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A Pilot Study to Determine the Effect of Interactive Device (FLASHFIT IWALL) on Improving Co-Ordination and Range of Motion Among Stroke Patients

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Abstract:

- ***Background:***

Stroke is a leading cause of long-term disability, often resulting in impairments such as limited coordination and restricted Range of motion (ROM). Interactive devices have become a significant area of focus in rehabilitation, has gained significant attention in recent years and also have been increasingly utilized in neurorehabilitation settings. FLASHFIT IWALL is effective in improving coordination and ROM, as they provide real-time feedback designed to enhance motor function through guided movement, offer customized, engaging patients in dynamic exercises that encouraged greater participation in therapy and intensive rehabilitation programs.

- ***Method:***

A quasi-experimental (Single group Pre and Post-test) study design was conducted. Stroke patients aged 35-65 years were screened and then selected based on inclusion and exclusion criteria with convenient sampling method. Over the course of 12 weeks, a single group will receive an intervention would be carried out for 20 minutes of each session, twice a week.

- ***Results:***

Statistical analysis revealed significant improvements in Coordination($p = 0.001$) and ROM ($p < 0.001$) between pre-test and post-test scores. Patients demonstrated enhanced motor function, increased ROM, and improved coordination . These findings highlight the effectiveness of FLASHFIT IWALL when integrated into conventional rehabilitation programs.

- ***Conclusion:***

The study concludes that FLASHFIT IWALL significantly improves co-ordination and ROM in stroke patients. Integrating such interactive technologies into stroke rehabilitation may serve as an effective adjunct to conventional therapies, accelerating recovery and enhancing the quality of life for stroke survivors.

Keywords: *Stroke, ROM, Coordination, Comprehensive Coordination Scale, Goniometer, Interactive Device, FLASHFIT IWALL.*

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I. INTRODUCTION

- *Stroke*

Stroke is a neurological disorder which is ranked worldwide as the third most leading cause of human morbidity and mortality. It is defined as the sudden onset of neurological deficits due to an abnormality in cerebral circulation with the signs and symptoms lasting for more than 24 hours or longer (1). Globally, Stroke ultimately ends up in long term disability (2) limiting their occupational performance. Stroke is caused either due to the brain cell death because of blood supply Ischemic stroke or bleeding

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inside or around the brain surface hemorrhagic stroke (3). It remains a serious medical emergency. Most common type of syndrome is Middle Cerebral Artery syndrome (4). The upper extremity is more common and severely impaired than lower extremity in middle cerebral artery syndrome. Hemiparesis of the contralateral upper limb remains a strong deficit both in acute and chronic stroke. In acute stroke manifestation of contralateral hemiparesis accounts for 80% and 40% in chronic stroke (5).

Motor impairments may occur with other neurological manifestations which prolong the recovery in rehabilitation process and thus requires scheduled and varied therapeutic interventions (6). The severity and recovery are inversely proportional. The site and extent of neurological lesion determine the impairments. Usually, spontaneous recovery is expected within 6 months post stroke. Beyond 6 months, the recovery process is slow and often results in plateau phase after year post stroke. The existing evidence supports reorganization and plasticity of the brain which determines either true recovery or recovery through compensation which usually occurs in subacute and chronic Stroke (7). In the field of Neurorehabilitation for stroke, a variety of interventions are emerging in rapidity and practiced with evidence to positive influence the stroke motor recovery (8).

➢ *Range of Motion in Stroke*

Joint range of motion is the amount of movement that is possible at a joint. It is the arc of motion through which a joint passes when moving within a specific plane (9). In stroke patients, reduced ROM is commonly observed due to muscle atrophy, joint stiffness, and decreased muscle tone, leading to functional impairments in daily living activities (10). Reduced ROM can lead to restricted function and impaired performance in occupational domains.

➢ *Coordination in Stroke*

Coordination is the ability to produce accurate controlled movements (9). Stroke often disrupts the brain's ability to coordinate physical, cognitive, and emotional functions. It can profoundly impact coordination by damaging the neural circuits responsible for motor control, balance, and sensory feedback. This impairment affects the ability to perform voluntary movements, maintain balance, and execute fine motor tasks, all of which are critical for independence and quality of life, contributing to challenges in recovery and rehabilitation. Various studies indicate that 50–70% of stroke survivors experience motor coordination deficits immediately after a stroke (11).

➢ *Interactive Device (FLASHFIT)*

FLASHFIT training refers to an interactive brain-body fitness tool, introduces an innovative approach in stroke rehabilitation by using sensory cues to stimulate brain responses through physical movement. These devices offer real-time performance feedback and promote brain plasticity, enhancing balance, strength, and motor function.It challenges and motivates the individual to workout effectively and helps to assess motor performance data instantly. There are a variety of interactive FLASHFIT devices such as IWALL, IFLOOR, IPODS, IPUNCH, ITRACK, IBALL, ICORE and ICORE (12).

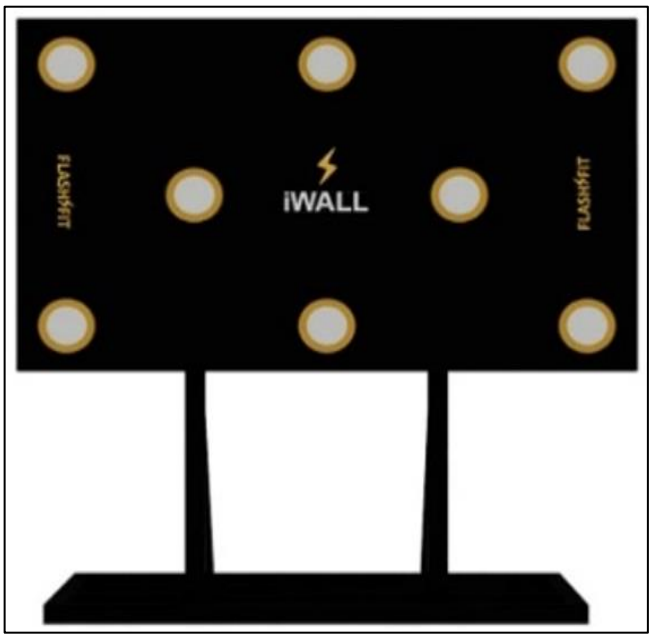

Fig 1 Interactive Device (FLASHFIT IWALL)

➢ *Occupational Therapy in Post Stroke Rehablitation*

Deficits in the upper limb lead to limited ROM and lack of coordinated movements of the arm, hands, and fingers, resulting in dependence in activities like eating and dressing (15). Even after months or years, upper limb deficits remain impaired in more than 50% of stroke survivors (16). Besides contralateral upper limb hemiparesis, other manifestations include muscle tonal changes, joint laxity, and motor impairment, commonly affecting reaching, grasping, and carrying objects (17). Upper limb limitations influence functional abilities, participation, and satisfaction in over 50% of stroke patients (18), with hand function deficits often persisting (19).Occupational therapists play a vital role in stroke rehabilitation, focusing on performance characteristics involving physical performance (20,21). To achieve quality occupational performance, upper limb functions are crucial. Rehabilitation involves collaboration between therapists and patients to set goals for daily living, work, and leisure activities (22). As upper limb impairments persist, rehabilitation services remain in demand (23).

➢ *Use of Technology in Post Stroke*

In stroke survivors, Neurorehabilitation occupies a major role (13). A broad array of rehabilitation for stroke survivors is targeted with functional outcome. Additionally, extensive treatment methods are in clinical usage to tackle physical deficits to enhance functional performance and social integration. Reviews of systematic interventions revealed a wide range of motor rehabilitation using different approaches; motor relearning, sensorimotor approaches, task-oriented approaches interacting with the real world, bilateral hand usage, constraint induced movement therapy, robotic training and biofeedback among many others. Every treatment approach has its own advantages and disadvantages. The care of the patients being the utmost

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priority in health care services, feeling bored and need for complete freedom in the treatment process is the topmost concern revealed by the stroke survivors. With the deficit in therapist based or conventional therapies, technology has taken an added advantage to fill the gap. It is a promising advancement in stroke rehabilitation in providing high practice sessions (14) (15) and improving rehabilitation professional's efficiency in delivering the therapy (16) (17).It also encourages the stroke survivors to be involved in treatment sessions independently without the continuous presence of the health professional. Digital health care system specifically with respect to Neurorehabilitation has gained tremendous popularity with its increase functional outcomes which are carried out by the patient himself or herself (18) in reducing the duration of stay in the hospitals (19)and faster integration into the society. Further, more technology has an added advantage in targeting specific treatment regimens which are on the top priority list of both the patient and the health care professional (20). With the steep rise in technology in various fields of medicine, technology usage in stroke rehabilitation rapidly emerging with evidence (21). Recent years usage of technology allows the patients to involve, participate and make desirable changes through game based immediate and ongoing feedback. Include performance characteristics involving physical performance (22) (23).

➢ *Aim and Objectives*

- *Aim:*

✓ To determine the effect of Interactive Device (FLASHFIT IWALL) on improving the Co-ordination and Range of motion of stroke patients.

- *Objectives:*

✓ To assess the Co-ordination and ROM for patients diagnosed with stroke Using Comprehensive Coordination Scale (CCS) Scale and Goniometer (pre-test).
✓ Providing intervention using Interactive Device (FLASHFIT IWALL).
✓ To reassess the Co-ordination and ROM using CCS and Goniometer (post-test).
✓ To Compare pre-value and post-value scores of Co-ordination and ROM to determine the effect of Interactive Device (FLASHFIT IWALL).

➢ *Need of the Study*

The rise of Stroke prevalence often results in motor impairments such as reduced co-ordination and restricted ROM. The use of recent technology has shown practice dependent magnification of affected arm through the assistance of cortical restructuring (24). Though with the steep rise in varied rehabilitative interventions, with regard to stroke rehabilitation, literature regarding different training methods or approaches could not determine the superiority of one over the other due to inadequate literature (25) often facing limitations in maintaining patient engagement and motivation. The interactive device (FLASHFIT IWALL) has shown potential to overcome these challenges. Such devices incorporate engaging visual and motor tasks that facilitate repetitive, task-oriented practice, which is essential for neuroplasticity and motor recovery (26). By integrating physical movements with interactive feedback, these technologies can enhance motor coordination and ROM while increasing patient participation and adherence (27). Despite these promising attributes, there is a lack of sufficient evidence on the effectiveness of such devices specifically in stroke rehabilitation. This study aims to address this research gap by evaluating the impact of the FLASHFIT IWALL on coordination and ROM in stroke patients. The findings could guide therapists in adopting evidence-based, technology-driven approaches to enhance patient outcomes.

II. REVIEW OF LITERATURE

- **Nandhini Varsha A** done a study on **"Impact of Interactive FLASHFIT Devices on Badminton Players' Performance"** .The study to determine out how interactive FLASHFIT devices improve badminton players' ability to perform efficiently in sports. To improve agility, endurance, and reaction time, badminton players must modify their physical activity regimens. Training must be modified in order to move, measure, and inspire badminton players to finish the goal. Badminton players who satisfied the inclusion and exclusion criteria were the participants of this study. They were chosen from the 3–18 age group. 10 badminton players from MYNDZ Badminton Academy were chosen. Using interactive FLASHFIT IFLOOR, PODS, IWALL, IPUNCH, ITRACK, IBALL, ICORE, and IJUMP, they engaged with conventional fitness training. To find out the effectiveness of interactive FLASFIT devices for the chosen badminton players, a pre-test and post-test evaluation has been carried out. The parent group reported that their players' agility, speed, and reaction time had all improved after the activity. Overall sports performance, including flexibility, endurance, reaction time, attention span, processing speed, and coordination, can be enhanced by combining interactive FLASHFIT devices training along with conventional fitness training. (12)
- **Rowland TJ, et al.** conducted a study on **"Occupational therapy intervention for adults with hemiplegia after stroke: A focused review"** investigated the Occupational therapy's role in Stroke. Many health professionals are involved in treatment for stroke. One of the health professionals involved in the multi-disciplinary stroke rehabilitation are occupational therapists. The major focus of Occupational therapy involves upper limb motor functions, sensation, cognition, emotions, perception and occupational participation either through remediation by various approaches or compensation or adaptation of the task or environment taking into consideration of individual characteristics. Overall Occupational Therapy focuses on holistic intervention to make the individual's independent to the maximum level. (28)
- **Saposnik G, et al.** did a study on **"Efficacy and Safety of iPad-Based Therapy for Stroke Rehabilitation"** a randomized controlled trial to test the novel home rehabilitation using iHOME for Stroke patients. The

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experimental group used I-pad for intervention and control group had a usual care. 30 participants participated in the study. Feasibility was analysed with usage time. It is considered successful usage of I-pad if used more than 140 minutes. Nine-hole peg test for fine motor skills and wolf motor function test were used as the outcome measures. The results concluded and placed the foundation for future research as it is safe, feasible and efficient in enhancing the underlying skills through tablet-based intervention. (29)

III. METHODOLOGY

➢ *Research Design:*

Quasi-experimental design. (single group pre and post-test).

➢ *Study Setting:*

The study was conducted in Occupational Therapy, Department of therapeutics – NIEPMD, Tamil Nadu.

➢ *Sampling Technique:*

Convenience sampling.

➢ *Sample Population:*

Patients diagnosed with stroke age of 35- 65.

➢ *Sample Size:*

- Sample size (n) = 15

➢ *Variables:*

- Independent variables – Intervention given by using Interactive device (FLASHFIT IWALL).
- Dependent variables – Range of motion and Coordination.

➢ *Screening Criteria*

- *Inclusion Criteria*

✓ Individuals of both genders.

✓ Age group between 35-65.

✓ Individuals who can be able to follow the simple instructions.

✓ Patients with limited Range of Motion.

✓ Patients with impaired coordination.

- *Exclusion Criteria*

✓ Patients who have visual impairment.

✓ Patients who have co-morbidities affecting motor performance such as dementia, orthopaedic conditions i.e., (Arthritis, Fractures etc..)

✓ History of seizures.

✓ Uncontrolled hypertension, unstable angina and myocardial infraction.

➢ *Duration of Study*

Twice a week for 12 weeks (24 sessions for each participant). Each session lasts for 20 minutes.

➢ *Tool Description*

- *Goniometer*

The “Half Circle” (180 degree) and “Full Circle”(360 degree) goniometer was the instrument used in this study. To figure out the best intervention plans, goniometer data has been used to measure the amount of ROM limits. When it comes to precision and accuracy, eye estimation of ROM is unreliable; in contrast, goniometer measurements enable ROM measurement much more precise. (30).This has been demonstrated that the universal goniometer exhibits good to outstanding reliability, but it depends upon the joint and ROM that is being evaluated (31).

- *Comphrensive Coordinaion Scale*

An evaluation of motor performance (endpoint movement) and quality of movement (joint rotations and interjoint coordination) based on observational kinematics, the Comprehensive Coordination Scale (CCS) evaluates coordination for multiple body segments. Two levels of movement description are used by the scale to assess motor coordination in people with neurological injuries: the motor performance level describes end point movements such as hand or foot movements, and the description of movement quality level describes limb joints/trunk movements which contribute to end point movement .It consists of 6 different tests such as Finger-to-Nose Test (FNT), Arm-Trunk Coordination Test(ATC), Finger Opposition Test(FOT), Interlimb Coordination Test(ILC-2), Lower Extremity Motor Coordination Test (LEMOCOT), Four-limb Coordination (both upper and lower limb movements) Test(ILC-4).

Each test encompasses several behavioural components that are evaluated using distinct rating scales that range from 3 (normal coordination) to 0 (impaired coordination). These scales evaluate various aspects of the motor behavior essential for completing the task. (32).The 6 tests in the CCS contain a total of 13 grading scales. Better motor coordination is indicated by higher CCS scores, which range from 0 to 69.The entire body's coordination score is quantified by the CCS total score.

- *Psychometric Properties*

Excellent inter-rater reliability (ICC = 0.97; 95% CI: 0.93-0.98) and inter-rater reliability (ICC = 0.98, 95% CI: 0.95-0.99).Content validity of the CCS was determined by a Delphi Study followed by a panel of 8 experts. From the result of these steps, Alouche et al. (2021) concluded that the instrument has strong content validity.

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➢ *Procedure*

Stroke survivors of age group 35-65 years were selected to participate in this study based on inclusion criteria .A convenience sampling was used for the study. The study was conducted at National Institute for Empowerment of Persons with Multiple Disabilities (NIEPMD), Chennai. The selected participants were given written consent for the willingness to participate in the study . CCS and Goniometer was used as screening tool and as well as primary outcome measure to assess the Coordination and ROM.15 stroke survivors who fulfilled the inclusion criteria were assessed using the CCS and Goniometer for the Pre-test. Duration of Intervention- 20 minutes per session, twice a week for a period of 12 weeks. Then using the same outcome measures for reassessment which has been done for all 15 participants. Post-test measure was administered at the end of the 12 week intervention. Data analysis was done. The results were obtained.

➢ *Intervention Protocol*

The treatment protocol developed for this study includes a series of exercises for rehabilitation divided according to the functional goals to be pursued. The 20-minutes of protocol for stroke rehabilitation consists of 2 sessions per week, designed to promote motor recovery i.e.,. Range of motion, Co-ordination and relaxation. Each session begins with a **5-minute warm-up** focused on improving the ROM through simple activities. These include gentle neck stretches, shoulder rolls, wrist and ankle circles, seated marching and arm raise combined with deep breathing exercises. These movements aim to increase joint flexibility, enhance circulation and prepare the body for more intensive activity.

The second component is a **10-minute interactive session using the FLASHFIT IWALL,** which combines motor control tasks with engaging digital activities. Introduce the device, explain their functionalities and demonstrate basic activities which is only for 1st session . Exercise of using affected upper extremity to touch the lights and complexity of the interactive device gradually increasing each week. This progression ensures continuous improvement in motor co-ordination, strength, ROM and neuroplasticity.

- *Key Factors of the Activity:*

✓ To improve ROM, the activity is graded by increasing the number of lights, thereby corresponding to an increase in upper movements.
✓ To improve Co-ordination, the activity is graded from a slow, broad movement that uses fewer joints to a rapid, precise action that uses more joints for the patient to be able to manage precise motor movements.

The final 5 minutes of each session are dedicated to relaxation and activation exercises. Techniques include guided deep breathing and passive stretching.

➢ *Description of Device*

Stand in front of FLASHFIT IWALL and keep tracking and use hands to touch on the moving green light.

➢ *For Consecutive Weeks*

The rehabilitation protocol is designed to be repeated across 12 consecutive weeks, ensuring gradually increasing ROM and Co-ordination while preventing plateaus. Each session focuses on the same 20-minutes which is 5 minutes of warm-up activities to increase ROM and flexibility, 10 minutes of engaging FLASHFIT IWALL interactive exercises that promote motor control and Co-ordination and 5 minutes of relaxation exercises to reduce stress, improve emotional well-being and prepare the body for recovery. By consistently practicing these activities 2 sessions per week, over a period of 3 months, significant improvements in ROM, motor function and psychological well-being, as supported by the research cited throughout this protocol. Over the course of 12 weeks, the protocol remains consistent in structure while gradually increasing the difficulty of the interactive FLASHFIT IWALL exercises. Each week, the speed and complexity of the interactive device activities is being gradually increased.

➢ *Intervention Protocol*

Table 1 Intervention Protocol

Weeks	Components	Duration	Activities
1-12	WARM UP	5 MINS	**1.GENTLE NECK STRETCHES:** Side-to-side, up-and-down movements. **2.SHOULDER ROLLS:** Forward and backward rotations. **3.DEEP BREATHING WITH ARM RAISES:** Inhale while lifting arms, exhale while lowering.
1-4	FLASHFIT IWALL	10 MINS	Upper limb movements corresponding to light delay of 6 seconds between the consecutive light. 1 Round = 10 lights
5-8			For the following weeks the light delay between them is decreased to 3 seconds, so that the number of lights is increased. 1 Round = 20 lights
9-12			Further time delay is decreased to 1 second, then the number of consecutive lights is increased, so that upper limb movements are equivalently increased. 1 Round = 60 lights
1-12	RELAXATION	5 MINS	**1.GUIDED BREATHING:** Inhale for 4 counts, exhale for 6. **2.PASSIVESTRETCH:** Gentle stretching to conclude.

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IV. RESULTS

The collected data was analysed and interpretated using the SPSS software, 27th version.

Table 2 Descriptive Statistics of the Age Group of Patients

Age (in years)	Frequency	Percentage	Mean ± SD	Min - Max
< 50	6	46.2	50.08 ± 9.215	35 - 65
> 50	7	53.8		
Total	13	100.0		

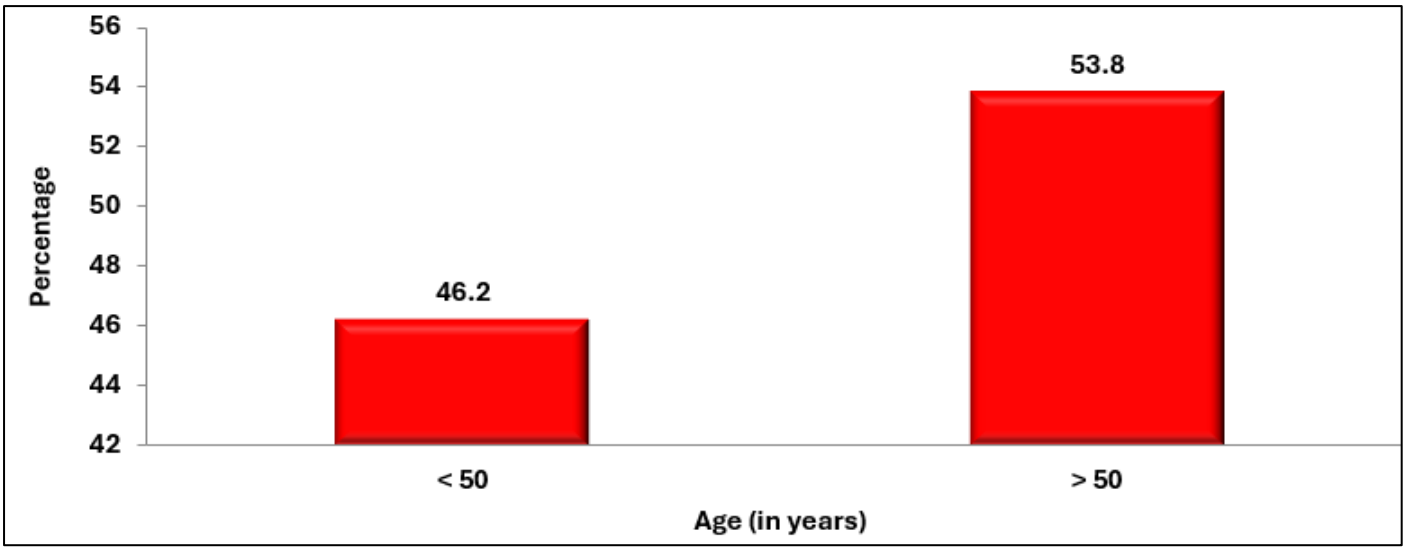

Fig 2 Descriptive Statistics of the Age Group of the Patients

The age group of the patients chosen for the study ranges from 35 to 65 years, constituting a mean value of age 50.08 also with a standard deviation of 9.215.

Table 3 Number of males and females participated in the study

Gender	Frequency	Percentage
Female	2	15.4
Male	11	84.6
Total	13	100.0

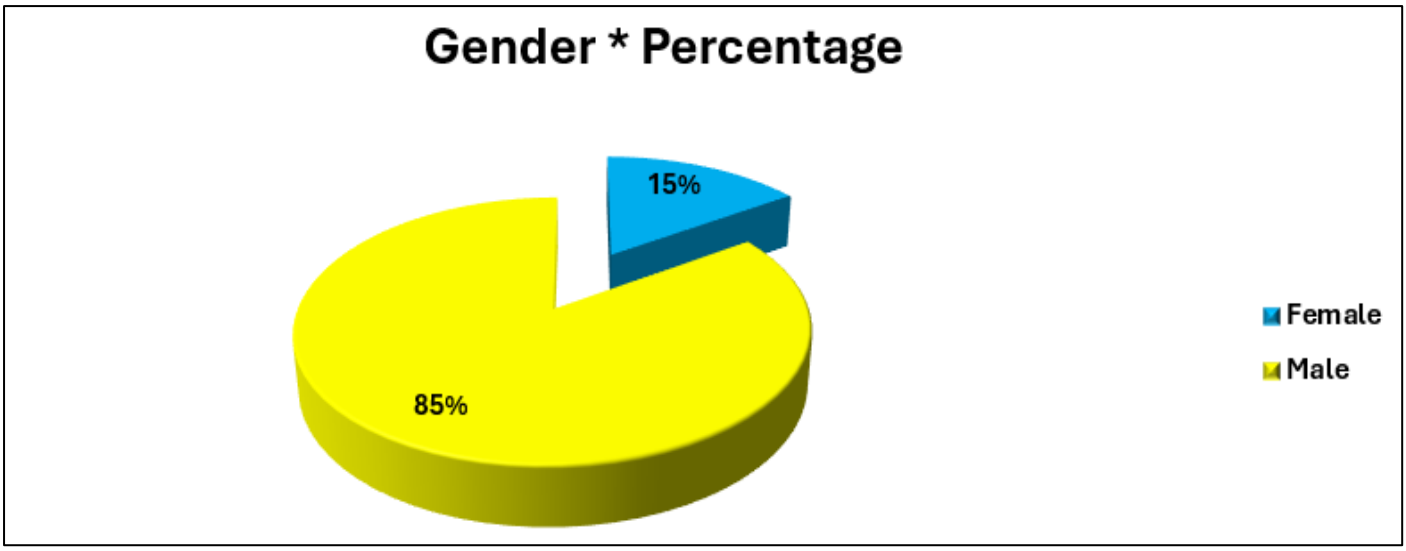

Fig 3 Distribution of Males and Females Participated in the Study

A total of 13 patients participated in the study, including 2 females and 11 males, constituting the 15.4%and 84.6% of the population respectively.

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Table 4 Comparison of Pre and Post-Test Scores of Co-Ordination

Co-ordination		Mean	N	Std. Deviation	Z – Value (P - Value)
FLASHFIT IWALL	Pre	41.31	13	5.089	-3.189 (0.001)*
	Post	53.15	13	2.940	

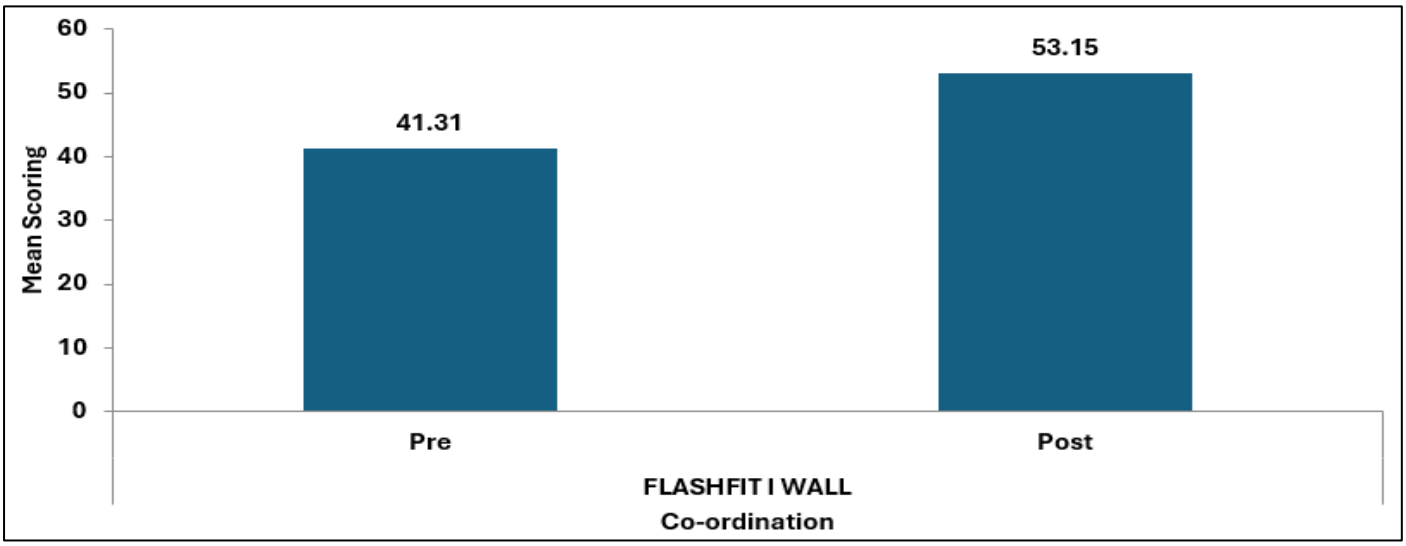

Fig 4 Pretest and Post-Test of Coordination

Table 5 Comparison of Pre and Post-Test Scores of Co-Ordination (Each Component)

Co-ordination		Mean	N	Std. Deviation	t – Value (P - Value)
Finger To Nose Test	Pre	17.08	13	2.326	-6.312 (0.001)*
	Post	19.62	13	1.261	
Arm Trunk Co-ordination Test	Pre	8.31	13	.855	-6.501 (0.001)*
	Post	9.69	13	.480	
Finger Opposition	Pre	6.08	13	1.441	-11.355 (0.001)*
	Post	8.77	13	.927	
Inter limb Co-ordination (Synchronous Anti-Phase Forearm Rotation)	Pre	2.15	13	1.068	-7.982 (0.001)*
	Post	3.62	13	.650	
LEMOCOT	Pre	7.38	13	.768	-18.341 (0.001)*
	Post	9.62	13	.768	
Inter limb Co-ordination (Upper and Lower Limb Movement)	Pre	1.15	13	.376	-5.196 (0.001)*
	Post	1.85	13	.376	

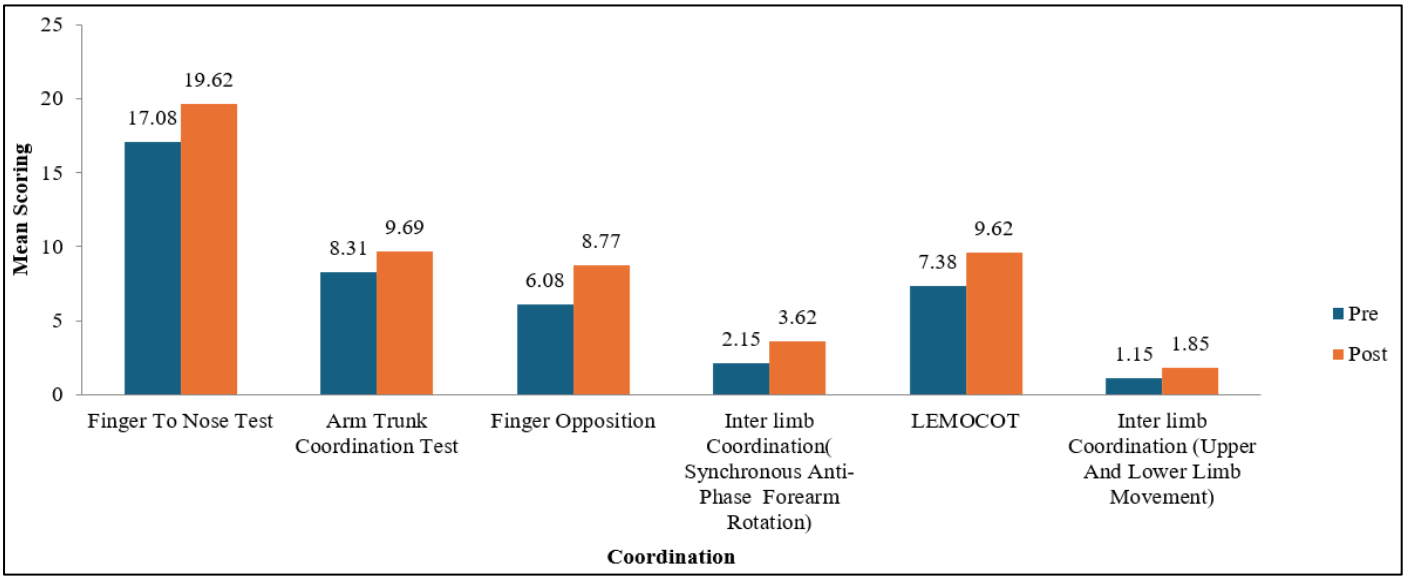

Fig 5 Descriptive Statistics for Coordination of Each Component

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Table 6 Comparison of Pre and Post-Test Scores of Range of Motion

Range of motion		Mean	N	Std. Deviation		t – Value (P - Value)
Shoulder	Flexion	Pre	76.15	13	10.439	-64.000 (0.001)*
		Post	81.08	13	10.531	
	Extension	Pre	20.00	13	9.354	-64.000 (0.001)*
		Post	25.00	13	9.314	
	Abduction	Pre	56.92	13	5.965	-31.500 (0.001)*
		Post	61.92	13	5.904	
	Adduction	Pre	56.92	13	5.965	-31.500 (0.001)*
		Post	61.92	13	5.904	
Elbow	Flexion	Pre	65.00	13	31.689	-7.407 (0.001)*
		Post	71.15	13	33.176	
	Extension	Pre	65.00	13	31.689	-7.407 (0.001)*
		Post	71.15	13	33.176	
Forearm	Pronation	Pre	30.38	13	9.456	-10.645 (0.001)*
		Post	34.08	13	9.197	
	Supination	Pre	29.23	13	10.175	-8.832 (0.001)*
		Post	34.23	13	9.757	
Wrist	Flexion	Pre	26.15	13	4.634	-28.700 (0.001)*
		Post	30.92	13	4.991	
	Extension	Pre	16.92	13	5.220	-64.000 (0.000)*
		Post	21.85	13	5.178	

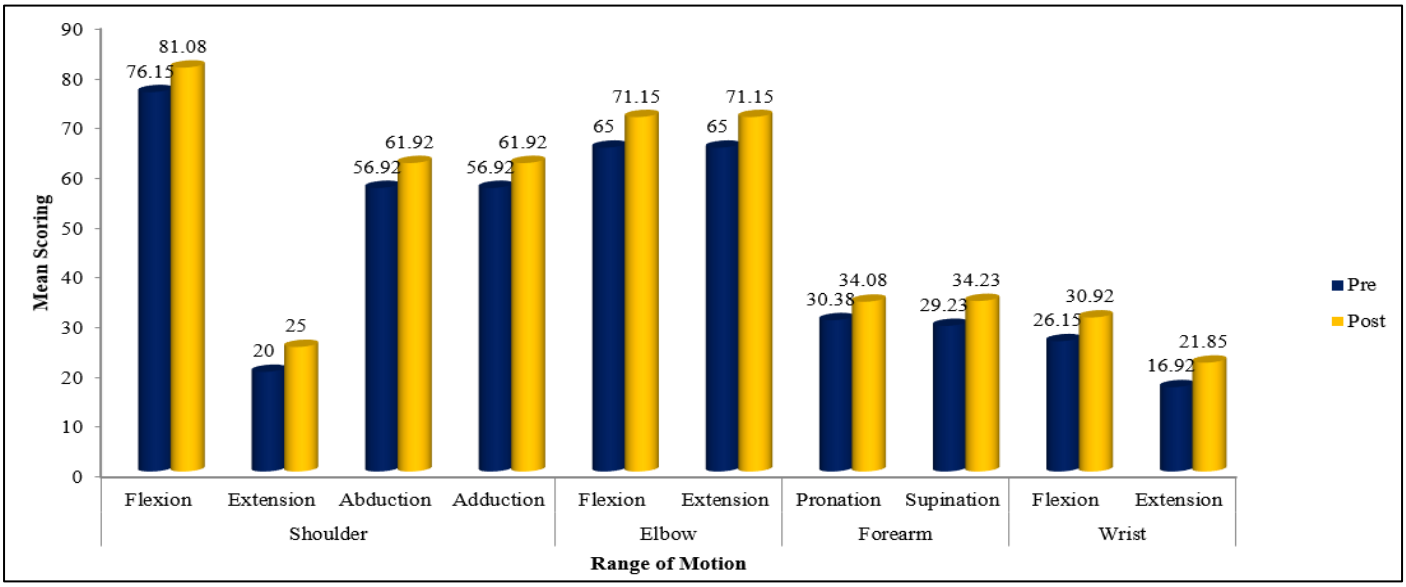

Fig 6 Descriptive Statistics for Range of Motion

V. DISCUSSION

The study aimed to determine the effectiveness of interactive device (FLASHFIT IWALL) to improve coordination and range of motion in adult stroke survivors. Total sample population of thirteen was selected by convenience sampling. The participants were selected based on the inclusion criteria. Coordination and ROM were assessed using CCS and Goniometer.

Tables 1 and 2 shows the descriptive statistics for the age and gender distribution of the study participants. The participants' ages ranged from 35 to 65 years, with a mean age of 50.08 years. Out of 13 participants, 2 were female and 11 were males, constituting the 15.4% and 84.6% of the population. The proportion of male participants in the study were significantly larger than that of female participants.

Table 3 and Table 4 explains statistical analysis for coordination. There is Significance difference between the Pre and Post test scores of Co-ordination in Stroke Patients. The Wilcoxon Signed Rank Test revealed a statistically significant improvement in coordination scores ($p = 0.001$) following the FLASHFIT IWALL intervention, with the mean score increasing from 41.31 (±5.089) in the pre-test to 53.15 (±2.940) in the post-test. Subcomponents of coordination, including the Finger-to-Nose Test (17.08 ±2.326 to 19.62 ±1.261), Arm-Trunk Coordination Test (8.31 ±0.855 to 9.69

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±0.480), Finger Opposition (6.08±1.441 to 8.77±0.927),Interlimb coordination (2.15±1.068 to 3.62±0.650), LEMOCOT (7.38±0.768 to 9.62±0.768) and Interlimb coordination(both upper and lower limb)(1.15±0.376 to 1.85±0.376)showed significant improvements ($p = 0.001$).These results suggest that the FLASHFIT IWALL intervention effectively enhances coordination in stroke patients. The interactive nature of the device likely provided patients with real-time feedback and the tasks were progressively challenging and facilitating motor learning by the integration of visual, auditory, and motor stimuli which enhances sensorimotor coordination by activating multiple brain areas (33). Similar to the study which shows that task-oriented training improves motor control and coordination in stroke survivors by promoting sensorimotor integration and cortical reorganization (34). Also, the multisensory training can significantly improve coordination in stroke rehabilitation (35) (36).

Table 5 shows that Significant improvements were observed in Pre and Post test scores of ROM across all assessed Upper limb joints, with p-values < 0.001. Shoulder flexion improved from 76.15±10.439 to 81.08±10.531, and wrist flexion increased from 26.15±4.634 to 30.92±4.991.Wilcoxon Signed Rank Test was used to compare the Pre and Post test scoring of ROM in Stroke patients at 5% level of significance was observed. These improvements are attributed to the repetitive, graded exercises provided by the FLASHFIT IWALL, which promote joint flexibility and reduce spasticity. Studies have shown that interactive devices can significantly enhance ROM by encouraging patients to perform movements within their maximum range repeatedly (37).

VI. CONCLUSION

This study demonstrates that 12 week intervention using the Interactive device (FLASHFIT IWALL) significantly improves coordination and ROM in stroke patients. Key findings include a statistically significant mean increase in coordination scores, and ROM improvement is seen across multiple upper limb joints. By combining technological innovation with therapeutic principles, the device promotes patient engagement and functional recovery. The use of Interactive device (FLASHFIT IWALL) can be customized by occupational therapists to meet the specific needs and goals of an individual. These findings underscore the importance of integrating interactive technologies into stroke rehabilitation programs to accelerate recovery, improve therapy outcomes.

VII. LIMITATIONS

- More number of heterogenous sample could have been chosen for this study.

RECOMMENDATIONS

- Longitudinal Studies can be done to determine the long-term effect of interactive device.
- Conduct studies to evaluate the cost-effectiveness of incorporating interactive devices into rehabilitation programs to assess feasibility for widespread clinical implementation
- Explore the use of interactive devices for other motor impairments or neurological conditions,(i.e., Parkinson's disease, TBI, or multiple sclerosis) to expand the application of the technology.
- Incorporate other functional and psychosocial metrics, such as quality of life, independence in activities of daily living (ADLs), and patient satisfaction, to provide a holistic view of the intervention's impact.

➢ *Declaration by Authors*

- Ethical approval: Approved

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