The effect of kinesiotaping on hand function in children with cerebral palsy

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Abstract: Cerebral palsy (CP) is a disorder characterized by abnormal muscle tone, posture and movement. The incidence of CP is 2-4 per 1,000 live births around the world. The upper extremity is frequently affected in children with CP. This leads to limited reaching, grasping and object manipulation, which also interferes with exploration, play, self-care and other activities of daily life**.** Kinesio taping (KT) is a relatively new method used in rehabilitation program of children with CP. Several studies have highlited that it can also be beneficial for improving hand function.

Keywords: cerebral palsy, diplegia, hand function, kinesiotaping, active range of motion

Introduction. Cerebral palsy (CP) is a neurological non-progressive disorder resulting from damage to non-mature brain that occurring before, during, or after birth and causes permanent disorder of movement and posture [1,17,18]. It is the most common movement disorder associated with lifelong disability and motor deficit [2,4,19,20]. It is classified topographically (hemiplegia, diplegia, and quadriplegia) or based on motor function as spastic and non-spastic (including athetoid, ataxic and dystonic). The prevalence of CP is about 2 to 2.5 per 1000 live births [3,4,21,22]. CP leads to spasticity, intensify reflexes, co-contraction, weakness or loss of movement control, muscle weakness, sensory integration defects, muscle coordination deficit, balance and postural control limitation [1, 4]. The upper limb is usually more severely involved compared to the lower one. This leads to limited reaching, grasping and object manipulation, which also interferes with exploration, play, self-care and other activities of daily life [5]. Orthopaedic surgery, constraint-induced movement therapy, occupational therapy, and traditional therapy are some of the common treatments, which are generally used in the course of CP treatment [2]. Furthermore, studies have emphasized the possible benefits of several recent methods such as taping, which is frequently used in paediatric rehabilitation clinics. Kinesiotaping is a new technique in the management of problems related to abnormal muscle tone, which are common problems in CP [6,7,23,25]. This method includes noninvasive adhesive elastic taping, the purpose of which is to restrain mechanically pathological movements, to preserve functional movements at the same time, and to enhance perceptive feedbacks [6,8,24,26].

Objective. The aim of this research work was to study whether kinesiotaping improve the hand functioning of the cerebral palsy children engaged in a rehabilitation program.

Materials and Methods

Subjects. Forty two children with medical diagnosis of spastic diplegic cerebral palsy were enrolled in this study. Children who met the following inclusion criteria were enrolled in the study; ages ranged from 4 to 8 years, hand flexor spasticity less than 3 according to Modified Ashworth Scale (MAS), and sufficient cognitive level to follow the directions of the testing protocols and tape acceptance.

The Exclusion criteria were

1) Any orthopedic surgery or botulinum toxin injection in the past 6 months,
2) Children with significant spasticity on the MAS of 3 or 4 (3 with considerable increase in tone, difficult passive movement and 4 with the affected parts rigid in flexion or extension),
3) Fixed contractures of upper limb, and
4) Children with allergic reactions to the adhesive compound of KT.

Patients were randomly assigned into two groups of equal number control group and study group. Study group received conventional occupational therapy program along with KT, while control received former only.

Measures. All evaluation performed before treatment and at the end of the second week of the treatment period. Instructions about the purpose and methods of testing were provided to make every child familiar with the device.

The Quality of Upper Extremity Skills Test (QUEST) scale was applied to evaluate the quality of upper limb skills. It comprises 33 items related to quality of movement in four domains that are essential components of normal developmental patterns between birth and 18 months (dissociated movements, grasp, weight bearing, and protective extension) (10). In this study, two domains of the QUEST (dissociated movement and grasp) were chosen as a primary outcome measure. The percentage score is calculated for each domain and the scores of the two domains can be summed to a total percentage score.

Goniometer was used to evaluate ROM of wrist extension, which is a hand held instrument used to measure range of motion.

Procedures. Study group: Wrist joint alignment was corrected towards extension for all the children and then an I strip kinesiotape was applied at the dorsum of the dominant hand and wrist and forearm (picture 1), extending from the common extensor origin proximally to the metacarpophalangeal joints to cover the wrist extensor muscles distally, without stretch at joints area and 50% stretch at muscular area for two weeks and changed every three days.

Picture 1. Kinesiotape at the dorsum of the dominant hand (photo taken by author)

Control group: Children of this group received the traditional physical therapy program for spastic cerebral palsy in the form of exercises to facilitate hand function (reaching, grasping, carrying and release and bilateral hand use) and strengthening exercises for the antispastic muscles. For each patient, six session performed for two weeks, three sessions per week**.**

Data analysis. Microsoft Office Excel 13 was used to analyze the data. P value of 0.05 was used to calculate the test of significance.

Results. Forty two children with spastic diplegic cerebral palsy participated in this study and they were classified into study and control groups. Each group included 21 children with age distribution showing that; 28 (67%) aged between 4-6 years and 14 (33%) aged between 7-9 years of both sexes. There was no statistically significant difference between the mean values of age, and muscle tone of both groups ($p > 0.05$).

Comparisons of pre-treatment values revealed no statistically significant difference between the control and study groups regarding QUEST and ROM variables.

Comparing pre and post treatment values of total QUEST scores in the control and the study groups, significant differences were found ($p=0.006$) and ($p=0.001$) respectively. Furthermore, comparing the pre and post treatment values for both groups in terms of wrist extension ROM, significant differences were in the control group ($p=0.038$) and in the study group ($p=0.001$) (Table 1). In post treatment comparison between the two groups (diagram 1 and 2), significant improvement was reported in terms of upper extremity skills and ROM in both groups favoring the study group ($p< 0.05$).

Table 1

Mean values (m± SD) of total QUEST score and wrist extension (degree)

	Control group		Study group	
	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
Quest total	34.1±3.1	37.3±2.8	33.7±2.7	46.2±3.5
Wrist extension ROM	35.6°±5.61	39.4°±5.32	35.55°±4.96	45.3°±4.82

Diagram 1

Comparison of total QUEST score mean values between groups

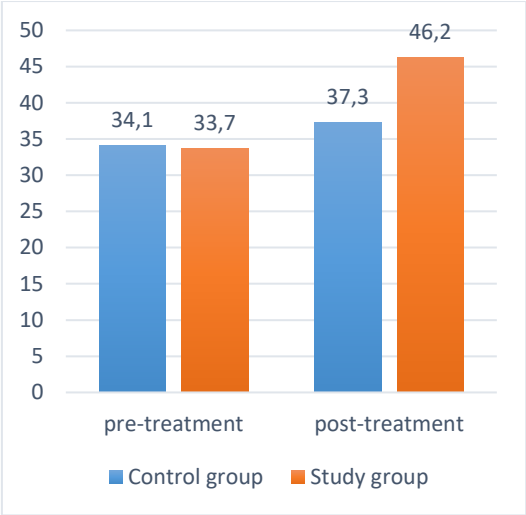
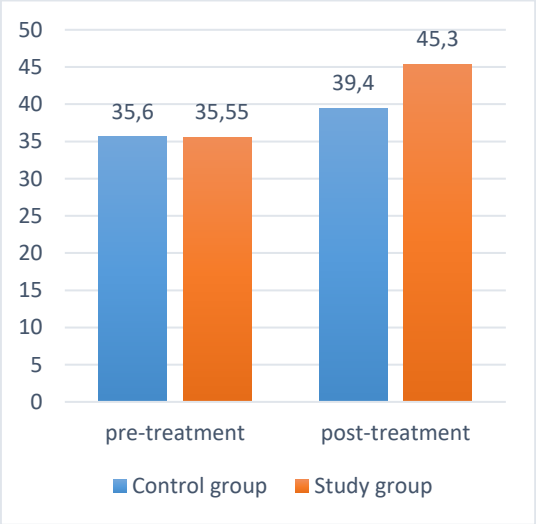


Diagram 2

Comparison of total wrist extension (degree) mean values between groups



Discussion. The aim of this study was to investigate the therapeutic effect of KT on functional performance of hand in spastic cerebral palsy children. The results showed a great improvement of hand function and wrist ROM when KT was applied. This probably favoured the breakdown of the pathological motor schemes, favouring the acquisition of more correct ones, allowing the emergence of a more fine manipulation with selective finger movements [8]. Taping for the dorsum of wrist and forearm could result in increased firing of cutaneous afferents on the underlying skin during wrist flexion. This could lead to enhanced proprioceptive feedback [11]. Complicated interactions at spinal cord level lead to integration of signals from the different proprioceptive afferents [8], which can affect muscle spindle sensitivity through modulation of gamma motor neuron firing, and perhaps alter the balance of muscle activity to strengthen wrist extensors over time [12].

The results of this study comes in agreement with a systematic review of literature on the effect of kinesiotaping techniques in children with cerebral palsy which done by

Zabih Allah, R. et al. concluded that Kinesiotaping technique, as an adjunctive treatment and in combination with other treatment techniques, can be effective in the neurological rehabilitation of children with cerebral palsy to improve gross and find motor function and dynamic activities, especially in higher developmental and motor stages [13]. In addition to this, significant improvements in upper extremity functions were seen both immediately and after 3 days of KT for children with acute rehabilitation setting [14] and in adults following stroke [15]. This also strengthens our findings regarding improvement of hand functions.

Conclusions. It can be concluded that application of kinesiotape along with conventional occupational therapy can improve hand function among children with spastic diplegic cerebral palsy, hence that they can have the functional independence, to meet demands of everyday life. Furthermore, long term randomized controlled studies are required to evaluate its real potential.

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