

**EFFECTS OF SPIDER CAGE THERAPY ON MOTOR CONTROL OF HEMIPLEGIC  
CEREBRAL PALSY CHILDREN**

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## ABSTRACT

Cerebral palsy was characterized by condition of position and movement due to pathology in brain. Brain injury occurred during fetal life or after birth, caused by oxygen deficiency, jaundice, premature and traumatic brain infection. Spider web, universal cage unit, functional training was used in protocols. Exercise training in spider cage unit that was used in different brain related diseases like CP, stroke, spina bifida, and SCI. Spider cage was 3 dimensional units that consist of metal having cord that are attached to different points on special belt. This belt placed in the region of waist of CP child, which provide support to CP child. Different functional training was performed in this spider cage unit. Cords that were elastic in nature can strengthen the weaker muscles. Spider cage used to control motor function like kneeling, half kneeling, one leg standing and jumping. New techniques and physiotherapy techniques were evented with the passage of period to manage patient with CP. Utilization of spider cage therapy was not new in physical therapy. It was used in cerebral palsy with new ideas. The objective of the examination was to find out the Effects of spider cage therapy in motor control of hemiplegic cerebral palsy children. The children who were diagnosed with hemiplegic cp. Age group between 4 years to 10 years using GMFCS scale and Modified Ashworth Scale. Data was collected from Mubarak Medical Complex, Khawaja Arshad Hospital and DHQ Sargodha who was meet the principles of inclusion and exclusion criteria. After this we were inform patient's attendant about our research, purpose, treatment procedure and then asked for consent. Randomization was done using random allocation of Lottery method. Patient was separated into II groups, experimental and control. In experimental group saw the results of spider cage unit on motor control of hemiplegic CP infants. The subject session consist of 5days/ week for 4 months. General body warm up exercises and then Spider cage therapy to improve motor control activities kneeling, half kneeling, one leg standing and jumping. In control group the subject received physical therapy for 5 days / week for 4 months. General body warm up exercise and then stretching exercises. Pre- reading, after 3 weeks, after 6 weeks and after 9 weeks assessment was taken before and after intervention.

**Key Words:** Cerebral palsy, Spider cage therapy, Hemiplegic, Motor control

## INTRODUCTION

Cerebral palsy was continual but it was non progressive condition of movement and posture,  
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related to functional limitations and cognitive, sensory issues, problem in communication (1).

This explanation add thought of action restriction, which was full word utilized in the International Classification of Functioning, Disability, and Health (ICF), as characterized by World Health Organization (WHO) in 2001 (2).

Prevalence of cerebral palsy children was 2.11 in 1000 living births in whole population. Cp children can be classified into spastic, ataxic, athetoid, mixed and low tone (3).

Hemiplegic children (cp) hold well-marked extremity engagement, inordinate thumb flexion, adduction and constricted wrist joint extension actively by babyhood. Post lesion anomaly move towards advanced abnormal condition, development of motor grouping. Perturbation visual, somatosensory and developmental neglect. Moving towards difficulties in using hand. Progressive bony changes and soft tissue may Happen, move towards contractures, that cause further function limitation in a vicious interval (4).

Cerebral palsy fall into different form depend on body parts look-alike hemiplegic, monoplegic, quadriplegic and diplegic (5).

Accurate reason of Cerebral palsy was static unexplored. Brain trauma happen earlier birth, at beginning time or after the birth of baby, 80% of cerebral palsy has most remarkably motor disorders (6).

Trouble in performing motor planning in hemiplegic cerebral palsy children moving towards limitations of everyday living action. The overall characteristic was obsessed cerebral control of motor function. A bigger part corticospinal tract injured, corticospinal tract was the most essential descending area calculating skilled, voluntary hand movements (7).

Researches have been conducted on Effects of spider cage therapy on motor control of cerebral palsy children in many countries including Pakistan but there was limited evidence available on effects of spider cage therapy on motor control of cerebral palsy child. This study will assist the rehabilitation team to view spider cage therapy for plan of care for CP children so that it will take efficient outcomes.

Gross motor function was termed as a leading impairing cause in the daily live carrying out activities of CP children (Ko J.2014). Recent researches shows that CP based children successfully

improve their gross motor functionality, if they provide a timely treatment and proper opportunity. GMFC focus on body movements including walking, sitting and use of mobility devices. This approach classifies the children between level I with to the lowest degree disability to level V with terrible impairment depending upon the disabilities and abilities present among children (8).

In another study, a comparison between hemiplegic and diplegic children was examined within gross motor function classification framework. The study used multiple validated tools of outcome approach, and proposed that the children suffering from hemiplegia would have better gross motor function as well as Gait movement, leaving poor upper extremity functions. The study was based upon 422 children, out of which 161 were hemiplegic and 261 were diplegic across seven centers of study. Findings revealed that the hemiplegic children show improved performance consistently and significantly in gait and poor performance in school function than diplegic children. Findings of the study further revealed that in GMFCS based level II, infant with hemiplegia walking quicker ( $p=0.017$ ), number 6.6 points high on E Proportion of GFM ( $p=0.017$ ), 6.7 numbers lower on School function or Upper Extremity subscale of the "Pediatric Outcomes Data Collection Instrument", and 9.1 points lower on WeeFIM selfcare ( $p=0.002$ ). The motor prediction of children with hemiplegia may be overestimated while those of children with diplegia may be underestimated based only on GMFCS level (9).

## MATERIAL AND METHODOLOGY

**Study Design:** Study design was randomized clinical trials (Iranian registry of clinical trial with Registration id IRCT20230707058703N1) to effects of spider cage therapy on motor control of hemiplegic cerebral palsy children.

**Sampling Technique:** Non-Probability Purposive sampling technique was used and subject was allocated in two groups. Randomization was done by lottery method.

**Study Population:** Children were spastic hemiplegic cerebral palsy.

**Study Duration:** Study duration was 4 months after approval of synopsis.

**Sample Size:** Sample size was 28 calculated by EPI tool.

**Study Setting:** Data was calculated from Mubarak medical complex, Khawja Arshad Hospital and DHQ Hospital Sargodha.

**Screening of Study Population:** Sample was screened on the basis of Inclusion and Exclusion

criteria.

### **Inclusion Criteria**

- Children diagnosed with hemiplegic cerebral palsy
- Age between 4-10
- Both male and females
- Modified Ashworth Scale (Grade 2)
- Able to cooperate and motivated will include in the study
- CP children who was able to understand and follow verbal commands was added in training and evaluation
- GMFCS level: II

### **Exclusion Criteria**

- Children with severe disability, seizure instability waiting for surgery
- Mentally retarded
- Multiple contracture
- Multiple any bone diseases
- Multiple deformity
- Hemiplegic with meningitis
- Multiple any bone diseases
- Multiple deformity
- Hemiplegic with meningitis

**Informed Consent:** Verbal and written consent was taken by patients or guardians before participation into the study.

**Data Collection Tool:** GMFCS-88 and Modified Ashworth scale outcome measures tools was used to collect information.

**Outcome Measures:** GMFCS-88 was used for categorize motor abilities of individual of cp as baseline start of intervention. While Modified Ashworth scale was used for spasticity.

**Data Collection Procedure:** Individuals was enroll into the study after complete the selection criteria. Participants was allocate into two groups. Randomization was done by lottery method. After verbal and written consent taken by patients or guardians before participation into the study.

Group A was experimental group while group B was control group. GMFCS-88 and Modified ashworth scale was exploited to find out the motor cognition and spacticity of infants with cerebral palsy before the start and at end of treatment. Data was collected after three weeks and then after six weeks and once again after nine weeks.

## **Intervention**

### **Group A: Experimental group**

In this group see the effects of spider cage therapy on motor control of hemiplegic cerebral palsy children. The subject session was consisting of five days in a week for 9 weeks. For training spider cage unit was used. Spider cage was 3 dimensional units that consist of metal having cord that were attached to different points on special belt. This belt placed in the region of waist of CP child, which provide support to CP child. Different functional training performed in this spider cage unit. Spider cage used to control motor function like kneeling, half kneeling, one leg standing and jumping. General body warm up exercise. Each exercise was performed for 20 minutes 10 repetitions, 5 days in a week, for 9 weeks.

#### Passive ROM

- Neck Rotation
- Elbow Flexion
- Elbow Extension
- Knee Extension
- Ankle Rotation

### **Group B: Control Group**

The subject received conventional physical therapy approach for five days in a week for nine weeks. General body warm up exercise. Each exercise was take place for 20 minutes 10 repetitions, 5 days in a week, for 9 weeks

#### Passive Range of Motion

- Neck rotation
- Elbow flexion
- Elbow extension
- Knee extension
- Ankle rotation

## Stretching Exercises

- Hamstring stretch
- Quadriceps stretch
- Knee to chest stretch
- Wrist stretch
- Shoulder stretch

These stretches was held for 5 second bilaterally followed by the therapist support and safekeeping the stretch, stretching force was constant and bear by the child at the end position for extra 40 second; 5 repetitions was performed.

**Data Analysis Procedure:** Statistical Analysis was done through SPSS 22 version.

## RESULTS

The purpose of the study was to determine effects of spider cage therapy on motor control of hemiplegic cerebral palsy children. For this purpose 28 patients was taken from Mubarak medical complex, Khawja arshad hospital and DHQ hospital sargodha. Two groups was formed, each group consisted of 14 patients. Group A received the spider cage therapy while Group B received conventional physical therapy only.

To test the null hypothesis that there is no significant effect of spider cage therapy on motor control of hemiplegic cerebral palsy children, inferential statistics was applied. Data was collected at baseline, after 3<sup>rd</sup> week, 6<sup>th</sup> week and 9<sup>th</sup> week. Before conducting inferential statistics, normality of data was checked. Through skewness, Kurtosis and  $Z = \text{Skewness}/\sqrt{SE}$ ,  $Z = \text{Kurtosis}/\sqrt{SE}$ . Kolmogorov-Smirnov and Shapiro-Wilk tests are “unreliable” with big samples, i.e.,  $> 300$ . In essence, they are too “sensitive”. If sample size between is less than 50 then  $Z < |1.96|$ , for normal distributed.

Data for gross motor function measure subscale D (Standing) followed the normal distribution, parametric tests were applied. Independent sample t test was conducted to find difference in Group A and Group B at pre-assessment, after 3<sup>rd</sup> week, 6<sup>th</sup> week and 9<sup>th</sup> week. Repeated Measures ANOVA was conducted to find difference in these outcome measures at 4 time points. The results were presented in the form of tables and graphs.

Data for MAS and gross motor function measure subscale C (crawling & kneeling) and

subscale E (walking, running & jumping) were not normally distributed, so non- parametric test was applied. Mann Whitney U test was conducted to find difference in Group A and Group B at pre-assessment, after 3<sup>rd</sup> week, 6<sup>th</sup> week and 9<sup>th</sup> week. Friedman test was conducted to find difference in these outcome measures at 4 times

## **Descriptive Statistics of Whole Sample**

### **4.1 Descriptive statistics of age of whole sample**

	Mean $\pm$ SD	Minimum	Maximum
Age	6.96 $\pm$ 1.79	4	10

**Table 4. 1:** Descriptive statistics of age of whole sample

The above table shows the descriptive statistics for the age of patients. The mean and standard deviation of age were 6.96 $\pm$ 1.79. The minimum age was 4 years, and the maximum age was 10 years.

### **4.2 Normality of age of whole sample**

	Skewness	SE	kurtosis	SE	Kolmogorov-Smirnov Sig	Shapiro-Wilk Sig.
Age	.140	.441	-.933	.858	0.200	0.145

**Table 4. 2:** Tests of Normality of age of whole sample

As values of Skewness and Kurtosis fall between -1.96 and + 1.96 and p- value of shapiro wilk test and Kolmogorov smirnov test was greater than 0.05. This shows that Data of age follow normal distribution.

### **4.3 Descriptive statistics of gender of whole sample**



	Frequency	Percent	Valid Percent	Cumulative Percent
Male	20	71.4	71.4	71.4
Female	8	28.6	28.6	100.0
Total	28	100.0	100.0	

**Table 4. 3:** Descriptive statistics of gender of patients

The above table shows the descriptive statistics for the gender of patients. Out of 28 (100%), 20 (71.4%) were male and 8 (28%) were female.

#### 4.4 Descriptive statistics of side of hemiplegia of whole sample

	Frequency	Percent	Valid Percent	Cumulative Percent
Right	17	60.7	60.7	60.7
Left	11	39.3	39.3	100
Total	28	100.0	100.0	

**Table 4. 4:** Descriptive statistics for side of hemiplegia of patients

The above table shows the descriptive statistics for side of hemiplegia of patients. Out of 28 (100%), 17 (60.7%) were with right hemiplegia and 11 (39.3%) were with left hemiplegia.

#### 4.5 Normality of age in both groups

Age	Skewness	SE	kurtosis	SE	Kolmogorov-Smirnov Sig.	Shapiro-Wilk Sig.
Group 1	.161	.597	-1.458	1.154	.200	.181

Group 2	.398	.597	-.122	1.154	.200	.534
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**Table 4. 5:** Tests of Normality of age in both groups

As values of Skewness and Kurtosis fall between -1.96 and + 1.96 and p- value of shapiro wilk test and Kolmogrov smirnov test was greater than 0.05 in both group 1 and group 2. This shows that Data of age follow normal distribution in both group 1 and 2.

#### 4.6 Frequency Distribution of Gender

Gender	Group 1		Group 2		Total	
	F	%	f	%	F	%
Male	11	78.6	9	64.3	20	71.4
Female	3	21.4	5	35.7	8	28.5

\*Group 1= Spider Cage therapy, \*Group 2= Conventional physical therapy

**Table 4. 6:** Table above shows the frequency distribution of gender of patients in both groups.

11 (78.6%) were male and 3 (21.4%) were female in group 1. 9 (64.3%) were male and 5 (35.7%) were female in group 2.

#### 4.7 Tests of Normality for Modified Ashworth Scale

	Tests of Normality					
	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statisti c	Df	Sig.	Statisti c	Df	Sig.
MAS score at Baseline	.211	28	.002	.885	28	.005

\*MAS= Modified Ashworth Scale, \*df=Degrees of freedom

**Table 4.7:** Normality tests of MAS in both treatment groups.

As values of Skewness and Kurtosis fall between -1.96 and +1.96 and p- value of shapiro wilk test and Kolmogrov Smirnov test was lesser than 0.05. This shows that Data of MAS don't follow normal distribution. Therefore non-parametric test were applied. Mann Whitney U test was used to determine the significant difference between two groups. Friedman ANOVA was used for within group comparison in group 1 and 2.

#### 4.8 Inferential Statistics for Modified Ashworth Scale

##### 4.8 (a) Comparison of mean change in Modified Ashworth Scale in both groups

Session	Group 1			Group 2			Mann Whitney U value	P. Value
	N	Mean $\pm$ S.D	Median Rank	N	Mean $\pm$ S.D	Median Rank		
Baseline	14	3.35 $\pm$ 1.00	13.07	14	3.71 $\pm$ 0.91	15.93	78	0.376
3 <sup>rd</sup> week	14	2.35 $\pm$ 1.00	11.04	14	3.21 $\pm$ .80	17.96	49.5	0.024
6 <sup>th</sup> week	14	1.71 $\pm$ 1.06	10.93	14	2.71 $\pm$ .99	18.07	48	0.021
9 <sup>th</sup> week	14	1.07 $\pm$ .99	10.32	14	2.21 $\pm$ .89	18.68	39.5	0.006

\*Group 1= Spider Cage therapy, \*Group 2= Conventional physical therapy, \*MAS= Modified Ashworth Scale, \*SD= Standard Deviation, \*Sig= Significance Value

**Table 4.8:** Between group comparison for mean change in MAS at Baseline, 3<sup>rd</sup> week, 6<sup>th</sup> week

and 9<sup>th</sup> week

Results demonstrated that mean and standard deviation value of MAS at baseline was  $3.35 \pm 1.00$  for group 1 and  $3.71 \pm 0.91$  for group 2. P value 0.335 that was being greater than 0.05 at baseline revealed that there was no significant difference of MAS score at baseline between both groups. Mean and standard deviation value of MAS at 3<sup>rd</sup> week was  $2.35 \pm 1.00$  for group 1, and  $3.21 \pm .80$  for group 2. P value 0.019 that was being less than 0.05 at 3<sup>rd</sup> week revealed that there was significant difference of MAS score at 3<sup>rd</sup> week between both groups. Mean and standard deviation value of MAS at 6<sup>th</sup> week was  $1.71 \pm 1.06$  for group 1, and  $2.71 \pm .99$  for group 2. P value 0.016 that was being less than 0.05 at 6<sup>th</sup> week shows that there was significant difference of MAS score at 6<sup>th</sup> week between both groups. Mean and standard deviation value of MAS at 9<sup>th</sup> week was  $1.07 \pm .99$  for group 1, and  $2.21 \pm .89$  for group 2. P value 0.003 that was being less than 0.05 at 9<sup>th</sup> week shows that there was significant difference of MAS score at 9<sup>th</sup> week between both groups. Group 1 that was treated with Spider Cage therapy shows more beneficial effects in reducing spasticity as compared to group 2 that was treated with Conventional physical therapy.

#### 4.8 (b) Within Group Comparison for MAS

The table shows that there was significant improvement in mean MAS score with p value < 0.05 across all the treatment sessions.

Session	Baseline			3 <sup>rd</sup> week			6 <sup>th</sup> week			9 <sup>th</sup> week			p. Value
	Group	N	Mean± S.D	Median	N	Mean± S.D	Median	N	Mean± S.D	Median	N	Mean± S.D	
Group 1	14	$3.35 \pm 1.00$	3	18	$2.35 \pm 1.00$	2	14	$1.71 \pm 1.06$	1.5	14	$1.07 \pm .99$	1	.000
Group 2	14	$3.71 \pm 0.91$	4	18	$3.21 \pm .80$	3	14	$2.71 \pm .99$	2.5	14	$2.21 \pm .89$	2	.000

\*p-value= Probability value, \*MAS= Modified Ashworth Scale

**Table 4.8:** Within group comparison for mean change in Modified Ashworth Scale score at Baseline, week 3, week 6 and week 9.

Above table shows that there was significant improvement in median MAS score across pre-intervention, week 3<sup>rd</sup>, week 6<sup>th</sup> and after week 9<sup>th</sup> measurement in subjects of both groups 1 and 2 with p value < 0.05. The table demonstrates that median value at baseline was 3, at 3<sup>rd</sup> week median was 2, at 6<sup>th</sup> week median was 1.5 and 9<sup>th</sup> week was 1 in group 1. P value was 0.000 that was less than 0.05 indicates that there was significant difference in MAS due to effect of spider cage therapy in group 1.

The table demonstrates that median value at baseline was 4, at 3<sup>rd</sup> week median was 3, at 6<sup>th</sup> week median was 2.5 and 9<sup>th</sup> week was 2 in group 2. P value was 0.000 that was less than 0.05 indicates that there was significant difference in MAS value due to effect of conventional physical therapy in group 2 subjects. Therefore spasticity was significantly reduced in both groups.

## DISCUSSION

CP was non progressive condition of motion and position, related to functional restrictions and cognitive, sensory impairments, difficulty in communication, brain disorder, and musculoskeletal problems. Hemiplegic cerebral palsy baby and children was a type of CP that may cause due to damage to the brain part (hemisphere) that involves in muscle movements. This harm may happen earlier, during or soon after birth. The term hemiplegic was defined as the damage was on one vertical one-half of the body. Motor control was the concept of movement in individuals that have a nervous system. Motor control saw reflexes as well as oriented movement. To control condition of movement, the nervous system must necessary to integrate sensory message (some from the external universe some from proprioception) and create the essential signals to muscles to accomplish a goal. This tract duration many subject, add multisensory integrating, signal process, coordination, cognition and biomechanics. Successful motor control was important to interacting with the worldwide to accomplish goals as well as for position, balance, and steadiness. The spider cage therapy allows the physical therapist to support cerebral palsy children with exercises and activities in different positions that modify motor learning and neuroplasticity. These positions consider quadriplegic position ( both on hands and knees), variations of crawling, kneeling, half kneeling, sitting one leg standing and standing.

As healthy individual can attain benefits by universal exercise therapy unit, likewise CP children can accomplish benefits from spider cage unit. Motor control can be achieved by various

conventional method of training but in universal exercise therapy unit, with the assistance of elastic cords and belts, it was effortless for physical therapist to control condition in the posture of children. Another hypothesis in using universal therapy unit was that it can stimulate the vestibular system when children was supported with the aid of elastic cord in spider cage exercise unit. Spider cage therapy can also be used to improve the spatial sense. Accurate weight bearing on joints also excite the receptors in joints, helpfulness to control condition and strengthen the joints. Spider cage training in Cerebral child improved the motor presentation and increased functional ability related to children without any issue in central nervous system (CNS).

I was collected data from Khawaja Arshad hospital Sargodha, Mubarak medical complex Sargodha and DHQ Sargodha. Number of patient was available in OPD physical therapy department. Hemiplegic cerebral palsy children was presented with one side weakness and difficulty in motor performing functions like kneeling, half kneeling one leg standing and jumping. 28 patients were enrolled in study. 14 patient was in enrolled in experimental group and 14 patient was enrolled in control group. The topic of my research is EFFECTS OF SPIDER CAGE THERAPY ON MOTOR CONTROL OF HEMIPLEGIC CEREBRAL PALSY CHILDREN. Patients were included in study on the basis of inclusion criteria. CP diagnosed with hemiplegia. Both genders were included male and female. Age between 4 to 10 years. Grade 2 Modified Asworth scale was used for spasticity and the hemiplegic CP on level II of GMFM scale.

GMFCS-88 scale was used to determine the motor abilities of hemiplegic cerebral palsy children. Data was collected after three weeks, after six weeks and after nine weeks.

The experimental group receive spider cage therapy for motor control. The patient session consists of five days in a week and the treatment was continuing for nine weeks. Spider cage itself is 3 dimensional unit, it is made up of metal and having elastic cords and one special belt. This special belt was wrapped on patient waist and the elastic cords are attached to this special belt on different points. The cords have two faces (hooks) one was attached on belt while the other one was attached on the spider cage unit. After this performing different exercises like kneeling, half kneeling, one leg standing and jumping. Session consist of one hour and the total session was 45. Before this children received general body warm up exercises. This exercises consist of Passive ROM: Neck rotation, Elbow flexion, Elbow extension, Knee extension and Ankle rotation. Each exercise session was consisting of 20 minutes 10 repetitions, five days in a week, for a 9 weeks. On GMFCS-88 scale item was C, D and E. From this item my focused was on kneeling, half kneeling,

jumping and one leg standing while other was not tested so not tested was considered 0.

It was difficult to handle cerebral palsy children. Some was stubbed children while some parents were not so cooperated. Some was so cooperated and concerned with their child, regular and give positive feedback on improvement of motor control of their children. Difficulty I faced was that the parents was hopeless that our child was CP so child will never be improved here I started counseling that spider cage unit have very good n positive effects on motor control. After counseling session parents was satisfied and start regular therapy. Results were seen after therapy parents were glad and become hopeful that our children will be improved.

The control group was the second group in this the subject was received conventional physical therapy for five days in a week for 9 weeks. Start of this group was general body warm up exercises like Passive ROM: Neck rotation, Elbow flexion, Elbow extension, Knee extension, Ankle rotation. Each exercise session consist of 20 minutes 10 repetitions, five days in a week, for 9 weeks. After this Stretching Exercises was Hamstring stretch, Quadriceps stretch, Knee to chest stretch, Wrist stretch and Shoulder stretch. This stretching exercises was performed like this the stretch was maintain for five seconds on both sides by physical therapist support and the stretch was safekeeping. The stretch force was held constant and that force or stretch was bearable by child at the end position extra 40 second, five repetitions performed

Spider cage unit was available in Khawaja Arshad hospital and Mubarak medical complex sargodha. So the subject that was received universal exercise therapy was included from these two hospitals. While the subject that was added in control group was taken from Khawaja Arshad hospital sargodha DHQ sargodha and Mubarak medical complex sargodha.

## **CONCLUSION**

The result of this study concluded that spider cage therapy can improve the motor control in hemiplegic cerebral palsy children. The examination show significant results of spider cage unit on motor control of children. Hemiplegic cerebral palsy children age between 4 years to 10 years.

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