

## Effects of Reformer training on the quality of life and functional balance in an acute stroke patient: A case report

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### ABSTRACT

Pilates is a form of exercise that can be used in stroke rehabilitation to improve gait and balance impairments along with their strength, posture, and quality of life (QoL). The purpose of this case report was to document the effectiveness of using the Pilates reformer to describe the outcomes of an 8-week program on the functional balance and the QoL in an individual with acute stroke. The QoL of the subject was assessed using the stroke-specific QoL scale, and the functional balance was measured using the mini BEST scale both at the baseline and after the end of 8 weeks after exercising on the Reformer. The comparison of the test results before and after 8 weeks suggests that there was an improvement in the balance and the QoL in the patient. Many studies are available suggesting the significance of mat Pilates on stroke patients. However, this case report asserts the significant effects of using a Reformer on an acute stroke patient.

**Key words:** Balance, Pilates, Quality of life, Stroke

Imbalance is a common and concerning impairment observed in stroke patients as it increases the risk of falls in them. These falls cause pathological fractures, which further reduces their mobility. It is observed that stroke patients with complaints of imbalance take a longer time to recover and attain functional independence than their counterparts with no imbalance problems. Impairments of gait, reduced independence in performing activities of daily living (ADL), and balance issues have a direct influence on the emotional status and the quality of life (QoL) of these patients [1].

The World Health Organization defines “QoL” as a person’s view regarding their position in society, including physical, social, and psychological domains. It states that the QoL is determined according to the health, lifestyle, psychological state, independence, and social environment of the individual [2].

Pilates is a form of exercise that can be used in stroke rehabilitation to improve gait and balance impairments along with their strength, posture, and QoL. The Pilates Reformer is used to incorporate the Pilates exercise technique for a challenging and intense workout. It is a traditional piece of equipment that looks like a bed with springs, a sliding carriage, ropes, and pulleys. The springs provide choices of differing levels of resistance as the carriage is pulled or pushed along the frame. A wide variety of exercises are done on the Reformer to promote length, flexibility, coordination, and balance [3]. The emphasis on breath control with each movement in Pilates boosts physical efficiency, correct postural alignment, and overall balance [4].

The emphasis on the elongation of each movement therein helps to open up the trunk and the pelvic area, allowing an

increased range of motion during dynamic activities. Hemiplegic patients tend to shift their weight completely on the non-affected side, which further causes weakness and poor motor control of the affected side [2]. Using Pilates on the Reformer on such patients helps facilitate proper breathing and alignment, improves balance, which further improves their QoL. Various studies are done on the effects of the mat-based Pilates training on chronic and sub-acute stroke patients and their effects on their balance. However, no study was done to evaluate the effects of Reformer based Pilates on the Quality of Life and functional balance in an acute stroke patient.

### CASE REPORT

This is a case report of a 56-year-old male, a shopkeeper by occupation who suffered from a stroke on November 24, 2019. He did not give any history of addictions but gave a positive family history of diabetes mellitus. The patient’s magnetic resonance imaging brain suggested an acute infarct in the right paramedian pons. On examination, his vitals were stable with a heart rate of 80 beats/min, respiratory rate of 28/min, and oxygen saturation at 100%. He developed hemiparesis on the left side. He was admitted to a tertiary care hospital on an in-patient basis for a week. After his discharge, he started rehabilitation in the physiotherapy department of the same hospital.

The patient complained of difficulty in walking, taking turns, climbing the staircase, and inability to use his left hand as smoothly as the right hand. He also complained of generalized weakness of

the left side and imbalance while he attempted to do his ADL independently. The patient mentioned that he felt under-confident when he had to walk in an open environment independently; he used manual support to navigate through busy, crowded areas, and uneven surfaces. He would get irritable frequently and had poor concentration.

Two weeks after the stroke, the patient came to the hospital for rehabilitation. His tone was grade +1 (mild spasticity) on the modified Ashworth scale. The sensory examination conducted suggested no significant deficits. His participation restrictions were going to his shop independently and fear at busy places such as the movie theater or the supermarket.

The functional balance was assessed using the mini-BEST scale. He scored a 17/28 on the scale, which indicates a moderate level of imbalance. He had difficulty in getting up from sitting on lower surfaces, standing on toes, and unilateral stance on the left (affected) leg. The compensatory stepping strategies were affected when challenged laterally and posteriorly. He had difficulty in standing with his eyes closed on foam and an inclined surface. The dynamic gait factors most affected were adjusting to the commands of changing gait speed, taking pivot turns, and obstacle crossing.

To measure his QoL, stroke-specific QoL score was used, he scored a 72/245. He scored himself the lowest under the domains of mobility, energy levels, social roles, upper extremity functions, work, and productivity among the other domains. Therapeutic interventions were started as follows: Day 1–3: In-bed exercises such as active-assisted to active range of motion exercises for bilateral upper extremity and lower extremity, log rolling, and bridging were taught to the patient. Transfer training, from supine-side lying-sitting with assistance was taught. Day 3–5: Balance training was done in a sitting position. In sitting with back support, weight shifts on the affected upper extremity were encouraged, and reach outs in different directions were given. Day 5–7: Balance training was done in standing and gait training in parallel bars with support.

The patient was discharged and given a home program, which entailed the exercises mentioned above under supervision. The patient came for rehabilitation on an outpatient basis and a reassessment was done. He was able to walk around the house using a cane on the non-affected side. The complaints of imbalance persisted. Pilates exercises on the Reformer were chosen as a form of treatment for him keeping in mind he was vitally stable, was a high functioning stroke patient with fair trunk control. The patient was taken on the Reformer thrice a week for 8 weeks. Each session was for 45 min. The list of exercises done on the Reformer is given in Table 1. The activity was repeated 10 times with the required rhythm of inspiration and expiration while maintaining the core activation. On the last day of the 8 week, the post-intervention measures were taken. The pre-post intervention scores are given in Table 2. The patient could confidently walk without a walking aid.

## DISCUSSION

The present study aims to show the efficacy of reformer-based Pilates training on the parameters of QoL and the functional

**Table 1: List of exercises done on the Reformer**

Name	Exercise	Muscle focus	
Foot work	Parallel heels	Hamstrings	
	Parallel toes	Quadriceps	
	V potion	Ankle plantar flexors	
	Heels		
	V position toes		
	Open V potion		
	Heels		
	Open V position toes		
	Calf raises		
	Single leg heel		
	Single leg toe		
	Abdominal work	Hundred prep	Abdominals
	Hip work	Frog circles openings	Hip abductors Hamstrings
Stretches	Kneeling	Hip flexors	
	Lunge	Hamstrings	
Full body integration	Knee stretch series	Abdominals	
	Scooter		
	Round back		
	Fat back		
Arm work	Arms supine series:	Latissimus dorsi	
	Extension	Triceps	
	Adduction		
	Up circles		
	Down circles		
Leg work	Single leg	Gluteus medius	
	Skating		
Lateral flexion and rotation	Side lifts	Abdominal obliques	
Back extension	Breaststroke prep	Back extensors	

**Table 2: Pre-post intervention scores**

Outcome measures	Pre-intervention	Post-intervention
Mini-BEST scale	17/28	26/28
Stroke specific quality of life measures	72/245	189/245

balance on a patient suffering from acute stroke. The result of this case study concludes that Reformer based exercises had a beneficial effect on these parameters after an 8-weeks training program. The patient was able to walk independently with the use of a walking aid. The Pilates exercises on the Reformer may be causing the improvement of balance due to strengthening of the trunk, the pelvis, and the lower limb muscles with the associated effects of maintaining equilibrium. As the correct execution of the movement requires skills of control and precision, fluidity of movement, the proprioceptive system is targeted; thereby allowing the subject to gain better postural control and movement [1].

Bulguroglu *et al.* did a study on multiple sclerosis patients comparing the effects of Pilates on mat and Reformer. Balance, functional mobility, core stability, fatigue severity, and QoL improved in both groups. Suggesting similar benefits were observed in Reformer and mat-based Pilates methods [5]. There are studies that claim Pilates exercises can be adapted to provide

gentle strength training for rehabilitation and also as a strenuous workout to challenge athletes. These exercises are designed to increase muscle strength, endurance, as well as flexibility and to improve posture and balance [6].

Pilates is reported to develop deep core muscles, which help improve spinal stability, reduce back pain, and control the Hip and pelvic joints [7,8]. A study done on chronic stroke patients showed an increase in the stride length, thus improving their gait speed after an 8 weeks of Pilates program [9]. This may be possible because Pilates exercises developed muscles such as the transverse abdominis and internal oblique that stabilize the body, thereby improving the stability of the spine, muscular strength, and flexibility of the hip and pelvis [10].

Few studies showed no benefit with the Pilates program. A study done by Kloubec did not find any changes after a 12-weeks Pilates program in an active middle age group. Another similar study done among college students suggested similar non-significant results [3]. The reason for this could be because improving functional balance in the younger population is both difficult and irrelevant.

Along with the improvement in the balance, this case study also shows Pilates exercises on the reformer help improve the QoL in the stroke patients. A decrease in the ability to perform ADL due to disabilities resulting from a stroke reduces an individual's independent lifestyle, thus affecting their QoL. Keeping this in mind, an effective rehabilitation program must comprise physical training and also help improve the QoL of stroke patients. A study done on chronic stroke patients by Yun *et al.* asserts that there was an improvement in both the balance and QoL after 12 weeks of Pilates program [1]. Positive changes were seen in the perception of QoL of an individual diagnosed with multiple sclerosis after Pilates exercises using the Reformer, Cadillac, and Ladder Barrel [11].

Kaur *et al.* explored the effectiveness of mental practice and Pilates-based training on core strength, mobility, and balance in five multiple sclerosis patients. The pilot study showed a significant difference in balance, mobility, and exercise compliance in these patients [12]. The intervention in his study was for 8 weeks on a single patient, it is possible that longer duration training may achieve greater effects. The outcome of 8 weeks of Reformer based training demonstrated the benefits gained by a stroke patient and also provides support to the use of

the Reformer in stroke rehabilitation. Further research on a larger sample size and for longer duration may be considered.

## CONCLUSION

This case study concludes that Pilates on the Reformer in acute stroke is effective in improving the balance and QoL.

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