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Original Research Article

EFFECT OF KINESIOTAPE SPRING ASSISSTED TECHINQUE FOR FOOT ON GAIT SPEED AND RHYTHMIC WEIGHT SHIFTS IN PATIENTS WITH STROKE

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ABSTRACT

Background and Purpose: Stroke survivors are impaired by asymmetric posture, reduced voluntary control of movement, abnormal body balance, and deficit of weight transfer which affects their postural control and walking ability thereby increasing risk of fall.Ankle dorsiflexion plays an major role in balance and gait.The purpose of the study was to see the effect of spring assisted technique of Kinesiotaping on gait speed and rhythmic weight shift in stroke patients. The hypothesis was that it would act as a support as well as stimulate primary dorsiflexors Tibalis Anterior thereby improving gait speed and static balance.

Methods and Methods: 10 subjects,both male and female with sub acute and chronic stroke were selected. Pre assessment was done by rhythmic weight shifts in which movement velocity and directional control of both right/left and front/back, gait speed was noted by 3 min walk test and laps counted. Kinesio tape was applied by spring assisted technique. After application immediately and after 3 days, rhythmic weight shift was checked on NeuroCom Balance Master and gait speed by 3 min walk was taken.

Results: Paired t test analysis showed there was no significant changes seen in right and left movement velocity and directional control , significant changes observed in anterior and posterior movement velocity and extremely significant changes observed in gait speed immediately as well as 3 days post application if Kinesiotape.

Conclusion: Spring assisted technique has a beneficial effect on gait speed and anterior/posterior movement velocity of rhythmic weight shifts. There was clinical improvement in anterior posterior weight shift directional control though not statistically significant.

KEY WORDS: Spring Assisted Techique, Kinesiotape, Balance ,Gait Speed, Movement Velocity, Directional Control.

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INTRODUCTION

Stroke, also called as cerebrovascular accident (CVA), is a rapidly developing loss of brain function due to disturbance in blood supply of brain caused by blocked or burst blood vessel [1].

WHO defined as a "Neurological deficit of cerebrovascular caused that persist beyond 24 hours or interrupted by a depth within 24hours" . Stroke can lead to a combination of muscle weakness or muscle imbalance, decreased postural control, muscle spasticity, poor voluntary control, and body malalignment. Stroke survivors especially have difficulty in balance and postural control for standing upright because they

are impaired by asymmetric posture, abnormal body balance, and deficit of weight transfer , and these factors have been implicated in the poor recovery of functional ability and an increased risk of falls [2]. Poor voluntary control also leads to deficits and deviations in gait.

Recovery of motor disorders related to walking and balance represent the most common objective for rehabilitation treatment. A decrease in proprioceptive sense causes a decrease in balance ability related to handling of postural control, joint movement position, and external sway.

Approximately 61–80% of the body weight in stroke patients is shifted to the unaffected lower extremity; this leads to an asymmetrical standing position [3]. This position causes a decline in balance ability as the body's center of mass is shifted to the unaffected side, leading to a disruption of symmetrical weight shifting in response to external movement. In addition to this, there is also a decrease in the limits of stability seen in stroke patients which in turn impairs balance [2].

Patients with strokes have disrupted normal rhythmic movement control and may exhibit slower than normal movement velocities, poor directional control, or a combination of these two problems. Apart from static and dynamic assessment of balance in the clinical setting which involves use of outcome measures such as Functional Reach test, Multidirectional reach test, Berg Balance test, newer objective methods involve use of Posturography devices such as Balance Master which can be used to assess as well as train Balance. One such domain is the assessment of limits of Stability which involves testing for rhythmic weight shifts [4].

The Limits Of Stability (LOS) protocol quantifies impairments in ability to intentionally displace the COG to the patient's stability limits without losing balance. The patient performs the task while viewing a real-time display of their COG position in relation to targets placed at the center of the base of support and at the stability limits [3]. For each of eight directions, the test measures movement reaction time, movement velocity, movement distance, and movement directional control [3].

Since the gait of hemiplegic patients shows decrease in partial muscle control and synkinetic patterns, efficient treatment plans and exercise methods are needed to achieve a normal walking pattern [4]. Studies have shown that 84% of stroke patients have involvement of more than one joint, and in 76% of these, the ankle joint is involved. Weak muscles and instability of the ankle joint cause a foot drop in stroke patients which is one of the major contributing factors for gait impairments in stroke survivors. In regard to balance and gait ability, the ankle plays a sponge-like role and controls the first stage of balance due to posture disturbance. Thus, problems with balance lead to increased difficulties in recovery of activities of daily living (ADL) function, gait and motor function and increase the possibility of injury from a fall [5].

Some patients may be fitted with an Ankle Foot Orthosis (AFO), brace, or splint that fits into the shoe to stabilize the ankle/foot. Gait training may be incorporated into the patient's physical therapy treatment plan.

For improving gait, many therapeutic techniques are used which take variable amount of time and gaining good control over voluntary movement is usually a prolonged process. Several neurofailitatory treatment techniques are used to facilitate contraction of weak muscles in stroke patients. In recent times, Kinesiotaping has been used extensively in musculoskeletal conditions in order to enhance muscle function.

There have been studies of Kinesiotape being used in neurological conditions as well [5]. According to Kenzo Kase, KT may be beneficial in enhancing muscle function, inhibiting muscle activity, improving circulation of blood and lymph,and decreasing pain through neurological suppression. Proprioceptive effects of KT have been also suggested [6].

The advantages of Kinesio Taping (KT) is that it can be combined with other treatments and guarantees safety, since it is a noninvasive method without side effect.(6) It has been proposed that Kinesio tape, which is placed on the skin, provides a greater cutaneous nociceptive signal and improves balance and gait ability by not only stimulating proprioceptive sense but also identifying the right position of the joint even in a comfortable posture with no

weight loaded [7] Besides, taping helps to maintain the coordination of agonist, synergist, and antagonistic muscles by controlling muscle tones, inducing body balance and muscle control recovery.Thus, balance and muscle control recovery through KT can increase gait speed [6].

Spring assissted technique or functional correction technique is corrective application of kinesiotaping in which application are always over structures where their position is to be corrected.(02)Ankle dorsiflexion plays an major role in balance and gait which is mostly impaired in stroke patients.Literature has shown that Kinesiotaping technique have significant increase in proprioception.Many studies involved taping the entire group of dorsiflexors group. We concentrated on spring assist technique hypothesing that it would act as a support as well as stimulate primary dorsiflexor Tibalis Anterior. It would be worthwhile to study whether this technique is effective to activate dorsiflexors and support ankle thereby improving gait speed and static balance. The aim of the study effect of kinesiotaping spring assisted technique for foot on gait speed and rhythmic weight shifts in patients with stroke.

MATERIALS AND METHODS

Study design: Experimental study, Study duration: 4 months, Study setting:BSTR hospital. Sample size: 10, Sample type: Purposive sampling.

Materials included: Pen,Paper,Balance master,KinesioTape. Test of significance: Paired t test. Out come measure: NeuroCom balance master, 3min walk test.

Inculsion criteria: Both males and females with sub acute and chronic stroke, Reduced dorsiflexion recruitment as seen by absence of heel strike, foot dragging during gait, Less than half the range of dorsiflexion possible actively.

Exculsion criteria: Any other neurological disorder or disability, Deformity related to ankle or foot, Skin disease affecting ankle or foot, Lower limb recent fracture.

Pre assessment: Pre-treatment assessment was done on Balance Master of which rhythmic weight shift (RWS) component was selected.This included assessing movement velocity while moving both right/left (RT/LT), directional control right/left, movement velocity front/back(FT/BK) and directional control front/back(FT/BK.). The RWS protocol quantifies the patient's ability to perform rhythmic movements of their COG from left to right and forward to backward at three distinct paces.i.e slow, moderate, fast.During performance of each task, the patient views a real time display of their COG position relative to a target moving at the desired pace and amplitude. For each direction and pace, the RWS measures movement velocity and directional control. Pre treatment 3 min walk test was be taken to examine gait speed. In which 15 meters of distance is marked and patients have to walk that distance as many times he can in 3min as much he can on his normal pace and the laps are counted.

Application of kinesiotape: KinesioTaping was done on patient after doing all examination. The Kinesiotape was applied using a spring-assist technique, also referred to as a functional correction.

The spring-assist technique utilizes both mechanical and sensorimotor stimuli to facilitate the ankle dorsiflexors muscles.

The application of the tape began with the patient's involved ankle passively positioned into full dorsiflexion.The length of the Kinesio tape used was measured from the anterior surface of the mid-tibial shaft to the base of the metatarsals on the dorsal surface of the foot.

The tape was then anchored on the anterior surface of the mid-tibial shaft, with approximately two inches of tape with no tension.With the ankle still in full dorsiflexion, the tape will be applied with 50-75% tension to the base of the metatarsals in the center of the dorsal surface of the foot. Another two inch anchor with no tension was applied distally over the metatarsals.

The ankle was passively positioned into full plantarflexion where the tape will be applied to the skin in a proximal to distal direction.

The tension of the Kinesiotape also elicits a reaction in the proprioception of the ankle joint thus stimulating a sensorimotor reaction in the targeted tissue.

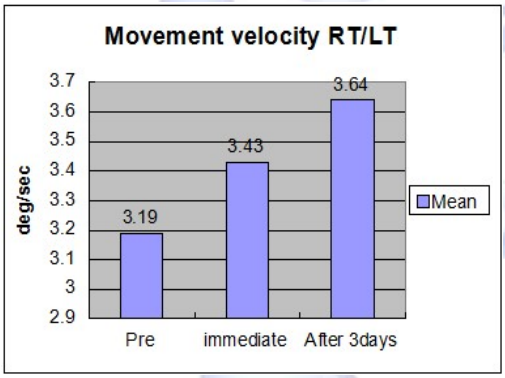
Due to the taping technique, the more the ankle falls into plantarflexion, the greater the tension

in the tape, thus a greater stimuli to the targeted tissue.

After application of kinesiotape: After application of kinesiotape immediate effect was seen on rhythmic weight shifts and movement velocity of right/left, front /back and directional control of right/left, front/back will be noted and by 3 min walk test gait speed was noted . After 3 days dorsiflexion facilitation will be again reported on rhythmic weight shift and gait speed by 3min walk test. Kinesiotape will be removed after taking reports.

RESULTS

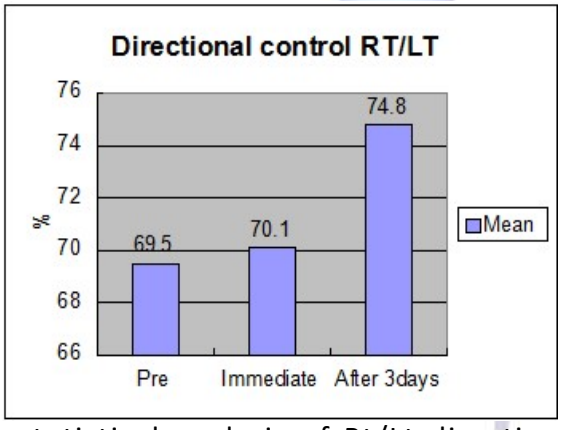
Graph 1: Shows the movement velocity RT/LT comparing mean of pre, immediate and after 3 days treatment.



In statistical analysis of movement velocity RT/LT before KT and immediately after KT application, p value is 0.3677 which is not significant.

In statistical analysis of movement velocity RT/LT before KT and after 3 days of KT application p value 0.1536 which is not significant

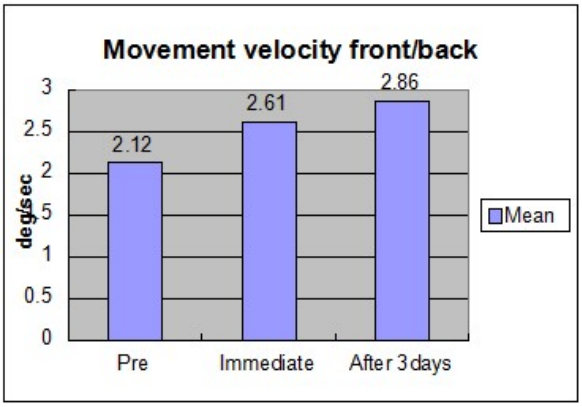
Graph 2: Shows directional control RT/LT comparing mean of pre immediate and after 3 days.



In statistical analysis of Rt/Lt directional control before KT and immediately after KT application, p value is 0.8710 which is not significant.

In statistical analysis of dirctional control RT/LT before KT and after 3 days of KT application p value 0.1594 which is not significant.

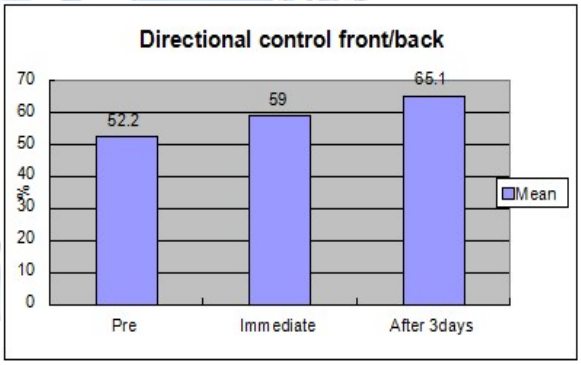
Graph 3: Shows movement velocity of front/back comparing mean of pre immediate and after 3 days.



In statistical analysis of movement velocity FT/BK before KT and immediately after KT application, 0.0353 which is significant

In statistical analysis of movement velocity FT/BK before KT and after 3 days of KT application p value is 0.0098 which is very significant.

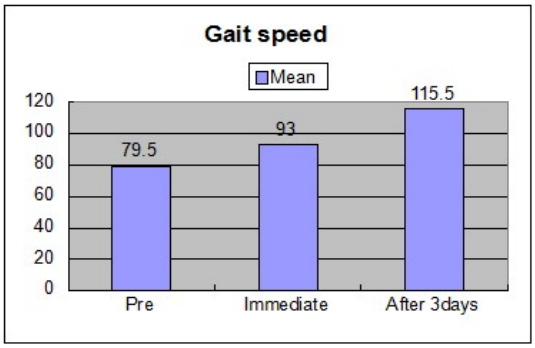
Graph 4: Shows directional control of front/back comparing mean of pre immediate and after 3 days.



In statistical analysis of directional control FT/BK before KT and immediately after KT application, p value is 0.0705which is not quite significant.

In statistical analysis of directional control FT/BK before KT and after 3 days of KT application, p value is 0.0515 which is not quite significant.

Graph 5: Shows gait speed comparing the mean of pre immediate and after 3 days.



In statistical analysis of gait speed before KT and immediately after KT application, p value is 0.0187 which is significant.

In statistical analysis of gait speed before KT and after 3 days of KT application, p value is 0.0001 which is extremely significant.

Total of 10 (both males and females) subjects were taken and immediate and after 3 days effects are seen. Rhythmic weigh shift Rt/lt and Ft/Bk movement velocity and directional control along with 3 min walk test were the outcome measures. The mean values of the same were compared pre assessment, immediately after application of Kinesiotape and after 3 days with tape application. Statistical analysis for each was done by using paired t- test.

DISCUSSION

This study was done to see the effect of kinesiotape spring assisted technique on foot for gait speed and rhythmic weight shifts in subacute and chronic stroke patients.

The study was performed in 10 subjects with chronic and sub acute stroke.Acute stroke patients were not included in the study as independent standing and walking was a pre requisite for assessing the outcomes measures. Kinesiotape spring assisted technique was applied to the patients and it was kept for 3 days. The outcome measures were rhythmic weight shifts and 3min walk test.

In this study, as shown in Graph 1 and Graph 2, there was no significant different seen pre and immediate post application of KT in Rt/Lt movement velocity with p value of 0.3677. There was no significant different seen before KT and after 3days KT in RT/LT movement velocity with p value of 0.1536.There was no significant different seen pre and immediate post application of KT in FT/BK movement velocity with p value of 0.8710. There was no significant different seen before KT and after 3days KT in RT/LT directional control with p value of 0.1594. This is possibly due to, kinesiotape is being applied to tibalis anterior muscle which is a prime dorsiflexors [9], while checking movement velocity and directional control of RT/LT prime muscle working are hip abductors and external rotation. As spring assisted taping technique only concentrates on tibialis anterior there is no significant change seen.

As shown in Graph 3, there was significant different seen pre and immediate post application of KT in movement velocity front/back movement velocity with p 0.0353. there was significant different seen pre and after 3 days post application of KT in movement velocity front/back movement velocity with p value 0.0098. As shown in Graph 4, there was not quite significant different seen pre and immediate post application of KT in directional control front/back movement velocity with p of 0.0705. There was not quite significant different seen pre and after 3days post application of KT in directional control front/back movement velocity with p of 0.0515. The spring-assist technique or functional correction technique utilizes both mechanical and sensorimotor stimuli to facilitate the ankle dorsiflexors muscles. Proprioception serves to orient the body in space. Through the mechanor-eceptors,there is sense of position and movement of joints. The proprioceptive afferents of the mechnoreceptors are involved in control of the postural motor system (static) [4]. The sensors are in joints, muscles, tendons, and in the skin. In this way,more information on position and exertion of the extremities and the body is transmitted [3].

Kinesiotape, which is placed on the skin, provides a greater cutaneous nociceptive signal and improves balance and gait ability by not only stimulating proprioceptive sense but also identifying the right position of the joint even in a comfortable posture. The ankle dorsiflexors also play an important role in backward reach by working eccentrically [4]. Via the tape application, the dorsiflexors are probably facilitated and help in improving the ankle strategy which helps to restore the center of mass to a position of stability through body movement centered primarily about the ankle joint thereby improving the limits of stability and weight shift in anterior posterior direction. There is typical synergistic muscle activity and body movements associated with correction for loss of balance in forward direction reaction [2].

This is supported by study done by Karlsson and Andreasson who suggested improved ankle movement control and contraction of the ankle

stabilizers were observed after application of kinesiology tape to the ankle.Therefore, KT is used widely to revitalize the ankle strategy for balance [17].

The mechanism of KT can be explained by gamma motor reflexes of the skin. Adhesion of the kinesiology tape on the skin allows continuous muscle contraction and induces relaxation of muscle tone by inputting information about the level of muscular contraction and allowing repetitive muscle contraction and release [18-20].

As shown in Graph 5, there was extremely significant different seen pre and immediate post application of KT in gait speed with p value of 0.0187. There was extremely significant different seen pre and after 3 days post application of KT in gait speed with p value 0.0001.

Gait speed is altered in patients with dorsiflexion weakness because patient show high steppage gait and circumduction gait as foot clearance is not possible. When kinesiotape is applied to tibialis anterior which is an prime dorsiflexor [8], this spring assisted technique or functional correction technique which maintains the foot in dorsiflexion and dropping of foot while walking is avoided which helps the patient in clearing the ground. AFO's are traditionally used to control ankle position, compensate for muscle weakness, minimize the abnormal gait pattern and increase the efficacy of walking. This kinesiotaping technique, by virtue of its application and position, maintains the ankle position so that the foot is maintained relatively neutral or in dorsiflexion, which helps to enhance the normal movement and increase the efficacy of walking [9]. As foot clearance is possible there is an significant increase in gait speed.This is in accordance with the study done by Woo-Il Kim, Yong-Kyu Choi, Jung-Ho Lee, Young-Han Park, who studied the effect of muscle facilitation using KinesioTaping on walking and balance of Stroke Patients and concluded that application of taping to the paralyzed parts of a stroke patient has a positive effect on improvement of typical asymmetric gait and walking speed.

CONCLUSION

This study suggested improvement in Movement velocity and directional control of Rhythmic weight shifts in the anterior/posterior direction after application of Kinesiotape using spring assisted technique for foot. Extremely significant improvement was observed on gait speed as the spring assisted technique prevents the foot from dropping and promotes foot clearance. But there was no significant effect on movement velocity RT/LT and directional control RT/LT as targeted muscle was tibalis anterior and for movement velocity RT/LT the main muscle group acting are the Glutei.

ABBREVIATIONS

RWS - Rhythmic weight shifts
KT - Kinesio tape
LT/RT - Right/Left
FT/BK - Front/Back

Conflicts of interest: None

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