



## Original Article

## Effects of Physiotherapy on Strength, Range and Function in Children with Erb's Palsy; An Experimental Study

Sarwat Anees<sup>1</sup>, Hafiz Syed Ijaz Ahmed Burq<sup>2</sup>, Muniba Afzal<sup>3</sup>, Muhammad Asrar Yousaf<sup>4</sup>, Tooba Amin<sup>5</sup> and Muhammad Rizwan<sup>6</sup><sup>1</sup>Department of Physiotherapy, Punjab Social Security Health Management Company Hospital Raiwind, Lahore, Pakistan<sup>2</sup>Department of Physiotherapy, Lahore General Hospital, Lahore, Pakistan<sup>3</sup>NUR International University, Lahore, Pakistan<sup>4</sup>Riphah International University, Lahore, Pakistan<sup>5</sup>Department of Physical Therapy, Fatima Memorial Hospital, Lahore, Pakistan<sup>6</sup>University Institute of Physical Therapy, The University of Lahore, Lahore, Pakistan

## ARTICLE INFO

## Key Words:

Physiotherapy, Strength, Function, Range of Motion, Erb's Palsy

## How to Cite:

Anees, S., Ahmed Burq, H. S. I., Afzal, M., Asrar Yousaf, M., Amin, T., & Rizwan, M. (2022). Effects Of Physiotherapy on Strength, Range and Function in Children with Erb's Palsy; An Experimental Study: Effects of Physiotherapy on Children with Erb's Palsy. *Pakistan Biomedical Journal*, 5(5). <https://doi.org/10.54393/pbmj.v5i5.462>

## \*Corresponding Author:

Sarwat Anees

Department of Physiotherapy, Punjab Social Security Health Management Company Hospital Raiwind, Lahore, Pakistan

[sarwataneesphysio@gmail.com](mailto:sarwataneesphysio@gmail.com)

Received Date: 19st May, 2022

Acceptance Date: 25th May, 2022

Published Date: 31st May, 2022

## ABSTRACT

Children who sustain brachial plexus injuries after birth face significant functional limitations due to a variety of sequelae affecting the shoulder, elbow, or forearm. These effects could be permanent or temporary. It is critical for proper joint development to maintain complete passive mobility while neurological function is being restored. Children with Erb's palsy are more likely to have weak muscles, which can be found by ultrasonography. **Objective:** To determine the effects of physiotherapy on strength, range and function in children with Erb's palsy. **Methods:** It was a clinical trial conducted at physiotherapy department outpatient at General hospital Lahore. A sample of 46 children aged between 0-10 years, with the C5 and C6 lesion and with limited range of motion were included while children with any history of previous or recent trauma or surgery to upper limb and to the other roots of brachial plexuses was excluded. Modified Mallet scale and active movement scale was used as outcome measures. The coin toss technique of randomization was adopted, with 'Heads' assigned to strengthening exercises and 'Tails' assigned to general treatment. Independent sample test was employed to assess pre and post differences. Physiotherapy treatments included neurodevelopmental approaches to improve proprioception input, orthosis, and electrical current stimulation. Free weights, resistance bands and manual resistance were used in the strength training. The active range of motion was evaluated using goniometry, and a baseline measurement was generated using a modified mallet scale. The treatment was given every day for six months. Post-intervention measures were implemented two, four, and six months following the intervention. SPSS 25.0 was used for data analysis. **Results:** The finding showed that pre-interventional oxford scale muscle strength for experimental group showed the mean and standard deviation (1.434± 0.5068), control group (1.65± 0.48) while Oxford scale muscle strength post intervention showed the results with the mean and standard deviation for the experimental group 3.13± 0.54 and control group 2.65± 0.48 and showed significant *p* value less than 0.005. **Conclusions:** The study concluded that physiotherapy integrated approach improved upper limb strength, ranges and functional abilities in patients with Erb's Palsy.

## INTRODUCTION

Erb's Palsy is one of the most common neurological birth injuries. It is also known as Erb's-Duchenne paralysis and defined as the paralysis of the arm which occurred due to the injury of the upper group of main nerves supplying it, specified as upper trunk of C5-C6 of the brachial plexus.

Though, in some cases C7 is also get involved. Brachial plexus injuries can cause movement disability and cutaneous sensation disturbances in upper arm. The most known cause of Erb's palsy is traction happened on the neck during difficult labour and delivery [1]. The severity of

the injury can resolve by itself with time or needs physiotherapy or surgery. The most common cause is known as obstetrical technique during delivery but two other major risk factors are also associated with Erb's palsy which is shoulder dystonia and foetus large size thus initiating difficult labour and instrumental assistive delivery. Most of the cases are resolved by time and there is no such permanent disability associated with Erb's palsy [2]. The child with this brachial plexus injury presents the sign and symptoms such as extreme extension and internal rotation of the limb, pronation of the forearm and flexion of the wrist which appears and named as waiter's tip deformity [3]. Moro reflex is absent in the arm with intact of grasping of hand of the same side diagnosed as Erb's Palsy [4]. An incidence of 0.9-1 per 1000 births has been reported for the brachial plexus birth injury in the United States. Erb's palsy accounts for about 47% of Brachial plexuses birth injuries. C7 injuries account for only 19% of the brachial plexuses birth injuries. Recovery rate in first few weeks is considered to be a good indicator for the final results and recovery [5]. The etiology of Erb's palsy can be mishandling during child birth such as excessive lateral rotation or stretching of the infant's head and neck to the opposite direction linked with shoulder dystonia and the head may be deviated away from the axial plane. Due to this brachial plexus tear and stretch can be occurred leading to Erb's palsy [6]. Erb's palsy can also be caused by having excessive pressure over pulling on the infant's arm during breech delivery [5,7]. Many children who are have obstetrician brachial palsy can be improved and recovered by 4-5 months of their age; however it may take 2-3 years for the fully functional limb and recovery. Some of the cases has been recovered without any treatment [8]. Fortunately, between 85-90% of the cases be seen who have recovered fully, treatment for this palsy is either rehabilitative therapy or surgery in severe cases [9]. Manual therapy is the first priority to be taken as rehabilitative therapy to for the prevention of fixed deformities and contractures thus one session per day is essential to maintain Range of motion of the limb and wrist and for the quick and full functional recovery. The most effective exercises are by manual therapy or bilateral motor planning activities [10]. One of the previous researches assessed the efficacy of electrical stimulation versus traditional physiotherapy in the early recovery of function in babies after a brachial plexus injury. The results of this research imply that functional electrical stimulation may be preferable to traditional approaches in the rehabilitation of individuals with Erb's paralysis in terms of achieving early functional recovery [11,12]. Justice et al., conducted a research on the effectiveness of neuromuscular electrical stimulation in the treatment of obstetrician palsy. Their narrative evaluation included four

articles and eleven patients with obstetrician palsy ranging in age from two to four and a half weeks [13]. Active range of motion, muscular strength, and a variety of somatometric measures were all assessed before and after the intervention. According to the findings, every patient's active range of motion improved, the circumference of the arm extended in some patients, and the length of the arm rose in one; nonetheless, there are mixed signals of an improvement in muscle strength. On the other hand, their investigation was made much harder by the fact that the measurements of physiotherapy equipment, such as the type of current, pulse length, treatment time, and so on, were very different [14]. Frade et al., did a narrative evaluation of the different rehabilitation treatments for OP patients and located 13 papers relevant to their inquiry [15]. They suggest the use of electrical stimulation and CIMT as additional noninvasive therapeutic options in addition to electrical stimulation and CIMT. According to the experts, the first is a commonly used strategy that speeds nerve tissue regeneration, reduces muscular atrophy, and improves functional muscle recovery following peripheral nerve loss. Both electro-stimulation and continuous active motion therapy (CIMT) are efficient methods for restoring muscle tone, range of motion, and strength in damaged muscles [14]. Kasnakova et al., included 17 children who had been diagnosed with obstetrician palsy in their study. The students were allocated into two groups at random [15]. Electromyography, the Active Movement Scale, the Mallet Scale, and the Manual Muscle Test were used to examine individuals before and after the intervention. Individuals in the intervention group received a comprehensive physiotherapy program [15]. A study investigating kinematic and electro-myographic activity of the shoulder during rehabilitation, found that a series of active range of motion, isometric, and isotonic exercises resulted in general strengthening of the injured muscle. This step was taken in order to get the best results. The benefits of PNF (progressive neuromuscular facilitation), scapular stability, and progressive resistive shoulder exercises are also supported by data. After revisional triangle tilt surgery, doctors should think about using these therapies, which have been linked to big changes in a patient's physical limitations, pain, and ability to function [16].

## METHODS

It was a clinical trial that took place at physiotherapy department outpatient at General hospital Lahore. A sample of 46 children age between 0-10 years, with the C5 and C6 lesion and with limited range of motion was included while children with any history of previous or recent trauma or surgery to upper limb and to the other roots of brachial plexuses was excluded. Modified Mallet scale and active

movement scale was used as outcome measures. Patients had assigned two groups named Group 1 as experimental group and Group 2 control group. The coin toss technique of randomization was adopted, with 'Heads' assigned to strengthening exercises and 'Tails' assigned to No treatment. A written consent was taken from the parents telling them about the key beneficial effects of the therapy. Group 1 experimental group was given physiotherapy integrated approach which included neurodevelopment techniques to improve proprioception, electrical current stimulation, orthosis and resistance strengthening exercises protocol such as use of free weights, thera bands and manual resistance exercises were included whereas Group 2 control group was given routine medical care. The active range of motion was evaluated using goniometry, and a baseline measurement was generated using a modified mallet scale. The treatment was given every day for six months. Post-intervention measures were implemented 2,4 and 6 months following the intervention. The researchers started by obtaining the children's names, ages, and residences from their parents. Among the other items of personal information acquired were names. The parents were then educated about the procedure and the potential advantages of the research for their children. SPSS 25.0 was utilized for data analysis. Independent sample test was employed to assess pre and post differences.

## RESULTS

The results regarding demographics such as gender of the patients showed the percentage of male 28.3% and female 71.3%, BMI normal 84.8%, overweight 15.2%, socioeconomic status higher 13.3%, middle 32.6%, lower 54.3%, birth procedures NVD 69.6%, C-section 30.4%, surgical procedure during active labor forceps delivery 47.8%, vacuum delivery 15.2%, spontaneous delivery 6.5% and NA 30.4% were found (Table 1).

		Experimental	Control
		Frequency (%)	Frequency (%)
Gender	Male	8 (34.8)	5 (21.7)
	Female	15 (65.2)	18 (78.3)
Body Mass Index	Normal	18 (78.2)	21 (91.3)
	Overweight	5 (21.7)	2 (8.7)
Socioeconomic Status	Higher	2 (8.7)	4 (17.4)
	Middle	11 (47.7)	4 (17.4)
	Lower	10 (43.7)	15 (65.2)
Birth Procedure	NVD	16 (69.6)	16 (69.6)
	C-Section	7 (30.0)	7 (30.4)
	Forceps delivery	12 (52.2)	10 (43.5)
Surgical procedure during active Labor	Vacuum delivery	3 (13.0)	4 (17.4)
	Spontaneous delivery	1 (4.3)	2 (8.7)
	NA	7 (30.4)	7 (30.4)

**Table 1:** Demographics Characteristics

Note: NVD-normal vaginal delivery

Pre-interventional oxford scale muscle strength for experimental group showed the mean and standard deviation (1.434+ 0.5068), control group (1.6522 0.4869) while Oxford scale muscle strength post intervention showed the results with the mean and standard deviation for the experimental group (3.1304+ 0.54808) and control group (2.6522+ 0.4869) and showed significant p value less than 0.005. Pre-interventional results regarding ranges such as abduction, external rotation, hand to spine movement, hand to mouth movement, hand to neck movement and supination showed non-significant value  $p > 0.005$  whereas post interventional results regarding ranges such as abduction, external rotation, hand to spine movement, hand to mouth movement, hand to neck movement and supination showed significant value  $p < 0.005$  (Table 2).

Variables	Group	Mean	SD	Sig. (2-tailed)
Range of motion of abduction	Experimental	3.7391	0.44898	0.750
	Control	3.6957	0.47047	
Mallet Score: Range of motion of abduction post-Intervention	Experimental	4.8261	0.38755	0.001
	Control	4.2174	0.73587	
Mallet Score: Range of motion of external rotation, Pre-Intervention	Experimental	2.5652	0.50687	0.145
	Control	2.3478	0.48698	
Mallet Score: Range of motion of external rotation: post-Intervention	Experimental	3.7391	0.44898	0.000
	Control	2.9565	0.63806	
Hand to spine movement	Experimental	2.3478	0.48698	0.337
	Control	2.2174	0.42174	
Mallet Score: Hand to spine movement post-Intervention	Experimental	3.6522	0.48698	0.000
	Control	2.9565	0.70571	
Hand to mouth	Experimental	2.3913	0.49901	0.247
	Control	2.5652	0.50687	
Mallet Score: Hand to mouth post-Intervention	Experimental	3.8696	0.34435	0.000
	Control	3.1739	0.57621	
Supination	Experimental	2.3043	0.47047	0.065
	Control	2.0870	0.2881	
Mallet Score: Mallet: Supination Post-Intervention	Experimental	3.4348	0.50687	0.000
	Control	2.7391	0.61919	
Hand to neck movement	Experimental	2.6087	0.49901	0.546
	Control	2.6957	0.47047	
Mallet Score: Hand to neck movement post-Intervention	Experimental	4.4130	0.80696	0.016
	Control	3.8043	0.83583	
Oxford Scale Muscle Strength	Experimental	1.4348	0.50687	0.145
	Control	1.6522	0.48698	
Oxford Scale Muscle Strength Post-Intervention	Experimental	3.1304	0.54808	0.003
	Control	2.6522	0.48698	

**Table 2:** Pre & Post Interventional Variables

## DISCUSSION

In this study the gender of the children were mostly females than male children. In comparison to other study it was found that there were 59.6% female children with brachial plexus injuries, (36.2%) were male children, and the gender for two (4.2%) of the cases were not documented [17]. BMI was seen another important as children with normal BMI was reported more than obese. As it was found in another research that children with Erb's palsy has normal BMI and this palsy has no such strong association with BMI of the child [18]. In this study, the findings about the birth procedures included normal vaginal delivery was 69.6%, and C-section 30.4% and surgical procedure during active labor Erb's palsy was directly related to forceps delivery which is more frequent cause of Erb's palsy with shoulder dystonia in comparison to the recent study it was reported that birth procedures are important factors for inducing Erb's palsy in mishandling during childbirth or excessive pressure or pulling upper limb during C-section delivery causing lesion to nerve roots of C5 and C6 [19]. During the evaluation of physiotherapy effects on range and function of upper limb in children with Erb's palsy it was seen in this study that pre interventional results regarding ranges such as abduction, external rotation, hand to spine movement, hand to mouth movement, hand to neck movement and supination showed non-significant value  $p > 0.005$  whereas post interventional results regarding ranges such as abduction, external rotation, hand to spine movement, hand to mouth movement, hand to neck movement and supination showed significant value  $p < 0.005$ . However; in one of the recent studies conducted to identify the holistic approach to manage Erb's palsy with physiotherapy and manual exercises and found significant results showing that ranges of shoulder and arm was increased after giving consecutive physiotherapy sessions for 6 weeks [20]. It was reported that about 0.4% of new born had injuries to their brachial plexus that were caused by birth, with Erb's palsy with neurapraxia being the most common type in about 48% of cases. Throughout the analysis, it was found no statistically significant gender differences between the two groups. Similarly, no statistically significant differences in side engagement were identified between the two groups. Both groups were influenced by the important factor of delayed obstructed labour [21]. Shoulder external rotation is critical in performing a wide range of actions that constitute everyday life activities. The capacity of the patient to externally rotate the affected limb should be restored as soon as possible. However, restoring external rotation is a difficult task for both the therapist and the patient, since only little improvements were seen on the modified Mallet scale, active movement scale, and scapular elevation [22]. Physical therapy for

patients with Erb's palsy has a positive impact on their impairments and challenges. There are no specialised physiotherapy techniques for Erb's palsy that seek to restore the patient's external rotation. On the other hand, surgical procedures that may restore the patient's external rotation are always disputed in terms of effectiveness and expense [23]. When treating Erb's palsy patients, therapists must continually concentrate on recovering the patient's ability to externally rotate their arms and shoulders. Based on the findings of this study, it was recommended that further research be conducted with the goal of overcoming the restricted gains in external rotation by using bigger sample numbers and more focused treatments [24].

## CONCLUSIONS

The study concluded that physiotherapy integrated approach improved upper limb strength, ranges and functional abilities in patients with Erb's Palsy.

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