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Research Article

THE EFFECTS OF SENSORY INTEGRATION THERAPY AND CONVENTIONAL THERAPY PROGRAMME ON SPASTICITY, BALANCE AND MOTOR FUNCTION IN SPASTIC DIPLEGIC CEREBRAL PALSY

Atahan TURHAN[1], Melek Güneş YAVUZER[2]

Abstract

Aim: This controlled experimental study was planned to investigate the effect of sensory integration therapy (SIT) added to conventional treatment programme (CTP) on spasticity, balance, motor function and functional independence in children with spastic diplegic type cerebral palsy (CP).

Method: The study included 22 children aged 4-17 years with diplegic type CP. The control and intervention groups received 45 minutes of CTP 3 times a week for 8 weeks, while the intervention group received 15 minutes of SIT in addition to CTP. The evaluations were performed 2 times before and after the treatment. The spasticity level of triceps surae, hamstring, hip flexor and hip adductor muscle groups were evaluated with the Modified Ashworth Scale (MAS), balance level with the Pediatric Berg Balance Scale (PBBS), motor function level with the Gross Motor Function Measure (GMFM-88), and functional independence level with the Functional Independence Measure for Children (WeeFIM).

Findings: There was a significant change in the Hamstring MAS value of the intervention group (p=0.008). There was a significant change in Triceps Surae MAS value of both groups (p<0.05). When the groups were compared in terms of change difference values in PBBS, a statistically significant difference was found in favor of the intervention group (p=0.001). When the groups were compared in terms of change difference values in WeeFIM, a statistically significant difference was found in favor of the intervention group (p=0.007).

Results: SIT added to CTP was more effective than CTP alone in terms of relaxing hamstring muscles, improving balance and increasing functional independence in patients with diplegic type CP.

Keywords: Cerebral Palsy, Sensory Integration Therapy, Sensory Processing Disorder.

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[1] Corresponding Author: Lecturer Dr., Kırşehir Ahi Evran University, Department of Physical Therapy and Rehabilitation, Kırşehir, Turkey atahanturhan@hotmail.com ORCID: 0000-0001-9510-925X

[2] Prof. Dr., Halic University, Physical Medicine and Rehabilitation Department, İstanbul, Turkey gunesyavuzer@halic.edu.tr ORCID: 0000-0002-2898-9389

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Spastik Diplejik Serebral Palside Duyu Bütünleme Terapisi Ve Geleneksel Fizyoterapi Programinin Spastite, Denge Ve Motor Fonksiyonu Üzerine Etkileri

Öz

Amaç: Bu kontrollü deneysel çalışma, spastik diplejik tip serebral palsili (SP) çocuklarda konvansiyonel tedavi programına (KTP) eklenen duyu bütünleme tedavisinin (DBT); spastisite, denge, motor fonksiyon ve fonksiyonel bağımsızlığa etkisini araştırmak üzerine planlandı.

Yöntem: Çalışmaya 4-17 yaş arası 22 diplejik tip SP'li çocuk dahil edildi. Kontrol ve müdahale grubuna 8 hafta boyunca haftada 3 kez 45 dakikalık KTP uygulanırken, müdahale grubuna KTP'ye ek olarak 15 dakika DBT uygulandı. Değerlendirmeler tedavi öncesi ve sonrası olmak üzere 2 defa yapıldı. Triceps surae, hamstring, kalça fleksörü ve kalça addüktörü kas gruplarının spastisite düzeyi Modifiye Ashworth Skalası (MAS) ile, denge düzeyi Pediatrik Berg Denge Ölçeği (PBDÖ) ile, motor fonksiyon düzeyi Kaba Motor Fonksiyon Ölçütü (KMFÖ-88) ile, fonksiyonel bağımsızlık düzeyi Pediatrik Fonksiyonel Bağımsızlık Ölçümü (PFBÖ) ile değerlendirildi.

Bulgular: Müdahale grubunun Hamstring MAS değerinde anlamlı bir değişiklik vardı (p=0,008). Her iki grubun Triceps Surae MAS değerinde anlamlı değişiklik görüldü (p<0,05). Gruplar PBDÖ'deki değişim farkı değerleri açısından karşılaştırıldığında, müdahale grubu lehine istatistiksel olarak anlamlı bir fark bulundu (p=0,001). Gruplar PFBÖ'deki değişim farkı değerleri açısından karşılaştırıldığında, müdahale grubu lehine istatistiksel olarak anlamlı bir fark bulundu (p=0,007).

Sonuç: KTP'ye eklenen DBT, diplejik tip SP'li olgularda hamstring kaslarının gevşetilmesi, dengenin iyileştirilmesi ve fonksiyonel bağımsızlığın artırılması açısından tek başına KTP'ye göre daha etkili olduğu görüldü.

Anahtar Kelimeler: Serebral Palsi, Duyu Bütünleme Terapisi, Duyusal İşleme Bozukluğu

1. INTRODUCTION

Cerebral Palsy (CP) is defined as a condition resulting from non-progressive damage to the developing brain of a fetus or infant, causing movement and postural problems (Patel et al., 2020; Sadowska et al., 2020). CP is a common condition in early childhood and can cause severe disability. Its prevalence in school-aged children is 2-2.5/1000. Despite improved modern perinatal/neonatal care, the prevalence of CP has increased. Studies have shown that it will continue to affect a large number of children (McIntyre et al., 2022; Vitrikas et al., 2020).

After the lesion in the brain in CP, motor development and sensory responses are affected together in children. These problems negatively affect the sensorimotor development of children with CP (Mailleux et al., 2020; Tsao et al., 2015). Existing motor problems in CP are affected together with sensory systems such as proprioception, tactile and vestibular. Therefore, the main problem has been defined as a sensorimotor disorder. Children with CP and sensory integration disorder have difficulty responding appropriately to the sensory stimuli they receive from their environment. As a result, they have difficulty performing activities of daily living (Papadelis et al., 2018; Pavão & Rocha, 2017). Sensory disorders in children with CP often coexist with motor disabilities. Moreover, sensory dysfunction itself can contribute to motor impairments in these children (Pavão et al., 2015).

Sensory integration theory was first explained by Dr Jean Ayres in the 1970s. This theory describes the neurological process involved in analyzing, organizing and making use of the sensory data that the individual receives from their own body and the outside world. Sensory integrity enables the individual to use their body effectively against the environment (Allen & Casey, 2017; Critz et al., 2015; Mahaseth & Choudhary, 2021). The main purpose of SIT is to provide an appropriate response by organizing planned and controlled sensory inputs at the brain level. This adaptive response is defined as a behavior aimed at adapting to sensory information from the child's environment. Ayres believed that the environment plays an important role in shaping the development of the young brain. Therefore, it is believed that it is possible to enhance the nervous system and motor function by providing controlled tactile, vestibular and proprioceptive sensory input (Camarata et al., 2020; Schoen et al., 2019).

According to the literature, the number of studies investigating the effect of SIT on children with CP is insufficient (Mittal et al., 2024). Due to this lack in literature, the aim of this study was to investigate the effect of SIT applied in addition to conventional physiotherapy on spasticity, balance and motor function levels in children with spastic diplegic type CP. It is believed that the data obtained at the end of the study will make a significant contribution to literature, both theoretically and practically.

2. METHODS

2.1. Participants

Participants aged 4 to 17 years were recruited from a private pediatric rehabilitation center. Children with spastic diplegic type CP and Gross Motor Function Classification System (GMFCS) level I and II were included in this study. Children who had undergone phenol and botulinum toxin A injections in the 6 months prior to the study, who had undergone previous surgery, and who had cardiopulmonary disease that could prevent movement were excluded from the study. Children with communication, hearing or vision problems were also excluded from the study.

2.2. Sample Size

G*Power 3.1.9.7 Software (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany) was used to calculate the sample size. Shamsoddini and Hollisaz applied SIT to children with CP in their study and the change in GMFM-88 scores was taken as the reference. In this group, the effect size was calculated to be 2,039 (Shamsoddini & Hollisaz, 2009). The sample size was calculated by taking $\alpha= 0.05$, $\beta= 0.98$, effect size f= 2.039 in the study, and the minimum number of participants to be included in the study was determined to be 20, including 10 people in each group. Taking into account that 10% of participants might drop out of the study, the minimum number of participants was set at 24, with a minimum of 12 participants in each group.

2.3. Study Design

This controlled intervention study was conducted in a private pediatric rehabilitation center in Istanbul between January 2018 and June 2018. The study was conducted after obtaining permission from the Halic University Clinical Research Ethics Committee (decision number: 24/11/2017-194) and the rehabilitation center. This study was registered as a controlled exercise trial (ClinicalTrials.gov ID: NCT05966428). The families of the children were given detailed information about the purpose and method of the study. An informed consent form was signed by the families of the children who volunteered to participate in this study. The study was conducted in accordance with the tenets of the Declaration of Helsinki. The children who met the inclusion criteria were divided into two groups, control and intervention. Randomization and blinding could not be achieved because some families considered the SIT to be a waste of time and some children found the study boring.

2.4. Treatment Programs

The control group received a conventional exercise programme. This exercise programme included stretching and strengthening, balance coordination, mobility and range of motion exercises. SIT was used in the intervention group in addition to the conventional exercise programme. SIT included tactile, proprioceptive and vestibular activities. These exercise programmes were carried out under the supervision of physiotherapists and occupational therapists with at least 4 years' professional experience. The tactile sensory activities consisted of materials such as stepping stones, tactile box, brushing, fabric walking path. The vestibular sensory activities consisted of materials such as hammock swings, trampolines, rope nets, river stones. The proprioceptive sensory activities consisted of materials such as weight-bearing activities, climbing wall, heavy lifting, deep pressure, big ball activities, tug-of-war and ball pits. There were no activities that disturbed the children. The control group received conventional therapy 3 days a week for 8 weeks. Each therapy session per day lasted 45 minutes in the control group. The intervention group received 45 minutes of conventional therapy and 15 minutes of SIT per session. The therapy programme continued 3 days a week for 8 weeks in the intervention group.

2.5. Assessment

A form asking for socio-demographic and clinical information about the children was included in the study. This form was completed in accordance with the answers given by the families. Sociodemographic and clinical information on the children was recorded. The assessments were carried out twice face-to-face by the same principal investigator, before the first treatment session began and after the treatment was completed.

2.5.1. GMFCS: The GMFCS has been developed to classify and describe the abilities of children with CP. Children are classified into 5 levels according to their motor skills, functional abilities, assistive technology and wheelchair requirements (Paulson & Vargus-Adams, 2017).

2.5.2. Modified Ashworth Scale (MAS): MAS is a method of assessing muscle tone during movement of the affected muscle. The muscle tone assessed on this scale is graded from 0 to 4 and scored from 0 to 5. A score of 0 indicates that there is no increase in muscle tone and a score of 4 indicates that the limb is rigid in flexion and extension (Yoo et al., 2022). The MAS was used to assess the level of spasticity in the triceps surae, hamstrings, hip flexors and hip adductors.

2.5.3. Pediatric Berg Balance Scale (PBBS): The PBBS is used to assess children's functional balance in activities of daily living. The scale consists of 14 items. Each item is scored from 0 (lowest function) to 4 (highest function). The total score ranges from a minimum of 0 to a maximum of 56. The scores are used to determine whether the balance is good or poor (Franjoine et al., 2022).

2.5.4. Gross Motor Function Measure 88 (GMFM-88): The GMFM-88 is a scale designed to measure motor function and changes in motor function in children with CP. This scale consists of 5 sub-dimensions and 88 items. These sub-dimensions are lying and rolling (size A), sitting (size B), crawling and standing on the lap (size C), standing (size D), running, walking and jumping (size E). The total score for the GMFM-88 is obtained by dividing the total score percentages in all sections by 5. The scores are given in 4 categories as '0' not starting the activity, starting independently '1', partially completing '2' and independently completing '3'. The total score is calculated as a percentage. Higher percentages indicate better motor function (Salavati et al., 2017).

2.5.5. Functional Independence Measure for Children (WeeFIM): WeeFIM has been adapted from the Functional Independence Scale (FIM) developed for adults. WeeFIM consists of 6 sections and 18 items: self-care, sphincter control, mobility transfers, locomotion, communication and social perceptions. These items are scored from 1 to 7 based on whether they received support to complete each task, whether they completed it on time, or whether they needed an assistive device. According to the scoring system, a minimum of 18 (fully dependent) and a maximum of 126 (fully independent) points can be obtained (Vostrý et al., 2022).

2.6. Statistical Analysis

Data were analyzed with SPSS 25 (SPSS Inc.; Chicago, IL, USA). Descriptive statistics were used for the demographic and clinical characteristics of the sample. The Shapiro-Wilk test was used to calculate the normality of the data set. As the number of patients did not allow for parametric tests, the non-parametric Mann-Whitney U test was used to compare two independent groups, and the Wilcoxon signed rank test was used for comparisons within groups. The Wilcoxon signed-rank test was used to compare pre- and post-treatment values to determine the effectiveness of the treatment applied. Chi-square test was used to compare categorical variables between independent groups. To understand the superiority of the applied treatments, the difference between the pre-treatment and post-treatment scores was calculated in each group. The groups were compared using the Mann-Whitney U test for difference in change. The level of significance was set at $p<0.05$.

3. RESULTS

The flow chart for this study is shown in Figure 1. A total of 24 children with spastic diplegic type CP were included in the study, 12 in the intervention group and 12 in the control group. One child from the control group and one child from the intervention group were excluded from the study because they did not attend the study regularly. In the end, the study was completed with a total of 22 patients.

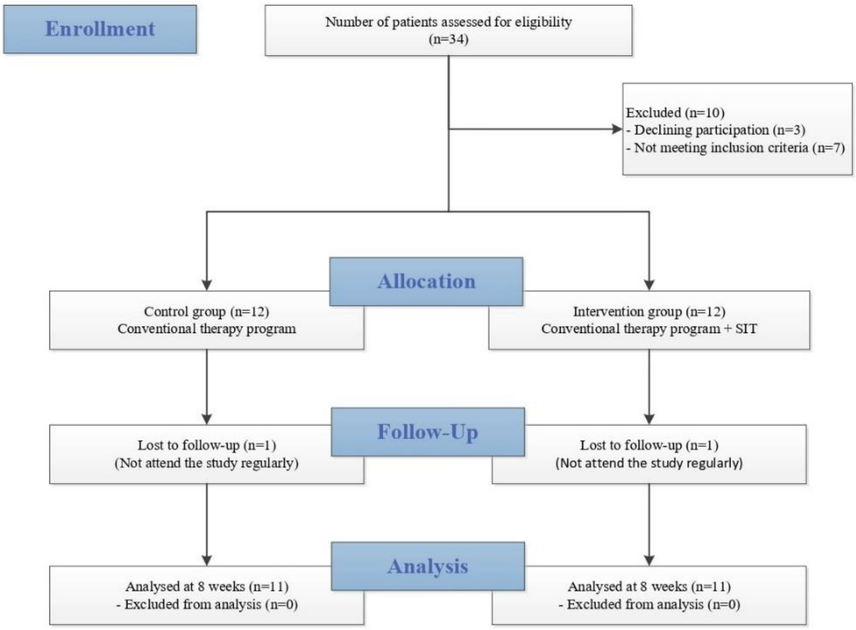

Figure 1. Consort Flow Diagram

The groups were compared in terms of socio-demographic characteristics such as age, sex, height, weight and BMI before treatment. The control group consisted of 5 boys and 6 girls with a mean age of 7.73±3.690 years; mean height 118.64±20.046 cm; mean weight 26.455±14.2799 kg; mean BMI 17.591±2.6610 kg/m2. The intervention group consisted of 4 boys and 7 girls with a mean age of 6.64±2.248 years; mean height 116.36±16.687 cm; mean weight 24.545±6.7062 kg; mean BMI 18±2.4613 kg/m2. There were no differences in age, sex, height, weight and BMI between the groups ($p>0.05$).

The pre-treatment GMFCS levels of the groups were compared. In the control group, there were 8 individuals with GMFCS level 1 and 3 individuals with GMFCS level 2. In the intervention group there were 3 people with GMFCS level 1 and 8 people with GMFCS level 2.

Comparison of MAS scores between groups is shown in Table 1. There was no difference between the groups in terms of pre-treatment spasticity levels ($p>0.05$). When the groups were compared in terms of triceps surae, hamstring, hip flexor, hip adductor MAS scores before and after treatment, there was a statistically significant improvement in triceps surae MAS scores in both groups ($p<0.05$). Hamstring MAS values showed a significant improvement only in the intervention group ($p=0.008$). The changes in hip flexor and hip adductor were not statistically significant ($p>0.05$). When the groups were compared for differences in MAS change before and after treatment, they were found to be similar ($p>0.05$).

Table 1. Comparison of MAS scores between control and intervention groups

Comparison of Pre-Treatment MAS Scores Between Control and Intervention Groups

	Control Group (n=11) **M± Sd**	**Intervention Group (n=11)** **M± Sd**	**p***
Triceps Surae	2.09±0.701	2.55±0.820	0.151
Hamstring	1.73±0.786	2.27±0.647	0.116
Hip Flexor	0.73±1.009	1.09±1.044	0.401
Hip Adductor	0.91±0.944	1.27±0.905	0.332

Comparison of MAS Scores of Control and Intervention Groups Before and After Treatment

	Groups	**Pre-Intervention** **M± Sd**	**Post Intervention** **M± Sd**	**Z**	**p****
Triceps Surae	Control Group	2.09±0.701	1.73±0.647	-2.000	**0.046**
	Intervention Group	2.55±0.820	1.82±0.405	-2.828	**0.005**
Hamstring	Control Group	1.73±0.786	1.82±0.405	-1.732	0.083
	Intervention Group	2.27±0.647	1.64±0.505	-2.646	**0.008**
Hip Flexor	Control Group	0.73±1.009	0.64±0.809	-1.000	0.317
	Intervention Group	1.09±1.044	0.73±0.905	-2.000	0.460
Hip Adductor	Control Group	0.91±0.944	0.73±0.647	-1.414	0.157
	Intervention Group	1.27±0.905	1.00±0.632	-1.732	0.083

Comparison of Differences in Changes in MAS Scores of the Control and Intervention Groups Before and After Treatment

	Groups	**Difference**	**p***
Triceps Surae	Control Group	-0.36±0.50	0.151
	Intervention Group	-0.72±0.46	
Hamstring	Control Group	-0.27±0.46	0.151
	Intervention Group	-0.63±0.50	
Hip Flexor	Control Group	-0.09±0.30	0.300
	Intervention Group	-0.36±0.50	
Hip Adductor	Control Group	-0.18±0.40	0.748
	Intervention Group	-0.27±0.46	

Note. MAS: Modified ashworth scale; M: Mean; Sd: Standard deviation; *: Mann whitney-u test; **: Wilcoxon signed-rank.

A comparison of the PBBS values of the groups is shown in Table 2. The groups were similar in terms of pre-treatment PBBS. PBBS values before and after treatment were compared within groups and a statistically significant improvement was observed in both groups (p<0.05). The groups were compared with each other for differences in the change in PBBS values before and after treatment and a statistically significant difference was found in favor of the intervention group (p=0.001).

Table 2. Comparison of PBBS scores between control and intervention groups

Comparison of Pre-Treatment PBBS Scores Between Control and Intervention Groups

	Control Group (n=11) **M± Sd**	**Intervention Group (n=11)** **M± Sd**	**p***
PBBS	31.55±6.424	28.27±5.934	0.151

Comparison of PBBS Scores Between Control and Intervention Groups Before and After Treatment

	Groups	**Pre-Intervention** **M± Sd**	**Post Intervention** **M± Sd**	**Z**	**p****
PBBS	Control Group	31.55±6.424	32.73±6.739	-2.565	**0.010**
	Intervention Group	28.27±5.934	31.36±6.005	-2.979	**0.003**

Comparison of Differences in PBBS Score Changes Between Control and Intervention Groups Before and After Treatment

	Groups	**Difference**	**p***
PBBS	Control Group	1.18 ± 0.98	**0.001**
	Intervention Group	3.09 ± 1.14	

Note. PBBS: Pediatric berg balance scale; M: Mean; Sd: Standard deviation; *: Mann whitney-u test; **: Wilcoxon signed-rank.

The comparison of the GMFM-88 scores of the groups is shown in Table 3. The pre-treatment GMFM-88 scores of the groups were similar. The differences between the groups in terms of change in GMFM-88 scores before and after treatment were compared and found to be similar (p>0.05).

Table 3. Comparison of GMFM-88 scores between control and intervention groups

Comparison of GMFM-88 Pre-Treatment Scores of Control and Intervention Groups

	Control Group (n=11) **M± Sd**	**Intervention Group (n=11)** **M± Sd**	**p***
GMFM-88	227.45±7.43	226.45±4.48	0.606

Comparison of GMFM-88 Score of Control and Intervention Groups Before and After Treatment

	Groups	**Pre-Intervention** **M± Sd**	**Post Intervention** **M± Sd**	**Z**	**p****
GMFM-88	Control Group	227.45±7.43	228.91±7.752	-2.724	**0.006**
	Intervention Group	226.45±4.48	228.73±4.650	-2.840	**0.005**

Comparison of Differences in GMFM-88 Score Change Between Control and Intervention Groups Before and After Treatment			
	Groups	**Difference**	**p***
GMFM-88	Control Group	1.45 ± 0.93	0.076
	Intervention Group	2.27 ± 1.10	

Note. GMFM-88: Gross motor function measure; M: Mean; Sd: Standard deviation; *: Mann whitney-u test; **: Wilcoxon signed-rank.

Comparison of WeeFIM scores between groups is shown in Table 4. The groups were similar in terms of pre-treatment WeeFIM scores (p>0.05). When the groups were compared in terms of WeeFIM scores before and after treatment, a statistically significant improvement was observed in both groups (p<0.05). The differences in WeeFIM scores between the groups were compared and a statistically significant difference was found in favor of the intervention group (p=0.007).

Table 4. Comparison of WeeFIM scores between control and intervention groups

Comparison of Pre-Treatment WeeFIM Scores Between Control and Intervention Groups			
	Control Group (n=11) **M± Sd**	**Intervention Group (n=11)** **M± Sd**	**p***
WeeFIM	89.45±6.90	88.09±6.14	0.748

Comparison of WeeFIM Scores Between Control and Intervention Groups Before and After Treatment					
	Groups	**Pre-Intervention** **M± Sd**	**Post Intervention** **M± Sd**	**Z**	**p****
WeeFIM	Control Group	89.45±6.90	91.45±6.758	-2.976	**0.003**
	Intervention Group	88.09±6.14	91.18±6.353	-2.994	**0.003**

Comparison of Differences in Changes in WeeFIM Scores Between the Control and Intervention Groups Before and After Treatment			
	Groups	**Difference**	**p***
WeeFIM	Control Group	2.0 ± 0.7	**0.007**
	Intervention Group	3.09 ± 0.7	

Note. WeeFIM: Functional independence measure for children; M: Mean; Sd: Standard deviation; *: Mann whitney-u test; **: Wilcoxon signed-rank.

4. DISCUSSION

This study found that SIT added to a conventional exercise programme in children with spastic diplegic CP was more effective in relaxing the hamstring muscles, improving balance and increasing functional independence than the conventional exercise programme alone. In addition, it was concluded that the conventional treatment programme was effective in improving balance, increasing functional independence and motor function and relaxing the Triceps surae muscles.

The pre-treatment motor levels of the intervention group were found to be significantly higher. This pre-treatment difference may have influenced the change in balance, motor function and functional independence scores after treatment. Lee noted that the motor levels of children with CP are strongly related to balance, motor function and functional independence (Lee, 2017).

Although the number of children with GMFCS level 2 was higher in the intervention group, greater improvements in balance and functional independence were observed. Many studies have investigated the relationship between GMFCS level and balance, motor function and functional independence in children with CP. Liao and Hwang investigated the relationship between GMFCS levels and balance scores in 15 children with CP. It was found that GMFCS levels decreased on tests where balance scores increased. He found that there was a significant relationship between GMFCS levels and balance (Liao & Hwang, 2003). Palisano et al's study of 586 children with CP found a strong correlation between the children's GMFCS levels and their motor function scores (Palisano et al., 2000). Daimano and Abel, in their study of 32 children with CP, found that children with CP who had the lowest GMFCS scores also had the highest functional independence scores (Damiano & Abel, 1996).

The groups were similar in terms of MAS, PBBS, GMFM-88 and WeeFIM levels before treatment. With these similarities, more objective results were obtained at the end of treatment. Relaxation of triceps surae muscle spasticity was achieved in both groups. The intervention group was not superior to the control group. This may be because a personalized sensory profile test was not done for every child with CP. This is because each child with CP has a different sensory profile, and children react differently to different sensory inputs. For example, some sensory inputs, such as touch, may have caused children with CP to overreact and increase spasticity in the triceps surae muscle. Relief of spasticity in the hamstring muscle was only seen in the intervention group. The vestibular stimuli applied in SIT may have caused relaxation in the hamstring muscle. Relaxation of spasticity in the hip flexor and adductor muscles was not observed in either group. The pre-treatment spasticity levels of the groups were low, and therefore the hip muscles were not adequately studied in the treatment programmes. This may have meant that the hip flexor and adductor muscles were not relaxed. There are other methods of reducing spasticity in children with CP. Park and Kim looked at the effectiveness of neurodevelopmental physiotherapy on spasticity, muscle strength and motor function in 175 children with CP. They found that neurodevelopmental physiotherapy was effective in reducing spasticity in children (Park & Kim, 2017).

Balance improvement was achieved in both groups. The improvement in balance was greater in the intervention group than in the control group. SIT had an effect on balance. This improvement in balance may be due to the effect of SIT on the vestibular system. Relaxation of spasticity in the hamstrings and triceps surae muscles may have increased functional independence and improved balance. There is insufficient research on the effect of SIT on balance in children with CP. Patel et al investigated the effect of SIT including visual, vestibular and proprioceptive stimuli on balance control in 17 children with CP. As a result of the study, a significant improvement in the children's balance scores was observed (Patel et al., 2015). Parashar et al investigated the effect of SIT with vestibular stimulation on balance in 30 children with diplegic CP. An improvement in balance was reported at the end of the study (Parashar et al., 2017).

Padnani and Arunachalam investigated the effect of SIT on motor function in children with diplegic CP. The improvement in motor function was more significant in the group that received SIT and conventional physiotherapy than in the group that received conventional physiotherapy alone (Padnani & Arunachalam, 2019). Shamsoddini and Hollisaz investigated the effect of SIT on motor function in 24 children with CP. They found a significant increase in motor function in the children who received SIT (Shamsoddini & Hollisaz, 2009). Tramontano et al, in their study of 14 children with CP, applied SIT that included vestibular stimulation to the children. They achieved a significant increase in motor function scores in the children (Tramontano et al., 2017).

The increase in functional independence score was found to be significant in the intervention group. SIT was effective in improving functional independence. A conducted research with a child with CP and applied a SIT programme that included vestibular stimulation to the child. He found a statistically significant increase in the child's functional independence score (An, 2015).

The main limitations of this study were the use of SIT in children with diplegic CP without sensory profile testing, the inability to randomize patient selection, the fact that the investigator performing the assessments was not blinded to the treatment programme, and the insufficient number of cases in the control and intervention groups. The pre-treatment GMFCS level of the control group was found to be significantly better than that of the intervention group. This may be the reason why there was no difference between the changes in motor function scores of the two groups. The level of the control group was better than that of the intervention group. If the GMFCS levels of the groups had been the same and the patients in the intervention group had been tested for sensation and a SIT programme had been prepared according to the sensory deficit, different results might have been found in the change scores for spasticity, balance and motor function.

In conclusion, SIT in addition to conventional treatment in diplegic CP is more effective in relaxing the hamstring muscle, improving balance and increasing functional independence, and is not superior to conventional treatment alone in improving motor function.

There are very few studies in literature investigating the effects of SIT in children with diplegic CP. More research should be done to address this deficiency. This study is an objective contribution to literature. SIT should be included in the physiotherapy programme of children with diplegic CP. The sensory profile of the individual should also be taken into account. GMFCS levels should also be taken into account when dividing patients into groups, and this should also be included in randomization. Future studies should include more sample groups and a randomized controlled blind study design.

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Conflict of Interest

There is no declaration of interest.

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