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SEAS Exercise to Treat Scoliosis and Improve Functional Activities in Children with Spastic Cerebral Palsy

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ABSTRACT

SEAS exercise to improve functional activities among the children with spastic hemiplegic cerebral palsy children. Single group pre- post experimental research design. Cerebral paralysis is a static encephalopathy which affects the immature brain and leads to permanent motor disability. Due to a combination of spasticity, muscle weakness and incompletion of muscle control, the spinal deformity occurs in rising patients with CP; it can lead to poor balance in the trunk and significantly limits patient function. SEAS exercise capacity to enhance the self-corrected posture by concentrating during everyday activities. Eighty eight subjects of spastic hemiplegic cerebral palsied children, aged 6-12, male and female with scoliosis were selected under purposive sampling technique and received SEAS exercise training for a period of eight weeks. pre and post outcome measures were assessed using Modified Ashworth scale and Scoliometer to measure the functional activity in the children Pediatric balance scale, functional gait assessment and Gross motor function were used. Significant changes in spasticity and scoliosis were observed, and functional parameters were increased. The results of the post-test mean values for all SEAS variables demonstrated substantial improved balance, reduced scoliosis and gross motor functions in those receiving SEAS protocol ($p<0.05$). The SEAS exercise proves there was a decrease in scoliosis and their by improvement in functional abilities among children with spastic hemiplegic cerebral palsy after eight weeks of intervention.

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INTRODUCTION

A group of movement and posture development disorders, which cause active limitations due to the non-progressive impairments in the fetal or infant brain, are known as cerebral palsy (CP). The most common forms of neuromuscular disabilities affecting children is CP, the world wide incidence being 2-2.5 per live births. In India the prevalence of cerebral palsy are around 45 per 1000, more in rural and less in urban populations. Infants under 1500 grams birth weight who survive have the possibility of cerebral Palsy (Sathish and Swarnakumari, 2017). The neuromotor analysis focuses on differ-

ent sub-categories such as hand functions, flexibility in posture, passive muscle tone, coordination and diadochokinesis. CP is identified as spastic, flaccid, athetoid and spastic and mixed in motor disorder patterns, accounting for 85% of all patients (Day, 2019). The most common form of spastic cerebral paralysis is where 70-80 percent of the cortex and brain pyramidal tract where links the motor cortex to the spinal cord are affected by injury. Spastic hemiplegics comprise 20-30% of all forms of cerebral paralysis, a unilateral paralysis. Spastic hemiplegic children are usually spastic or muscular on one side of the body (Persson-Bunke *et al.*, 2015).

Due to the combination of spasticity, muscle weakness and inadequate muscle regulation, spinal deformation in children with CP occurs; it can result in impaired trunk coordination and substantially reduces the functional ability of the patient. The development of the trunk disequilibrium and the associated pelvic obliquity can affect both standing and walking capability of outpatients (Negrini *et al.*, 2019).A cob angle of >45^{o} at an early age has been found to predict significant progression of a CP scoliosis. Children are at a higher risk of forming, organizing, decreasing the coordination of the limbs and lower weight bearing on the affected side, which can affect the maintenance of an upright posture and gait (Chitra and Nandini, 2005).

The cerebral paralysis of each patient primarily depends in terms of the extent of their condition or other related factors on their own individual wishes. The most common treatment given to cerebral palsy children are Surgery, Physical Therapy, Occupational Therapy, Speech Therapy and Behavioral Therapy. The most common therapies in the field of brain paralysis are physical therapy. The therapy also begins at a young age and improves strength, stability, agility, enhanced motor functioning of the infant, balance, stamina, pain management, posture, gait and overall health (Levitt and Addison, 2018).

Physical therapy for scoliosis includes auto-correction, co-ordination, pacing, ergonomic corrections, muscle resistance / strength, spinal neuro regulation, through ROMs, respiratory ability / learning, side shifts and stabilization (Berdishevsky, 2016).

SEAS are the term for "Scientific Exercise Approach to Scoliosis." SEAS is a single exercise program designed in any case of conservation therapy, standalone in low-mediate-grade development, to mitigate the risk of bracing, in order to improve correction and preparation and prevent / reduce secondary effects in relation to bracing in medium-high curves during development (Elanchezhian and Swarnakumari, 2019b; Romano *et al.*, 2015). The SEAS is focused on unique active self-correction strategies conducted without medical help and integrated in functional activity focusing on the patient's cognitive behavioral strategy to improve medication compliance (Elanchezhian and Swarnakumari, 2019a).

This SEAS research is designed to train the function of a neuromotor, leading to self-correction during everyday activity.

Figure 1: Single Leg Balance

Figure 2: Cat- Camel exercise

MATERIALS AND METHODS

Study settings and population

The study was conducted at various physiotherapy centers in Kanyakumari and Kanchipuram districts. Subjects for the study were 88 spastic hemiplegic cerebral palsy children.

Study Design

This study was to find out the efficacy of SEAS exercise on increasing the functional independence in spastic hemiplegic cerebral palsied children. The study design used was Single group pre experimental research design i.e. the assessment was done before and after the intervention of SEAS exercise program for a period of 8 weeks.

Inclusion criteria

Male and female children between the age group of 6-12, Spastic hemiplegic CP children, children with scoliosis and capacity to follow normal instructions.

Exclusion criteria

Children with other types of CP, Fixed deformity, Age above 12 years, Children underwent surgery, Instable seizures, Mental Retardation and Children under Botox injection (Das and Ganesh, 2019).

Tools

Modified Ashworth Scale, Pediatric Balance Scale (PBS), Functional Gait Assessment, Gross motor functional measure and Scoliometer (Das and Ganesh, 2019; Baba *et al.*, 2017).

Intervention

Pre values of the outcomes were taken after the inform concern from the parents of the subjects, participated in the study. The successful self-correction is a corrective motion chosen according to the condition, morphological characteristics, and posture of the individual. Assessment assessments guide the choice of activities that are most appropriate for the particular patient. The aim of self-correction is to restore the physiologically normal condition as near as possible. The key goal of SEAS is to strengthen the stability of the spine in effective self-correction. The basic principles include: neuromotor control, proprioceptive training, balance, organizing of patterns of trunk muscle recruitment, neural structures which support axial and arm muscle management and the role of cognitive systems in body design and spatial coordinate mapping. Assistive equipment like balance boards offered at the start of SEAS only for the patient to achieve more effective automatic correction at a later stage of the retreat. The mirror is the only tool for intense self-correction that supports patients during SEAS. Mirror is used because the activation of the mirror neuron has a significant neuro-physiological effect (Tsirikos and Spielmann, 2007). Axial, static, and dynamic balance of the trunk is strengthened by positive equilibrium reactions. This is critical for posture recovery, because of its impairments in cortical brain centers that regulate scoliosis balance. Respond to the various requirements of social life and encourage the individual to maintain self-reliance when conducting daily activities (Romano *et al.*, 2015).

SEAS exercise protocol

The 88 spastic hemiplegic cerebral palsied children were administered with the following exercise protocol (Table 1).

All the sessions lasted for a period of 30-45 minutes for eight weeks. For these exercises, 2 sessions were completed and 1 session every day, 5 days a week. The outcome measure was carried out after 8 weeks of SEAS exercise program to look for improvement.

RESULTS AND ANALYSIS

The outcomes were tabulated and were analyzed using SPSS version 21. The descriptive data are explained in the Table 2. Potential differences between pre and post scores of Modified Ashworth Scale using Chi square test, Pediatric Balance Scale, Functional Gait Assessment, Gross motor functional measure and Scoliometer were analyzed using independent "t" test.

The statistical results prove that there was a significant decrease in scoliosis with CP children ($p<0.05$), explained in Table 3. The results of our study was supported by Joseph M. Day et al., in their study state there is evidence that the Similar to conventional exercises, the SEAS approach is more effective in rising Cobb angles, practiced specific methodology using a variety of instructional elements like mirrors, photographs, and video all to facilitate effective execution of treatment exercises. Three key goals exist. Next, a symmetrically formed pelvis and shoulder girdle. Second, a primary change to a normal posture with a particular emphasis on kyphotization or a reversal of the thoracic spine, and lordotization of the lumbar spine. They found that SEAS exercise had an important impact on reducing scoliosis in spinal deviation patients (Vialle *et al.*, 2013).

Mudasir Rashid Baba et al., The main goal of SEAS is to boost the vertebral stability of successful self-correction. The activity conducted exclusively by SEAS aims at training the neuromotor system, which contributes to the flexibility of posture during everyday activities. Consequently, successful SEAS auto-correction without external assistance must be qualified. Training plays a key role in reducing curve growth in AIS below 20 degrees. The study found that the controlled exercise system is superior to controls on the reduction of spinal defects to improve quality of life in AIS (Elanchezhian and Swarnakumari, 2019a). Stefano Negrini et al., studied on conservative and Seas exercise on adult sco-

Table 1: SEAS Protocol for the subjects

Exercise	Protocol with dosage
Pelvic Tilts	Pelvic tilts with a back and knees are bent; the feet are flat on the floor and the stomach muscle is straightened and the buttock is bled for 5 seconds and repeated 10 times per cycle.
Cat-camel	The children were held quadrupled, tight abdominals with their heads straight on their sides, and knees. The people were breathed deeply and raised their lower rib case, looked slightly upwards across their chest to the floor. They returned with tight abdominals again to the starting role. 10 times per set repeated (Figure 2).
Double – Leg Abdominal press	The children were placed on the back with their knee bent and their feet flat on their floors and maintained their neural posture, lifted the legs one at a time from the floor at a 90o angle with their knees and hips bent, pushed their hands to their knees while bringing their knees straight to their shoulders. Designed for three deep breaths. 10 times per set repeated (Figure 1).
Single – Leg Balance	With both eyes opened the children were made to bend one knee up and balance on one foot. Initially made with hands supported and then unsupported. All these were performed in front of a mirror to help visualize a straight spine. Repeated 5 times per set.

Table 2: Descriptive Data of subjects involved in the study

s.no	Subjects		Side involved	
1	Male	Female	Right side	left side
	56	32	50	38

Table 3: Comparison of Pre and post values of the outcomes

Assessment Tools		Mean ± SD	P value
Pediatric Balance Scale	Pre test value	47.95 ± 4.86	0.000**
	Pos test value	51.58 ± 3.50	
Functional Gait Assessment	Pre test value	19.16 ± 5.18	0.000**
	Pos test value	24.00 ± 2.77	
Gross motor functional measure	Pre test value	88.36 ± 8.56	0.000**
	Pos test value	94.73 ± 3.75	
Scoliometer	Pre test value	25.10 ± 7.45	0.000**
	Pos test value	20.42 ± 7.66	
Modified Ashworth Scale	Pre test value	1.39 ± 0.72	0.000**
	Pos test value	1.35 ± 0.48	

*** p< 0.001 was considered statisticallysignificant

liosis have been researched on scoliosis diagnosis. Important discrepancies were observed at the beginning and end of care for the clinically relevant hump and plumb line distances in the SEAS community. They found after analysis that SEAS exercise had strong results in the scoliosis reduction (Elanchezhian and Swarnakumari, 2019c)

Hence this proves that SEAS exercise can be implemented on children with scoliosis especially with CP.

CONCLUSIONS

SEAS exercise on CP children had a remarkable improvement in decreasing their scoliosis and also was found that there was an increase patient's alertness of the deformity, emphasizing an self-governing auto-correction by the patient and use of exercises in which balance reactions are elicited. SEAS seems straightforward by needing less physiotherapist guidance and using less home exercises recommended at a lesser dosage than any of the other exercise strategies common to scoliosis. The statistical results prove that the SEAS exercise can be administered on subjects with CP to decrease their scoliosis and by which there can be improvement in their functional activities.

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Conflict of Interest

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