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Effect of Pilates and Yoga on Balance in Subjects with Hemiparetic Stroke – A Comparative Pilot Study

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ABSTRACT

Background: In patients with stroke, balance is mainly affected in day-to-day life activity. Pilates and yoga include physical and mental components focusing on breathing control, spinal alignment and flexibility via multiple exercises. Pilates focuses on core stability and spinal alignment, whereas yoga combines specific postures, movement sequences, relaxation and meditation.
Aim: To compare the effect of Pilates and Yoga on balance in patient with hemiparetic stroke.
Material & Method: This study was conducted in various neurological set ups of Surat. 10 hemiparetic stroke patients were randomly assigned into 2 groups: 5 in group A (Pilates & conventional physiotherapy exercise) and 5 in group B (Yoga & conventional physiotherapy exercise). Patients in both groups received intervention for 3 days/week for 45 minutes for 4 weeks. Conventional physiotherapy was given 6 days/week. Balance was assessed by using Berg Balance Scale. Data were recorded at baseline and after 4 weeks of training. Descriptive statistics was calculated using mean and standard deviation, Paired t-test was used to find difference within group and independent t-test for between group comparison.
Result: The results showed there was no significant difference in between group on balance but there was improvement in balance in both groups.
Conclusion: After 4 weeks of training, there was significant improvement in balance in both groups. And there was no significant difference in pilates versus yoga in patients with hemiparetic stoke.
KEYWORDS: Balance, Hemiparetic stroke, Pilates, Yoga.

BACKGROUND

Stroke (Cerebrovascular accident [CVA]) is the abrupt loss of neurological function caused by an obstruction of blood flow to the brain [1]. According to WHO, stroke is defined as “rapid development of clinical signs and symptoms of a focal neurological disturbance lasting for more than 24 hours or even leading to death in worst case scenarios with no apparent cause other than the vascular origin” [2]. There are 2 causes of stroke: 1.thrombotic or embolic

infarction 2.due to haemorrhage [1]. The prevalence rate of stroke ranges from 84-262/100,000 in rural areas and 334-424/100,000 in urban areas. The incidence rate is 119-145/100,000 based on recent studies [3].

Postural balance can be defined as the ability to control centre of mass (COM) within the base of support (BOS) [4]. It is necessary for optimal performance of many activities of daily livings [5]. Impaired postural balance is a common problem after stroke and a common cause of fall [6]. Balance impairment is an important dysfunction faced by stroke patients since the risk of falls is high in the initial one-year post-lesion [7].

Pilates training is mainly based on regulatory exercise training from spinal neutrality and was found to be highly effective for recovering physical functions such as improving balance, flexibility, muscle and cardiopulmonary functions in stroke patients [8]. There are 8 principles of Pilates: control, breathing, flowing movement, precision, centring, stability, range of motion and opposition. Pilates exercise help in achieving dynamic balance in an upright position by improving flexibility, strength, postural control using resistance and changing the body's orientation to gravity [9].

Yoga is derived from the Sanskrit word 'Yuj' which means to unite implying main focus on the union of mind, body and spirit [10]. Yoga traditionally targets the physical body, using postures (asanas), diaphragmatic breathing (pranayama) and meditation (dhyana) [11]. Yoga is believed to act at both psychological and physical levels and improvements in self-efficacy and confidence. These changes may lead to a change in behaviour and ultimately improvement is seen in health [12]. In yoga, the mind is encouraged to focus specifically on what happens inside the body and where the body is located in space, thus increasing awareness. On physical level, yogic postures are called asanas, which can be done alone or in group, as the limbs of the body provide necessary weight and counter weight [13]. There are many asanas in yoga that is used for improving balance.

As in many recent advances, individually Pilates and Yoga both are proven effective but there is scarcity of literature to prove which one of these two treatments, is more effective. The purpose of the study is to compare the effect of Pilates and Yoga on balance among hemiparetic stroke patients.

MATERIAL & METHOD

Ethical clearance was taken from Institutional Ethical Committee (IEC). 10 hemiparetic patients were recruited from various physiotherapy set ups of Surat. The purpose of this study was explained and a written informed consent and demographic details were obtained from all the subjects. Patient allocation was done on the basis of random sampling method. They were divided into two groups A and B. Inclusion criteria: (1) patient age group is between 45 - 70 years. (2) Male & female both. (3) Duration of stroke 2 week - 6 month. (4) Participants who have scored ≤1+ grade on Modified Ashworth Scale (MAS). (5) Participants who have scored ≥4 grade on Voluntary Control Grade. (6) Participants who have weakness on one side of the body. (7) Able to stand or walk with or without assistance. (8) Willingness to participate. Exclusion criteria: (1) Any orthopaedic disorder, other neurological condition, cardiovascular

condition. (2) Patients with spasticity and flaccidity. (3) History of recurrent stroke. (4) Patients who are blind, deaf, unable to speak and dementia. (5) Uncooperative patient. (6) Lack of understanding.

Description of the groups is as follows:

Conventional physiotherapy exercise protocol was given after intervention.
Group A - Pilates+ Conventional PT
Group B - Yoga + Conventional PT

After the selection, a pre-intervention measurement of balance was taken by using BBS. The study was conducted for 3 days/week for 45 minutes for 4 weeks. Conventional physiotherapy was given 6 days/week. Study intervention:

Group A: Pilates + Conventional PT Pilates [14]:

The pilates group received a set of 9 pilates exercise. The exercise was done on mat or plinth. All exercise was done with the rhythm of inspiration and expiration, 1 set with 10 repetitions and a rest period of 2 minutes before starting the next exercise. Table 1 Pilates Protocol Spine twist Performed in kneel standing: with clasp hands the upper extremities are elevated forward at 90-degree flexion and spine is twisted by turning from side to side Side leg lift Performed in standing- hip abduction, adduction with hand supported in parallel bar Tandem stance Standing with heel touching the toe of the other foot (can use assistance if needed) Ball wall squat Performed in standing against a wall with Swiss ball in the lumbar region and performing semi squats with the spine maintained erect.

Pilates	Description
Bridge	Performed in crook lying by lifting the pelvis off the mat
Alternate toe taps	Performed in lying with both hips and knees in 90-degree flexion followed by alternate tapping of toes on the mat
Side to side	Performed in crook lying: the lower body is twisted from side to side while maintaining the upper body in neutral
Side kick	Performed in side lying: the upper leg is abducted as if kicking sideways
Quadruped	Performed in quadruped position simultaneously raising reciprocal arm and leg

Spine twist	Performed in kneel standing: with clasp hands the upper extremities are elevated forward at 90-degree flexion and spine is twisted by turning from side to side
Side leg lift	Performed in standing- hip abduction, adduction with hand supported in parallel bar
Tandem stance	Standing with heel touching the toe of the other foot (can use assistance if needed)
Ball wall squat	Performed in standing against a wall with Swiss ball in the lumbar region and performing semi squats with the spine maintained erect

Group B: Yoga + Conventional PT Yoga:

The Yoga group received a set of 9 asanas exercise. The exercise was done on chair, mat or plinth. Each yoga pose is held for 10-60 seconds followed by 10-20 seconds of rest and perform each yoga pose 3-5 times.[5] Table 2: Yoga Protocol [15].

Modified Asanas	Description
Setu bandha sarvangasana (bridge pose)	Performed in supine position, bend the knees, and place the feet flat on the floor. Bring the feet as close to the glutes. On an exhale, press the feet down into the floor and simultaneously push the hips off the floor. Tighten the buttocks and maintain a parallel space between thighs and knees, and push firmly onto the arm, which extended under the body
Chakravakasana (cat cow pose)	Performed in quadruped position, hands in front of the shoulders and knees immediately below the hips. Cat pose, exhale and round the spine towards ceiling. Keep the shoulders and knees in same place. Release the chin towards the chest, rounding gently. Cow pose, chest towards the ceiling, back arches, belly extended towards the
Utkatasana (chair pose)	Performed in standing position by feet touching the floor and back should be straight and head looking straight ahead. Inhale and extend arms approximately 45 degrees in front of the torso, firm the shoulder blades. Exhale and bend the knees, full pose has the thighs parallel to the floor. And move towards lowering the thighs in this pose, and release.
Tadasana (mountain pose)	Performed in standing, stand upright and heels of the feet slightly apart. Lift all ten toes and spread as wide as possible. Engage the core and tuck tailbone slightly. Firm the quadriceps and lift the knees, allowing the arches of both feet to lift while feet remain planted.
Jathara parivatanasana(reclining spinal twist)	Performed in lying flat on the back and bring the knees into the chest. Extend each arm, with the palm up and in line with the shoulders. The pressure between the extended arm and the ground to counterbalance the twist. Try to keep the shoulder blade on the floor. On inhale and lengthen the torso and then exhale and increase twist.
Virabhadrasana (warrior pose)	Performed in standing, extend the one foot back in a high lunge position, and other foot pointing straight ahead and knee bent and foot directlt under the knee. Raise the arms overhead, lifting the ribs away from the pelvis and lift the torso and bring arms overhead. And relax the arms and legs.
Eka Pada Utthita Tadasana (Shooting star pose)	Performed in standing, one arm against the wall, expand the arms and legs, engage the thigh by activating quadriceps, tuck the tailbone slightly without rounding the lower back. Extend the torso and head towards ceiling. Transfer the weight to one leg and lift the other leg off the ground and then release.
Goasana (table top)	Performed in quadruped position, hands directly under shoulders, palm flat on the ground, and knees directly under the hips. Flatten the back, press into the palms, and straighten the back.
Pada Sanchalasana (cycling pose)	Performed in supine lying, legs are straight and arms by sides with palms facing down. Inhale and raise one leg, band the knee and exhale bring the thigh close to chest and other leg straight. Do cycling in forward and backward direction and repeat the same in other leg.

Conventional PT:
Conventional physiotherapy exercise protocol for both group:

- Active/ passive range of motion exercise of upper and lower limb
- Slow sustain stretching of spastic muscles
- Strengthening of antagonist muscles
- Balance training
- Gait training
- Gripping exercise (as per need of patient)

Outcome Measure:

Berg balance scale (BBS): The BBS is used to assess static and dynamic balance. BBS has 14 questions for multi-tasking activity. Its maximum score is 56. The inter-rater and intra-rater reliability of BBS for the patients with stroke was 0.97 and 0.98, respectively. There is a high risk of falling if the score is 44 or less [7].

STATISTICAL ANALYSIS

Analysis of data was done using SPSS Version 20.00. Descriptive analysis was done by calculating mean and standard deviation. Normality of distribution was done by using the Shapiro wilk test. For normally distributed data, paired t-test was used for within group comparison and independent sample t-test was used for between group comparison. The level of significance was set at 95% ($p<0.05$).

RESULT

Table 1: Baseline Characteristics

CHARACTERISTICS		FREQUENCY(N)	%
Age group(years)	45-50	5	50%
	51-55	2	20%
	56-60	0	0
	61-65	1	10%
	66-70	2	20%
Gender	Male	5	50%
	Female	5	50%

Table 2: Within group comparison of differences of means

Group	Outcome measure	Pre-test score		Post-test score		P-value
		Mean	SD	Mean	SD	
Group A	BBS	37.8	8.814	49.2	4.969	**0.003 ($p<0.05$)**

Table 2 shows that there is significant improvement in BBS for both the groups($p<0.05$)

Table 3: Between group comparison of differences of means

Outcome measure	Group	Pre-test score		Post-test score		Mean difference	P-value
		Mean	SD	Mean	SD		
BBS	Group A	37.8	8.814	49.2	4.969	11.4±3.845	0.772
	Group B	32.8	5.449	43.6	4.878	10.8±0.571	(p>0.05)

Table 3 shows there is no significant difference between two group comparison.

DISCUSSION

The purpose of this study was to assess the effect of pilates v/s yoga on balance in patients with hemiparetic stroke.

Intra group analysis showed improvement in balance in both groups. Inter group analysis showed balance have no significant improvement.

The improvement of body balance after Pilates exercise may be due to strengthening of the trunk, pelvic and lower limb muscles with the concomitant effects of maintaining equilibrium. Since the correct execution of the movements requires skills like, e.g. movement fluidity, control and precision, the proprioceptors also contribute to the correct execution of the Pilates exercises. The improved integration of this information about joint position or muscle length and tension should enable an elevated kinaesthetic quality, thereby allowing the subjects to better control posture and movements, although there is no direct evidence that support this. Since the impairment of kinaesthesia and proprioception have been described in stroke subjects, exercises aimed at stimulating the kinaesthetic sense should be recommended for this population.

Yoga has been demonstrated to improve muscular strength and endurance, balance, flexibility and motor coordination. Breathing and meditation techniques used in yogic interventions have been reported to improve sensory awareness and interoception, increase parasympathetic activity, enhance the regulation of autonomic input and modulate the body's pain response system.

Lourembam Surbala et al justified that 8 weeks of Pilates intervention improved functional balance and quality of life($p<0.05$) in sub-acute stroke subject. This positive effect was probably by strengthening the muscles involved in postural control and by improving the

quality of proprioceptive regulation of muscle actions and thus, improving the quality of life in these population [14].

Arlene A. Schmid et al suggested that pain, neck range of motion, hip passive range of motion, upper extremity strength, and the 6-min walk scores all significantly improved after 8 weeks of engaging in yoga. A group therapeutic-yoga intervention may improve multiple aspects of physical functioning after stroke [11].

In this study, it has been showed that the pilates and yoga both were improving balance in patients with hemiparetic stroke.

CONCLUSION

After 4 weeks of Pilates and Yoga both are effective in improving balance in patients with hemiparetic stroke but it could not prove which one is better.
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Conflict of interest: **Nil**

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