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QIGONG MASSAGE TREATMENT FOR SENSORY AND SELF-REGULATION PROBLEMS IN YOUNG CHILDREN WITH AUTISM: A RANDOMIZED CONTROLLED TRIAL

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Abstract

Autism is commonly associated with disturbances of the sensory nervous system, digestion and sleep. This manuscript presents a randomized controlled study evaluating the effect of a five-month intervention directed towards improving measures of sensory impairment, digestion and sleep in 46 children with autism under six years of age. The intervention, Qigong Sensory Training (QST) is a qigong massage intervention based in Chinese Medicine. It is two-pronged, with trainers working with children directly 20 times over the five months, and parents giving the daily massage protocol to their children. Improvement was evaluated in two settings: the pre-school and home, by teachers (blind to group) and parents. Teacher evaluations showed that children receiving the QST intervention had significant classroom improvement of social/language skills, and reduction in autistic behavior compared to wait-list controls. Parent data confirmed the findings in the teacher data, indicating that the gains had generalized across contexts. A model for understanding and treating sensory and self-regulation problems in autism is advanced, outcomes data supporting the model are presented, and the limitations of the research discussed.

Qigong Massage Treatment of Sensory and Self-Regulation problems in Young Children with Autism: A Randomized Controlled Trial

It is increasingly recognized that the diagnosis of autism is associated with multi-system impairment (Kern & Jones, 2006; Chauhan & Chauhan, 2006). It is common for children with autism to have impairments involving the sensory nervous system (Leekam, 2007; Dunn, 2006), digestion (Valicenti-McDermott, 2006; Wakefield, 2005), and sleep (Dominick, 2007), and these adversely impact the child's ability to focus, pay attention, and learn, as well as aggravate the severity of autistic symptoms (Kern, 2007; Malow, 2006). The sensory and physiological disturbances associated with autism can place a heavy burden on families and offer an excellent opportunity for early intervention (Silva, Cignolini, Warren, Skowron-Gooch & Budden, 2007.

For millennia, Chinese medicine has utilized global approaches to improving health and reversing illness such as qigong (pronounced "chee-gong"), acupuncture and Chinese herbs. It is estimated that there are more than 3,000 varieties of qigong, involving massage, slow movements, breathing and meditation. Qigong is practiced widely in China, not only in clinics and hospitals for specific illnesses, but also in homes and schools for the improvement of health; the qigong practitioner does not have to be an expert, and almost anyone can learn to practice qigong to improve his or her own health. (For further description of qigong written for a Western audience, see *The Way of Qigong* by Cohen, 1997.) During the last ten years, interest in complementary alternative medicine (CAM) modalities has grown in the Western world and occupational therapists world-wide are showing an interest in the application of CAM practices such as qigong, to augment their clinical practice.

Qigong, acupuncture and Chinese herbs are theorized to have their therapeutic action on *the energy field* the body, which then causes *changes in physiology and anatomy*. Briefly stated,

these three disciplines utilize an ancient map of the bioelectric field, which describes the main direction and pathways of energy flow permeating and circulating in the body, specific points that can be used to regulate that flow, and a system of channels that regulate physiology and link the sensing surface of the body to the brain and inner organs. Diseases are described in terms of their impact on energy flow, and treatment is purported to improve the overall quality and quantity of energy as well as relieve the specific impediments to flow.

Over 2,000 research papers have reported beneficial impacts of qigong on physiological systems. (Sancier, 2007). Applications include such diverse illnesses as hypertension (Lee, Pittler, Guo & Ernst, 2007), coronary disease (Stenlund, Linstrom, Granlund & Burell, 2004), asthma (Reuther & Aldridge, l998), and chronic pain (Lansinger, Larsson, Persson & Carlsson, 2007), In patients taking chemotherapy, qigong is reported to improve immune function (Yeh, Lee, Chen & Chao, 2006) and reduce toxicity as evidenced by reduced diarrhea, as well as improve appetite and strength (Quizhi & Li, l988).

For the last 7 years, our research has investigated the effects of a five-month qigong massage intervention for young children with autism with a methodology that was developed in the l980s by Dr. Anita Cignolini (Silva and Cignolini, 2005). The methodology has since been tailored for application in Early Intervention programs and all research has been done in the under-six age range. The intervention, now known as Qigong Sensory Training (QST), is two-pronged, involving a total of 10 hours of direct treatment of children by trained Early Intervention/Early Childhood Special Education (EI/ECSE) personnel, as well as daily treatment by parents with a follow-through massage. Three modest, preliminary studies have reported improvements in sensory, digestive and sleep disturbances as well as improvements in measures of autism (Silva et al, 2005, 2007; Silva, Ayres & Schalock, 2008). The authors hypothesized

that due to the improvements in physiology, children were calmer, more comfortable, more aware in social situations, and therefore better able to learn social and language skills.

We are often asked to explain how results from treatment with qigong massage might differ from results obtained with conventional treatments for sensory impairment (see Baranek, 2002). Where conventional therapies are based on the Western medical paradigm informed by knowledge of the anatomy and physiology of the physical body, the Eastern paradigm is informed by knowledge of the energy field of the body, which, while ancient, is compatible with the relationship between energy and matter described by modern physics. In the Eastern model, energy circulates continuously through the body, regulating itself through an elegant and highly specific system of channels and points that are precisely described by Chinese Medicine. An illness of any part of this system, will effect the energy of the whole. The qigong practitioner's knowledge of this energy map of the body, informs the choice, location, and direction of manual techniques applied, and allows for treatment of *the part*, which can be at the surface (e.g. skin hyper-sensitivity) or deep (e.g. diarrhea), as well treatment of *the whole*. This is the basis for the specific and general improvements that are associated with treatment, and the reason why qigong massage can be used to provide lasting relief from internal conditions, particularly of children. In the end, over time, different scientific paradigms, one material, and the other energetic, have created treatments that are different, and do different things.

Video has been used extensively in our research to record the process of change in response to the intervention (Silva et al, 2005, 2007, 2008)**.** As has been reported in published results, the video shows that, concomitant with decreases in sensory impairment, children acquired foundational social abilities such as eye contact, joint attention and pretend play, and had improvement of self-regulation with regards to sleep, digestion and self-soothing. These

compelling, anecdotal observations and parent reports of interim change, in conjunction with significant improvement in pre-post data, have shaped our working model for autism, which proposes that impairment of sensory and self-regulation systems underlies the development of autism, and that qigong massage treatment improves autism by normalizing sensory impairment and self regulation.

The Western theory expounding the links between sensory, social, and self-regulatory deficits in autism can be found in the polyvagal theory, which is based on an understanding of the mammalian parasympathetic nervous system, and its regulatory influence on physiological state, tactile pain thresholds, and the components of the social engagement system (Porges, 1995, 2001, 2004). Research on the mammalian parasympathetic nervous system has shown that cranial nerves regulating movements of suckling, speech, facial expression, middle ear muscles (e.g., tuning in to the human voice as opposed to background noise), and turning the head and eyes (e.g. to facilitate eye contact), share the same brainstem nuclei as those that regulate digestion and self-soothing. The polyvagal theory advances that coordinated activity between these cranial nuclei (collectively known as the vagal system), and related cortical structures, is required for mammalian social and physiological functioning, and that a deficit or dysregulation of vagal tone is present in autism. Data in children with autism has shown that vagal tone, as reflected in measurements of respiratory sinus arrhythmia, is different than typically developing children (Porges,2004.)

The Eastern counterpart of this sensory, social and autonomic linkage is to be found in the Five Phase Theory of Chinese medicine, where each of the five senses is associated with a system of physiological functions, such that severe or longstanding impairment of a sense can effect the underlying system and vice versa. These sensory/system relations inform the qigong

massage methodology and are often seen clinically in autism. For example, impairment of touch is associated with disturbances of the mind and sleep, impairment of vision is associated with disturbances in the physiology of irritability and aggression, impairment of taste/smell is associated with disturbances in digestion, and impairment of hearing is associated with delays in toilet training. (For further description of the Five Phase Theory see *The Essential Book of Traditional Chinese Medicine* by Liu Yanchi

The current study continues our exploration of a model which proposes that sensory and physiological impairment are central to the development of autism, and advances our investigation of the effect of the QST intervention on autism. It replicates and extends an earlier study (Silva et al, 2007) with a larger sample of 46 children, and evaluates the child in two settings, the home and pre-school. Because the behavior of young children with autism varies from setting to setting, and is impacted by multiple variables including familiarity, predictability, and level of sensory stimulation (Lord & McGee, 2001), a more complete picture of the child's changes in response to treatment was sought from pre-school teachers (blind to group), and parents. The research was designed to submit the components of the proposed model for autism to treatment and pre/post testing: 1) sensory impairment, 2) physiological system impairment, 3) developmental deficits, and 4) autistic behavior. **We hypothesize that a five-month qigong massage intervention aimed at improving function of sensory and physiological systems in the body will significantly improve severity of autism as measured by standardized tests of behavior and developmental abilities.**

Method

Participants

Selection of children and parents. Recruitment was conducted by sending an invitation

letter to parents of children between three and six years of age receiving autism services from two Education Service Districts (ESD) serving six counties in Oregon. Criteria for entry into the study were: 1) age under six, 2) eligible for early intervention services for autism, and 3) no complicating medical diagnoses or chronic medication. The majority of children attended EI pre-schools 5-10 hours per week; four attended Oregon's RPATS pre-school program (Regional Program Autism Training Sites), which utilizes behavioral and research based methods a similar number of hours per week. Forty-six (46) children (37 males and 9 females) met eligibility criteria and completed the full treatment protocol (See Table 1.). Parents agreed not to begin additional interventions for autism during the study, to transport their children to the 20 training and treatment visits, and to give their child a daily qigong massage for the duration of the study.

Institutional Review Board approval for all aspects of this project was sought and obtained from the Western Oregon University Institutional Review Board..

----------Insert Table 1 about here----------

Measures.

Social/language abilities and maladaptive behavior in the school and home settings were measured with the Pervasive Developmental disorders Behavior Inventory (PDDBI) Teacher and Parent Versions (Cohen and Sudhalter, 2005). The PDDBI is a two-part rating scale *designed to assess changes in response to intervention programs* in children having a Pervasive Developmental Disorder (PDD-NOS), autism or Asperger's syndrome. The two parts assess social/language abilities (Receptive/Expressive Social Communication Abilities Composite – REXSCA/C) and maladaptive behavior (Approach/Withdrawal Problems Composite – AWP/C),

and include a section on sensory impairment (PDDBI Sensory). Results are reported in standard scores with a mean of 50 and a Standard Deviation of 10. The REXSCA/C includes core features of autism such as joint attention, and pretend play, as well as gestural, receptive and expressive language. The maladaptive behavior score is not specific for autism, but is a general measure of maladaptive behaviors seen in PDD including stereotyped behaviors, social interaction deficits, and a wide variety of behaviors such as fears, semantic/pragmatic deficits, arousal regulation, and temperament.

The parent and teacher versions of the PDDBI have questions in common, as well as questions related to the particular setting. Discrepancies between parent and teacher scores are expected, and the correlation of .32 is consistent with other published data. Discrepancies reflect different behavior in different settings as well as different relationships with the different informants.

The PDDBI has gone through extensive development and validation and been determined by external reviews to demonstrate construct and criterion validity sufficient for use in research. The Inventory has also been found to be reliable, with high levels of internal consistency (alphas range from .80 - .98 across the various domains and constructs.) Test-retest stability is also high, with coefficients ranging from .60 - .99 across domains and constructs. Parent – Teacher agreements were somewhat lower (.24 - .82) across domains and composites.

Because the PDDBI behavioral measure is not specific for autism, the Autism Behavior Checklist was chosen to evaluate autistic behavior in the classroom, (Krug, Arick, & Almond, 1980, 1993). The ABC measures behaviors typical of autism in five domains: sensory, relating, body and object use, language, and social and self-help. The ABC provides raw scores ranging from 0 – 167; with a score of 54 or higher being consistent with autism. Eaves and Williams Jr.

(2006) reported an alpha coefficient of .89 and concluded the ABC total score has adequate reliability for use as a screening instrument.

In the absence of a standardized parent questionnaire evaluating multi-system impairment, the Sense and System Checklist (SSC) was developed to obtain information on changes in sensory impairment, appetite, digestion, and sleep. The choice, grouping, and weighting of the questions on the questionnaire derive from the Five Phase Theory of Chinese Medicine as referenced in the introduction. Scores are divisible into Sense scores (ranging from 0-40) and Systems scores (ranging from 0-27). An internal consistency alpha coefficient of .826 has been demonstrated in studies to date. A pre-post correlation of total scores of .623 as also been demonstrated. The Sense scores can be correlated with changes in the PDDBI Sensory, the main difference between the two instruments being a relatively higher proportion of questions dedicated to impairment of touch/pain in the newer instrument. The SSC questionnaire is available online at www.qsti.org. Raw scores are reported ranging from 0 – 67.

Design and Procedure

A multi-site, randomized, controlled trial design was employed with participating children from each of the two sites separately assigned to either QST/intervention or wait-list control conditions. A multi-site procedure was used to meet the treatment design requirements at the two geographically disparate sites. Participating children included five older siblings of accepted children who were also treated. Participating children were randomly assigned (using a random number generator) to intervention and wait-list control groups with the following caveats:

- The mid-Willamette Valley and South Coast Education Service District participants were

assigned separately to conditions to meet therapist to participant requirements.

- 5 sets of siblings were co-assigned to conditions due to parental involvement in treatment.

These random assignment procedures resulted in the group sizes shown in Table 1.

Research questions for this investigation evaluated pre and post treatment data for the components of the QST model - sensory impairment, system impairment, abnormal behavior and social/language delay, in two contexts, home and school. We were also interested in testing the maintenance effect of QST after 5 months from the end of treatment.

Qigong massage training. The qigong massage training of trainers has a defined, skill-based curriculum in applied Chinese science relative to autism. Trainers are expected to master a theoretical and practical understanding of the child with autism according to concepts important to Chinese science: yin, yang, qi, channels, toxicity, block, and deficiency (Yanchi, l988). Initial training consists of 50 hours of material dedicated to developing the skills and understanding necessary to lead the treatment process and train the parents. Following the initial training, trainers receive weekly supervision while they work with two families of children with autism, and conduct the five-month intervention. The pilot evaluation of this training program is described in detail in Silva, Ayres and Schalock (in press).

Trainers meet with families for 20 training visits over 5 months. At each visit the child receives a qigong massage treatment from the therapist, and parents receive training and support in the follow-through massage given daily by the parent to the child.

Use of Video. Six of the 20 sessions are videotaped and the videotapes reviewed by the principal investigator to verify fidelity with the treatment methodology and identify trends in response to treatment. In addition, they were edited into a teaching presentation of the progress of each of the 46 children. This was shown to the trainers at the mid and end-point of treatment

to allow for further skill-development.

Data Collection Procedures. Data were collected for both the QST/treatment and wait-list control groups prior to the initiation of the QST massage intervention and immediately following the final massage sessions. A third set of data to evaluate the maintenance/stability of treatment outcomes was collected from parents five months after the intervention was completed. Teachers were sent packets with instructions for filling out the Autism Behavior Checklist and the Teacher PDDBI. Both instruments are designed to be administered individually or in groups and completed by the informant with assistance provided only to clarify the meaning of a question. Parents completed the Parent PDDBI, selected portions of the Vineland II Adaptive Behavior Scale and the QST Sensory and Systems Checklist.

QST trainers and treatment methodology. Fifteen (15) QST trainers provided the intervention to the children in the study. Consistent with our commitment to provide training to EI/ECSE programs, 10 EI/ECSE professionals underwent training and supervision during the study.

Results

Data Analysis

Data analyses were conducted in several sequences. Initially, pre-assessment scores for treatment and control groups were analyzed to determine equivalence. This was important in determining the appropriate analyses to conduct to test the main hypotheses of the study. MANCOVA was utilized with group as the independent variable, pre-assessment scores on the main outcome measures as dependent variables, and age in months as the covariate for parent and teacher generated data separately. Post-hoc univariate ANCOVA and Bonferroni adjusted

individual t-tests for independent samples were conducted to further test group equivalence on the pre-assessment outcome measures to document more precisely any differences that might exist on more specific impairments and abilities.

The next set of analyses tested the changes that occurred in the scores from pre to post intervention assessments. These analyses were conducted to document any changes exhibited from pre to post in both treatment and control groups and determine whether these changes were statistically significant. Paired t-tests were used to conduct these analyses.

To test the hypotheses that the QST intervention has a significant main effect, MANCOVA was conducted separately on parent and teacher generated data using post assessment scores as the dependent variable, group as the independent variable and pre assessment scores as covariates. Parent and teacher data was treated separately to reflect the different contexts with which observations were conducted: the home and the classroom. MANCOVA was employed due to the deviations from full random assignment as discussed previously. Univariate ANCOVA follow-up tests with Bonferroni adjustments were employed when overall MANCOVA test was significant to identify specific differences in outcomes by group. SPSS generates Partial Eta-squared as an effect size estimate in the GLM (Tabachnick & Fidell, 1989; Haase, 1983). Partial Eta-Squared is equivalent to R^2. Using the formula for deriving r from Cohen's d (Hedges, 1982), it is possible to establish ranges in partial Eta^2 that coincide with Cohen's original small, medium and large classifications (Cohen, 1988) with numbers in the range from .01-.06 indicating a small effect size, numbers in the range of .06 and .14 indicating medium size effect and numbers > .14 indicating a large effect size.

A correlation analysis was conducted to determine the relationship between changes in measures of sense/system impairment and autism outcomes measured by the parents. The r^2

value is an appropriate measure of association effect size estimate (Kline, 2004) and can be interpreted as the percent of variance in the correlational variable accounted for. For example, if the $r^2 = .64$, 64% of the change in the outcome is accounted for by changes in the sense/system impairment scoring tool.

Finally, to determine whether treatment effects maintained over time, one-way repeated measures MANOVA was conducted on parent PDDBI pre-post-followup data from an intact cohort of 19 treatment group participants. Within-group one-way repeated measures ANOVA employing post-hoc pairwise Bonferroni-corrected comparisons were conducted to further test equivalence over time on each outcome measures.

Pre-Assessment Equivalence

Analysis of the parent and teacher generated pre-assessment data for the 46 participants completing the study was conducted using MANCOVA using group as the dependent and age as a covariate on the pre-assessment outcome scores. The Pillai's Trace criterion was adopted as the most conservative test statistic (Olsen, 1979). For the parent generated data, this analysis revealed no overall statistical differences between groups at pre-assessment, Pillai's Trace = .258, $F(7,35) = 1.739$, $p = .132$. While no overall differences were found, a Bonferroni adjusted post-hoc univariate analysis of variance identified two variables for which significant differences did exist: the PDDBI Social/Communication Composite $F(1,41) = 5.98$, $p < .05$ and the PDDBI Autism Composite $F(1,41) = 4.75$, $p < .05$.

For the teacher generated data, this analysis revealed no overall statistical differences between groups at pre-assessment, Pillai's Trace = .198, $F(5,32) = 1.58$, $p = .194$, . While no overall differences were found, a Bonferroni adjusted post-hoc univariate analysis of variance identified one variable for which significant differences did exist: the PDDBI Sensory domain

$F(1,36) = 8.22$, $p < .01$. The presence of these differences in both the parent and teacher data and the deviations from full random assignment indicated MANCOVA would be preferable to test for main treatment effects and control for initial differences.

Pre to Post Assessment Changes

Sensory and system impairments, abnormal behaviors and social/language abilities were assessed both before and after the intervention. A change in the negative direction indicates improvements on sense/system impairments and abnormal behavior. A change in the positive direction indicates improvement on developmental abilities. Analyses of pre to post scores indicated significant improvement for treatment group participants on all measures. With one exception, significant differences were not obtained for wait-list control group participants. The exception was the teacher measure for maladaptive behavior (PDDBI AWP/C), in which case both treatment and control group children improved, presumably due to the effect of the classroom program.

----------Insert Table 2 about here----------

Pre-Post Intervention Effects

Multivariate analysis of covariance (MANCOVA) was used to test for the intervention effects in the classroom and home settings related to sensory and system impairment, abnormal behaviors and measures of social/language skills. Results for teacher data indicate an overall treatment effect on outcomes, $F(4,30) = 3.457$, $p = .019$, partial $eta^2 = .316$. Bonferroni adjusted post-hoc univariate ANCOVA found significant treatment effects for PDDBI Social/Communication Composite $F(1,33) = 7.36$, $p = .01$, partial $eta^2 = .182$, and the Autism Behavior Checklist $F(1,33) = 10.25$, $p = .003$, partial $eta^2 = .237$.

Results for parent data indicate an overall treatment effect on outcomes, F (7,27) = 2.70, p = .029, partial eta^2 = .412. Bonferroni adjusted post-hoc univariate ANCOVA found significant treatment effects for the Sense and Systems Checklist F(1,33) = 17.49, p = .0002, partial eta^2 = .346, PDDBI Sensory domain F(1,33) = 9.10, p = .005, partial eta^2 = .216; PDDBI Maladaptive Behavior Composite F(1,33) = 16.1, p = .0003, partial eta^2 = .328; PDDBI Social/Communication Composite F(1,33) = 8.23, p = .007, partial eta^2 = .200; and the PDDBI Autism Composite F(1,33) = 14.11, p = .001, partial eta^2 = .299. These results are presented in Table 3, and discussed below.

----------Insert Table 3 about here----------

1. Treatment outcome on blinded teacher measures of autistic behavior and social/language abilities. Scores from the Autism Behavior Checklist, and the PDDBI Maladaptive Behavior Composite and Social/Communication Composite were used in the analysis. Significant main intervention effects were found for the Autism Behavior Checklist, and the PDDBI Social/Communication Composite, indicating that teachers blind to group, observed significant improvements in autistic behavior and social/language abilities in the classroom in treated children. The effect sizes (partial eta^2), are in the moderate category. No significant treatment effect was found on the PDDBI measure of maladaptive classroom behavior, with both treatment and control group improving significantly on pre-post measures.

2. Treatment outcome on parent measures of behavior and social/language abilities. Scores from the Parent Maladaptive Behavior Composite and PDDBI Social/Communication Composite and were used in the analysis, Significant main intervention effects were found for both measures, indicating that in the home environment QST improved social/communication skills, and maladaptive behavior. Effect size estimates were in the large range.

3. Treatment outcome on parent measures of sensory and system impairment. Scores from the Sense and System Checklist and PDDBI Sensory were used in the analysis. Significant main intervention effects were found on both sense and system variables, indicating that the treatment positively impacted both. The effect sizes (partial eta^2) are in the large category.

4. Correlations between changes in parent measures of sense/system impairment and measures of autism. Correlations were calculated between measures of sense and system impairment (SSC, PDDBI Sensory) and the three composite scores of the PDDBI (Maladaptive Behavior Composite, Social/ Communication Composite, and Total Autism Composite). All correlations were highly significant, with the highest r values being found relating change scores on the Sense and System Checklist with behavioral changes: +.819 (p.0001) for behavioral improvement; -.409 (p .005) for new social and language learning, and +.686 (.0001) for total autism score. See table 4 for all correlations.

----------Insert Table 4 about here----------

5. Maintenance of treatment effect five months after study completion. This question was addressed by repeating the end of study parent and teacher measures for the treatment group, five months after the end of the study, and analyzing whether there were any differences. Descriptive data on the intact cohort of 19 is shown in Table 5. Overall one-way repeated measures MANOVA on parent measures was significant (Wilks' Lambda F[6,13] = 7.85, p=.001). Repeated measures one-way ANOVA on each outcome measure revealed significant differences in all scores between the three times of measurement. Sphericity assumptions (Mauchly's Test) were violated for Sensory (p=.048) and Social/Communicaiton (p=.01). The Greenhouse-Geisser epsilon was used to correct degrees of freedom. Sensory F (1.58, 27.68) = 17.34, p = .00005; Maladaptive Behavior Composite F (1.82, 32.71) = 21.3, p = .000002; Social/Communication

Composite F (1.41, 25.39) = 8.36, p = .003 and Total Autism Composite F (1.75, 31.58) = 20.62, p = .00004. Post-hoc pairwise Bonferroni-corrected comparisons revealed that while all pre-post and pre-follow up mean differences were significantly different from each other, none of the post-follow-up mean differences were significantly different.

-------Insert Table 5 about here----------

Discussion

Results of blinded teacher data in this randomized controlled trial confirmed the hypothesis that the QST intervention reduces the severity of autism as measured by standardized tests of behavior and developmental abilities. Teacher data (moderate effect sizes) was corroborated by parent data (large effect sizes). Consistent with published data for the PDDBI, calculations of parent–teacher discrepancy scores were similar across control and treatment group. Thus, effect size differences would appear to reflect different behavior in different settings and differing roles of the informants. Since parent responses to developmental questionnaires, are known to be accurate when parents are asked to assess *current, observable* child behavior, (Squires, Potter, Bricker & Lamorey, 1998), as in these study measures, the larger effect size in parent data may be due to the parent having more specific information about the child's abilities, or a proximal vs distal effect of setting on the acquisition of foundational skills i.e. first language is usually demonstrated in the home before the pre-school.

The Sense and System Checklist developed for this research, showed a significant and large improvement in sensory and physiological systems in the treatment group that was not present in the control group. The improvement was stable at 10 months, indicating that a lasting change in physiological state had occurred. Correlational analysis of changes in sensory/system scores and behavior scores showed that changes in sense/system scores accounted for 67% of the

improvements in behavior. This very high correlation between two aspects of autism that are not generally considered to be closely related, reflects a principle that all teachers are familiar with: a child will behave better when they are calm and comfortable, than when they are not. Not surprisingly, given the lag time necessary to learn and demonstrate specific skills, correlations between changes in sensory/system scores and measures of learning were lower, though still significant.

Examination of videotaped treatments for trends in response to treatment, documented the acquisition of three foundational social abilities necessary for social learning: the ability to orient to a social encounter, the ability to disconnect smoothly from it, and the experience of pleasure in it. All three are mediated by the parasympathetic nervous system according to polyvagal theory (Porges, 2004). The first, the *social orientation* response, is a response whereby, when gently touched or spoken to, the child is able to orient their face to the person, seek eye contact, listen for their voice, and be ready to receive the communication. The social orientation response to the trainer was missing at the beginning of treatment, but observable by three weeks, and was usually associated with a smile, indicating pleasure. The second, the *ability to self-soothe* underlies the child's ability to remain calm while making the many transitions required by family and pre-school life. This response generally appeared in the third month of the intervention, and followed the appearance of deep relaxation or sleep during the massage. Instead of responding to the request for change *as a loss*, with tears or a tantrum, the children were able to keep themselves calm, while they stopped one activity and transitioned to the next. Finally, as mentioned in previous papers (Silva et al, 2005, 2007, 2008), as the intervention progressed, children who responded initially to gentle touch with no response, or a withdrawal response, normalized their tactile responses, and began to show *evidence of pleasure* in the

massage, smiling at the therapist, saying "massage?" and jumping up onto the massage table without being asked. This ability to expect and experience pleasure and satisfaction in a social encounter such as the treatment visit, provided a basis for ongoing positive reinforcement of social learning behaviors.

Given that a main treatment effect of the qigong intervention was a calmer and more comfortable physiological state, and increased social development, we can hypothesize that the delay in social development seen in autism, is the result of a sensory/physiological disability that can be at least partially accommodated, rather than a fixed and permanent limitation in the brain or genes. This offers the hope that autism is a more malleable condition than previously thought, and the possibility that with early intervention, the child can improve their learning from the social environment, and overcome some or all of their developmental delays.

Although it is encouraging that with this study we appear to have a promising medium-term intervention for sensory and self-regulation problems in children with autism, that can be easily administered by parents and trained interventionists, the reader is cautioned that the research is still preliminary. Treatment data on a much larger number of children needs to be collected. Data showing maintenance effect at ten months needs to be repeated under controlled conditions, and long-term outcomes data are yet to be obtained. Clinical experience suggests that parents need to continue the home program, albeit with decreasing frequency, until the child is stable at a more normal developmental rate for one or more years, but a study linking the severity of autism to the optimum length and intensity of the intervention, remains to be done.

It is our intention in the coming year, to further our research by gathering data on the effect of qigong massage on the autonomic nervous system of young children with autism, using a measure of vagal tone, as well as measure the impact of the parent component of the

intervention alone. Last but not least, as we continue training and research in EI/ECSE programs, we hope to train many more pediatric occupational therapists, as is our belief they are ideally suited to learning the QST methodology due to their holistic orientation, training in sensory and self-regulation issues, and clinical experience with children on the autism spectrum.

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Table 1.

Participant demographics.

Demographic Variable	Group	
	Treatment Group (N= 25)	Wait-List Control Group (N= 21)
Children (N=46)		
Gender		
Male	19	18
Female	6	3
Chronological Age (Months)		
Mean	65.2 (20.7)	53.3 (18.7)
Minimum	25	27
Maximum	117	92
Nature of Autism		
Regressive	13	9
Non-Regressive	12	12

Table 2. Pre to Post Scores on Measures of Sensory Impairment, Behavior, and Developmental skills for Treatment and Control Groups

Group and Scale	Pre-Assessment	Post-Assessment	Change
Treatment Group			
Autism Behavior Checklist	48.5 20.8	33.9 18.6	-14.6*** 12.9
Teacher PDDBI (M=50, SD=10)			
Maladaptive Behavior (AWP/C)	50.9 10.4	44.0 7.6	-6.9*** 7.3
Social/Language/Communication Abilities (REXSCA/C)	53.7 9.7	56.7 9.7	3.0** 4.9
Parent PDDBI (M=50, SD=10)			
Sensory score	54.2 9.6	46.2 9.1	-8.0*** 5.6
Maladaptive Behavior (AWP/C)	56.8 11.5	45.6 10.8	-11.2*** 8.0
Social/Language/Communication Abilities (REXSCA/C)	57.5 6.8	61.1 7.0	3.6** 5.3
Sense and Systems Checklist			
Sense Checklist (0 – 40)	16.4 6.2	10.8 5.6	-5.6*** 5.5
Systems Checklist (0 - 27)	8.2 3.7	4.8 3.3	-3.4*** 3.4
Wait-list Control Group			
Autism Behavior Checklist	64.3 33.8	59.4 35.4	-4.9 19.3
Teacher PDDBI (M=50, SD=10)			
Maladaptive Behavior	56.5 13.3	49.7 12.2	-6.9** 8.7
Social/Language/Communication Abilities	47.0 13.0	47.6 12.1	0.6 4.3
Parent PDDBI (M=50, SD=10)			
Sensory score	56.0 9.6	55.3 10.0	-0.7 7.5

Group and Scale	Pre-Assessment	Post-Assessment	Change
Maladaptive Behavior	59.5	57.5	-2.0
	10.7	10.4	7.3
Social/Language/Communication Abilities	49.0	49.2	0.2
	13.1	12.8	5.0
Sense and Systems Checklist			
Sense Checklist (0 – 40)	19.5	18.7	-0.8
	6.1	6.6	5.5
Systems Checklist (0 – 27)	10.1	10.1	0
	4.5	3.4	3.5

[a] N = 19 for follow-up, parent only data from treatment group
[*] Paired t-test $p < .05$
[**] Paired t-test $p < .01$
[***] Paired t-test $p < .00$Table 3.

Table 3. Summary of MANCOVA and ANCOVA Results for Intervention Effects on Measures of Sensory Impairment, Behavior and Developmental Skills[a]

Variable	Group Main Intervention Effect		
	F[b]	p	Partial Eta[2]
Teacher Data			
MANCOVA	3.47	.019	.316
ANCOVA			
Autism Behavior Checklist (0-167)	10.25	.003	.237
Teacher PDDBI (M=50, SD=10)			
Maladaptive behavior (AWP)	2.38	.133	.067
Language/Social Abilities (REXSCA)	7.64	.010	.182
Autism Composite	4.05	.052	.109
Parent Data			
MANCOVA	2.70	.029	.412
ANCOVA			
Parent PDDBI (M=50, SD=10)			
Sensory Domain	9.10	.005	.216
Maladaptive behavior (AWP)	16.1	.0003	.328
Language/Social Abilities (REXCSA)	8.23	.007	.200
Autism Composite	14.11	.001	.299
Sense & Systems Checklist (0-67)	17.49	.0002	.346

[a] Pre treatment scores used as covariates to control for individual difference.
[b] MANCOVA Fs are the Pillai's Trace.

Table 4. Correlations among sensory and systems measures and PDDBI scores for children in both treatment and control groups.

Scale	PDDBI Sensory change	PDDBI Behavior change	PDDBI Abilities change	Total Autism score change
		(n=46)		
Change in Sense Checklist pre/post	.520**	.736**	-.446*	.655**
Change in Sense and Systems Checklist Pre/post	.565**	.819**	-.409*	.686**

* p. < .01, ** p. < .0001

Table 5. Intact treatment group cohort means and standard deviations

	Assessment		
Measure/Variable	Pre-Intervention	Post-Intervention	5 Month Follow up
Parent PDDBI (M=50, SD=10)		(N=19)	
Sensory/Perceptual Approach Behaviors	52.8 9.9	45.4 9.8	43.5 9.6
Approach/Withdrawal Problems Composite	54.2 10.3	43.6 9.3	43.9 8.3
Receptive/Expressive, Social Communication Abilities Composite	56.5 8.7	60.1 10.2	59.8 9.2
Autism Composite	49.3 11.7	38.5 11.7	38.6 9.9