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VESTIBULAR STIMULATION IN IMPROVING MOTOR PERFORMANCE OF SPASTIC CEREBRAL PALSY CHILDREN

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Abstract

Objective: The purpose of this study was to determine the effect of vestibular apparatus stimulation in increasing the motor performance of children with spastic cerebral palsy.

Methodology: In this study 18 children were taken through non-probability purposive sampling technique and randomly assigned to experimental group and Control group. Gross Motor Classification System (GMFCS) has been used to classify functions of upper and lower extremities of all the subjects. Therapeutic intervention was conducted 4 times per week during 3 months. All subjects from experimental group were stimulated with vestibular stimulation through Swiss balls and swings for duration of 30 minutes in order to reduce spasticity. At the end of treatment session a second assessment of motor functions and abilities was conducted by using Gross Motor Function Classification Scale (GMFCS).

Result: The significant P value is (0.00) for Gross Score in both experimental group and Control group . Since Group Statistics box revealed that the (Mean ± S.D) for pre and post in experimental group (-20.11 ±6.71) and Control group is (-4.03 ± 1.46) and so we can conclude that there is significant difference between experimental group and Control group results with significant improvement in Lying/Rolling with p-value 0.001, significant improvement in Sitting with p-value 0.002, significant improvement in Crawling/Kneeling with p-value 0.007*, significant improvement in Standing score with p-value 0.004.

Conclusion: We can conclude that vestibular stimulation along conservative physical therapy helps to improve Lying, Sitting and Standing in spastic cerebral palsy children. As considering comparison of means we can observe better results shown by experimental group .

Key Words: Vestibular apparatus, Postural reflexes, Vestibular apparatus stimulation, Postural tone, Gross Motor Function Classification Scale

INTRODUCTION

.Cerebral palsy is divided into various types depending upon their clinical presentation. Such as spastic, athetoid, ataxic and hypotonic. Most common form of cerebral palsy is spastic CP that affects up to 80 percent of patients is known as spastic paresis.(Hagberg et al., 2001).There is much emphasis on overall rehabilitation of cerebral palsy children, but the type of intervention and its determinants vary from each approach. The miraculous outcomes of neural plasticity lead to successful rehabilitation of brain injury. Development and stimulation of alternate motor pathways can result into restoration of lost functions in injured brain areas. The constant change in neural cell anatomy in response to sensory stimuli will result into altered functions at synaptic junction. In this way a sensory stimuli can help brain, in acquiring new motor pathways and coordination for improved functional outcomes. (Katušić et al., 2011).

The tone of antigravity muscles is maintained by constant excitatory stimuli from pontine reticular nuclei and inhibitory stimuli from medullary reticular nuclei. The equilibrium in tone of these antigravity muscles is developed by the commending action of vestibular nuclei that maintain balance between excitatory and inhibitory signals from their respective nuclei.(Guyton and Hall, 2006). Although little is known about the relation of muscle spasticity and physical functions of body, most of the interventional strategies focus on improved motor performance with a decrease in muscle spasticity. (Gorter et al., 2009). The decrease in postural muscle tone not only helps in improving flexibility and freedom of movement but also prevents bony and soft tissue deformities.

The poor balance in cerebral palsy is always linked with limited physical functions, this shows that many management approaches emphasize on better Control group of posture which could help a child to his/her stability more efficiently. (O'Reilly et al., 2011)

It is the first study explaining the relationship of vestibular system stimulation and its effect on muscle tone that will be conducted in Pakistan. With the help vestibular system stimulation, spasticity can be effectively reduced thus improving gross motor functions, motor abilities and postural tone as well as better quality of life in children with spastic cerebral palsy.

Methodology

This was a quasi experimental study, conducted at Mobility Quest, (Lahore and Rahim Yar Khan) and Sheikh Zayed Medical Collage/Hospital, Rahim Yar Khan. With the consent of parents, children were randomly assigned to experimental group and Control group. Pretest assessment was taken and noted down. Group A received both conservative physiotherapy (passive ROM exercises, passive stretching techniques) and vestibular stimulation (via Swiss ball and platform swing) while group B only received conservative physiotherapy. Vestibular stimulation of 1 hour was given for five days a week and 16 consecutive weeks. Pre test and post test measurements of Lying/ Rolling, Sitting, Crawling/ Kneeling and Standing were taken by using Gross motor function scale (GMFS). Data was entered and calculated through SPSS Ver 20.Mean and standard deviation of all the pretest and posttest values of Lying/ Rolling, Sitting, Crawling/ Kneeling and Standing were calculated. Correlation between pretest value and posttest values was also calculated. The paired sample t test applied to the pretest and posttest values of experimental group and Control group s, however to determine the improvement in motor function of both experimental group and Control group s, independent sample t test is applied.

Results:

Demographics overall experimental group and Control group

Demographics of the study showed both male and female children were enrolled in the study with age of mean±SD (4.5±1.83). In experimental group 27.8% were male and 22.2% were female while Control group contained 22.2% male patients and 27.8% female. Out of all these patients 38.9% in experimental group and 22.2% in Control group belong to middle socioeconomic class while only 11.1% in experimental group and 16.7% in Control group were from higher class. 11.1% patients of Control group were from lower socioeconomic class.

Experimental group Paired t-test within group analysis

Variable	Pre Mean±SD	Post Mean±SD	P-value
Lying/Rolling	36.8±15.33	63.94±11.56	0.00*
Sitting	30.13±23.09	53.28±22.06	0.00*
Crawling/Kneeling	15.85±13.47	42.05±18.13	0.00*
Standing	6.82±6.14	27.01±19.01	0.002*
Walking/Running/ Jumping	0.76±2.30	4.62±10.72	0.213*
Gross Score	18.07±9.02	38.18±11.35	0.00*

* (P <0.005); there is a significant difference between groups

Control group Paired t-test within group analysis

Variable	Pre Mean±SD	Post Mean±SD	P-value
Lying/Rolling	23.73±22.8	31.79±21.17	0.00*
Sitting	13.12±17.26	19.24±17.23	0.00*
Crawling/Kneeling	11.88±13.39	16.65±16.75	0.013*
Standing	3.12±4.00	4.27±6.40	0.225*
Walking/Running/ Jumping	0.00±0.00	0.00±0.00	-
Gross Score	10.36±10.74	14.39±11.56	0.00*

* (P <0.005); there is a significant difference between groups

Independent t-test between Experimental group and Control group analysis

Variable	Post Mean±SD experimental group	Post Mean±SD Control group	P-value Sig.(2-tailed)
Lying/Rolling	36.8±15.33	31.79±21.17	0.001*
Sitting	30.13±23.09	19.24±17.23	0.002*
Crawling/Kneeling	15.85±13.47	16.65±16.75	0.007*
Standing	6.82±6.14	4.27±6.40	0.004*
Walking/Running/ Jumping	0.76±2.30	0.00±0.00	0.214
Gross Score	18.07±9.02	14.39±11.56	0.000*

Independent t-test applied on posttest scores of experimental group show significant improvement when comparing post mean±SD of Gross Score **18.07±9.02** in experimental group and post mean±SD of Gross Score **14.39±11.56** and a p-value 0.000*, significant improvement in Lying/Rolling with p-value 0.001*, significant improvement in Sitting with p-value 0.002*, significant improvement in Crawling/Kneeling with p-value 0.007*, significant improvement in Standing score with p-value 0.004*.

Discussion

In this study, the significant increase in outcome effects of vestibular apparatus stimulation versus traditional physiotherapy techniques for treatment purpose was showed. The program was conducted for a period of 6 months, revealed marked increase in motor performance of spastic CP children measured through GMFM. The aim of VS is to enable the cerebral palsy children to participate in day-to-day activities and to master important tasks in their environment. The

rehabilitation literature reveals a relationship of changes in labyrinthine signals and resultant changes in muscle tone (Androwis et al., 2013).

The results revealed that the Posttest score of Lying/ Rolling, Sitting Crawling/Kneeling and Standing for experimental group show significant improvement with a P value (0.000), (0.000), (0.000) and (0.002) respectively. However the score of Posttest Walking/Jumping in both groups do not vary much with a P value (0.213). The significant P value is (0.00) for Gross Score in both experimental group and Control group. Since Group Statistics box revealed that the (Mean ± S.D) for pre and post in experimental group (-20.11 ±6.71) and Control group is (-4.03 ± 1.46) and so we can conclude that there is significant difference between experimental group and Control group.

Conclusion

We can conclude that vestibular stimulation along conservative physical therapy helps in more improved Lying, Sitting and Standing in spastic cerebral palsy children. Although the independent t-test score fails to show much difference between the significant values of both groups, however considering comparison of means we can observe obvious improvements in all the results of experimental group variables.

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