

Sensory Integration vs.
Behavioral Approaches to
Problem Behaviors in Autism

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Sensory Behaviors

- The DSM-IV-TR (APA 2000) criteria for Autism include
 - Restricted repetitive and stereotyped patterns of behavior, interests and activities, further described as:
 - Stereotyped and repetitive motor mannerisms (e.g., hand or finger flapping or twisting or complex whole body movements)
 - These behaviors are often described as serving a sensory function, (Cunningham & Schreibman, 2008) or as indicative of sensory motor difficulties or dysfunction in individuals with autism. (Baranek 2002)

Sensory Motor Dysfunction

- Sensory motor dysfunction is said to occur in most autistic children and many other children with developmental disorders, (Dawson & Watling, 2000)
- This dysfunction is displayed in unusual behavior believed to have a “sensory” function. This includes a range of behaviors that are seen in connection with specific environmental events.

Sensory Processing Problems

- Idiosyncratic responses to sensory stimuli and unusual motor patterns are reported to reflect sensory processing problems. It is suggested that these patterns are related to underlying dysfunction in autism. Treatment recommendations are made that are designed to remediate this underlying dysfunction and provide for improved function.

Treatment Recommendations

- The most commonly recommended interventions for these sensory behaviors is Sensory Integration Therapy or a variation of this such as Auditory Integration, Visual Therapy, Patterning, use of a “sensory diet” and related interventions such as weighted vests, vestibular stimulation, hugging machines, wraps weighted blankets etc.

Rationale

- Sensory Integration Therapy (SIT) is based on the assumption that the child is either over stimulated or under stimulated by their environment.
- Therefore SIT is intended to improve the ability of the brain to process sensory information leading to improved function of the individual.

SIT Theory

- According to Ayers (1979), under ordinary conditions people experience events via multiple senses. They integrate this information in order to understand the world. Normally children learn to do this in during development. Children with autism are impaired in their ability to integrate this information. The therapy provides a healing experience so that the child can modify their brain function and develop the ability to integrate information

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Who Recommends SIT

- A Google search for Autism Treatment brings up a number of recommendations. Many of these web sites include sensory treatments such sensory integration including:
 - Web MD
 - Centers for Disease Control and Prevention
 - eMedicineHealth
 - HealthCommunities.com

Assumptions and Questions

- The SIT model however includes a number of assumptions and raises a number of questions.
- Is there a clear relation between the identified behavior and ability to process sensory information?
- Do autistic individuals display patterns of over or under responsiveness to environmental stimuli?

Questions and Assumptions 2

- Do SIT interventions produce a reliable change in the sensory behaviors?
- Do SIT interventions produce reliable changes in other problem behaviors or improvement in function?
- Is there a way to measure sensory processing?

Assessment of Sensory Problems

- The typical method of assessment has been the use of questionnaires such as The Sensory Experiences Questionnaire (Baranek et al, 2006) and The Short Sensory Profile (Lane et al, 2010)
- These questionnaires are given to care givers, teachers or parents.
- Ratings are then used to describe subtypes of sensory dysfunction.

Examples of Questions from Short Sensory Profile

- The rater is asked if the child:
- Reacts emotionally or aggressively to touch
- Fears falling or heights
- Doesn't seem to notice when face or hands are messy
- Props to support self (even during activity)
- Responds negatively to unexpected or loud noises

Classification of Subtypes

- Lane et al, (2010) describe 3 clusters or subtypes
- Typical low energy/weak combined with taste/smell sensitivity
- Atypical low energy/ atypical taste/smell sensitivity
- Typical low energy/weak atypical taste/smell

Patterns of Sensory Symptoms

- Baranek et al (2006) found both hyper and hypo responsiveness simultaneously in 38% of subjects.
- Sensory symptoms were common in autistic children and children with other developmental disabilities.
- Autistic children tended to be more hypo-responsive in non-social contexts

Range of Sensory Symptoms

- There appears to be no agreed criteria for identifying “sensory” symptoms. Examples range from more obvious behaviors such as covering ears when loud noises occur to almost any stereotyped behavior. Any unusual reaction to an environmental event may be labeled a sensory symptom. Intense interest or lack of attention to events are both labeled sensory symptoms.

Problems with this Research

- The questionnaires are subjective and not clearly operationalized raising concerns about reliability and validity.
- Given this lack of operational definitions it is unclear how to measure changes in sensory processing.
- There is a lack of a clear link between the symptom subtype and hypothetical dysfunction or interventions.

Problems with the Model

- The model of autism as a disorder of sensory processing is problematic. The term sensory processing is a hypothetical construct and no identifiable processes are specified or defined. The logic is circular. Sensory processing difficulties are identified based on problem behaviors which are said to be caused by sensory processing problems.

What is Known About Sensory Dysfunction in Autism 1

- There is little support for a general baseline over-arousal or pattern of abnormalities in habituation in individuals with autism.
- There is some support for physiological hypo-responsiveness in children with autism.
- There are no empirical studies of an inconsistency theory of sensory processing.
Rogers & Ozonoff, (2005)

What is Known About Sensory Dysfunction in Autism 2

- The constructs of sensory and repetitive behaviors have not been well defined or their relationships carefully examined.
- The assumption that stereotyped behaviors have a sensory origin and have a cross modality unitary relationship has not been supported. Rogers & Ozonoff, (2005)
- The relationship between autonomic arousal, behavioral responsiveness and sensory profiles are weak and over or under responding may

What is Known About Sensory Dysfunction in Autism 3

- Increased levels of sensory-related behaviors are found in many groups with developmental delays.
- Theories of sensory defensiveness in autism are unsupported. Stereotyped behaviors do not increase with increased levels of sensory stimulation. Stereotypes do not seem to increase arousal levels either.
- Rogers & Ozonoff, (2005)

Sensory Sensitivity and Perceptual Motor Performance

- Minschew & Hobson (2008) evaluated sensory questionnaire responses and performance on neuropsychological tests of sensory perception. They compared individuals with high functioning autism and a typical sample. The autism subjects reported a higher rate of sensory symptoms. Sensory perceptual exam performance was not different but higher sensory perceptual function was more impaired in the autistic sample. There was little correlation between sensitivity reports

Tactile Sensitivity

- Guclu et al, (2007) evaluated tactile sensitivity in normal and autistic children. They found no differences in tactile thresholds or responses to a clinical questionnaire. There were no significant correlations between the questionnaires and threshold measures. There were high correlations between the tactile and emotional sections of the questionnaire suggesting the “sensory” problems are emotional rather than sensory in origin.

Anxiety and Sensory Behaviors

- One possible connection between sensory behavior and anxiety is explored by Green & Ben-Sasson, (2010). They suggest that sensory over reactivity may cause anxiety, anxiety may cause sensory over reactivity or they may be unrelated. They argue that if understanding this relationship could lead to therapeutic interventions. For example they expect weighted vests would help reduce anxiety.

Conclusions About Sensory Dysfunction

- Sensory symptoms may well be secondary rather than primary features of autism and may represent an emotional difference rather than a difference in sensory processing.
- Given the finding of a pattern of hypo-responsiveness to sensory stimulation and reports that hypo-responsive children benefit less from SIT the efficacy of this approach is questionable.

Implications of the Sensory Model

- If it is assumed that the problem behaviors and difficulties displayed by an autistic child are the result of a sensory processing disorder then the logical response is to accommodate the child, and attempt to meet sensory needs.
- Families guided by this model modify their lives and accommodate the problems rather than seeking solutions involving behavior change. (Schaaf et al, 2011)
- Contrast this with a functional perspective.

Reviews of SIT for Autism

- Dawson & Watling (2000) note that parent questionnaires report high rates of sensory processing abnormalities in autistic children. However studies of interventions to facilitate auditory, visual and motor integration provide no or equivocal support for auditory integration training and no firm conclusions were supported for SIT.

Reviews of SIT for Autism

- Baranek (2002) reviews efficacy of sensory and motor interventions for children with autism. Approaches include SIT, other sensory approaches, sensory stimulation, auditory integration, visual therapies, sensory motor handling, physical exercise and assorted other interventions. Methodology is often weak and there is limited support for any of these interventions. Baranek concludes SIT needs to be used in structured settings.

Reviews of SIT for Autism

- Lang et al (2012) reviewed 25 studies of SIT. Three studies showed some positive effects, 8 found mixed results and 14 found no benefit. The 3 studies with positive results were seriously flawed in methodology. They conclude the evidence does not support use of SIT for education or treatment of children with ASD disorders.

Is SIT a Fad Treatment?

- Zane et al (2008), argue that SIT is a fad treatment. They cite standards proposed to evaluate the quality of research evidence for effectiveness, including use of experimental design, control of bias, and multiple studies by multiple investigators. They conclude that applying these standards SIT is an unsupported treatment.

Why is SIT Popular

- SIT or variations of it including sensory diets are frequently recommended by OTs, other professionals and on the Internet
- People involved in providing sensory interventions, teachers and families of people receiving these treatments report perceived improvement and value the treatments.
- Families are often desperate for a solution and accept the theory uncritically.

A Functional Perspective

- The sensory integration and related approaches assume the function of sensory behavior is to regulate the individual's internal state. Functional assessment has repeatedly demonstrated that a particular behavior may have different functions in different contexts. Some researchers have included functional assessment or analysis in studies of SIT or component interventions.

Behavioral Interventions vs. SIT in Treatment of Self-injury

- Devlin et al, (2009) compared a behavioral intervention with SIT in treatment of a 9 yr old boy with self-injury behavior. Functional analysis indicated that SIB was maintained by negative reinforcement by escaping demands. Using an alternating treatment design, the behavioral intervention was shown superior to SIT in reducing self-injury behavior.

Details

- To more clearly evaluate the evidence about interventions for sensory problems two studies will be discussed in more detail
- Devlin et al (2011)
- Kane et al (2004)

Behavioral Interventions vs. SIT for Challenging Behaviors

- Devlin et al, (2011) compared a behavioral intervention to SIT. The subjects in this study were 4 boys between 6 and 11 years old and diagnosed with autism. Problem behaviors included self-injury, stamping of feet, crying, hair pulling, hand mouthing, hand biting and finger biting.
- The design involved alternating treatments provided primarily in the regular classroom.

Devlin et al, (2011) 1

- Sensory integration equipment included a net swing, a trampoline, a therapy ball, a “peanut” ball, beanbag, blanket, chewy tubes, a surgical brush and sponge.
- The outcome measure was frequency of problem behaviors (incidents per day).
- Self-injury behavior was blocked.
- Two subjects had functional assessment conducted using questionnaires. Two subjects also had functional analysis

Devlin et al, (2011) 2

- Salivary cortisol levels were measured.
- Baseline data was collected for 5 days prior to interventions.
- Interventions were provided over a period of 10 days in a random alternating pattern for each subject.
- SIT included a sensory diet approach including joint compression, brushing, swinging, jumping on the trampoline, wrapping in a blanket, chewing, and massage of lips and

Devlin et al, (2011) 3

- Each student had an individually defined behavioral program including elements like errorless learning, extinction and differential reinforcement of alternative responses, positive practice and over correction, and variable schedules of reinforcement.
- Following the presentation of the alternating treatments a best treatment phase was provided.

Devlin et al, (2011) 4

- For each participant the behavioral intervention was more effective in reducing challenging behavior than SIT.
- Little change in problem behaviors was seen from baseline to the SIT condition.
- Cortisol levels were low and showed minimal changes across conditions.

Weighted Vest Interventions

- Weighted vests are a specific intervention that can be a component of SIT or sensory diet interventions. The rationale is that deep pressure experienced from wearing the vest will have an impact on sensory processing problems, sensory behaviors, and problem behaviors including self-injury behavior. Some of this research includes functional assessment. That research is reviewed next.

Weighted Vests, Stereotypy and Attention

- Kane et al, (2004) studied 2 boys 2 girls ages 8 to 11. They had been diagnosed as having autism spectrum disorders or PDD NOS. All had been identified as having sensory integration needs.
- Outcome measures were attention to task and stereotypy during 10 minute intervals assessed

Kane et al, (2004)

- The study involved 3 conditions, no vest as baseline, weighted vest, and unweighted vest.
- The weighted or unweighted vest was presented in a counterbalanced order.
- In each condition the child was presented with an object such as a book and then the therapist did not interact for the rest of the 10 min.

Kane et al, (2004)

- Three of the participants showed of the vest did not increase attention to task or stereotyped behavior.
- One subject showed reduced stereotypy with the unweighted vest and increased with the weighted vest.
- One student showed decrease attention wearing the vest, and one resisted the vest.

Weighted Vest, Functional Analysis and Self-injury

- Carter, (2005) conducted a functional analysis to determine maintaining contingencies for self-injury in a 4 yr old boy. The functional analysis conditions were presented with the vest and without it, and when a sinus infection was considered present or absent. The presence of the sinus infection was associated with increased SIB but the vest had no impact on this behavior.

A Review of Weighted Vest Use in Children with ASD

- Stephenson & Carter (2008) review 7 studies of weighted vests in children with ASD and other disabilities. They conclude that consistent positive effects of wearing weighted vests are not demonstrated which is consistent with findings on SIT in general. Although some of the studies reported some positive results problems with methodology and data analysis make the results questionable.

Weighted Vests and Self-Injury

- Doughty & Doughty,(2008) evaluated the effect of a weighted vest on self-injury in a 14 yr old male with autism and other disabilities. Functional analysis was conducted to determine variables maintaining self-injury. A second functional analysis was conducted with the student wearing the vest. The vest had no clinically significant effect on self-injury.

Weighted Vests and In-seat Behaviors

- Cox et al (2009) studied the use of weighted vests on in seat behavior in 3 children with autism, intellectual disabilities and sensory processing abnormalities. Using an alternating treatment design they found no increase in appropriate in seat behavior from use of the vests. In contrast a non contingent reinforcement condition did produce increased appropriate behaviors.

Weighted Vests and Engagement

- Reichow, et al (2010) evaluated weighted vests on engagement, stereotyped behavior and problem behavior in 3 boys with autism or other developmental delays using an alternating treatment design. Two of the boys had been wearing weighted vests part time in the past. The vests produced no changes in 2 students and may have increased problem behaviors in one student.

Weighted Vests and Problem Behavior

- Quigley et al,(2011) evaluated the effects of weighted vests on problem behavior in 3 boys. They used weighed vests at 5% and 10% of body weight. Functional analysis was conducted to identify conditions maintaining the problem behaviors. The weighted vests had no effect on target behaviors but functional communication training did lead to a decrease in the problem behaviors for all 3 students.

Weighted Vests and Classroom Behavior

- Hodgetts et al, (2011 a), evaluated the effects of weighted vests on classroom behavior on 10 children with autism. Weighted vests had no effect on sitting time on 3 students, but did decrease off task behavior for 3 students and no effect on off task behavior for 4 students. Off task behaviors remained moderate to high with the use of the weighted vests.

Weighted Vests, Stereotyped Behavior and Arousal

- Hodgetts et al, (2011 b), evaluated weighted vests in the treatment of stereotyped behavior in 6 individuals with autism. They also measured effects on arousal level as indicated by heart rate. They found no decrease in stereotyped behavior using the vests. The vests are expected to reduce arousal but no student showed reduced heart rate and one showed an increase.

Summing Up Evidence

- Careful evaluation of Sensory integration based treatment leads to the conclusion that the interventions are not consistently effective. Almost all problem behaviors are assumed to be related to “sensory” processing problems and the solution is to somehow remediate this problem by providing selected sensory experiences. It is unclear how such experiences will produce a change that normal environmental stimuli fail to produce.

Derivative Treatments

- Several other interventions have been developed based roughly on the ideas behind sensory integration utilizing visual and auditory sensory stimulation.
- These derivative approaches will not be reviewed in this presentation but the evidence base is similarly deficient.
- See for example Tharpe, (2001), and Mudford et al, (2000), for a discussion of auditory integration

Function and Stereotypy

- Stereotypy is common in autistic individuals and interferes with learning and other important activities such as social activities.
- It can be understood as operant behavior maintained by automatic reinforcement, socially mediated reinforcement including attention and tangible contingencies.
- Functional assessment including functional analysis allows identification of the function and development of effective interventions.

Assessment and Treatment of Stereotypic Behavior in Autism

- Reed et al (2012) review the literature on stereotypic behavior. A variety of typographies have been described. The majority of studies did not use functional assessment or identify the function of the behavior. A variety of interventions using reinforcement, punishment and antecedent strategies are described. Assessment of treatment integrity is typically neglected.

Functional Analysis

- A methodology for functional analysis has been well described and is essential in identifying the function and designing appropriate interventions for problem behaviors including stereotyped behaviors, so called sensory behaviors and self-injury.
- Iwata et al (1994), Iwata & Worsdell (2005)

When the Function is Sensory

- Functional assessment may determine that the problem behavior is partially or completely maintained by automatic reinforcement. In these instances interventions will need to identify appropriate ways for the individual to gain reinforcement of the same type as that obtained by the problem behavior.

Strategies for Sensory Behaviors

- In those cases where the reinforcement is automatic the replacement activities may include access to stimulation contingent on engaging in desired behaviors. Some solutions are suggested in papers by Murray et al (2009), and Mays et al (2011).
- It is critical to assess function rather than assume and defer to these replacement strategies.

Automatic or Direct Reinforcement

- Some problem behaviors are automatically reinforced. Some sources suggest this would be better described as direct reinforcement because the behavior puts the individual in direct contact with the reinforcement, Cipani & Schock (2011).
- Regardless of terminology if functional assessment indicates the problem is maintained this way then interventions need to be designed accordingly.

Consider the Premack Principle

- It may be practical to allow access to the opportunity to engage in the problem behavior contingent on engaging in desired lower probability behavior and not engaging in the problem for a predetermined interval. The intervention may also require blocking of the problem behavior if it does occur outside of planned intervals where it is allowed.

Premack

- This intervention may need to begin with short intervals of appropriate behavior followed by allowing the directly reinforced behaviors and gradually increasing the duration of appropriate behaviors before reinforcement.
- While the intervention may not decrease the desire to engage in the problem behavior it may make it much less disruptive.

Omission Training

- Conceptually similar to a Premack contingency, Omission training involves training the individual to mand an opportunity to engage in the directly reinforced behavior and this mand occasions initiation of a DRO interval. The client is taught to forgo the target behavior for a defined interval and reinforced by access to the directly reinforcing behavior. If the problem behavior occurs in the omission interval the timing of the interval is restarted.

DRO

- Applying the DRO contingency like the Premack contingency may need to begin with short intervals and that can be gradually lengthened as the individual learns to delay reinforcement.

Finding a Replacement

- If the problem behavior is directly reinforced it may be practical to find a similar behavior that does not have some of the disadvantages of the problem behavior.
- Some of the techniques used in sensory diet interventions may actually work because they provide reinforcement that is similar to that obtained by the problem behaviors.

Establishing Operations

- If assessment identifies establishing operations then manipulation of antecedent conditions may be an effective intervention. For example it may be that self-stimulating behaviors are more likely to occur if the general level of environmental stimulation is low. Increasing the level of stimulation in the environment may act as an abolishing operation.

Technology

- In the final analysis ABA provides a technology including assessment and intervention strategies which can reliably change problem behaviors. The effects of intervention can be measured. This fits the definition of evidence based treatment. The same can not be said for Sensory Integration Therapy.