Gluteal taping to improve gait in spastic hemiplegic cerebral palsy children: A randomized control trial

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Abstract

Background: Cerebral palsy (CP) is the most prevalent mobility disorder in children, resulting in long-term disabilities and various impairments. The clinical manifestations of CP vary among affected individuals. CP is associated with a wide range of disorders, and a broad spectrum of symptoms may present. Children with CP commonly experience muscle hypertonia, challenges in postural control, difficulties in ambulation, and an increased risk of falls. **Objective:** The primary objective of this study was to determine the impact of KT on gait metrics and functional activities following gluteal taping. **Methods:** The cohort study comprised 60 patients with spastic hemiplegia, aged 4–12 years, who were randomly allocated to experimental and control groups. Informed consent was obtained from all parents. The control group underwent traditional training, whereas the experimental group received gluteal taping of the affected gluteus. Both groups participated in 45-minute training sessions three times a week for six weeks. **Results:** The effect of gluteal taping was evaluated using paired t-test. The post-test mean values of all gluteal taping variables demonstrated improvement compared to those of the control group ($p < 0.05$). **Conclusions:** The investigators found that gluteal taping improved both gait metrics and functional abilities in participants with spastic hemiplegic cerebral palsy.

Keywords: Hemiplegic cerebral palsy; gluteal taping; spasticity; gait; functional activity.

BACKGROUND

Spastic hemiplegic cerebral palsy (CP) is a type of CP that affects only one side of the body, either the right or left[1]. CP is the most prevalent cause of childhood impairment, affecting 2–2.5 out of every 1000 newborns[2]. In 2011, approximately 25 lakh children in India were estimated to have cerebral palsy[3]. Spasticity presents a significant barrier to CP rehabilitation in young individuals, leading to muscle soreness or spasms, difficulty in bed mobility, transfers, improper seating positions, impaired ability to stand and walk, dystonia, posturing muscle contracture resulting in joint deformity, bone deformation, joint subluxation or dislocation, and decreased functional independence[4]. Most children with CP ambulate with a stoop, stiff-knee gait, excessive hip flexion, toeing, or equinus[5].

Ambulation is frequently impaired in children with CP due to structural and functional limitations, which not only affect their health but also limit their ability to keep pace with their peers. Gait speed, often referred to as the sixth vital sign, is a simple, objective, and accurate measure of walking activity in children with CP and has been associated with functional ability and overall quality of life. The debilitating effects of CP include gait abnormalities, such as reduced gait speed. These mobility impairments and ambulatory difficulties can significantly limit a child's activities of daily living, diminishing their quality of life and capacity for social interaction. Gait speed may be predictive of

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community ambulation and, hence, is relevant for assessing disabilities[6]. Treatments for gait disorders in patients with CP are often complex and challenging. Orthopedic surgery, spasticity control, physical therapy, and orthotics are the four types of interdisciplinary interventions utilized for patients with gait difficulties[7].

Independent ambulation facilitates activities of daily living, enhances bone density and cardiovascular endurance, and reduces obesity, among other benefits. Consequently, independent ambulation is considered the primary objective of clinical and community-based rehabilitation for numerous children with cerebral palsy (CP). Therapeutic approaches for improving ambulatory capacity in children with CP include strength training, cardiopulmonary endurance training, functional electrical stimulation, task-oriented gait training, neurodevelopmental treatment approaches, and proprioceptive neuromuscular facilitation[8].

Kinesio tape (KT), also referred to as elastic therapeutic tape or elastic sports tape, possesses unique elastic properties that distinguish it from other strapping tapes. One study demonstrated that when utilized in conjunction with other treatment modalities, the KT technique may facilitate or inhibit muscle function and maintain joint structure in the upper extremities in hemiplegia[9]. The promising effects of KT have led to its application in studies assessing gait in diverse populations. Isolated trials have revealed positive effects of KT in healthy individuals and those with musculoskeletal disorders. Studies examining the effects of KT on individuals who have experienced strokes have also yielded promising results[10]. Multiple KT application designs can be employed, each with varying impacts. As the type of application influences the effect of KT, it is crucial to introduce diverse application methods to demonstrate its efficacy. The primary objective of this study was to determine the impact of KT on gait metrics and functional activities following gluteal taping.

METHOS

The study comprised 60 patients with spastic hemiplegia of both sexes, aged 4–12 years. The participants were randomly selected and allocated into two groups: a control group (n=30) and an experimental group (n=30). The control group subjects received conventional physiotherapy (a general exercise program/regular physiotherapy), which encompassed stretching, strengthening, endurance, balance, coordination, range of motion activities, and overground walking training, with an emphasis on the task-specific walking program, enhancing flexibility, improving the range of motion in the joints, enhancing arm and leg strength, improving coordination, and developing both static and dynamic balance[16].

In the experimental group, tape was applied to the affected side while the subject maintained a standing position. To protect the skin, a hypoallergenic tape was applied without tension. Subsequently, sports tape was applied to the protective tape with tension. The taping process involved placing three pieces of tape while the researcher provided support to the buttocks (Figure 1). The taping technique comprised three steps: (1) applying tension to the tape laterally and superiorly from the medial aspect of the gluteal fold towards the greater trochanter; (2) applying tape from the medial aspect of the gluteal fold to the superior aspect of the buttock above the gluteus maximus muscle belly, elevating the buttock; and (3) applying tape from the superior end of the second piece of tape to the greater trochanter. It is important to note that the tape was specifically applied to the buttock and not to the posterior aspect of the thigh[17]. Both the experimental and control groups received training in sessions of 45 minutes duration, three times per week, for a total period of 6 weeks (Figure 2).

Figure 1. Gluteal taping

Figure 2. Gait training in daily activity

Study setting

A private pediatric therapy center.

Sample size

Sixty subjects (30 in each group) with provisional diagnoses of spastic hemiplegic CP were referred to the physiotherapy department and were selected for the study.

Inclusion criteria

Children of both sexes aged 4–12 years who were diagnosed with spastic hemiplegic cerebral palsy. The participants were selected based on their Ashworth spasticity grades, which ranged from 1 to 4.

Exclusion criteria

were as follows: children who had undergone orthopedic surgery or injections of botulinum toxin, oral tablets, or intrathecal myorelaxing medicines; children with significant limitations in the passive range of motion in the lower limbs; and children with no mental impairment. Children with CP were excluded when they had been diagnosed with ataxia, dystonia, or seizures in the past and had participated in therapeutic programs other than physical therapy[11].

Outcome measures

The study commenced with an assessment of the outcomes of participants prior to the treatment program. The same outcomes were reassessed following the completion of the study. The Modified Ashworth Scale was utilized to evaluate spasticity in the hip adductors, hamstrings, gastrocnemius muscles, and soleus muscles by examining the joint angle at which a 'catch' occurred during a rapid passive stretch[12].

Each participant's gait parameters were measured using a measuring tape to determine the distance traversed before and after the treatment program (Figure 3). Step length was defined as the average distance covered in a step, either from heel to heel or toe to toe. Stride length was defined as the distance between two successive placements of the same foot. Cadence was defined as the number of steps per given time[13].

The Timed Up and Go test was employed to assess the improvement in an individual's functional ability. The procedure commenced with the patient in a seated position. The patient then stood up, walked 3 m, turned around, walked back to the chair, and sat back down when instructed by the therapist. The entire procedure was subsequently performed. Participants were permitted to use assistive equipment, and the assistive device utilized was documented[14]. The lower extremity functional scale was employed to assess the functional status of the lower extremity[15].

RESULTS

Data analysis and interpretation

Sixty children were enrolled in the study, comprising 35 males and 25 females diagnosed with spastic hemiplegic CP (Table 1). The control group consisted of 17 males and 13 females, with a mean age of 6.85 years and a standard deviation of 2.27. The study group included 18 males and 12 females, with a mean age of 6.40 years and a standard deviation of 2.18.

Figure 3. Assessment of step length and stride length using coloured footprints

Table 1. Descriptive data

Group	Sex		Age	SD
	Male	Female	Mean	
Conventional group	17	13	6.85	2.27
Experimental group	18	12	6.40	2.18

The paired sample t-test was employed to compare the pre- and post-test values of the conventional and experimental groups. The Wilcoxon signed-rank test was utilized to compare the Ashworth Scale scores within the groups (Table 2).

Table 2. Comparison within groups—conventional group and experimental group

	Pre-test value		Post-test value		t value
	Mean	sd	Mean	sd	
Step length					
Conventional group	25.40	8.13	30.30	7.94	-15.07
Experimental group	22.65	7.19	40.00	7.91	-20.63
Stride length					
Conventional group	43.25	15.52	47.40	15.85	-6.59
Experimental group	39.65	13.27	69.25	16.97	-11.29
Cadence					
Conventional group	52.90	10.00	58.95	10.62	-11.29
Experimental group	58.05	10.93	78.15	10.33	-22.48
Lower extremity functional scale					
Conventional group	41.60	12.14	54.40	10.18	-14.82
Experimental group	37.90	7.93	61.30	10.05	-13.72
Timed Up and Go test					
Conventional group	42.80	12.19	37.80	10.75	9.65
Experimental group	43.15	10.73	24.20	6.00	10.54
Ashworth Scale					
Conventional group	2.35	0.48	1.60	0.59	7.55
Experimental group	2.45	0.51	1.20	0.41	10.16

An independent sample t-test was conducted to compare the conventional and experimental groups. The Mann-Whitney test was employed to evaluate the post-test Modified Ashworth Scale values (Table 3). The results demonstrated a statistically significant improvement in the experimental group compared with the control group ($p<0.05$).

Table 3. Comparison of between groups—conventional and experimental groups

	Pre-test value Mean ± sd	Post-test value Mean ± sd	t value	p value
Step length				
Conventional group	25.40 ± 8.13	30.30 ± 7.94	-1.13	0.000*
Experimental group	22.65 ± 7.19	40.00 ± 7.91	3.84	
Stride length				
Conventional group	43.25 ± 15.52	47.40 ± 15.85	-0.78	0.000*
Experimental group	39.65 ± 13.27	69.25 ± 16.97	4.20	
Cadence				
Conventional group	52.90 ± 10.00	58.95 ± 10.62	1.55	0.000*
Experimental group	58.05 ± 10.93	78.15 ± 10.33	5.79	
Lower extremity functional scale				
Conventional group	41.60 ± 12.14	54.40 ± 10.18	-1.14	0.038*
Experimental group	37.90 ± 7.93	61.30 ± 10.05	2.15	
Timed Up and Go test				
Conventional group	42.80 ± 12.19	37.80 ± 10.75	0.09	0.000*
Experimental group	43.15 ± 10.73	24.20 ± 6.00	-4.93	

Ashworth Scale				
Conventional group	2.35 ± 0.48	1.60 ± 0.59	0.63	0.019*
Experimental group	2.45 ± 0.51	1.20 ± 0.41	-2.46	

DISCUSSION

The results demonstrated that gluteal taping produced significant improvement, and these findings are consistent with those of previous studies. The effects of kinesio taping on elbow extensor muscles during reaching in right-sided hemiparetic stroke patients were examined and compared. Taping improved elbow extensor function by increasing the velocity and efficiency of the taped arms. The untaped arms exhibited reduced speed and efficiency. This finding corroborates our primary hypothesis that taping facilitates arm movement. In this study, taping enhanced the right upper extremity movement in right-handed patients with right-sided hemiparetic stroke. This result aligns with previous research conducted on healthy adults, adults affected by CP, and stroke patients. Taping could thus potentially assist patients with right-sided hemiparetic stroke in improving their right upper extremity movement[18].

An exploratory study was conducted to investigate the immediate and short-term effects of tape, in conjunction with traditional physiotherapy, in enhancing seated postural stability in stroke patients. The authors of this study hypothesized that taping the thoracic spine and abdominal muscles would improve pelvic alignment and forward reach in patients with stroke. These findings demonstrated an immediate improvement in sitting balance in stroke patients and may contribute to minimizing the adverse outcomes of postural asymmetry in sitting after a stroke[19].

A physical therapist, proficient in Kinesio Taping (KT) techniques, meticulously cleansed the designated area with an alcohol swab prior to applying I-shaped elastic KT to the four trunk muscles, extending from their insertion to their origin, utilizing the following positions: in the hooking position, the KT was applied to the rectus abdominis muscle from the xiphoid process and the fifth to seventh costal cartilages to the proximity of the pubic symphysis. In the side-lying position, KT was affixed to the external oblique muscle from the inguinal region to the T12 spinous process and from the xiphoid process to the anterior region of the iliac crest in the same position as the internal oblique muscle. For the erector spinae muscle, KT was administered from the ipsilateral transverse process at T12 to the posterior sacral iliac crest. The results demonstrated that applying KT to trunk muscles is highly efficacious for improving balance in stroke patients[20].

The purpose of therapeutic taping is to engage neuromuscular function and provide mechanical support to the shoulder. Patients were provided with tape with a width of 5 cm. The facilitation approach was employed to tape the deltoid, supraspinatus, and teres minor muscles. The supraspinatus was initially taped. The shoulder was positioned in a 30° abduction posture with mild flexion and internal rotation, and the humeral head was restored to its normal position. The initial 4 cm tape was applied without tension at the original supraspinatus location. The remaining strip was then wrapped around the muscle to the insertion point with 25–50% of the full possible tension. Subsequently, the patient's shoulder was abducted to 30°. The central part of the deltoid muscle was taped by applying the first 4 cm of the strip over the acromion process with no stretch and stretching the rest of the strip downward to the deltoid tuberosity with 20–30% stress. The shoulder was flexed with slight internal rotation before taping the teres minor.

The study found that Kinesiology taping is beneficial for hemiplegic shoulder pain. Kinesiology taping has demonstrated efficacy as a method for alleviating shoulder discomfort, increasing the active range of motion (AROM), reducing subluxation, and enhancing muscular activation in individuals experiencing hemiplegic shoulder discomfort after a stroke[21]. Consistent with other related studies, the present study indicated that kinesio gluteal taping could improve gait parameters in children with spastic hemiplegia.

CONCLUSION

Gluteal taping resulted in a statistically significant improvement in gait parameters among children with spastic hemiplegic cerebral palsy. This improvement was attributed to reduced stiffness and enhanced functional capacity. While conventional treatment also yielded positive outcomes for all parameters, the children who received gluteal taping demonstrated significantly greater improvements. These findings suggest that gluteal taping may be an efficacious intervention for children with hemiplegic CP, as it can enhance gait measurements and overall functional performance.

Ethical approval: The design of the study was approved by Ethical Committee, Holy cross college, Tiruchirappalli, India (HCC-26/11/20). Written informed consent was obtained from the parents of the children included in the study

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