

Effect of Action Observation Therapy In Spastic Kinds of Cerebral Palsy

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A B S T R A C T

Background: Cerebral palsy (CP) is a disorder that is characterized by developmental delay, postural impairments and movement dysfunction such as manual ability deficits or in coordination. It occurs either in the fetal period or in infancy due to brain insult. Treatments to enhance the manual ability and functional improvement are Physiotherapy, Neuromuscular electrical stimulation, Occupational Therapy, casting & splinting and Pharmacologic agents. Moreover, a possible new rehabilitative approach called Action observation therapy (AOT) that stimulates the motor areas in the brain.

Methodology: RCT study was carried out at National Institute of Rehabilitation Medicine and OASIS physiotherapy and rehabilitation center, Islamabad from January 2018 to July 2018 with total 6 months duration with aim to determine the effect of AOT in functional mobility and manual dexterity of UL in spastic CP. For this 22 patients were selected from which 11 received AOT with routine physiotherapy and remaining 11 were treated with only routine physiotherapy. Both groups received treatment for three sessions per week of 8 weeks. Assessment was done by abillhand kids test and box & block test. With the comparison of pre and post assessment, those patients who received AOT with routine physiotherapy were shown much improvement in their daily actions especially with the dominant hand.

Results: The interventional study was conducted to determine the effects of action observation therapy in patients with cerebral palsy. Results showed significant improvement in AOT group with the p-value <0.05. Mean rank score of Box and Block test with dominant hand in experimental group was 16.45 and in control group mean rank score was 6.55 and mean rank score of Box and Block test with non-dominant hand in experimental group was 16.91 and in control group mean rank score was 6.09 with p value 0.001 that showed statically significant reduction in disability. In this study, AOT group showed more significant improvement on abhilhand kids and box and block test (BBT) with p value (< 0.05).

Introduction

A clinical syndrome known as cerebral palsy is a developmental disorder presenting as movement and postural problem.¹ Rosenbaum et al. (2007) explain the CP by stating that defective gross and motor skill functioning and coordination, atypical motor ability, are the key traits of cerebral palsy. These motor impairments can result in problem with gait, feeding and swallowing, coordination of eye movements, speech articulation, and other problems with musculoskeletal dysfunction, attitude,

and participation in communal.² Ndurumo (2002) and Saladin (2004) explained that CP is described by complete loss of movement, decrease strength, loss of coordination or others malformation of the movement control center of the CNS.³

Cerebral palsy (CP) is the one of the major cause of severe bodily disability in early age, almost 2 to 2.5 per 1000 children an estimated prevalence rate in developed states.⁴

In 2008, the prevalence rate was approximately 3.1 per 1000 births by age 8 years in the United States¹ and in 2006 in Sweden, it was 2.2 per 1000 live births.⁵ In developed countries childhood motor disability incidence ratio is 2-2.5/1000 live births, and cerebral palsy is one of common cause.⁶

In developing countries, the prevalence rate 11.2 per 1000 live births of preterm infants was reported in last decade. In Pakistan, strongly associated risk factor with the prevalence of CP is lacking maternal education in population.⁷ Children with critical cerebral palsy and related disorders may have subsequent mediation before progression to adult accommodations: surgical operation to stomach, surgical procedures, BOTOX treatment, and antiepileptic therapy, surgery of hip, spasticity treatment, and surgical correction of scoliosis, artificial or mechanical aid, wheelchair, interlude care, home modifications, and specific education. Moreover, some supplementary penalties that may be concealed because they have no correlation to health care, and so are omitted, or since they are associated with ability deficit rather than outlay.⁸

Cerebral palsy is classified by the type of movement problem i.e. spastic, athetoid, hypotonic or mixed and by involve body parts, it may be tetraplegia / quadriplegia i.e. involvement of all limbs. There are different classifications of CP according to the involvement of body parts, limbs, and movement problem. Classification of movement-related problems includes hypotonia, athetoid, spastic or mixed. Quadriplegia, tetraplegia classified as a body part or all limb involvement.⁹ The warning signs of cerebral palsy are the developmental delay, low or high muscle tone and abnormal posture that help in the definitive diagnosis of cerebral. Medical lab tests are to illustrating the cerebrum by apply computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound are favorable bodily diagnostic tests. Close observation is necessary for rule out the associated impairments like eye and ear disorders, fits, perceiving problem with pain and touch and intellectual impairment and can help to perform full examination and clinical evaluation and to establish the diagnosis.¹⁰ More conciliation has been done on categorization of cerebral palsy in words of the intensity of functional impairment. Likewise, a before decades, Palisano and his fellows invented the GMFCS, which

explains 5 stages of gross motor ability, Other measurements have been invented for fine motor capabilities, such as, the Bimanual Fine Motor Function (BFMF) Classification, the ABILHAND-Kids, and the Manual Ability Classification System.¹¹ Early danger signs of cerebral palsy such as delay in milestone development, walk on toes, continuous clenching hand, the small size of head, seizure, irritation, bad engulf, dominance of one hand on earlier than the age of 2 year (showing one sided body weakness), and adductor tightening of legs. Moreover, early signs may be the constancy of basic reflexes.¹²

Academy of Cerebral Palsy and Developmental Disability (AACPDM) currently noticed that the management of CP child depends upon the socioeconomic status, caregiver and environment is more important than his or her justified estate of disease.¹³

There are different interventions and strategies to improve functions of upper limb, include physiotherapy, occupational therapy, motor learning, neurodevelopmental treatment, movement training, virtual-reality training, strength training, soft and rigid splinting, CIMT Constraint induced manual therapy, casting, pharmacologic agents and neuromuscular electrical stimulation.¹⁴

Action observation therapy is another new possible rehabilitative approach for CP child that is used to stimulate the motor areas of the brain and try to improve everyday activities. This therapeutic approach is based on a theoretical frame of the discovery of neurons and its functional abilities which are called "mirror neurons" Action observation therapy is a new advancement in neuro-rehabilitation, valid in neurophysiology, and presenting a well ground model of translational medicine, in neurorehabilitation.¹⁵

Methodology

A single blinded randomized controlled trial was conducted at Department of Physical Therapy, National Institute of Rehabilitation Medicine and OASIS physiotherapy and rehabilitation center, Islamabad, from January 2018 to July 2018 with total 6 months duration with aim to determine the effect of AOT in functional mobility and manual dexterity of UL in spastic CP. Sample size was calculated by OpenEpi tool online. Spastic

cerebral palsy was included with MAS between 1 and 2 of both genders, aged from 5 to 15 years. Ensure that the child understood the desired actions. On the basis of inclusion criteria, 22 participants included in the study. Participants were randomly assigned into two groups by lottery method i.e. Group A (n = 11) and group B (n = 11). For this 22 patients were selected from which 11 received AOT with routine physiotherapy and remaining 11 were treated with only routine physiotherapy. Both group received treatment for three sessions per week of 8 weeks. Assessment was done by abillhand kids test and box & block test.

Group A received the action observation therapy with conventional physical therapy while Group B received the conventional physical therapy including, movement training, eurodevelopmental therapy (NDT) and stretching. Treatment was given for three sessions per week of 8 weeks. Informed consent was taken from all participants in both Urdu and English language.

In Action observation therapy, Video clips were showed with daily actions that required the use of upper limb involving arms and hands, (i.e. grasping an object, using a pencil, pouring water etc.) will be presented for 9 to 12 minutes. After watching of each video clip, child is asked to perform the action so accordingly the child had observed, to the best of his/her capability. Total numbers of video clips were four .Each video clip is comprised of 3 motor action. Total motor action was 12.¹⁴ List of tasks were presented through video clips are coming after. Upper limb functional training actions include,

1. Placing blocks into a carton
2. griping a pen to sketch a line
3. swing cards upturn down
4. transferring coins into a cash box
5. stacking up mugs
6. Using a ladle
7. unscrewing jar caps
8. closing and opening zippers
9. buttoning up trousers/shirts
10. filling a cup with water
11. rolling up a towel
12. transferring water bottle

This treatment was given in 3 sessions per week for a total of 8 weeks. Each session was of 45 min. Baseline

assessment was done at 0 week and Post-assessment was done after 8 weeks of treatment.¹



Figure 1 Children Placing Blocks in a carton

Conventional physical therapy: Functional physical therapy (Functional physical therapy, as defined is promoting functional skills with Physical therapy). Movement training, Neurodevelopmental therapy (NDT) and Stretching. This treatment was given in 3 sessions per week for a total of 8 weeks. Each session was of 25 min. Baseline assessment was done at 0 week and Post-assessment was done after 8 weeks of treatment.

Results

Among 22 patients there were 77.3% male and 23.7% female in the study. In experimental group 90.9% were male and 9.1% female and in control group 63.6% were male and 36.4% female. Mean age of participants was 8.36 ± 3.499 . In experimental group mean age was 9.00 ± 3.768 and in control group mean age was 7.73 ± 3.259 . In general, 27.3 patients were diagnosed with spastic hemiplegia, 22.7% patients with spastic diplegia while 50.0% patients with Spastic quadriplegia. In the experimental group, there were 36.4 % of patients were diagnosed with spastic hemiplegia, 27.3% with spastic diplegia while 36.4 % were with Spastic quadriplegia. In control group, there were 18.2% of patients were diagnosed with spastic hemiplegia, 18.2% with spastic diplegia while 63.6% were with Spastic quadriplegia.

The Mann-Whitney U test shows P value $< .05$ that shows that both variables have significant difference within groups. The results of the study show that there is statistical significant difference exist between the groups because p value of all variables is $< .05$.

In current study pre and post comparison in experimental group (AOT) p value of all variables is <.05 which shows there is difference between both conditions. Whereas pre and post comparison in control group (CPT) p value of all variables is <.05 (except non-dominant) which shows there is difference between both conditions. Non-dominant p>.05 shows there is insignificant difference in pre and post conditions.

Discussion

This experimental study was conducted to comparison action observation therapy and Functional physical therapy in patients with cerebral palsy. Only 22 patients were recruited in study. 11 patients were included in group A (experimental) and 11 in Group B (control). The interventional study was conducted to determine the effects of action observation therapy in patients with cerebral palsy. Manual dexterity and functional movement were measured by Box and block Abilhand -kids test. Patients followed the study by randomly divided in to

Control and Experimental group. One group received action observation therapy along with conventional treatment and other were treated with only conventional treatment. Results shown significant improvement in AOT group with the p-value <0.05. Mean rank score of Box and Block test with dominant hand in experimental group was 16.45 and in control group mean rank score was 6.55 and mean rank score of Box and Block test with non-dominant hand in experimental group was 16.91 and in control group mean rank score was 6.09 with p value 0.001 that showed statically significant reduction in disability. In this study, AOT group showed more significant improvement on abhilhand kids and box and block test (BBT) with p value (< 0.05).

A Randomized Controlled Trial conducted by TaeHoonKim, et al to find out the Effects of Action Observational therapy Plus Brain Computer Interface Based Functional Electrical Stimulation on Paretic Arm Motor Recovery in stroke patients. Results of study showed that a both AOT plus BCI based FES with

Table I: Comparison of baseline values between experimental and control group

Test variables	Group allotted to patients	Median(Interquartile Range)	Mean Rank	Z value	P value
Dominant	AOT	24(10)	16.45	-3.588	0.001
	Conventional PT	3(4)	6.55		
Non dominant	AOT	14(6)	16.91	-3.924	0.001
	Conventional PT	2(2)	6.09		
ABILhand-KIDS	AOT	29(7)	17.00	-3.983	0.001

Table II: Pre and Post scores of experimental group.

Test Variables	Median(Interquartile Range)AOT	Median(Interquartile Range)AOT	Mean Rank	Z value	P value
Dominant hand	12(9)	24(10)	6.00	-2.943	0.003
non dominant	8(7)	14(6)	6.00	-2.943	0.003
AABIL HAND KIDS	16(9)	29(7)	6.00	-2.955	0.003

Table III: Pre and post scores of control group.

Test Variables	Median(Interquartile Range)CPT	Median(Interquartile Range)CPT	Mean Rank	Z value	P value
Dominant	1(4)	3(4)	3.50	2.264	0.024
Non dominant	1(2)	2(2)	1.50	-1.342	0.180
AABIL Hand KIDS	1(7)	3(5)	3.50	-2.264	0.024

conventional therapy are effective than only conventional therapy, in improving arm motor performance. This combination of therapy plays significant role in reducing motor impairments and also improves motor activity of upper limb in stroke patients¹⁶

Another study conducted by Kirkpatrick et al to determine the effects of parents delivered AOT on upper extremity function in hemi sided cerebral palsy children. Results were, Combined-group improvements in combine group was ($p < 0.001$), observed in Assisting Hand Assessment and Melbourne Assessment at 3 months, were sustained at six months. On ABILHAND-Kids test, results also showed that improvement at 3 months ($p = 0.003$), sustained at six months. Continuous practice with Action observation and without AOT which delivered by parents was effective in upper limb function and could be alternative therapist input.¹⁷ Results of this study shows significant improvement in AOT group with the p -value < 0.05 . Mean rank score of Box and Block test with dominant hand in experimental group was 16.45 and in control group mean rank score was 6.55 and mean rank score of Box and Block test with non-dominant hand in experimental group was 16.91 and in control group mean rank score was 6.09 with p value 0.001 that showed statically significant reduction in disability. In this study, AOT group showed more significant improvement on abhilhand kids and box and block test (BBT) with p value (< 0.05).

Giuseppina Sgandurra conducted a RCT to determine the influence of Action observation therapy (AOT) in the Upper extremity of CP Children. The properties of the mirror neuron system suggest a new type of upper limb (UL) rehabilitation in children with unilateral cerebral palsy (UCP), based on observation of action therapy followed by execution of a variety of observed movements (AOT). In a randomized, block-designed, evaluator-blinded trial, 24 upper limb cerebral palsy children with mild to moderate hand disorder were divided into two groups. The experimental group watched video clips of unimanual and bimanual goal-directed activities and then subsequently performed same actions with either only hemi paretic upper extremity or with both upper extremities for one hour per day for three successive weeks. The control group executed the actions likewise in the similar sequence as the

experimental group, but had observed computer games. The primary outcome measure was Assisting Hand Assessment (AHA) scale while the ABILHAND-Kids and Melbourne assessment were secondary measure. Results were evaluated at first week, eighth weeks, and 24th week after the completion of the treatment. The significant improvement in the experimental group was more ($P = .008$) in score variations for the Assisting Hand Assessment (AHA) at the primary final 1st week ($P = .008$), 8th week ($P = .019$), and 24th week ($P = .049$). Significant changes were not found for Melbourne assessment scale and ABILHAND-Kids. Action observation therapy with upper limb in cerebral palsy child were found to be effective for daily activities of upper extremities, revealing a advance rehabilitation approach on the basis of the neurophysiological model of motor learning.¹⁸ Results of this study shows significant improvement in AOT group with the p -value < 0.05 . In this study, AOT group showed more significant improvement on abhilhand kids and box and block test (BBT).

Conclusion

Action observational therapy approach is a novel approach. It is concluded that this study shows that AOT has a positive effect on the manual abilities of the upper limbs in CP children. It is concluded that AOT is another approach that help to improve the manual dexterity and function and could be practical for CP child rehabilitation.

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