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ORIGINAL ARTICLE

Effects of Cryotherapy on Hand Function in Children with Spastic Cerebral Palsy

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ABSTRACT

Objective: To explore the effects of cold therapy and functional task exercises for reduction of spasticity and hand function improvement in children with spastic Cerebral palsy.

Study Design: Randomized control trial.

Place and Duration of Study: Physiotherapy Department of Allied Hospital and Children hospital Faisalabad after taking informed consent from participants. January 2019 to April 2019.

Material and Methods: A convenient sample of 30 Spastic Cerebral Palsy children considered. The treatment group received cold therapy + FTE (Functional Task Exercises) and the control group received FTE only. Data was collected through (Modified Ashworth Scale) MAS, goniometry and, (Quality of Upper Extremity Skills Test) QUEST.

Results: After treatment post-spasticity results showed a non-significant p-value and post-hand function results revealed significant p-values. (.022 that is <0.05). Through the difference in mean values treatment group was more effective in reducing spasticity, so results showed the intervention used in the treatment group was clinically notable.

Conclusion: In this study, the combination of cryotherapy and functional task exercises was more successful in reducing spasticity and improving hand function.

Key Words: *Cold therapy, Functional task exercises, Hand function, Spastic cerebral palsy*

INTRODUCTION

Spastic cerebral palsy (CP) is the most common type of cerebral palsy, in people with spastic CP muscles feel stiff and their movement may look stiff and jerk.¹ 1 in 500 neonates with an estimated prevalence of 17 million people worldwide affected by Cerebral palsy.² Cerebral palsy birth prevalence is small but ethnic imbalance permits advanced study.³ No counteraction was detected in the CP among girls and boys during recent years. There is no consistent difference in boys

and girls motor function levels. The risk factors are higher for males.⁴

Mobility, communication, eating and drinking issues, intellectual disability, learning difficulties, hearing impairment, vision impairment, behavior, and emotional wellbeing, sleep issues, spinal and hip abnormalities, and bowel & bladder control are troubled in Cerebral palsy The level of severity and combination of symptoms in Cerebral palsy differ in each child. For example, one child may have problem with one hand and fine tasks &

another child may have difficulty in speech or no control over their movement.

Classification is based on severity, topographical features, and motor function. (Spastic Cerebral Palsy: increased muscle tone, stiff limbs. Non-spastic cerebral palsy: fluctuating muscle tone, floppy limbs), Categorization based on gross motor function classification system (Gross Motor Function Classification System has increased rapidly over the past 7 years but there is room for further improvement).⁵

This study will consider the flexor compartment of the forearm as a region of intervention (cold therapy, FTE) Superficial muscles of the forearm: Flexor Digitorum Superficialis, Flexor carpi Ulnaris, and Flexor carpi radialis, Palmaris Longus, Pronator Teres, Bicep Brachi, Brachioradialis, and Brachialis. Deep muscles of the forearm: Flexor Digitorum Profundus, Pronator Quadratus, Flexor Pollicis Longus. Palmaris longus and flexor digitorum superficialis are weak flexor muscles of the forearm but play important role in hand function mainly involve in opposition, of thumb & flexion of ICP, MCP, and wrist.

Physical Therapy Intervention was cold packs and FTE. The word "cryotherapy" was first used in 1908 by A.W. Pusey.⁶ The attend to use cold temperatures in physical therapy is continuously increasing but awareness in this area is quite far from satisfaction, any new research on the usage of cold therapy is a greeting and valuable source of details from the views of physiotherapy practice.

Functional training is a type of exercise that involves activity performed in daily life for training the body. Activities are designed to include task and condition-specific practice in areas relevant to each patient with a general goal of functional independence. Fine motor skills are improved by hand therapy exercises. Alone resistance exercises in cerebral palsy may not enhance other activities, task involving specific functional tasks magnified activities in people with spastic cerebral palsy there may be long-term benefits of this type of training in slowing the deterioration of muscle function.⁷

Cryotherapy promotes analgesics effects by increasing nerve conduction latency and it reduces pain, spasticity, edema, and disability more than heat therapy. Application of ice therapy

in the form of ice packs for 20 minutes, 3 times in 5 days of week aids in return to full activity.⁸

This study was conducted to explore the aftermaths of cryotherapy when used in coalition with functional task exercises to ward off upper limb spasticity and enhance hand function in children with spastic CP.

Objective: To determine the effects of functional task exercises and cryotherapy for the reduction in spasticity and improvement in hand function.

Hypothesis

H1: There is a significant effect of combination of cryotherapy and Functional task exercises as compared to only Functional Task Exercises in reducing spasticity and improving hand function.

H0: There is no significant effect of combination of cryotherapy and Functional task exercises as compared to only Functional Task Exercises in reducing spasticity and improving hand function.

MATERIAL AND METHODS

Study design: A quantitative (experimental) study was conducted by randomized control trial in which participants were allocated into two groups named group A and group B. Group A received a combination of cryotherapy + FTE and the other received only FTE.

Study setting: The study population was patients presented with CP in the Physiotherapy department of Allied Hospital Faisalabad and Children Hospital Faisalabad.

Duration of study: The duration of this study was four months. Firstly, we prepared our synopsis got approval from the research committee, and reviewed the literature. After this, we collected data and applied the intervention to patients in the next two months, arranged and applied statistical analysis to data, concluded, and interpret results.

Study Population: The population of this study was children with cerebral palsy age ranged from 4 to 8 years with spasticity of grade 1 to 3 according to MAS. Children with fixed contracture were excluded.

Sample Size: In this study sample size was 30 patients both genders were taken having spasticity in elbow and wrist flexors with a reduction in hand function especially grasp.

Inclusion & Exclusion Criteria

Inclusion criteria:

1. Include male and female patients
2. Age range 4-8 years.
3. Subjects with spasticity in elbow & wrist flexors.
4. Subjects with MAS grade 1 – 3.
5. Subjects can sit independently.
6. Skin sensation should be normal in the upper limb.
7. Cognitive ability should be sufficient that he/she follow simple verbal commands and directions during tests and training.

Exclusion criteria:

1. Fixed contracture and deformity in the upper limb.
2. The patient should not be treated with anti-spastic drugs & procedures before and during the treatment.

Parameters of Study

The research was conducted by using a questionnaire, goniometer. Cryotherapy (gel pack), Spasticity, and Functional task exercises (hand function).

Spasticity

Pre-Spasticity

	Group	N	Mean	Std. Deviation	p-value
Pre Spasticity	Treatment group	15	5.47	4.719	.970
	Control group	15	5.40	4.748	

Interpretation

The pre-spasticity p-value is not significant 0.970.

Post-Spasticity

Post .Spasticity	Treatment group	15	2.87	4.257	.241
	Control group	15	4.93	5.147	

Interpretation

Post-spasticity results showed non-significant p-value (.241). But through the difference in mean values analyzed the treatment group was more effective in reducing spasticity. Pre mean of the

Outcome Measures

Primary outcome: Modified Ashworth Scale (for spasticity)

Secondary outcome: Manual Goniometer (for ROM) and Quality of Upper Extremity Skill Test (for hand function).

Statistical Analysis: Collected data entered into SPSS version 21 software and is used for making graphs, tables and charts. It is used to determine the efficacy of both treatment cryotherapy & FTE on reduction of spasticity and improvement in hand function. An independent T-test was applied for analysis of results.

Spasticity results showed a non-significant P-value of 0.241. The pre-mean of the treatment group was 5.47 ± 4.71 and of the control group was 5.40 ± 4.74 . Post mean of the treatment group was 2.87 ± 4.25 and of control group was 4.93 ± 5.14 . Mean was showing betterment occur in both groups more in the treatment group. Post-hand function results revealed significant p-values of 0.022.

RESULTS

This study included thirty spastic CP children. Girls were 18 and boys were twelve their age range from 4 to 8 years. Treatment applied to flexors of upper limbs.

treatment group was 5.47 ± 4.71 and of the control group was 5.40 ± 4.74 . Post mean of the treatment group was 2.87 ± 4.25 and of the control group was 4.93 ± 5.14 . Mean was showing betterment, more in the treatment group but improvement is minor.

Hand Function: This study used Quality of Upper Extremity Skills Test QUEST (Grasp) for evaluation of hand function in spastic CP children.

Hand Function	Group	N	Mean	Std. Deviation	p-value
Pre Hand Function	Treatment group	15	44.4387	20.81033	.976
	Control group	15	44.6853	23.85929	
Post Hand function	Treatment group	15	69.8907	16.04049	.022
	Control group	15	50.3653	26.21717	

Interpretation

P-values of hand function before treatment disclosed non-significant results after treatment revealed significant p-values. P-value was 0.022 which is <0.05 from this concluded that the p-value of treatment was more significant. When we combined post spasticity and post hand-function p-values according to the statement of hypothesis come to the point that combination was better than FTE only. Alternative hypothesis accepted.

Range of motion: ROM measured by manual Goniometer

Interpretation

Post wrist right range of extension showed a p-value (0.034) means improvement occurs other values were not showing much change. Improvement only in Range of Motion of right-sided wrist extension.

DISCUSSION

The unique feature of this study was that the combination of cryotherapy and functional task exercises applied, interventions complemented each other. Functional task exercises were not considered in previous studies that reduce spasticity but the result of this study showed that it has some effects on spasticity reduction. This study showed significant results on a combination of cold packs and functional task exercises so in future patients get benefit and physiotherapist come to know that they can use these interventions professionally in their setups.

Immediately after application of cold therapy children received the physical and occupational program for 2 hours three times per week for a consecutive three months and elbow and wrist flexors it includes manual passive stretching, Hand weight-bearing (HWB), Passive Range of

Motion and proprioceptive training (PET). But in this study cold therapy applied with functional task exercises for 2 months, three times per week and activities included wringing of wet cloth, carrying a plastic bottle of water transfer from one hand to another, crinkle a sheet of paper into a ball from one hand to another and try to spread it back off into a flat piece of paper, emplace one hand on the table and try to lift each finger one at a time off the table and roll the pencil between the thumb and fingers. Results were noteworthy. It indicated that hand-function was sustainable for the reduction of spasticity.

Task-specific balance training improved the sensory organization of balance control in children.⁹ On comparison of pre and post mean values of functional task exercises group it revealed that there was a statistical significance. Resistance exercises consolidate more on the extension and flexion activities of fingers with the elastic band, hand gripper, and squeezing a ball. Functional exercises had emerged into everyday tasks.¹⁰ Evidence is shortly related to Functional task exercises in spastic cerebral palsy but results showed that FTE had a great role in improving hand function and increasing grip p-value (0.22). In this way writing skills also got better. Previous studies showed that functional task exercises focused more on day to day activities. These exercises are safe as compare to stretching and resistance exercise.

Treatment of spasticity affects hand function. Cold therapy applied for 20 minutes on elbow and wrist flexors and arms positioned in mid supination to achieve long duration reduction in spasticity.

In this study, due to the reduction in flexor spasticity: wrist extension improved more in the treatment group. In previous researches, there was also fruitful improvement in elbow and wrist extension by the application of cold therapy.

Children are allowed grasp and manipulate objects in a further skilled strategy due to the betterment of the wrist extension and minimization of spasticity.

CONCLUSION

This study concluded that the combination of cryotherapy and functional task exercises was more effective in the reduction of spasticity and improvement of hand function.

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