Effect of Kinesiotaping for Hand Function in Children with Cerebral Palsy: A Randomized Controlled Trial

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How to cite this article: Jeena James, Jasrah Javed, Divya Mohan et. al. Effect of Kinesiotaping for Hand Function in Children with Cerebral Palsy: A Randomized Controlled Trial. Indian Journal of Physiotherapy and Occupational Therapy 2023;17(2).

Abstract

Background: Cerebral palsy is the most common chronic disability. Lesions or defects in the immature brain cause sensori motor impairment, which compromise the development of upper limb function in cerebral palsy. Restricted movement of the upper limbs may cause limitation in the functions and performance of ADL which affect their quality of life. Recent studies have proven that kinesiotape plays an important role in the management of hand functional activity.

Design: Randomized controlled trail was conducted on 28 cerebral palsy children with impaired hand function were included in the study based on the inclusion and exclusion criteria. Participants were randomly divided into 2 groups, group a. kinesiotaping with functional hand activities and group b. sham taping (Kinesiotape without tension) along with functional hand activities. Control group received sham tape (kinesiotape without tension). Outcomes were measured using quality of upper extremity skill test (QUEST) and Upper limb physician rating scale (ULPRS).

Conclusion: The study proved that the short term effect of kinesiotaping application along with functional hand activities has no significant effect on improving hand function in children with cerebral palsy.

Key Words: Cerebral palsy, Hand function, Kinesiotaping, CP, disability.

Introduction

Cerebral palsy (CP) is a group of permanent disorders of the development of movement and posture, causing activity limitation, that are attributed to nonprogressive disturbances that occurred in the developing fetal or infant brain. The motor disorder of cerebral palsy is often accompanied by disturbances of sensation, perception, cognition, communication, and behavior by epilepsy, and by secondary musculoskeletal problems.[1]

Globally, studies have reported the prevalence range of cerebral palsy from 1.5 to 4 per 1000 live births or children.[2] A recent study has stated that in India children aged between 2 to 9 years are highly affected by neurodevelopmental disorder including cerebral palsy. The percentage ranges from 6.5% to 18.5%.[3]

Lesions or defects in the immature brain cause sensorimotor impairment, which compromise the development of upper limb function in cerebral palsy.[4] Restricted movement of the upper limbs may cause limitation in the functions and performance of ADL

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which affect their quality of life. These impairment which leads to poor hand function in both hemiplegic and diplegic CP that include pinch, grip, prehension, dexterity, grasp, reach, hold, release, manipulation, push, pull, lift, displace and fixate.[5]

The motor impairment of the hand include muscle weakness, spasticity (hypertonia) or dystonia, reduced muscle length, restricted passive and active ROM, impaired motor planning, decreased dissociation of fingers and reduced hand arches.[6,7,8,9] Decreased muscle strength result in reduced grip strength, pinch force and reduction in force generation to grasp different objects.[9] Spasticity can results in spasm or contracture. Abnormal posture can also leading to joint deformities which results in grasp difficulty across wrist and fingers. The most common abnormal posture is elbow flexion, pronation of forearm, wrist flexion, finger flexion and thumb in palm is noted. The thumb held flexed inside the palm impairs grip and grasp and lack of abduction and extension limits the size of the object the patient can grasp[10]. The presence of thumb in the palm will obstructs the function of other fingers. It may even contribute to rejection of the hand and cause problems in ADL. Swan neck deformity, intrinsic minus and intrinsic plus deformity are other common deformities seen in children with CP. Degree of upper limb deformity significantly affect the function of the upper limb.[10, 11] The impaired hand function originates from the deficiencies in motor coordination, and selective motor control as well as muscle weakness, and deficient integration of sensory motor function.[6.7.8.9] Motor planning and fine motor coordination are required for grasping to control multiple degrees of freedom available in the hand and fingers. Children with CP deficits in motor planning and execution that impact the timing and coordination of joint movements, orientation of the hand to object size and use. [9] Many therapeutic methods are used to treating the sign of CP including botulinum toxin injection, orthopedic surgery, medications, physical therapy, occupational therapy etc.[12,13]. Physical therapy use various dynamic approaches including bobath approach, sensory integration (SI), neurodevelopmental therapy(NDT), bimanual therapy, CIMT, stretching and strengthening and functional hand activities which shows significant improvement in hand functions.[12] However, there are limitation in using above methods as some of them require longer treatment durations, higher degree of co-operation and motor practice from the child, which may be reduce efficacy due to their poor co-operation and motivation. While some approaches tend to be less focused to retraining hand functions.[12.13] A method used for reducing problems of hand and upper limb in children with spastic cerebral palsy is Kinesio taping (KT). [14] The application of kinesiotape will enhance skin receptor output, stimulating supraspinal centers, and thus improves joint position and kinesthetic senses and proper development of the motor control. And also it strengthen weakened muscles, control joint instability, assist with postural alignment, and relax an over-used muscle , increase sensory stimulation, increase functional motor skills, and improve functional independence.[12,13,14,15,16,17] A review conducted on therapeutic effects of kinesio taping in children with cerebral palsy and explained about the characteristics of kinesiotape, physiological effect of kinesiotaping and the various type of kinesiotape using in pediatric population has also shown the effectiveness in recovery of upper limb, motor function and solving dysphagia.[16]

Methodology

A Randomized controlled trail was conducted on 28 cerebral palsy children from Oxford College of physiotherapy, Samarthanam Trust for disabled and Fame India Special School having impaired hand function. All the subjects who gave consent for participation and who fulfilled the selection criteria were randomized. Randomization was done by another therapist. Consent for the participation in the study was obtained form the parents of the children participated by signing a consent form.

Treatment was carried out for a period of 3 weeks on each group. Outcomes were measured using quality of upper extremity skill test (QUEST) and Upper limb physician rating scale (ULPRS).

Particpants included in the study were children with spastic unilateral and bilateral cerebral palsy, both male and female, of age group between 4 to 8 years, according to Manual Ability Classification System (MACS) grade 2 and 3 and Spasticity, according to Modified Ashworth Scale 1, +1 and 2. They were able to follow and accept verbal

instructions. Selected children had proper functional vision. Children excluded form the study were those who had taken botox therapy or muscle relaxant past 3 month, who underwent any surgery for upper limb within past 6 month, those with active seizure disorder (High frequency of seizure disorder) or those having allergic (systemic) reaction to tape.

Procedure:

Ethical clearance was obtained from ethical committee of The Oxford College of the physiotherapy. Baseline assessment was done at the commencement of the protocol. Participants were allocated to one of the two groups according to the inclusion criteria, either Group A (Kinesiotaping + Functional hand activities) or Group B (Sham Application of sham taping [Kinesiotape without tension-2 days, 3 sessions weekly] +functional hand activities with tape on (2 times per day, 45 minutes/ 3 weeks. Application of kinesiotape) [KT-2 days,3 session weekly] + Functional hand activities with tape on(2 times per day, 45 minutes/ 3 weeks).

Procedure for group A

The experimental group (Group A): participated in kinesiotape application along with functional hand activities program three times in a week. The children performed hand functional activities with the kinesiotape on. Instructions were also given to the caregiver of the children. Demonstrations for ten exercises (Switch on a bedside lamp, turn a single page of kid's book, push a hole in clay with finger, hold a bottle or glass with half filled water, transfer small ball (textured ball) & put into a bowl, pick up nuts and release in a plate, slide the coins from flat surface, put into purses, open a lid of tiffin box, sharpen a pencil, push a cardboard box from the table) were done under the supervision of parents at the home. Hand activities performed twice a day and each session were at least 45 minutes in duration for a period of 3 weeks.

Procedure for group B

The Control group (Group B): received sham tape (kinesiotape without tension) followed by the same procedure as experimental group carried for 3 weeks. Functional hand activities primarily focusing on the forearm, wrist and hand movements were given after application of sham taping. It was measured by same functional outcome measures used for experimental group.

Statistical Analysis

Paired t test and independent sample t test were used as a statistically tool for detecting the significant difference within the group and between the group. Descriptive statistics (mean and standard deviation) were also calculated for all the measurements consideration for the study.

Results

Table 1: The mean and SD of pre and post test scores outcome measures of experimental and control group.

(n = 28)		Mean	SD
QUEST	Pre	55.71	14.60
	Post	55.51	14.11
ULPRS	Pre	24.20	5.39
	Post	24.50	5.40

Table.2. Comparison of QUEST and ULPRSat pre test between the groups.

Pre-Test	Groups	Mean	SD	t	p-value
QUEST	Experimental	52.29	12.73	-1.051	0.307
	Control	59.14	16.19		
ULPRS	Experimental	24.40	5.99	0.162	0.873
	Control	24.00	5.03		

*p=0.05

The Independent sample "t" test was used to compare QUEST and ULPRS at pre test between the groups. There was no difference ($p > 0.05$) in QUEST and ULPRS at pre test between the groups.

Table 3: Within group comparison of QUEST and ULPRS

	Experimental Group					Control				
	Groups	**Mean**	**SD**	**t**	**p-value**	**Groups**	**Mean**	**SD**	**t**	**p-value**
QUEST	Pre	52.3	12.7	0.498	0.630	Pre	59.1	16.2	0.745	0.475
	Post	52.2	12.3			Post	58.9	15.6		
ULPRS	Pre	24.4	6.0	-0.361	0.726	Pre	24.0	5.0	-1.861	0.096
	Post	24.5	6.3			Post	24.5	4.6		

*p=0.05

The Paired "t" test was used for the within group comparison of QUEST and ULPRS. There was no difference ($p > 0.05$) in QUEST and ULPRS within experimental group as well as control group.

Table 4: Comparison of effectiveness (pre – post) in QUEST and ULPRS between the groups.

(Pre-Post)	Groups	Mean	SD	t	p-value
QUEST	Experimental	0.13	0.82	-0.328	0.747
	Control	0.28	1.19		
ULRPS	Experimental	-0.10	0.88	1.037	0.314
	Control	-0.50	0.85		

The Independent sample "t" test was used to compare the effectiveness (pre – post) in QUEST and ULPRS between the groups. There was no difference ($p > 0.05$) in the effectiveness in QUEST and ULPRS between the groups.

Discussion

In the current study, primary objective was to find out the short term effectiveness of kinesiotaping application while training of functional hand activities in children with unilateral and bilateral cerebral palsy in improving hand function. According to the result when compared between and within the Group A (KT+ functional hand activities) and Group B (Sham taping +functional hand activities) has no significant improvement on hand activities in children with cerebral palsy.

The current study discovered that kinesiotaping and functional hand activities had no discernible effect on hand function in children with unilateral and bilateral cerebral palsy.

The results of all previous studies were favorable and they were long term studies. But the current study is short term, which may be the cause of the unfavorable outcome or result. This study can be useful in the future if conducted over long term and in a conducive environment. KT and functional hand excersice have their own value from a rehab standpoint. It will be great in the future to combine the effectiveness of both for a efficient rehab.

Kinesiotaping and functional hand exercises can hasten the child's recovery and help them develop better neuromuscular coordination over time, which will greatly increase their ability to lead a normal life. Giving children useful hand exercises is crucial from a rehabilitation perspective, and it can be more effective when combined with the evidence-supported benefits of kinesiotaping, such as increased range of motion (ROM), improved function, reduced pain, and improved quality of life (QL).

Conclusion

The study concludes that, short term effect of KT along with functional hand activity exercise programme has no improvement in hand function in children with cerebral palsy. This study hereby accepts the null hypothesis that there is a no significant effect of KT along with functional hand activities on improvement of hand activities in children with cerebral palsy.

Conflict of Interest: Nil.

Source of Funding: None

Ethical Clearance: Ethical committee of The Oxford College of Physiotherapy, Bangalore, Karnataka

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