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Case Report

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To study the effect of kinesiotaping on scapular stability and upper limb function in sub-acute and chronic stroke patients – a pilot study (case series)

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ABSTRACT

Objectives

To study the effect of Kinesiotaping on functional performance of the hemiplegic upper extremity using Fugl Meyer Physical Performance Assessment Scale.

Methods

In this pilot study, 6 sub-acute and chronic stroke patients were selected. Kinesiotaping was applied to upper trapezius and serratus anterior muscles of the affected side for 3 days. Fugl Meyer Physical Performance Assessment Scale for the motor performance on hemiplegic upper extremity before and after the application of Kinesiotape was done. Data analysis was done on 3rd day.

Results

On pre post analysis, Fugl Meyer Physical Performance Assessment Scale showed a statistically significant improvement ($p < 0.0001$). A sample size of 6 subjects showed improvement in motor domains of shoulder, wrist and hand. Wilcoxon matched-pairs signed-ranks test was used to analyse the pre and post difference of Fugl Meyer Physical Performance Assessment Scale with results as very significant with p-value of 0.0083.

Conclusion

Kinesiotaping may be effective in improving functional motor performance in hemiplegic upper extremity in recovering hemiplegic patients.

Keywords: Hemiplegic upper extremity, Fugl Meyer Scale, Kinesiotape, Functional motor performance.

INTRODUCTION

Stroke is one of the leading causes of death and disability in adults. Approximately 70% of post-

stroke patients have sensorimotor deficits in the upper limb (UL), which result in contralateral hemiparesis injury. These sensorimotor deficits can

include somatosensory alterations, which impair movement control and joint stability [3].

Common post-stroke motor disorders are spasticity (hypertonia) and muscle synergy that induce distinctive and complex movement patterns. Muscle synergy is the mass contraction of multiple muscle groups and occurs in the arm due to various upper extremity movements. Increased muscle tone in the post-stroke hemiplegic limb often negatively interferes with functional motor recovery of the upper limb and with correct postural control [10]. Lack of functional ability in the upper extremities after stroke restricts usage, and causes asymmetric posture and contracture in daily life, thus exacerbating functional limitations of the upper limbs [4]. A number of techniques are used widely by the physiotherapists to treat the spastic hemiplegic patient but very few therapists are concerned about proximal control of scapulo-thoracic joint. Scapulo-thoracic joint has its direct relationship with shoulder, elbow and wrist as a close kinetic chain. In residual paralysis hemiplegic, patient does not have proximal stability at scapulo-thoracic joint. People with motor dysfunction like stroke spontaneously utilize these compensatory strategies in order to achieve a goal and there is a strong tendency for such compensations to become learned. In recovering hemiplegic patients, the appropriate training strategies need to be investigated early in order to prevent compensatory movements substituting for the more effective movements [1].

There is literature supporting the evidence that afferent input to the spinal cord by the movement of the proximal joints can reduce spasticity and so facilitate the normal movement. Abnormal scapula alignment and movement, or scapulo-thoracic dyskinesis, can result in clinical findings consistent with instability of the shoulder complex. Thus taping to the scapula applied in such a way that which muscles are hyperactive and produces abnormal synergistic movements of the scapula during arm raising activity and prevents the normal functioning of the affected upper extremity and restricts the normal movements of the scapula are inhibited [1].

Kinesiotaping has gained significant popularity over the last few years and is now widely utilized across the world by sports medicine and rehabilitation practitioners as a taping modality that is believed to provide protection to injured joint

complexes and muscles. The protective action afforded by Kinesiotape (KT) is related to its ability to improve proprioception by stimulating mechanoreceptors and thus muscle activation patterns [5].

Scapular taping has its effects to improve alignment, which promotes improved movement patterns, to alter length-tension properties by stretching tissues that are too short and reducing tension placed on tissues that are too long, to provide support and reduce stress to myofascial tissues under chronic tension to provide kinesthetic awareness of scapular position during rest and movement. Here, in this study, taping to scapula has been used to inhibit hyperactive upper trapezius muscle to depress the scapula in its normal resting position. It will prevent associated movements of shoulder elevation during arm raising activities. Taping also has been used to facilitate the Serratus anterior muscle which helps in elevating, laterally rotating and protracting the scapula, which is restricted or absent in spastic hemiplegic patients due to disuse or weakness of the Serratus anterior muscle. Thus facilitation of it allows the hemiplegic patient to move his arm above the head in forward flexion or abduction [1].

CASE REPORT

Subject 1

Subject 1 was 63 year old man who had a right cerebrovascular accident 3 years before the start of our study, which caused left hemiplegia. He had a history of Hypertension before the episode. After one year following his episode of stroke, he spent several weeks in Out-patient rehabilitation facilities.

For 2 years, he has been taking physical therapy in Talegaon hospital and is active in performing the household chores by himself. He can ambulate independently without the use of any assistive devices. He had a history of fall once in past 3 years. He was independent in all self-care activities except dressing and undressing clothes.

Subject 2

Subject 2 was 49 year old man who had a right CVA 3 months before the start of study, which caused left hemiplegia. He had a history of Hypertension and Diabetes Mellitus before the

episode. Immediately after the stroke, he was started acute stroke rehabilitation facilities in the hospital, where he received inpatient physical therapy interventions. After getting discharged from the hospital, he continued to take physical therapy at Talegaon Rural Hospital. He could ambulate independently without any use of assistive devices within the house premises, although he needed some assistance while going outdoors. He was independent in all the self-care activities except bathing and dressing clothes and needed assistance of family members for the same. Before the start of the study, subject 2 had received physical therapy for 2 months.

Subject 3

Subject 3 was 39 year old man who had a right CVA 3 months before the start of study, which resulted in left hemiplegia. Patient had no history of Hypertension or any other co-morbid conditions before the onset of CVA. After 3 months of CVA, he had a fall at home which resulted in the Intertranchanteric fracture of the femur of the left side. So, he was admitted to the Talegaon hospital where the fracture was surgically treated with plates and screws. The treatment for the symptoms of CVA as well as the fracture were then started. He was dependent on his wife for the ambulation and toileting activities. During his stay at the hospital, he recovered well for the fracture as well as the hemiplegia.

Subject 4

Subject 4 was a 62 year old man with the history of Right CVA 6 months before the study, which caused Left hemiplegia. Patient had a history of Hypertension and Diabetes Mellitus before the onset of CVA. After 3 months of stroke, patient started with out-patient rehabilitation. Patient could ambulate independently without any assistance or assistive devices in the house as well as outside in the community. He was independent in all the self-care activities except dressing upper segment. He needed the assistance of his family members for the same. Before the start of the study, he had received physical therapy for 3 months.

Subject 5

Subject 5 was a 62 year old man with the history of Right CVA 32 years before the study

resulting in left hemiplegia. Patient had a long history of Hypertension before and uncontrolled Diabetes Mellitus after the onset of CVA. Patient did not receive physical therapy for 32 years because of lack of knowledge regarding it. He had a history of fall 3 times in the last 32 years. Patient could ambulate with the help of cane while in the community. He also depended on his family members for self-care activities like bathing, toileting and dressing-undressing clothes.

Subject 6

Subject 6 was a 52 year old man with the history of Right CVA 3 months before the study resulting in left hemiplegia. Patient had a history of Hypertension and Diabetes Mellitus before the onset of CVA. Immediately following the episode of stroke, patient was given acute care and indoor patient rehabilitation facilities in the rural hospital. He could ambulate independently without any assistive devices inside the house but needed some assistance while outside in the community. He had a history of fall 15 days before the start of study. Patient could independently perform his self-care activities like bathing and toileting activities. He has been receiving out-patient physical therapy for around 2 months.

METHODOLOGY

Type of study was Experimental pre-post study with Purposive sampling method. The study was carried out at Bhausaheb Sardesai Talegaon Rural Hospital. 6 sub-acute and chronic stroke patients were selected. Hemiplegic patients with cognitive and perceptual disorders; any associated history of trauma and other medical conditions of hemiplegic upper extremity; spasticity greater than Grade 3 according to Modified Ashworth Scale; contractures and deformities of the upper limb and any sensory, behavioral dysfunction and emotional liability were excluded from the study. Informed consents were taken from all the subjects. Kinesiotape was applied to the elevators, i.e., upper trapezius, and retractors i.e., serratus anterior, which pulled the scapula into a fixed elevated and retracted position.

Procedure of taping



For Kinesiotaping of Upper trapezius, the tape was measured from the middle of the acromion process to the hairline on the nape of the neck. The descending part of the trapezius muscle in the elongated position, i.e. the cervical vertebrae (CV) were tilted towards the opposite side flexion and rotation to the same side. The base was affixed to the insertion site of the acromion in the resting state. The muscle was elongated and the base anchored with skin displacement, then the tape was

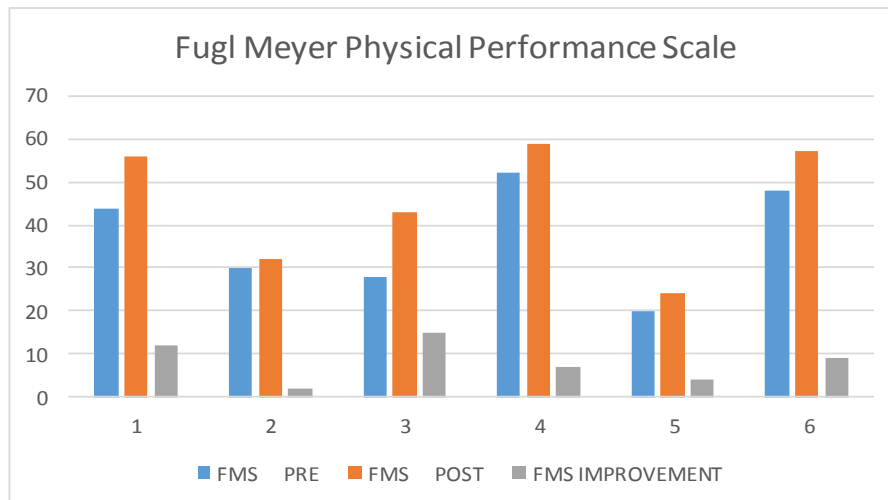
affixed with 10% tension over the belly of the muscle to the point of origin at the hairline on the nape of the neck. The tape was rubbed in the elongated muscle position [13].

For Kinesiotaping of Serratus anterior facilitation and inferior angle abduction, the tape was applied from 2 cm medial to the scapular border, following the line of the ribs down to the mid-axillary line [8].

RESULTS

Table.1. Demographic data

SR NO.	AGE	GENDER	PRE FMS	POST FMS	IMPROVEMENT
1	63	MALE	44	56	12
2	49	MALE	30	32	2
3	39	MALE	28	43	15
4	62	MALE	52	59	7
5	62	MALE	20	24	4
6	52	MALE	48	57	9



- Initial and final evaluations were done before application and after removal of the Kinesiotape.
- A sample size of 6 subjects showed improvement in motor domains of shoulder, wrist and hand.
- FMS is the outcome measure which was used in the study and statistical analysis in the group between pre and post scores was taken by Wilcoxon matched-pairs signed-ranks Test.
- Fugl Meyer score increased during the study duration by mean difference of 8.167.
- Non-parametric Spearman correlation coefficient (r) = 0.9429.
- The one-tailed P value is 0.0083, considered very significant.

DISCUSSION

The study was designed to find out the effect of Kinesiotape on scapular stability and upper limb function in sub-acute and chronic stroke patients. The study was done on 6 sub-acute and chronic stroke patients which were selected according to the inclusion criteria. In this study, it was found that the pre and post-mean scoring of Fugl Meyer Physical Performance Assessment Scale for motor extremity showed a difference of 8.167 and the P value was 0.0083 which is considered very significant.

Subjects 2 and 5 showed little improvement in comparison with the other 4 subjects as the baseline parameters for the pre-scoring of Fugl Meyer Motor Assessment Scale are less.

According to a study by Dylan Morrisey (Journal of Bodywork and Movement Therapies), Taping is a useful adjunct to a patient-specific integrated treatment approach aiming to restore full pain-free movement of the shoulder girdle. Taping is particularly useful in addressing movement faults at the scapulo-thoracic, glenohumeral and acromioclavicular joints. If taping can be applied in such a fashion that a relatively short overactive muscle is held in a lengthened position then there will be a shift of the length tension curve to the right and lesser force development through decreased actin-myosin overlap during the cross-bridge cycle at the point in joint range at which the muscle is required to work. The taping method used to inhibit upper trapezius activity has been investigated in a pilot study (O'Donovan 1997) and shown to have a significant inhibitory effect on the

degree of upper trapezius activity in relation to lower trapezius during elevation [8]

Effects of muscle taping

Change in tone: Tonus is a state of tension maintained by impulses from the CNS as well as through peripheral afferent signals (joint, muscle, skin) as peripheral feedback regulation. Skin receptors are activated by the tape, thereby strengthening additional peripheral afferent signals. Influence can be exerted on tonus regulation via these mechanisms.

-Support of muscle control: Proprioception (deep sensibility) serves to orient the body in space. Through the mechanoreceptors, we sense the position and movement of our joints. The proprioceptive afferents of the mechanoreceptors are involved in the control of the postural motor system (static) and directed motility (dynamic). The sensors are in the joints, muscles, tendons, and in the skin. The proprioceptors in the skin are reached by means of the tape. In this way, more information on position and exertion of the extremities and the body is transmitted.

Support of joint function: Joints are moveable connections between bones. The capsular ligament apparatus and the musculature are also involved in the control of joint movement. The mobility of a joint depends upon the type of joint and the surrounding structures (muscles, ligaments, and capsule). The joint functions can be supported using K-Tape application. By influencing the muscle tone, imbalances can be corrected and balance restored to the muscle group. A better sense of movement can be attained by stimulating proprioception. Corrective functional and fascial applications, like passive support, result in improvement of joint function, lead to pain attenuation and consequently to a shorter healing process [13].

In a study by Alexander M and Stynes S (NCBI), the application of Sports tape overlaying the Fix tape inhibited trapezius on average by 22%. This inhibition did not last once the tape was removed. This suggests that any change in shoulder girdle symptoms or movement, which occurs with the application of this particular tape, is not explicable on the basis of the facilitation of the lower fibres of trapezius [11].

EIKhatib (Journal of Advanced Research) suggests that the position of the upper extremity

following a stroke affects not only the patients' ability to reach, hold, and manipulate an object but also their ability to stand up and walk; therefore, taping can lead to improvements in the upper extremity after the stroke [10].

Kneeshaw (Journal of Bodywork and Movement Therapies) suggests that taping from the onset of stroke until restoration of muscle tone may prevent the onset of hemiplegic pain by enforcing proper positioning [10].

In a study conducted by Cools AM and Witvrouw EE, Twenty healthy shoulders were examined with surface EMG recordings on the three parts of trapezius and serratus anterior muscle during dynamic full range of motion abduction and forward flexion. The movement direction and tape and no-tape conditions were randomized. The results of investigation revealed no significant influence of tape application on EMG activity in the scapular muscles in healthy subjects. Future research will be necessary to examine other parameters of neuromuscular control in order to determine possible proprioceptive changes in muscle recruitment with tape application [15].

In the study conducted by Dhwanit Shah, Divakar Balusamy (Chron Young Sci 2013;4:121-9), Rigid Scapular taping has improved the alignment of the scapula by inhibiting the hyperactive upper trapezius and facilitating the weak Serratus anterior muscle by altering length-tension properties of muscles and providing kinesthetic awareness of scapular position during rest and movement of upper extremity. Scapular taping also produces traction and pressure on the skin which provides the cutaneous sensory cues, thus providing additional proprioceptive input to the Central Nervous System, which helps in orientation of the scapula [1].

CONCLUSION

From the above discussion and result, we conclude that Kinesiotaping may be effective in improving functional motor performance in hemiplegic upper extremity in recovering hemiplegic patients along with traditional physiotherapeutic exercises.

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