A Comparison of the Effectiveness of Supported Seating System in Motor Performance of Children with Cerebral Palsy

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Abstract: ***Aim**: To find the effectiveness of two different seating devices in promoting the Fine motor components, viz. Grasp and Visual-Motor Integration in children with Cerebral Palsy. **Objectives**: To evaluate and compare the effectiveness of two different seating devices in improving the motor control in children with Cerebral Palsy. **Methodology**: A quantitative, comparative study design was constructed for this study. A total of 30 Cerebral Palsy children, with minimum age of 2 years, who are developing head control but do not have sitting balance and who are able to fit into the dimensions of seating devices were included. The sample taken for the study were subjected to baseline neuromotor evaluation. Participants were divided in two groups comprising of 15 subjects, each received 8 weeks of intervention on their respective seating devices and a pre & post evaluation was done on PDMS-2, followed by 2 weeks of rest. After this interchanging their seating devices for next 8 weeksby evaluating on PDMS-2 for pre & post results. The subjects were made to sit in the system for 1hour, thrice a week for 8 weeks. **Results**: We have concluded that both the seating devices bring out a positive outcome in Grasp and Visual-Motor Integration in children with Cerebral Palsy. Supported seating device B was much favoured by most mothers over the seating device A.***

Keywords: Occupational Therapy, Cerebral Palsy, Seating Devices, PDMS-2.

1. Introduction

CEREBRAL PALSY is a static encephalopathy that can be defined as a non-progressive lesion of the immature brain that results in impairment of movement and postural control, and is the most common physical disability in childhood(1). Different approaches to treatment are taken within Occupational therapy, such as neuro-developmental treatment (NDT), the Vojta method, or sensory integration (SI). Study done by (Koman 2002) reported that 50% of children with CP receive OT (12). Often, special adaptive seating devices are relied upon, for postural control and stability. Thus, Occupational Therapists routinely prescribe adaptive seating devices for children with Cerebral Palsy to promote their function and improve their developmental capabilities (1, 2, 3, & 4).

Sitting promotes stabilization to the pelvis and trunk allowing the hands and upper extremities to be free, facilitating manipulation of objects, exploration, increased learning opportunities and interaction with the environment for the infant. According to Trefler and Taylor (1991) positioning equipment and, in particular seating systems, can help the individual with disability to participate more fully in activities at home, school, work and in the community(5). However, little empirical proof exists to support these putative effects. Thus, the lack of compelling evidence indicates the need to develop sound ways to measure and interpret adaptive seating device outcomes.

2. Methods

2.1 Patients

A total of 30 Cerebral Palsy children were selected for the study. Children with Cerebral Palsy with minimum age of 2 years, having functional hearing and vision senses. Cerebral Palsy children, who were developing head control but did not have sitting balance, and were able to fit into the dimensions of seating devices were included in the study. Whereas children with Cerebral Palsy who were currently using or have earlier used a seating device at home or other settings or having any other debilitating neuromuscular condition affecting sitting, were excluded from the study

Table 1: Summary of the data for Experimental Group I

Parameter	*SDA 1st	SDA 2nd	**SDB 3rd	SDB 4th
Mean	37.933	44.66	44.73	50.8
Standard Deviation	25.75	27.06	27.35	29.11
Standard Error	6.649	6.98	7.06	7.516
Median	34	44	44	50

*SDA=Seating Device A, **SDB=Seating Device B

2.2 Study Procedure

A quantitative, comparative study with crossover protocol design was selected. Approval from the ethic committee was obtained, the sample taken for the study were subjected to baseline neuromotor evaluation. Initial i.e. 1st Evaluation on Peabody Developmental Motor Scales Second Edition (PDMS-2) {Fine motor scales} was done. Thereafter; the subjects were allocated to seating device A. The subjects were made to sit in the system for 1hour, thrice a week for 8 weeks and training for hand function was incorporated.

2nd Evaluation was done on PDMS-2 after completion of 8 weeks. A gap of 2 weeks was provided. Care was taken that children do not use any other **"seating system"** available in the department or outside, during the gap period.
Occupational Therapy program was continued throughout the protocol. After the gap period the 3rd Evaluation on PDMS-2 was carried out. Then subjects were allocated on seating device B and same intervention protocol was followed. After completion of 8 weeks of protocol, 4th Evaluation on PDMS-2 was done. 15 subjects had followed this order of protocol. Other 15 subjects followed a reverse order of protocol i.e. first subjected to seating device B and then seating device A.

2.3Intervention

Both the groups had received 8 weeks of intervention on their respective seating devices, followed by 2 weeks of rest and then again interchanging their seating devices for next 8 weeks.[7]Meanwhile, when the seating devices were used, the subjects simultaneously received their regular sessions in the Occupational Therapy Department.

Hand function training, visual motor training, social interaction skills training, and feeding intervention were some of the interventional activities planned during the 1hour session while sitting on the device. Individualized angling of back rest and lap board was provided for seating orientations and upper extremity functional needs of the children.

2.4 Instruments and tools used

The two seating devices compared in this study were:
1) Seating device A (SDA) was Leckey"s Squiggles Early Intervention Seating Device.
2) Seating device B (SDB) wasTumble Forms 2 Universal Corner Chair.

Peabody Developmental Motor Scale Second Edition (PDMS-2) was used as an outcome measure and it evaluated the components of grasp and visual motor integration.

3. Results and Statistical Analysis

Table 1 shows the parameters of EG-I for mean which were 37.93, 44.66, 44.73 and 50.8 for 1ST (baseline), 2ND, 3RD and 4TH evaluations on PDMS-2 respectively. Total numbers of subjects were 15 with 9 male and 6 female children.

Table 2: Paired t-test between SDA 1st& SDA 2nd.

	Mean	Difference in Mean	t value	P value
SDA(1st)	37.93	-6.733	4.283	0.0008
SDA(2nd)	44.66			

Table2 indicates that there is significant difference between the 1st and 2nd Evaluation scores of Seating Device A in Experimental Group I subjects after the Paired „t" test was applied (p=0.0008). This implies there is significant improvement in grasp and Visual motor integration of the subjects after use of SDA.

Table 3: Paired t- test between SDB 3rd& SDB 4th.

	Mean	Difference in Mean	t value	P value	Level of significance
SDB(3rd)	44.73	-6.067	6.43	0.0001	Significant Difference
SDB(4th)	50.80				

Table3 indicates that there is significant difference between the 3rd and 4th Evaluation scores on Seating Device B in Experimental Group I subjects after the Paired „t" test was applied (p=0.0001). This table expresses that there is significant improvement in grasp and visual motor integration of the subjects after use of SDB.

Table 5: Paired t-test between SDB 1st& SDB 2nd.

	Mean	Difference in Mean	t value	P value	Level of significance
SDB(1st)	37.46	-8.2	5.72	0.0001	Significant Difference
SDB(2nd)	45.66				

Table5 indicates that there is significant difference between the 1st and 2nd Evaluation scores of Seating Device B in Experimental Group II subjects after the Paired „t" test was applied. This shows increase in grasp and VMI scores of EG-II children from baseline to 2ND evaluations post use of SDB.

Table 6: Paired t-test between SDA 3rd& SDA 4th.

	Mean	Difference in Mean	t value	P value	Level of significance
SDA(3rd)	45.33	-4.4	5.8	0.0001	Significant Difference
SDA(4th)	49.73				

Table6 indicates that there is significant difference between the 3rd and 4th Evaluation scores of Seating Device A in Experimental Group II subjects after the Paired „t" test was applied.

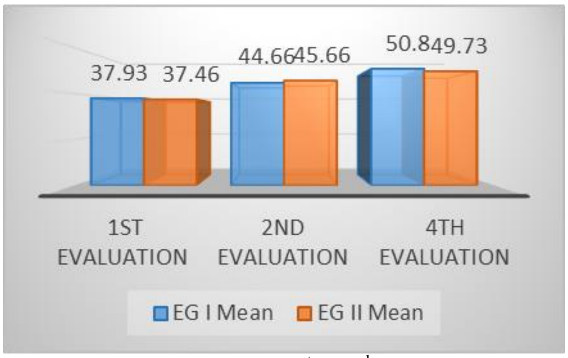
Graph A: shows comparison of mean scores of 1ST (Baseline), 2ND& 4TH Evaluations for Experimental Group I and Experimental Group II. It can be inferred that there is a steady improvement in Grasp & VMI scores inboth groups when children were to use both the devices.

As there is poor significant difference of scores in 1ST (Baseline), 2ND& 4TH Evaluations of both the experimental groups. It appears that both the devices have been equally effective in improving Grasp & VMI scores of subjects with CP included in this study.

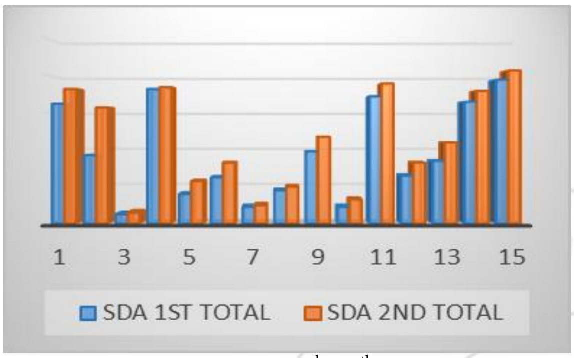
Table 4: Summary of data of Experimental Group II

Parameter	SDB 1st	SDB 2nd	SDA 3rd	SDA 4th
Mean	37.46	45.66	45.33	49.73
Standard Deviation	18.54	20.05	20.28	22.13
Standard Error	4.788	5.17	5.23	5.71
Median	38	52	52	57

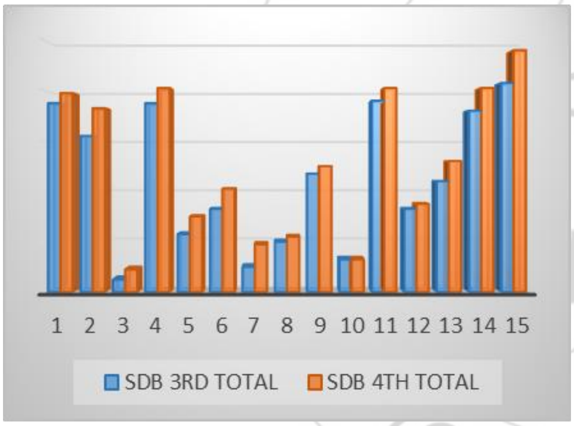
Graph A: Comparison of means of 1st , 2nd& 4th Evaluation scores for EG-I & EG-II.



Graph 1: EG-I comparison of 1st& 2nd Evaluation score



Graph 2: EG-I comparison of 3rd& 4th Evaluation scores.

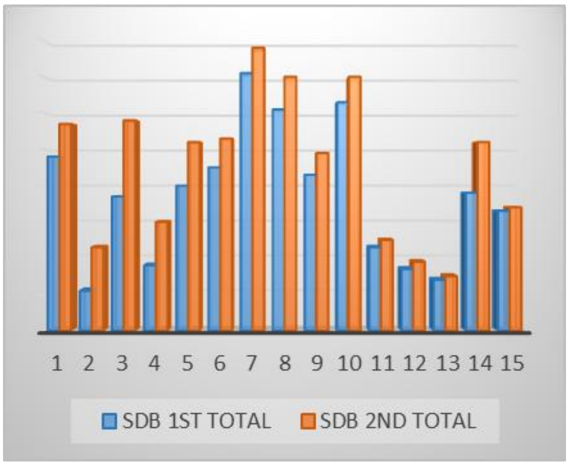


Graph1 shows the comparison of total scores of 1st and 2nd Evaluations before and after the use of Seating Device A for the 15 subjects of Experimental Group I.

Graph2 shows the comparison of total scores of 3rd and 4th Evaluations before and after the use of Seating Device B for the 15 subjects of Experimental Group I.

Subject no. 15 of EG-I, a CP Diplegic 48 months child showed increase of 13 scores i.e. from 83 to 96 after SDB training. Since SDB keeps the child"s lower extremities in relaxed position by not stretching the T/C/Ds. However, it gives good supported seat or back to make use of both upper extremities and explore the world. Whereas SDA facilitates in keeping the lower extremities in maximal corrected position with saddle seating and optimal back angle.

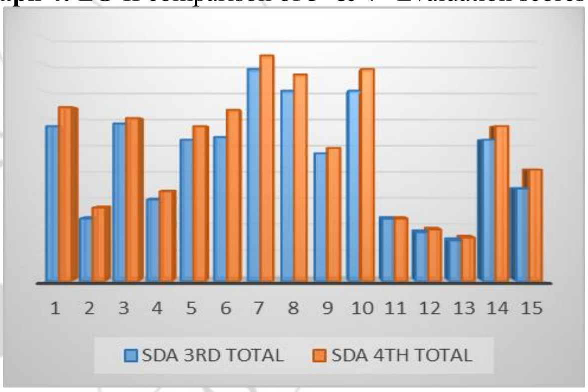
Graph 3: EG-II comparison of 1st& 2nd Evaluation scores.



Graph3 shows the comparison of total scores of 1st and 2nd Evaluations before and after the use of Seating Device B for the 15 subjects of Experimental Group II.

Graph4 shows the comparison of total scores of 3rd and 4th Evaluations before and after the use of Seating Device A for the 15 subjects of Experimental Group II.

Graph 4: EG-II comparison of 3rd& 4th Evaluation scores



4. Discussion

From the above data analysis and results orientation, we have found significant difference within the group values i.e., children showed good scores on hand function performance skills, with introduction of two seating systems. But, when put to test for comparison between two seating systems, the study did not show significant difference in performance scores.

The study was designed to test the applicability of two seating systems. The subjects were divided into two equal groups. Each group was introduced to a seating system for 8weeks followed by 2 weeks gap. This was then continued by exposing boththe groups to alternate seating systems. Children selected for the study were primarily on the basis of their inability to sit. The mean age of subjects was 42 months. There were children as old as 78 months in the sample of this study who were not able to sit. The youngest child in the sample was 24 months. This wide age range helps us to know the applicability of this system on wider population. The seating devices included in this study could not accommodate children with bigger frame or dimensions.

After the use of both supported seating systems with these 30 children by crossover protocol there are statistically significant changes in scores of grasp and VMI on PDMS-2. The seating interventions appear to have enabled most children to gain a stable, supported sitting posture, from which they could use their hands to engage in various activities.

Also it was noted that children with spastic lower extremities with moderate to severe tightness of lower extremity musculature improved less on Grasp & VMI scores with SDA and more with SDB. This could be due to the fact that SDA facilitated maximal corrected position of lower extremities with saddle seating and optimal back angle. But this put the pelvis in a challenging situation. As reviewed by Stavness C (2006), who examined the clinical assumption that a stable pelvis leads to improved hand function [3]. On the other hand, SDB kept the child"s lower extremities at ease, without stretching the tightened muscles of lower extremities thereby putting less challenge on the pelvis. It also provided firm trunk support and harnessing, as against SDA, which provided less harnessing.

It appeared that applicability of SDB will improve grasp and VMI thereby enabling feeding (ADL), pre writing and play skills, if used by the child at home or in classroom. And SDA use will monitor lower extremity posture, along with trunk posture and thereby facilitate on improving child"s hand function skills.

Chung Julie. et al. (2008), concluded from her meta-analysis that there are conflicting findings for saddle seats and optimal seat/ back angle for improving sitting posture and postural control in CP children [44].

And, recommended that more research is needed to examine the link between improved posture and postural control on increased upper limb ability.Pope et al. (1994), in a study monitoring 9 CP children for 3 years, came with findings of poor relevance for upper extremity dexterity and functions on saddle seats [37].

Children with seizures had regression of scores and remained as low scorers and even showed no change from baseline after the study period .But, the seating systems did not allow the children to deteriorate further.

During and after the study period, mothers expressed more confidence and satisfaction in use of Seating Device B due to its easy to clean and strapping system, which secured their child. They also expressed that their child had better socialization on SDB.

Several parents reported that their child's skills improved, while others reported that their children were happier and more eager to sit and do activities and were now able to engage in face-to-face social interactions, resulting in more socialization.

5. Conclusion

Both the seating devices bring out a positive outcome in Grasp and Visual-Motor Integration in children with Cerebral Palsy. Thus proving that," there is positive effect of both the seating devices on motor control in children with Cerebral Palsy." Child with CP who has not achieved sitting milestone can be intervened for use of seating device. And, children in the transition phase of sitting to quadruped can also utilize these chairs for an overall outcome for upper extremities, trunk and pelvis.

Supported seating device B was much favoured by most mothers over the seating device A.

6. Limitation & Recommendations

The sample size was small, hand dominance was not taken into account and this study only assessed the fine motor skills. Also, parent"s feedback was not quantified. This study can be carried out with many other standard scales like Alberta Infant Motor Scale (AIMS), Gross Motor Function Measure (GMFM), Bruininks-Oseretsky Test (BOT). These seating devices can also be examined, in number of settings such as community and familiar setting such as home.

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