



Comparative Study Of Yoga & Physiotherapy Practices To Improve Stability And Balance In Stroke Patients: A Systematic Review

Anjali Baghel¹, Guru Deo^{2*}

¹PGDYTMP Scholar, Morarji Desai National Institute of Yoga, New Delhi-110001, India

^{2*}Assistant Professor (Yoga Therapy), Department of Yoga Therapy, Morarji Desai National Institute of Yoga, 68 Ashoka Road, New Delhi-110001. India.

***Corresponding Author: Dr Guru Deo**

*Assistant Professor (Yoga Therapy), Department of Yoga Therapy, Morarji Desai National Institute of Yoga, 68 Ashoka Road, New Delhi-110001. India.

Email:- gurudeoyoga15@gmail.com, +918088489025

Abstract

Introduction: Stroke is a cerebral vascular disease caused by the interruption of the blood supply to the brain, cutting off the supply of oxygen and nutrients. With impaired motor and sensory functions, stroke patients suffer from deficits in balance control which plays crucial role in ambulatory function and thus as an important clinical indicator. Balance is defined as the ability to maintain center of mass (COM) within the stability limits, the boundaries of the base of support (BOS). Balance control can be quantified by limit of stability (LOS) test, expressed by movement velocity, displacement excursion, and directional control

Aim: To systematically review all the existing literature of yoga practices and physiotherapy to improve balance and stability in stroke patients.

Objective: There were some objectives to fulfill the set aim; to find out the intervention and its effectivity from two domains-yoga and physiotherapy in stroke patients; to the effect of core stability exercises physiotherapy on patient outcomes after stroke; to see the effectivity of yoga in stroke patients and to see the effectivity of physiotherapy practices in stroke patients.

Materials & Method The study design is a systemic review so there will be no need of participation of subject

However, the search strategy will be comprised of electronic databases Medline (PubMed) Google Scholar, Cochrane, Scopus and Springer. All study was identified and searched as per inclusion which were published in English. Articles were searched by the keywords: physiotherapy and yoga, stroke and balance, yoga practices and balance, yoga and strength, stroke, rehabilitation, hemiparesis and mobility.

Result There were published 203 articles related to physiotherapy and 30 articles of yoga in the current review. After scrutiny of the entire articles at different stages, 10 articles of physiotherapy and 4 articles

<p>CC License CC-BY-NC-SA 4.0</p>	<p>of yoga were included at the last for review. As, there is scarcity of literature stating effects of yoga on balance in stroke patients. Results showed that asana and pranayama practices are proven to be effective to improve balance in stroke patients.</p> <p>Conclusion: After reviewing all the existing literature, it has been concluded that yoga and physiotherapy are effective approach to treat number of neuromuscular conditions. Results showed that asanas and pranayama play effective role to improve balance in stroke patients. Core stability exercises of physiotherapy improves trunk control and dynamic balance after stroke who require improvements in trunk control and balance.</p> <p>Key words: <i>Stroke, Vascular Disease, Yoga, Physiotherapy, Balance.</i></p>
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Introduction

Stroke is a cerebral vascular disease caused by the interruption of the blood supply to the brain, cutting off the supply of oxygen and nutrients. Damage to the brain tissue leads to sensory, motor, cognitive, and emotional deficits. With impaired motor and sensory functions, stroke patients suffer from deficits in balance control which plays crucial role in ambulatory function and thus as an important clinical indicator. Balance is defined as the ability to maintain center of mass (COM) within the stability limits, the boundaries of the base of support (BOS). Therefore, it is crucial to improve balance control in order to improve the balance-related activities for individuals with stroke. Several elements, such as strengthening, postural control, weight shifting, and agility exercise, are necessary to be incorporated during balance training. (Ernst, 1990)

The blood vessels that carry blood from the heart to the brain are called arteries. The brain needs a constant blood supply to transport the oxygen and nutrients it needs to function. Certain arteries supply blood to specific areas of the brain. A stroke occurs when one of the arteries leading to the brain is blocked or ruptures. As a result, parts of the brain do not receive the blood they need and begin to die. (Ping & Chung, 2022) Normal arterial blood flows easily through clear arteries. Blocked arteries can be blocked by plaque (fatty material in the walls of arteries), or blood clots that reduce blood flow to the brain and cause a stroke. Atherosclerosis is caused in part by cholesterol or plaque buildup. A transient ischemic attack (TIA) has the same signs and symptoms as a stroke, but it doesn't last as long. The plaque or blood clot breaks down and blood flow to the brain is restored, and no permanent damage is done. (Kim et al., 2016)

Ischemic stroke is the most common, accounting for 80% of strokes, and occurs when blood flow to the brain is blocked due to clogged blood vessels. It occurs in small blood vessels and causes a pathological form of atherosclerosis due to uncontrolled chronic hypertension. These strokes occur in the basal ganglia, internal capsule, thalamus and pons. (Ping & Chung, 2022)

A hemorrhagic stroke occurs when a blood vessel in the brain bursts and bleeds. Patient sudden feels difficulty walking, dizziness, loss of balance or lack of coordination. There is a sudden severe headache with no known cause. Transient Ischemic Attack (TIA) takes place when an artery in the brain or one that goes to the brain is blocked for a short time, blood flow slows down or stops. This can cause a transient ischemic attack, also called a mini-stroke. (Muhammadiyah et al., 2020) When a TIA happens, the artery either becomes unblocked after a short time or a new path opens up and blood flow is normal. A stroke on the left side of the brain affects the right side of the body and experience some of the signs and symptom: speech and language problems; inability to read, write and learn new information; impaired ability to do math or to organize, reason and analyze things. A stroke on the right side of the brain affects the left side of the body and patient experiences problems with depth perception or directions, such as up or down, and front and back ; inability to be creative, such as painting a picture, or to appreciate art and music; failure to recognize the emotion in someone's voice. (Unc & Stroke, n.d.)

Yoga, as adjunctive therapy and a way of promoting and maintaining wellness, offers an excellent example of the mind-body connection. It has been suggested that yoga has diverse clinical and non-clinical applications in the physiotherapeutic process. This is mainly attributed to the degree of complexity and

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multidimensionality of influences that is apparent in both yoga exercises and physiotherapy as continuous processes. The similarities between yoga and physiotherapy on the conceptual level includes physiological, psychological, spiritual, social and educational dimensions of human health. (Bastille & Gill-body, 2010)

Yoga exercises combined with physiotherapeutic processes, both in clinical and non-clinical settings, can affect various body structures and systems such as the musculoskeletal, nervous, visceral, endocrine and immune system. This would be beneficial for patients with neurological, orthopedic, metabolic and psychosomatic disorders. Nevertheless, the main strength of this form of activity is that all the body's dimensions (i.e. cells, tissues, organs) can be influenced simultaneously within one entire system. (Zou et al., 2018) The rationale for this combination is that yoga's philosophy and physical exercises (asanas) share a number of basic underlying principles of the physiotherapeutic process. The principles of yoga resonate with the principles of the physiotherapeutic process as in their holistic approach towards health and well-being of an individual. Therefore, the aim of this study is to present yoga's potential role in terms of the whole physiotherapeutic process. The practice of such conceptual congruence may require some changes in the physiotherapy curriculum which might be useful for the future therapists. The authors hope that through this conceptual synthesis physiotherapists will gain an understanding of the philosophy and some practical knowledge of yoga. (American Heart Association, 2018)

Practicing yoga exercises leads to the autonomic nerve plexuses and the endocrine system stimulation by an increased pressure in the abdominal wall. Thus, it is suggested that yoga asanas improve the performance of the cardio-respiratory system, enhance lung function together with increased strength and endurance of respiratory muscles, leading to increased vital capacity (VC). It also normalizes blood pressure and improves immunity, reduces heart rate (HR), respiratory rate (RR) and increases red blood cell volume. (Bastille & Gill-body, 2010)

There is also increasing evidence that yoga and physiotherapy both are readily accepted by the elderly population, the use of yoga & physiotherapy for stroke rehabilitation appears to be under-researched when compared with other health conditions. If review evidence demonstrates that yoga & physiotherapy which is more effective in stroke rehabilitation, the proportion of stroke patients who might benefit from yoga practice could be increased. Hence it is important to undertake this review to systematically examine and critically appraise the most up-to-date evidence of yoga for stroke rehabilitation. A review that achieves these goals can be a valuable tool in providing reliable information for both stroke survivors and healthcare teams regarding whether to consider yoga or physiotherapy as a viable option in stroke rehabilitation. There are so many studies relevant to yoga and physiotherapy interventions in brain stroke but no comparative understanding study of yoga practices & physiotherapy interventions and their effectivity in stroke found. It is the need of the hour to systematically review all the existing literature stating the effects of yoga and physiotherapy in improving balance of stroke patients.

Review of Scientific Literatures

Stroke is a serious and disabling global health problem. Stroke is the leading cause of permanent disability in Europe and the United States (US). Stroke is a leading cause of motor disability with a substantial number of people who have had a stroke experiencing moderate to severe motor disability. Americans living with motor limitations report a negative impact on their daily lives including functional limitation. Even though 50%-70% of people regain functional independence, stroke leads to long-term limitations in activity³⁹ and participation. (Rojek et al., 2020)

Stroke is caused when a blood vessel bursts (hemorrhagic stroke) or has a blocked clot (ischemic stroke) which cuts off the supply of oxygen and nutrients, resulting in interruption of blood supply to the brain and damage to the brain tissue. The most common symptom of a stroke is sudden weakness or numbness of the face, arm, or leg, most often on one side of the body, occurring in 90% of the stroke cases. The effects of a stroke depend on which part of the brain is injured and how severely affected. A very severe stroke can even cause sudden death. Stroke treated with similar techniques, which include: Antiplatelet and anticoagulants, Clot-breaking drugs, stents and surgery were found necessary. Stroke caused by bleeds or leaks in the brain (hemorrhagic stroke) also treated using Yoga Prana Vidya (YPV) healing successfully as complementary medicine enabling the patient to fully recover within few days. (Ping & Chung, 2022)

The main rehabilitation goals will use physiotherapy with kinesiotherapy programs at regular intervals in patients recovering from stroke are the kinetic utilization as soon as possible before stiffness and muscle contractions are progressed. Physiotherapy sessions after stroke are a continuous healthcare process and there are cases such as intensive therapy sessions for sensory and motor stimulation that are evaluated even for chronic stroke patients for improving function and use of the affected limb in their daily activities. (West & Bernhardt, 2013)

The strongest evidence, resulting from the excellent scoring based on Pedro scale supports the fact that balance training is an effective adjunct to routine physiotherapy to improve dynamic balance and static balance in patients with chronic stroke. Good evidence indicated augment tradition physiotherapy or treadmill exercises programme to improve dynamic balance. However, training on its own does not appear to have any benefit in patients with chronic stroke as indicated in the moderate quality study. They indicated no statistically significant difference in any balance-related outcome measure between or within groups. This finding casts some doubt as to whether training would be an effective method to deliver balance training in a home setting without therapists' input. Further research is recommended to confirm or refute this concern. (Lai et al., 2022)

All of the included studies have similar methodological weakness. None of the included studies performed sample size calculation for the primary outcome measure and the sample size could be considered to be small. Therefore, the result of the included studies is likely to contain type one error. The relatively small sample size also lacks external validity and therefore the reported findings may not necessary be applicable to the wider population. The intensity and duration of intervention also varied widely between studies and no justification was provided in any of the studies. Several studies included training in addition to routine rehabilitation without increasing the equivalent amount of input in the control group. This reduced the rigorousness of the study as no firm conclusion could be drawn on whether the observed benefits were related to the additional training or due to the intervention. Further research is essential to identify the optimum "dosage" of recovery programme. Seven studies had risk of bias due to the lack of blinding of either therapist or participants. (Miller & Sciences, 2013)

All the included studies utilized different system, ranging from sophisticated laboratory-based device to standard commercial gaming device. While they all come under the category it is likely that there are differences between the devices and therefore there may exist different level of effectiveness in balance ability. As indicated in another review, it is difficult to determine the impact of each individual system on the outcomes. It is therefore not possible to draw conclusion as to which type of system is the most cost-effective. (Desveaux et al., 2015)

Summary of Scientific Literatures

Sr. No.	Title	Author	Sample	Research Method	Assessment	Conclusions
1.	Efficacy of treatment with a kinaesthetic ability training device on balance and mobility after stroke: A randomized controlled study	(Gok et al., 2008)	15	Randomized Controlled Trial (RCT)	Fugl-Meyer Stroke Assessment Instrument (FMA), total motor and locomotor subitem scores of the Functional Independence Measure (FIM)	effective in improving balance
2.	Use of VirtualReality to Enhance Balance and Ambulation in Chronic Stroke	(Kim et al., 2016)	12	Randomized Controlled Trial (RCT)	Berg Balance Scale scores dynamic balance angles	augmented effect on balance and associated locomotor recovery conventional therapy

3.	Visual Biofeedback Balance Training Using Wii Fit after Stroke	(Barcala et al., 2013)	20	Randomized Controlled Trial (RCT)	visual biofeedback using Wii Fit Body symmetry (baropodometry), static balance (stabilometry), functional balance (Berg Balance Scale), functional mobility (Timed Up and Go test), Functional Independence Measure for ADL's.	an improvement in body symmetry, balance.
4.	Co-Designing a New Yoga-Based Mindfulness Intervention for Survivors of Stroke	(Thayabaranathan et al., 2022)	03	A Formative Evaluation	Movement-based mindfulness interventions (MBI)	Yoga practice is more effective in maintaining efficacy and inhibiting recurrence
5.	The Efficacy of Balance Training with Video Game-Based Therapy in Subacute Stroke Patients	(Morone et al., 2014)	25	Randomized Controlled Trial (RCT)	(Berg Balance Scale-BBS), and secondary outcomes were disability (Barthel Index-BI), walking ability (Functional Ambulation Category), and walking speed (10-meters walking test)	improving balance and reducing disability in patients with subacute stroke.
6.	A Yoga-Based Exercise Program for Chronic post-stroke hemiparesis.	(Bastille & Gillbody, 2004)	1	Randomized Controlled Trial (RCT)	Berg Balance Scale (BBS) and the Timed Movement Battery (TMB) Stroke Impact Scale (SIS)	Yoga increased QoL & spinal flexibility better than physical therapy exercises
7.	Effectiveness Of Ankle Strategy For Improving Balance In Stroke Patients	(Fahima, 2015)	14	Experimental Study	Berg Balance Scale (BBS)	physiotherapy with Ankle Strategy are better to improve balance and proprioception
8.	Comparison of physio ball and plinth trunk exercises regimens	(Karthikbabu et al., 2011)	30	a pilot randomized controlled trial	physio ball, Trunk Impairment Scale and	the groups improved on trunk control and functional balance but the experimental group

	on trunk control and functional balance in patients with acute stroke				Brunel Balance Assessment	improved more significantly than the control group
9.	Combining Yoga Exercise with Rehabilitation Improves Balance and Depression in Patients with Chronic Stroke:	(Lai et al., 2022)	40	A Controlled Trial	Taiwanese Depression Questionnaire, $p = 0.002$ and balance (Berg Balance Scale, $p < 0.001$)	yoga group showed significant improvement in balance & depression, In old age people poor balance but not depression
10.	The effect of additional core stability exercises on improving dynamic sitting balance and trunk control for subacute stroke	(Cabanas-Valdés et al., 2016)	80	Randomized Controlled Trial (RCT)	Tinetti Test, Brunel Balance Assessment, Postural Assessment Scale, Berg Balance Scale	Core stability exercises improves trunk control, dynamic sitting balance, standing balance, gait and ADL's in subacute post-stroke patients.
11.	The effects of Ai Chi rehab for balance in individuals with chronic stroke.	(Ku et al., 2020)	20	Randomized Controlled Trial (RCT)	Balance performance assessed by limit of stability (LOS) test and Berg balance scale (BBS). Fugl-Meyer assessment (FMA) and gait performance.	Ai Chi is feasible for balance training able to improve weight shifting in anteroposterior axis, functional balance, and lower extremity control.
12.	Effectiveness of physiotherapy interventions in brain plasticity, balance and functional ability in acute stroke survivors	(Muhammadiyah et al., 2020)	32	A Randomized Controlled Trial (RCT)		Physio rehab effective in improving balance and functional ability of stroke patients
13.	Effects of Exoskeleton Gait Training on Balance, Load Distribution, and Functional Status in Stroke.	(Rojek et al., 2020)	44	A Randomized Controlled Trial (RCT)	the Barthel Index, and the Rivermead Mobility Index.	Balance improved, load transfer from the backfoot to the forefoot
14	Wii Fit balance training or progressive balance training in patients with chronic stroke: A randomised controlled trial	(Yatar & Yildirim, 2015)	15	A Randomized Controlled Trial	Wii Balance Board and dynamic balance function assessed with the Ber, Timed Up and Go test, Dynamic	improving the balance functions, balance confidence, and activities of daily living.

					Gait Index, and Functional Reach Test	
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The aim of the study was to systematically review all the existing literature yoga practices and physiotherapy to improve balance and stability in stroke patients.

There were some objectives to achieve the set aim: to find out the intervention and its effectivity from two domains-yoga and physiotherapy in stroke patients; to the effect of core stability exercises physiotherapy on patient outcomes after stroke; to see the effectivity of yoga in stroke patients; to see the effectivity of physiotherapy practices in stroke patients.

Materials & Method

The study design is a systemic review so there was the search strategy comprised of electronic databases PubMed, Google Scholar, Cochrane, Scopus and Springer. All studies were identified and searched as per inclusion which were published in English. Articles were searched by the keywords: physiotherapy and yoga, stroke and balance, yoga practices and balance, yoga and strength, stroke, rehabilitation, hemiparesis, mobility.

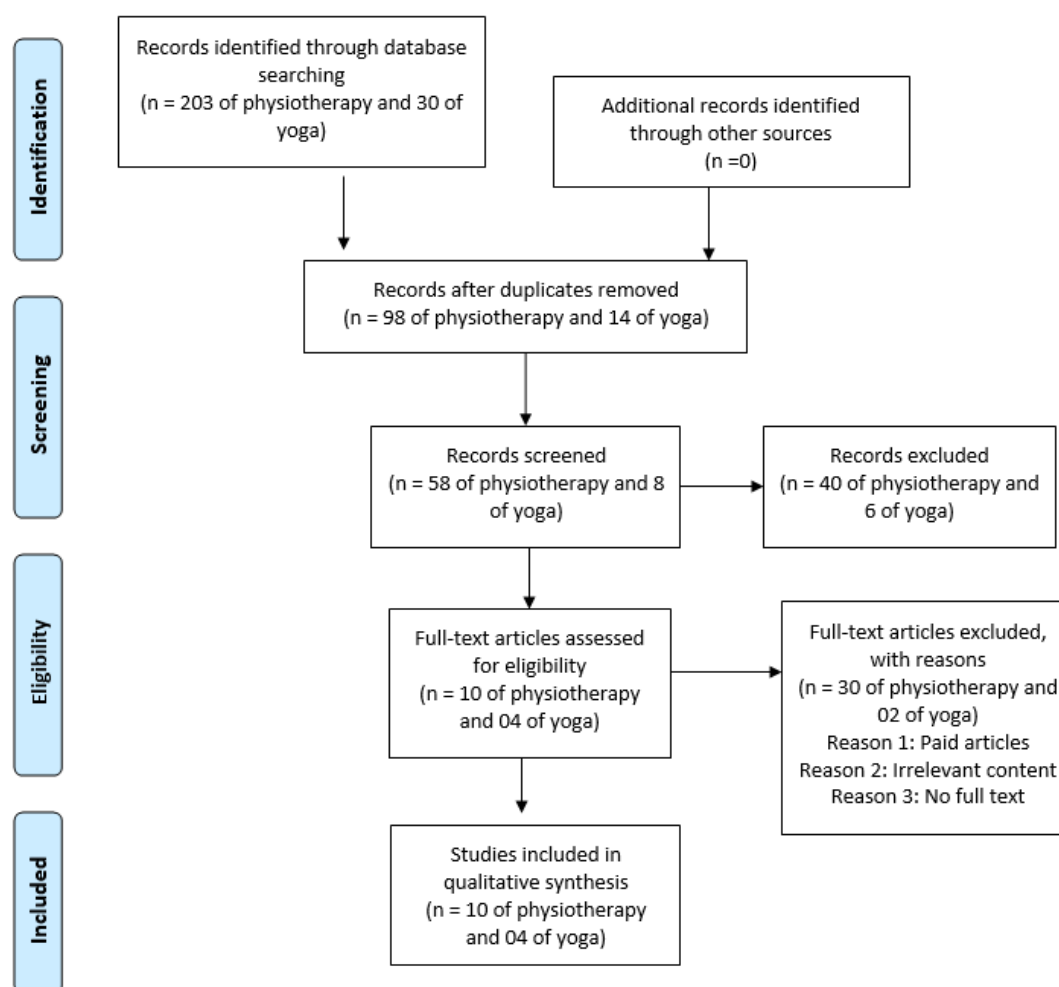
To carry out the review of literature certain inclusion criteria were set which includes : paper published from January 2010 to Jan 2022; full length paper published in English; studies having target group with age above 40 years, both genders; research paper having interventions on balance and stroke with Yoga practices; research paper having physiotherapy practice on balance in stroke; independent Yoga intervention research papers from January 2010 to Jan 2022; independent physiotherapy intervention research papers from January 2010 to Jan 2022.

There were some exclusion criteria which consists of : studies in which no health- related discussion; studies which included other intervention than Yoga independently or physiotherapy; studies which were irrelevant to the topic; studies with mixed intervention on stroke patients; studies in language other than English.

Result

There were published 203 articles related to physiotherapy and 30 articles of yoga in the current review. After scrutiny of the entire articles at different stages as given in Figure-1, 10 articles of physiotherapy and 4 articles of yoga were included at the last for review. As, there is scarcity of literature stating effects of yoga on balance in stroke patients. Results showed that asana and pranayama practices are proven to be effective to improve balance in stroke patients. It has been shown from studies that in the starting phases of stroke pranayama practices are effective in producing significant effects in balance and posture.

The main objective of this systemic review was to evaluate the effect of physiotherapy and yogic practices on improving balance and stability in stroke patients. To the best of authors knowledge this is the first study done to evaluate the effects of physiotherapy and yogic practices in improving balance and stability of stroke patients. In this study fourteen randomized controlled trials (RCTs) were included. All fourteen studies were used for systemic review. Out of fourteen nine RCTs were compared the effectiveness of physiotherapy and yoga practices and three studies are experimental, two studies of formulative evaluation and one was pilot study.

Figure 1: PRISMA Flow Diagram

Discussion

This study is proposed to review all the existing literature comparing the effects of yoga and physiotherapy on balance in patients with stroke. As a result of stroke, patients have problems with locomotion and transfers, which lead to frequent falls. Leisure activities constitute a fundamental human right and an important factor to quality of life. Individual with physical disabilities often do not participate in such activities. Thus, virtual reality can serve as a form of rehabilitation associated to leisure, as patients perceive this technique as pleasant and successful. Virtual reality appears to provide various opportunities and motivation for leisure activities among young adults with physical disabilities. Ease of use and adaptability make this a viable option for such patients.

Virtual reality biofeedback has emerged as a new computer assisted paradigm that allows greater training intensity while providing sensory feedback. The balance exercises used in both treatment methods include weight shifting activities closely related to static balance, i.e., the ability to maintain a chosen posture with minimal postural sway. These exercises aim to improve postural control by increasing anteroposterior and mediolateral weight transfer and reducing postural sway, but not focusing on improving dynamic balance. As postural control is a prerequisite for most functional activities, weight shifting exercises aimed at improving postural control, may have significant balance measurements applied to the patients for that purpose showed that functional performance was improved. (Paci et al., 2020)

Finally, the comparison of the results of our study to previous studies of early physical activity after stroke may be limited by inconsistencies in the classification of physical activity and the possible heterogeneity of patient populations across studies. Although the same model of behavioural mapping has been employed in a number of studies, notably it is the same as that used in the stroke, to more accurately compare physical activity levels with other acute stroke services, (Paldhikar et al., 2016)

Another author combined yoga with standard stroke rehabilitation and compared it only to depression and balance rehabilitation in patients. 40 patients aged 30-80 years who had a stroke more than 90 days ago were divided equally according to age stratification and patient's wishes. In the intervention group, 16 people completed 8 weeks of stroke rehabilitation combined with 1 hr of yoga twice a week. Another 19 patients received standard rehabilitation as controls. The yoga group showed significant improvements in depression. However, in the control group, only balance improved, but depression was not improved. Further analysis found that men and women coped with depression but men improved their balance better than women. Depression in patients with left hemisphere involvement was improved more significantly than in patients with right hemisphere involvement, and balance improved equally regardless of the location of lesion. In the case of patients under the age of 60 depression and balance were significantly improved after rehabilitation. Older age is largely associated with imbalance but not in depression. Combining yoga with rehab can improve depression and improve balance. Differences may be influenced by factors related to gender, location of brain lesions and age.

Another study showed the effects of a yoga-based exercise program on people with chronic (more than 9 months) hemiplegia after stroke. Many stroke survivors report poor health due to reduced activity levels. Yoga provides stroke survivors with an easily adaptable, gentle alternative exercise program. Four patients with chronic hemiplegia after a stroke participated in the study. The main outcome measures were the Berg Balance Scale (BBS) and Time Movement Battery (TMB). The secondary endpoint was the Stroke Impact Scale (SIS). The primary testing phase varied from subject to subject and ranged from 4 to 7 weeks. The 8-week intervention phase consisted of twice-weekly 1.5-hour yoga sessions at the subjects' homes. Primary outcome data were collected weekly and secondary outcome data were collected before the baseline testing phase and before and after the intervention phase. Subjects 1, 2 and 4 improved their TMB scores and subjects 3 and 4 improved their BBS scores. Result shows that yoga can help stroke survivors. (Karthikbabu et al., 2011)

Load on the feet in the groups showed a small and in significant tendency for the load on the non-use limb to decrease. Significant load transfer from the hind paw to fore paw was observed in the control group. Both forms of rehabilitation produced significant changes in functional status. Exo GT exoskeleton training and classical physical therapy both lead to functional improvement in ischemic stroke patients. However, improvements were observed in more categories in the experimental group, indicating that exoskeleton treatment could potentially have a greater impact on functional status. The load transfers from the hind foot to the forefoot observed in the control group was undesirable. This study showed that the Ekso GT exoskeleton could be a promising tool for rehabilitation of patients after stroke. (Lai et al., 2023)

Another study aimed to compare the effects of Wii Fit balance training (WBT) and progressive balance training (PBT) approaches on balance functions, balance confidence, and activities of daily living in chronic stroke patients. A total of 30 patients were randomized into the WBT (n=15) and PBT (n=15) groups. Primary measurements were static balance function measured with a Wii Balance Board and dynamic balance function assessed with the Berg Balance Scale, Timed Up and Go test, Dynamic Gait Index, and Functional Reach Test. Secondary measures were balance confidence assessed with the Activities-specific Balance Confidence scale and activities of daily living evaluated with the Frenchay Activity Index. There was not remarkable difference between the two treatments in dynamic balance functions, balance confidence, and activities of daily living. Although both of the approaches were found to be effective in improving the balance functions, balance confidence, and activities of daily living, neither of them was more preferable than the other for the treatment of balance in patients with chronic stroke. (Lai et al., 2022)

Another study aimed to assess the effect of video game-based therapy emerged as a potential valid tool in improving balance in several neurological conditions with controversial results, whereas little information is available regarding the use of this therapy in subacute stroke patients. The aim of this study was to investigate the efficacy of balance training using video game-based intervention on functional balance and disability in individuals with hemiparesis due to stroke in subacute phase. Fifty adult stroke patients participated to the study: 25 subjects were randomly assigned to balance training with Wii Fit, and the other 25 subjects were assigned to usual balance therapy. A balance training performed with a Wii Fit as an add on to the conventional therapy was found to be more effective than conventional therapy alone in improving balance and reducing disability in patients with subacute stroke. (Posadzki & Parekh, 2009)

A study investigated the effectiveness of Ai Chi compared to conventional water-based exercise on balance performance in individuals with chronic stroke. A total of 20 chronic stroke patients were randomly assigned to either Aichi exercise or regular water-based exercise for 60 minutes, 3 times a week for a total of 6 weeks. Balance is assessed using the Limit of Stability (LOS) test and the Berg Balance Scale (BBS). The Fugl-

Meyer score (FMA) and gait were documented for lower extremity motor control and walking ability, respectively. (Ernst, 1990)

Another study reported the effects of core stability exercises on trunk control, seated and standing dynamic balance, gait, and activities of daily living in patients with subacute stroke, randomized controlled trial centre in-patient rehabilitation hospitals. Eighty patients were randomly assigned to an experimental group and a control group. Both groups underwent conventional therapy for five days/week for five weeks and the experimental group performed core stability exercises for 15 min/day. The patients were assessed before and after intervention. The mean difference indicates more improvement in balance in the experimental group than in the control group. As a result of observing the pre and post-test in the study, the statistically significant variables were lifting, lifting an object from the floor in a standing position, placing the substitute leg on a stool or chair while standing without a support. The strategic exercises and traditional therapy was more effective than conventional therapy alone in improving balance in stroke patients. (Karthikbabu et al., 2011)

Another study aimed to investigate the effect of physiotherapy interventions on brain neuroplasticity by evaluating the brain plasticity regeneration, balance and functional ability. A randomized controlled trial was conducted with 64 stroke patients from three hospitals in the Surakarta region, Indonesia. Control groups (n = 32) received conventional physiotherapy and intervention groups (n = 32) received neurorestoration protocol, which both lasted for seven days. Both groups showed improvements in all parameters but only balance and functional performance had a statistically significant outcome. Another author studied the effects of trunk exercises performed using the physio ball as against the plinth, on trunk control and functional balance in patients with acute stroke. The experimental group performed task-specific trunk exercises on an unstable surface (physio ball) while the control group performed them on a stable surface (plinth). The trunk exercises performed on the physio ball are more effective than those performed on the plinth in improving both trunk control and functional balance in acute stroke patients, suggesting a task-specific effect and also a carry-over effect. (Cabanas-Valdés et al., 2016)

Another study reported the visual biofeedback balance training on balance, body symmetry, and function in post-stroke hemiplegic patients. The subjects were 20 adults with hemiplegia after stroke. The experimental group performed visual biofeedback balance training using Wii Fit along with traditional physical therapy. The control group received only traditional physical therapy. The physical therapy program combined with balance training involving visual biofeedback (Wii Fit®) led to an improvement in body symmetry, balance, and function among stroke victims. However, the improvement was similar to that achieved with conventional physical therapy alone. (Barcala et al., 2013)

Study investigated the additive effects of virtual reality on balance and walking function in chronic hemiplegic stroke patients. Twenty-four adults with hemiplegic stroke were randomly assigned to either an experimental group (n=12) or a control group. Both groups received traditional physical therapy for 40 minutes per day, 4 days per week for 4 weeks. The experimental group received an additional 30 minutes of virtual reality treatment in each session. Equilibrium was determined using the Balance Performance Monitor (BPM) and Berg Balance Scale (BBS) test. Gait performance was determined by the 10-m walking test and Modified Motor Assessment Scale (MMAS), and spatiotemporal parameters were obtained using GAIT Rite. Analysis of variance and correlation statistics were performed at $P < 0.05$. In the balance test, the experimental group had improved BBS scores, balance and dynamic balance angles (ability to control weight shifting) compared with the controls ($P < 0.05$). In the gait performance test, the experimental group showed significant improvements in velocity, Modified Motor Assessment Scale scores, cadence, step time, step length, and stride length ($P < 0.05$). Improvement in dynamic balance angles was correlated with velocity and cadence ($P < 0.01$). This study demonstrates that virtual reality has an augmented effect on balance and associated locomotor recovery in adults with hemiparetic stroke when added to conventional therapy. (French et al., 2016)

Another author combined yoga with standard stroke rehabilitation and compared it to the rehabilitation alone for depression and balance in patients. Forty patients aged from 30 to 80 who had suffered a stroke 90 or more days previously were divided evenly with age stratification and patients' will. In the intervention group 16 completed 8-week stroke rehabilitation combined with 1 h of yoga twice weekly. Another 19 patients completed the standard rehabilitation as the control group. The yoga group showed significant improvements in depression (Taiwan Depression Inventory, $p = 0.002$) and balance (Berg Balance Scale, $p < 0.001$). However, in the control group, only balance improved ($p = 0.001$), but depression ($p = 0.181$) was not improved. Further analysis found that both men and women coped with depression, but men improved their balance better than women. Depression in patients with left hemisphere involvement was

improved more significantly than in patients with right hemisphere involvement, and balance improved equally regardless of the location of the lesion. In the case of patients under the age of 60, depression and balance were significantly improved after rehabilitation. Older age is largely associated with imbalance, but not with depression. Combining yoga with rehab can improve depression and improve balance. Differences may be influenced by factors related to gender, location of brain lesions, and age. (Fahima, 2015)

Strength of the study

This is the first systematic review to see the comparative impact of yogic and physiotherapy practices to improve balance and stability in stroke patients. This study may be useful to give direction for preparing protocol in combined form with techniques and practices of Yoga and physiotherapy in stroke patient.

Limitation of the Study

The limitations of this study may be summed up as : small number of published research considered with some symptoms of stroke; some of the major symptoms of stroke such as limb edema, neuropathic pain and sensory disturbances have not been evaluated and lack of equal number of combined interventional studies related to Yoga and physiotherapy.

Future Recommendations

Further high-quality clinical trials are required to explore the benefit of physiotherapy and yogic practices in comparison to each other or as an adjunct to non-physiotherapeutic treatment option on stroke.

Conclusion

After reviewing all the existing literature, it has been concluded that yoga and physiotherapy both are effective approach to treat a number of neuromuscular conditions. Results showed that asanas and pranayama play effective role to improve balance in stroke patients. Core stability exercises of physiotherapy improves trunk control and dynamic balance after stroke who require improvements in trunk control and balance.

Conflict of Interests: Authors declare no conflict of interest.

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