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The Significance of Comforting Touch to Children with Autism: Sensory Processing Implications for Occupational Therapy

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The Significance of Comforting Touch to Children with Autism: Sensory Processing Implications for Occupational Therapy

Abstract

Background: Children with autism have unusual sensory processing issues. The aim of this study was to examine how mothers comforted their children. Clinical observation has shown that mothers of children with autism often have difficulty calming their children. This study describes the differences in the response to comforting touch among children diagnosed with autism and normally developing children.

Method: The study was a self-report survey using a questionnaire to compare the responses of mothers of children with autism (N = 25) to mothers of typically developing children (N = 26).

Results: The results showed that the methods used to comfort children with autism and normally developing children was different.

Conclusion: Mothers of typically developing children reported more success by using comforting touch, whereas mothers of children with autism reported more success by comforting their children with visual and auditory stimuli.

Keywords

Autism, Comforting Touch, Entrainment, Relaxation Response, Soothability, and Sensory Processing

Cover Page Footnote

We acknowledge the Department of Samuel Merritt University for allowing faculty and graduate students to collaborate on research.

Credentials Display and Country

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Background and Literature Review

The incidence of children being diagnosed with autism continues to increase at an alarming rate. It is estimated that 1 in 68 children fall in the autism spectrum (Centers for Disease Control and Prevention [CDC], 2012). The CDC report (2012) shows that most children with ASD are diagnosed after the age of 4, although some children are diagnosed as early as the age of 2. New diagnostic criteria in the DSM-5 is based on observed behavior, which includes persistent deficits in social communication and social interaction across multiple contexts as manifested by deficits in social-emotional reciprocity; deficits in nonverbal communicative behaviors used for social interaction; and deficits in developing, maintaining, and understanding relationships (Autism Speaks, 2016).

Autism is referred to as a spectrum disorder because symptoms and behaviors vary widely among individuals. Recent studies by Marco et al. (2012) and Chang et al. (2014) are among the first to compare structural connectivity in the brains of children with an autism diagnosis to those with a sensory processing disorder diagnosis and with a group of typically developing boys. In these imaging studies, only the children with autism showed impairment in the inferior fronto-occipital fasciculi (IFOF), the inferior longitudinal fasciculus (ILF), the fusiform-amygdala, and the fusiform-hippocampus tracts, which are significant tracts for social-emotional processing. Many times, children with sensory processing disorders have been classified with children with autism because they manifest similar behaviors.

Huss (1977) discussed the importance of using touch in occupational therapy and how it is physiologically necessary for normalizing homeostasis. A child's ability to process and integrate sensory information impacts his or her quality of social interactions and relationships with the mother. Children with autism often display sensory processing abnormalities, which can cause them to have negative responses to human contact.

Comforting touch is a form of somatosensory input that is applied with the intent to cause a calming effect. Many practitioners believe comforting touch is the most successful method to calm children who are distressed (Baranek, 2002; Cullen, Barlow, & Cushway, 2005; Day, 1982). Several objective studies have been conducted to explore the use of comforting touch and/or massage to reduce stress in adults and preterm infants in intensive care units (Baranek, 2002; Harris & Richards, 2010). Physiological measures show that when comforting touch is applied to infants they exhibit higher hematocrit levels; they require less oxygen; and they have less apnea, better weight gain, and higher scores on motor development (Harrison, Williams, Berbaum, Stem, & Leeper, 2000). Some research has suggested that Qigong massage has a calming effect on children with autism (Silva & Schalock, 2012; Silva, Schalock, Ayres, Bunse, & Budden, 2009; Silva, Schalock, & Gabrielsen, 2011). Numerous studies on animal models also suggest that appropriate tactile input during the early years promotes optimal growth and development (Field, Diego, Hernandez-Reif, Deeds, Figuereido, 2006; Lane & Schaaf, 2010; Montagu, 1986). Sladyk,

Jacobs, and MacRae (2010) discussed comforting touch in the context of therapeutic use of self. There is considerable evidence that suggests children with autism have nervous systems that tend to be more excitable and are less able to habituate to perceived aversive sensory stimuli, and that their levels of arousal are the result of an imbalance of excitatory and inhibitory mechanisms (Anzalone & Williamson, 2000; Baranek & Berkson, 1994; Blakemore et al., 2006; Rubenstein & Merzenich, 2003). Sensory processing disorders are well documented in the basic science literature (Kern et al., 2006) and the clinical literature (Dunn, 1997; Dunn, 1999; Dunn, 2001; Tomchek & Dunn, 2007).

Studies have suggested that the aversion a child with autism has to physical contact can negatively impact the mother-child relationship (Cullen & Barlow, 2002a; Cullen, Barlow, & Cushway, 2005; Dicke, Baranek, Schultz, Watson, & McComish, 2009). The mother's feelings of competence in the parenting role are dependent on the observation that her attempt to comfort is appreciated (Elliott, Reilly, Drummond, & Letourneau, 2002; Peláez-Nogueras, Field, Hossain, & Pickens, 1996).

Comforting touch has been emphasized in the early literature as one of the most effective methods of comforting infants (Day, 1982; Korner & Thoman, 1972). Comforting during times of distress is often a daily activity between mothers and typically developing children. The term comfort is used here in the context of a sensory experience and social interaction that influences the quality of the parent-child relationship. The term comfort is also used to describe the soothing or consoling of a typically developing child. Common methods of calming young children include picking them up and holding them, stroking (swaddling), rocking, and providing deep pressure (Field, Lasko, Mundy, Henteleff, 1997; Harrison et al., 2000).

Children diagnosed with autism may respond to a light touch with a level of distress and anxiety that is disproportionate to the intensity of the stimulus (Baranek & Berkson, 1994; Blakemore et al., 2006; Tomchek & Dunn, 2007). The aversion to comforting touch in children with autism has been frequently reported in the literature (Baranek, David, Poe, Stone, & Watson, 2006; Cullen & Barlow, 2002a; Cullen & Barlow, 2002b; Cullen, Barlow, & Cushway, 2005; Konstantareas & Stewart, 2006; Silva & Schalock, 2012). Mothers of children with autism can experience great difficulty in bonding with their child (George & Solomon, 1999; Gray, Watt, & Blass, 2000). The literature also supports the premise that children with autism become upset more often and are more difficult to comfort than typically developing children (Kim, Szatmari, Bryson, Streiner, & Wilson, 2000; Konstantareas & Stewart, 2006). Behavioral cues of appearing to be comforted are rarely observed in children with autism (Siegel, 1999; Tomchek & Dunn, 2007).

The somatosensory system provides sensory protection and awareness of the environment in normally developing children (Anzalone & Williamson, 2000; Dunn, 1999). Sensory processing disorders are common clinical manifestations in children on the autism spectrum (Kern et al., 2006; Marco et al., 2012; Rogers, Hepburn, & Wehner, 2003). The Sensory Profile

(Dunn, 1999) is used by occupational therapists to evaluate the way children process sensory information. Kientz and Dunn (1997) found that children with autism had an overall difference in their responses on the Sensory Profile. Many children with autism exhibit behaviors similar to tactile defensiveness, which includes withdrawal, avoidance, negative expressions, or over arousal (Blakemore et al., 2006; Kern et al., 2006). Mothers often refer to this uncontrollable excitable behavior as a "melt down." Based on the review of the literature, we hypothesized that children who fall in the autism spectrum have significant impairments in sensory processing and sensory regulation that impacts their ability to engage in social interactions with their mothers (Rubenstein & Merzenich, 2003; Tomchek & Dunn, 2007).

Method

The purpose of this study was to compare mothers of children with autism and mothers of typically developing children in regard to how much difficulty they experience in comforting their children, the methods of comfort they have found to be successful, and whether or not there is a relationship between their child's soothability in response to comforting touch. Participants were recruited through online advertisements and from early intervention and early childhood education programs in Oakland, CA. Data were collected using an internet survey.

We hypothesized that mothers of children with autism would report more difficulty in providing comfort than mothers of typically developing children.

Participants

Autism group. The first group of participants included 25 first-time mothers between the ages of 27 and 48 years, with a mean age of 35.9 years. Marital status included 23 married, one living with a partner, and one divorced/separated. Race/ethnicity included 18 people identified as White/Caucasian, four as Asian, one as Hispanic/Latino, and two unknown. Each mother reported that her child was diagnosed on the autism spectrum (18 males, 7 females) between the ages of 1 year 11 months and 6 years, with a mean age of 4.2 years. All but one child had received early intervention services.

Control group. The second group of participants included 26 first-time mothers between the ages of 23 and 42 years, with a mean age of 35.8 years. Marital status included 19 married, four living with a partner, two divorced/separated, and one single/never married. Race/ethnicity included 17 people identified as White/Caucasian, two as Asian, two as Black/African American, three as Hispanic/Latino, and two unknown. The control group had no known special needs (13 males, 13 females) and were between the ages of 1 year 10 months and 4 years 6 months, with a mean age of 3 years (see Table 1).

Table 1

Demographics of Mothers and Children

N = 25	Age Range	Mean Age	Marital Status	Race/Ethnicity
Autism	27-48	35.9	23 Married 1 Partner 1 Divorced	18 White 4 Asian 1 Hispanic 2 Unknown
N = 26	Age Range	Mean Age	Marital Status	Race/Ethnicity
Normal Devel.	23-42	35.8	19 Married 4 Partner 2 Divorced 1 Single	17 White 2 Asian 2 African Am. 3 Hispanic

Autism Group Children

N = 25	Age Range	Mean Age	Males	Females
	1 year, 11 months	4.2 years	18	7

Normally Developing Group Children

N = 26	Age Range	Mean Age	Males	Females
	1 year, 10 months	3 Years	13	13

Instruments

The researchers designed a standard questionnaire to determine what methods the mothers used to comfort their children, how their children reacted to physical contact when upset, and how effective they were in calming their children. We used open-ended questions to ask the mothers to list the methods that they found to be most effective in comforting their children, and to describe a recent event when they tried to comfort to the child (see Appendix for a complete copy of the questionnaire).

Soothability. Two questionnaire items were designed to assess the mothers' general level of success in comforting their children when they were upset or in distress. Two items were used to explore the methods that the mothers used to provide comfort to their children when their children were upset. Three items were used to assess the child's general response to being touched when upset or distressed. The first item gave the mothers a list of options to choose from to indicate how much distance their children preferred to have between them. The second item asked the mothers to indicate how many times their children became upset in a typical day, and out of this number, how many times the children enjoyed or rejected comforting touch or physical contact.

Comforting touch and soothability. Based on the data from question 6, ratios were calculated for the number of times children enjoyed or rejected being touched to the number of times they became upset in a typical day. Correlational analyses were performed for each group, as well as for the entire sample, to test the hypothesis that children who are more accepting of contact comfort are easier to soothe, and that those who are more rejecting of touch are more difficult to soothe.

Data Analysis

T-test analyses were used to determine significant differences between the two groups in relation to soothability, methods of providing comfort, and response to contact comfort. The hypothesis was evaluated as a two-tail analysis, allowing for a Type 1 error rate of .05. The Pearson Product-Moment Correlation Coefficient (*r*) was used to examine patterns of correlation between measures of soothability and the number of times that a child is upset and when the child enjoys physical contact or resists physical contact, both across groups and within each group.

Results

The t-test analyses of the child's soothability showed the difference was significant between groups for time taken to get the child to stop crying ($t = -2.92$, $p = .006$). The mothers of the children on the autism spectrum reported taking more time to get their children to stop crying. There was also a significant group difference in the level of difficulty in providing comfort ($t = -2.18$, $p = .034$), with the mothers of the children on the autism spectrum reporting having more trouble determining how to comfort their children more often than the mothers of the typically developing children.

Significant group differences were found for hugs ($t = 2.79$, $p = .011$), with more of the mothers of the typically developing children reporting hugging as a successful method of comfort. The mothers of the children with autism were significantly more likely to report using music ($t = 2.68$, $p = .011$) and visual input ($t = -2.66$, $p = .011$) as successful interventions for comforting their children.

Significant group differences were found for enjoyment of being picked up when upset ($t = 2.45$, $p = .022$) and enjoyment of being kissed when upset ($t = 2.33$, $p = .025$) with the mothers of the typically developing children more likely to report their children's responses to be positive.

Correlational Analyses

There were significant moderate correlations for response to comforting touch and soothability. Higher proportions of time a child enjoyed touch when upset was related to less time taken to stop crying ($r = -.46$, $p \leq .05$) and less difficulty in comforting ($r = -.59$, $p \leq .05$). The greater amount of time a child rejected touch when upset was related to more time taken to stop crying ($r = .33$, $p \leq .05$) and more difficulty in comforting ($r = .63$, $p \leq .05$).

When groups were analyzed separately, correlations for reaction to comforting touch and soothability were significant only in the autism group. More enjoyment of comforting touch was correlated with less time taken to stop crying ($r = -.6$, $p \leq .05$) and less difficulty in comforting ($r = -.84$, $p \leq .05$). Likewise, more rejection of contact comfort correlated with more time taken to stop crying ($r = .45$, $p \leq .05$) and more difficulty in comforting ($r = .76$, $p \leq .05$).

Discussion

The mothers of the children in the autism spectrum group described the process of comforting their children to be an unpleasant experience. However, the mothers of the typically developing children implied more confidence in providing comfort to their children when they were distressed.

As expected, the results supported the hypothesis that the mothers of the children with autism have greater difficulty in comforting their children than do mothers of typically developing children. The mothers of the children with autism reported taking more time to stop their children from crying and more difficulty in determining how to comfort their children.

Comforting Touch and the Relaxation Response

The results supported the hypothesis that a relationship exists between a child's response to comforting touch and his or her level of relaxation. The relaxation response is related to the shift from the sympathetic fight or flight response to a more calm parasympathetic response (Benson & Proctor, 2011). Across the entire sample, moderate correlations showed that the higher the proportion of time that children responded positively to touch when upset, the less time it took to get them to stop crying, and the less difficulty mothers experienced in determining how to comfort them (see Figure 1).

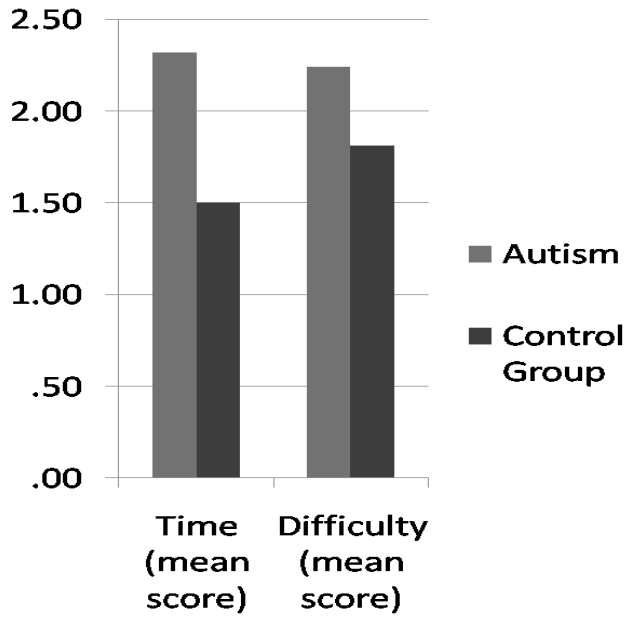

Figure 1. Relaxation response.

The mothers who reported that their children rejected comforting touch reported more difficulty in comforting their children. This data does not necessarily mean that comforting touch is directly related to soothability. However, the data suggests that children with autism are both more difficult to calm and more likely to reject comforting touch (see Figures 2 and 3).

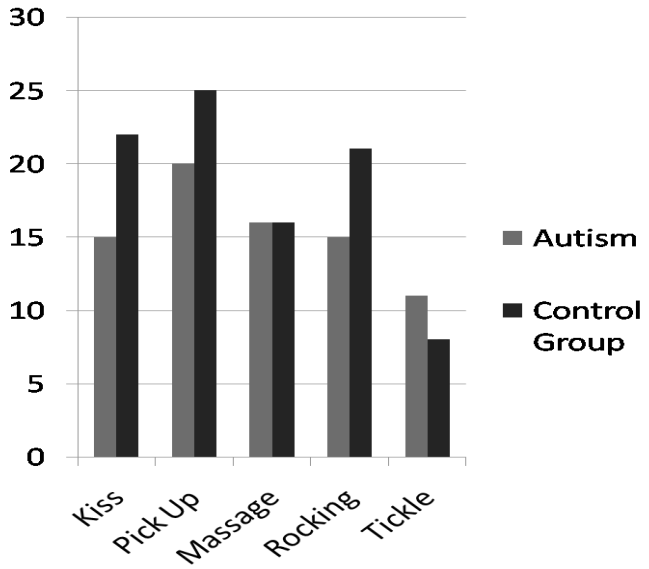

Figure 2. Methods that had a calming effect when child was upset.

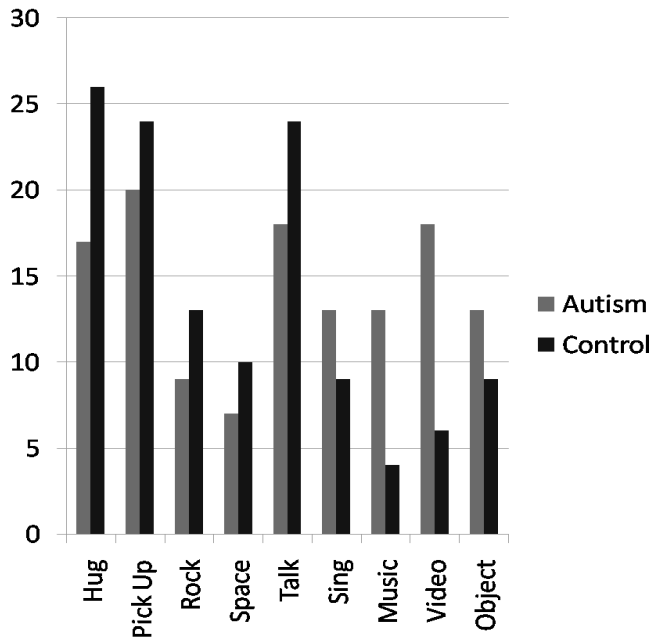

Figure 3. Methods of comfort found to be most successful.

Clinical Implications for Occupational Therapy

The findings of this study should be interpreted with caution because of the small sample size, and because it is difficult to extrapolate if the children were in the autism spectrum or had sensory processing disorders. The results of this study do support the evidence that children with autism are not likely to be soothed by comforting touch alone. The evidence derived from this study and new developments in neuroscience research provide a conceptual framework for occupational therapy intervention. Recent Diffusion Tensor Imaging (DTI) studies have shown that the brains of children with autism and children identified as having sensory processing disorders share disturbances in white matter pathways but have different connectivity in social-emotional pathways (Marco et al., 2012; Yi-shin et al., 2014). The children with autism showed impaired connectivity in the temporal tracts associated with auditory processing, social-emotional processing, and attention. The children with autism also showed diminished connections essential to the processing of facial emotion and memory (Bunim, 2014). In an Electrophysiology study using continuous EEG signal recordings, Brandwein et al. (2015) found that children diagnosed with autism processed auditory input less rapidly than typically developing children. This study suggests that how fast the brain responds to sights and sounds could help to objectively identify the severity of autism. Their data showed the more delayed the response, the more severe the symptoms. The study found a significant but weaker correlation between the severity of symptoms and the speed of processing the combined audio-visual signals. According to Marco et al. (2012), imaging studies have revealed that children with autism show a diminished early response in the primary somatosensory cortex (S1). This finding is most evident in the left hemisphere. While great strides have been made regarding diagnosis and treatment, understanding the neural underpinnings of autism and developing a quantitative measure of neurologic activity is critical to designing targeted interventions and measuring treatment response. As this area of research becomes more refined, occupational therapists must consider more distinct approaches to treating children with autism and children with sensory processing disorders. At the present, the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) has been silent on the diagnostic criteria for sensory processing disorders. Some alternative methods of treatment for children with autism may be necessary based on the evidence acquired from this study.

Entrainment and Neuronal Oscillations

Two lines of neuroscience research have emerged that have provided evidence for shifting away from the use of tactile input for children with autism. The diffusion tensor imaging studies show that deficits in connectivity of white matter support the observations of the mothers in our survey that comforting touch is rejected while activities that involve listening to soft music with repetitive slow rhythms can indeed provide a method of calming children with autism. One theory that helps to explain the calming effect of music on the nervous system is the concept of entrainment, which is broadly defined as the adjustment of the pace or

cycle of one activity to match or synchronize with that of another (Ancona & Chong,1996). In other words, neurons in the cortex form behavior-dependent oscillating networks that respond to certain auditory frequencies, rhythms, and sounds (Buzsáki & Draguhn, 2004). Each time the nervous system is exposed to a sound or a pattern of rhythms it creates an evoked potential or action potentials causing groups of neurons to fire in synchrony to the input. Neuroscientists use event-related potentials to provide a direct measure of the brain's response to sensory input.

Human electroencephalographic (EEG) studies on brainwaves reflect the oscillation frequencies in the cortex (Lakatos, Karmos, Mehta, Ulbert, & Schroeder, 2008). These studies have revealed differences in auditory, visual, and sensory-perceptual processing in children with autism (Brandwein et al., 2015; Russo et al., 2010). Aberrant cortical assembles of neurons and local circuit neurons can result in an imbalance of excitation and inhibition (Rubenstein & Merzenich, 2003). Pyramidal neurons in the somatosensory cortex receive excitatory input from other cortical pyramidal cells and thalamocortical afferent fibers, as well as inhibitory input from multiple subtypes of GABAergic interneurons (Daw, Ashby, & Isaac, 2007). In typically developing brains, Delta waves are seen at frequencies of 0.5-4 waves per second. These are the slowest type of brain waves but have the highest amplitude (strongest signal). Delta waves are common in typically developing children under 1 year of age and occur during sleep. Theta waves occur at frequencies of 4-8 waves per second, and are also called slow wave activity. Theta waves are often observed in children with autism and ADHD (Coben, Linden, & Myers, 2010). Alpha waves occur at a frequency of 8-13 waves per second and are observed in adults who are relaxed or meditating with their eyes closed. Beta waves occur at frequencies 13-30 per second. Beta waves are seen in people who are awake or alert with their eyes open or closed. Beta waves are often measured in the frontal lobes (responsible for conscious thought and movement) and in central regions of the brain. Gamma waves occur at frequencies of 30-80 waves per second and occur when the person is highly alert. The frequency of brain waves corresponds to behavior because they are caused by neuronal action potentials, which occur due to changes in the electrical charge of the neurons (Buzsáki, 2011; Paulk, Zhou, Stratton, Liu, & van Swinderen, 2013). Therefore, when the brain is active, neurons communicate more rapidly using network oscillations and electrical signals, which link neurons into assemblies and can facilitate synaptic plasticity and consolidation of memory (Buzsáki, 2011; Buzsáki & Draguhn 2004). This electrical activity produced by neurons is recorded in real time as brain waves on electroencephalogram (EEG) monitors.

As previously mentioned, the response time to sensory input may be used scientifically to measure the severity of autism (Brandwein et al., 2015). In addition to slower responses to auditory input, children with autism appear to have dysregulation of brain wave activity. Lai et al. 2010 reported that children with autism demonstrate a shift to randomness of brain oscillations on functional magnetic resonance imaging. There is

also growing evidence that brain waves can be regulated through entrainment activities and EEG neurofeedback training (Coben, Linden, & Myers, 2010; Coben & Padolsky, 2007). Presumably, EEG neurofeedback works through operant conditioning (Hill & Castro, 2009; McCormack, Douglas, Pauley, & Sinquefield, 2010). One simple way of promoting entrainment to synchronizing the regulation of neuronal oscillations is to engage children on a circle activity where they must look at one another and perform rhythmic motions, such as beating drums, clapping hands, or tapping to music. Repetition of such an activity is an important element in neuroplasticity (Kleim & Jones, 2008). Daily repetition of an activity takes about 15 days before neuronal assemblies in the cortex achieve long-term potentiation (Racine, Chapman, Trepel, Teskey, & Milgram, 1995). In general, high frequency rhythms produce oscillations that are confined to smaller neuronal assemblies, whereas slow rhythms produce oscillations that recruit larger networks of neuronal assembles (Buzsáki & Draguhn, 2004). According to Hebb (1949), neurons that fire together, wire together. This may be why applied behavioral therapy (ABA) is so effective with children with autism. ABA practitioners apply the same stimulus and vocal rewards over and over again to produce consolidation of a simple task.

Conclusion

Occupational therapy practitioners must continue to review the neuroscience literature because it has many implications for therapy. We must determine which interventions are effective on an individual basis and have evidence to support their efficacy for reimbursement, and to educate legislators who propose bills that can impact the scope of practice for practitioners who treat children with autism. If occupational therapists can help parents feel more successful in comforting their children during times of distress, the relationship between the parent and the child is likely to improve (George & Solomon, 1999; Kuhn & Carter, 2006).

Occupational therapists can consult with families and use standard evaluations to identify the unique ways children with autism process sensory input (Baranek et al., 2006; Dunn, 1999). When a child with autism rejects comforting touch, it may be helpful for the parent to understand that the child's response is not a rejection but the result of a sensory processing imbalance. Studies suggest that activities that promote auditory and visual processing may provide a better way to calm a child with autism and promote habituation to sounds in the immediate environment. Without such an understanding, a mother may feel rejected or ineffective. Occupational therapists can also "team–up" with neuroscientists and neuropsychologists to examine the child's imaging patterns on fMRI, EEG's, and Diffusion Tensor studies to better understand behaviors and modes of sensory processing. Based on new evidence, effective interventions may be evolving to support specific occupations and behavioral responses in the parent-child relationship.

The purpose of this study was to compare mothers of children with autism to mothers of typically developing children to understand the degree of difficulty they experience in comforting

their children. As proposed in the hypothesis, mothers of children with autism have more difficulty using touch to calm their children when they are distressed. Evidence suggests that slow, repetitive auditory input and visual input may be more expeditious.

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Appendix

Comfort and Soothability Questionnaire

Instructions:

The following questions refer to the ways in which you soothe or provide comfort to your child when he or she is upset or in distress. For each statement, please select the response which best represents your opinion.

Please answer each question as best you can. There are no wrong answers.

1. It usually takes me _____to get my child to stop crying.
    a. Less than 2 minutes
    b. 2-5 minutes
    c. 5-10 minutes
    d. 10-15 minutes
    e. More than 15 minutes
2. How often do you have trouble figuring out how to comfort your upset child?
    a. I never have trouble comforting my child
    b. Sometimes I have trouble comforting my child, but I'm usually successful.
    c. About half of the time I have trouble comforting my child.
    d. I usually have trouble comforting my child.
    e. I always have trouble comforting my child.
3. When my child is upset, I can usually comfort him/her by:
    a. Picking up YES / NO
    b. Hugging or holding YES / NO

c. Rocking YES / NO

d. Singing YES / NO

e. Talking YES / NO

f. Playing music YES / NO

g. Giving a favorite toy or blanket YES / NO

h. TV or videos YES / NO

i. Giving him/her space YES / NO

4. What seems to be the best way to comfort your child?

5. When your child is upset or in distress, how close does he or she usually like to be to you?

    a. So close that we are touching

    b. Close but not touching (up to 4 feet away)

    c. My child prefers some space (more than 4 feet away)

6. In a typical day, how many times does your child become upset or appear to be in distress?_____

    a. Out of this number, how many times a day does your child typically:

        i. Enjoy being touched (hugged, held, massaged, etc.) by you? _____

        ii. Pull back or turn away when touched?_____

7. When your child is upset or in distress, does he or she ever enjoy:

    a. Kisses with you YES / NO

b. Being rocking in your arms YES / NO

c. Being picked up by you YES / NO

d. Being tickled by you YES / NO

e. Being massaged by you YES / NO

8. Describe a time in the past week when you wanted to comfort your child. What happened and how did this make you feel?

9. If you have any comments about this survey, experiences you would like to share, or if you would like to elaborate on one of your responses, please use the space below. Your response is optional.