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# The Effect of a Three Point Sensory Diet on Vocal and Verbal Behavior in a Non-Verbal Child on the Autism Scale

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THE EFFECT OF A THREE POINT SENSORY DIET ON  
VOCAL AND VERBAL BEHAVIOR IN A NON-VERBAL CHILD  
ON THE AUTISM SPECTRUM

A Capstone Experience/Thesis Project  
Presented in Partial Fulfillment of the Requirements for  
the Degree Bachelor of Science with  
Honors College Graduate Distinction at Western Kentucky University

By

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\*\*\*\*\*

Western Kentucky University  
2010

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## ABSTRACT

The study involved a single subject, a non-verbal child on the autism spectrum, in a clinical setting over a 10 week period. The subject was on a three point sensory diet that was administered before therapy sessions. The tactile, vestibular and proprioceptive systems were targeted with deep pressure touch, a suspension swing, and joint compression. The primary focus was on participation in therapy and language development with specific attention given to the increase of vocalizations and/or verbalizations. The child experienced the sensory diet for schedule of 1 week off, 2 weeks on, 1 week off, 2 weeks on, 1 week off and 1 weeks on for the 10 weeks. A graduate student speech-language pathologist was assigned to plan, direct and work with the client for one hour twice a week for 10 weeks. A student researcher observed to document data and oversee progress. From this study, positive efficacy of sensory integration therapy was seen in direct relation to an increase in vocalization/verbalization as well as the client being more engaged in the therapy session and in daily life.

Keywords: autism, non-verbal, sensory diet, vocalization, verbalization

Dedicated to all children and adults on and off the autism spectrum who may have a Communication Disorder. Through studies like this it is possible to find a better way to give a voice to those who cannot advocate for themselves.

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## FIELD OF STUDY

Major Field: Communication Disorders



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## CHAPTER 1

### LITERATURE REVIEW

#### Introduction

The literature review encompassed three aspects: 1) to determine what previous efficacy had been found in Sensory Integration Therapy (SI Therapy) in relation to “readying” children to learn, which by definition means to meet their individual sensory needs which will allow them to be calm, alert and ready to focus and learn, 2) the efficacy of SI Therapy specifically relating to children with autism and 3) to determine the efficacy of SI Therapy on children with autism in specific relation to its effect on their communication skills.

Literature has been published about the first and second aspect, but not the third. SI Therapy, from infancy with founder A. Jean Ayres, has been seen to have positive results in “readying” children. “The intervention is unique in that it addresses the underlying substrates of dysfunction rather than just the functional difficulties itself. Ayres (1972) states:

A sensory integrative approach to treating learning disorders differs from many other approaches in that it does not teach specific skills...Rather, the objective is to enhance the brain's...capacity to perceive, remember, and motor plan (as a basis for learning)...Therapy is considered a supplement, not a substitute to formal classroom instruction.” (Schaaf & Miller, 2005)

The true efficacy has yet to be determined due to limitations of research studies, such as number of subjects, differing types of communication disorders studied, reliability and validity of research techniques, and even lack of publication of findings in peer reviewed journal articles. However, when applied to children with autism, although studied as well, there is little data to fully support the theory that SI Therapy helps them specifically to be “ready”. Autism is still a new concept in which professionals are beginning to specialize. SI Therapy, although not as new, is still new when applied to individuals with autism, who have stereotypical sensory defensive behavior, which SI Therapy targets. The theory of SI therapy in relation to children with autism and its efficacy on increased communication has yet to be fully studied. The review of literature was done to determine what, if any, research had been done in that particular area and if so what the efficacy of it was.

In the reviewing the literature three themes evolved. The first the theme concerned SI Therapy in relation to “readying” children. The second theme concerned SI Therapy in relation to children with Autism. The third theme, unaddressed in most literature, concerned SI Therapy in relation to children with Autism and the efficacy on increased communication. These will be reviewed by theme and organized by date. While

many articles and journals were read during the research and cited in the bibliography, only eight will be discussed for purpose of this review. Furthermore a comparison will be done to show similarities and/or differences in the studies, as well as their implications as they relate to this study. Lastly, a discussion will be made about the lack of literature concerning SI Therapy's effect on communication when used on children with Autism.

## Literature Reviewed

### *Introduction*

“The theory of sensory integration was developed by A. Jean Ayres (Ayres, 1972, 1979, 1989), an occupational therapist with postdoctoral training in educational psychology and neuroscience. Guided by her roots in the clinical field of OT, Ayres developed the theory of sensory integration to explicate potential relationships between the neural processes of receiving, modulating, and integrating sensory input and the resulting output: adaptive behavior.” (Schaaf & Miller, 2005) It is of the highest importance to mention Ayers as the founder of the theory of sensory integration, developed originally for children with learning disorders, as others reference Ayers consistently throughout their research. However, review of Ayers publications will not be discussed as a focus of this review. Ayers' research began in 1972 and while it did provide a foundation, there are other publications that are more recent and do not merely focus on the theory of sensory integration but its implications to “readying” children with and without autism. However, as it pertains to other research; specific quotations made by Ayers may be used.

*Theme One: The Efficacy of “Readying” Children through SI Therapy*

In 1983, Dr. Kenneth Ottenbacher, Assistant Professor, School of Allied Health Professions, University of Wisconsin-Madison, did a literature review entitled: *Developmental Implications of Clinically Applied Vestibular Stimulation*. He cites Ayres (1972) first using vestibular stimulation as one aspect of SI Therapy. Moving forward, he mentioned use of vestibular stimulation as popular treatment for children with developmental delay disorders, but with the lack of theoretical rationale in literature. Ottenbacher also notes Schilder (1933) as one of the “first investigators to hypothesize the importance of the vestibular system in overall human development.” His findings were consistent with other literature reviewed in that it “confirmed the importance of the vestibular system and its relationship to other CNS structures in developing motor skills, integrating postural reflexes, establishing coordinated eye movements and visual attention skills, developing exploratory behavior, and regulating arousal level” (Ottenbacher, 1983). Conclusively, the literature review, done by Ottenbacher (1983), “strongly suggested that vestibular stimulation provided as supplemental environmental enrichment can enhance arousal level, visual exploratory behavior, motor development, and reflex integration in infants who are at risk and in young children with developmental delay disorders. Seventeen of nineteen studies in which some form of vestibular stimulation was used reported positive effects in at least one area of development.” Documentation and reports of findings were still need at the time of his review. The most important question he proposed in the review was: “What are the long term effects of treatment programs using vestibular stimulation?” (Ottenbacher, 1983).

In 1989, Sharon Cermak, EdD, OTR and Anne Henderson, PhD, OTR, published a paper entitled: *The Efficacy of Sensory Integration Procedures*. SI efficacy is the extent to which SI procedures have been proven to be beneficial. Discussion of what SI is, what procedures are effective, why and how SI works, and outcome measures were initially discussed. Factors influencing effectiveness were also discussed. Those variables included: treatment (sequence of sensory input, therapist induced vs. child induced stimulation), patient (age, sex, diagnosis, severity), and therapist (sex, personality, expectations). Considering the variables helps to understand how and why SI Therapy works. Procedures and/or outcomes measured may differ due to those variables. In their conclusions, Cermak and Henderson (1989) found that there is still a need for studies of the relative efficacy of sensory integration procedures for children with differing diagnoses, differing degrees of disabilities, and different ages.

In 1999, Daria Mauer, Oklahoma State University published a journal article titled *Sensory Integration Therapy: Issues and Applications of Sensory Integration Theory and Treatment with Children with Language Disorders*. Mauer (1999) notes that because speech and language acquisition depends on multiple sensory processes, it is important for SLPs to understand that normal SI processes are required for communication. SI theory is based on the premise that the integration of the sensory system provides the foundation for success in development of motor abilities, organization, attention, language, and interpersonal relationships. Mauer also states the importance of the relationship between SI therapy and SLPs. Symptoms that qualify a child for SI therapy may have an impact on their language and learning abilities.

Therefore, collaborative efforts must be made between professionals working with a child and SLPs should examine principles and procedures of SI as they relate to acquisition of speech and language. Mauer (1999) found that Ayres (1979) hypothesized that neural systems that impair function may be remediable and that the control of the tactile, vestibular, and proprioceptive sensory input is believed to enhance nervous system function. Ayers (1979) also theorized that if the lower levels of the brain, such as the sensory systems, were properly functioning then that would lead to proper functioning of higher levels, such as language. By targeting those specific lower levels, the end product would be that specific higher levels could be reached. For example, if the muscles and joints were targeted for proprioception then activity level, attention span and emotional stability would increase. If those increased that would lead to purposeful activity, attention centered functions, and visual-spatial perception. If those areas were increased it would lead to academic learning ability, increased daily living activities and improved behavior. The end product would be learning, organizing, specialization of the brain and body, self control, self confidence, concentration, self esteem, abstract thought, and language. “According to Ayres (1979), the end product of SI therapy is the ability to communicate through language. Although found controversial, SI therapy has been seen to provide significant change in clinical reports. Those reports identify the behaviors during and after therapy which include improved ability to organize responses to the physical environment, increased language and reading development, improved social interaction and play, as well as increase ability to attend to the task or maintain emotional control. SI intervention continues to be controversial despite those reports due to studies with small sample size, inconsistent definitions of the dependent/independent variables,



types of sensory integrative dysfunction and SI treatment, and inconsistent outcomes.

Mauer (1999) noted Parham & Maillox (1996) when they stated that “a child with autism who exhibits difficulties in sensory modulation may be helped to respond in a more adaptive way to sights, sounds, touch, and movement experiences. This enhancement may lead to improved ability to attend to language and academic tasks and, thus, improve language use and academic achievement.” Mauer (1999), as past researchers have found, also believed that further research was needed. Specifically she stated that research should be done in speech language pathology to separate and identify the areas of language learning that may be enhanced by SI therapy, as well as which children are most likely to benefit. The shift needs to go from “How effective is the program?” to “How does it work and for whom?”

Also in 1999, Mona Griffer, Marywood University, published an article, *Sensory Integration Therapy: Is Sensory Integration Effective for Children with Language-Learning Disorders*. Her review of SI and findings were similar to those found by Mauer (1999). However, in Griffer’s review, she did an overview of influential case studies to date. Ayers and Mailloux (1981) conducted a single-case experimental study with four young children who had been diagnosed as aphasic to support their contention that vestibular sensory input facilitates auditory-language processing and speech-language production. In critique of those findings that the results were improved post SI therapy, Schaffer(1984) found errors that compromised the validity of the results. Conclusions were also drawn by Polatajko (1982) that there was a weak relationship between vestibular function and academic learning. In 1982, Ottenbacher conducted a meta-

analysis of eight studies in which 47 statistical tests were used to evaluate the effectiveness of SI therapy administered to children with learning disability, mental retardation, and other various disabilities. Results found that SI therapy was most effective when the dependent variable was motor or reflex measured and least effective when language was measured. Also SI therapy was most effective with subjects who had been diagnosed as being at-risk or with aphasia and least effective with those diagnosed with mental retardation. Although the results suggest the effect of SI Therapy appears to have empirical support, the 47 statistical tests were not compared to any other treatments in the clinical setting. In addition to Ayers (1972) and Ottenbacher (1982), five well controlled case studies, done from 1984-1992, were reviewed in which two of the five focused on language. The results of those case studies found no significant effect on the dependent variable due to SI therapy. There is little empirically based evidence to support the validity of SI theory and the effectiveness of the treatment that can be derived from such principles for clinical populations. Again, there was an identification of the need for “more statistically powerful and methodologically sound empirical studies and outcome measures” (Griffer 1999).

In 2005, Roseann Schaaf (Department of Occupational Therapy, Thomas Jefferson University; Philadelphia, Pennsylvania) and Lucy Miller (University of Colorado, Health Sciences Center, Director of the Sensory Integration Research and Treatment Center; Denver, Colorado) published an article: *Occupational Therapy using a Sensory Integrative Approach for Children with Developmental Disabilities*. In addition to an introduction and overview of SI Schaaf and Miller also included the current uses

and applications. Key challenges included: 1) The Just Right Challenge, 2) The Adaptive Response, 3) Active Engagement and 4) Child Directed. 1) The Just Right Challenge in which the therapist creates playful activities achievable by client and although challenging the child will always be successful, 2) The Adaptive Response in response to the Just Right Challenge the child adapts their behavior with new and useful strategies, 3) Active Engagement in which the therapist creates challenging, playful sensory rich environments to entice the child to participate and play actively but to incorporate new, advanced abilities that increase repertoire skills and processing, and 4) Child Directed in which the therapist constantly observes the child's behavior and reads the behavior cues and thus following the child's lead/suggestion to create sensory rich activities. These principles are unique because they address the underlying dysfunction rather than just the dysfunctional difficulties. Therapy provides opportunities for engagement in sensory motor activities rich in tactile, vestibular, and proprioceptive sensations. Schaaf and Miller (2005), when reviewing current evidence to support this approach, suggest that consensual knowledge and empirical research are needed to further elucidate the theory and its utility for a variety of children with developmental disabilities. They found that this is especially critical given the public pressure by parents of children with autism and of other developmental disabilities who note the utility of SI Therapy for helping their children function more independently. They also concluded that key limiting factors to research included lack of funding, paucity of doctorate trained clinicians and researchers in OT, and the inherent heterogeneity of the population of children affected by sensory integrative dysfunction.

*Theme Two: The Efficacy of “Readying” through SI Therapy on Children with Autism*

In 2000, Geraldine Dawson and Renee Watling of the University of Washington published an article: *Interventions to Facilitated Auditory, Visual and Motor Integration in Autism*. In a review of the evidence, Dawson and Watling looked at the prevalence of sensory motor abnormalities in autism and the effectiveness of three interventions designed to address such abnormalities as: 1) sensory integration therapy, 2) traditional occupational therapy, and 3) auditory integration training. They discovered that “although sensory processing and motor abnormalities were neither universal nor specific to autism, the prevalence of such abnormalities in autism was relatively high. There was, however, little controlled research on the effectiveness of interventions designed to address those abnormalities” (Dawson & Watling, 2000) Four objective outcome studies of SI therapy were identified. Those were of such small scale that no firm conclusions regarding efficacy could be made. “Although sensory and motor impairments were commonly found in autism, the interventions that had been designed to address them had not been well validated. In the case of SI therapy...there existed so few studies that conclusions could not be drawn” (Dawson & Watling, 2000). They also concluded that there was very little known about which ages or subgroups of individuals were most likely to benefit from therapies addressing sensory and motor difficulties.

In 2002 Grace Baranek, University of North Carolina at Chapel Hill, published an article titled *Efficacy of Sensory and Motor Interventions for Children with Autism*. This publication had three main purposes: 1) summarize empirical literature with respect to sensory and motor development/abnormalities in children with autism, 2) evaluate the

scientific basis of sensory and motor interventions used with children with autism, and 3) describe implications of these findings for education and further research. The original model founded by Ayres was criticized as being outdated. The assumption that sensory experiences had an effect on learning was less controversial at that point; however, the mechanisms through which this occurs were somewhat ambiguous and often debated. Baranek (2002) also touched on the classic approach to SI Therapy which included utilizing a direct one-on-one intervention model in a clinic environment that requires specialized equipment (e.g. suspended swings). Treatment plans included therapy 1-3 times per week for 1 hour sessions. The classic approach differed from a Sensory Diet, a SI based program, that included a home or classroom program of sensory based activities aimed at fulfilling a child's sensory needs. A schedule of frequent and systematically applied somatosensory stimulation (i.e., brushing, joint compression) was followed by a set of activities designed to meet the child's sensory needs and it was integrated into the child's daily routine. Also discussed was the Alert Program in which a child, usually higher functioning with verbal capabilities, is given additional cognitive strategies to assist with arousal modulation. In summary of the case studies reviewed, Baranek (2002) found that some of the treatments used provided questionable rationale for their use with children with autism and have empirical evidence to evaluate their efficacy with the population. Several programs suffer due to the fact that they are based on the outdated assumptions concerning older neurological theories which have been disproven or with other theories that have yet to be modernized. The volume of studies in the area were found to be low and findings were often mixed due to methodological constraints such as small samples, weak designs, observer bias, ect. The biggest limiting factor identified

was that many studies failed to directly link changes in the purported dysfunction mechanism to the functional changes in behavior. They either provide outcome measures of the proximate behaviors or the broader functional behaviors; rarely do they link both in systematic and measurable ways. Another conclusion reached by Baranek (2002) was that because autistic symptoms are manifested differently across development and that heterogeneity exists within the autism spectrum, it's likely that individualized patterns of reactivity may be associated with differential treatment outcomes. A further concern was with intervention, in that most of the studies provided limited follow-up after intervention, so it is unknown whether positive effects are sustained long-term. However, Baranek quotes Rogers (1998) in saying that the lack of empirical data does not infer that the treatment is ineffective, but rather that efficacy has not been objectively demonstrated. Baranek concludes that given that at least some positive findings were noted with respect to the sensory and motor interventions reviewed, future research must move from the current level of small scale, poorly controlled, unsystematic studies of effectiveness, to a level that demands scientific rigor and well controlled large scale designs.

Finally, in 2007, an article was posted titled *Sensory Integration Treatment Yields Promising Results for Children with Autism* which discusses sensory treatments done by Beth Pfeiffer, Ph.D., OTR/L, BCP and Moya Kinnealey, Ph.D., OTR/L, from the Occupational Therapy Department in Temple University's College of Health Professions, which states that parents of children with autism are increasingly turning to SI treatment to help their children deal with the disorder. Promising results are being found in that

71% of parents pursued alternative methods of treatment that included SI and 91% of those who did found that it helped. In the 2007 study conducted by Pfeiffer and Kinnealey Temple University researchers found that children with autism spectrum disorders who underwent SI therapy exhibited fewer autistic mannerisms, which often inhibit learning, compared to children who received standard treatment. Pfeiffer and Kinnealey found that children assigned to SI intervention groups also reached more goals specified by their parents and therapists. However, Pfeiffer also notes that as parents are seeking SI approach because of positive results, more research is need to scientifically establish its effectiveness. The study completed, for which the article was posted, took place at a summer camp for children with autism in which participants were between ages 6 and 12 years old and diagnosed with autism of PDD-NOS. One group (17) received traditional fine motor therapy and the other group (20) received SI therapy. Each child received 18 treatment sessions over a six week period. Statisticians were randomly assigned to groups and both primary researchers and parents were blinded. While both groups showed significant improvements, the children in the SI group showed more progress in specific areas at the end of the study. Pfeiffer (2007) noted that the pilot study provided a foundation for how design should be randomized control trials for SI interventions with larger sample sizes. There is a real need for research such as this to validate what is happening with SI in the profession of OT.

#### *Similarities and/or Differences and Implications of Literature Reviewed*

From the 1970's to present there has been greater understanding gained in theories regarding sensory integration. More is understood in the way the brain deals with

sensory input and how dysfunction can cause negative effects on other areas of development. As studies progressed, the end result was that SI therapy did work to help children function better. However, all studies agreed in that more research is needed to identify the true efficacy of the therapy in relation to how it works and for whom. Over time, SI therapy has moved from just encompassing OTs to now SLPs as well. Professionals need collaboration to use therapies effectively and reach scientific conclusions. As SI is modernized and moved across professions, more in-depth and specific research should be done to find its true efficacy. As SI pertains to children with autism, though studies point to its positive efficacy, there is no significant data to represent that belief. As SI therapy began as theory and now shows positive efficacy, SI therapy in relation to decreasing autistic mannerism in children on the spectrum will have to be studied further and develop stronger research to prove the relationship.

*Theme Three: SI Therapy's Effect on Communication when used on Children with Autism*

SI therapy in relation to increasing communication in children with autism has yet to be reported. Little or no research has been done to produce results for the issue. While SI therapy is believed to work, research is being done as it pertains to decreasing autistic mannerisms; no work is being promoted as to how it benefits the child specifically. In theory, represented in several articles in this review, decreasing the autistic mannerisms through SI therapy should increase communication skills due to the lower levels being targeted first which allow the higher levels to then function more normally. However, no research, that has been published, touches on the issue to prove or disprove the hierarchical theory. Studies, such as this one, although small scale and with limitations,



make a step towards collecting and analyzing data for that specific purpose. As SI therapy is being used and found helpful, the questions of how it works and for whom still remain unanswered. The purpose of the following research is to begin to answer that question. As a foundational study, the hope is to create an interest, as well as a beginning for which more research can follow.

## CHAPTER 2

### PROBLEM SUMMARY

There is research, past and present, published about the theory of Sensory Integration (SI) as an effective therapy however, to date, the question still remains: Who does it work for and how? SI Therapy is used with children who have Sensory Processing Dysfunction. This may be a diagnosis of its own, however it is commonly found in children with other primary disorders, such as Autism. “Sensory Integration refers to the ability to organize, integrate, and use sensory information from the body and the environment” (Mauer, 1999). Children who have Sensory Processing Dysfunction are not able to ready themselves at the most basic level and because of that cannot perform at more complex levels. This theory dates back three decades to an occupational therapist and licensed clinical psychologist, Jean Ayres. SI is defined by Ayres (1979) as “the way the brain processes and organizes sensations.” The sensory input is first integrated in the lower levels of the brain that deal with arousal, learning, alertness, and self regulatory behavior. If those lower levels of the brain are not able to process those basic needs, then higher needs such as language development will be hindered. If a child has a sensory processing problem then his/her brain is not “primed” to learn. Occupational Therapist, Bonnie Hanschu (2002), suggests using the “Ready Approach.” To be ready is have to ability and quickness to adapt. An unregulated brain can easily become overwhelmed and

quickly lose the ability to adapt to any situation. “When the flow of sensation is disorganized, life can be like a rush-hour traffic jam,” (Ayres, 1979). In 2008, Laura Barker, M.S. OTR, took Hanschu’s concept of the Ready Approach and applied it to Sensory Integration Therapy with a direct focus on the three main sensory systems of tactile, vestibular, and proprioceptive. It is from her theory that more specific research into the areas is being done. With more results to support her theory, Hanschu’s, and Barker’s work alike, can be credited as a new approach to Sensory Processing Dysfunction, specifically in children on the Autism Spectrum.

The underlying development of such skills as language comes from our three main sensory systems: tactile, proprioceptive, and vestibular. Tactile refers to touch where receptors under the skin give the ability to learn. Proprioceptive refers to muscles, tendons and joint and gives physical sense of self. Vestibular refers to the inner ear which gives sense of movement and gravity. If these systems are not properly functioning and input is disrupted, a person would have a hard time knowing how to feel, much less be able to learn from these experiences. SI Therapy focuses on these systems individually. In theory, working with these systems initially will lead to productivity in other, more complex, areas of development. Although for speech language pathologists, working with these systems is not the direct focus. The target for speech-language therapy is cognition and vocalization/verbalization; however, working with SI theory and strategies indirectly will enhance the results in language therapy. Mauer (1999) states an example from Parham and Mailloux (1996), in which a child with autism who exhibits difficulties in sensory modulation may be helped to respond in a more adaptive way to sights, sounds,

touch, and movement experiences. This enhancement may lead to improved ability to attend to language and academic tasks and, thus, improve language use and academic achievement.

Although this idea seems simple enough, there has not been enough empirical evidence in the last thirty years to prove this theory. “Many studies have been criticized for their small sample size, inconsistent definitions of the dependent and independent variables, types of sensory integrative dysfunction, and SI treatment, and inconsistent outcomes, (Mauer, 1999). In 2002, Grace Baranek, did a review of studies involving SI therapy specific to children with Autism over the past thirty years with a focus on the most recent decade and found that efficacy in the therapy was hard to establish. Although a positive result was most always found when SI therapy was used, it was not enough to promote the therapy. Two individual cases were listed where single subjects were treated using classical SI therapy (Case-Smith&Bryan, 1999 and Linderman & Steward, 1999). These cases were similar in subject, design and intervention. Both received positive feedback, although one was on general improvement, behavior and interaction but not peer interaction while the other was an increase only in social interactions specifically. These cases, although very similar evoked very different results. Although, both cases had positive results, that alone was not enough to promote the benefits of SI therapy because of the varying outcomes.

There are documented treatment outcomes in sensory integration therapy, which show the benefits in treating the sensory systems. Although this positive feedback cannot add to the efficacy of SI therapy, which keeps the treatment from being fully

recognized, it is still a step in the forward direction. Articles written conclude that SI therapy is an effective therapy that produces positive results. However, in most cases, there is a lack of empirical evidence and the questions of how it works, for whom it works, and how it is effective still remain. Professionals cannot promote a therapy that is not fully developed. For Speech Language Pathologists even less research and evidence is referenced as to the implications of SI therapy on development of vocalization/verbalization. There is a need to tie SI therapy to specific language cases and to conclude, finally, how beneficial it is. One fact is certain: more research needs to be done in this area; research that is published so professionals may gain enough knowledge to make conclusions about the efficacy of this therapy in helping to increase language skills.

To start that process of research development, Beth Pfeiffer, PhD, OTR/L, BCP, and Moya Kinnealey, PhD, OTR/L, from the Occupational Therapy Department in Temple University's College of Health Professionals did a study "to bring more scientific understanding to occupational therapy using a sensory integration approach" (Nguyen, 2007). On the basis that "in 2007, 71% of parents who pursued alternatives to traditional treatment used sensory integration methods, and 91% found these methods helpful," (Nguyen, 2007) Pfeiffer and Kinnealey found that children with autism who underwent sensory integration therapy exhibited less autistic mannerisms which inhibit learning. Pfeiffer (2007) stated, "This pilot study provided a foundation for how we should design randomized control trials for sensory integration interventions with larger sample sizes. Specifically, it identified issues with measurement such as the sensitivity of evaluation

tools to measure changes in this population.” With each study there is the opportunity to close a gap in understanding and to move toward validating these theories. Only with this positive kind of improvement in research will children with Sensory Integrative Dysfunction begin to feel the full effects of what this therapy can offer.

## CHAPTER 3

### RESEARCH QUESTION

#### Working Question

The specific working research question addressed through this study was: What is the effect of a 3 point sensory diet on vocal and verbal behavior on a non-verbal child on the autism spectrum with compromised sensory processing? Specifically, conclusions were sought as to how the diet would affect the child, a 7.8 year old female, when given the 3 point sensory diet before language therapy sessions in comparison to sessions where she would not receive the 3 point sensory diet. The client being on the autism spectrum, with compromised sensory processing, was often found to be overwhelmed with simple tasks in therapy sessions, as well as in daily life. Too much noise, light, or touch, for example, might be followed with a meltdown and a break in the session. A meltdown may, for this client, include resistant behavior, whining, crying and/or screaming. The overload of her sensory system before, during and after therapy, in theory, hinders her productivity in language therapy sessions, as well as in everyday life. Targeting those systems before activities, such as language therapy, may help the client to be more “ready.” The concept of being “ready,” adapted from “The Ready Approach” formulated by Hanschu, was put with the concept of Sensory Integration Therapy by Barker to target

those three main systems, which include vestibular, tactile and proprioceptive. Targeting those sensory systems initially would, in theory, help a child to be “ready” to learn and could be followed with higher level activities. From those ideas by Hanschu, Barker made her theory known and presented it at the 2009 Kentucky Speech Language Hearing Association’s Annual Convention. From that presentation and from specific interest in the autism population the specific research question for this study was formulated. Sensory Integration Therapy has shown to be beneficial with those children on the autism spectrum who are stereotypically sensory defensive. Barker’s theory of targeting the three sensory systems to ready a child were implemented in this study and data was collected to show its positive or negative efficacy on vocal and verbalizations in a child who could benefit not only from the potential increase in communication, but the decrease of sensory defensiveness as well.

### Possible Limitations

In this study, existing and potential limitations were taken into consideration. Limitations can be expected from all aspects including the client, the environment, as well as the study itself. First to be considered was the lack of verbal feedback from the client. Because she is indeed non-verbal there was no direct indication of what worked best to help ready and maintain the client, she specifically could not verbalize her likes/ dislikes or wants/needs. Only through observation could these assessments be made by her therapist, researcher and supervisor. Secondly, this study was conducted in a university clinic setting which limited the amount of time the client could be seen per week, as well as the number of times per semester. For the data



collected in this study there were three school breaks scheduled which put her out of therapy for 1 week, 1 week, and then 6 weeks. Those breaks did not allow the diet schedule to have the consistency needed to make definite correlation between the diet and her behavior. Furthermore, it did not allow documentation of progression/regression during those times when she was off the diet but not available to be observed within the clinic setting. Finally, a consideration was that the diet was not used across settings. Each of the client's environments provided different strategies for enhancing productivity. For example, the client had home, school, speech therapy and autism program environments in which she participated. Each one had a different approach, although it was attempted to work towards the same goals and objectives. Prior success/failure in a day at a different setting using a different manipulative may influence her participation in the study. Each limitation was taken into consideration by the team at the clinic.

Observations of behavior were discussed before and after sessions and agreed on by the team to make up for the client's lack of verbal communication. Therapy with/without the implementation of the diet was scheduled in advance to try to be as consistent as possible, taking the breaks into consideration. Observations and communication were made by the team with the parents to address previous environment's role on the therapy session.

While all limitations could not be avoided, the awareness of what they were may have helped in keeping the study as effective and consistent as it could be.

### Expected Outcomes

Prior to the beginning of the study, expected outcomes were formulated to predict what would be found by implementing the three point sensory diet before language

therapy session in relation to the research question. It was hypothesized that a positive efficacy of sensory integration therapy could be seen in direct relation to participation in language therapy and the development of both vocalizations and verbalizations. While on the diet the client should, from the prediction, participate more in sessions and have an increase in her number of vocalizations and verbalizations. While maintaining the state of readiness and level of participation in the session, it was also predicted that it would carryover and that the client would also be able to maintain that state of readiness and be more engaged in other environments in which she participated as well. Prior to the prediction that results would be seen in the child's number of vocalizations and verbalizations, baseline data was recorded. From that data it was found that the client was more vocal than the team initially thought, but the hypothesis was that the number would continue to increase with the implementation of the diet. Also an increase in her number of verbalizations, which were minimal when the baseline data was recorded, was expected to be seen. However, it was suspected that when taken from the sensory diet, first in a short amount of time for the on/off schedule and then for a longer amount of time for the university breaks, that the child would show a regression of the ability to remain "ready" and thus show a decrease in her number of vocalizations and verbalizations. This prediction would indicate how long the therapy would continue to benefit the client once taken from then diet. If positive efficacy could be seen with the diet and regression when off the diet, then the diet would be something that does benefit the client and will be, after the study, implemented daily across settings to help "ready" the client and continue to increase her communication.

## CHAPTER 4

### METHODOLOGY

The study involved a single client, a non-verbal 7.8 year old female on the autism spectrum, in a university speech clinic setting over a 10 week period. The client was on a three point sensory diet that was administered before therapy sessions during “on” weeks. “On” weeks denote weeks where language therapy and the three point sensory diet were used together. “Off” weeks were where language therapy was used alone. The tactile, vestibular and proprioceptive systems were targeted with deep pressure touch, a suspension swing, and joint compression for sensory integration. It was anticipated that the tactile therapy of deep pressure touch would activate touch receptors under the skin and give the body the ability to learn. The vestibular therapy involved using the suspension swing to provide linear movement for an anticipated enhanced sense of movement and gravity. Proprioceptive therapy involved joint compression to move muscles, tendons, and joints and was anticipated to provide the body with a physical sense of self. The direct focus of therapy was on increased participation in therapy sessions and development of vocalizations/verbalizations.

After a two week baseline period, where no data was collected for the study because of the awaited approval from the Human Subjects Review Board, the client experience the diet with a schedule of one week off the diet, two weeks on the diet, one

week off the diet, two weeks on the diet, one week off the diet and one week on the diet. (1 off, 2 on, 1 off, 2 on, 1 off, 1 on).

An integrated model was used where therapy was documented at delivery (per session) and over time (semester one and semester two). Data was recorded for two semesters, however, results and conclusions were only taken from semester one. Data was collected before each session involving the use of or lack of the sensory diet, and then also during session to document changes in participation and language use. Behavioral observations were also recorded. A data collection sheet (Figure 4.1) was made by the researcher and used to rate participation, rate joint attention, and document behavior within the session. They were also used to collect the number of vocalizations/verbal approximations and whether those were imitative or spontaneous.

A student speech-language pathologist was assigned to work with the client for one hour twice a week for ten weeks. While the therapist planned therapy and worked to facilitate the client as her primary clinician, the researcher documented data and observed progress. This arrangement worked well with the client and the study because it allowed the clinician to be hands on and implement the therapy techniques without interruption and the researcher could fully collect the data without interruption. This process helped the client to get the most out the therapy session and the clinician and researcher to get the best and most accurate results.

The specific three point sensory diet was the biggest part of the methodology, and was responsible for results produced within in study. The diet comprised of the

following: a one point suspension swing, deep pressure, and joint compression. A one-point suspension swing was used to target the vestibular system with linear movement. The client sat in the swing with arms and legs completely in the swing and was moved from rest to front to back to front to back to rest. Then she was moved from rest to left to right to left to right to left to rest. Verbal directions of the movements are repeated while they are being implemented. Each linear movement sequence was implemented one time. Depending on the reaction of the client it may have been repeated for a second sequence. This was completed at the beginning of the session only when the client was “on” the diet. From the room where the swing was located, the client was escorted to her therapy room for the language therapy session. Deep pressure touch was provided at this time to target the tactile system by activating touch receptors under the skin. Surface tissue on the arms and legs were pressed firmly and sequentially. This was done over her entire body before the beginning of the session only when the client was “on” the diet. It was also implemented throughout the session as needed for a sensory break. Tickles and pats were sometimes substituted for or used with the deep pressure sequence when deep pressure was used throughout the session. Joint compression was used to target the proprioceptive system by compressing the muscles, tendons, and joints. Compression was applied to the wrists, elbows, shoulders and knees sequentially with the right and left side of the body. This was done with each joint once at the beginning of session only when the client was “on” the diet. It was also implemented throughout the session as needed for a sensory break by dancing and jumping during a gross motor portion of the session.

To see the collection of this data, see the following chart (Figure 4.1):

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VOCALIZATION	# OF TIMES	VERBALIZATION	# OF TIMES
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/si/ (imitation for yes) (w/ nod)		"hi" (imitative)	
/si/ (spontaneous for yes)		"puzzle" (imitative)	
imitative vocal play for tickles - /tIkəs/ or /tIkəsa/		"tummy" (imitative)	
spontaneous vocal play - /tIkəs/ or /tIkəsa/		"sides" (imitative)	
spontaneous resistant vocalization (MMM, OOO)		"where" (imitative)	
spontaneous vocalization		"back" (imitative)	
(spontaneous/imitative)		"up" (spontaneous)	
(spontaneous/imitative)		other: (spontaneous/imitative)	
(spontaneous/imitative)		other: (spontaneous/imitative)	
(spontaneous/imitative)		other: (spontaneous/imitative)	
(spontaneous/imitative)		other: (spontaneous/imitative)	
(spontaneous/imitative)		other: (spontaneous/imitative)	
<b>OTHER</b>	<b># OF TIMES</b>	<b>PARTICIPATION</b>	<b># OF TIMES</b>
laugh		w/ verbal cue only	
scream		w/ multimodal cue	
<b>DEEP PRESSURE</b>	<b># OF TIMES</b>	<b>JOINT COMPRESSION</b>	<b># OF TIMES</b>
pat		dance	
rub		high five	
tickle		clap	

Figure 4.1. Data Collection Sheet, 2009. Used to document number of vocalizations, verbal approximations, participation and behavior per session. Those were recorded as either imitative or spontaneous.

## CHAPTER 5

### RESULTS

The results of the first 10 weeks of the study were analyzed with the use of charts and graphs to organize the data. Chart 5.1 details the number of vocalizations and verbalizations by session and Chart 5.2 details the same numbers by week, in relation to being “on” or “off” the three point sensory diet. The “on” weeks are noted in red. This depiction, allowing the increases and decreases to be seen per session as well as per week, shows an in depth look at how the diet affected the therapy sessions.

Week	Dates	ON/OFF	# Vocalization	# Verbalization
1	9/28, 9/30	OFF	39, 53	13, 0
2	10/12, 10/14	ON	76, 86	15, 18
3	10/19, 10/21	ON	89, 67	44, 17
4	10/26, 10/28	OFF	65, 67	26, 27
5	11/02, 11/04	ON	78, 50	31, 24
6	11/09, 11/11	ON	55, 34	55, 69
7	11/16, absence	OFF	61, --	7, --
8	11/30, 12/02	ON	47, 47	24, 12

Figure 5.1. Number of Vocalization and Verbalization per Session, 2009.

WEEK	ON/Off	TOTAL VOCALIZATIONS	TOTAL VERBALIZATIONS
1	OFF	92	13
3	ON	162	33
4	ON	156	61
5	OFF	132	53
6	ON	128	55
7	ON	89	124
8	OFF	61	7
10	ON	94	36

Figure 5.2. Total Number of Vocalizations and Verbalizations per Week, 2009.

The study was recorded over a ten week period documenting vocalizations and verbalizations. The data included eight weeks of language therapy sessions during which five weeks included the implementation of the three point sensory diet. The number of vocalizations and verbal approximations recorded increased during the weeks where the client was “on” the diet and decreased when she was “off” the diet. Specifically, the chart (Figure 5.2) indicates the variations weekly.

During week one, while off the diet, the client produced 92 vocalizations and 13 verbalizations. She did not attend therapy for week two because of a university break, therefore changes between week one and two cannot be discussed because no therapy was implemented and the schedule for on/off the diet was omitted. However, between



weeks one and three there was an increase in vocalizations by 70 and verbalizations by 20.

Staying on the diet for week four there was a decrease in vocalizations by 6 but an increase in verbalizations by 28, which is over 100% increase. Going off the diet from week four to five there was a decrease in both vocalizations by 24 and verbalizations by 8, but the number for week five are still an increase overall from week one.

Back on the diet week six there was a slight decrease in vocalizations by 2 and a slight increase in verbalizations by 2. This is still viewed as a success clinically because the overall goal was to increase the total number of verbalizations. From week six to seven, still on the diet, there was a significant decrease in vocalization by 39 but there was also a significant increase in verbalizations by 69, which was, again, an increase of more than 100%. These results are clinically viewed as a success since verbalization is the main goal.

During week eight, the last off week, the client was only in attendance for one session so the data shows a significant decrease in number from week seven. The correlation of the numbers dropping can be related to the absence as well as the diet being off. The number of vocalizations showed a decrease by 28 and the number of verbalizations showed a decrease by 117.

Week nine was missed for the second week long university break, therefore no therapy was implemented and the schedule for on/off the diet was omitted as in week two.

From week eight to week ten, when the client was on the diet for the last time, there was an increase of both vocalizations by 33 and verbalizations by 29. The numbers for week ten are similar to the data recorded for week one. The lower numbers for each could be contributed to the significant break in language therapy because of the break, no diet implementation, and no school. Between weeks eight and ten the environment for the client was very different than previous weeks, which could be possible implications for the low count.

Overall from week one to ten there was an increase in vocalizations by 2 and verbalizations by 23. Throughout the semester during weeks when the client was on the diet, an increase in either vocalizations, verbalizations or both was seen. The total number of verbalizations for the semester increased from a baseline of 13 to 36 which is more than a 100% increase.

The following graph (Figure 5.3) is a line graph that, as in Figure 5.2, details the increases and decreases in vocalizations and verbalizations per week according to when the client was on or off of the diet. Weeks 2, 3, 5, 6 and 8 were all weeks where the client was on the diet. Those weeks all show an increase in verbalizations from the previous week where the client was off the diet. During week 2 and 8 there was also an increase in vocalizations from the previous week where the client was off the diet.

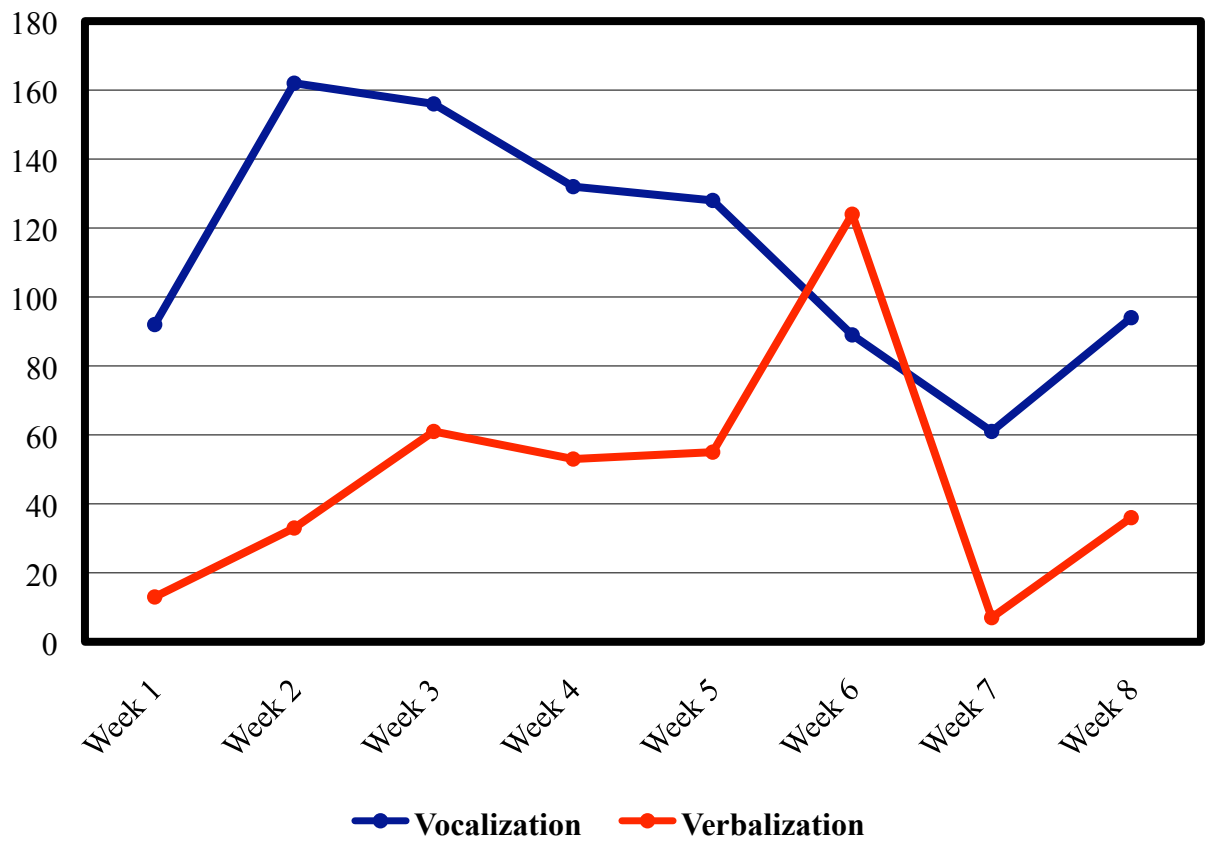


Figure 5.3. Number of Vocalizations and Verbalizations per Week, 2009.  
 Vocalizations in blue. Verbalizations in red.  
 Weeks 2, 3, 5, 6, 8 were “on” weeks. Weeks 1, 4, 7 were “off” weeks.

## CHAPTER 6

### CONCLUSIONS

Conclusions were drawn from the data that was recorded over a ten week period documenting vocalizations and verbalizations. The data included eight weeks of language therapy sessions during which five weeks included the implementation of the three point sensory diet. From the data, a positive correlation can be seen between the diet and the increase in the number vocalizations, especially the number of verbalizations. This increase can be seen both per session, as well as per week. Not only was the client more vocal and more verbal during the weeks when she was on the three point sensory diet, she was also more alert and active in therapy sessions.

The client would often come to the clinic frustrated or tired from a long day at the Autism program and/or school prior to coming to language therapy sessions. After using the three point sensory diet before and during the language therapy session, she would be more alert and her ratings for participation were significantly higher. She also decreased resistant behaviors such as self-stimming, whining, crying, and/or screaming. Self-stimming was often produced by hand flaps and in the vocalization of “oooo’s” and “mmmm’s.” She would do this when frustrated, and/or push away from the table. Often she would whine or cry when her frustration was not acknowledged. She also had increased joint attention with her clinician and would do tasks to completion. Joint

attention was defined as sharing focus on an object/activity with the clinician, demonstrated by eye contact and following directives with minimal cueing. Furthermore, when on the diet the client was more vocal and verbal throughout the entire session. She often vocalized bi-labial syllables continuously to herself as well as to her clinician, again showing increased joint attention throughout the session. Productions of the syllables were not intended to be word approximations, but through continuous vocalization she let the clinician know she was alert and ready to work. The frequency of her vocalizations and verbalizations increased overall as seen in the data recorded. Additionally she improved the quality of her vocal and verbal behavior. One example was when the client began saying the initial sound /æ/ for apple when seeing and matching an apple to a basket of other apples. She not only began saying the initial sound and increased the number of times she attempted it, she also developed the sound from /æ/ to /æp/. This was a significant step forward. She not only did it with the fruits she matched, she attempted many initial and final sounds, often attempting both sounds together rather than separate.

The results and research data gathered during the study point to the efficacy of the three point sensory diet on the increase of vocal and verbal behavior. Not only did the diet help to “ready” the client, it also helped to increase her use of language in speech therapy sessions.

In addition to data being collected on vocalizations and verbalizations there were additional anecdotal observations, showing increased interaction, which will be presented. At the beginning of the semester, during which the diet was implemented,

goals for the client included the following: 1) increasing vocalizations, which were at that point mostly the vowels /a/, /i/, /u/ and manipulating them into verbalizations, 2) increasing choices made on the clients AAC device, the SpringBoard Lite, 3) verbalizing “done”, “yes”, “no”, and “bye”, 4) engaging in social play, 5) following one step directions, 6) using joint attention through eye contact when requesting objects, and 7) matching colors through objects and pictures.

With implementation of the three point sensory diet, a new data sheet was made to record those goals with specific focus on the number of vocalizations and verbalizations per session. Also, the levels of cueing were modified to better detail the data collection to show the client’s progress towards goal completion. The original cueing documentation categories were “no assistance, minimal assistance, or hand over hand assistance.” Those cueing documentation categories evolved to, from least restrictive to greatest amount of cueing, “verbal cueing, visual cueing, guided assistance, and tactile cueing.”

During a typical therapy session, the clinician would greet the client in the hall at eye level, smile and tell her “hi.” Often a hug or physical touch was used to greet her as well. Prior to implementation of the diet the client was very sensory defensive, coming in with fingers in her ears, requiring whispered voices to be used, and resisting the physical touch, requiring modified behavior from the clinician. The same routine was used after implementation of the diet but would on the “on” days be followed by the diet which included the suspension swing, deep pressure and joint compression prior to going to the therapy room.

The clinician noted that on “off” days the client tended to be much more defensive when it came to completing daily objectives. Whether the session was characterized by having less vocalization, exhibiting frustrated behavior, or having low motivation to work, a decrease in participation and vocal/verbal behavior was noted. The client would self-stimulate more often and have a visible desire for sensory input. Self-stimulation included grinding teeth, closing/squinting eyes, raising arms, tensing muscles and/or humming. Often the client would cue to the clinician the desire sensory input by taking her hands and putting them on her back, legs or arms to signify she wanted deep pressure. Teeth grinding increased on days when the clinician could not give her the sensory input. The clinician also noted difficulty maintaining engagement in activities on “off” days compared to “on” days. Eye contact was also low and the client sometimes exhibited a scream letting the clinician know she did not want to participate. The clinician specifically stated that during those sessions the client “became upset, did not enjoy dancing at the end of the session, as she had in the past, required full tactile cueing to complete tasks, and often pushed objects away.”

On days when the diet was implemented, the client would enter the therapy room more prepared to begin the session. This was seen through her body manner, facial expression, and motivational level. Prior to entering the room, during transition, interaction and vocalizations in the hall were increased. The client progressed from imitating a few vowel sounds to imitating, vocalizing and verbalizing phonemes. Phonemes for words such as “back” were /b^/ or /bukubu/ or “legs” were /l/ or /g/. She also imitated the first phonemes in the fruit names orange, pear, banana and apple. As

mentioned previously /ae/ became /aep/. She also imitated the first phonemes in the color names blue, red, and yellow, as well as the animals' horse and cow. She imitated /ksh/ for her toy koosh, eh-ha-waa for "everywhere" when asked where she wanted tickles. She verbalized the names for her mom, dad, and brother. The clinician noted that the client's vocabulary repertoire of verbal approximations went from around 5 to 33 phonemic sounds and/or word approximations.

On days when the diet was used, the client's joint attention by eye contact and attention to task when on the diet was increased. She looked at and responded to the clinician when her name was called, when a question was asked, and when she wanted an object. She appropriately had humor, laughing when a situation was funny, such as the clinician's hair being messed up after dancing.

Prior to the implementation of the diet, the client wanted nothing to do with specific activities, such as playing dress up. While on the diet, the client would have curiosity and seeks to know what activities and/or objects the clinician had. She would lean to look in her bag, anxiously pull out the dress up items and put them on, or imitate the motion for putting them on in a request for the clinician to help. During activities such as this, the client would initiate interaction and would leave the objects on for at least 5 minutes, something her high sensory vulnerabilities would not have allowed her to do previous to the diet. She also sat in her chair appropriately and participated in vocal turn taking. Gross motor movements were also imitated, something that would not have previously occurred. Overall, on days when the diet was implemented prior to therapy



sessions, the clinician noted increased eye contact, the client being more actively engaged in activities, increased imitation, increased vocal turn taking and verbal engagement.

Thus, the three point sensory diet, in terms of objective as well as subjective data, shows a positive efficacy in increased vocal and verbal behavior in a child on the autism spectrum. However, further research is needed with a larger sample size to determine the efficacy of the SI diet's implications on communication.

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