

EFFECT OF LOWER LIMB KINESIO-TAPING ON BALANCE AND WALKING IN STROKE PATIENTS

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Key points: -kinesio taping, stroke, lower extremity weakness, balance, gait, muscle strength, Muscle fiber tension, sensory nerve activity, irradiation phenomenon

Abstract

In this research article, Kinesiology tape was applied to lower extremities of the paralyzed parts of the patients to analyze the effects on gait and balance ability. The improvement of balance and walking ability can be induced by direct stimulation of muscles of paralyzed parts of extremities(Song MH, 2008). This study showed significant differences in results of berg balance scale(BBS) and 10 meter walk test applying kinesiology taping directly to paralyzed parts of body($p < 0.001$). Based on this result, it can be inferred that applying Kinesiology taping facilitating muscle activation in non-paralyzed parts of the body, induced gait symmetry and decreased weight bearing on non-affected side.

INTRODUCTION

Stroke is a central nervous system disease that causes partial loss and functional disorder of the brain due to a disability of blood supply in blood vessels of the brain (Prange GB, 2006). Stroke patients showed abnormal walking patterns as compensation due to muscular weakness and loss of balance ability (Wall JC, 1979). They experience a decrease in balance and walking

ability because of symmetrical weight shifting incapability and display an asymmetrical step length as a result of the relatively weakened acceleration force of paralyzed extremities(Roerdink M, Beek PJ; 2011). Since the gait of hemiplegic patients shows decreases in partial muscle control and synkinetic patterns, efficient treatment plans and exercise methods are needed to achieve a normal walking pattern (Kim K, Lee, 2011).

Kinesiology tape was developed by Japanese chiropractor kensokase in 1970s as a method of assisting physical treatment of damage tissue while maintain full range of motion-unlike traditional taping method, which restrict movement.

Mechanism of taping with regard to the enhancement of muscle strength and muscle control is that cutaneous fusimotor reflex increases fiber tension, resulting in excitation of primary and secondary nerve endings, thus, helping afferent sensory nerve activity (Delahunt E, Lim C, 2013). The mechanism of taping is improvement of muscle strength by excitation of gamma motor nerves in skeletal muscles as the

taped part raises the tension of fiber(Murphy PR, Lee MH, 2011).

By ultimately adjusting muscle tension when it is mixed with strong voluntary movement, balance between the protagonists, synergists, and antagonists is maintained, and physical balance is recovered (Gilleard W, 1998).

Methods

A sample of 30 male and female stroke patients were selected. Subjects were randomly selected as per SRS(simple random sampling) methods.

Inclusion criteria

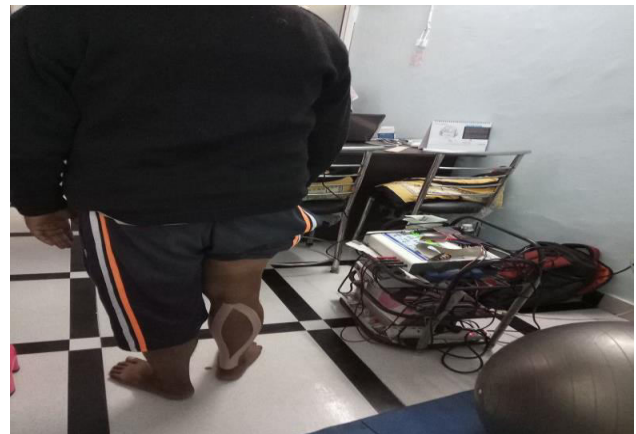
1. Occurrence of stroke in past 3 months based on computed tomography or magnetic resonance imaging without deficit in visual field;
2. MMSE score > then 21/30
3. Ability to understand instructions and communicate;
4. Absence of vestibular disorder/cerebral concussion at the time of study;
5. Ability to maintain standing position and walk atleast 10m independently.

Exclusion criteria

1. Cognitive deficit;
2. Fracture or non-specific skin disease
3. Any history of pain;
4. Ankle surgery;
5. Vertigo, dizziness, and/or any balance related disorders(G.G. Simoneau 1997, J.M. de-la-Morena 2015)
6. Subject taking any advance technique of rehabilitation like NDT & taping from other therapist.

Procedure

A physical therapist applied 5cm wide kinesiology tape to Rectus Femoris, Tibialis anterior, and Gastrocnemius of lower extremity of affected side. The experimental group was applied KT before performing therapeutic exercises and change after 24 hours before intervention and the control group performed therapeutic exercises but didn't received kinesiology taping. Each intervention was conducted 5 times a week for 4 weeks and measurements were performed pretest, after 24 hours of taping and at the end of each week till 4th week and measurements again taken after removal of taping the next day of experimental group. Balance ability was assessed based on BBS and walking speed using 10MWT.



Result

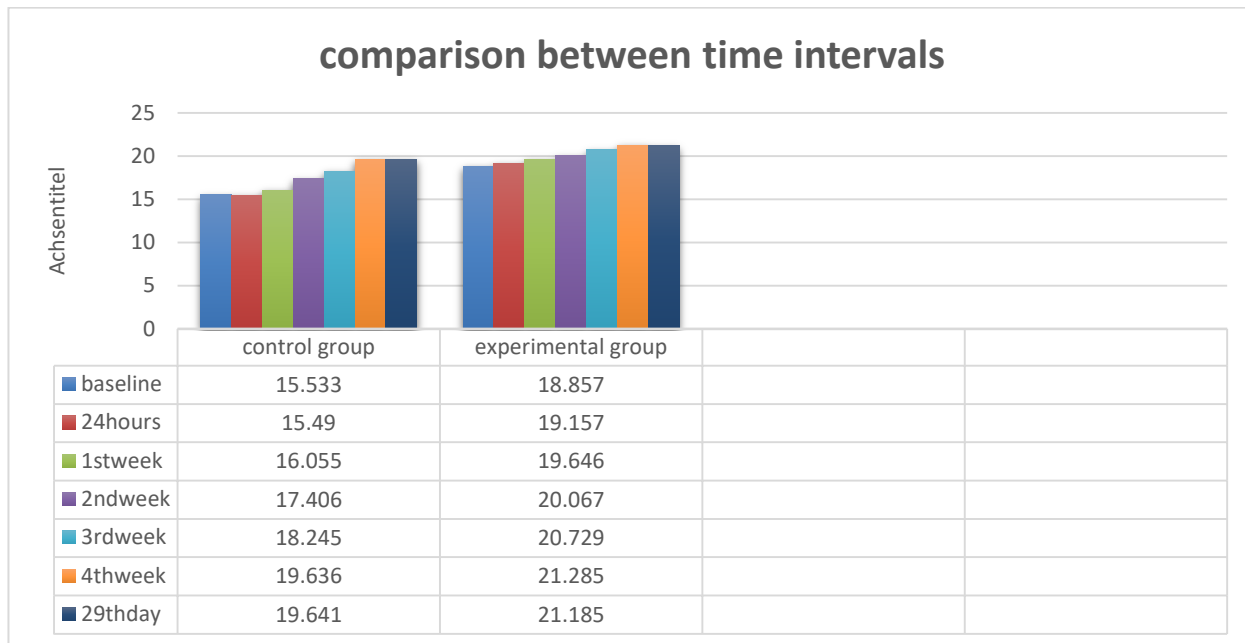
Depicted the scale and groups and number of subjects participating in each scale and group where N= number of subjects

	BETWEEN SUBJECT FACTORS	NUMBER
SCALE	10 meter walk test (10MWT)	30
	Berg balance scale (BBS)	30
GROUP	Control group	15
	Experimental group	15

Summary of two- way Repeated measures ANOVA for BBS and 10MWT

Variable	Interval	F value	P value	Partial eta square
BBS	Baseline	261.08	<0.001	.080
	24 hours	273.71	<0.001	.097
	1st week	308.25	<0.001	.094
	2nd week	434.85	<0.001	.063
	3rd week	504.51	<0.001	.055
	4th week	529.81	<0.001	.023
	29th day	524.20	<0.001	.020
10MWT	Baseline	261.08	<0.001	.080
	24 hours	273.71	<0.001	.097
	1st week	308.25	<0.001	.094

	2nd week	434.85	<0.001	.063
	3rd week	504.51	<0.001	.055
	4th week	529.81	<0.001	.023
	29th day	524.20	<0.001	.020



Discussion

In this research, KT was applied to the lower extremities of the paralyzed parts of the stroke patients to analyze the effects on gait and balance ability. Brain damage causes hemi paralysis depending on the region in which the damage is located, and 70 to 75% of patients have difficulty in full recovery and have accompanying problems such as motor, gait, sense, and activities of daily living disturbances(, Liu GZ, Yao QH, et al

2010). Such disorders reduce mobility and activities of daily living, and a lack of mobility in the lower extremities in particular has an adverse effect on gait and balance (Do KP, et al, 2014). Balance and gait disturbances especially result in an unstable standing posture and walking due to muscle tone disorder and weight bearing on the non-affected side rather than visible or vestibular abnormalities(, Nissan M, Pillar T, et al,1984). The representative asymmetric walking pattern of stroke patients is believed to be the result of weakened strength due to deteriorated hip flexors in the paralyzed lower extremity increasing the

swing time during the swing period, causing excessive motion of non-paralyzed parts of the body as a means of compensation to increase the gait speed, which may lead to a more asymmetric gait pattern.

Such improvement is believed to be just speed increase without any effect on walking cycle and symmetry (Patterson KK, 2008). The most ideal walking pattern for stroke patients is to increase the walking speed and improve the asymmetric walking pattern (Brunnstrom S, 1964). Page et al. reported that functional independence of stroke patients can be improved through the treatment for symmetry (Page SJ, Sisto, 2002).

From this, it can be inferred that improvement of balance and walking ability can be induced by direct stimulation of muscles of the paralyzed parts of extremities (Song MH, 2008). The initial mechanism with regard to the enhancement of muscle strength and muscle control is that cutaneous fusimotor reflex increases fiber tension, resulting in excitation of primary and secondary nerve endings, thus, helping afferent sensory nerve activity (Delahunt, Lim C, Park, 2010&2013).

The mechanism of taping is improvement of muscle strength by excitation of gamma motor nerves in skeletal muscle, as the taped part raises the tension of the fiber (Murphy PR, Lee MH, 2011). In addition, spatial summation makes neurotransmitter isolated and postsynaptic potential is generated without action potential of pre-synaptic nerve. In other words, an additive effect occurs by stimulating many nerve fascicles that compose synapses simultaneously through taping.

Finally, an irradiation phenomenon occurs in the area of increased reaction strength.

This study showed significant differences in the results of the BBS and 10MWT applying KT directly to paralyzed parts of the body ($p<0.001$).

Based on these results, it can be inferred that applying KT facilitated muscle activation in non-paralyzed parts of the body, induced gait symmetry, and decreased weight bearing on the non-affected side. In addition, there was a significant decrease in the results of the 10MWT in which walking speed was measured after KT ($p<0.05$). This suggests that applying KT leads to improvement not only in gait symmetry but also in walking speed through muscle facilitation in the paralyzed parts of the body (27).

This is because KT effectively stimulated the proprioceptive sense, muscle spindles, Golgi tendons, etc., and strengthened muscles in the affected parts. Furthermore, the results for the BBS generally seemed to be improved, but there was no significant statistical difference in the experimental group.

There were no significant differences in the results of the BBS, and 10MWT in the control group. This study found a significant differences in comparison of the effects of treatment between the 2 groups on the results of the BBS and 10MWT ($p<0.05$).

Experimental group showed significant improvement in the BBS and 10MWT compared with the control group. This research was conducted to investigate the effects of KT applied to the lower extremities on asymmetric gait, walking speed, and balance ability in stroke patients in a time frame. The experimental group, which received KT, showed significant improvement in the BBS and 10MWT.

At 29th day after removing the tape the results of BBS and 10MWT is NOT retained as were in 4th week and was significant ($p < 0.05$)

Additionally, the experimental group showed significant improvement in comparison with the control group in the BBS and 10MWT. Thus, it can be interpreted that applying KT to the paralyzed parts of a stroke patient has a positive effect on improvement of typical asymmetric gait and walking speed.

However, this research had small number of subjects and needs more validity as an evaluation index of asymmetric gait in stroke patients, and it was not possible to control every effectible situation excepting treatment arbitration. Moreover, there was also a geographical limitation, as a limited number of patients were recruited from one local hospital, so it may be difficult to generalize the results to stroke patients in general.

CONCLUSION

The present study examined the effects of taping on stroke patients' balance ability and gait ability. A taping-applied group and a general control group were administered therapeutic exercise programs for 5 times per week for four weeks and tape was changed in every 24 hours. Results show significance of taping effects.

According to the results, therapeutic exercise with the application of taping increased proprioception and thus was effective in improving the balance, and gait abilities of stroke patients in this group. But additional studies will be needed to confirm the effectiveness of the treatment.

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