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Long-term Effect Of PNF Kinesio Taping On Range Of Motion Of Ankle Dorsiflexion, Dynamic Balance And Walking Speed In Chronic Stroke Patients With Foot Drop- A Randomized Clinical Trial

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ABSTRACT

BACKGROUND: The spastic foot, which is common in subjects after stroke, is characterized by "foot drop",this is due to planterflexion stiffness, dorsiflexion weakness, and a decreased ankle dorsiflexion range of motion (DF-ROM).

So the purpose of this study was to find which technique among sham taping & PNF K taping is more effective to increase ROM ankle dorsiflexion, dynamic balance and walking speed in chronic stroke patients with foot drop.

AIM: To study the effect of PNF K taping on range of motion of ankle dorsiflexion , dynamic balance and walking speed in chronic stroke patients with foot drop.

METHODOLOGY: Subjects were selected by using simple random sampling. 58 subjects were selected by inclusion criteria. Subjects were evaluated for df,dynamic balance and walking speed by universal goniometer,berg balance and 10m walking test. subjects got treatment for 5 weeks for 4 consecutives. Patch test was done for the subjects who got kt treatment. Experimental group PNF K taping will be applied to hams and ta muscle followed by gait training 45-60min. Control group sham taping and gait training will be given for 45-60 min.

RESULT: Long term effect were seen in both the groups. But PNF K Taping showed significant difference then Sham taping.

CONCLUSION: In conclusion, this study demonstrates that PNF kinesio taping significantly enhances ankle dorsiflexion, dynamic balance, and walking speed in chronic stroke patients with foot drop compared to sham taping. These findings support the integration of PNF kinesio taping into rehabilitation protocols, offering a promising approach to improving functional outcomes in this population.

Clinical Implication: According to the therapist both the techniques can be used to treat foot drop but PNF K Taping group is more effective then Sham taping in clinical practice in both techniques for Long term effects

KEYWORDS: ktape, PNF, sham taping, gait, dynamic balance, ankle dorsiflexion, stroke, foot drop.

INTRODUCTION

A stroke is a type of acute neurologic injury in which there is a disruption in the blood flow to a portion of the brain. It is referred to as a cerebrovascular accident (CVA).[6]

The stroke incidence in 2019 was 110.7/100,000 in India.[8]

Chronic stroke is referred to as at least six months after an initial stroke event.[2] Leading chronic movement disabilities due to residual hemiparesis in the limbs. In chronic movement disability, deficits of foot and ankle proprioception are most highly associated with falls.[2]

Foot drop is common in hemiplegic patients when the tibialis anterior muscle, which is a dorsiflexor of the ankle, is activated improperly [1]. this is due to plantarflexion stiffness, dorsiflexion weakness, and a decreased ankle dorsiflexion range of motion (DF-ROM).

Furthermore, "foot drop," or the incapacity to elevate the front portion of the ankle and toe, is a common feature of the spastic foot in stroke survivors.[2]

Prevalence of foot drop in stroke is 20 to 30 %.[19]

Common problem due to foot drop are bodyweight leaning towards the non-paretic side Which reduces their balance that leads to fall. [2] and inability to dorsiflex the ankle during the swing phase of gait.[10] this is due to functional impairment which reduce gait velocity.Walking and other activities of daily living (ADLs) are hampered due to foot drop,.[9]

In stroke patients, the unaffected lower extremity bears between 61 and 80 percent of their body weight, this position prevents symmetrical weight shifting in response to external movement, causing a decrease in balance capacity when the body's centre of gravity is displaced to the unaffected side.

In addition to making lower extremities more rigid, a decline in balancing ability impairs independent walking, which causes the sensation of long-term incapacity.[12]

For the evaluation of foot drop in patients with stroke the of passive ankle dorsiflexion ROM, modified roots protocol is used. As due to foot drop imbalance is noted in chronic stroke patients for which Berg balance test is used as an evaluative measure and the gait is evaluated by 10-meter walking test. To describe mental and cognitive functions and the neglect phenomenon, MiniMental State Examination (MMSE) is used. And for the spasticity, modified Ashworth scale is used.

Various research has been done such as PNF, bobath, transcutaneous peroneal nerve stimulation, functional electrical stimulation, ankle foot orthosis and moving treadmill training (MTT) in chronic stroke with foot drop.

It was recently discovered that Kinesio taping helps in correction of foot drop and equinus deformity.

KT may either inhibit or promote muscular tension according to the application method to the relevant muscles, in order to normalize the action of moving protagonists. By ultimately adjusting muscle tension when it is mixed with strong voluntary movement, balance between the protagonists, synergists and antagonists is maintained, and physical balance is recovered.

Advantage of KT are: -Low cost and easy application and KT is easy to apply compared to other treatment methods; exercise combined with KT may be also used.[2]

During post-stroke therapy, using a Kinesio tape to the lower extremity has been shown to improve lower-extremity motor function, reduce lower-extremity spasticity, improve balance, and improve ambulation and gait metrics in patients.

Furthermore, for stroke patients, kinesio tape prior to Proprioceptive Neuromuscular Facilitation (PNF) intervention may enhance functional recovery.[1] The PNF KT is an intervention used to induce functional muscle synergy and improve functional movement. [2]

Prior studies states that because the trial was shorter in duration, no additional prognosis or longterm benefit could be reported. The purpose of this study is to identify the long-term effects of PNF Kinesio taping on range of motion of ankle dorsiflexion, dynamic balance and walking speed in chronic stroke patients with foot drop . And hypothesized that applying the Kinesio tape to the Tibialis anterior muscle (TA) and Hamstrings muscle (HM) according to the PNF pattern would improve gait parameter, ankle dorsiflexion and dynamic balance in stroke patient with foot drop more than when applied only to the TA.[1]

OBJECTIVES

- To assess the long-term effect of PNF Kinesio taping on Ankle dorsiflexion range of motion in chronic stroke patients with foot drop using goniometer.
- To assess the long-term effect of PNF Kinesio taping on Dynamic balance in chronic stroke patients with foot drop using Berg Balance test.
- To assess the long-term effect of PNF Kinesio taping on Walking speed in chronic stroke patients with foot drop using 10-m walking test.

HYPOTHESIS

NULL HYPOTHESIS:

- There will be no significant long-term Effect of PNF Kinesio taping on Ankle dorsiflexion range of motion in chronic stroke patients with foot drop.
- There will be no significant long-term Effect of PNF Kinesio taping on Dynamic balance in chronic stroke patients with foot drop.

- There will be no significant long-term Effect of PNF Kinesio taping on Walking speed in chronic stroke patients with foot drop.

ALTERNATE HYPOTHESIS:

- There will be significant long-term Effect of PNF Kinesio taping on Ankle dorsiflexion range of motion in chronic stroke patients with foot drop.
- There will be significant long-term Effect of PNF Kinesio taping on Dynamic balance in chronic stroke patients with foot drop.
- There will be significant long-term Effect of PNF Kinesio taping on Walking speed in chronic stroke patients with foot drop

REVIEW OF LITERATURE

1. **Dongyun lee and youngsook bae et al (2021)** conducted study on short term effect of kinesiotaping of lower leg proprioceptive neuromuscular facilitation pattern on gait parameter and dynamic balance in chronic stroke with foot drop. A total 22 chronic stroke patients were randomly assigned to experimental (n = 11) and control groups (n = 11). All subjects underwent conventional therapy and gait training for 50 min. The experimental group additionally received KT of tibialis anterior muscle (TA) and hamstring muscles according to the PNF pattern. The control group received KT of only TA. They concluded that the short-term effect of application of lower leg kt according to pnf pattern increased the gait ability and dynamic balance of chronic stroke patients with foot drop.
2. **Donghwan park and youngsook bae et al (2021)** conducted study on pnf k taping improves ROM of ankle dorsiflexion and balance ability in chronic stroke patients. This crossover study included 18 patients with stroke. The subjects were randomly assigned to three interventions: barefoot, ankle KT (A-KT), and PNF-KT. The A-KT was applied to the gastrocnemius and tibialis anterior (TA) muscles, and subtalar eversion. The PNF-KT was applied on the extensor hallucis, extensor digitorum, and TA muscles and concluded that the application of pnf-kt may be feasible therapeutic method for improving ankle movement and balance in patients with chronic stroke.
3. **Belma fusun koseoglu and asuman dogan et al (2017**) conducted study to investigate the effect of the kinesio tape application to the tibialis anterior on rehabilitation outcomes of the stroke patients. Twenty patients with stroke were allocated into two groups: the first group of ten patients was assigned to receive kinesio tape in addition to the conventional rehabilitation program while a second group of 10 patients was assigned to receive a conventional rehabilitation program only. The result of this study suggests that kinesio tape can be used as an ankle training method.
4. **Hye-In Bae and Myeong-Ho lee et al (2022)** conducted study to examine the immediate effects of applying ankle eversion taping using kinesiology tape in chronic stroke patients. Seventeen stroke patients underwent three interventions in random order. The subjects were initially assigned randomly to an ankle eversion taping, placebo taping, or no taping for each intervention. Ankle eversion taping was used for mechanical correction and was involved in ankle dorsiflexion and eversion. The tape was

stretched by 30–40%. Placebo tapping was applied in the same form as eversion tapping but was not stretched. The result of this study suggests that the application of ankle eversion taping that uses kinesiology tape instantly increased the gait ability of chroinc stroke patients.

5. **Woo-Il Kim and yong kyu choi et al (2014)** conducted study the effect of muscle facilitation using kinesio taping on walking and balance of stroke patients. The experimental group was applied taping before therapeutic exercise, and the control group received only therapeutic exercise. Functional gait was measured using the straight-line walking test, and dynamic balance ability was measured using the Berg Balance Scale. Walking velocity was measured with the 10 m walking test. The result of this study suggests that application of taping to the paralyzed parts of a stroke patient has a positive effect on improvement of typical assymmetric gait and walking speed.
6. **Kumar, S and Kumar, A et al (2023)** conducted study on Effect of PNF Technique on Gait Parameters and Functional Mobility in Hemiparetic Patients. In this study two group pre-test- posttest design. A sample of convenience of 30 subjects affected by cerebrovascular accident of ischemic injury took part in this study. They were divided into two groups i.e. an Experimental group and a Control group with 15 patients in each group. The subjects of this study were the residents of northern Haryana and the mean age of the patients was 59.30 years. They concluded that PNF technique has significant effect on gait parameters & functional mobility as compared to conventional therapy in patients with hemiplegia. The findings show that the walking speed has a significant effect on functional mobility in stroke patient.
7. **Young-Hyeon bae and Suk min lee et al (2015)** conducted study was to observe the effects of lower-leg kinesiology taping on balance ability in stroke patients with foot drop. Design. Randomized controlled trial study. Method. Thirty stroke patients with foot drop were randomly divided into two groups. The experimental group underwent kinesiology taping, and the control group underwent placebo taping. Balance ability was assessed before and after taping in both groups. They concluded that Kinesiology taping temporarily improved static balance ability in stroke patients. However, its effect on dynamic balance was not verified. Therefore, further research on the influence of long-term kinesiology taping on dynamic balance and gait ability is suggested.

8. Xincan Ji and Hao-Yang Guo et al (2023) conducted study To analyze the trend of stroke incidence in Chinese and Indian residents from 1990 to 2019, and to predict the future incidence trends to provide scientific reference for stroke prevention and control measures in China and India .Methods they downloaded the stroke incidence data of China and India residents from the GBD2019 database from 1990 to 2019 and calculate the annual percentage change (APC) and the average annual percentage change (AAPC).And predict stroke incidence by 2042.Results in India 110.7/100,000 in 2019,while the incidence of stroke in the Indian population shows an upward trend, increasing to 133.85/100,000 and 209.16/100,000 for men and women, respectively. They Concluded That age-standardized incidence of stroke in both China and India showed a decreasing trend from 1990 to 2019. In both countries, the risk of stroke increased with increasing age and period and decreased with birth cohort.

9. Megan M. Konor and Sam Morton et al (2012) conducted study to determine the reliability of ankle ROM measurements using three different techniques. Methods: Twenty healthy subjects (mean±SD, age=24±3 years, height=173.2±8.1 cm, mass=72.6±15.2 kg) participated in this study. Ankle dorsiflexion ROM measures were obtained in a weight-bearing lunge position using a standard goniometer, digital inclinometer, and a tape measure using the distance-to wall technique. All measures were obtained three times per side, with 10 minutes of rest between the first and second set of measures. and They concluded that all three techniques had good reliability andlow measurement error, with the distance-to-wall technique using a tape measure and inclinometer methods resulting in higher reliability coefficients (ICC2,3=0.96 to 0.99) and a lower SEM compared to the goniometer (ICC2,3=0.85 to 0.96)

10.Cameron J. Powden and Teralyn K. Dodds et al (2019) conducted study on systematic review to assess the reliability and responsiveness of the SEBT/YBT. Relative intra and inter-rater reliability was examined through intraclass correlation coefficients (ICC). A total of nine studies were included in this review. Six studies examined the inter-rater reliability and seven assessed intra-rater reliability. Median ICC values for intra-rater reliability were 0.88 (Range = 0.84 – 0.93), 0.88 (Range = 0.85 – 0.94), and 0.90 (Range = 0.68 – 0.94) for the anterior, posteromedial, and posterolateral directions, respectively. Conclusions: There is grade A evidence to support that the SEBT/YBT have excellent inter and intra-rater reliability when used in healthy adults.

11.Darren Kai-Young Chenga and Matthieu Dagenais el at (2021) conducted study to synthesize existing literature describing test protocols and measurement properties of distance-limited walk tests in people post-stroke. Data were extracted from 43 eligible articles. Among the 12 walk tests identified, the 10-metre walk test (10 mWT) at a comfortable pace was most commonly evaluated. Measurement error values ranged from 0.04–0.40 and 0.06 to 0.20 for the 10 mWT at comfortable and fast and paces, respectively. CONCLUSIONS: The 10 mWT has the most evidence of reliability and validity. Findings indicate that studies that include people with severe walking deficits.

METHODOLOGY

- **Type Of Study:** An Experimental Study**.**
- **Study Design:** Pre And Post Experimental Study.
- **Type Of Sampling:** Simple Random Sampling**.**
- **Sample Size:** 58**.**
- **Study Duration:** 6 Months.
- **Study Setting:** Hospitals Of Sangli District.

MATERIALS

Fig 1:Universal goniometer

Fig 2:Swiss ball

Fig 3: Kinesio tape

Fig 4: Stopwatch

Fig 5: Measuring tape

Fig 6: Plinth

INCLUSION AND EXCLUSION CRITERIA

INCLUSION CRITERIA

- Patient between 50-70 years of age and of either sex.
- 6 months or more since the diagnosis of stroke with foot drop were included.
- Modified Ashworth scale score of ≤ 2.
- Brannstrom's stage of motor recovery for the affected lower limb range 3-5.
- Able to walk independently for over 10m without assistive devices.
- Insufficient ankle dorsiflexion during the swing phase of the gait cycle.
- A mini-mental state examination scores greater than 24/30.

EXCLUSION CRITERIA

- Allergy to the kinesio tape or having a skin disease.
- Botulinum toxin Type A(BTX-A) injection for the past 6 months.
- Patients with an open wound that hinders the application of kinesiotape.
- Current orthopedic problem involving the lower extremities and spine that could affect balance.
- Ankle surgery, vertigo, dizziness and/or any balance-related disorder.
- Patient who has severe cardiovascular or pulmonary problems.

OUTCOME MEASURES

1. Universal Goniometer
2. Berg Balance scale
3. 10 m walking test
4. Mini-mental state examination
5. Modified Ashworth Scale

Universal Goniometer

Reliability- Standard goniometer: - (ICC=0.93-0.96)

Range of motion (ROM):

Maximal active ankle dorsiflexion ROM was measured in a non weight-bearing position using a standard plastic goniometer. All testing was completed with the participant barefoot. Three measures were obtained on the affected ankle and the best performance was used for analysis [3]

Fig:7 ANKLE ROM GONIOMETRY

Berg balance scale

BBS. The 14-item BBS identifes and evaluates balance impairment in patients with hemiplegia and has been reported to be responsive to clinically meaningful changes.When a subject was unable to independently complete a test item, he/she was given 3 attempts, and the score on the best attempt was recorded. A total score for all items was determined for each subject " (maximum score = 56 points)(12) .

The BBS is clinically used for patients with senile disease or hemiplegia resulting from stroke to evaluate their balance ability during movement or in a standing position. It consists of 4 items; each has a score from 0 to 4 with a maximun possible score of 56. When the score is less than 45 points The patient needs a tool for aiding gait and has a high risk of fall.[7]

FIG 8. BERG BALANCE SCALE

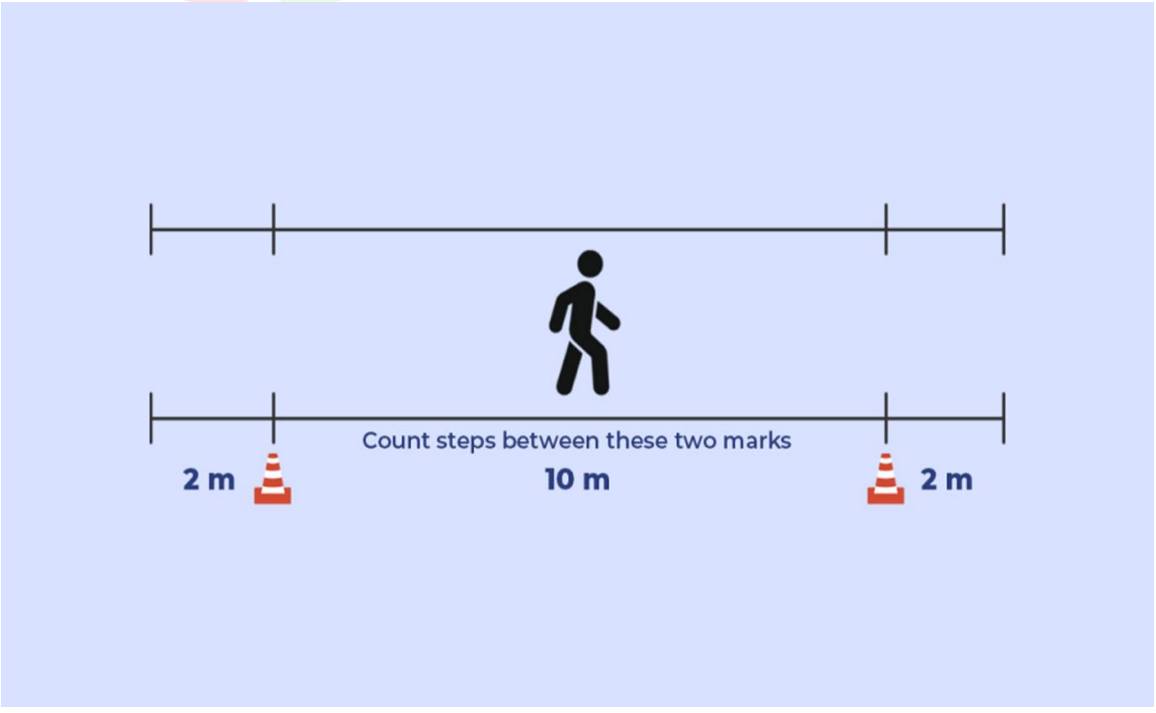
Category	Component	Score
Sitting balance	Sitting unsupported	0-4
Standing balance	Standing unsupported	0-4
	Standing with eyes closed	0-4
	Standing with feet together	0-4
	Standing on one foot	0-4
	Turning to look behind	0-4
	Retrieving object from floor	0-4
	Tandem standing	0-4
	Reaching forward with an outstretched arm	0-4
Dynamic balance	Sitting to standing	0-4
	Standing to sitting	0-4
	Transfer	0-4
	Turning 360 degrees	0-4
	Stool stepping	0-4
Total		0-56

10 m walking test (10MWT)

Reliability- ICC=0.80-0.99

The 10 m walking test (10MWT) was also measured with a tapeline, and duct tape was attached to the start and end points of the 10 m course to mark the path.An additional distance of 4 m was also marked with tape, providing 2 m at the back and in the 2 m at the front of the lane to give the subjects sufficient room for acceleration and deceleration.The subjects were asked to walk at a normal speed as usual.[5] The walking time was measured from the moment patient's foot passed the start line to the end line in 0.01-second increments with a stopwatch. Each patient performed the test 3 times after an initial practice run, and the average was calculated as the result. The 10MWT showed highly reliable results the test-retest reliability was 0.95 and the interobserver reliability was 0.90.[5]

FIG 9. 10 MWT



PROCEDURE

ETHICAL CLEARANCE

↓

SCREENING OF INCLUSION AND EXCLUSION CRITERIA

↓

EXPLANATION OF INTERVENTION IN VERNACULAR LANGUAGE

↓

WRITTEN CONSENT FORM TAKEN

↓

PRIOR AND AFTER TO TREATMENT, THE OUTCOME MEASURES (PRE-MODIFIED ASHWORTH SCALE, MINI-MENTAL STATE EXAMINATION) (PRE AND POST 10 M WALKING TEST, Y-BALANCE SCALE, UNIVERSAL GONIOMETER) WILL BE MEASURED.

↓

SUBJECTS DIVIDED INTO TWO GROUPS AND INTERVENTION WILL BE GIVEN FOR 5 TIMES A WEEK DURING THE 4 CONSECUTIVE WEEK.

↓

SUBJECT WILL BE RANDOMLY DIVIDED INTO TWO GROUP

↓

EXPERIMENTAL GROUP
PNF K Taping will be applied to HAMs and TA muscle followed by Gait training 45-60min.

CONTROL GROUP
Sham taping and Gait training will be given for 45-60 min.

*5 TIMES A WEEK DURING THE 4 CONSECUTIVES WEEK.THE KT WILL BE CHANGED EVERY 3 DAYS DURING THE STUDY PERIOD

PROTOCOL

INTERVENTIONS:

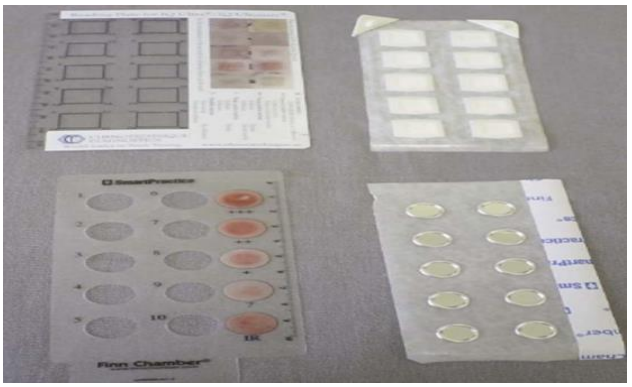
The participants will be allocated into two groups: the first group will be assigned to receive KT in addition to the conventional rehabilitation program (Intervention Group) while a second group will be assigned to receive a conventional rehabilitation program only (Control Group). The KT will be changed every 3 days during the study period. The patients will be informed that they are allowed to take a shower with the tape on, however, the tape should be dried off totally after the shower. Also, in case of patient experiencing any skin

allergy or itchiness, the patient must take off the tape immediately.[3]

PATCH TEST:

Before deciding to use KT-tape a test patch will be applied to exclude contact allergy. A small test patch is applied. Observe the skin around the tape. The area must not become red, swollen or seriously itchy. The test patch will stay for 24 hours. Patient will be asked to check the area around the tape regularly. Check the skin one day after removal. Test patch will be applied to the upper back, upper arms and upper thighs.[17]

FIG 10. PATCH TEST



PNF TAPING PATTERN

The PNF taping used the maximum length of a standard 5 cm tape. From the extended position of the flexion–adduction–external rotation pattern of the leg. The PNF taping will be attached from the origin to the insertion points to facilitate muscle activity of the TA muscles in a supine position.[2]

Applying kinesiology taping

- Tape will be applied to the paretic leg before performing conventional therapy. It will be applied to the TA and HAMs along with gait training in experimental group on the lower extremity paretic side only. Patients would be asked to remove the hair at the site of application.
- The therapist will apply the tape from the lateral condyle of tibia to the base of first metatarsal bone with the participant in the supine position, after maximal plantar flexion of the ankle joint.
- To apply the tape to the HAMs, the table height will be adjusted to the level of the participant's anterior superior iliac spine while standing, and the participant will flex the trunk to induce anterior tilting of the pelvic bone.
- Following this, the tape will be applied from the ischial tuberosity of the pelvis to the medial condyle of tibia and fibular head. During application, the tape will not be stretched for 5 cm from the initial site and then stretched 30% for the remaining parts.

FIG 11. KTAPING FOR TAM

Fig12.Taping on Hamstring muscle

FIG 13.Taping on Tibialis Anterior

GAIT TRAINING

1. Sitting on a Swiss ball and reaching out for objects (10 repetitions).
2. Sit-to-stand from a stool (10 repetitions).
3. Performing double legged stance for 10 counts (normal base of support) and then with decreased base of support for 10 counts.
4. Performing tandem stance for 10 counts (If the patients find tandem stance difficult, then he can maintain the same by increasing the step length).
5. Performing unilateral stance for 10 counts with or without minimal support.
6. Reciprocal leg flexion and extension in standing i.e. marching with or without minimal support.
7. Stepping forward, backward and sideways on a stepper.
8. Stepping over boards of various heights (6 inches, 8 inches, 10 inches).
9. Standing up from a chair, walking four steps, performing a bilateral stool touch and walking back to the chair.
10. Forward and backward walking in tandem walking pattern. [22]

*The duration for exercises is approximately 45 - 60 min

STATISTICAL ANALYSIS

Normality test using Shapiro-Wilk

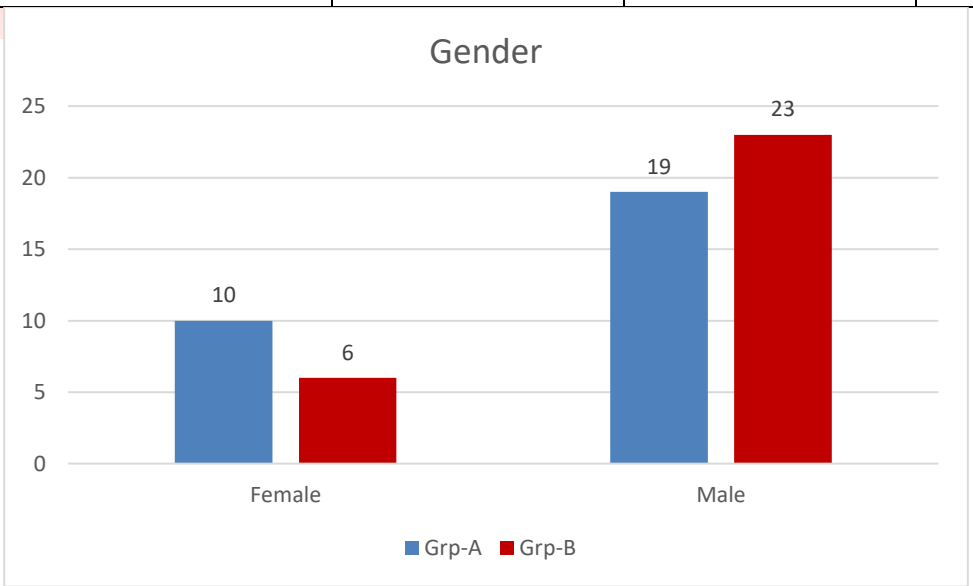
TABLE NO. 1

Variable	Time Frame	Group A		Group B	
		z-value	p-value	z-value	p-value
GONIOMETER	Pre	0.819	0.001	0.817	0.001
	Post	0.827	0.001	0.879	0.003
BBS	Pre	0.842	0.001	0.820	0.001
	Post	0.847	0.001	0.868	0.002
10M WALKING TEST	Pre	0.890	0.006	0.744	0.001
	Post	0.818	0.001	0.818	0.001
MMSE	Pre	0.928	0.049	0.749	0.001
	Post	0.853	0.001	0.918	0.027
MAS	Pre	0.412	0.001	0.184	0.001
	Post	0.561	0.001	0.460	0.001

Statistical analysis were performed by using SPSS 23, and as the sample size is less than 2000 so Shapiro-Wilk test used to identify the normality and found data do not follows normal distribution by ($P < 0.05$). Data set is not normally distributed as all the variables have not indicated p-value greater than 0.05 in the observation. We shall use non-parametric test for data analysis purpose in the following sections. As the collected data is not normally distributed, to find out the effect within the group, paired sample Wilcoxon test is used. Between groups analysis is done using Mann Whitney Test. $P < 0.05$ considered as statistically significant in the study (CI 95%).

TABLE NO. 2

Particular		Group		Total
		Grp-A	Grp-B	
Gender	Female	10	6	16
	Male	19	23	42
Total		29	29	58

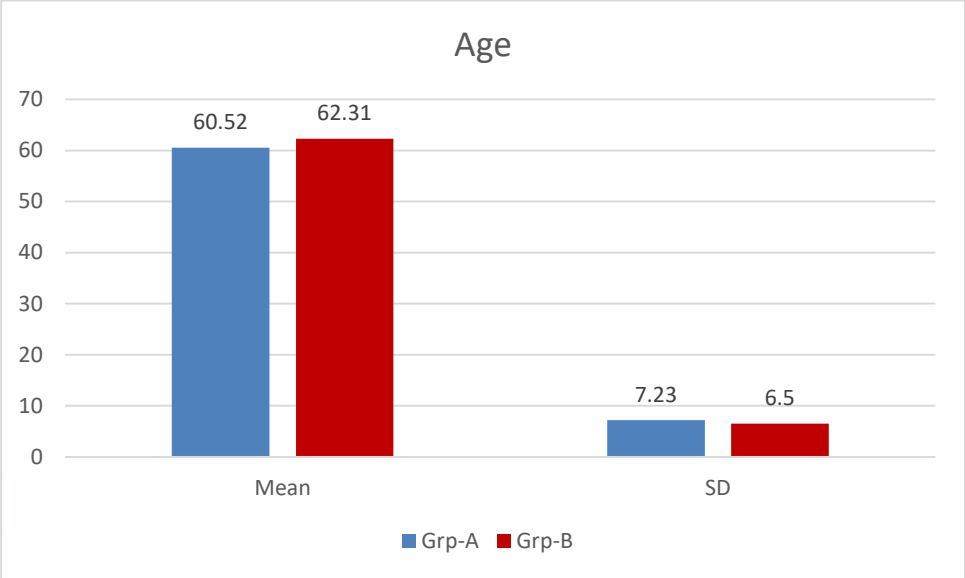


GRAPH NO. 1

Between group analysis using Mann Whitney Test

TABLE NO. 3

Variable	Group	Mean	SD	z-value	p-value
Age	Grp-A	60.52	7.23	1.015	0.310
	Grp-B	62.31	6.50		



GRAPH NO. 2

Within group Pre and post test

Comparison of pre-test and post-test scores of GONIOMETER in two Groups by paired sample Wilcoxon test

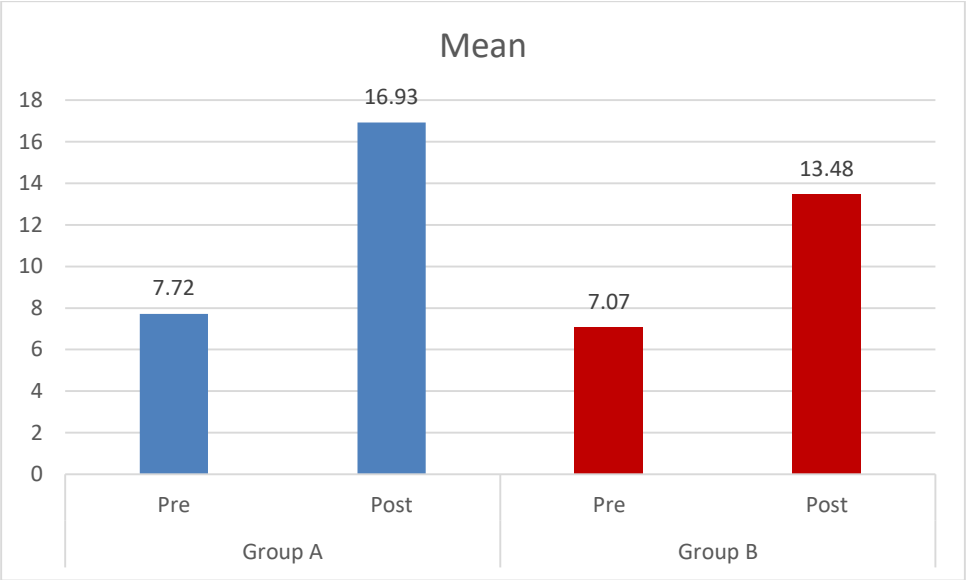
TABLE NO.4

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	7.72	3.09	9.21	2.78	3.31	4.712	0.001*
	Post	16.93	2.30					
Group B	Pre	7.07	2.31	6.41	3.32	1.93	4.555	0.001*
	Post	13.48	1.84					

The mean value in group-A indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 2.92 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The mean value in group-B indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less than pre value. The effect size or Cohen's D indicates 2.41 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention

GRAPH NO. 3



Within group Pre and post test

Comparison of pre-test and post-test scores of BBS in two Groups by paired sample Wilcoxon test

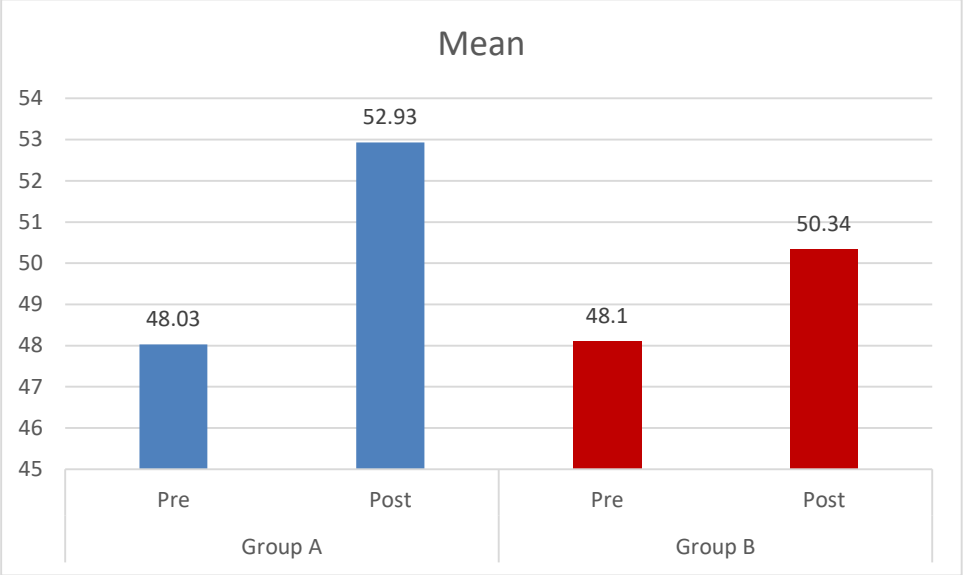
TABLE NO. 5

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	48.03	0.98	4.90	1.40	3.50	4.731	0.001*
	Post	52.93	1.16					
Group B	Pre	48.10	0.98	2.24	1.21	1.85	4.583	0.001*
	Post	50.34	1.01					

The mean value in group-A indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 1.81 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The mean value in group-B indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is equal to pre value. The effect size or Cohen's D indicates 2.03 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention

GRAPH NO. 4



Within group Pre and post test

Comparison of pre-test and post-test scores of 10M WALKING TEST in two Groups by paired sample Wilcoxon test

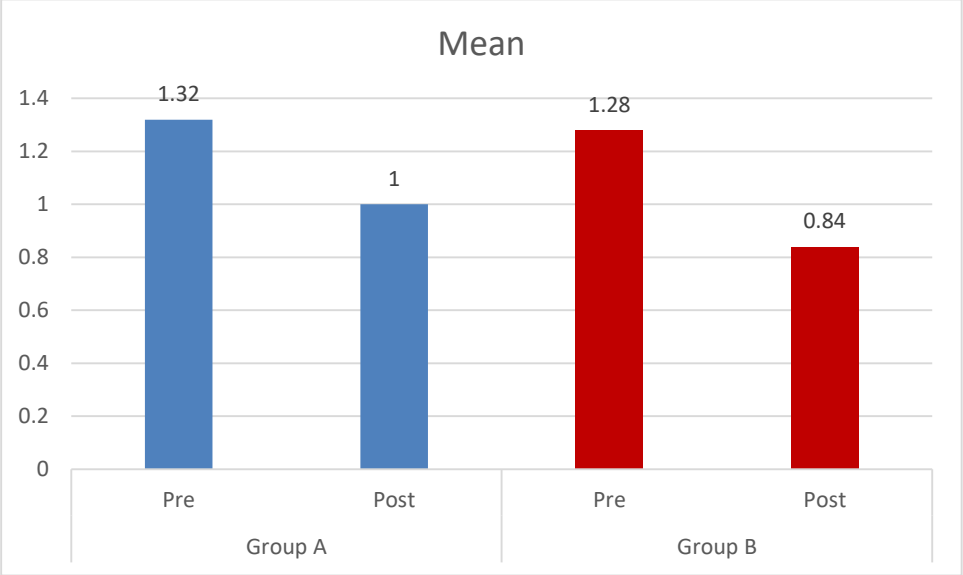
TABLE NO. 6

c	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	1.32	0.21	0.32	0.23	1.40	4.661	0.001*
	Post	1.00	0.24					
Group B	Pre	1.28	0.24	0.45	0.27	1.66	4.683	0.001*
	Post	0.84	0.27					

The mean value in group-A indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 1.45 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The mean value in group-B indicated changes post treatment and higher values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 2.09 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention

GRAPH NO. 5



Within group Pre and post test

Comparison of pre-test and post-test scores of MMS in two Groups by paired sample Wilcoxon test

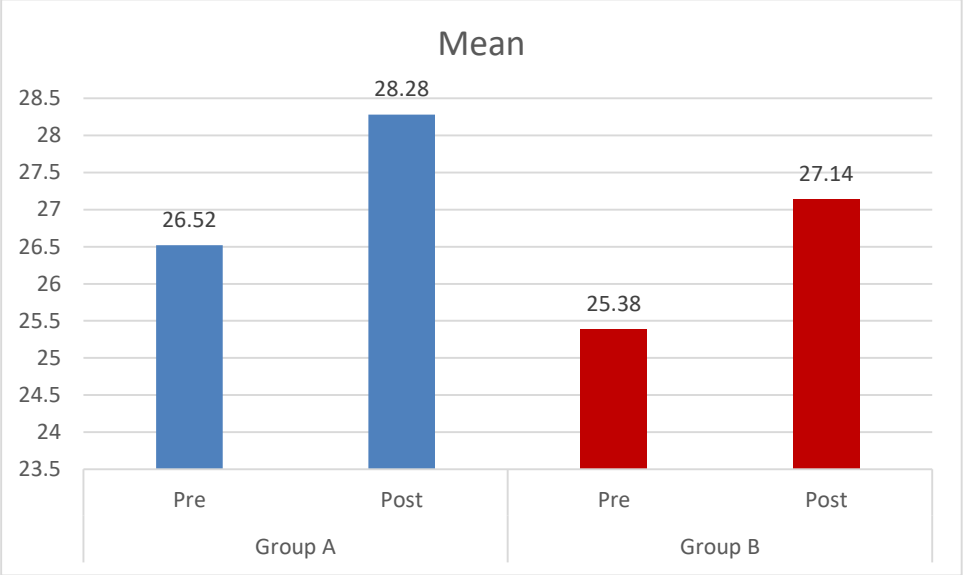
TABLE NO. 7

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	26.52	2.13	1.76	1.57	1.12	4.249	0.001*
	Post	28.28	1.56					
Group B	Pre	25.38	1.68	1.76	2.25	0.78	3.833	0.001*
	Post	27.14	2.15					

The mean value in group-A indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 2.84 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The mean value in group-B indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 1.63 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention

GRAPH NO. 6



Within group Pre and post test

Comparison of pre-test and post-test scores of MAS in two Groups by paired sample Wilcoxon test

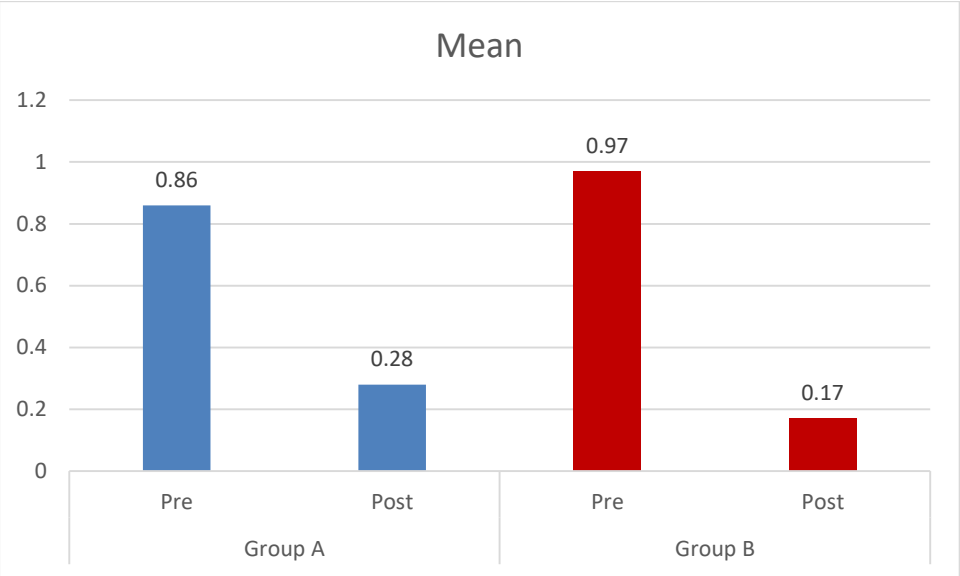
TABLE NO. 8

Groups	Times	Mean	SD	Mean Diff.	SD Diff.	Effect size	z-value	p-value
Group A	Pre	0.86	0.35	0.59	0.50	1.17	4.123	0.001*
	Post	0.28	0.45					
Group B	Pre	0.97	0.19	0.79	0.41	1.92	4.796	0.001*
	Post	0.17	0.38					

The mean value in group-A indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 2.84 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention.

The mean value in group-B indicated changes post treatment and lower values are recorded for post treatment outcome and also the standard deviation shows the consistency with post treatment value which is less to pre value. The effect size or Cohen's D indicates 1.63 value which is assumed to be very high in effect size as per the standard parameters of reference. Based on the results of the test analysis at 5% significance level, there is a significant statistical reliable difference between the pre & post treatment values with p-value is less than the 5% significance level (i.e. 0.001 < 0.05) in the study and therefore it justifies the improvements in health outcome post intervention

GRAPH NO. 7



Between groups analysis using Mann Whitney independent samples

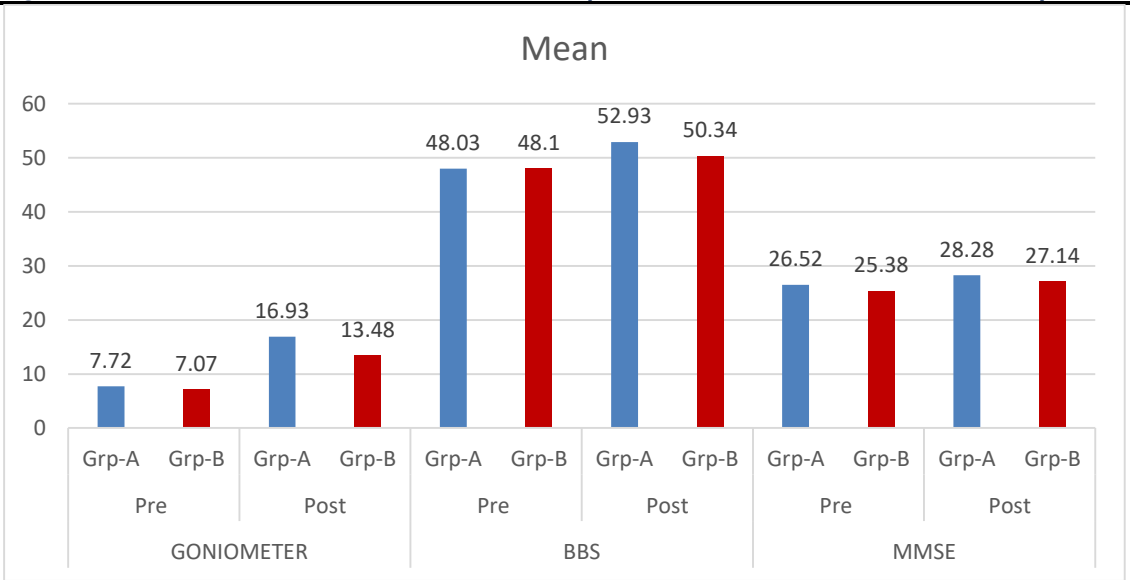
TABLE NO. 9

Group	Time Frame	Group	Mean	SD	z-value	p-value
GONIOMETER	Pre	Grp-A	7.72	3.09	0.622	0.534
		Grp-B	7.07	2.31		
	Post	Grp-A	16.93	2.30	**4.913**	**0.001**
		Grp-B	13.48	1.84		
BBS	Pre	Grp-A	48.03	0.98	0.281	0.779
		Grp-B	48.10	0.98		
	Post	Grp-A	52.93	1.16	**5.939**	**0.001**
		Grp-B	50.34	1.01		
MMSE	Pre	Grp-A	26.52	2.13	**2.105**	**0.035**
		Grp-B	25.38	1.68		
	Post	Grp-A	28.28	1.56	**2.206**	**0.027**
		Grp-B	27.14	2.15		

From the above table it is observed that between groups analysis is non-significant for GONIOMETER pre time frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups.
From the above table it is observed that between groups analysis is significant for GONIOMETER post time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups

From the above table it is observed that between groups analysis is non-significant for BBS pre time frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups.
From the above table it is observed that between groups analysis is significant for BBS post time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups

From the above table it is observed that between groups analysis is significant for MMSE pre time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups.
From the above table it is observed that between groups analysis is significant for MMSE post time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups



GRAPH NO. 8

Between groups analysis using Mann Whitney independent samples test

TABLE NO. 10

Group	Time Frame	Group	Mean	SD	z-value	p-value
10M WALKING TEST	Pre	Grp-A	1.32	0.21	1.014	0.311
		Grp-B	1.28	0.24		
	Post	Grp-A	1.00	0.24	**2.522**	**0.012**
		Grp-B	0.84	0.27		
MAS	Pre	Grp-A	0.86	0.35	1.391	0.164
		Grp-B	0.97	0.19		
	Post	Grp-A	0.28	0.45	0.936	0.349
		Grp-B	0.17	0.38		

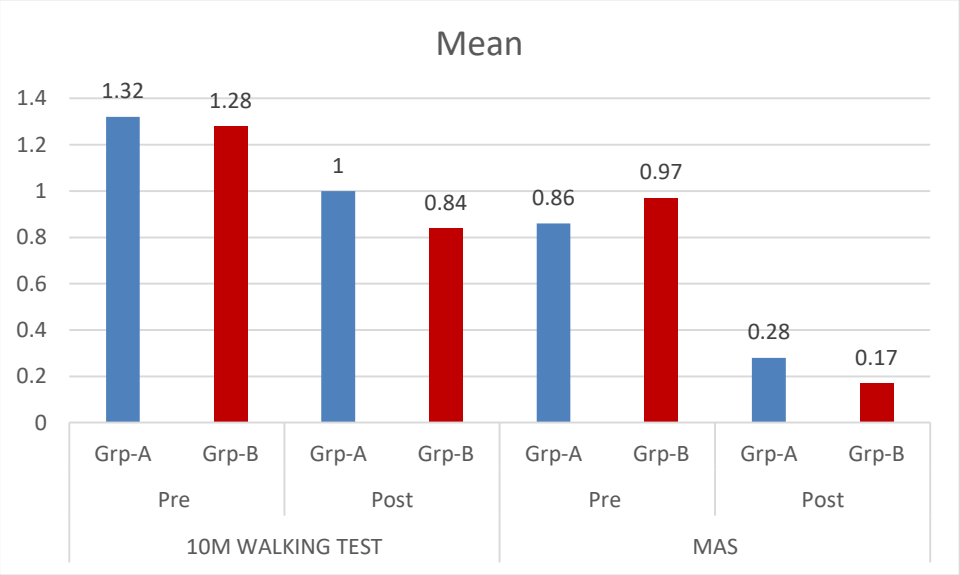
From the above table it is observed that between groups analysis is non-significant for 10M WALKING TEST pre time frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups.

From the above table it is observed that between groups analysis is significant for 10M WALKING TEST post time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups

From the above table it is observed that between groups analysis is non-significant for MAS pre time frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups.

From the above table it is observed that between groups analysis is non-significant for MAS post time frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups

GRAPH NO. 9



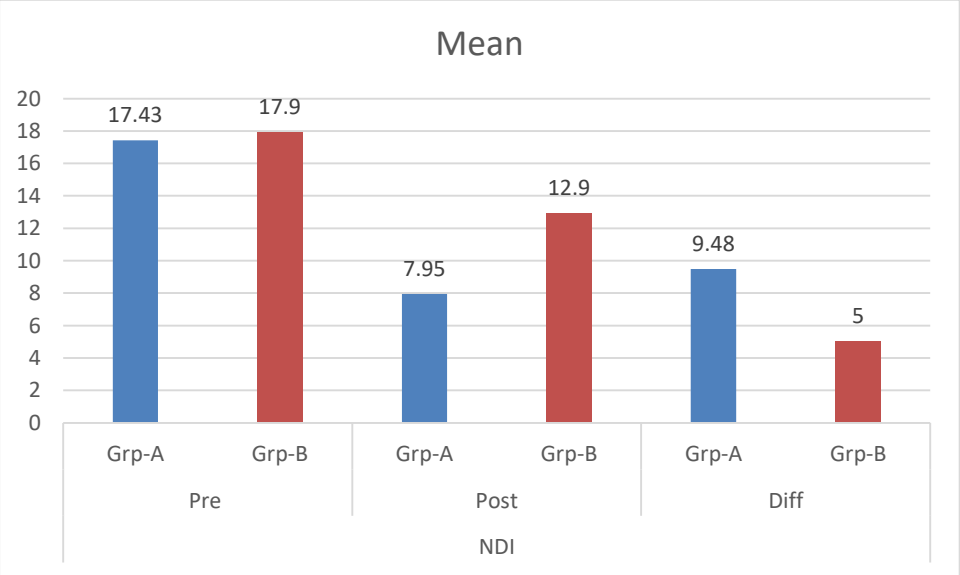
Between groups analysis using Mann Whitney independent samples test

TABLE NO. 11

Group	Time Frame	Group	Mean	SD	z-value	p-value
NDI	Pre	Grp-A	17.43	7.49	0.267	0.790
		Grp-B	17.90	7.48		
	Post	Grp-A	7.95	4.91	**2.700**	**0.007**
		Grp-B	12.90	6.06		
	Diff	Grp-A	9.48	3.34	**4.165**	**0.001**
		Grp-B	5.00	3.07		

From the above table it is observed that between groups analysis is non-significant for NDI pre time frame at 5% level significance as the p-value is more than 5%. It shows non-significant differences between the groups. From the above table it is observed that between groups analysis is significant for NDI post time frame at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups From the above table it is observed that between groups analysis is significant for NDI difference values at 5% level significance as the p-value is less than 5%. It shows significant differences between the groups

GRAPH NO. 10



DISCUSSION

This study investigated the long term effect PNF kinesio taping on range of motion of ankle dorsiflexion, dynamic balance and walking speed in chronic stroke patients with foot drop.

The purpose of this study was to see the Long-term effect of PNF kinesio taping on range of motion of ankle dorsiflexion, dynamic balance and walking speed in chronic stroke patients with foot drop. In this study pre & post treatment were analysed. It was statistically proven that both the techniques show increase in ROM. PNF taping was slightly better technique than sham taping. hence there is significant difference in long term effect in PNF K taping group then sham taping.

58 subjects were recruited in this study according to inclusion & exclusion criteria. They were divided into 2 groups 29 of each by simple random sampling technique. Patch test was done prior to the study. Procedure was told to the subjects. Subject were Randomly Divided Into Two Group Experimental Group PNF K Taping was applied to HAMs and TA muscle followed by Gait training 45-60min. Control Group Sham taping and Gait training was given for 45-60 min.

The intervention was carried for 5 times a week during the 4 consecutives weeks.The kt was changed every 3 days . The mean of Pre & Post values were compared. The results were found extremely significant within the groups respectively & significance between the groups suggestied both the groups showed significant effect in the treatment effects.

This Suggests That KT To According The PNF Pattern Most Significantly Improved Dynamic Balance Because Gait Parameter Was Increased However, Positive Effects Of KT In Enhancing Balance Function Short-Term Or A Long-Term Recovery Were Noted In Few Studies, Indicating That Either A Application Of KT Can Make Some Difference . Therefore, The Authors**(Dongyung lee and youngsook bae)** Suggested That Long-Term Studies Are Needed To Prove The Effect Of The Balance Of KT According To PNF Pattern Application.

Hence The Present Study Showed Long Term Effect Of Pnf Kinesio Taping On Range Of Motion Of Ankle Dorsiflexion, Dynamic Balance And Walking Speed In Chronic Stroke Patients With Foot Drop .

Hence the present Study Showed there Is Significant Difference In Long Term Effect In PNF K Taping Group Then Sham Taping.

Sham Taping is kind of pseudo taping in which we attached the tape to the area without any stretching it is used to make placebo effect.

This study aimed to evaluate the long-term effects of PNF kinesio taping on range of motion (ROM) of ankle dorsiflexion, dynamic balance, and walking speed in chronic stroke patients with foot drop. The results indicated significant improvements in all measured outcomes for both the PNF kinesio taping group (Group A) and the sham taping group (Group B). However, the magnitude of improvement was greater in the PNF kinesio taping group, suggesting its superior efficacy in rehabilitation.

The findings reveal that PNF kinesio taping resulted in a significant increase in ankle dorsiflexion ROM, as evidenced by the goniometer scores. The effect size (Cohen's D = 2.92 for Group A) indicates a very large clinical significance, reinforcing the idea that PNF taping can effectively enhance ROM. This improvement is particularly crucial for stroke patients, as limited ankle dorsiflexion can impede mobility

and functional independence. Previous studies have highlighted similar benefits of kinesio taping, indicating that it may facilitate muscle activation and joint positioning, which could explain the observed improvements.

Both groups demonstrated significant gains in the BBS scores, with a more pronounced improvement in Group A. Dynamic balance is a critical component of mobility, especially in stroke rehabilitation, where gait stability is often compromised. The increase in BBS scores aligns with existing literature that supports the role of kinesio taping in enhancing proprioception and neuromuscular control. By applying the tape according to PNF patterns, it is likely that participants experienced improved sensory feedback, leading to better balance performance.

The 10M Walking Test results further emphasize the positive effects of PNF kinesio taping. Both groups showed reduced walking times post-treatment, indicating enhanced walking speed. However, the PNF kinesio taping group exhibited a statistically significant improvement compared to the sham group (z-value = 2.522, p = 0.012). This enhancement in walking speed is critical for daily activities and overall quality of life for stroke survivors. The results suggest that PNF kinesio taping may support not only physical rehabilitation but also psychological well-being by facilitating increased participation in community activities.

The MMSE scores demonstrated significant cognitive improvements post-treatment in both groups, which may reflect the holistic benefits of the intervention. Cognitive function can significantly influence rehabilitation outcomes, and improvements here may facilitate better adherence to rehabilitation programs. Additionally, reductions in muscle tone as indicated by the MAS scores further support the efficacy of PNF kinesio taping in managing spasticity, a common issue in stroke patients.

The between-group analyses highlighted significant differences in post-treatment outcomes across several measures, particularly in the Goniometer, BBS, and 10M Walking Test. These results underscore the superior effectiveness of PNF kinesio taping compared to sham taping. The lack of significant differences in pre-treatment measures indicates that randomization was effective, ensuring that both groups were comparable at baseline. The observed improvements in the PNF group suggest that the application of kinesio taping, particularly with PNF patterns, may have a meaningful impact on the rehabilitation process.

The findings of this study have important implications for rehabilitation practices. The evidence supporting the use of PNF kinesio taping as an effective intervention for improving ROM, balance, and walking speed in stroke patients with foot drop highlights its potential as a valuable adjunct to standard rehabilitation protocols. Therapists should consider incorporating PNF kinesio taping into their treatment plans, particularly for patients with significant mobility limitations.

CONCLUSION

In conclusion, this study demonstrates that PNF kinesio taping significantly enhances ankle dorsiflexion, dynamic balance, and walking speed in chronic stroke patients with foot drop compared to sham taping. These findings support the integration of PNF kinesio taping into rehabilitation protocols, offering a promising approach to improving functional outcomes in this population.

CLINICAL IMPLICATION

According to the therapist PNF K Taping techniques can be used to treat foot drop but PNF K Taping group is more effective then Sham taping in clinical practice in both techniques for Long term effects.

LIMITATIONS AND SUGGESTIONS

LIMITATIONS

1. The present study had few limitations, Number of subjects were limited
2. Gender distribution was unequal with smaller number of female participants in both the groups.
3. Since we included patients with a modified Ashworth Scale score of less than 2, there is a chance that patients with high functional states would be selected more heavily than patients with low functional ability.

SUGGESTIONS

We conducted a comparison between a group of patients who had Kinesio Tape application only and a group of patients who received kinesio tape. Utilizing both TAM and HMS based on the PNF Pattern. A prior study described how patients with prolonged walking experienced strengthening of the quadriceps muscle (QM) as a result of rehabilitation; however, no appreciable changes in gait or balance were observed after Kt the Qm prior to CT. We did not therefore consider comparing the kinesio tape application results to the TAM and HMS with those of kinesio tape application to the TAM and QM

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