"TO FIND THE EFFECTIVENESS OF STRENGTHENING EXERCISES ALONG WITH STRETCHING EXERCISES IN THE GAIT PATTERN OF STROKE PATIENTS"

DISSERTATION

Submitted for the partial fulfillment of the requirement for the degree of

MASTER OF PHYSIOTHERAPY(MPT)

(Elective MPT-NEUROLOGY)

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By

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I hereby declare that the dissertation entitled **"TO FIND THE EFFECTIVENESS OF STRENGTHENING EXERCISES ALONG WITH STRETCHING EXERCISES IN THE GAIT PATTERN OF STROKE PATIENTS" was done by V.RAJASEKAR (REG NO:271620222).**For the partial fulfillment of the requirement of Master of Physiotherapy Degree. The dissertation had been done under the direct supervision and guide at **Madha College of Physiotherapy, Chennai**. And submitted the same during the year October 2018 to **The Tamilnadu Dr.M.G.R. Medical University, Chennai.**

Signature of the Candidate

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INTRODUCTION

INTRODUCTION

The term “stroke” is defined as acute focal neurological deficit of cerebrovascular origin. Clinically a variety of deficit are possible including changes in the level of consciousness and impairments of sensory, motor, cognitive, perceptual and language function to be as stroke focal neurological defects must persist for at least 24 hours.

Stroke is one of the leading causes of death and disability in India. The estimated prevalence rate of stroke range, 84-262/100,000 in rural and 334-424/100,000 in urban areas. The incident rate is 119-145/100,000 based on the recent population studies.

Despite improvements in emergency treatments for stroke, many stroke survivors are left with functional problems. It has estimated that approximately 30% of survivors require some assistance in activities of daily living [ADL] and about 20% of require assistance with mobility. Comprehensive rehabilitation may improve functional abilities of stroke survivors.

Risk factor of Stroke are Blood pressure, Atrial fibrillation, Smoking, Cholesterol, Diabetes, Stress, Family history. The major clinical features of stroke is blackened vision in one or both eyes, headache, numbness which may be accompanied by vomiting, dizziness. Stroke affect upper limb & lower limb and one half of the body. The gait pattern in stroke patient is primarily influenced by spasticity, synergic organization etc. the loss of control over the sequential timing of muscular activities may result in asymmetrical step and stride length. A lesion affecting the CNS commonly results in disruption to the motor neurons with result that the individual experiences paralysis of muscles. One of the common problems which is seen in hemiplegics is spasticity. It is a disorder of the sensory motor system characterized by a velocity depended increase in muscle tone with exaggerated tendon jerks resulting from hyper excitability of stretch reflex. Chronic spasticity can lead to changes in the involved and neighboring muscles. Stiffness, contracture, atrophy and fibrosis may inter act in pathologic regulatory mechanism to prevent normal control of limbs. Investigation include CT, MRI, Blood test, ECG, Carotid ultrasound, Cerebro angiography. Medical management of stroke is emergency care anticoagulation therapy, antiplatelet agent.

Among the various method of the conventional physiotherapy management include ROM exercise to keep joint flexible and stretching exercise to maintain muscle length.

The convention physiotherapy is strongly against the use of strengthening exercise for many group of spastic muscle. The Bobath Neuro developmental therapy advised against the use of

Strengthening exercise as proponents left that increased effort would increase evidence that exercise can be associated with decrease in hyper reflexia muscle stiffness.

The presence of functional impairment in hemiplegia is due to either spasticity or too much mobility and too little stability. The spasticity is more common .the gait pattern in hemiplegia is primarily influenced by abnormalities in muscle tone and synergic organization influence of non-integrated early reflexes, abnormal righting and balance reaction and diminished co-ordination. The loss of control over the sequential timing of muscular activities may result in asymmetrical step and stride length. Spastic hemiplegic individual will have excess hip flexion with adduction and internal rotation also known as circumductory gait. A lesion affecting the central nervous system commonly results in a disruption to the motor neurons with the result that the individual experiences paralysis of muscles. Among the various method of management the conventional physiotherapy management includes ROM exercise to keep joint flexible and stretching exercise to maintain muscle length. IFT, TENS, also helpful for stroke hot and cold pack also reduced spasticity.

NEED OF THE STUDY

The idea that ‘increase effort will increase spasticity’ – still persist and many Neuro Rehabilitation Centre in the country are not using strengthening exercise in spastic adults with hemiplegia. Though spastic also shows some muscle weakness which can be improved by strengthening exercises, thus the study is planned to find out the effectiveness of strengthening exercise for the lower limb in gait performance in adults with using step length, stride length and speed.

OBJECTIVE

To achieve maximum gait performance in step length in response to strengthening exercise for adults with hemiplegia.

To achieve maximum gait performance in stride length in response to strengthening exercise for adults with hemiplegia.

To achieve maximum gait performance in speed in response to strengthening exercise for adults with hemiplegia.

HYPOTHESIS

NULL HYPOTHESIS:

The null hypothesis states that there is no significant difference in gait performance with strengthening exercise along with stretching for adults with spastic hemiplegia

ALTERNATIVE HYPOTHESIS:

The alternative hypothesis states that there is significant difference in gait performance with strengthening exercise along with stretching for adults with spastic hemiplegia

REVIEW OF LITERATURE

REVIEW OF LITERATURE

1. Milner brown suggests that in individuals following brain lesion, strengthening ex exercise technique neural co-ordination between against and antagonist muscles and synchronization of motor unit activity.

2.Girmby suggest that imposed immobility in central nerve system lesion is associated with a secondary atrophy and weakness of muscles.

3.Hakkinen & Komi concluded that in strengthening exercise the early changes in strength may be accounted for principally neural factors and with hypertrophy of muscles themselves becoming a gradually increasing contribution as the training proceeds.

4.Lehnkuhl LD, Smith LK States that isotonic muscle contraction can be resisted manually and therapist can very the meet the change in strength capabilities of the muscle through out the range of motion.

5.McCarteny et al concluded that increase in strength considered to be due to neural adaptation have been reported in patience with neuro muscular disease and this exercise affects both structure and function of muscles.

6.Bohannon suggests that in neurological rehabilitation strengthening exercises of various types shown to improve both strength and performance.

7.Phil Baton Rouge the purpose of this clinical commentary is to discuss the current concepts of muscle stretching interventions and summarize the evidence related to stretching as used in both exercise and rehabilitation.

8.Fowler EG, HO TW, Nwigwe Al, Dory F J et al In their experimental study to test the premise that the performance of exercises with maximum effort will increase the spasticity in people hemiplegia concluded that the results do not support the premise exercise with maximum effort increase spasticity in people hemiplegia.

9.Dodd KJ, Taylor NF Graham HK, Morten JP, Browniee M, McFadyen AK et.al In their study to investigate the effects of progressive strength training of quadriceps and hamstrings muscles in children with cerebral palsy concludes that “A future large scale randomized controlled study would be of value to substantiate these results, as the small convenience sample and lack of control group limits this study. However the finding that no adverse effect accompanied the positive outcomes in strength and function may encourage clinicians to consider resistance training along side standard therapeutic interventions.

10.Lee et al & Fizk et al states that an increase in the movement following the sessions of prolonged stretching was usually associated with a corresponding increase in other movements too.

11.Trambly F, Malouin F In a study on the effects of a session of muscle stretch on reflex and voluntary muscle activation in 22 adult with spastic hemiplegia adult of the experimental group underwent prolonged muscle stretching of the triceps surae by standing with the feet dorsi-flexed on a till table for 30 minutes concluded that repeated sessions of PMS may have beneficial effects in the management of spasticity adults hemiplegia.

12.Magnusson SP concluded a study on visco elastic stress relaxation during static stretch in normal and spinal cord injured persons and concluded that there is a decline in passive torque(Resistance to stretch offered why muscle) in the 90 seconds static phase for both control and spinal cord injured patients and decline in resistance to static stretch was due to visco elastic stress relaxation.

13.Tasikh,YehCY,ChanyHY,Chen JJ In a study evaluate the effect of a single session of prolonged muscle stretch of the triceps surae by standing with the feet dorsiflexed on the tilt table for 30 minutes suggested that 30 minutes of PMS is effective in reducing motor neuron excitability of the Triceps surae and in spastic hemiplegia provided a safe and economical method for treating stroke patient.

14.Youdas JW et al conducted a study on the effect of static stretching of the spastic muscle tendon unit on active ankle dorsiflexion ROM and concluded that 6 weeks program of per day static stretching for up to 2 minutes is not sufficient to increase active ROM.

15.Yeh CY, Chen JJ, Tasi KH subjected that the application of PMS with constant torque could reduce not only the elasticity o hypertonic muscle but also there viscosity in the stroke patient.

16.YehCY,Tasi KH, Chen JJ concluded that the present biomechanics assessment indicated that both passive muscle stretching treatment modes (constant torque prolonged stretching and constant angle PMS treatment) reduced the viscous elastic component of hyper tonic muscle.The constant torque PMS treatment was more effective than the conventional constant angle stretching technique.

17.Cerny, Ada and Canning described a persuader requiring a stop watch,2 marking pens with washable ink and a walk way of suitable length for gait parameters measurements.

18.HOLDEN In a study of 61 neurogically impaired patients used ink foot prints on a paper avoid walk away. High inter rates and test retest reliability was deported using the inked foot print method to determine the following variables velocity, cadence, step length and stride length. This investigators also found a strong linear relationship tested and a functional ambulation classification test protocol that was developed Massachusetts general hospitals.

19.White H, Jenkins J, Neacewe Tylwski C, Waalker J In their study to determine the effect clinically prescribed ankle foot orthotics have on the temporal and spatial parameters of velocity, stride length and step length and found to be these parameters were significantly improved and cadence was the only parameter found to not to be statistically different.

20.Verheyden G.et al 2006 This study clearly indicates that trunk performance is still impaired in non acute& chronic stroke patients. When planning future follow up studies , use of the trunk impaired scale has the advantage that it has no ceiling effects.

DESIGN AND METHODOLOGY

METHODOLOGY

STUDY DESIGN

Quazi Experimental

STUDY SETUP

1.Madha Medical College and Research Institute Hospital, Kovur, Thandalam Chennai.

2. Focus Rehabilitation Centre Porur, Chennai.

Population:

All the patients who certified the selection criteria were the population of the study.

Sample size:

30 subjects (Group A-15 patients and GroupB-15 patients).

Inclusion criteria:

1. Moderately increase muscle tone (grade2 Modified Ashworth Scale).
2. Age group between 50 and 70 years.
3.Patients obeying commands.
4. Ambulatory adult.
5. Patient with moderate neurological deficit.
6. Patients having duration less than 3months of stroke attack.
7. Patients who are willing.

Exclusion criteria

1. Patient with associated cognitive deficit.

2. Patient with any lower limb joint deformity.

3.Any other major medical problems.

VARIABLES

Independent variables:

* Step length

*Stride length

*Speed

Dependent variables:

*Stretching exercises

*Strengthening exercises

SETTING:

The study is conducted in the Madha Medical College and Research Institute Hospital, Kovur, Thandalam, Chennai.

Tools and material used:

Materials:

* Inch tape

*Stop watch

*Water colour

*Chart paper

*Rowing machine

*Data collection sheet

Procedure

Prior sanction was obtained from the authority for the study. A total of spastic adult diagnosed by a neurologist/ physiatrist were selected randomly with due consideration of inclusion and exclusion criteria. They were divided into 2 groups group A-control and group B-experimental using simple random sampling method. Each group were included with 15 patients. After obtaining the informed consent, subjects of each group were administered the treatment programs. Pre and post, test values of gait performance were taken by means of step length, stride length and speed to find out the effects of treatment programs the walkway was prepared with chart paper for 8 meters and the patients both foot dipped on the prepared water colour prior to the gait performance. Patients started walking from a point 2 meters behind the chart paper was marked-one point one meter away from the starting end and the other mark 2 meter away from the first mark. Patients were allowed for a free walk to the end of the walk way, meanwhile the stop watch was started as one of the limbs cross the first mark and cross the first mark and stop- watch was stopped as one of the limbs crosses the mark. The time taken to cross these marks were notes. After completing the 8 meter was 3 consecutive stride length were measured and the mean was used for the calculation. The speed was calculated by dividing the time taken to traverse the 2meter distance by 2.

Treatment procedure

Treatment were given for 3 days per week for a 10 week for a 10 weeks duration

Treatment protocol for control group

The control group was consisted of 15 patients

One day one after taking the pre, test gait performance the control group were treated with a stretching exercise for one hour. The importance were given particularly to his flexors, hip adductors, knee flexors and plantar flexors. Prolonged muscle stretching exercise for 30 minutes on a tilt table with foot dorsiflexed in position was given 60 seconds static manual stretching 8 repetitions per session.

Treatment protocol for experimental group

The experimental was consisted of 15 patients

Following basic assessment and after measuring the pretest gait performance on day one, the experimental group were treated with the same stretching procedure as for the control group and also they were given strengthening exercise program for the same group of muscles .the technique used was manual resistance exercises in full ROM -12 repetitions per session. Later each patient was given rowing machine exercise 12 repetitions. The post, test values of gait pattern were taken and computed for comparison.

Strengthening exercises for hip flexors of lower limb to the right sided hemiplegic patient.

Stretching exercises for hamstring muscles of lower limb right sided hemiplegic patient.

DATA ANALYSIS

DATA ANALYSIS

Students paired “t” - test was used to compare step length stride length and speed of the gait pattern within the control group. The formula used is:

$$t = \bar{d} / sd\ \sqrt{n}$$

$$\sqrt{\frac{\sum d^2 - n(d)^2}{n-1}}$$

Where n=number of patients

SD= standard deviation

d=difference between initial and final reading

d=mean difference between initial and final reading

For comparing control group responses over experimental group responses towards treatment, analysis of co-variance(ANCOVA) was used with pre –test scores as co-variant.

ANCOVA design is a noise reducing experimental design. It results posttest course for variability on the co-variant(pre-test). The ANCOVA model used is

$$Y=a+bX+Cz+dXZ+e$$

Where Y= the post test scores

X=P re –test scores

Z=Case(either experiment or control)

a=Intercept coefficient of variable case

d=Interaction coefficient of pre-test scores and case

e=Error term or residual

STATISTICAL ANALYSIS

STEP LENGTH

A Paired t-test

A Table for comparison of Pre Test & Post Test values of Step length in both Control and Experimental group.

Group	Pre-test Mean	Post-test Mean	Mean Difference	Standard deviation		Paired 't' value	P-level	% Gain
				Pre test	Post test			
Control	30.733	33.133	2.4	11.853	11.605	8.29	0.00001	7.81
Experiment	31.6	35.73	4.133	8.122	8.396	14.223	0	13.08

The control group of mean value step length posttest 33.133 with standard deviation (SD) 11.605 Which is lower than the mean value of the pre test 30.733 with SD. 11.853 and "T" – value 8.29 which statistically significant with ($p<0.005$) 0.0001.

The experimental mean value of step length post value 35.73 with SD 8.396 which is lower than the mean value of the pre test 31.6 with Standard deviation.

ANCOVA RESULTS FOR STEP LENGTH

A table for comparison of mean values of between & within group of Control& Experimental group for step length parameter.

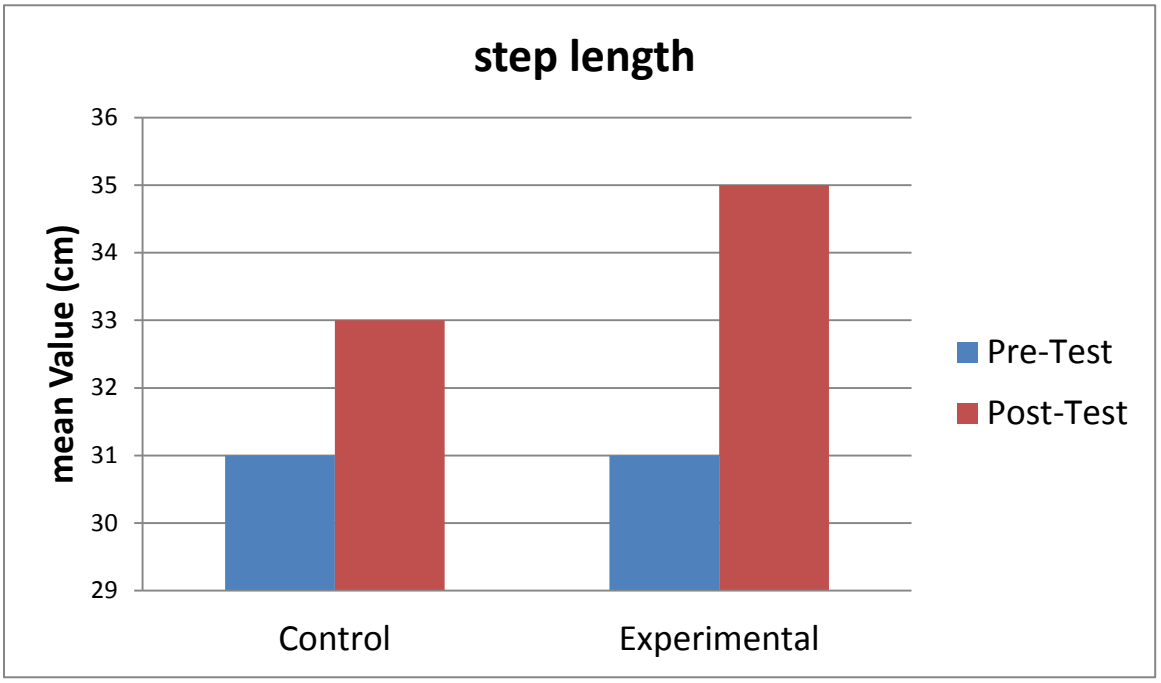
Source of Variation	Mean Sum Of Squares	F-Ratio	P-Level
Between Groups	22.696	17.465	0.000275
Within Groups	1.299		

From the above ANCOVA table the F-ratio is 17.465 and corresponding P-level is 0.000275 this indicate that there exist highly significant difference in step length between the control group and experimental group.

Percentage difference: The percentage improvement of step length from the initial value in control group is 7’81% and in experimental group is 13.08%.When comparing the percentage difference in improvement of step length between control group and experimental group.There is a difference of 5’27% at the end of treatment

Graph-1

A Graph for comparison of pretest & posttest values of Step length in both Control and Experimental group.



STRIDE LENGTH

A Paired t-Test

A table for comparison of Pre & Post Test values of stride length in both Control and Experimental group.

Group	Pre-Test Mean	Post test Mean	Mean Difference	Standard deviation		Paired 't' value	P-Level	% Gain
				Pre test	Post test			
Control	60.733	65.1333	4.4	24.417	23.9996	11.3428	0.00000	7.243
Experiment	62.866	70.866	8	15.842	16.172	12.2202	0.0000	12.73

The control group of mean value of stride length in post test is 65.1333 with SD of 23.999 which is lower than the mean value of the pre test 60.733 with SD "T"- value 11.3428 which is statistically significant with($p<0.005$) 0.000.

The experimental group mean value of stride length is post test is 70.866 with SD of 16.172 which is lower than the mean value of the pre test 62.866 with SD 15.842 "T"

ANCOVA Result for Stride length

A table for comparison of mean values of between & within group of Control & Experimental group for stride length parameter.

Source of Variation	Mean Sum of Squares	F-ratio	P level
Between groups	98.1686	22.04935	0.000069
Within groups	4.45221		

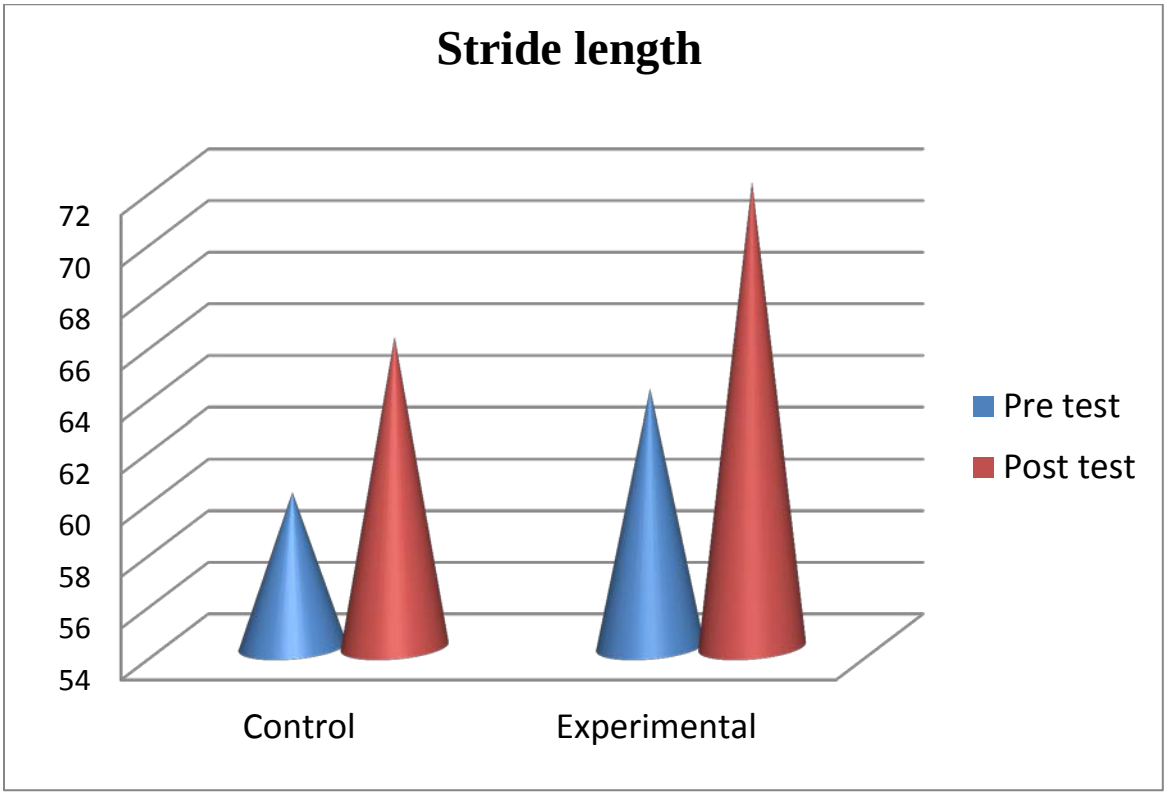
From the above ANCOVA table the F- ratio is 22.04935 and corresponding p-level value is 0.000069. This indicates that there exists highly significant difference in stride length between the Control Group.

Percentage Difference:-The percentage improvement of stride length from the initial value in control group is 7.243% and in experimental group is 12.73%.

When comparing the percentage difference in improvement of stride length between control group. There is difference of 5.48% at the end of treatment.

Graph-2

A graph for comparison of pre test & post test mean values of stride length in both Control and Experimental Group.



SPEED

A Paired t-Test

A table for comparison of Pre & Post Test values of speed in both Control and Experimental group.

Group	Pre-Test Mean	Post Test Mean	Mean Difference	Standard deviation		Paired' t' Value	P-Level	% Gain
				Pre Test	Post Test			
Control	0.5973	0.64533	0.048	0.1499	0.14711	13.0524	0.00000	8.035
Experiment	0.62866	0.75	0.1213	0.1485	0.16579	12.8327	0.00000	19.299

The control group mean value of speed is post test is 0.64533 with SD of 0.14711 which is lower than the mean value of the pre test 0.5973 with SD 0.1499 " T" value 13.0524 which is statistically significant with ($p<0.005$) 0.000.

The experimental group mean value of speed in post & test 0.75 with SD of 0.16579 which is lower than the mean value of the pretest 0.62866 with SD 0.1485 "t" value of 12.8327 which is statistically significant with ($p<0.005$) 0.000.

ANCOVA RESULTS FOR SPEED

A table for comparison of mean values of between & within group of Control& Experimental group for speed parameter.

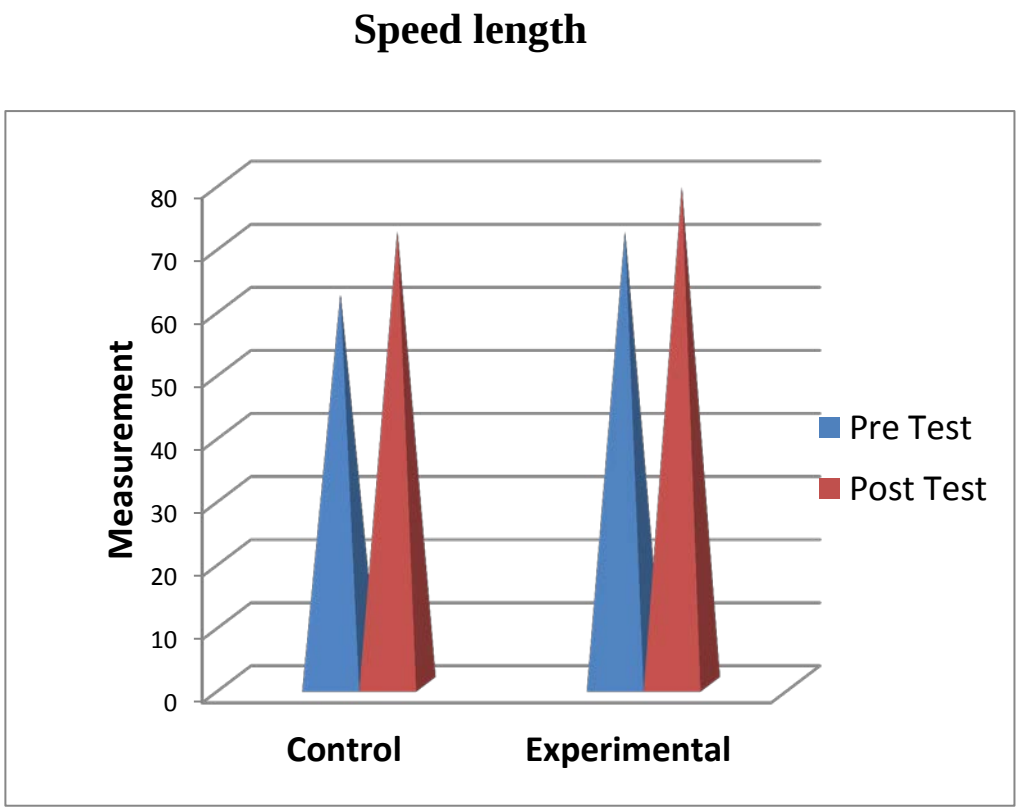
Source of Variation	Mean Sum Of Squares	F-ratio	P-Level
Between Group	0.037898	49.01854	0.00000
Within Group	0.000773		

From the above ANCOVA table the F- ratio is and 49.01854 corresponding p- level is zero. This indicates that there exist highly significant difference in the speed between the control group and experimental group.

Percentage Difference –The percentage improvement of speed from the initial value in control group is 8.035% and in experimental group is 19.299%. When comparing the percentage difference in Improvement of speed length between control group and experimental group. There is a difference of 11.264% at the end of treatment.

Graph 3

A graph for comparison of Pre Test & Post Test values of speed in both Control and Experimental group.



RESULTS AND DISCUSSION

RESULTS

The statistical results of the study is highly significant in both Control & Experimental group in all the three parameters of the gait pattern – Step length, Stride length, Speed length, following both strengthening & stretching exercises, on which the Experimental group showed higher percentage of improvement comparatively.

DISCUSSION

The study was an experimental study conducted to assess the effectiveness of strengthening exercise in the gait performance of adults with spastic hemiplegics the age of the subject were almost identical in both the groups[mean age of control group is 60 and of experiments group is 60] and all the subjects were hemiplegics.

Both groups were assessed in the first day and the last day of the treatment. The tools taken for measuring the outcome were step length, stride length and speed of the gait pattern.

The control group was given stretching exercise. Prolonged muscle stretching for plantar flexors and static manual muscle stretching for the other involved muscle groups of lower limb 8 repetitions per sessions.

The experimental group received same stretching procedures and manual resistance exercises in full ROM and rowing machine exercise12 repetition per sessions. The pretest and post-test values of gait parameters of both groups were computed for comparison.

The step length in the control group shows a t-value 8.290 and the corresponding p-level value is 0.0001, which indicates the highly significant difference between the pre-test and post-test values. The post-test mean value is 33.133 is higher than the pretest mean value 30.733 showing that here is significant improvement in control group.

The step length in the experimental groups shows a t-value of 14.223 and the corresponding p-level value 0.0000 which indicates that there is highly significant difference between the pre-test and post-test scores of experimental group.

On comparing the percentage gain in each group the step length in the experimental group has a percentage gain of 13.08% which is greater that the percentage gain of control group 7.81% again showing the 5.27% improvement of step length experimental group that the control group.

The stride length in the control group shows a t-value 11.34278 and the corresponding p-level is zero which indicates the highly significant difference between the pre-test and post-test values the posttest value mean value 60.733 showing that there is significant improvement I stride length of the control group.

The stride length in the experimental group shows a t-value of 12.2202 and the corresponding p-level value 0.000 which indicates that there is highly significant difference between the pre-test and post-test scores of experimental group.

The post-test means 70.866 which are grater than the pre-test mean 62.866 showing the highly significant improvement in experimental group.

On comparing the percentage gain in each group the stride length in experimental group has a percentage gain of 12.76 which is greater than percentage gain or control group 7.243 again showing the 5.487% improvement of stride length in experimental group than the control group.

The speed in the control group shows a t-value 13.0524 and the corresponding p-level value is zero which indicates the highly significant t difference between the pre-test and post, test mean value 0.597 showing that there is significant improvement in speed of control group.

The speed in the experimental group I group shows a t value of 2.8327 and the corresponding p level value zero which indicates the t there is highly significant difference between the pre-test and post-test scores of experimental group.

The post-test means 0.5 which is greater than the pre, test mean 0.8 showing the highly significant improvement I experimental group.

On statistical analysis using ANCOVA T to compare the experimental group responses over the control group responses, the calculated value is 49.01854 and corresponding p- value zero indicating the highly significant difference between the control group and the experimental group.

On comparing the percentage gain in each group p the speeding experimental group has a percentage gain of 19.299, which is greater than the percentage gain of control group 8.035 again showing the 11.264% improvement of speed in experimental group than the control group.

Thus a per the t-test result and comparing the pre-test and post-test mean values there is significant improvement of gait pattern in control group and experimental group.

As per the ANCOVA there is significant difference is step length, stride length and speed in the experimental group stating that there is significant improvement in all the outcome measures of the gait pattern to the experimental group than the control group.The improvement of gait pattern in the control group is attributed to the fact that prolonged muscle stretching program is effective in reducing spasticity in adults with hemiplegia as proved by Richards CL, Malouin F et al-1991. Stretching is probably and essential component for relieving muscle stiffness in spastic patient. It could be related to the mechanical changes in themusculotendinous unit or plastic changes within central nervous system and modulation synaptic efficacy associated with neuro transmitter changes on a cellular level. Static stretch improves muscle flexibility through the use of intrinsic mechanism that produces autogenic inhibition of tight muscle via Golgi tendon organ mechanism. Thus stretching program is an important part or treatment of spasticity and serves passively to elongate chronically shortened spastic muscles[Susan B.O Sulivan, Physical Rehabilitation Assessment and treatment 1998.

Magnusson SP concluded that static stretching exercise increased joint ROM as result of change in stretch tolerance according to Taylor DC Dalton JD JR states that static stretching of 6-60 seconds will modify muscle spindle activity allowing slight increase in muscle length.

All these factors might have contributed for the improvement I of gait pattern I the control group.

There is significant comparative improvement in the gait pattern in experimental group with a percentage gain of 5.27% in step length, 5.487T in stride length and 11.264% in speed than the control group.

This could be attributed to be effect that the strengthening exercise produces a number of neuro muscular changes in neural drive and in muscle. Here in this spastic muscle the strength training program rather that increasing spasticity it is more likely that repetitive strengthening exercise might decrease spastic both by improving neural control of muscle and maintaining the excitability of muscle.

Stiffness of a limb is typically associated with a lack of skill in motor performance. A gradual acquisition of skill is accompanied by a decrease in muscle force, a degree in co-contraction of agonist and antagonist and more efficient motor unit recruitment.

CONCLUSION

CONCLUSION

This study adds to the accumulating evidence that strengthening exercise is beneficial in improving the walking ability of adults with spastic hemiplegia. The finding that there is no adverse effect accompanied with the positive outcomes.

LIMITATIONS AND SUGGESTIONS

LIMITATIONS:

1.Study was conducted for a short period of time.

2.Limited sample size.

3.The study groups were not homogenic in sex wise distribution

4.The outcome measure used was only simple gait parameters

5.Spasticity measurement of muscles were not done before and after study.

6.No follow up could be done.

7.All measurement were taken manually and this may introduce human error, which could treat the reliability of the study.

SUGGESTIONS

1.Future studies can use muscle strength and spasticity as one of the outcome measure.

2.To establish the efficacy of the treatment a large sample size study is required.

3.To make the result more valid a longer duration study may be carried out.

4.Further studies can be conducted to find out the effects of strengthening exercise on other spastic conduction in gait performance.

5.Further studies can be conducted males only or females only.

6. Advanced techniques is strengthening exercises can be used.

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APPENDICES

APPENDIX-1

NEUROLOGICAL ASSESSMENT CHART

Name:

Age:

Sex:

Occupation:

Address:

Height:

Weight:

IP/OP NO:

Referred by:Dr.

Chief complaints:

Past medical history:

Present medical history:

Associated problems:

Vital signs:

OBSERVATION:

Build:

Postures

Skin changes

Deformity

External appliances

EXAMINATION:

1. Higher functions

Level of consciousness

Memory

Orientation

Vision

Hearing

Communication

2.Cranial nerve examination

3.SensoryAssessment

Superficial sensation

Deep sensation

Cortical sensation

4.MotorAssessment

Tone

Range of motion

Superficial reflexes

Deep tendon reflexes

Voluntary control

Hand function

Bladder and bowel function

Gait

APPENDIX-2

MASTER CHART

s.no	Step length(affected)				stride length(affected)				Speed(affected)			
	Experimental group		Control group		Experimental group		Control group		Experimental group		control group	
	Pre test	Post test	pre test	Post test	Pre test	Post test	pre test	Post test	Pre test	Post test	Pre test	Post test
1	25.10	40.48	46.2	55.13	63.15	110.35	97.3	114.32	55.05	75.05	85.06	95.05
2	43.80	48.50	48.1	52.12	78.05	112.89.	95.10	110.01	40.90	50.30	90.06	100.07
3	41.78	48.65	48.3	55.19	90.80	115.03	100.2	105.0	47.78	65.70	95.20	100.2
4	26.47	40.54	41.40	45.40	100.06	117.78	95.08	98.03	60.40	80.40	95.0	100.06
5	36.88	37.39	40.13	48.35	70.60	101.23	80.60	90.07	48.60	99.01	85.60	90.60
6	42.50	45.12	44.50	47.40	80.34	106.02	95.04	100.05	59.60	90.65	87.70	85.06
7	37.60	40.71	47.34	53.12	25.86	88.73	92.70	101.09	45.75	80.05	83.69	76.46
8	37.34	39.74	41.35	48.30	50.71	93.60	87.09	60.10	48.30	78.31	87.76	75.67
9	31.95	40.39	45.40	50.35	50.24	95.75	83.98	73.89	45.21	72.0	86.20	70.65
10	29.15	37.20	40.15	50.20	25.30	35.78	68.76	76.46	85.09	75.61	80.64	75.07
11	25.19	37.25	35.20	45.21	13.60	70.10	86.04	72.05	80.64	75.98	70.65	75.05
12	26.78	38.60	37.25	45.40	30.34	69.50	83.76	75.67	70.65	70.65	68.30	72.03
13	24.60	35.50	3527	40.12	36.60	65.80	80.64	75.20	68.98	78.76	70.65	65.70
14	19.80	36.85	38.14	45.25	40.54	67.62	70.65	70.20	86.98	80.50	60.35	70.40
15	21.80	38.65	36.9	41.10	35.99	69.75	68.02	75.30	97.76	85.06	47.05	80.06

Patient Consent Form

I
Mr/Mrs……
……
…….Here by consent to participate in the study conducted by RAJASEKAR.V Final year master of physiotherapy student of Madha College of Physiotherapy, Kundrathur, Chennai.

Signature of Patient