Original Article

Effectiveness of Strength Training in Post Stroke

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Abstract

The study was done to evaluate the effectiveness of strength training in post stroke. This was an experimental randomized study, conducted at various Physical Therapy OPD setting areas. Sample n = 30; 3 females and 12 males as experimental group and 3 females and 12 males as control group were selected through probability sampling. Mean age of 57 with middle recovery stage of post stroke were included. Different selected strength training exercises were applied on experimental group to assess spasticity, cadence and manual muscle testing. Result was taken by using Mann – Whiteny U test for outcome measures as in cadence, spasticity and manual muscle testing. The result of two outcome measure shows significant result which means the strength training is more effective than the conventional treatment for post stroke of middle recovery stage.

Key Words: Post Stroke, spasticity, strength training, conventional treatment.

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Introduction

A stroke is a serious medical condition that occurs when the blood supply to the brain is disturbed. Like all organs, our brain needs the oxygen and nutrients provided by our blood to function properly. If the supply of blood is restricted or stopped, brain cells begin to die. This can lead to brain damage and possibly death. Stroke is a medical emergency, and prompt treatment is essential because the sooner a person receives treatment for a stroke, the less damage is likely to happen. There are two main causes of strokes: Ischemic (accounting for 70% of all cases): the blood supply is stopped due to a blood clot. Hemorrhagic: a weakened blood vessel supplying the brain bursts and causes brain damage. In England, strokes are a major health problem. With over 111,000 people having a stroke every year, they are the third largest cause of death. The brain damage caused by strokes means that they are the largest cause of adult disability in the UK. People who are over 65 years of age are most at risk from having strokes, although 25% of strokes occur in people who are under 65 years of age. It is also possible for children to have strokes. Strokes can usually be successfully treated and they can also be prevented. (Berg, K., Wood, 2008).

Following a healthy diet, taking regular exercise, drinking alcohol in moderation and not smoking will dramatically reduce your risk of having a stroke. Strokes can be treated using a combination of surgery and medicines. However, many people will require a long period of rehabilitation after a stroke, and not all will recover fully. The signs and symptoms of a stroke vary

from person to person, but they usually begin suddenly. As different parts of your brain control different parts of your body, your symptoms will depend upon the part of your brain that has been affected and the extent of the damage. The main stroke symptoms can be remembered with the word FAST: Face – Arms – Speech – Time. Face. The face may have fallen on one side, the person may not be able to smile, or their mouth or eye may have drooped Arms. The person with suspected stroke may not be able to raise both arms and keep them there because of arm weakness or numbness. There may be slurred speech. Other signs and symptoms may include dizziness, communication problems, difficulty talking and understanding what others are saying, problems with balance and coordination, difficulty swallowing, severe headaches, numbness / weakness resulting in complete paralysis of one side of the body, and loss of consciousness (in severe cases). One of the problems with strokes is that people who are affected by them often have problems communicating with others. The treatment for a transient ischemic attack involves addressing the conditions that led to it, while trying to prevent those conditions causing a bigger, more serious stroke include one or more cognitive functions can be disrupted by a stroke. Cognitive functions i.e. communication – both verbal and written, Spatial awareness – having a natural awareness of where your body is in relation to your immediate environment, Memory**,** Concentration**,** Executive function– the ability to plan, problem solve and reason about situations, and Praxis – the ability to carry out skilled physical activities, such as getting dressed or making a cup of tea. You can be taught a wide range of techniques that can help you're-learn' disrupted cognitive functions, such as recovering communication skills through speech therapy. There are also many methods that can be used to compensate for any loss of cognitive function, such as using memory aids or a wall planner to help plan daily tasks. (Berg, K., Wood, 2008).

Recommendations depend heavily on expert opinion, since scientific evidence on the efficacy of rehabilitation programs or individual interventions is limited. Further research is urgently needed. Nonetheless, adherence to these guidelines should help to reduce the variations that currently exist in stroke rehabilitation practices and lead to more effective use of rehabilitation facilities. (J. Roman et al, 2002).

Sometimes, physiotherapy can last months or even years. The treatment is stopped when it is no longer producing any marked improvement to your condition. After having a stroke, many people experience problems with speaking and understanding, as well as with reading and writing. This is called aphasia and is sometimes also known as dysphasia. Aphasia can be caused by damage to the parts of the brain that are responsible for language, but it can also be due to the muscles that are involved in speech being affected. Smoking is a major risk factor for strokes because it raises your blood pressure and can cause a build-up of fatty plaques in your arteries. Deep vein thrombosis occurs in around 5% of people who have had a stroke will experience a further blood clot in their leg, known as deep vein thrombosis (DVT). (J. Roman et al, 2002).

Pakistan is sixth most populous country in the world with an estimated population of approximately 167 million by July 2008. There are no sizeable community based epidemiologic studies on stroke from Pakistan. Stroke is the third most common cause of death and the first leading cause of disability in developed and developing countries.[2] According to World Health Organization estimates, 5.5 million people died of stroke in 2002, and roughly 20% of these deaths occurred in South Asia (Bhojo A. Khealani, 2008).

Literature Reviews

Sullivan et al (2004), described outcomes associated with a therapy that combine task specific and strength training in patients of post stroke. Single patient was examined for the period of 15 months post onset. Various modules of strength training were attempted including limb loaded cycling exercise, treadmill supported body weight training etc. Finally, there was increased strength in key muscles in gait. The author further described the view, that resisted muscle strengthening program have been shown to increase walking velocity, decodes that voluntary exercises, treadmill acti-

Sullivan et al (2004).

Exercise Prescription	Duration	Effects	Result
Loaded cycling x/s and treadmill supported Weight training	15 Months	Increased strength in key muscles	Increased walking velocity

Dr. Akbari and Karim (2004).

Exercise Prescription	Duration	Effects	Result
Strengthening by Dynamometer	12 sessions	Quadriceps and Gastro-soleus tone decreased	Strength training is effective in reducing spasticity

R.J Greenwood et al (2006).

Exercise Prescription	Duration	Effects	Result
Non-progressive Strengthening exercise	6 – 12 months	Knee extensors strength improved	Low intensity Strength training helps decreasing tone and improves strength.

vity and skills and forced limb used can promote the brain plasticity and functional changes in human at larger scale.

Dr. Akbari and karimi (2004), conducted a clinical randomized trial. There were 34 patients of hemiplegia with mean age of 49 in trials. Muscles strength (kg) measured by using the dynamometer and tone was graded on the Modified Ashworth Scale (MAS) before and after 12 sessions, followed by the strengthening exercises protocol. All muscles strength of the unaffected lower extremity increased after the intervention whereas, measures of quadriceps and gastro-soleus tonicity decreased. The result supports the effectiveness of the lower limb training to reduce the spasticity in addition to improving muscle strength in the chronic stage of stroke.

Dobkin B.H. (2005), highlighted an outcome of a stroke, followed by a review of formal guidance. Clinical problem facing in acute stage after survival, tend to show a plateau of gains in recovery three to four months after stroke. On the basis of evidences, the article focuses on sound randomized trials and meta analysis of functional use of the arm and walking, the most important targeted therapy is the skilled exercises and the strengthening workout for the body musculature. In the trial, resisted exercises with adequate motor control improved the strength and functional activities.

J.D. Moreland et al (2005), determined the resistance strengthening exercise to improve gross motor function by taking randomized controlled trial. Five inpatients were taken, divided into 2 groups, the experimental group performed lower extremity passive exercise 3 times a week, whereas the control group did the same exercise for the same duration but without resistance, finally, the study were not effective when compared with the same exercise given without resistance.

M. Michelle et al (2004), evaluated the efficacy of resisted extremity strength, furthermore, this training evacuated function, disability in the long term stroke patient. The total numbers of sample were 42 with mean age of 50 years with diagnostic criteria as mild to moderate post stroke. The training revealed the importance of adapting strength training in post stroke and results in reduction in functional limitations and disability.

L.F. Salmella et al (1999) investigated the effect for strength training on the stroke patient. The strengthening interventions sessions including the therapeutic strength training for lower extremity, warm up, aerobics, followed by the cool down period. The 10 weeks strengthening program resulted in significant improvement in all measures outcomes of performance and disability.

Sullivan K. et al (2006), described and discussed outcomes associated with a therapy program that combines task specific and strength training in an individual post stroke. The participant was a 38 years old female with right middle cerebral artery stroke evaluated 15 moths post onset. She ambulated independently with an AFO and straight cane with free and fast over ground velocity of 0.50 m/s and 0.62 m/s. Post treatment walking speed is increased 18% for free and 14.4% for fast velocity; 6 minutes walking distance increased 4%. This discussion revealed clinically meaningful changes in walking function when associated with a combined therapeutic program including both task specific and LE strength training.

Dr. Stoeckmann (2009), determined the effect of

load type (elastic, viscous, or mass0 on the muscle activation and co-contraction during resisted forward reaching in the paretic and paretic arms after stroke. 20 participants (10 with hemiplegia and 10 without neurologic involvement) reached forward with each arm against equivalent elastic, viscous and mass loaded. Normalized shoulder and elbow EMG impulses were analyzed. He concluded that the paretic arm after stroke when reaching forward was resisted with ciscoes or mass loaded. The paretic arm responded with higher muscle activation than the matched control arm. Small increase in muscle activation were also analyzed in the non paretic arm, suggested that viscous loads elicited strong muscle activation with minimal co-contraction.

R.J. Greenwood et al (2006), investigated the effects of low intensity training for ambulatory stroke patients. Ten volunteer 6 – 12 months after first – ever unilateral stroke, walking independently with or without aids were recruited. Three sets of baseline measure were taken at 2 weekly interval; volunteer then attended twice weekly sessions of low intensity progressive strengthening exercises and were assessed after each series of 8 sessions to a maximum of 24 sessions. As a result, the strength of the knee extensors was improved after training. On cessation of training, isometric strength increased by 58% and concentric strength by 30%. These finding supports the use of low intensity strength training after stroke and confirm published evidence.

Lexell J. et al (2008), written an article on muscle strength training gait performance and physiotherapy after stroke, published in Minerva medica. The review summarized the effect of lower limb progressive resistance training (PRT); loads of 70% or more of the maximum strength. The main highlights of the review, PRT is a safe and effective way to improve muscle strength, post stroke, without negative effect on muscle tone. Furthermore, improvement in muscle strength positively influence gait performance and perceived participation.

Ulla-britt Flansbjer et al (2006), evaluated the effects of strength training on muscle function, gait performance and perceived participation in subjects with chronic mild to moderate post-stroke hemiparesis. The result showed that 10 weeks of PRT significantly improved knee muscle strength, without any increase in muscle tone. Gait performance improved, with slow walkers at baseline having the best gains. Improvements in gait performance were, furthermore, related to improvement in perceived participation. For the control group there were some improvement s in gait performance, but low or no increase in knee muscle strength and perceived participation.

Methodology

Study Design

This study was an experimental randomized study. Randomized control (RCT) techniques were implemented for the sampling procedure. There were 30 post stroke out patients selected and evaluated at different intervals of time.[15] Individual as experimental group exposed to varioous strengthening program. The isometric work outs, weight bearing medium progressive exercises and active assisted isometric exercises, free weights and mechanical forces. PNF (Proprioceptive Neuromuscular Facilitation Techniques) were performed actively with repeated contraction for the experimental group. Around 10 to 12 repetition of each exercise was performed with pauses of breathing and relaxation exercises. Exercises were performed in gymnasiums and progressions were noted on different intervals. All exercises were performed to evaluate the cadence / change in muscular strength of ankle planter flexors and gluteus maximus. Each individual of the experimental group performed 2 to 3 sets of each exercise. Free Weights were used to evaluate and to facilitate the muscular strength of ankle planterflexors and gluteus maximus during gait cycle. However, Passive resisted exercises was encouraged for upper and lower limb of the affected side to evaluate and to improve the functional capability by means of strengthening workup.

Inclusion Criteria

Age > 45 years post stroke within 90 days.
Residual paresis in the lower extremity.
Ability to sit unsupported for 30 seconds.
Ability to follow 3 steps command
Least degree of the associated reaction.
Survivor with stable C.V.S system.

Survivor without fixed contracture of the lower extremity.

Exclusion Criteria

Experienced intermittent claudication while walking less than 200 meters.

Serious cardiac condition (history of the CHF, documented serious and unstable cardiac arrhythmias.

Hypertrophic cardiomyppathy.
Severe aortic stenosis.
Angina and dyspnea at rest or during ADL.
Class 3 or class 4 heart diseases.
History of severe COPD.
Oxygen dependent severe weight bearing pain.

Preexisting neurological disorders such as ALS, dementia, Parkinsonism or previous stroke residual progressive neurological deterioration.
History of major head trauma.
Lower limb amputation.
Non healing ulcers on the lower extremity.
Renal dialysis and ESRD.
Legal blindness, severe visual impairment.
A history of significant psychiatric illness.
Life expectancy less than 1 year

Arthritis or orthopaedic problems that limit the PROM of the lower extremity.
Knee flexion contracture of 10 degrees.
Knee flexion ROM < 90 degree.
Hip flexion contracture > 25 degree.
Ankle planter flexion contracture > 15 degree.
Major PSD.
History of pulmonary embolism within 6 months.
Uncontrolled diabeteswith recent weight loss.
Frequent insulin reactions.
Severe HTN with systolic > 200 mmHg and diastolic > 110 mmHg.

Unable to travel 2 to 3 times / week for outpatient strength training program.

Data collection tools consists of both materials and apparatus for the purpose of assessment and implementation as well. Flow sheet assessment of the stroke, scales for upper and lower synergistic extremity pattern, MMT(manual muscle testing) grading scale for muscle strength, IADL (instrumental activities of daily living scale) for the functional capabilities. Both materials and apparatus were used for experimental and control group.

Results

Thirty patients (15 experimental group and 15 control group of mean age of 57, with middle recovery stage of post stroke were monitored for the effectiveness of strength training. After 6 months of Physical Therapy sessions and on the basis of results taken for the cadence, MMT (manual muscle testing) and spasticity by using the Mann – Whitney U test. The result was found to be more significant (65.31%) for cadence, MMT(manual muscle testing) of (Gluteus Maximus) and less significant (31.32%) for MMT (Ankle Planterflexors) and spasticity. This shows that the values of 2 outcome measures supports the results because of their significance at $P > 0.05$ and $df = 28$ for one tailed test. The result of 2 outcome measures shows significant result which means the strength training is more effective than the conventional treatment for post stroke patients.

Conclusion

After the analysis of research studies, it was possible to verify that strength training did not promote tonus increase in the trained subjects, yet presented beneficial effects in relation to the power of spastic muscles. In addition, this can be an important tool in physical therapy treatment when a subject's functionality is emphasized.

Recommendation

The physical rehabilitation of individuals typically ended within several months after stroke because it was believed that most if not all recovery of motor function occurred during this interval**.** This research can be recommended for future studies as if it would be highly appreciated if the strength training protocols will be given through using the biofeedback sensorimotor approaches for the post stroke survivors as It would further be interpreted, evaluated and implemented for post stroke survivors who are in progression from the sub-acute to late recovery stage to maximize their independence and functional recovery.

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