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Literature Review on the Effect of Balance Training on Cognition in Stroke Patients

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Abstract: ***Background: 'stroke' is a common cause of death in the adult population in 21st century. Some form of cognition impairment occurs among 72% of stroke patients. After the stroke, getting back to a good cognitive condition along with functional independence can be challenging and sometimes is a long - term process of recovery. Two third of stroke survivors exhibit cognitive impairment issues post - stroke. Conventional physiotherapy plays a crucial role in retaining the patient's cognition, independence, and regular functional activities after a stroke. Aim: This study aims to conduct a review of current available evidence and studies on the effect of balance training on retaining cognition in post - stroke patients. Methods: This review adheres to the Prisma guidelines and employs a comprehensive search strategy of pubmed, PEDro, cureus, elsevier, frontiers, google scholar, ScienceDirect, and research open databases to identify relevant articles. Inclusion criteria are applied to select articles published between 2000 and 2022 for analysis in this review. Results: Based on the inclusion criteria, 7 studies were included. The result of this review provides evidence that balance training shows a significant impact on retaining cognition in stroke patients. Conclusion: The result of this review provides evidence that many stroke patients show cognitive impairment post - stroke. Balance training helps in improving cognition, giving better results than conventional therapy alone. Implications: We can optimize recovery by using balance training alone with conventional therapy and design them in a way that can closely match the activities of daily living.***

Keywords: Stroke, balance training, cognition, post - stroke, physiotherapy, hemiplegia

1. Introduction

In the adult population, Stroke is one of the most common reasons that causing neurological disability. Above a quarter of all deaths in developing countries like India, conditions like stroke are responsible. (1) In the top leading causes stroke occupies second place in causing death in conditions. (2) One - third of the patients who suffer stroke will die, one - third of patients will survive with severe disabilities and the remaining one - third will make a good recovery with functional independence. (3)

One of the leading causes of long - term disability in the adult population stroke records the highest incidence. (2) According to the world health organization CVA or cerebrovascular accident is a term which is synonymous with 'stroke' and it can be defined as a hall mark of accelerating partial/complete cerebral function disturbance that last more than 24 hours or can cause death with no other particular reason than vascular origin except those cases with recovery within 24 hours. These latter cases are termed as ' transient ischaemic attacks ' (TIA) and because they are often a harbinger of completed stroke, they have received considerable attention over the past two decades. (1)

American stroke association / American heart association defines stroke as an episode of neurological dysfunction due to silent brain, spinal cord, retinal ischemia, or silent cerebral haemorrhages leading to accelerating partial/ complete cerebral function disturbance that last more than 24 hours or can cause death with no other particular reason than vascular origin (1)

In India, the incidence and prevalence of stroke around twenty percent occur in people younger than 40 years of ages. (3) (4) (5) Asian countries are having prevalence rates higher in cases of stroke, unlike Caucasian countries which have the higher prevalence of coronary heart diseases and cancers. (6) (7)

Mortality of stroke records more in women when compared to men. (6) over few years the burden of stroke in people younger than sixty - five years of age has increased and as well as in people of age 20 to 64 years also the incidence has increased. (4) in the increment of the mortality rate of stroke, poverty is also playing a major role in developing countries through less accessibility for emergency medical attention and available poor infra - structure of health care management.

A person with a stroke will exhibit clinical features of hemiparesis, sensory deficits, diplopia, dysarthria, facial drooping, difficulty walking, confusion, dizziness, memory issues, and sudden headaches without a proper cause. Cognition impairment and memory dysfunction are common symptoms that significantly affects the quality of life of stroke survivor by reducing functional independence. Stroke can cause damage in a number of cognitive functions, including language, orientation, memory, and attention. Stroke affects attention and executive functions more than

memory at the time of diagnosis. (8) Later at various intervals memory might have affected.

The mechanism of post - stroke impairment of cognition is due to neuroanatomical and small cerebral vessel lesions which cause the damage to cells of the hippocampus, lesions of white matter, and cerebral microbleeds which will be resulting in vascular impairment in the cognitive areas of the brain resulting post - stroke cognition impairment. (9) recentclinical evaluation of the neuropsychological assessment of stroke studies shows that among 72% of stroke patients shows some sort of impairment in cognition, among them 42% had cognitive impairment without dementia. (10)

Physiotherapy evidence - based practices for stroke rehabilitation generally include a variety of treatments including positioning, electrical stimulation, balance training, sitting - standing training, gait and mobility training, electrotherapy, treadmill training, walking, stretching exercises, B, early mobilization, mirror therapy, splinting, cardiorespiratory training, strength (progressive resistance) training, hydrotherapy, and cognitive exercises. As in physiotherapy, there will be a first focus on the restoration of activities of daily living.

Despite the present available rehabilitative strategies, there is a window of enhanced neuroplasticity early after stroke, during which the dynamic response of the brain to injury is heightened and there will be more effectiveness of rehabilitation. Initiation of rehabilitative strategies within the first 2 weeks of stroke shows many beneficial results while intensive therapy in the first 24 hours is not preferable and may be harmful. (11)

Studies show that balance training is beneficial for post - stroke patients. (12) Balance training is the practice of using exercises to improve stability. Balance training includes exercises for the core and leg muscles that are responsible for a body to keep in upright posture. Hence in elderly patients balance training is included as it helps in fall prevention. In some cases, balance training exercises are recommended for patients with debilitating ailments affecting vestibular inputs, and muscle strength.

Changes in the center of gravity and base of support have an impact on maintaining functional balance during dynamic activities. Balance training is also used during recreation, for athletes, who wish to improve posture, strength, coordination, and stability. This is because it is effective for postural and neuromuscular control improvements. Balance training exercises are graded. Depending on individual, these exercises could be categorized as easy, mid, and hard. This implies that the intensity of the exercise is dependent on the consideration of the patient's abilities, disabilities, and treatment goals.

Through balance training increment in the cortical thickness of many areas of the brain specifically areas dealing with balance and cognitive functions is observed. (13) By neuroplasticity mechanism after several months of balance training studies found that patients exhibit improvement in the performance of cognitive functions. (14)

Balance training refers to an exercise regime that works on the improvement of an individual's ability to maintain their line of gravity within their base of support while doing different varieties of activities. Balance training helps in improving balance and cognition in stroke patients. Cognition plays a main role in balance and gait. So, improving cognition will improve the quality of life in post - stroke patients.

2. Methodology

Source: A comprehensive search on pubmed, PEDro, cureus, sage journals, science direct, elsevier, Google scholar, frontiers.

Study selection: the inclusion criteria for the study involved selecting articles that met the following criteria: randomized controlled trials, quasi - experimental studies, case reports, systemic reviews, special reports, and meta - analysis were taken.

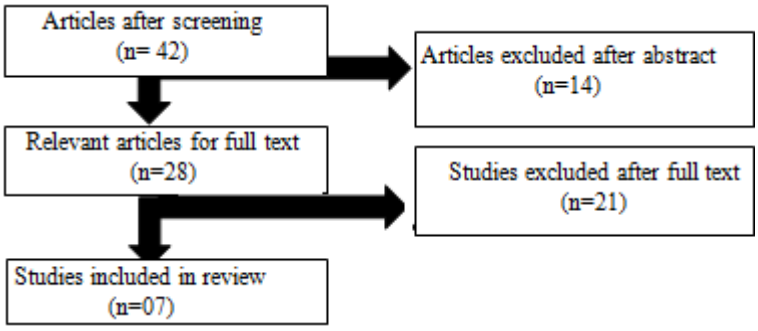
Objective: the objective of this study is to find the effectiveness of balance training on retaining cognition in post - stroke patients.

Inclusion criteria:

- Articles that included stroke
- Articles published only in English
- Articles containing the full text
- Articles included both genders
- Articles published from 2000 to 2022

Exclusion criteria:

- Articles in other languages
- Articles with no related title
- Articles with no related abstract
- Articles not related to keywords



3. Review

S. No.	Author name	Study design/sample size	Outcome measures	Objective	Result	Level of evidence
1	Renjen P et. al (10)	Quasi - experimental study	National Institute of health stroke scale (nihss), Barthel index, pgi battery of brain dysfunction, siqcode.	To find out the frequency of cognitive impairments in acute stroke patients	They found that about 72% of the patients had some form of cognitive impairment after stroke, out of which 30% had dementia and 42%v had CIND.	ii
2	Chen c. et al (12)	Randomized control trail / 41	Smart balance master, Brunnstrom staging and FIM (functional independence measure)	To evaluate if the balance training program had any delayed effects on patients with hemiplegic stroke.	The study found significant improvements in patients who underwent balance training, and that those patients showed better self - care ability at a follow - up of 6 months as compared to the patients who only underwent conventional therapy.	i
3	Ayelet dunsky (13)	Mini review	-	To test if balance and coordination exercises have any effect on the quality of life in older people.	After evaluating several available literatures, the review states that a combination of balance and coordination exercises have a positive effect on the behavioral and neurophysiological outcomes as well as the quality of life in older adults.	v
4	Rogge a. et al (14)	Randomized control trial / 40	Stability platform, balance error scoring system, force plate, graded maximal ergo spirometry, orienting and perspective taking test, german intelligence structure test, wilde intelligence test	To test if balance training has any positive effect on improving cognitive function, especially memory, and spatial cognition.	After 12 weeks of balance training, they found that it had a positive effect in improving the cognitive function of the healthy adult, especially memory and spatial function. They however found no evidence of cardiorespiratory fitness to have any effect on cognition.	i
5	Milos dordevic (15)	Randomized control trial	Clinical balance test, orientation test	To test improvements in orientation and balance after using slackline training	After 1 month of slackline training, they concluded that it enhances relevant balance abilities.	i
6	Giovanni morone et al (16)	Randomized control trial	Berg balance scale, Barthel index, functional ambulation category, 10mwt.	To assess the effectiveness of balance training in sub - acute stroke patients with video game - based therapy.	They found effective improvements in balance and reduction in disability in patients with subacute stroke after 4 weeks of balance training with video game - based therapy.	i
7	Caroline gurvich et al. (17)	Literature review	-	To find the relation between vestibular function, psychic disorders, and cognition	They concluded that several psychiatric symptoms such as depression and anxiety are commonly linked to vestibular function.	v

(Systemic reviews, meta - analysis, RCTs) – level i
(non - randomized control trails, case - control trails) – level ii
(pre - test - post - test designs, cross - sectional designs) – level iii
(Single - subject designs, case series) – level iv
(Case reports, narrative literature reviews) – level v

4. Discussion

Pushpendra nath Renjen et al. A quasi - experimental study found up to 72% of patients with some form of cognitive impairment following stroke, with the frequency being more in patients with left - side lesions, silent infarcts and cortical atrophy. Age seemed to be a factor as well with the prevalence of impairment higher in older aged patients, as well as haemorrhagic stroke patients having the higher prevalence compared to ischemic stroke patients. They also cited neurophysical assessment to be an important part of the clinical evaluation and is best to be done after about 3 months after the stroke has stabilized. (10)

I - Chun Chen et al in 2002 RCT found improved dynamic balance and FIM scores in patients who received visual

feedback training, although they didn't find any significant improvements in the static balance after a 6 - month follow - up. Their results showed that although standing balance and locomotion were highly interrelated, changes in one function might not reflect changes in the other. (12)

In a mini review *Ayelet Dunsky* in 2019 suggested that older adults be exposed to a combination of balance and coordination exercises for 2 - 3 sessions each week, which incorporated exercises such as static and dynamic stability postures, changes in BOS, changes in COG and different standing surfaces, so as to improve their quality of life and that these exercises should be introduced in a gradual manner which ensures adjustment by the person as well as safety. They also suggested the progression of the exercises to higher difficulty levels and incorporating both motor and cognitive tasks. (13)

In an RCT done by *Rogge a* et al. In 2017 found that dynamic function measurements were significantly improved in patients who received visual feedback training, as compared to patients who received only conventional therapy, and that they also showed better self - care ability. They suggested that balance training may be beneficial for patients who have suffered from hemiplegia. (14)

In 2017 RCT done by milos dordevic et al. Giving 1 month of slackline training to 25 patients was found it to be a novel approach to enhancing balance abilities. They also said that this approach can be modified to be advantageous for the elderly population and those who are at risk of neurodegeneration. (15)

Giovanni morone et al in their RCT found enhancements in balance and independency in ADLs in patients with subacute stroke by using video game - based therapy. They also found partial benefits in walking ability recovery, as well as reduced need for aids/supervision during walking. They suggested video game - based therapy could be used as a suitable add - on for increasing the time spent by patients involved in potentially beneficial activities. (16)
Caroline gurvich et al did a literature review in 2013 in which they examined the association between the vestibular system and various psychiatric disorders. They found that they concluded that several psychiatric symptoms such as depression and anxiety are commonly linked to vestibular function. Although their findings remained inconclusive. (17)

5. Conclusion

Based on the studies that were reviewed and analysed I concluded that balance training shows a positive effect on the balance performances of post - stroke patients as well as in retaining post - stroke cognitive impairment. It also can be concluded that much focus on balance training along with conventional therapy gives better results in retaining cognitive performance and improving functional independence. As Cognition is one of the crucial aspects in stroke rehabilitation and the functional independence of an individual there is a need for more focus on these studies as the information is less which is available.

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