auditory SOR
Purpose

• An exploration of the effectiveness of a SBI, The Listening Program (TLP), with children diagnosed with ASD who demonstrate auditory SOR.
  – 1. Does a SBI reduce observable behaviors of auditory SOR with a child diagnosed with an ASD?
  – 2. Does a SBI improve the sensory processing abilities with a child diagnosed with an ASD?

Sound-Based Interventions

• **Sensory-based intervention** - typically occur in the child’s natural environment and consist of applying adult-directed sensory modalities to the child with the aim of producing a short-term effect on self-regulation, attention, or behavioral organization (Watling, Koenig, Davies, & Schaaf, 2011).

• **Sound-based interventions** - Therapy approaches that use the auditory system (i.e., therapeutic listening and auditory integration training) to promote integration and organization of the central nervous system (Case-Smith & Arbesman, 2008).
• TLP utilizes psychoacoustically modified music in certain frequency zones.
• The music itself is designed to have listening sessions that include a warm-up, training and integration (ABT, 2008).
• Modules allow the listener to become accustomed to the music before the optimal sensory stimulation frequencies are achieved.
• The listening schedule is one to two times per day for 5 days, followed by a 2-day break.

Procedures

• Approval granted by the ISU Human Subjects Committee.
• Parental consent was obtained prior to data collection.
• The participant
• 6 year old female
• Diagnosed with moderate ASD
• Demonstrated auditory sensory over-responsiveness.
Value of Single Case Design

- Single subject design allows for the evaluation of diverse responses and profiles of subjects in response to experimental interventions instead of analyzing general trends and averages (Kennedy, 2005).
- Implementation may be better aligned with clinical practice.

Single case ABA design

- A(1) and A(2) participant came in weekly for:
  - Examiner based observation session, Sensory Over-Responsiveness Scale (SORS)
  - Caregiver questionnaire, the Sensory Processing Measure, (SPM)
- B phase the intervention was implemented.
  - TLP, Listening to 15 minute sessions twice daily at home.
- She also came in biweekly for the SensOR & SPM
Procedures

• During the B phase the participant took part in daily listening,
  – 15 minute listening sessions, two times per day of psycho-acoustically (frequency, volume, tempo, instrument location) modified classical music (Mozart, Haydn, and Bach).
• The participant received listening equipment and music, which included a CD player, an amplifier and specialized headphones from ISU.

B Phase Intervention

• Developed
  – With guidance from the developer of TLP
  – Considering limited time and resources of researcher and client
  – Limitations of the research design
    • Longer duration of intervention – treatment decay
B Phase Intervention

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<tr>
<th>B Phase Treatment</th>
<th>Week 1</th>
<th>Week 2</th>
<th>Week 3</th>
<th>Week 4</th>
<th>Week 5</th>
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<td>Sensory Integration</td>
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<td>Sensory Integration</td>
<td>Speech &amp; Language</td>
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Data Analysis

- The SOR scales presentation of a stimulus consisting of a variety of every day sounds of varying frequency levels.
  - The sessions were video recorded and scored/coded at a later date by two separate raters.
Data Analysis

• The SPM was completed each treatment session by the same caregiver.
  – It was scored after each observation the session by two separate raters.

Data Analysis

• Self Stimulatory Behavior (SSB), squinting her eyes and staring off to the side, was a high area of concern to the parent’s of the participant.
  – Scored off of SOR video footage for both frequency and duration during SOR observation session.
Sensory Processing Measure

SensORScales

[Graphs and charts showing data over weeks]
Acknowledgements

• Materials, equipment, and space utilized within this study were funded through generous gifts and grants from the Department of Physical and Occupational Therapy, the Sensory Processing Disorder Foundation, Advanced Brain Technologies and Wal-Mart in Blackfoot Idaho.
Implications for Practice

- limited outcome studies
  - Should consider them experimental
  - Should strive to generate empirical outcome tracking via single subject design
  - Measureable GAS goals related to functional outcomes
  - Identify the specific challenging behaviors related to sensory processing that SBI’s can improve

Other studies

• Advanced Brain Technologies (ABT). (2015). The listening program. (Available at: http://www.thelisteningprogram.com)