



EFFECT OF CLOSE KINEMATIC CHAIN VERSES OPEN KINEMATIC CHAIN EXERCISES ON KNEE HYPEREXTENSION IN STROKE SURVIVORS.

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ABSTRACT

Background: The purpose of the study was to evaluate the effect of close kinematic chain exercises, open kinematic chain exercises, and compare the effect of close kinematic chain and open kinematic chain exercises on knee hyperextension in stroke survivors

Method: A total of 40 patients were equally divided into two groups using block randomization (Group A, Group B) Group A was given close kinematic chain exercises and Group B was given open kinematic chain exercises.

Result: Pre and post treatment protocol was analysed using paired t-test and unpaired t-test. Un-paired t-test showed that there was extremely significant difference seen in p value for extension (Goniometer) of 0.0001.

Conclusion: open kinematic chain exercises are significantly effective in reducing hyperextension of knee in stroke survivors

KEYWORDS : Stroke, Knee hyperextension, close kinematic chain exercises, open kinematic chain exercises.

Introduction

Stroke is defined as the sudden loss of neurological function caused by an interruption of the blood flow to the brain. Neurological deficits must be present for at least 24 hours to be classified as stroke.¹

Stroke is classified as ischemic stroke, hemorrhagic stroke and transient ischemic attack. Ischemic stroke is the most common type, which results from clot block or lack of blood flow, oxygen and nutrients to brain. During ischemic stroke, the vessels which are occluded are mainly major cerebral artery. There is lack of oxygen to cerebral tissues due to decreased blood flow and perfusion which causes irreversible damage and cell death due to necrosis.²

Hemorrhagic stroke results from intracerebral hemorrhage in subarachnoid space. It occurs due to brain aneurysm or atrioventricular malformation in intradural and subarachnoid space, hematologic disorders, drug abuse or when weakened blood vessels burst and bleed into or around brain.³

There are many risk factors for stroke, non-modified and modified. Non-modified where age, gender, low birth weight, race- ethnicity, genetic factors and modified where hypertension, cigarette smoking, diabetes, atrial fibrillation, diet and nutrition, obesity, infection. Signs and symptoms of stroke includes severe headache, fatigue, difficulty in walking, dizziness, trouble in balance and problem in co-ordination, confusion, difficulty in speaking or understanding the language, disturbance in vision, weakness are present in the face, arm, leg on one side or both the side of body. Individuals with stroke have neurological complications like neuromuscular dysfunction, dysphasia, cognitive impairments, altered emotional status, perceptual dysfunction, seizures, bladder and bowel dysfunction.²

Stroke also known as cerebrovascular accidents that causes disability, It affects neurology of human body and causes hemiparesis, hemiplegia and quadriplegia[1] Stroke is an important cause of disability in India with the estimated prevalence of 119 to 145/1,00,000⁴

Hyper tonicity of quadriceps and plantar flexors and weak hamstrings leads to hyperextension of knee which is commonly observed in individual with stroke who are self ambulant.⁵

Abnormal gait pattern reduce ability to balance and can lead to deformity and muscle wasting. Knee hyperextension is extension of affected knee beyond the neutral anatomical position during

stance phase of gait. Knee hyperextension is common kinematic problem in gait people with hemiplegic stroke. People who suffering from stroke shows muscle weakness which results in limitation in mobility function including walking.⁶ Stroke survivors bear most of body weight on non-affected limb, during stance phase weight-bearing asymmetry may lead to compensatory strategies.⁷

Weakness of voluntary knee joint movements can be caused by different mechanism and dysfunction of co-contraction of muscles.⁸

There are many complications that would appear because of the hyperextension which would lead to minimal recovery or hamper the patient recovery so there is need to focus on knee hyperextension in stroke survivors.⁵

Aim : To investigate the effect of close versus open kinematic exercise on knee hyperextension in stroke subjects.

Objectives: To compare the effect of close and open kinematic chain exercise in measures of reduction of knee hyperextension in stroke subjects.

Materials and Methodology

Ethical clearance was obtained from the ethical committee, KIMS DU, Karad. A experimental study was conducted at Physiotherapy Department of Krishna institute of medical sciences. 40 subjects were divided into two groups using block randomization method. Group A: 20 subjects (15 males, 5 females) received close kinematic chain exercises. Group B: 20 subjects (14 male, 6 female) received open kinematic chain exercises. The Patient were selected on the basis of the inclusion criteria.

A written consent was taken and the purpose and procedure of study of the study were explained to the subjects. A detailed neurological assessment was taken. Participants with ischemic and hemorrhagic stroke. Subjects with hyperextension of knee, both males and females were included in the study. Unstable vitals, Participants with any musculoskeletal condition like osteoarthritis, ligament laxity, Stroke secondary to traumatic brain injury were excluded from the study. Pretreatment assessment was taken by outcome measure using goniometer.

The control group received close kinematic chain exercises(5 days/6 weeks) And the exercises performed were-

1. Bilateral leg press (10 to 15 repetitions)

2. Treadmill training (10 minutes)
3. Stationary cycling exercises (10 to 15 repetitions)
4. Sit to stand (10 to 15 repetitions)
5. Weight shifted lunges (10 to 15 repetitions)

The Experimental group received open kinematic chain exercises(5 days/6 weeks) And the exercises performed were-

1. Active assisted exercises (10 to 15 repetitions)
2. resisted exercises with - weight cuff (10 to 15 repetitions)
 - Elastic band (10 to 15 repetitions)
3. Stright leg raise (10 to 15 repetitions)
4. Hamsting sets (10 to 15 repetitions)

After 4 weeks the post the post treatment re-assessment for knee function was taken with the help of outcome measure using goniometer.

Statistical analysis

Range of motion (using goniometer) – Intragroup comparison (Within the group) using paired t test.

In Group A , mean and standard deviation of range of motion on pre-intervention was 7.8 ± 1.322 , which was reduced to 3.95 ± 0.8256 . The P value was found to be <0.0001 which was extremely significant.

In Group B, the mean and standard deviation of range of motion on pre-intervention was 7.75 ± 1.372 , which was reduced to 2.25 ± 0.5501 . The P value was found to be <0.0001 which was extremely significant.

Table 1 – pre and post comparison of range of motion within the group

Group	Pre training Mean \pm SD	Post training Mean \pm SD	P value	Inference
	Extension	Extension	Extension	
Group A	7.8 ± 1.322	3.95 ± 0.8256	<0.0001	Extremely significant
Group B	7.75 ± 1.372	2.25 ± 0.5501	<0.0001	Extremely significant

Range of motion (using goniometer) – Intergroup comparison (between the groups) using un-paired t-test.

On comparing the pre-intervention values, the result between two groups using un-paired t-test revealed that there was no statistically significant difference seen in p value = 0.9072. and on comparing the post-session values, the result between two groups using unpaired t-test revealed that there was extremely significant difference seen with p value 0.0001.

Table 2 shows comparison of mean and standard deviation of range of motion between the group.

Group	Group A Mean \pm SD	Group B Mean \pm SD	P value	Inference
	Extension	Extension	Extension	
Pre training	7.8 ± 1.322	3.95 ± 0.8256	0.9072	Not significant
Post training	7.75 ± 1.372	2.25 ± 0.5501	0.0001	Extremely significant

Discussion

Knee hyperextension is major challenge in rehabilitation in stroke patients. It results in loss of mobility, abnormal gait pattern and makes them functionally dependant in others and hampers their daily living activities.

As a patient live with this disabilities there is need of some effective intervention for reducing knee hyperextension. Traditionally many intervention have been designed to improve Abnormal gait pattern

in stroke patients but knee hyperextension has remained a missing condition in treating hemiplegic patients, so there is need to concentrate on this particular condition.

Previous study done on effect of closed kinetic and open kinetic chain exercises using knee reposition sense in chronic stroke patients by Kyu-young Lee, Won-Seob Shin and he reported that CKC is useful for improving knee reposition sense and OKC is useful for improving knee joint stability in chronic stroke patients.

This study was undertaken considering all mention point, and the aim of study was to find out effect of Close kinematic chain exercises and open kinematic chain exercises on knee hyperextension in stroke survivors.

Non-weight bearing exercises mostly affect the concentric muscle contraction and weight bearing exercises affect the eccentric contraction of muscle.

There was significant improvement in knee function by open kinematic chain exercises as they are mostly affect the isolated knee extensor muscle as well as it provide traction , and stability by external mean and helps in better recovery. improvement by exercises is due to "use-dependant plasticity" following brain lesion which involve number of neurons and strength of the neural networks in the exercises task which is directly related to its repetition of exercise practice. As a patient achieved knee control the task was made more complex by increasing the repetition of exercise.

Close kinematic chain exercises includes more functional task and provide sensory feedback , improve motor control and joint proprioception but it does not show any significant effect on muscle strength of knee. This accounts to better improvement with open kinematic chain exercises as compared to close kinematic chain exercises.

In Controlled group mean score pre intervention was 7.8 and at the end of the post intervention it improved to 3.95 with the mean difference was 3.850 (p value <0.0001). In Experimental group mean score pre intervention was 7.75 and at the end of post intervention it improved to 2.25 mean difference was 5.500 (p value <0.0001).

Our results supports our hypothesis that the score of impact of knee hyperextension reduced in open kinematic chain exercises (Group B) post treatment.

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