ORIGINAL ARTICLE

Effects of Mobilization with Movement Versus Static Stretching among Patients with Stroke, Hyderabad, Sindh Province, Pakistan

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ABSTRACT

Objective: The study aims to evaluate the effects of mobilization with movement versus static muscle stretching in stroke patients.

Study Design: A multicenter interventional study.

Place and Duration of Study: This Study was conducted at Three different hospitals named Majee Hospital, Surgi Care Hospital, and St. Elizabeth Hospital Hyderabad, Sindh-Pakistan from January 2022 to June 2022.

Methods: Purposive sampling was used to investigate the effects of two mobilization techniques, Mobilization with Movement and Static Muscle Stretching, on post-stroke gait. Ethical approval was obtained. Standardized rehabilitation therapy (30 min/session) combined with either technique (3x/week) was delivered for 4 weeks. Ankle Dorsiflexion Passive Range of Motion, Berg Balance score, cadence, and speed were assessed pre-and post-intervention. Data analysis utilized SPSS version 25.0.

Results: The total Sample size was 70(45.7%), equally divided into two groups. The Mobilization group showed significant improvement in all outcome measures compared with baseline (*P*<0.05). Including Ankle Dorsiflexion Passive Range of Motion (0.011), Berg Balance Score (0.000), Gait Speed (0.000) and Cadence (0.005). Gait speed and cadence showed more improvement than other parameters.

Conclusion: The study reveals that Mobilization training, combined with standard rehabilitation, significantly improves Ankle Flexion Passive Range of Motion, Berg Balance Score, gait speed, and cadence in post-stoke patients or patients in the recovering stage.

Keywords: *Ankle Range of Motion, Gait Parameters, Korean Mini-Mental Scale, Stroke*

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Introduction

Stroke or CVA is the abrupt loss of neurological activity brought about by an interference of the blood stream to the cerebrum. Atherosclerosis is the major causing factor of cerebrovascular accident; it occurs in four arteries, mainly including Carotid artery, middle cerebral artery, vertebral and basilar artery.[1] Clinically, patients present with changes in the level of consciousness and loss of motor and sensory functions. The condition is diagnosed as a stroke if the neurological function loss remains for 24hours. Motor deficiencies lead to paralysis or

weakness, with paralysis referred to as Hemiplegia and weakness as Hemiparesis.[2] Within 6 months following a stroke, disabilities may be observed based on Etiology: It can be classified as Hemorrhage, Thrombosis, and embolus. Specific vascular territories affected include the Anterior, posterior and medial Cerebral Artery Syndrome.[3] The scoring range for stroke severity is 0-42 points, with a higher score indicating greater severity. The highest incidence of stroke in Pakistan was noted among individuals between the ages 75 and 85 and is higher in urban areas. Stroke prevalence is 95 per 100,000 persons per year for the years 2000 to 2016.[4] There are many signs and symptoms patients present with like headaches may be unilateral or bilateral, spontaneous fainting due to dim or loss of vision and coordination, decreased muscle strength of arm or leg sometimes on the face. Loss of balance May be accompanied by nausea or vomiting, and speech or comprehensive disorder will be the rarest symptoms among all.[5] The first step in the patient assessment is detailed history taking, which is the most important tool of assessment then we move forward towards the systemic review to identify the presence of any disease related to body systems, Physical tests including joint integrity, muscle strength, cranial nerve function test and motor and sensory functional test is also the part of assessment. Postural control and gait are also very important to assess mobility.[6] Its physiotherapy management includes 3 phases in the acute care facility, low-intensity rehabilitation begins when the patient is medically stable, typically within 72 hours. The therapist aids in continuously monitoring the patient's rehabilitation during acute care and is alert to significant changes in the patient's conditions. Early mobilization prevents the harmful effects of bed rest and de-conditioning. It also helps to improve the patient's level of consciousness and regain functional independence. Its 2nd phase includes Intensive hospital rehabilitation is an independent rehabilitation facility. Patients having symptoms of either moderate or severe limitation in daily activity or severe residual impairment can benefit from this rehab facility. Less intense services can be provided for a duration of 60 to 90 minutes. Phase rehabilitation services are provided to chronic post-stroke patients whose symptoms last for more than 6 months, whether they are present in the community or at home. Education and instruction to the family and patient about the home exercise programme for the importance of maintaining exercise restore health, fall prevention, and safety.[7,8] Deterioration in quality of life after stroke primarily manifested in basic activities such as self-care of the body, ability to communicate, and eat. In general, those patients seemed to be more affected by the physical domain than the psychosocial domain.[9] Mobilization with movement is defined as the Simultaneous application of sustained accessory mobilization applied by a therapist is known as mobilization with movement. It is an active physiological movement to the patient's end-range. With over pressure is then supplied as a barrier without pain. To restore daily accessory movements in confined dorsiflexion range of motion therapists typically use mobilization methods. In weight-bearing position, mobilization applied during movement (MWM) allows active dorsiflexion on the ankle.[10] Stretching is the Lengthening or extending of one's body part to its full length to improve restricted range and decrease the risk of injury that is short and hypo mobile over the period of time. Stretching exercises can be performed by a patient independently after careful instruction and close supervision can be a more appropriate intervention. Types of stretching are Active stretching, passive stretching, dynamic stretching and Neuro-muscular Proprioceptive facilitation stretching. The active stretching approach involves adopting and holding a stance while focusing solely on the muscles of the targeted group. Flexing the ankle back and forth, for example, requires the activation of the calf muscles to retain the toes in a pointed posture and lift them toward the shin.[11,12] The presence of ankle joint spasticity in patients with stroke causes the shortening of flexor muscles and limits their movement, as the ankle plays a vital role in

maintaining balance and gait pattern; the stiffness will affect the function of the ankle joint, thus resulting in independence and restrict the participation with the society .To increase ankle function and range ankle range of motion exercise, stretching and strengthening of muscles and mobilization techniques are used.[13,14] Current study aims to evaluate the effects of mobilization with movement versus static muscle stretching in stroke patients in different hospitals of Hyderabad, Sindh-Pakistan.

Methods

This was a multicenter interventional study with a non-probability purposive sampling technique from January to June 2022. This was carried out at different hospitals named Majee Hospital, Surgi care Hospital and St. Elizabeth Hospital Hyderabad, Sindh-Pakistan. Prior Ethical approval was taken from the Institute Review Board of Isra University Karachi campus held on dated: 15th January 2020 vide letter no: ERC/163/2020. Inclusion Criteria were patients ≥6 months of hemorrhagic or ischemic stroke**,** Ankle Dorsiflexion Passive Range of Motion should be <8° on the paralytic side**,** Ability to perform independent gait without assisted devices over 10 m distance, Patient with moderate to severe stroke**,** Korean Mini-Mental State Examination scale is the assessment tool for dementia should show minimum score of 24, Both male and female and Age in between 45 - 70 years. Exclusion criteria were any surgical history in the lower extremities, fractures or any other neurological disease**,** Contraindications of ankle joint mobilization and Patient with any orthotic device**.** Standard rehabilitation therapy for 30 min per session including AROM and PROM of motion exercises for 10 minutes followed by weight bearing training in sitting, standing and walk in same time were given followed by Mobilization with Movement or Static Muscle Stretching techniques three times per week depend on the group they belong. Ankle DF-PROM, Berg Balance score, cadence and speed (m/s) were measured after 4 weeks of training. Universal goniometer, Mulligan Belt, incline board, Berg Balance scale, Gait parameters, Korean Mini Mental Scale were the

tools. An informed consent was signed by each participant. After 4 weeks' treatment, Characteristics of patients including all outcome measures was assessed by physical therapist before and after treatment. Participants of both groups were given MWM/Static stretching for 30 min per session over the course of 1-3 days accompanied standard physiotherapy. For mobilization with movement training A non-elastic belt was used which was passed around the waist of the therapist and affected leg of the patient During this technique the patient was standing in full extended position, the therapist will have applied Sustained anterior glide which was maintained for 10 seconds and the patients was then asked to perform a slow dorsiflexion movement till its end range during the gliding. With a 1-min rest between sets, 3 sets of 10 repetitions was applied, For Static muscle stretching A 20° incline board was used for the treatment, the patient was asked to stand on it and slightly bend the knee as far as he felt the stretch in gastrocnemius muscle. 3 sets of ten repetitions were applied with 1 mint rest. Outcome measures are 1-Ankle Dorsiflexion Passive Range of Motion: With the knee bent to 90° in a prone lying position, DF-PROM of the ankle was measured. On the lateral malleolus, the 14-inch plastic goniometer was used and placed on the body's central axis. Should be measured three times in repetition but the average result was used for analysis Gait Parameters include Speed and cadence, were analyzed. Cadence was recorded by the number of steps taken per minute. Speed was recorded by asking the participants to walk 10m in each session digitally; a digital stopwatch was used to record the time in seconds 3-Berg Balance Score Scale includes fourteen items having different activitiestasks to evaluate functional ability in performing routine activities of life in three fundamental positions with the score ranging between 0 and 4, the maximum value should come out to be 56 points. SPSS version 25.0 was used for data analysis. Continuous data was presented as mean and standard deviation. Categorical data is presented as frequency and percentages. Student *t*-test tests independent and paired were used to analyze the normality of

Table-1: Demographic Information of the Patients

Group		Static muscle Stretching (n=35)	Mobilization with Movement (n=35)	Total
Gender	Female	14 40.0%	18 51.4%	32 45.7%
	Male	21 60.0%	17 48.6%	38 54.3%
Type of Stroke (Ischemic/Hemorrhagic	Ischemic	17 48.6%	17 48.6%	34 48.6%
	Hemorrhagic	18 51.4%	18 51.4%	36 51.4%
Hemiplegic side (Left/Right)	Left	18 51.4%	18 51.4%	36 51.4%
	Right	17 48.6%	17 48.6%	34 48.6%

the data collected. The *P*-value of < 0.05 was set as statistical statistically significant.

Results

Demographic data was collected from 70 participants, including Age, Gender, Type of Stroke, Hemiplegia Side, Disease Duration, and K-MMSE scale score, as shown in table 1 and 2. The Mean Age in MWM is (60.17±8.767) and in SMS (60.37±8.981). In the MWM group, 51.4% were female and 48.6% were male, while in the SMS group, 40.0% were female and 60.0% were male. In both groups, 48.6% were ischemic disease and 51.4% were hemorrhagic disease patients. In both groups, the affected side was 51.4% left and 48.6% right. (Table 1 and 2).

The Mean value of Disease duration in MWM is (8.51±1.837) and SMS is (8.03±1.706). The Mean Ankle DF-PROM in the Pretest of MWM is (6.51 ±0.50) and the Post-test value is (14.70 ±1.60) while the Pretest of SMS (is 6.54 ±0.50) and Posttest value is (13.71 ±1.56) which shows the posttest values of both groups were significantly higher than the Pretest value (*P*<0.00) as shown in figure.1.

The Mean Ankle DF-PROM Post-Test value of MWM is higher in significance than in SMS. The Mean Berg Balance score in Pretest of MWM

(33.83 ±3.12) and Posttest is (44.17 ±4.34) while the Pretest of the SMS group (33.77 ±3.17) and Posttest is (39.26 ±1.78) which shows the posttest of both groups is significantly higher than the Pretest value (*P*<0.00) as shown in figure.1.

The Berg Balance Score Posttest value is increased in the MWM group than in the SMS group. The Speed (m/s) in the Pretest of the MWM group is (1.42 ±0.33) and Posttest is (2.30 ±0.19) while the Pretest of the SMS group is (1.41 ±0.32) and Posttest is (1.93 ±0.16) which shows the posttest value of both groups was significantly higher than the Pretest value (*P*<0.00) as shown in figure.2

Speed in the post-test value of the MWM group increases as compared to the SMS group. The Cadence in the Pretest of the MWM group is (72.31 ±10.64) and Posttest is (98.69 ±6.76) while the Pretest of group B SMS is (74.91 ±7.94). The posttest is (93.37 ±8.40) which shows the posttest value of both groups was significantly higher than the Pretest value (*P*<0.00), as shown in Figure 2. PosttestThe posttest value of the MWM group in cadence

Table-2: Continuous Variables Comparison with Groups

Group		n	Mean	Std. Deviation	Std. Error Mean	*P*-value
Age	Static muscle Stretching	35	60.37	8.981	1.518	0.707
	Mobilization with Movement	35	61.17	8.767	1.482	
Disease Duration	Static muscle Stretching	35	8.03	1.706	0.288	0.256
	Mobilization with Movement	35	8.51	1.837	0.311	

Table-3: Comparison of Groups on Clinical Parameters

Status	Within Groups Comparison	Mean ± Standard deviation	*P*-value
Pre KMMSE score	Mobilization with Movement	23.34 ±0.68	0.733
	Static muscle Stretching	23.29 ±0.71	
Post KMMSE score	Mobilization with Movement	26.17 ±1.31	0.727
	Static muscle Stretching	26.06 ±1.41	
Pre DF-PROM	Mobilization with Movement	6.51 ±0.50	0.814
	Static muscle Stretching	6.54 ±0.50	
Post DF-PROM	Mobilization with Movement	14.70 ±1.60	0.011
	Static muscle Stretching	13.71 ±1.56	
Pre BBS	Mobilization with Movement	33.83 ±3.12	0.94
	Static muscle Stretching	33.77 ±3.17	
Post BBS	Mobilization with Movement	44.17 ±4.34	0.000
	Static muscle Stretching	39.26 ±1.78	
Pre-Gait	Mobilization with Movement	1.42 ±0.33	0.833
	Static muscle Stretching	1.41 ±0.32	
Post Gait	Mobilization with Movement	2.30 ±0.19	0.000
	Static muscle Stretching	1.93 ±0.16	
Pre Cadence	Mobilization with Movement	72.31 ±10.64	0.251
	Static muscle Stretching	74.91 ±7.94	
Post Cadence	Mobilization with Movement	98.69 ±6.76	0.005
	Static muscle Stretching	93.37 ±8.40	

*P-values were produced by using Mann Whitney U test. *It was considered statistically significant at P-value ≤ 0.05

result showed that the mobilization with movement significantly improved the dorsiflexion PROM of the ankle. BBS score between the groups is significantly increased in MWM with a mean difference of 8.1 compared with SMS. Results also showed marked improvement when we analyzed the difference within the group, with a mean of 2 in the SMS group and 9.1 in the MWM group. Our result is the same as the previous studies.[16,17] A literature
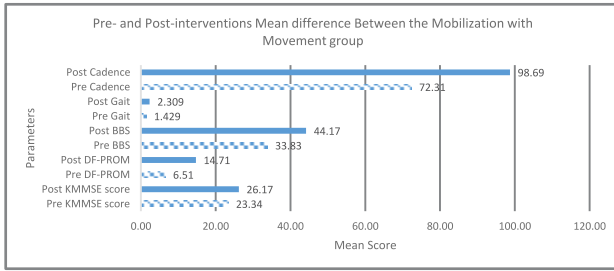
Fig.1: Pre- and Post-interventions Mean difference Between the Mobilization with Movement Group
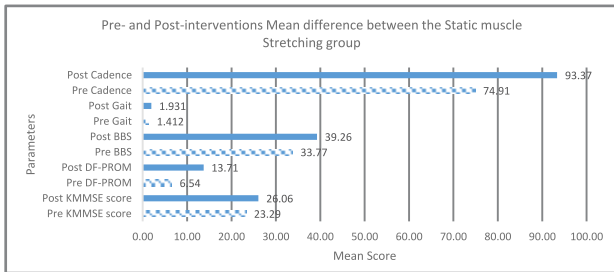

Fig.2: Pre- and Post-interventions Mean difference between the Static muscle Stretching group

published by Mecagni et al. conducted a study on community-dwelling women aimed to find out the correlation in both outcome measure of balance and ankle ROM after analyzing data results show that restriction in ankle range of motion decreases the balance ability of the patient with stroke.[18,19] Further, another literature by an and Jo conducted a study to find out the effects of mobilization on patients with CVA. End of his study showed that mobilizations with movement. Results show that the strength mobility of the ankle was increased after MWM.[20,21] Gait parameters, including Cadence and speed (m/s), were analyzed and significantly improved in between and within the group's analysis. Cadence between the groups increased with a mean difference of 13 in the MWM group and within the group with a mean of 19.4 in MWM and 7.1 in SMS. Speed between the group increased with the mean difference of 8 in MWM and within the group with the mean of 15.7 in MWM and 7.2 in SMS. The results of the above study were the same as the study conducted by. Hui-Chan et al. who's aim are to find out the correlation between ankle dorsi and plantar flexor capability and Tightness in stroke patients with walking endurance as an outcome measure covering a distance of 6-min. The

conclusion shows that there is a marked increase in the strength of the dorsiflexor. In Weight-bearing position, mobilization with movement is performed with a posterior talus glide by the therapist to increase active ankle dorsiflexion. In our study during MWM we asked the patient to perform lunges with dorsiflexion actively and slowly. When we performed single leg lunges it caused the gastrocnemius muscle to contract leads to the planter flexors contraction resulting in the improvement of planter flexion ROM and strength. Stance stability of the affected side was also increased due to increase strength of knee extensors after applying Mobilization with movement. Stretching force occurred after the MWM application was greater than the static stretching, which means speed and cadence increased in MWM.[22,23] A study done by Go Junhyeok et al. a researcher in 2021 conducted a research to examine the combine effects of ankle joint mobilization and calf stretching on gait speed in patient with stroke. For this purpose, he made two groups, Group A (joint mobilization) and Group B (stretching+ Joint mobilization). Each group has 10 participants, which was selected on the basis of inclusion criteria. Parameters which were , and cadence 10-meter walk test included are 10MWT/sec, step-length of the affected side, velocity, and cadence, and 10-meter walk test, and the GAIT Rite system was used to measure these parameters.[20] mint intervention is given to both the groups including 10mint anteroposterior mobilization with 10mint stretching to JMSG and only 20mint anteroposterior mobilization to JMG. Each step includes 10 rounds with 1 mint rest after each round. Results of the study showed that JMSG was significantly improved only in step length than the JMG ($P<0.05$), but velocity and cadence are improving more in JMSG.

Due to limited time and non-cooperative participants, an insufficient sample size was obtained, which made it difficult to identify

significant relationships in the data. The larger the sample size, the more precise the result.

Conclusion

After 4-week treatment, all outcome measures improved significantly when compared with the measure values. Dorsiflexion Passive Range of Motion, Berg Balance Scale score, speed, and cadence in the MWM group were improved more than in the static muscle stretching group. The 4-week treatment duration should be increased by 8 weeks with combination of different physical therapy techniques thirdly the muscle stretching should be done passively with the help of another therapist for both muscles at a time, including gastrocnemius and Soleus because they are the primary planter flexor of ankle joint and for dorsiflexion tibialis anterior muscle should be part of the stretching.

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Authors Contribution

DQ: Idea conception, study designing, data collection, manuscript writing and proofreading

PL: Study designing, data collection, manuscript writing and proofreading

MFF: Study designing, data analysis, results and interpretation, manuscript writing and proofreading

AY: Study designing, data collection, manuscript writing and proofreading

SAM: Study designing, manuscript writing and proofreading

ST: Study designing, manuscript writing and proofreading

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