Effect of Adding Kinesiotaping on Chronic PhasePost Stroke RehabilitationReceiving Weight Shifting Training on Walking Speed

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Effect of Adding Kinesiotaping on Chronic Phase Post Stroke Rehabilitation Receiving Weight Shifting Training on Walking Speed

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Abstract

Background : Stroke is the leading cause of disability including decreased walking speed. It is estimated that 73% of stroke sufferers have a lack of motor control and result in limited mobilization. Kinesiotaping(KT) is a method that can be added to other forms of exercise including weight shifting training. With the addition of kinesiotaping is expected to occur improvements in muscle performance and balance so that the speed of walking increases. The objectives of this study was to prove the effect of the addition of KT on chronic stroke rehabilitation that gets weight shifting training on walking speed.
Methods : This study is a randomized controlled trial pre-test and post test control group design. There were 18 subjects of chronic stroke rehabilitation patients divided into 2 groups, namely the control group that got weight shifting training (9 people) and the treatment group that got the addition of kinesiotaping to weight shifting training (9 people). The walking speed assessment was measured before and after 4 weeks of treatment.
Results : There was a significant difference in the mean walking speed before and after treatment in each group ($p<0.001$). In the treatment group 0.60 ± 0.08 and 0.68 ± 0.07 at the end. In the control group 0.62 ± 0.05 at the beginning and 0.64 ± 0.05 at the end. There was a sigificant difference in the mean walking speed increase in both groups ($p<0.001$).
Conclusion : The mean increased walking speed was higher in the group that got the addition of KT in chronic phase stroke rehabilitation who received weight shifting training.

Keywords : stroke, walking speed, weight shifting training, kinesiotaping

INTRODUCTION

Stroke is one of the neurological syndromes that can cause disability in human life. Data in Indonesia shows a trend of increasing stroke cases both in terms of death, incidence, and disability.[1] Stroke patients are generally disturbed by asymmetrical postures, reduced voluntary control of movement and balance that does not normally affect walking ability which can increase the risk of falling. Research shows that 84% of stroke patients have motor involvement of more than one joint, and 76% have ankle joint involvement. Muscle weakness and ankle joint instability cause drop foot in stroke patients which is the main factor for gait disturbance in stroke patients. This disorders will cause a decrease in walking speed which can interfere daily activities.[2,3]

There are many techniques to improve walking speed. Various neurofacilitator techniques can be used to facilitate weak muscle contractions in stroke survivors. Recently, kinesiotaping (KT) can be used for musculoskeletal conditions to improve muscle function. Improved balance and muscle control through KT can increase walking speed.[4] The ability to initiate and control weight shifts is a requirement for independent walking. Study from Jung *et al.*, 2014 reported that weight shift training is beneficial in improving trunk control and proprioception in stroke patients with chronic hemiparesis.[5] This study assessed the effect of adding KT in post-acute stroke patients who received weight shifting training on increasing walking speed.

METHODS

The study design was a randomized controlled trial in patients with chronic phase stroke rehabilitation who were members of the stroke community at Dr Kariadi Hospital and Elisabeth Hospital Semarang. The study was conducted with the approval of the Ethics Commission of the Faculty of Medicine, Diponegoro University Semarang Number 280/EC/KEPK/FK-UNDIP/XII/2020. The study was conducted on January 18 - March 2, 2021. The method of taking subjects was consecutive sampling and simple randomization.

. Inclusion criteria included post-stroke patients with first attack >6 months and <5 years, age 50–60 years, able to maintain standing position ≥ 5 minutes and able to walk independently without aids 50 meters (without looking at gait), normal vision or if any visual impairment has been corrected, no cognitive impairment, ankle spasticity MAS score 1–2, ankle dorsiflexor muscle strength at least 3. Exclusion criteria include uncontrolled hypertension (blood pressure >180/110), patients with hemispatial neglect, vestibular, proprioception, and perception disorders, there are open wounds or non-specific skin diseases in the kinesiotaping application area, hypersensitivity to kinesiotaping materials, diabetes mellitus with GDS levels >250 mg/dl or accompanied by sensory disturbances. The drop out criteria were if the patient did not do weight shifting training and kinesiotaping was not applied for more than 2 days within the time span of the study.

Total subjects were 18 people, divided into 9 subjects in each group. Randomization was carried out using a simple method, in which the subject took an envelope containing one of the groups. In the treatment group, participants received a home program in the form of weight shifting training and KT application, while in the control group, participants only received weight shifting training. The treatment was carried out for 4 weeks. KT application is carried out for 5 days interspersed with 1 day rest before the next KT application. Assessment of walking speed was carried out before and at the end of the 4th week of the study.

KT application was carried out on the tibialis anterior muscle by facilitation and on the gastrocnemius muscle by inhibition. The principle of weight shifting training involves lower limbs that experience weakness by giving or transferring the patient's body weight without moving the leg position.

The results of the normality test for data distribution using the Shapiro Wilk test showed that the data were normally distributed in age, stroke duration, VO2max, walking speed, and height. Data that is not normally distributed, namely BMI. The normally distributed data were tested using the unpaired t-test while those that were not normally distributed were tested by the Mann Whitney U test. The hypothesis test for differences before and after treatment used a paired t-test because the data was normally distributed. All data is processed with the help of a computer using SPSS® software. Significance in this study was obtained if a p value <0.05 was obtained with a 95% confidence interval.

RESULTS

The characteristics of the study subjects in both groups at the initial examination of all the variables mentioned in Table 1, there was no significant difference between the treatment group and the control group with a p value >0.05.

The effect of adding kinesiotaping to weight shifting training on the walking speed of post-stroke rehabilitation patients in the chronic phase can be seen in Table 2.

The initial walking speed before treatment in the treatment group was 0.60±0.08 meters/second and in the control group 0.62±0.05 meters/second with a value of p=0.523. For the final walking speed after treatment in the treatment group 0.68±0.07 meters/second and the control group 0.64±0.05 meters/second with a value of p = 0.185.

In Table 2, it can be seen that there is a significant difference in the average walking speed before and after

TABLE 1
Characteristics of subjects

Characteristics		Group		p
		Treatment (n=9)	Control (n=9)	
Age (years)		55.78±3.03	55,78±2,64	1.000§
Gender	Male	7 (77.8%)	7 (77.8%)	1.000¥
	Female	2 (22.2%)	2 (22.2%)	
Stroke Duration (months)		21.00±7.28	21.00±7.28	1.000§
Hemiparese	Dextra	7 (77.8%)	7 (77.8%)	1.000¥
	Sinistra	2 (22.2%)	2 (22.2%)	
BMI (kg/m^2)		21.85±1.18	21.74±0.98	0.825‡
BH (centimeter)		161.00±2.83	161.56±3.91	0.734§
Activity	Low	7 (77.8%)	7 (77.8%)	1.000¥
	Moderate	2 (22.2%)	2 (22.2%)	
MMT ankle dorsiflexor	3	1 (11.1%)	1 (11.1%)	1.000¥
	4	8 (88.9%)	8 (88.9%)	
VO2 max		10.48±0.89	10.35±0.70	0.730§
BBS		43.11±1.27	44.00±1.87	0.255§

Information: §Independent t; ¥Chi square; ann whitney
BMI : Body Mass Index; BH : Body Height; MMT : Manual Muscle Test; BBS : Berg Balance Scale

TABLE 2
Comparison of the Walking Speed of the Treatment and Control Groups

Walking Speed	Group		p
	Treatment (n=9)	Control (n=9)	
Early	0.60±0.08	0.62±0.05	0.523§
End	0.68±0.07	0.64±0.05	0.185§
p	<0.001¶*	<0.001¶*	
Delta	0.08±0.02	0.02±0.01	<0.001§*

Information: *Significant (p < 0.05); § Independent t; ¶ Paired t

treatment in each group (p <0.001). The mean increase (delta) of walking speed in the treatment group was 0.08 ± 0.02 meters/second and in the control group 0.02±0.01 meters/second. From the statistical test showed that there was a significant difference in the average increase in walking speed in the two groups (p<0.001).

DISCUSSION

Disruption of gait patterns in stroke patients during the stance phase and swing phase will result in a decrease in cadence (number of steps per minute), stride length (activity that occurs between the time the heel of the foot touches the floor with the heel of the same foot touching the floor again), step length (activities that occurs between the heel of one foot with the heel of the other foot) and there is an increase in step width.[6,7]

In this study, the group that was only given weight shifting training experienced a significant increase in walking speed before and after treatment (0.08 ± 0.01 meters/second; p<0.001). This is in accordance with the results of a study by Anderson *et al.* in 2015 which

reported an improvement in gait and ambulation in chronic phase stroke patients.[8]

In stroke patients, the patient tends to shift the body's weight towards the healthy side of the leg so that learned disuse occurs. Weight shifting training exercises can overcome this so that there is an increase in balance through postural control and proprioceptive improvement and can improve gait patterns during the stance phase. Someone with a bad balance tends to have a longer stance phase than normal people. With weight shifting training, the stance phase becomes more balanced between the healthy side and the parese side so that there is an increase in stride length and cadence which will increase walking speed.[5,9]

In the treatment group that received additional KT, there was a significant difference in the increase in walking speed before and after treatment (0.08 ± 0.02 meters/second; p<0.001). Significant differences were seen in the mean increase in walking speed between the control and treatment groups (p<0.001). This shows that the addition of KT in the medical rehabilitation phase of chronic stroke that receives weight shifting training can significantly increase walking speed. In Jung *et al.*'s study it was reported that there was an increase in the value of balance function which was thought to be directly related to an increase in sensorimotor function in the form of improved coordination, muscle strength and flexibility in the lower limbs. With this improvement, walking patterns will improve and result in an increase in walking speed.[5]

Installation of KT with facilitation techniques on the tibialis anterior muscle makes the insertion and origin close to the center of mass, as well as the muscle fibers, fascia and skin above it. This KT stretch will facilitate muscle movement through peripheral feedback regulation to the central nervous system resulting in an increase in muscle contraction and relaxation of the antagonist muscles. In addition, the tibialis anterior muscle which is facilitated by KT also improves the ankle strategy. The ankle joint not only supports the body through weight bearing and leg muscle function, but also provides sensory information and continuously stimulates a sense of posture control through the foot's contact with the ground during movement. The function of the tibialis anterior muscle is to stabilize the ankle when the foot hits the ground during the stance phase and then acts to lift the foot off the ground during the swing phase. Thus, activation of the tibialis anterior muscle is also important for ankle stability and proprioception.[10,11]

In chronic phase stroke patients, muscle weakness contributes greatly to gait disturbances. One of them is the weakness of the dorsiflexor muscles which will cause impaired walking mobility function which is characterized by a decrease in walking speed, where the patient shows a walking pattern with circumduction to make leg clearance which is difficult to do.[4] Application of KT with facilitation techniques on the tibialis anterior muscle which is a primary ankle dorsiflexor can maintain the ankle in a dorsiflexed position and can prevent or reduce the occurrence of drop foot when walking thereby helping the patient in ground clearance. By allowing for foot clearance, there is a significant increase in walking speed.[11]

In stroke patients there is parese on one side, so the patient tends to rely on the healthy side which results in difficulties in doing weight shifting training. Therefore, the addition of KT in post-stroke chronic phase patients who receive weight shifting training will help improve the ankle joint strategy, facilitate the contraction of the tibialis anterior muscle who experience weakness and reduce gastrocnemius muscle tone. Thus the addition of this KT will facilitate the exercise to be more optimal.[4,10]

In accordance with the results of a study by Sheng Y, *et al.* in 2019 on sixty chronic phase stroke patients with foot drop which stated that immediately after facilitating KT application to the tibialis anterior muscle, there was an increase in the walking balance ability of stroke patients with drop foot. In this study, we used KT in facilitation for the tibialis anterior muscle and inhibition for the gastrocnemius muscle.[11]

Application of KT with inhibition techniques on the gastrocnemius muscle makes the insertion and origin away from the center of mass, as well as the muscle fibers, fascia, and overlying skin so that KT stimulation will inhibit muscle contraction through peripheral feedback regulation to the central nervous system and will reduce muscle contraction and increase antagonist muscle contraction. This resulted in reduced spasticity of the gastrocnemius muscles resulting in better ankle dorsiflexion. Inhibition techniques in the gastrocnemius muscles help reduce spasticity that occurs in chronic phase stroke rehabilitation patients. By decreasing muscle tone through stimulation of an inhibitory kinesiotaping stretch on the gastronemius muscles, the muscles work better.[4,11]

In muscles and tendons, KT can improve its function through mechanical receptors, namely the Golgi tendon organ in the muscle tendon junction. The Golgi tendon organ controls the muscle spindles during movement. Stimulation of mechanoreceptors with the application of KT inhibition of the gastrocnemius muscle through the Achilles tendon will inhibit the Golgi tendon organ thereby helping to regulate the tone of the gastrocnemius muscle. Thus the spasticity of the gastrocnemius muscles is reduced.[10,12]

CONCLUSION

The results of this study indicate that the addition of KT in the post-stroke chronic phase rehabilitation that receives weight shifting training will increase the average walking

speed higher. The addition of KT can be used in the chronic phase of post-stroke rehabilitation to increase walking speed. In the next study, follow-up could be carried out 1 month after treatment to determine the duration of effectiveness of adding KT in the chronic phase of post-stroke rehabilitation that received weight shifting training.

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