Effects of Clock Turn Strategy on improving Turning Ability, Dynamic Balance and Fear of Fall in stroke patients

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ABSTRACT

Background: Stroke is the sudden loss of neurological function caused by lack of blood flow to the brain and it is the second most common cause of death and disability worldwide. Falls related with turning is common in stroke survivors and fall injuries during turning tasks are 8 times more common than walking straight forward. It is of utmost importance to understand the strategies for turning among this physically challenged population in order to identify what rehabilitation strategies should be. The capability to change walking direction such as turning is compromised in chronic stroke survivors that may put them at risk of falls and limitations in ADL. The clock turn strategy aims to reduce gait disturbances, improve Turning Ability and Dynamic Balance when turning in a narrow space such as bathroom or corridor.

Objective: The aim is to find out the effect of Clock Turn Strategy on turning ability, dynamic balance and fear of fall in stroke patients.

Methodology: A convenient sampling of 26 middle cerebral artery stroke patients including   male and female patients were taken from medicine department, Pravara Rural Hospital. The patients were assessed for Turning Ability, Dynamic Balance and Fear Of Fall using 'Timed Up And Go Test', '180° Turn Test', 'Berg Balance Scale' and 'Fall Efficacy Scale'. They were given the Clock Turn Strategy for 4 weeks thrice a week. After the therapy, post assessment was done.

Results: Clock Turn Strategy showed highly significant increase in Turning Ability [number of steps t=5.82(right) 't'=3.73(left), time taken 't'=2.76(right), 't'=2.22(left)], Dynamic Balance('t'=2.94,)and ('t'=2.82), and reduction in Fear Of Fall('t'=3.24) after giving the protocol for 4 weeks. The 'p' value for all the outcome measure was p=0.001.

Discussion and conclusion: The present study concluded that there is a significant improvement in Turning Ability, Dynamic Balance and Fear of Fall when given the Clock Turn Strategy along with the conventional physiotherapy treatment in the patients with Middle Cerebral Artery stroke.

Keywords: Clock Turn Strategy, Middle Cerebral Artery Stroke, Turning Ability, Dynamic Balance, Fear of Fall.

INTRODUCTION:

Stroke is the sudden loss of neurological function caused by lack of blood flow to the brain. Ischemic stroke is when a blood clot develops blocking the flow of blood to the brain thereby leading to lack of oxygen and nutrients to the brain. Hemorrhagic stroke occurs as a result of ruptured blood vessels, causing leakage of blood in or around the brain. [a]

Turning is considered to be a multifaceted task that entails the combination of muscle coordination, vestibular, visual, and proprioceptive information in series with horizontal reorientation of gaze, head and body segments. [4]

However, falls associated with turning is common in stroke survivors and **fall injuries during turning tasks are eight times more common than walking straight forward.** Various epidemiological studies have specified that the incidence of fall range from 16% to as great as 73% after 6 months of stroke with at least 20% reported multiple falls. Moreover, falls occur frequently during walking.[4]

Indicators of trouble during turning were grounded on 4 categories of movement: staggering during the turn, the absence of pivoting during the turn, using 5 or more steps or weight shifts to achieve the turn, and taking 3 seconds or longer to accomplish the turn. Therefore, it is paramount to understand the strategies for turning among this physically challenged population in order to identify what rehabilitation strategies should be. [4]

Patla et.al.,categorized turning into 2 categories: step and spin (pivot) turning. Step turning consist of change in the direction to the opposite side of the stance limb, whereas a spin turn involves a change in the direction towards the stance limb. Studies have compared advantages between both strategies. Hase and Stein proposed that step turn strategy is suitable and more stable because it involves a wider base of support while changing direction as equated to spin turn in a healthy subject. This was supported by Taylor, Dabnichki, and Strike who compared 90° spin and step turns on three-dimensional kinematic and kinetic analysis among the healthy population. They found that step turn has more advantages than the spin turns such as a wider base of support and less involvement of movement coordination. [4]

It was concluded that the capability to change walking direction such as turning is impaired in chronic stroke survivors that may put them at risk of falls and limitations in ADLs. Other studies approved that dysfunction of the reorientation of axial body segments towards the new direction is a major deficit in stroke survivors. [4]

The Clock-Turn Strategy is a cognitive movement strategy to enhance turning performance. Cognitive movement strategies are a set of compensatory skills to develop mobility function. The principle of the cognitive movement strategies is to decompose a complex motor task into discrete steps, so one can consciously plan and rehearse the task before execution. [1]

Purpose of the study:

Specific therapies are required to improve turning ability through which dynamic balance is improved and fear of fall is reduced in stroke patients. The Clock Turn Strategy helps the stroke survivors to improve the above problems. There is evidence of the clock turn strategy effectiveness in Parkinson disease but more evidence is needed regarding its effectiveness in stroke patients.

Aim: To assess the effect of the clock turn strategy on improving turning ability, dynamic balance and reduce fear of fall in stroke patients.

Objectives of the study:
1) To assess the effect of clock turn strategy on improving turning ability in stroke patients.
2) To assess the effect of clock turn strategy on improving dynamic balance in stroke patients.
3) To assess the effect of clock turn strategy in reducing fear of fall in stroke patients.

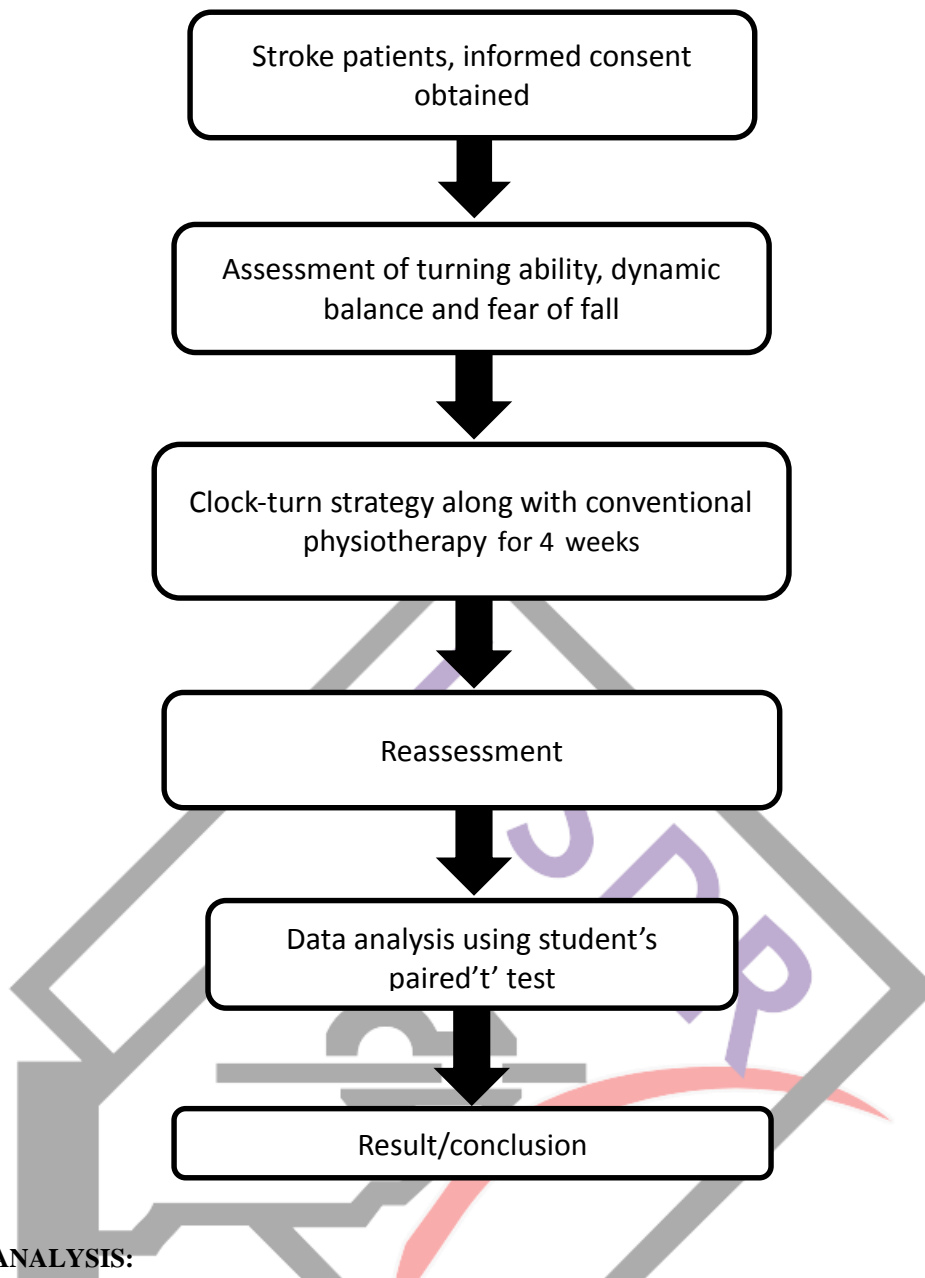## 2. METHODOLOGY AND RESEARCH DESIGN:

Ethical clearance was obtained from the institutional Ethical Committee. This study was an experimental study which involved Convenient Sampling. The patients were the In-patients and out-patients of Neuro-physiotherapy department of Dr.A.P.J Abdul Kalam College of Physiotherapy, Pravara Institute of Medical sciences, Loni bk. Ahmednagar. A sample size of 26, both dominant and non-dominant side MCA stroke patients within the age group of 40 - 70 years were selected. The intervention period was of 4 weeks.

3. OUTCOME MEASURES:

The patients were assessed for turning ability, dynamic balance and fear of fall pre and post-therapy. The scales used for assessing turning ability was 180° turn test, for dynamic balance assessment Timed Up and Go Test and Berg Balance Scale were used. For assessing fear of fall the Fall Efficacy Scale was used.

4. INTERVENTION:

The intervention protocol was built to improve turning ability, dynamic balance and reduce fear of fall in stroke patients. The patients were assessed before the intervention using 180° Turn Test, Timed Up and Go Test, Berg Balance Scale and Fall Efficacy Scale. The Clock Turn Strategy was given for weeks, three times a week. After 4 weeks posttest was done.

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│  Stroke patients, informed  │
│      consent obtained       │
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              ▼
┌─────────────────────────────┐
│ Assessment of turning       │
│ ability, dynamic balance    │
│ and fear of fall            │
└─────────────────────────────┘
              │
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┌─────────────────────────────┐
│ Clock-turn strategy along   │
│ with conventional           │
│ physiotherapy for 4 weeks   │
└─────────────────────────────┘
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┌─────────────────────────────┐
│        Reassessment         │
└─────────────────────────────┘
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│ Data analysis using         │
│ student's paired 't' test   │
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┌─────────────────────────────┐
│     Result/conclusion       │
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5. STATISTICAL ANALYSIS:

The objective of the study was to find out the effects of Clock Turn Strategy on improving Turning Ability, Dynamic Balance and Fear of Fall in stroke patients along with conventional physiotherapy treatment.

Statistical analysis was done using the Microsoft Excel. Various statistical measures such as mean, standard deviation [SD] and test of significance such as Student's Paired't' test were utilized to analyze the data. The results were concluded to be statistically highly significant with $p=0.001$. Paired't' test was used to compare the difference in scores between the pre-intervention and post-intervention values in a group.

DEMOGRAPHICS

Table 1: Age and Gender wise distribution

Age	Female	Male	Total
45-55	11	6	17
55-65	4	5	9
Total	15	11	26

Graph 1: Age and Gender wise distribution
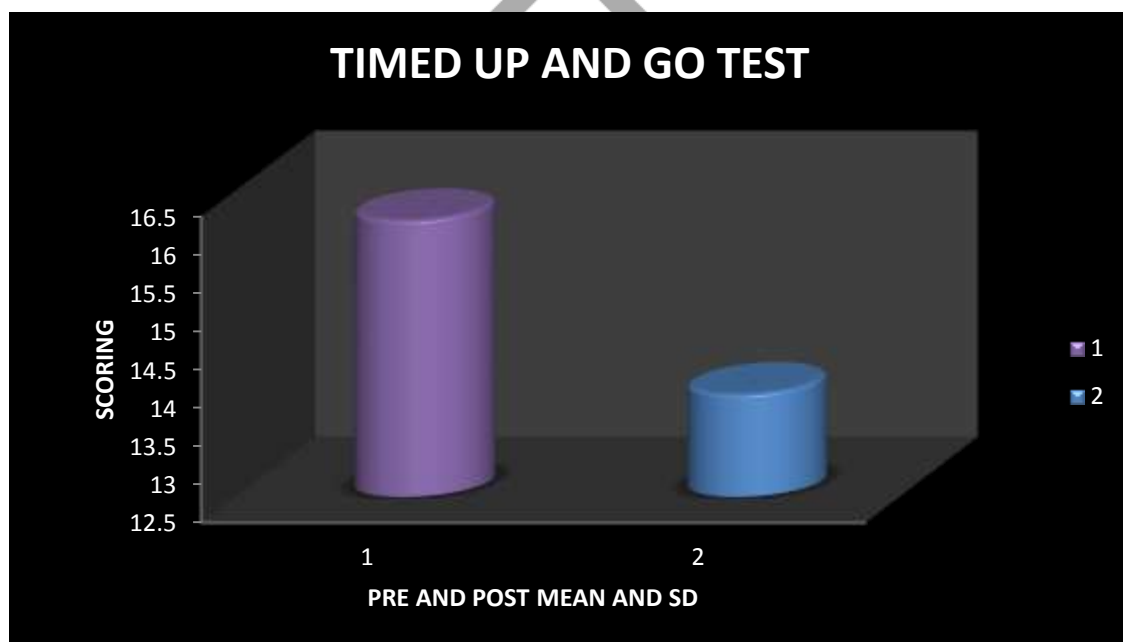
TIMED UP AND GO TEST (TUG):
        The Timed Up and Go test (TUG) was used to measure dynamic balance.
        The pre-intervention mean average score and standard deviation for TUG test in the participants was 16.11±1.925. After 4 weeks of intervention period the mean average score and standard deviation for these participants was 13.84±2.
        There was statistically significant difference in the mean average scores of the Pre and Post Intervention values of TUG test in the patients.('t'=2.94, ,'p'=0.001). The result is highly significant.

Table 2: pre and post values of Timed Up and Go test

TUG	PRE M±SD	POST M±SD	't' VALUE	'p' VALUE	RESULT
	16.11±1.925	13.84±2	2.94	0.001	HIGHLY SIGNIFICANT

Graph 2: pre and post values of Timed Up and Go test

180°TURN TEST:
        The turning ability was measured with the help of 180° Turn Test.
        The pre-intervention mean average score and standard deviation of the number of steps taken during 180° turn test in the participants was 5.67±1.04 (right) and 5.73±1.11 (left). After 4 weeks of intervention period the mean average score and standard deviation for these participants was 4.96±0.82 (right) and 4.96±0.99 (left).
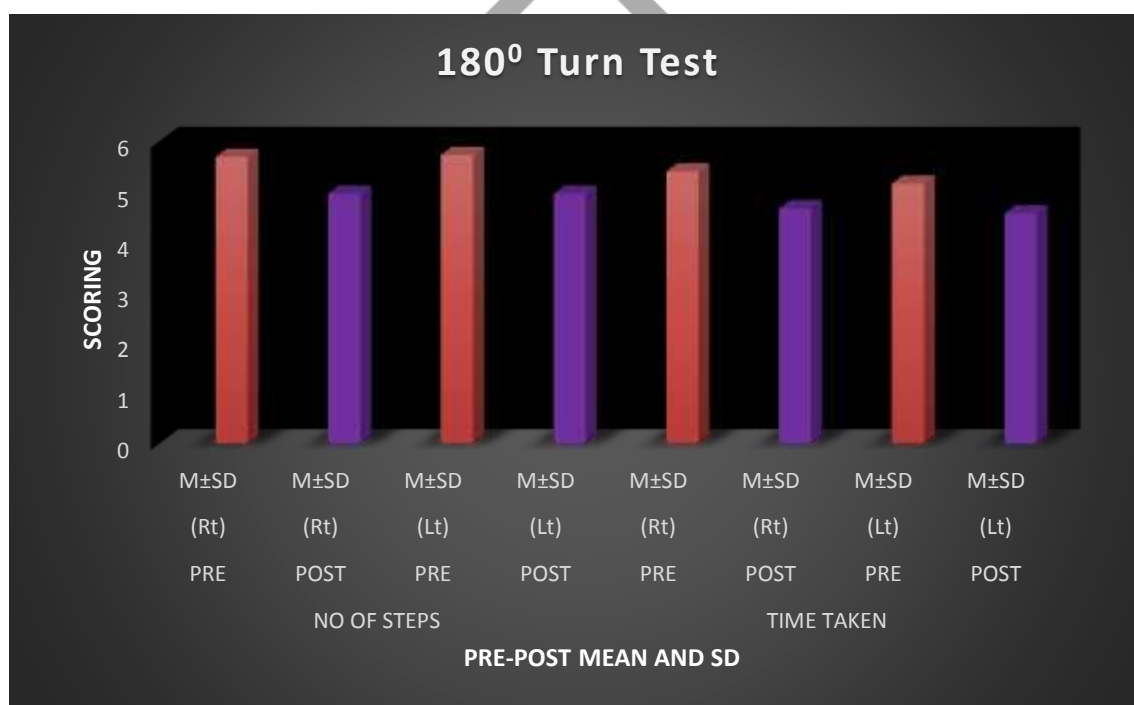   Furthermore the pre-intervention mean average score and standard deviation of the time taken during 180° turn test in the patients was 5.40±1.38 (right) and 5.16±1.47 (left). After 4 weeks of intervention period the mean average score and standard deviation for these participants was 4.67±1.31 (right) and 4.57±1.23 (left).
        There was statistically significant difference in the mean average scores of the Pre and Post Intervention values 180° turn test in the patients [no of steps 't'=5.82(right) 't'=3.73(left), time taken 't'=2.76(right), 't'=2.22 ,('p'=0.001)]. The result is highly significant.

Table 3: pre and post values of 180° Turn Test

180 TURN TEST	NO OF STEPS				TIME TAKEN			
	PRE	POST	PRE	POST	PRE	POST	PRE	POST
	(Rt) M±SD	(Rt) M±SD	(Lt) M±SD	(Lt) M±SD	(Rt) M±SD	(Rt) M±SD	(Lt) M±SD	(Lt) M±SD
	5.69±1.04	4.96±0.82	5.73±1.11	4.96±0.99	5.40±1.38	4.67±1.31	5.16±1.47	4.57±1.23
T VALUE	5.82		3.73		2.76		2.22	
P VALUE	0.001		0.001		0.001		0.001	
RESULT	HIGHLY SIGNIFICANT		HIGHLY SIGNIFICANT		HIGHLY SIGNIFICANT		HIGHLY SIGNIFICANT	

Graph 3: pre and post values of 180° Turn Test

BERG BALANCE SCALE (BBS):

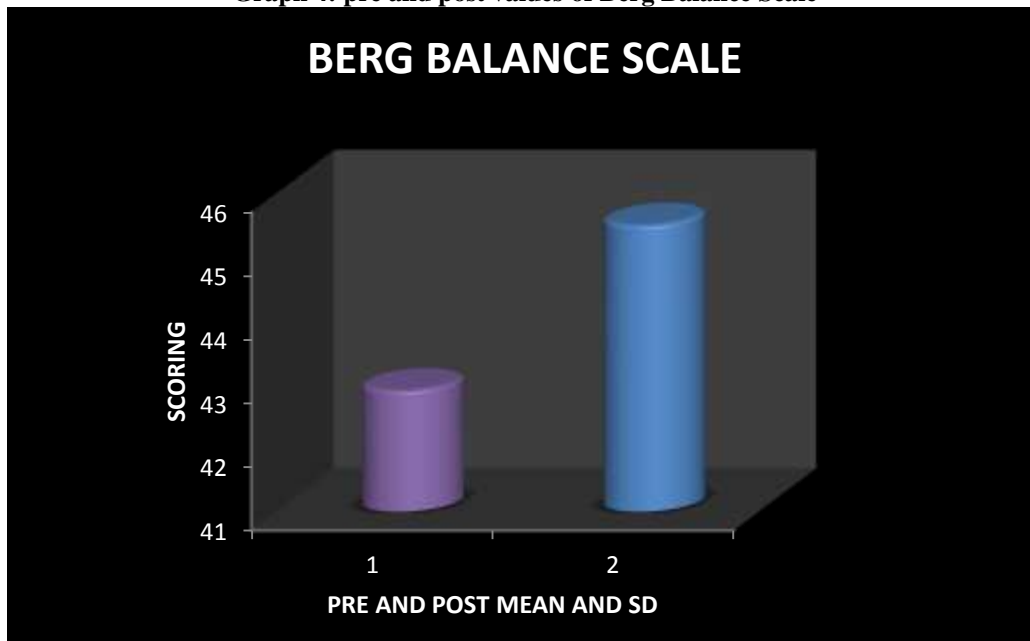The Berg Balance Scale was used to measure dynamic balance.

The pre intervention mean average score and standard deviation for BBS in the participants was 42.9±5. After 4 weeks of intervention period the mean average score and Standard deviation for BBS for these participants was 45.5±4.25.

There was statistically significant difference in the mean average scores of the Pre and Post Intervention values of BBS in the patients. ('t'=2.82, 'p'=0.001).

Table 4: pre and post values of Berg Balance Scale

BBS	PRE M±SD	POST M±SD	't' VALUE	'p' VALUE	RESULT
	42.9±5	45.5±4.25	2.82	0.001	HIGHLY SIGNIFICANT

Graph 4: pre and post values of Berg Balance Scale

FALL EFFICACY SCALE (FES):
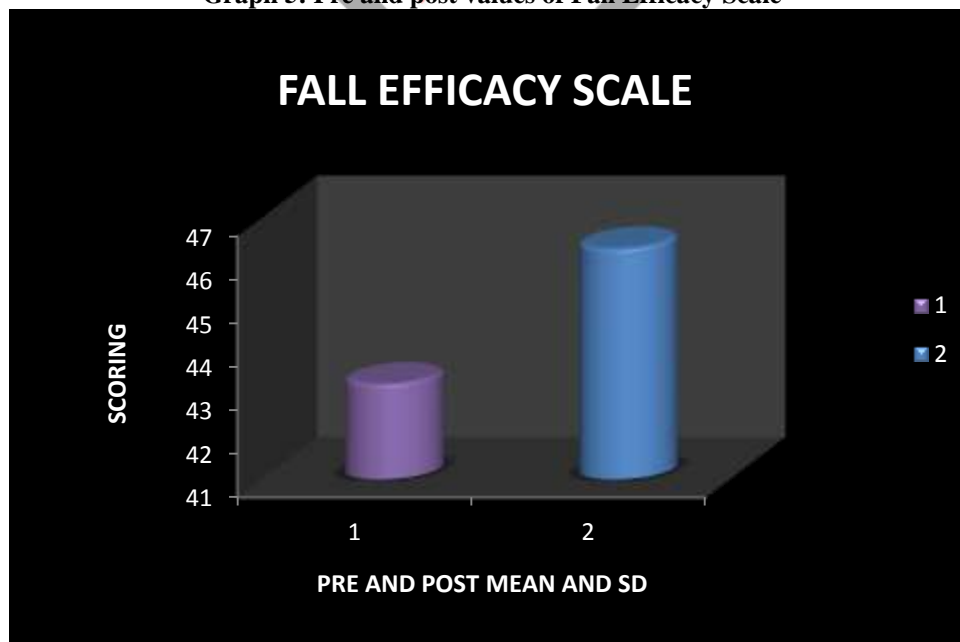
Fear of fall is measured by the Fall Efficacy Scale.

The pre intervention mean average score and standard deviation for FES in the participants was 43.19±5.23. After 4 weeks of intervention period the mean average score and Standard deviation for FES for these participants was 46.3±4.25.

There was statistically significant difference in the mean average scores of the Pre and Post Intervention values of FES in the patients. ('t'=3.24, 'p'=0.001)

Table 5: Pre and post values of Fall Efficacy Scale

FES	PRE M±SD	POST M±SD	't' VALUE	'p' VALUE	RESULT
	43.19±5.23	46.3±4.25	3.24	0.001	HIGHLY SIGNIFICANT

Graph 5: Pre and post values of Fall Efficacy Scale

6. DISCUSSION:

Stroke is the sudden loss of neurological function caused by lack of blood flow to the brain. Falls associated with turning is common in stroke survivors especially among community dwelling, chronic survivors. Fall injuries during turning are eight times more common than during walking straight forward. Some of the indicators of turning difficulty are using 5 or more steps or weight shifts to accomplish the turn and taking 3 seconds or longer to accomplish the turn. [3]

According to Yang WC, Hsu WL et.al., (2016) the clock-turn strategy is a cognitive movement strategy to improve turning performance. The cognitive movement strategies are a set of compensatory skills to develop mobility function. The principle of the cognitive movement strategies is to decompose a complex motor task into discrete steps, so one can consciously plan and rehearse the task before execution. The clock-turn strategy is an example of the cognitive movement strategies for turning in a narrow space. [1]

TIMED UP AND GO TEST (TUG):

In the Timed Up and Go test there was highly significant improvement in the results. The pre-intervention mean average score and standard deviation for TUG test in the patients was 16.11 ± 1.925. After 4 weeks of intervention period the mean average score and standard deviation for these patients was 13.84 ± 2. ('t'=2.94, 'p'=0.001).

The TUG test was chosen as one of the assessment tools in this study because it measures balance and mobility that relate to real life meaningful activities such as walking and turning. [5]

The clock turn strategy is a cognitive movement strategy, which is a set of compensatory skills to improve mobility function. Therefore, it is an effective way in improving dynamic balance.

180° TURN TEST:

The pre-intervention mean average score and standard deviation of the number of steps taken during 180° Turn Test in the participants was 5.67 ± 1.04 (right) and 5.73 ± 1.11 (left). After 4 weeks of intervention period the mean average score and standard deviation for these participants was 4.96 ± 0.82 (right) and 4.96 ± 0.99 (left).

Furthermore the pre-intervention mean average score and standard deviation of the time taken during 180° Turn Test in the patients was 5.40 ± 1.38 (right) and 5.16 ± 1.47 (left). After 4 weeks of intervention period the mean average score and standard deviation for these participants was 4.67 ± 1.31 (right) and 4.57 ± 1.23 (left).

Stroke survivors show a reduction in gait parameters during 180°turn. They required longer time and increased number of steps [3]. In the present study with the help of clock turn strategy the patients showed improvement in the number of steps taken as well as the time taken during turning as this cognitive movement strategy helps to decompose a complex motor task into discrete steps, so one can consciously plan and rehearse the task before execution.

BERG BALANCE SCALE (BBS):

The pre intervention mean average score and standard deviation for Berg Balance Scale in the patients was 42.9 ± 5 and the post intervention values was 45.5 ± 4.25. ('t'=2.82, 'p'=0.001).

Yang WC, Hsu WL et.al., claims that the clock-turn strategy emphasizes attentional focus on decomposing turning into discrete step-to cycles and thus helps maintain a stable step pattern during turning. It also helps in improving dynamic balance as the patient can consciously plan and rehearse the task before execution. [1]

Thus in the present study this protocol resulted in significant improvement in the dynamic balance in stroke patients.

FALL EFFICACY SCALE (FES):

The pre intervention mean average score and standard deviation for FES in the patients was 43.19 ± 5.23 and the post intervention values was 46.3 ± 4.25. ('t'=3.24, 'p'=0.001). In the present study there was considerable improvement in the fear of fall in patients which was assessed using Fall Efficacy Scale.

According to Manaf H, Justine M, Omar M et.al., the ability to change walking direction such as turning is impaired in stroke survivors that may put them at risk of falls. Following fall, stroke patients may suffer from soft tissue injuries, fractures, depression, and inactivity due to fear of fall. [3] The clock turn strategy increases the confidence in patients thereby reducing their fear of fall.

7. CONCLUSION:

The conclusion based on the results of difference in pre-post mean scores of Timed Up and Go Test, 180° Turn Test, Berg Balance Scale and Fall Efficacy Scale shows that there is a significant improvement in the Turning Ability, Dynamic Balance and Fear Of Fall in stroke patients when treated with Clock Turn Strategy along with conventional physiotherapy treatment for 4 weeks.

LIMITATION OF STUDY

- The study was conducted on stroke patients.
- The sample size was limited.
- The study was conducted on a limited age group i.e. 45-65 years.
- The intervention was done only for 4 weeks.
- The study was limited to Pravara Rural Hospital.

FUTURE SCOPE OF STUDY

- Studies can be done in patients with other types of stroke.
- A comparison study can be done between Clock Turn Strategy and other conventional therapies in stroke patients.

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