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Comparison between stretching and strengthening exercise on the improvement of spastic ankle function in hemiplegic patients.

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ABSTRACTS

Background and Objectives: Stroke is caused by an interruption of the blood supply to the brain. Stroke is defined as abrupt onset of a focal neurological deficit lasting more than 24 hours. It is also known as a cerebrovascular accident or CVA (Easton JD, Hauser S and Martin J, 2001) Stroke can have an effect on a variety of different muscle groups. These changes can range from major to minor, and will usually require rehabilitation to improve. Ankle stiffness in stroke patients resulting problems such as asymmetric postures, balance and the loss of motor control in performance. Anchache; et al state that the spinal excitability in response to the flexor in the back of the ankle extending particuriy increases when stroke patient is walking, and in early stance phase ,the functional recovery of the flexor of the back of ankle joints influences the improvement in the patients.

Methods: The study included a total of 30 age matched subjects that were divided in two groups i.e group A (STRENGTHENING) and GROUP B(STRECHING) In both groups 30 minutes of exercise therapy is given on spastic ankle joints. The exercises were performed once a day, six times per week for six weeks. Changes in spastic ankle function were compared among the two groups BY

PAIRED T TEST.

Results: The strengthening exercise therapy group showed significant improvement in ankle function than stretching group.

Discussion and Conclusion: This study demonstrated that strengthening exercise program was more effective than stretching exercises for improvement on spastic ankle function in hemiplegic patients.

Key Words: Stroke, ankle stretching, ankle strengthening.

Background:

Stroke is defined as loss of neurological function caused by an interruption of the blood supply to the brain(Barclay-Goddard RE, Stevenson TJ and Poluha W, 2004). Stroke is defined as abrupt onset of a focal neurological deficit lasting more than 24 hours. It is also known as a cerebrovascular accident or CVA(Easton JD, Hauser S and Martin J ,2001).An acute stroke refer to the first 24 hours period of time. Focal neurological deficit lasting less than 24 hours (5 to 20 minutes) known as transient ischaemic attack. Stroke classification is done on the basis of its etiology as either ischaemic (87%) or haemorrhagic (13%)(Donnan GA ,Fisher M, Madeod M ,Davi SM and Lancet ,2008).Ischaemia is produced by occlusion of a cerebral artery, embolic, and microartery occlusion. Haemorrhagic Stroke is caused mainly by spontaneous rupture of blood vessels or aneurysms or secondary to trauma (Warlow C, Sudlow C, Dennis M, Wardlow J and Sandercock P,2003). Stroke effects the nervous system is made up of brain and spinal cord, and a network of nerves throughout the body. This system sends signal back and forth from the body to the brain. This change in perception is because the brain might not understand the sensations, like warmth or cold. foot drop is common type of weakness or paralysis, damage to the different part or area of brain. Stroke effects on muscular system depending on which area of the brain is damaged, Stroke can have an effect on a variety of different muscle groups. These changes can range from major to minor, and will usually require rehabilitation to improve. effects one side of the brain. When messages cannot travel properly from the brain to the body's muscles, this can cause paralysis and muscle weakness. Weak muscles have trouble supporting the body, which tends to add to movement and balance problems (www.heath .com>health>Judith Marcin.MD , 2017) Ankle stiffness in stroke patients resulting problems such as asymmetric postures, balance and the loss of motor control in performance. The ankle joint ,which is important in gait,absorbs,shocks during walking ,provides a stable bearing surface in a weight bearing posture and enables the advance of the lower limbs.Anchache state that the spinal excitability in response to the flexor in the back of the ankle extending particuriy increases when stroke patient is walking, and in early stance phase ,the functional recovery of the flexor of the back of ankle joints influences the improvement in the patients. Therefore, stretching can increase the ROM of ankle joint and strengthen the flexor in the back of ankle joint are necessary. Spasticity is defined as increased resistance to passive movement due to a lowered threshold of tonic and phasic stretch reflexes (Burke, 1972).it is defined as "disordered sensory-motor control, resulting from an upper motor neuron legion, presenting as intermittent or sustained involuntary activation of muscles"(Pandyan AD ,Gergoic M, Barnes MP ,Wood D, Van Wijck F and Burridge,2005). It can range from mild muscle stiffness to severe, painful, uncomfortable muscle spasm , it is associated with some common neurological disorders like , stroke , multiple sclerosis, cerebral palsy, spinal cord and brain injury , and neuro degenerative diseases affecting the upper motor neuron, pyramidal and extra pyramidal pathways(Bavikatte G and Gaber T, 2009) The changes in muscle tone probably result from alterations in the balance of inputs from reticulospinal and others descending pathways to the motor and interneuronal circuits of spinal cord, and the absence of an intact corticospinal system. Loss of descending tonic or phasic excitatory and inhibitory inputs to the spinal motor apparatus, alterations in the segmental balance of excitatory and inhibitory control, denervation super sensitivity, and neuronal sprouting may be observed. Once spasticity is established, chronically shortened muscle may develop physical changes such as shortened muscle may develop physical changes such as shortening and contracture that further contribute to muscle stiffness.(Bhakta B.B ,Cozens J.A and Chamberlain M.A, 2000). As spasticity effects on ADL there is decreased range of movements, abnormal postures (stigmatization), problems with hygiene, dressing, mobility, transportation and pain, also accompanies spasticity. If not treated, it results in muscle shortening, fibrosis, calcification and fixed contractures. Although spasticity is not the sole sign of UMN syndrome, it is one of the major factors contributing to handicap. One may expect that reducing spasticity may improve to some degree disturbed motor function (Diet V, Quintern J and Berger Wet,1981)

Objective:

- To study the effect of stretching exercises on ankle function in stroke patients.

● To study the effect of strengthening exercise on ankle function in stroke patients.

● To study the effect of stretching on ankle spasticity.

● To study the effect of strengthening on ankle spasticity.

● Comparisons between stretching and strengthening on ankle function.

● Comparison between stretching and strengthening on spasticity of ankle.

Procedure:

Patient will be selected according to inclusion or exclusion criteria given below in the table 1.

Subjects were explained about the aim and procedure of the study and inform consent was taken from each subject. All the participants who fulfil the inclusion criteria were included in the study.Subjects divided into 2 groups by convenient sampling method .All the patients signed an informed consent form and were informed about the whole procedure testing and training. In both the group A and B range of motion of ankle joint is measured by pre and post by using universal goniometer.

Strength is measured by using strain gauge.

Intervention:

The subject was instructed to lie down in supine line anatomical position and goniometer was placed on ankle joint .The axis of the goniometer was placed against the lateral mellolus of the moving arm is parallel to fifth metatarsal and stationary arm along the fibula. Then the subject was asked to down the ankle and then up the ankle joint .for inversion and eversion movt. Axis of goniometer is placed on talus bone and stationary arm along with tibial tuberosity and moving arm parallel to 2nd toe and tend to do inside and outside of the joint. Reading were recorded by goniometer.

The strength of Plantar, dorsi flexor and evertor, inverter muscle will be measured using strain gauge in supine position and fixed the ankle joint in neutral position while the strain gauge will be tied firmly on the big toe. And asked the patient do Plantar and dorsi flexion with maximum effort against the resistance. Same as for inversion and eversion movements. (Cho, I.S., &AN H.D. ,2014),(Biotitic U.S., Carrie A.S., Turner T., Suwignjo P.,1999)

Now to do same procedure in another group.After the completion of the above protocol the subjects in group A were selected for stretching exercise and group B for strengthening exercise .stretching of TA by manually in supine position on a couch by passive stretching method.

Inclusion Criteria:

● Age -30-60

● Gender-both male and female.

● MAS SCORE: stages 1-2.

● MMSE –According to MMSE cognitive scale used in stroke patient to understand the aim of

study.

● To understand and follow the instruction.

Exclusion Criteria:

● Orthopedic condition, fracture, infectious condition Terminal illness

● Terminal illness

● Severe cardiac condition

● Uncontrolled Diabeties and Hypertension

● Sensory issue

● Deformity

Instrumentation:

● Strength-Strain Gauge

● ROM-Goniometer

● Thera Band(using the lightest grade yellow

● Couch

●

Figure. 1- Strain Guage and Universal Goniometer

Figure. 2- Yellow Thera band

Result:

Demographic data A total of 30 subjects were included in the study. There were 53% males and46% female in the study.

*Table*1: Demographics

Gender distribution

Gender	Group A	Group B
MALE	9	8
FEMALE	6	7

Table 2: comparison of pre and post planter flexion (PF) of group A and B.

Groups	Pre PF(X_t SD)	Post PF	T
Group A (Mean ±SD)	17.07±2.840	23.47±2.800	1
Group B	17.53±2.800	26.60±1.844	1
P value	0.6539 (not significant)	0.0012 (Significant)	

p<0.0 p<0.05* significant

The mean difference between the Pre and Post Plantar flexion after stretching (Change in motion). T=14.379 is highly significant at P<0.05 for Group A and for Group B i.e. strengthening group T=18.410 is also highly significant at P<0.05.

Table 3: comparison of pre and post dorsiflexion (DF) of group A and B.

Groups	Pre DF (Mean±SD)	Post DF(Mean±SD)	T
Group A (Mean ±SD)	8.87±1.959	11.47±1.959	1
Group B	8.07±1.981	17.47±1.457	9

P<0.001

The mean difference between the Pre and Post Dorsi flexion after stretching (Change in motion). T=13.667 is highly significant at P<0.05.

Table 4: comparison of pre and post inversion (IN) of group A and B.

Groups	Pre IN (Mean±SD)	Post IN(Mean±SD)	T
Group A	14.47±3.962	17.40±4.579	1
Group B	15.80±3.299	26.87±1.807	7

P<0.001

The mean difference between the Pre and Post Inversion after stretching (Change in motion). T=1.002 is significant at P<0.05.

Table 5: Comparison of pre and post Eversion of group A and B.

Groups	Pre DF (Mean±SD)	Post DF(Mean±SD)	T
Group A	11.33±2.127	13.80±2.242	1
Group B	12.73±1.751	20.30±1.447	6

P<0.001

The mean difference between the Pre and Post Eversion after stretching (Change in motion). T=1.968 is significant at P<0.05 for Group A and for Group B i.e. strengthening group T=6.57 is highly significant at P<0.05

Table 6: comparison of pre and post planter flexion of group A and B after strengthening

Groups	Pre PF (Kg)(Mean±SD)	Post PF(Mean±SD)	T
Group A	6.25±1.218	8.07±1.959	0
Group B	6.31±1.215	9.80±1.424	3

P<0.001

The mean difference between the Pre and Post Plantar Flexion after strengthening (Change in motion). T=0.453 at P<0.05 for Group A and for Group B i.e. strengthening group T=3.62 is significant at P<0.05

Table 7: comparison of pre and post dorsiflexion of group A and B after strengthening.

Groups	Pre DF (Kg)(Mean±SD)	Post DF(Mean±SD)	T
Group A	8.87±1.959	11.4±1.959	1
Group B	8.07±1.981	17.47±1.457	9

P<0.001

The mean difference between the Pre and Post Dorsi Flexion after strengthening(Change in motion). T=1.112 at P<0.05 for Group A and for Group B i.e. strengthening group T=9.517 is significant at P<0.05

Table 8: comparison of pre and post inversion of group A and B after strengthening.

Groups	Pre IN (Kg)(Mean±SD)	Post IN (Mean±SD)	T
Group A	14.47±3.962	17.40±4.579	1
Group B	15.80±3.299	26.87±1.807	7

P<0.001

The mean difference between the Pre and Post Inversion after strengthening

(Change in motion). T=1.002 is significant at P<0.05 for Group A and for Group B i.e. strengthening group

T=7.447 is highly significant at P<0.05

Table 8: comparison of pre and post Eversion of group A and B after strengthening.

Groups	Pre EN (Kg)(Mean±SD)	EN (Mean±SD)	T
Group A	4.57±1.021	5.83±1.144	1
Group B	5.19±1.092	8.03±0.897	5

P<0.001

The mean difference between the Pre and Post Eversion after stretching

(Change in motion). T=1.624 at P<0.05 for Group A and for Group B i.e. strengthening group T=5.842 is significant at P<0.05

Discussion:

Stroke is defined as abrupt onset of a focal neurological deficit lasting more than 24 hours. Stroke leads to neurological distruption which results in deficits in various systems of the body. Stroke hampers the normal functioning of the body, after stroke spasticity begins which will be causing the hypertonicity in the muscle of the affected region .it also leads to weakness weakness in the affected extremity in this study patients with ankle musculature spasticity were recruited. we compared the two different treatment protocol for 6 weeks. A total of 30 patients are divided into two groups :group A was provided with stretching exercise and group B provided strengthening exercises for six consecutive weeks. Data was analysed through spss version 18 and statistical test used was t test at p<0.005.The result of study showed that strengthening has significantly better effects in spastic ankle musculature function than the stretching . Group B shows better result as we measured the pre and post readings of the test. Ankle plays an important role in maintaining the balance , range of motion of ankle provide the base for initiating the gait cycle; ankle musculature helps in maintaining the balance over the different surface. Balancing of the stroke patients is affected , due to which gait deformity occurred in stroke patients, strengthening exercise therapy can help of to reduce the spasticity, and increase the ankle range of motion, hence improving balance. Various studies support the result of our study that stretching is beneficial in improving balance and ankle muscular function. A study conducted on 40 healthy elderly to improve the ankle musculature strengthening using yellow and red theraband for 6 weeks 3day a week, the result of the study showed thet ankle strengthening exercises using theraband are beneficial in improving the ankle range of motion strength of ankle muscle and studies also supports that strength plays an important role in maintaining the balance.(Komal ,Raju and Astha Jain, Nov,(2018)) and (Kyunghoom kim ,MSC,PT,Sukmin Lee,PhD,PT,Donghoon Kim,Msc,PT,and Kyou Sik Kim,Msc,PT,Sep,2018.) Hence the study proves that strengthening exercises are better than stretching exercises.

Conclusion:

Ankle plays important role in ambulation in this study we had compare two different techniques to improve the ankle function. After six week of training the results supports that ankle, strengthening exercises has significant better result over ankle stretching exercises. Strengthening will be beneficial for improving the ambulatory status of stroke patient and reintegrate them into society.

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