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Original study

Kinesiology taping Vs conventional physiotherapy in improving neuromuscular and gait outcomes in ambulatory children with spastic cerebral palsy: A randomized controlled trial.

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Abstract

Background:
Neuromuscular impairments and gait dysfunction are common in children with spastic cerebral palsy and significantly affect functional mobility. Kinesiology taping has been proposed as an adjunct intervention to enhance neuromuscular performance.

Objective:
To compare the effects of kinesiology taping and conventional physiotherapy on neuromuscular function and gait performance in ambulatory children with spastic cerebral palsy.

Methods:
This randomized controlled trial included 85 ambulatory children with spastic cerebral palsy aged 3–12 years (GMFCS I–III). Participants were assigned to kinesiology taping (44) or conventional physiotherapy (41) groups. Interventions were administered 3 times weekly for 12 weeks.

Results:
Out of the 85 total participants, 47 were male, while 38 were female. The mean age of the participants in the KT and conventional PT groups was 7.89 ± 2.77 years and 7.71 ± 2.70 years, respectively, with a mean weight of 26.11 ±7.07kg and 25.50 ± 6.76kg, respectively. There was no significant difference in the physical characteristics of participants between the two groups at baseline ($p>0.05$). The KT group showed significant improvements in neuromuscular function ($p = 0.001$) and gait performance ($p =0.001$) over the intervention period. The conventional physiotherapy group showed significant improvement in gait performance ($p =0.001$) but not in neuromuscular function ($p = 0.151$). Between-group comparisons revealed no statistically significant differences at baseline, 6 weeks, or 12 weeks for both PNRS and EVGS ($p > 0.05$).

Conclusion:
Kinesiology taping improves both neuromuscular function and gait performance in ambulatory children with spastic cerebral palsy after 12 weeks of intervention, but does not demonstrate clear superiority over conventional physiotherapy.

Recommendation:
Clinicians should incorporate kinesiology taping into the rehabilitation of ambulatory children with spastic cerebral palsy, as an alternative to conventional physiotherapy, particularly for improving neuromuscular function and gait performance.

Keywords: cerebral palsy; kinesiology taping; gait performance; neuromuscular function; pediatric rehabilitation
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Background of the Study

Cerebral palsy (CP) is the most common cause of motor disability in childhood, with a prevalence of approximately 2–3 per 1,000 live births.[1,2] It is characterized by permanent disorders of movement and posture resulting from non-progressive disturbances in the developing brain.[3,4]

Children with spastic CP commonly present with neuromuscular impairments such as muscle weakness, impaired selective motor control, and abnormal muscle tone, which contribute to gait abnormalities including equinus, crouch gait, and stiff-knee gait.[5,6] These impairments significantly limit functional mobility and independence.[7]

Conventional physiotherapy, including strengthening, stretching, and task-specific training, remains the cornerstone of management.[8,9] However, it may not fully address deficits in neuromuscular control and gait performance.

Kinesiology taping (KT) has gained popularity as a therapeutic modality aimed at enhancing proprioception, facilitating muscle activation, and improving joint alignment through cutaneous stimulation.[10,12] Previous studies have suggested that KT may improve motor function and postural control, although evidence remains inconsistent.[13,15]

Given the increasing clinical use of KT and the need for evidence-based practice, this study aimed to compare the effectiveness of KT and conventional physiotherapy in improving neuromuscular and gait outcomes in ambulatory children with spastic cerebral palsy.

Methodology

Eighty-five ambulatory children diagnosed with spastic cerebral palsy (GMFCS levels I–III), aged 3–12 years, were recruited from selected hospitals in Lagos, Nigeria, where they were undergoing physiotherapy. Those who met the inclusion criteria were randomly selected into 2 groups: the KT group (44) and the conventional PT group (41) using the fishbowl method of randomization (Figure 1).

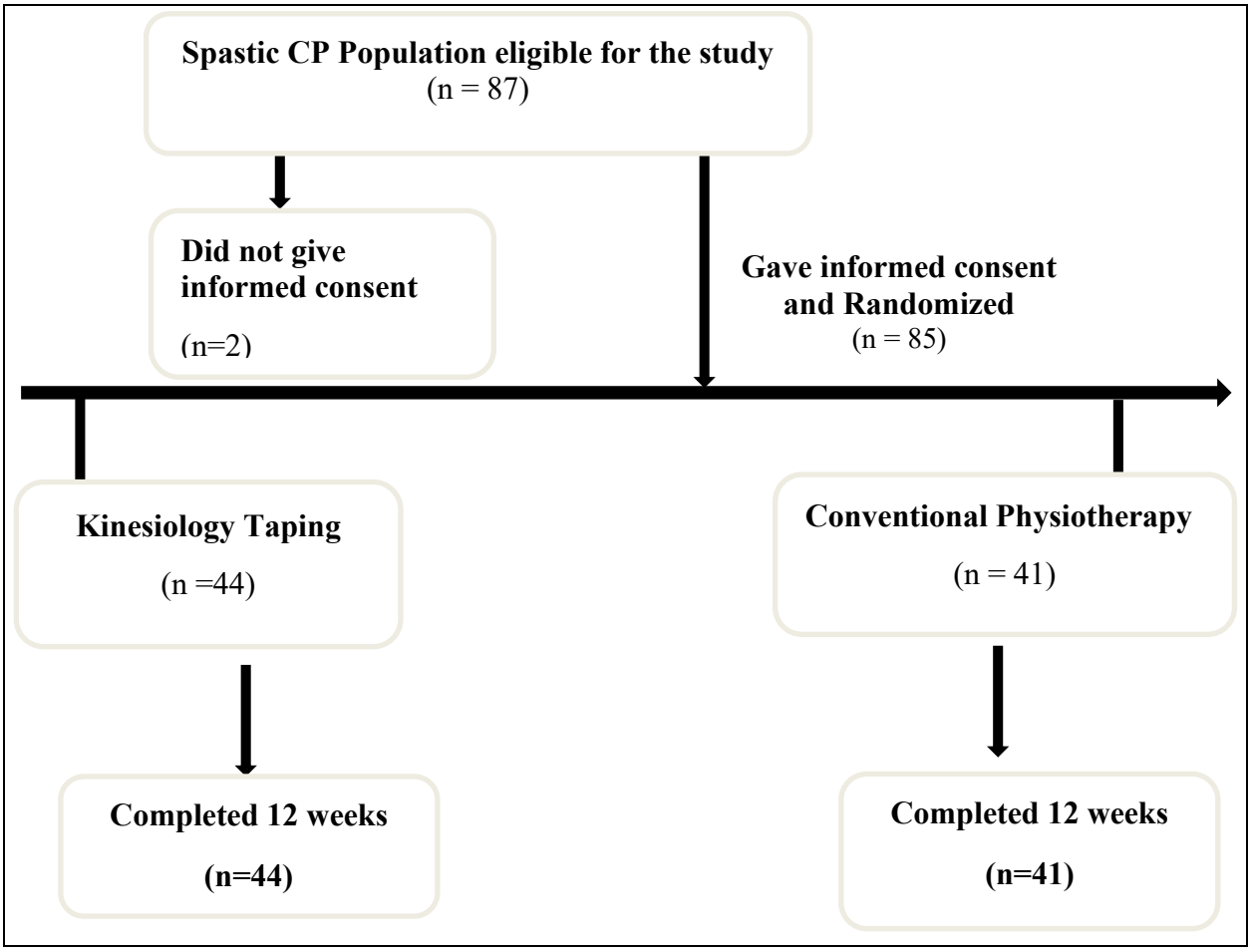

Figure 1: Flow Chart Diagram of participants in the study.

Inclusion criteria:

- Diagnosis of spastic cerebral palsy
- Ability to ambulate independently or with assistive devices
- Age 3–12 years old

Exclusion criteria:

- Recent orthopedic surgery (<6 months)
- Botulinum toxin injection within 6 months
- Severe cognitive impairment

Procedure for data collection:

Participants who met the inclusion criteria and whose parents/guardians gave informed consent were randomly assigned to either group 1(KT) or 2 (conventional PT) using the fish bowl method. A total of 100 papers were wrapped and put in a pool. There were 50 papers for each of the groups. Each participant was made to pick a number as they became available and assigned to the group corresponding to the number they picked.

The study was double-blinded to both the participants and the research assistants (RAs). Two groups of blinded RAs (a total of 6), who are licensed physiotherapists with not less than two years of working experience, were trained on the assessment, treatment procedures, and data collection processes. The first set of RAs served to administer the treatments (4 physiotherapists = 2 per group) while the other set (2 physiotherapists) served to assess the participants. The RAs who treated the participants were blinded to the groups of the participants, while those who served to assist in assessments were blinded to both the group and the treatment. The participants were also blinded to their group.

Intervention Protocol

Kinesiology Taping:

Kinesiology tape (Kinesio Tex Gold Light Touch (LT)®, Black colour USA) was applied to each participant's trunk and lower extremities according to Kenzo Kase's Kinesio taping method.10 Specifically, this was on the erector spinae, gluteus medius, hamstrings, rectus femoris, gastrocnemius, and tibialis anterior.

For the erector spinae muscle application, the participants were bent slightly forward in a sitting position, two I-strips tapes were applied 1-2cm lateral to the spinous processes from the sacrum to the 10th or 12th Thoracic vertebrae (T10-T12) using the muscles technique of 30% stretch (Figure 2). For the gluteus medius muscle, two I-strips (one on each side of the spine) were applied from the iliac crest to the greater trochanter. The base of the tape was placed unstretched with the subject in a neutral body position. For the hamstring muscles (medial and lateral), I-strip tape was applied with 10% stretch from the Ischial tuberosity through the posterior thigh and anchored at the fibular head without stretch.

For the rectus femoris, the tape was applied from 10 cm below the anterior superior iliac spine to the superior edge of the patella (without tension). The tape was then crossed from the edges of the patella (with maximum tension) and fixed below the inferior edge of the patella while the knee was flexed.

For the tibialis anterior muscle, the kinesiology tape was attached along a line that passed the medial epicondyle of the ankle and the medial sole and went to the centerline of the instep with the ankle in a state of plantar flexion.

Parents/guardians were instructed to leave the tape on the participants till they come for the next session, when it will be removed and replaced with new ones. They were taught how to maintain them during bathing or play activities. This was done 3 times per week for a total of 12 weeks.

Figure 2: A participant receiving kinesiology taping to the erector spinae muscle

Conventional Physiotherapy Group:

Participants allocated to this group received a neurodevelopmental and task-oriented physiotherapy programme, commonly used in the management of children with spastic cerebral palsy, according to standard protocol for 30-45 minutes.8,9 This includes:

1. Passive Stretching held for 30 seconds, 5 repetitions per muscle group
2. Bridging exercise (8 repetitions, 3 sets)

3. Sit to stand exercises (10 repetitions, 3 sets)
4. Reaching tasks in standing (3-5 minutes)
5. Standing balance training (5-10 minutes)
6. Walking education/gait training (3-5 minutes)

This was carried out 3 times per week for a total of 12 weeks.

Outcome Measures

Neuromuscular function: Paediatric Neuromuscular Recovery Scale (PNRS)
Gait performance: Edinburgh Visual Gait Score (EVGS)
Assessment Timeline: Baseline, 6 weeks, and 12 weeks

Ethical Approval:

This was sought and obtained from the College of Medicine, University of Lagos Health Research and Ethics Committee (Health Research Committee assigned number: CMUL/HREC/08/24/1573)

Trial Registration:

The study was also registered with the Pan African Clinical Trial Registry with a unique identification registry number PACTR202504754023730

Data Analysis

Data were analyzed using IBM SPSS Statistics (version 27.0). Continuous variables were presented as mean ± standard deviation, while ordinal outcomes were reported as median (interquartile range). Within-group comparisons were performed using the Friedman test with Dunn–Bonferroni post hoc analysis. Between-group comparisons were conducted using the Mann–Whitney U test. Statistical significance was set at $p < 0.05$.

Results

Baseline Characteristics

There were no statistically significant differences between the KT and conventional physiotherapy groups in age, height, or weight ($p > 0.05$), indicating baseline comparability (Table 1).

Table 1: Comparison of Physical Characteristics of Participants Between both Groups

Variable	KT Mean ± SD	Conventional PT Mean± SD	p-value
Age (years)	7.89 ± 2.77	7.71 ± 2.70	0.158
Weight (kg)	26.11 ±7.07	25.50 ± 6.76	0.241
Height (cm)	124.76 ± 17.28	123.34 ± 17.05	0.267

Key: KT: Kinesiology Taping
PT: Physiotherapy

Within-Group Comparisons

Neuromuscular Function (PNRS)

The KT group showed Significant improvement (P =0.001) while Conventional physiotherapy showed no significant improvement (p = 0.151) (Tables 2 and 3)

Gait Performance (EVGS)

Both KT and Conventional PT groups showed Significant improvement (p=0.001) (Tables 2 and 3)

Table 2: Within-group Comparison of Pediatric Neuromuscular Recovery Scale Score at Baseline, 6-week, and 12-week Intervention

Outcome	Group	Median Score			p-value
		Baseline	6-Week	12-week	
PNRS	KT	15.00	[16].00	17.00	0.001*
	Conventional PT	14.00	15.00	15.00	0.151
EVGS	KT	28.50	23.00	20.00	0.001*
	Conventional PT	31.00	27.00	26.00	0.001*

**Significant at p≤0.05*
Key: PNRS: Pediatric Neuromuscular Recovery Scale
EVGS: Edinburg Visual Gait Score
KT: Kinesiology Taping
PT: Physiotherapy

Table 3: Post-hoc Test for Within-Group Comparisons of Duration of Intervention for Neuromuscular and Gait Functions

Outcome	Group	Test Variable		Z value	p value
PNRS	KT	Baseline	6-week	-5.77	0.001*
			12-week	-5.64	0.001*
		6-week	12-week	-5.29	0.001*
	Conventional PT	Baseline	6-week	-4.37	0.072
			12-week	-3.89	0.063
		6-week	12-week	-0.45	1.000
EVGS	KT	Baseline	6-week	-5.75	0.001*
			12-week	-5.59	0.001*
		6-week	12-week	-4.63	0.001*
	Conventional PT	Baseline	6-week	-5.33	0.001*
			12-week	-5.29	0.001*
		6-week	12-week	-2.04	0.731

**Significant at p ≤ 0.05.*
Key: PNRS: Pediatric Neuromuscular Recovery Scale
EVGS: Edinburg Visual Gait Score
KT: Kinesiology Taping
PT: Physiotherapy

Between-Group Comparisons

There was no statistically significant difference between the two groups across the duration of intervention for both PNRS and EVGS (P>0.05) (Table 4)

Table 4: Comparison of Neuromuscular and Gait Functions Between Groups at baseline, 6-week and 12- week Intervention

Outcome	Duration	KT (Median Score)	Conventional PT (Median Score)	p value
PNRS	Baseline	15.00	14.00	0.569
	6 weeks	16.00	15.00	0.232
	12 weeks	17.00	15.00	0.061
EVGS	Baseline	28.50	31.00	0.299
	6 weeks	23.00	27.00	0.178
	12 weeks	20.00	26.00	0.063

PNRS: Pediatric Neuromuscular Recovery Scale
EVGS: Edinburg Visual Gait Score
KT: Kinesiology Taping
PT: Physiotherapy

Discussion

This study investigated the comparative effects of kinesiology taping and conventional physiotherapy on neuromuscular and gait outcomes in ambulatory children with spastic cerebral palsy. The findings demonstrate that KT produced significant improvements in both neuromuscular function and gait performance, whereas conventional physiotherapy resulted in significant improvements only in gait.

The observed improvements in the KT group may be attributed to enhanced proprioceptive input and facilitation of neuromuscular activation via cutaneous stimulation. The application of elastic tape is believed to stimulate mechanoreceptors, thereby improving sensorimotor integration and motor unit recruitment.[10,11] These mechanisms are consistent with previous reports indicating that KT can modulate muscle activation patterns and improve functional performance.[16]

Despite these within-group improvements, between-group comparisons did not reach statistical significance. This suggests that while KT is effective, it may not be superior to conventional physiotherapy when used as a standalone intervention. However, the consistent trend toward greater improvements in the KT group, particularly at 12 weeks, indicates potential clinical relevance. This aligns with

emerging evidence emphasizing the importance of sustained neuromodulatory interventions in pediatric neurorehabilitation.[17,18]

From a clinical perspective, KT may serve as a valuable alternative to conventional physiotherapy. Its ease of application, low cost, and non-invasive nature make it particularly suitable for pediatric populations.

Conclusion

Kinesiology taping significantly improves neuromuscular function and gait performance in children with spastic cerebral palsy. Although it does not demonstrate clear superiority over conventional physiotherapy, it may provide additional clinical benefits and should be considered as an alternative in rehabilitation programs.

Recommendation

Based on the findings of this study, it is recommended that clinicians should incorporate kinesiology taping into the rehabilitation of ambulatory children with spastic cerebral palsy, as an alternative to conventional physiotherapy, particularly for improving neuromuscular function and gait performance.

Acknowledgement

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Limitations:

This study is limited by funding, with the use of the Edinburgh Visual Gait Score (EVGS) and Pediatric Numeric Rating Scale (PNRS), both of which may be subjective and may be influenced by assessor variability and participant response bias, as opposed to the use of an instrumented 3D motion gait system and surface electromyography, respectively.

Generalizability:

The generalizability of these findings is limited by the study sample, which may not be representative of the broader pediatric population with cerebral palsy in terms of age range, severity, and functional levels.

Data availability:

Data is available upon request.

Author contribution:

BIA: Conceptualization, data collection, data analysis, manuscript preparation
CAG: Conceptualization, research supervision, data analysis, manuscript review
DOO: Research supervision, manuscript review

List of Abbreviations

CP – Cerebral Palsy
KT – Kinesiology Taping
WBV – Whole-Body Vibration
PNRS – Paediatric Neuromuscular Recovery Scale
EVGS – Edinburgh Visual Gait Score
GMFCS – Gross Motor Function Classification System
RCT – Randomized Controlled Trial
IQR – Interquartile Range
SD – Standard Deviation

Source of Funding

No external funding was received for this study. The research was self-funded by the first author.

Conflict of Interest

None declared.

Author Biography

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