RESEARCH ARTICLE

A comparative study to assess the effect of balance training with and without taping on balance in stroke patients

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Abstract

Objective: To evaluate the effect of balance training with and without taping on balance in patients with sub-acute or chronic stroke.

Method: The parallel-arm, prospective study was conducted at the Pakistan Institute of Rehabilitation Sciences, Islamabad, Pakistan, from May to August 2023, and comprised stroke patients of either gender aged >35 years who had a stroke onset history of at least three months. The patients were randomised into experimental group A, exposed to balance training with taping, and control group B, exposed to balance training without taping. The intervention was administered for 30 minutes per day, three sessions per week for four consecutive weeks. The Berg Balance Scale was used at baseline and post-intervention. Data was analysed using SPSS 26.

Results: Of the 36 participants with mean age 52.19 ±11.38 years, 18(50%) were in group A; 11(61.1%) females and 7(38.39%) males. The remaining 18(50%) patients were in group B; 10(55.6%) females and 8(44.4%) males. Both the groups showed significant improvement in terms of balance recovery compared to baseline values ($p<0.05$), but group A patients showed significantly higher results than their group B counterparts ($p<0.05$).

Conclusion: Balance training with taping was found to be more effective for the improvement of balance than balance training without taping in sub-acute to chronic stroke patients.

Keywords: Balance training, Taping, Stroke patients, Comparative study, Balance improvement. (JPMA 76: 672; 2026)

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Introduction

The World Health Organisation (WHO) states that a cerebrovascular accident is characterised by rapidly developing clinical manifestations of a localised or global functional imbalance of the brain, symptoms that persist at least a day or more, or that result in death, and symptoms that are solely caused by vascular damage.[1] Stroke is estimated to occur in 5.5 million people globally each year, and affects 13.7 million people worldwide in one year, making it the second most common cause of death.[2]

The majority of chronic stroke patients have lower limb somatosensory deficits. When at least six months have passed since the first stroke, the condition is considered to be chronic.[3] In 2019, there were 101.5 million stroke cases worldwide. Stroke is becoming the second leading cause of death worldwide, and 50% of occurrences of stroke result in persistent movement difficulties because of residual hemiparesis in the limbs.[4]

Balance issues are common in stroke patients because of neurological problems.[5] Due to uneven weight support when standing, postural sway on the forehead rises in stroke patients, and the more the body sways, the accuracy of the action is lost even more. The loss of eyesight and proprioception of the ankle joint is a factor in postural agitation in stroke patients.[6]

Among older adults, stroke is considered the most common cause of falls. This is due to the fact that balance disorders, which are a frequent complication of stroke that affect activities of daily living (ADLs) and increases the risk of falls in stroke patients.[7] Balance training is one of the key components in stroke rehabilitation with the purpose of improving static and dynamic balance. The primary concern in stroke rehabilitation is to prevent falls among patients so balance training is included in rehabilitation programmes.[8,9]

There are different treatment technique to enhance balance of the impaired limb for patients of cerebrovascular accidents (CVAs), including balance exercises and Kinesio Taping (KT).[10] Balance exercises are one of the simplest, patient-centred treatment protocols to enhance balance of stroke patients. Previous studies enumerate balance exercises that include intense balance training programme, including five minutes of warm-up, 10 minutes of static balance exercises, such as squats (two leg stance) and leg stance, 10 minutes of dynamic balance exercises, such as jogging end to end, 10 minutes of sideways walking or

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running with crossovers, 10 minutes of forward walking or running along a zigzag line, and five minutes of cool-down.[11] The exercise paired with KT may be utilised to help back pain patients with their pain and postural balance because KT is simpler to use than other types of treatments.[12] KT is mostly utilised for stroke victims' lower-limb physiotherapy since it has the impact of improving balance and gait.[11,13]

Stroke is common and affects balance, but sustained proprioceptive neuromuscular facilitation (PNF) on alternating periods helps connect signals to the brain, improving neuromuscular facilitation by sending constant neural signal to higher centres with increased synapsis transmission and formation, enhancing balance in stroke patients.[14] There are different methods for neurological muscular facilitation, but balance training with taping provide a constant PNF signal for enhancement of balance as it has advantages over other methods, including easy application and accessibility.[15,17] Though balance training in earlier trials was equally beneficial in enhancing stroke patients' gait and balance abilities, not much research has been done on the effects of tape directly applied during exercises for balance.[18] The current study was planned to evaluate the effect of balance training with and without taping on balance in patients with sub-acute or chronic stroke.

Patients and Methods

The parallel-arm, prospective study was conducted at the Pakistan Institute of Rehabilitation Sciences, Islamabad, Pakistan, from May to August 2023. After approval from the institutional ethics review board and the ethics review committees of Shifa Tameer-e-Millat University, Islamabad, and the Shifa International Hospital, Islamabad, the sample size was calculated using OpenEpi with alpha value 95% and power 80% in line with literature.[19] The sample was raised using non-probability convenience sampling technique, in line with Consolidated Standards of Reporting Trials (CONSORT) guidelines,[20] from among patients visiting the Pakistan Institute of Medical Science (PIMS), Islamabad. Those included were spastic paralysis of the lower limb patients of either gender aged >35 year. The participants had hemiparesis with stroke onset of >3 months and <18 months, and could walk >10 meters independently, with or without a walking aid, and who had a Mini-mental state of examination (MMSE) score of 24 or higher[21] and could understand the goals of the study. Those who have had surgery on their lower extremities in the past, had skin conditions or extremely sensitive skin, those who reported pain during dorsiflexion of the ankle joint, and those with a modified Ashworth Scale score >2 were excluded.[22]

After taking written informed consent, the patients were randomised using the lottery method with the help of pre-sealed opaque envelops. Those in experimental group A received balance training with taping, while those in control group B received balance training without taping. Data was collected using a self-structured questionnaire.

In group B, the balance training plan included 5 minutes of warm-up period, 10 minutes of static balance exercises, such as squats (two-leg stance), and one-leg stance, 10 minutes of dynamic balance exercises, such as jogging end to end, sideways walking or running with crossovers, forward walking or running in a zigzag line, backward walking or running in a zigzag line, and 5 minutes of cool-down period.[11]

In group A, KT was used for ankle taping for supporting the ankle joint.[13] The tibialis anterior, peroneus tertius, peroneus longus and extensor hallucis longus muscles, which are frequently utilised to stabilise the ankle joint in stroke patients, were taped.[17] Each subject underwent 20 minutes of balancing training while having KT applied to the four muscles. The peroneus tertius was stabilised by supinating the ankle joint and attaching one end of the tape to the 5th metatarsal on the involved side, and the opposing end to the fibular 1/3 area in the direction of the muscle fibres. With the ankle joint supinated, one end of the tape was secured to the base of the first metatarsal, and the other end was secured to the lateral process of the fibula in the direction that the muscle fibres ran for peroneus longus. One end of the tape was inserted between the big toe and the index toe, while the ankle joint was pronated on the affected side. The other end of the tape was then linked to the tibialis anterior in the direction that the muscle fibre ran. One end of the tape was divided

Figure-1: Taping applied to the ankle joint on the paralysed side of a stroke patient.

into four pieces, and the tape was applied to the extensor digitorum longus by placing it from the second to the fifth toe on the paralytic side, and across the fibular 2/3 region (Figure 1). Each participant had 20 minutes of balance training with KT applied to the four muscles. Warm-up and cool-down exercises were performed for 5 minutes before and after the intervention.

The intervention in both the groups was administered for 30 minutes per day, three sessions per week for four consecutive weeks. The Berg Balance Scale (BBS) was used at baseline and post-intervention to assess balance.[23]

Data was analysed using SPSS 26. Data normality was testing using the Shapiro-Wilk test, and it was found to be normally distributed. Parametric tests, including independent sample test for intergroup analysis and paired sample t test for intragroup analysis, were used. P<0.05 was considered significant.

Results

Of the 55 patients assessed, 36(65.45%) were included (Figure 2). The overall mean age was 52.19±11.38 years. There were 18(50%) patients in group A; 11(61.1%) females and 7(38.39%) males with mean age 53.83±11.38 years. The remaining 18(50%) patients were in group B; 10(55.6%) females and 8(44.4%) males with mean age 50.56±11.46 years.

In group A, the affected side was right in 9(50%) cases and left in the remaining 9(50%). The mean duration of onset was 8.96±4.69 months, and the mean MMSE score was 26.06±0.73 points. In group B, the affected side was right in 10(55.5%) cases and left in 8(44.4%). The mean duration of onset was 10.77±4.18 months, and the mean MMSE score was 26.50±0.70 points (Table 1).

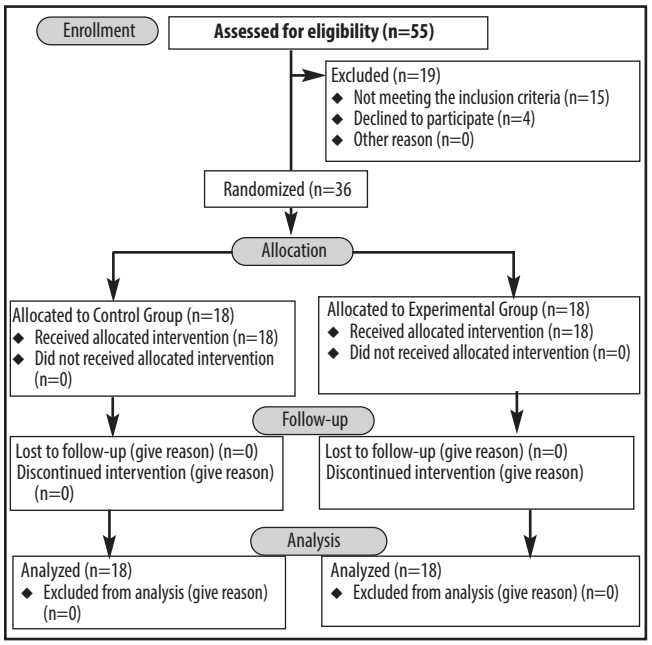

Figure-2: Consolidated Standards of Reporting Trials (CONSORT) flowchart.

Table-1: Patient characteristics (n=36).

Characteristics	Experimental Group (n=18)	Control Group (n=18)
Mean Age (years)	53.83±11.39	50.56±11.47
Weight (kg)	71.33± 8.89	74.05±11.02
Height (cm)	146.56± 37.11	157.72±21.84
Disease Duration(months)	8.96± 4.69	10.78± 4.18
MMSE (points)	26.06±0.73	26.5± 0.70
Right Side Body Stroke	9	10
Left Side Body Stroke	9	8

MMSE: Mini-mental state of examination.

Table-2: Intergroup comparison of Berg Balance Scale scores.

Berg Balance Scale	Pre (mean±SD)	Post (mean±SD)	p-value
Experimental Group	37.83±1.38	50.06±2.60	0.001
Control Group	37.33±1.61	41.5±2.23	

SD: Standard deviation.

Both the groups showed significant improvement in terms of balance recovery compared to baseline values ($p<0.05$), but group A patients showed significantly higher results than their group B counterparts ($p<0.05$) (Table 2).

Discussion

In the current study, the use of KT showed significant improvement in balance compared to barefoot treatment. A recent study showed KT helped chronic stroke patients with their balance and ankle dorsiflexion-range of motion.[17] Another study concluded that treating stroke patients with ankle non-elastic tape could greatly enhance their ability to walk and balance.[18] The use of KT appears to be an efficient physical therapy approach in hemiplegic individuals.

A study investigated the immediate effects of KT with respect to tibialis anterior and ankle joint on mobility and balance ability among chronic hemiparesis cases. KT was used to treat the leg muscle in the anterior compartment, and the findings implied that KT might aid stroke patients in walking more effectively.[24]

A study revealed that PNF-KT improved static balance by enhancing tibialis anterior functional muscles' ability to work together synergistically. The study also analysed joint position sense (JPS), which is the ability to recognise joint position. After KT, JPS in the paralysed ankle greatly improved.[25]

The current study has limitations as the sample was not representative of the national population. Large-scale,

multicentre studies are needed to validate the current findings, and to explore the cause-effect relationship of individual muscles with proprioception.

Conclusion

Balance training with KT considerably improved balance compared to balance training without KT, indicating that KT is a potentially effective therapeutic approach for enhancing mobility in patients with sub-acute to chronic stroke.

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Conflict of Interest: None.

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Author Contribution:

AFK: Concept, design, data acquisition, analysis, interpretation, drafting, final approval and agreement to be accountable for all aspects of the work.

FB: Concept, design, drafting, final approval and agreement to be accountable for all aspects of the work.

SG: Drafting, final approval and agreement to be accountable for all aspects of the work.

RH & EK: Data acquisition, analysis, interpretation and agreement to be accountable for all aspects of the work.

SF: Data acquisition, analysis and interpretation.