Adjunctive Sensory Integration Therapy for Children with Developmental Disabilities in a Family-based Early Intervention Program

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Abstract

Objective: In this study, we investigated whether adjunctive sensory integration therapy (SIT) can benefit children with developmental disabilities (DD) who participated in a family-based early intervention program. Methods: Children aged 2–4 years who had been diagnosed with a DD were placed into 1 of 3 intervention groups. Children in the day-care group (n = 15) received a daily, family-based treatment program in a day-care center. Those in the outpatient clinic (OC) + SIT group (n = 15) participated in a weekly outpatient family-based treatment program with an adjunctive SIT. The OC group (n = 15) participated in a weekly outpatient family-based treatment program, which was used as the control group. With the copy of Mullen Scale of Early Learning (MSEL), we assessed all children both before and after a six-month of intervention. Furthermore, we asked children’s caregivers to fill out the both survey copies of the World Health Organization Quality of Life-BREF and the Parenting Stress Index-Short Form. Results: Children in the day-care group demonstrated significant improvements in all development domains as measured with MSEL (p < 0.01 or p < 0.001). Children in the OC + SIT group exhibited similar developmental progress as those in the day-care group. Furthermore, the OC + SIT group demonstrated significantly greater improvements in receptive language (p < 0.01) and early learning composite score (p < 0.01) than the children in the OC group. But the caregivers’ quality of life and parenting stress remained unchanged through the six-month intervention. Conclusion: Our findings revealed the potential effect of adjunctive SIT on children’s development. The authors hope that our study data can provide a reference for early intervention strategies for children with DD.

Key words: intensive early intervention, Mullen’s scale of early learning, pre-test/post-test, the World Health Organization Quality of Life-BREF

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Introduction

A child with a developmental disability (DD) is referred to one who does not reach developmental milestones within the normal age range [1]. In general, children with DD may experience delay in four areas – language or speech, motor, social and emotional function, as well as cognition [2]. According to the United Nations World Health Organization (WHO), the prevalence of DD among preschool children is about 6%–8% [3]. The case numbers of DD in Taiwan in 2011 and 2012 were estimated to be 15,848 and 17,324, respectively [4]. Early intervention is a type of preventive treatment for infants and young children with DD, with the goal of facilitating children’s physical, cognitive, communication, self-help, emotional, or adaptive skills [5-7]. Improving parenting skills and providing adequate family support during early intervention have been correlated with the positive outcome of children with DD, thus reinforcing the importance

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of involving caregivers in early intervention programs [8, 9]. In addition to caregivers’ involvement, highly intensive early intervention has been linked to better progress in children’s development [10, 11].

Sensory and motor experiences are the basis of neurodevelopment and language development [12, 13]. Sensory integration is defined as a neurophysiological process that integrates sensory information from the body and environment to contribute to emotional regulation, learning, behavior, and participation in daily life [14, 15]. Trouble tolerating or processing sensory information is commonly observed in many developmental behavioral disorders [16]. Therefore, sensory integration therapy (SIT) has been designed to address sensory processing difficulties and to help organize and control environmental sensory inputs [17]. Children who have problems processing and integrating sensory information and difficulties performing daily tasks can benefit from intervention [18]. But the current literature about the effectiveness of SIT for children with disabilities is mixed and controversial [19, 20]. The inconsistent results of previous studies may be related to the heterogeneity of the study methods. Previous literature has indicated that SIT has positive effects on arousal level, visual exploratory behavior, motor development, and reflex integration [21]. Therefore, we hypothesized that adjunctive SIT added to an early intervention program could be an effective beneficial method for children with DD in certain developmental domains, such as language, motor skills, and cognition. Furthermore, family-based early intervention programs have been popular as an effective strategy for DD children [22, 23]. Currently, no studies have investigated whether adding SIT to a family-based early intervention program can improve children with DD.

In this study, we intended to evaluate whether adjunctive SIT is beneficial for children with DD who participated in a family-based early intervention program, as well as to explore whether the caregivers’ quality of life and parenting stress changed throughout the six months of intervention. We recruited children who participated in a weekly treatment program without SIT as the negative control group and children attending a daily treatment program in a day-care center as the positive control group.

**Methods**

**Sample population**

The institutional review board at Chang Gung Memorial Hospital has approved this prospective, non-randomized, open-label study to evaluate the effects of adjunctive SIT in family-based treatment programs of children with DD (IRB protocol number = 103-1229B, and date of approval = May 12, 2014). After providing a complete description of the study, we got informed consent from the children and their primary caregivers. We registered this study at ClinicalTrials.gov (NCT03223688).

Study subjects were children with DD who participated in an early intervention program at Kaohsiung Chang Gung Memorial Hospital, the largest general hospital in southern Taiwan. Each child received a joint assessment done by a pediatrician, a rehabilitation doctor, a child psychiatrist, a speech therapist, a physical therapist, an occupational therapist (OT), and a social worker. After being confirmed the DD diagnosis, the child was scheduled for prescribed family-based early intervention at the same hospital. We enrolled children with DD (between 2 and 3 years old) who participated in the program during from 2014 to 2016. Patients were excluded if they had a history of comorbid autism spectrum disorder, epilepsy, cerebral palsy, and other major physical or genetic diseases. The participants were divided into three different groups based on their method of intervention, which was chosen based on the willingness and expediency of the children’s caregivers.

The day-care group consisted of children and their caregivers who participated in the day-care treatment program. Children and their caregivers were recruited from two treatment courses (with eight parent-child pairs in each course). The treatment was provided by two experienced OTs in the morning weekdays, and each session was lasted for 4 h with a 10-min break in between. The goal of the sessions was to enhance children’s development through cognitive training, a behavioral modification plan, and parental skills training. Those therapists helped the caregivers improve their nurturing and parenting skills, as well as their techniques for influencing them.

The outpatient clinic (OC) + SIT group consisted of children and their caregivers who attended a weekly OC treatment program. Children and their caregivers were recruited from two treatment courses (with 8 and 7 parent-child pairs in the two courses, respectively). This program was also led by two experienced OTs, and each session was lasted for 1 h, once a week. The contents of those sessions included cognitive training, a behavioral modification plan, and parental skills training. Those OTs also did adjunctive SI therapy to improve children’s sensory motor development in an additional hour.

An OT assessed the sensory processing of each child, planned intervention accordingly, and provided sensory strategies for the home, such as pressure touch with lotion, slow rhythmic swinging in straight planes of movement, slow rocking, or an oral activity like drinking with a straw from a water bottle. SIT uses calming techniques like deep-pressure massage, slow regular swings, and soothing or calming experiences to help anxious children. Using such organizational techniques as proprioceptive activities (pushing, lifting heavy objects, etc.) and oral movements (chewing, blowing, etc.) can help children who are over-responsive or underreactive to become more focused. Using such alert techniques as fast shaking, fast bouncing on the bed, etc., can help children who are under-responsive, passive, or sleepy to make them more focused.

The OC group consisted of children and their caregivers who participated in a weekly OC program. Children and their caregivers were recruited from two treatment courses (with 8 parent-child pairs in each course). This treatment was also
provided by two experienced OTs, and each session was lasted for 1 h, once a week. The sessions consisted of cognitive training, a behavioral modification plan, and parental skills training.

During the six-month intervention period, we lost one child in the day-care group and one in the OC group during the follow-up. In the end, 15 children and their caregivers in the day-care group, 15 in the OC + SIT group, and 15 in the OC group completed the early intervention program and the related assessments.

**Measures**

We evaluated the outcomes of the early intervention programs using the children’s six-month retention rate in the program and developmental changes during the study period. The children with DD that entered the program were assessed using the Mullen Scales of Early Learning (MSEL) at both the first visit (pretest) and a follow-up visit six months later (posttest). The children’s caregivers were requested to fill out both copies of the WHO Quality of Life-BREF (WHOQOL-BREF) and the Parenting Stress Index-Short Form (PSI-SF).

We also administered a copy of a structured questionnaire to gather information related to sociodemographic characteristics the demographics of children (gender, age, premature birth, and birth weight), as well as family characteristics (age and educational level of parents, as well as annual family income). Children were clinically diagnosed using the International Classification of Diseases, 9th revision, Clinical Modifications (ICD-9-CM) code, including developmental speech or language disorder (315.3), developmental coordination disorder (315.4), mixed development disorder (315.5), and unspecified delay in development (315.8 or 315.9).

The MSEL, a standardized developmental assessment for newborns through children 68 months of age, offers an overall index for measuring cognitive ability and developmental delay [24]. This assessment includes five subscales: gross motor (only for children younger than 33 months), visual reception, fine motor, expressive language, and receptive language. Once each item is scored, the initial scores in each of the five subscales are converted into normalized age-specific scores called T scores. The T scores of all of the subscales except for the gross motor one are then added together and converted into the early learning composite score. This scale has been effectively applied to assess children’s developmental levels [25].

The WHOQOL-BREF, a self-administered questionnaire, is a 26-item version adapted from the WHOQOL-100. The WHOQOL-BREF has been useful in surveys of both general and specific populations, as well as in differentiating the health benefits created by various different treatments [26]. This questionnaire is scored in four categories: physical capacity (7 items), psychological well-being (6 items), social relationships (4 items), and environment (9 items). All items are rated on a five-point Likert scale with a higher score indicating a higher quality of life. Previous studies have reported that the WHOQOL-BREF has good test–retest reliability and content validity in Taiwan [27].

The PSI-SF includes 36 items (rated on a five-point Likert scale) and stems directly from the 120-item PSI full-length test [28]. The PSI-SF has been widely adopted for evaluating parenting stress based on the interrelationship between the characteristics of parent and child [28]. The PSI-SF provides scores in the following subscales: (a) parental distress, (b) parent–child dysfunctional interaction, and (c) difficult child [29]. Studies have reported that the PSI-SF Chinese version is a reliable assessment tool in clinical practices for identifying parenting stress with a need for intervention [30].

**Statistical analyses**

We compared groups with one-way analysis of variance and Chi-square test for continuous variables and categorical variables, respectively. The paired-*t* test was used to examine whether the scores of each subscale in MSEL, WHOQOL-BREF, and PSI-SF improved during the six-month intervention. Furthermore, we also did analysis of covariance (ANCOVA) to calculate the least square mean (standard error) change from baseline, as well as the between-group differences, with children’s age, gender, and baseline values as covariates.

We analyzed all study data with Statistical Package for Social Science version 16.0 (SPSS Inc., Chicago, Illinois, USA). The differences between groups were considered significant if *p*-values were smaller than 0.05 (two-tailed).

**Results**

In this study, 15 children participated in the day-care group (mean age = 2.2 years, 60% male), 15 children in the OC + SIT group (mean age = 2.4 years, 66.7% male), and 15 children in the OC group (mean age = 2.3 years, 53.3% male) and fully completed the study (Table 1). Upon recruiting these children (baseline), their most common diagnosis was developmental speech or language disorder (100%) across the three groups. At baseline, the OC group exhibited higher T scores of receptive language (*p* < 0.05) and early learning composite score (*p* < 0.05), compared to the day-care group. Regarding family characteristics, no significant differences were observed at baseline among the three intervention groups.

Table 2 presents the changes in children’s development, as well as caregivers’ quality of life and parenting stress, between baseline and the six-month follow-up. Among the MSEL measurements for children, we found significant improvements in visual perception, expressive language, and early learning composite scores in all three groups during the six-month early intervention programs. Fine motor scores only significantly improved in the day-care group (*p* < 0.01), but not in the OC + SIT group (nonsignificant) or the OC group (nonsignificant). Perceptive language was significantly improved in the day-care group (*p* < 0.01) and the OC + SIT group (*p* < 0.05) but not in the OC group (nonsignificant) over that same six-month period.

Figure 1 depicts least square mean changes in the MSEL assessments during the six-month study, as well as the between-
group differences, with children’s age, gender, and baseline values as covariates. In comparison with the OC group, the least square mean changes in receptive language and early learning composite scores after the six-month intervention were significantly greater in the day-care group and OC + SIT group, respectively. No significant differences were observed in changes of receptive language and early learning composite scores between the day-care group and the OC + SIT group. Furthermore, we found no significant differences in the changes of visual reception, fine motor, and expressive language scores between any pairwise group comparisons.

**Discussion**

The results of this study indicated that SIT may have a positive effect when integrated with family-based cognitive training. As shown in Table 2, we found that the improvements of all developmental domains in the OC + SIT group resembled those of the day-care group. Moreover, the OC + SIT group
Table 2. Scores of children’s development, caregivers’ quality of life, and parenting stress at baseline and 6 months later for children who participated in three different early intervention programs

<table>
<thead>
<tr>
<th>Variables</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Pretest</th>
<th>Posttest</th>
<th>Pretest</th>
<th>Posttest</th>
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<tbody>
<tr>
<td></td>
<td>Day-care group</td>
<td>OC + SIT group</td>
<td>OC group</td>
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<td></td>
<td>(n=15)</td>
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<td><strong>Mullen Scales of Early Learning</strong></td>
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<td>Visual reception</td>
<td>31.5 ± 10.0</td>
<td>47.2 ± 9.6***</td>
<td>33.7 ± 9.1</td>
<td>47.3 ± 8.9***</td>
<td>39.6 ± 13.9</td>
<td>49.3 ± 11.8**</td>
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<tr>
<td>Fine motor</td>
<td>38.4 ± 7.4</td>
<td>44.1 ± 7.0**</td>
<td>38.9 ± 10.8</td>
<td>43.9 ± 9.0</td>
<td>45.3 ± 7.3</td>
<td>46.1 ± 11.9</td>
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<tr>
<td>Receptive language</td>
<td>33.1 ± 12.0</td>
<td>43.9 ± 7.3**</td>
<td>37.9 ± 11.3</td>
<td>45.4 ± 8.1*</td>
<td>45.7 ± 13.7</td>
<td>45.2 ± 11.2</td>
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<tr>
<td>Expressive language</td>
<td>26.7 ± 4.0</td>
<td>43.1 ± 9.0***</td>
<td>28.5 ± 7.8</td>
<td>46.5 ± 9.0***</td>
<td>29.4 ± 6.8</td>
<td>43.5 ± 13.2***</td>
</tr>
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<td>Early learning composite scores</td>
<td>67.7 ± 10.1</td>
<td>89.8 ± 12.7***</td>
<td>72.0 ± 14.2</td>
<td>91.9 ± 15.0***</td>
<td>81.3 ± 16.2</td>
<td>92.6 ± 19.4***</td>
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<td><strong>WHOQOL-BREF</strong></td>
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<td>Physical health</td>
<td>25.4 ± 3.3</td>
<td>25.5 ± 4.4</td>
<td>25.3 ± 4.9</td>
<td>25.4 ± 4.3</td>
<td>26.1 ± 3.3</td>
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<td>Psychological health</td>
<td>20.1 ± 4.4</td>
<td>19.3 ± 4.2</td>
<td>19.2 ± 3.8</td>
<td>19.7 ± 3.6</td>
<td>19.2 ± 3.6</td>
<td>20.0 ± 3.8</td>
</tr>
<tr>
<td>Social relations</td>
<td>14.1 ± 1.8</td>
<td>14.1 ± 1.6</td>
<td>13.1 ± 2.1</td>
<td>12.7 ± 2.1</td>
<td>13.7 ± 2.0</td>
<td>13.5 ± 2.7</td>
</tr>
<tr>
<td>Environment</td>
<td>30.5 ± 4.5</td>
<td>31.5 ± 4.2</td>
<td>29.7 ± 5.6</td>
<td>29.1 ± 6.0</td>
<td>30.9 ± 4.9</td>
<td>30.5 ± 4.8</td>
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<td><strong>PSI Short-Form</strong></td>
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<tr>
<td>Parental Distress</td>
<td>57.2 ± 35.1</td>
<td>54.3 ± 31.1</td>
<td>67.5 ± 24.2</td>
<td>60.1 ± 22.0</td>
<td>53.3 ± 25.6</td>
<td>55.4 ± 30.5</td>
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<tr>
<td>Parent-child dysfunctional interaction</td>
<td>54.9 ± 25.3</td>
<td>57.8 ± 16.7</td>
<td>54.9 ± 29.5</td>
<td>52.5 ± 26.8</td>
<td>42.9 ± 28.4</td>
<td>37.3 ± 22.4</td>
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<tr>
<td>Difficult child</td>
<td>72.1 ± 31.4</td>
<td>59.9 ± 27.0</td>
<td>61.1 ± 33.2</td>
<td>58.3 ± 30.4</td>
<td>61.6 ± 31.4</td>
<td>52.9 ± 26.1</td>
</tr>
<tr>
<td>Total score</td>
<td>63.1 ± 31.6</td>
<td>60.8 ± 23.6</td>
<td>60.8 ± 30.1</td>
<td>55.9 ± 26.1</td>
<td>54.9 ± 29.5</td>
<td>50.4 ± 26.2</td>
</tr>
</tbody>
</table>

\*p < 0.05; \**p < 0.01; \***p < 0.001 using \(t\)-test \((n = 45)\).

Data are expressed as mean ± SD or n (%).

SD, standard deviation; WHOQOL-BREF, the brief version of the World Health Organization Quality of Life; PSI, parent stress index.

Figure 1. Changes in least square mean of the developmental scores assessed using the Mullen Scales of Early Learning during early intervention for six months \(p < 0.05\); \**p < 0.01; \***p < 0.001 using analysis of covariance (ANCOVA) test \((N = 45)\). Day-care group, children who participated in a daily intervention program \((n = 15)\), OC + SIT group, children who participated in a weekly outpatient intervention program, with an adjunctive SIT \((n = 15)\). OC group, children who participated in a weekly outpatient intervention program without SIT \((n = 15)\).

VR, visual reception; FM, fine motor; EL, expressive language; RL, receptive language; ELCS, early learning composite score.

Figure 1 demonstrates that the children who received adjunctive SIT in a weekly intervention program (OC + SIT group) showed the greatest degree of developmental improvements as the children that received daily training (day-care group), as well as greater improvements in receptive language and early learning composite scores than those in the OC group. These results indicate that incorporating a SIT into a weekly early intervention program may further influence DD children’s success. Sensory integration procedures have a generalized effect on brain function, not only resulting in an increased ability to organize purposeful interaction with the social-emotional environment but also increasing the capacity for cognitive potential [12, 13]. The SIT is an effective beneficial method for children with DD in all developmental domains, including language, fine motor skills, gross motor skills, and cognition. Previous studies have shown that SIT can influence motor coordination abilities, sensory processing functions, and cognition in preterm infants [32] and children with high functioning autism [33]. SIT helps children outperformed the OC group significantly in improving receptive language \((p < 0.05)\) over six months.

As shown in Table 2, children who received daily intervention (the day-care group) showed the greatest degree of developmental progress, while the children who received weekly intervention without SIT (the OC group) showed the lowest improvement levels. Previous studies have indicated that family involvement in an early intervention program is a vital predictor of an advantageous outcome [8, 9]. Therefore, the three treatment groups in our study were all based on family-orientated intervention strategies. The difference between the day-care group and the OC group was the intensity of the early intervention (daily vs. weekly). The intensity or frequency of early intervention for DD children has previously been associated with better outcomes [9, 31]. The day-care group demonstrated greater improvements in children’s development, particularly in receptive language and overall cognitive function (Figure 1).

The children who received adjunctive SIT in a weekly intervention program (OC + SIT group) demonstrated similar developmental improvements as the children that received daily training (day-care group), as well as greater improvements in receptive language and early learning composite scores than those in the OC group. These results indicate that incorporating a SIT into a weekly early intervention program may further influence DD children’s success. Sensory integration procedures have a generalized effect on brain function, not only resulting in an increased ability to organize purposeful interaction with the social-emotional environment but also increasing the capacity for cognitive potential [12, 13]. The SIT is an effective beneficial method for children with DD in all developmental domains, including language, fine motor skills, gross motor skills, and cognition. Previous studies have shown that SIT can influence motor coordination abilities, sensory processing functions, and cognition in preterm infants [32] and children with high functioning autism [33]. SIT helps children
with sensory processing issues by exposing them to sensory stimulation in a repeated and structured way and has become widely accepted as an intervention method for enhancing language-learning disorders and academic difficulties in children [34]. Our findings support that SIT has adjunctive benefits for children with DD who receive early intervention.

In our study population, caregivers’ quality of life and parenting stress showed no significant changes during the six-month study period, but other PSI indices did not show any significance. Since caregivers of children with DD may experience poorer psychological well-being than those of children with typical development [35], caregivers’ quality of life and parenting stress may be a vital outcome indicator for early intervention [36]. Ideally, early intervention practitioners not only facilitate children’s development but also provide customized family-oriented services to relieve parenting stress and enhance the quality of life of caregivers [37]. In this study, DD children’s caregivers may benefit from parenting skills and children’s developmental progress. Nevertheless, the caregivers may put in remarkable effort participating in the early intervention program, thus placing both an economic and time burden on them. Therefore, their parental stress and quality of life did not significantly improve during the follow-up period (Table 2).

**Study limitations**

- The current study did not use random assignment for allocation and relied on the caregivers’ choice. In clinical settings, patients with more severe developmental delays may have had more opportunities for intensive treatment. Although the characteristics of the children and caregivers did not significantly differ at baseline, the day-care group tended to have the most significant DD, while the OC group had the least significant DD. Therefore, the results of this study are likely influenced by selection bias.
- The study sample size is quite small, thus potentially inadequate power to detect differences in the outcomes between groups, if any.
- Although we arranged both a negative and a positive control group, we did not recruit DD children without any intervention or children and caregivers from a day-care group with SIT. Therefore, we could not verify whether children’s development progress was derived from early intervention or their natural maturation. Moreover, the lack of day-care group plus SIT participants makes it impossible to determine whether adjunctive SI therapy can provide additional benefits for day-care children.
- The results of this study cannot only be attributed to the positive effect of SIT, but also can be explained by the therapy duration. More therapy leading to more improvement (day-care group had 4 h/weekday, OC + SIT group had 2 h/week, and OC group had 1 h/week). Finally, DD classification was based on ICD-9 diagnostic criteria. The underlying etiologies of DD were heterogeneous, so the results may not be able to be generalized to children with DD in other populations.

**Summary**

The results of this study revealed that adjunctive SIT in a weekly family-based early intervention program for children with DD had a similar effect as that of an intensive daily training program. Furthermore, the children that received adjunctive SIT in their weekly training program showed greater improvements in receptive language and overall cognitive scores than those who underwent weekly training without SIT. Based on those findings, we suggest that SIT may have a positive effect when integrated with family-based cognitive training, and that this information can serve as a reference for future early intervention strategies for children with DD and their caregivers.

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**Conflicts of Interest**

All authors declare no potential conflicts of interest in writing this article.

**References**

11. Hwang AW, Chao MY, Liu SW: A randomized controlled trial of...
Hsieh, et al.: Sensory integration for developmental delay


