THE EFFECT OF BACKWARD WALKING TRAINING ON GAIT VELOCITY AND FUNTIONAL BALANCE IN STROKE PATIENTS

A dissertation submitted in partial fulfillment of the requirement for the degree of

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ELECTIVE – ADVANCED PT IN NEUROLOGY

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SUBMITTED IN THE PARTIAL FULFILLMENT OF THE REQUIREMENT FOR DEGREE OF "MASTER OF PHYSIOTHERAPY" AT THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY,

CHENNAI

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INTERNAL EXAMINER

EXTERNAL EXAMINER

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APRIL-2011

DECLARATION

I hereby declare and present my project work entitled "**THE EFFECT OF BACKWARD WALKING TRAINING ON GAIT VELOCITY AND FUNTIONAL BALANCE IN STROKE PATIENTS"** The outcome of the original research work undertaken and carried out by me, under the guidance of **Mr.E.MAGESH**,M.P.T.,(Ph.D).**, RVS COLLEGE OF PHYSIOTHERAPY,** Sulur, Coimbatore.

I also declare that the material of this project work has not formed in any way the basis for the award of any other degree previously from the Tamil Nadu Dr. M.G.R Medical University.

SIGNATURE

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ABSTRACT

Purpose of the study

The objective was to study the effect of backward walking training improving on gait velocity and functional balance in stroke patients.

Materials and methods

30 stroke patients were randomly assigned to group A and group B.The outcome measures were 10 meter walk test, functional reach test and cadence. Pre and post session intervention value of out come measures were noted in 1st and 42nd day of intervention.

Result

This study shows that there is significant improvement in gait velocity and functional balance in two groups. But the subjects in group A showed significant improvement than the subjects in Group B.

Conclusion

This study concludes that the backward walking training demonstrates significant improvement on gait velocity and functional balance in stroke patients.

Keywords

Stroke, Gait, Gait velocity, Cadence, Brunnstrom motor recovery stages

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Introduction

I- INTRODUCTION

Gait is one of the basic Component of independent function commonly affected by either neurological disease process or injury. Gait deviation in person with hemiplegic have been described according to their Biomechanical and kinesiological abnormalities and terms of the loss of centrally programmemed motor control mechanisms.

Perry described common problem of the hemiplegic gait as loss of controlled movement into planter flexion at heel strike, loss of ankle movement from heel strike to mid stance and loss of the normal combination of movement patterns at the end of stance and at the end of swing. Decreased muscle activation is one of the primary cause of gait deficit in the early post-stroke phase.

Loss of walking ability is a major problem after stroke, recovery of walking is a priority goal for most patients. Gait outcome is a significant factor that influences a patient's chance of

returning to their premorbid environments. Rehabilitation can be an effective treatment following stroke. **F**riedman stated, the individual with a history of stroke attained the ability to ambulate, the more likely it was that independent walking would be re-established.

The gait of the person with hemiplegia has been described as slow and asymmetric. The diminished velocity of the hemiplegic gait, in comparison to normal has been reported repeatedly along with associated limitation in cadence, stride length and gait velocity. The velocity decrement has potentially important functional implications. For example, signals at pedestrian crossings, are geared towards a much faster walking velocity. This slow walking velocity has been decreased joint movement, amplitude and step length as well as inability to produce selective movement in the joints of the lower limb and poor balance. Attempts to increase walking velocity by hemiplegic subjects may result in problems of safety and a more abnormal gait pattern. This deterioration of performance appears to be worthy of consideration as an important rehabilitation concern.

The Typical hemiplegic gait is characterized by asymmetry of timing in single limb support phase on the affected and unaffected legs. Asymmetrical gait pattern leads to increased energy expenditure and risk of fall. Consequently improvements in symmetry provide an important clinical marker of recovery. The gait training alone often leads to an asymmetrical gait pattern in many patients with stroke.

Learning to walk backwards correctly has been recommended to improve the movement components required walking forwards. Therefore, backward walking has been promoted as a

treatment strategy to improve gait. During backward walking the same motor programme is used as during forward walking. Backward walking appears to create more muscle activity in proportion to effort than forward walking. Additionally, backward walking demands a greater level of energy expenditure, oxygen consumption, metabolic response and cardio respiratory than forward walking.

Yea-Ru Yang concluded that gait analysis in stroke patients, asymmetric gait pattern and gait parameter were improved after receiving the backward walking training.

The purpose of the study is to examine the effectiveness of backward walking training on gait outcome and functional balance of post stroke patients.

AIM AND NEED OF STUDY

There are many biological researches done on gait training for stroke patients hence there is need of clinical implication to assist the integrity of such biological research.

It is needed to evaluate effectiveness of backward walking training on gait velocity and functional balance in stroke patients.

OBJECTIVE

To study the effect of backward walking training on gait velocity and functional balance in stroke patients.

HYPOTHESIS

Null Hypothesis

There is no significant effect of backward walking training on gait velocity and functional balance in stroke patients.

Alternative Hypothesis

There is significant effect of backward walking training on gait velocity and functional balance in stroke patients.

Review of Literature

II- REVIEW OF LITERATURE

RELATED REVIEWS ON BACKWARD WALKING

1) S.M MARDEN – LOKKEN et al., 2006

Conducted a study on effects of backward walking training in a post stroke patient of 58 years old male. He concluded that programme of additional backward walking may improve efficiency of gait in individual with post stroke patients.

2) TROY L HOOPER et al., 2005

Conducted a study on the effects of graded forward and backward walking on 27 study subjects VO2 and HR were measured using open circuit calorimetric and electrocardiogram and concluded that backward walking on a treadmill elicit a greater percent HR (max) and percent

VO2 (max) than does forward walking under the same condition and, if incorporated into sustained training regimens, would be expected to improve aerobic endurance. Sang-wan et al conducted a study on the effect of forward walking and backward walking on quadriceps muscles with treadmill inclination surface electromyography analysis on 11 subjects and concluded that backward walking up an incline may place additional muscular demands on individual.

3) YEA-RU YANG et al., 2004

Conducted a randomized controlled trial on gait outcomes after additional backward walking training in patient with post stroke. He found that asymmetric gait pattern in patients with post stroke improves after receiving additional backward walking training.

4) J. DUYSENS et al., 1996

Conducted a study on backward and forward walking use different pattern of phase dependent modulation of cutaneous reflexes in humans and concluded that during forward, but possibly running in reverse, thereby causing a shift both in the timing of the reflex reversal and in the period of reflex suppression.

RELATED REVIEWS ON GAIT OUTCOMES

1) CHRIS KIRTLEY, 2006

Conducted a study on human locomotion temporal-parietal parameter uses a easy method of recording speed, cadence, stride length. They marked a distance of 10 meter on the floor which is the walkway. Since their measurement will assume that the subjects are walking at a constant speed, there is also some distance before and after the walkway to allow the subject to accelerate. They start the stopwatch at the movement the subject crosses the start line, count the number of steps taken, stop the stopwatch when the subject crosses the finish line. Calculate speed, cadence stride length where speed is distance / time, cadence is number of steps/min and stride length is (120 X speed) / cadence).

2) Green j, Forster, Young et al., May 2002

Conducted study on assess the reliability of gait speed in late-stage stroke patients. They conclude reliability of walking three times to 10 meters repeatedly during two assessments of one week apart. Within-assessment gait speed measured at home is highly reliable.

3) HERBER P. VON, 1995

Conducted a study on to assess gait parameter and patterns of patients with stroke gait analysis was used to test 49 ambulatory patients with stroke and 24 controls and concluded that gait analysis can be important in documenting abnormalities and determining the effects of therapeutic modalities.

RELATED REVIEWS ON FUNCTIONAL REACH TEST

1) Katz-Leurer M, Fisher et al., 2009

Studied the Reliability and validity of the functional reach test at the sub-acute stage of post-stroke. The FRT in all directions on both occasions exhibited high reliability. The responsiveness to the paralytic side was high.

2) FUJISAWA HIROYUKI et al., 2005

Studied the significance of functional reach test and one-footed standing ability on the affected side may be important for improving walking ability for patient with hemiplegia.

3) PATRICIA S SMITH et al., 2005

Studied the best clinical tool for measuring balance individuals with post stroke subjects concluded that subject's performance on the Berg balance scale was closely associated with performance on the functional reach. Therefore, the clinician may elect to use the shorter functional reach as a measure of balance where efficient use of time is the primary goal.

3) DUNCAN et al., 1990

Evaluated the depth of measuring balance using functional reach test in 128 volunteers. He concluded that FRT may be useful for detecting balance impairment change in balance performance overtime.

RELATED REVIEWS ON STROKE REHABILITATION

1) HSU –A.L et al., 2009

Conducted study on analysis of impairment in influencing gait velocity and asymmetric of hemiplegic patients after mild to moderate stroke on 26 subjects who are able to walk independently without any assistance device and concluded that gait velocity was mainly affected by weakness of the affected hip flexors and knee extensor, gait asymmetric was influenced primarily by the degree of the spasticity of the affected ankle planter flexors.

2) PATRICA KLUDING et al., January 2009

Conducted a study on lower extremity strength difference predicts activity limitations in 26 chronic stroke patients and concluded that strength deficits in the hemiplegic lower extremity should be an important target for clinical intervention to improve function in patients with chronic stroke.

3) STEFAN HESSE et al., August/September 2006

Conducted a study on machines to support motor rehabilitation after stroke, 10 years of experience in Berlin on 155 acutely stroke patients and concluded that machines were always supplementary tools that assisted the therapist and enable more intense practice there by improving treatment.

Operational Definition

III- OPERATIONAL DEFINITION

Stroke:

Stroke is defined as rapidly developed clinical sign of a focal disturbance of cerebral function of presumed vascular origin and of more then 24 hours duration**.**

Gait:

Gait described as a translatory progression of the body as a whole, produced by coordinated rotatory movement of body.

Gait velocity:

Gait velocity is the rate of linear forward motion of the body. This can be measured in meter or centimeter per second.

Cadence:

Cadence is the number of steps taken by a person per unit of time. Cadence may be measured as the number of steps per second or per minute.

Research Design & Methodology

IV- RESEARCH DESIGN AND METHODOLOGY

RESEARCH DESIGN:

Randomized Experimental Study.

STUDY SETTING:

MEENAKSHI MISSION HOSPITAL AND RESEARCH CENTRE,

MADURAI

SAMPLE SIZE:

30 Samples will be selected by random sampling technique.

Group A = 15 = EXPERIMENTAL GROUP

Group B = 15 = CONTROL GROUP

STUDY DURATION:

Six Weeks study.

INCLUSION CRITERIA:

1 First ischemic stroke involving right MCA territory

2 Left side hemiplegic patients with symptoms less then six months.

3 Brunnstrom stage 3-4 for lower extremity

4 40 to 50 Age limit male stroke patients

5 Stable medical condition to allow participation with testing Protocol and intervention.

EXCLUSION CRITERIA:

1 Patient with any comorbidity or disability other than stroke that would Preclude gait training

2 Stroke involved other arterial territories and hemorrhagic stroke

3 Orthopedic and other gait influencing disease

4 Cancer patients (SOL)

5 RTA patients

6 Sensory impairment involved lower limb

VARIABLES:

1. Independent Variable:

    1 Stroke rehabilitation.

    2 backward walking.

2. Dependent Variable:

    1 Gait velocity

    2 Functional balance.

MATERIALS:

1 Tape Measure

2 Chalk Piece

3 Stop watch

4 Yard Stick

MEASUREMENT TOOLS:

1 10 meter walk test

2 Functional reach test.

3 Cadence

MEASURMENT PROCEDURE

GAIT SPEED 10 METER WALK TEST

Measure a 10 meter distance and mark the ends with chalk on the floor. Position the subject approximately 3 feet behind the 10 meter line and instruct the subject to walk at a comfortable speed. Then document the time taken to cover the distance using stopwatch. Repeat for 3 times and calculate the average time and convert to meter/min.

FUNCTIONAL REACH TEST

It provides a quick screen of balance problems in older adults. It is the maximal distance one can reach forward beyond arms length while maintaining a fixed BOS in the standing position. The test uses a level yardstick mounted on the wall and positioned at the height of the

patient's acromion. The patient stands sideward next to the wall (without touching), feet normal stance width and weight equally distributed on both feet. The shoulder is flexed to 90^0 and elbow extended with the hand fisted. An initial measurement is made of the position of the 3rd metacarpal along the yardstick for forward reach, the patient is instructed to lean as for forward as possible without losing balance or taking a step. A second measurement is taken also using the 3rd metacarpal for reference. This measurement is than subtracted from the initial measurement.

CADENCE

Cadence is the number of steps taken by a person per unit of time. Cadence may be measured as the number of steps per second or per minute

Cadence = number of steps / time

TREATMENT PROCEDURE

30 Stroke patients participant were randomly allocated, 15 subjects in control group and 15 subjects in experimental group. Subjects in both groups participated in 40 min of stroke rehabilitation programme, training programme was given three times a week for six weeks. All training session were performed by a physical therapist. Subjects in the experimental group received additionally 10-15 min of backward walking training. The backward walking training programme was based on methods as described by Davies.

First, the subject is asked to take step backwards within parallel bars and can support him with the unaffected hand as required. The therapist provides assistance to move the subject's leg in the correct position. When the subject can move the leg back with correct pattern, the therapist gradually reduces the amount of assistances.

Secondly, as the movement components have been practiced, and the subject has taken

over actively with only slight help, the therapist facilities walking backward within parallel bars

Thirdly, the subject walks backwards actively away from the parallel bars.

Finally, the distance and speed of walking backward progressively increased. All backward walking training session were performed by physiotherapist.

Pre assessment and post assessment for 10m walk test, FRT, and cadence were measured for both groups. Data were tabulated & analyzed using suitable statistical tool.

Data Analysis & Interpretation

V- DATA ANALYSIS AND INTERPRETATION

PAIRED 't' TEST

The paired 't' test is used to compare the statically significant difference between pre & post test values of Group A & Group B.

1. $$S = \sqrt{\frac{\sum d2 - (\sum d)2}{n}} \Big/ \sqrt{n-1}$$

1. $$\bar{d} = \frac{\sum d}{n}$$

2. $$t = \bar{d} \Big/ \sqrt{\frac{}{n}}$$

s

Where

$\bar{d}$ = Calculate mean difference between pre & post test values

d = difference between pre & post test values

n = Sample Size

S = Standard deviation

UNPAIRED 't' TEST

The unpaired 't' test was used to compare the statistically significant difference between Group A and Group B.

$$T = \frac{\bar{x}_1 - \bar{x}_2}{s} \sqrt{n_1 n_2}$$

$$\sqrt{n_1 + n_2}$$

$$S = \sqrt{\frac{\sum(X_1 - \bar{X}_1)^2 + \sum (X_2 - \bar{X}_2)^2}{n_1+n_2-2}}$$

n_1 = Total number of subjects in group A.

n_2 = Total number of subjects in group B.

X_1 = Difference between pre test Vs post test value of group A.

$\overline{X}_1$ = mean value of difference between pre test Vs post test value of group A.

X_2= Difference between pre post test value of group B.

$\overline{X}_2$= Mean value of difference between pre test Vs post test value of group B.

PAIRED 't' TEST

TABLE – I

Shows statistical mean value of functional reach test

SUBJECT	FUNCTIONAL REACH TEST	
	EXPERIMENT	CONTROL
Pretest mean	6.61	6.81
Post test mean	10.53	8.53
S.D	2.16	2.63

In experimental group functional reach test mean , pretest value was 6.61 and post test value was 10.53 for 14 degree of freedom at 0.05 level of significance, the 't' table value is 2.145 and 't' calculated value is 8.66 which is greater than 't' value and in control group

functional reach test mean , pretest value was 6.81 and post test value was 8.53 for 14 degree of freedom at 0.05 level of significance, the ‘t’ table value is 2.145 and ‘t’ calculated value is 4.47 statistically significant.

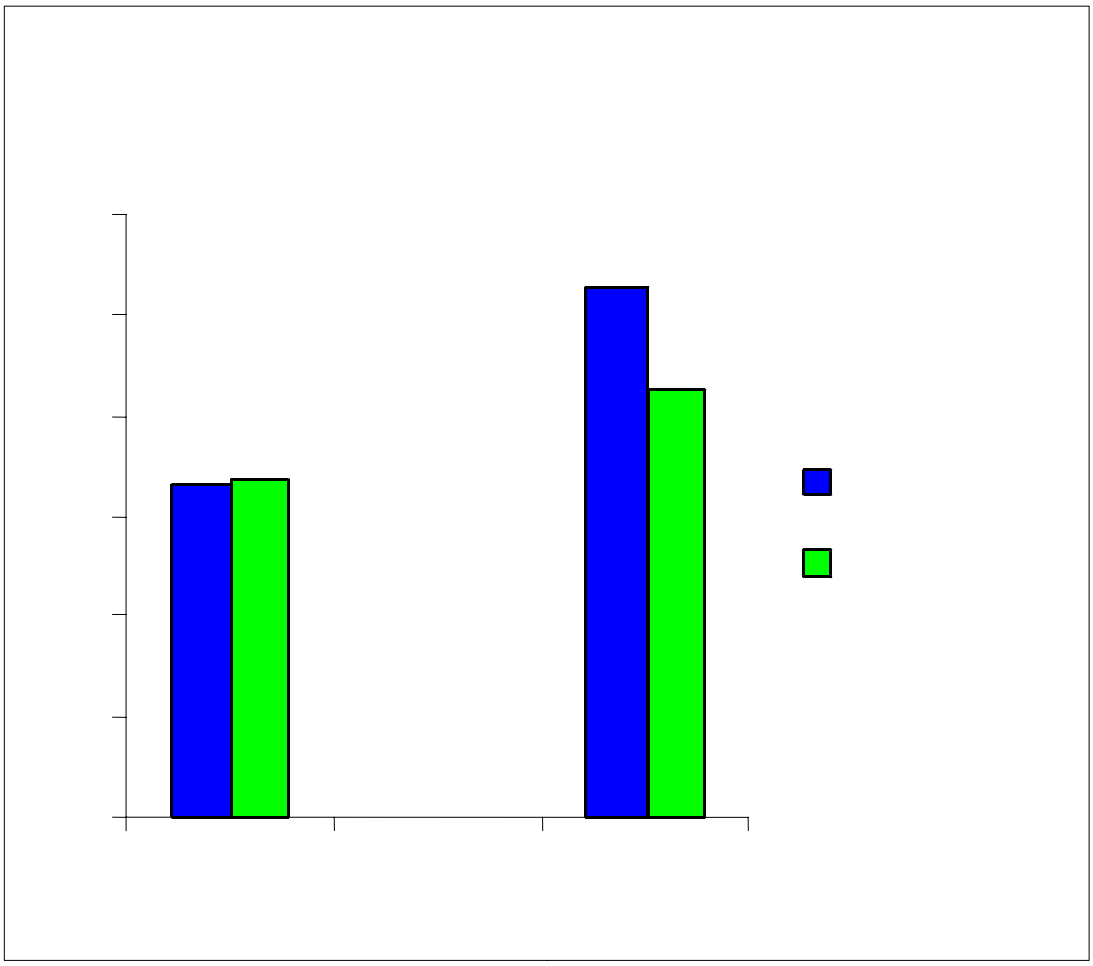


TABLE – II

Shows statistical mean value of 10 meter walk test

SUBJECT	10 METER WALK TEST

	EXPERIMENT	CONTROL
Pretest mean	27.65	26.87
Posttest mean	47.12	32.23
S.D	5.78	6.53

In experimental group 10 meter walk test mean , pretest value was 27.65 and post test value was 47.12 for 14 degree of freedom at 0.05 level of significance, the 't' table value is 2.145 and 't' calculated value is 24.66 which is greater than 't' value and in control group 10 meter walk test mean , pretest value was 26.87 and post test value was 32.23 for 14 degree of freedom at 0.05 level of significance, the 't' table value is 2.145 and 't' calculated value is 13.78 statistically significant.

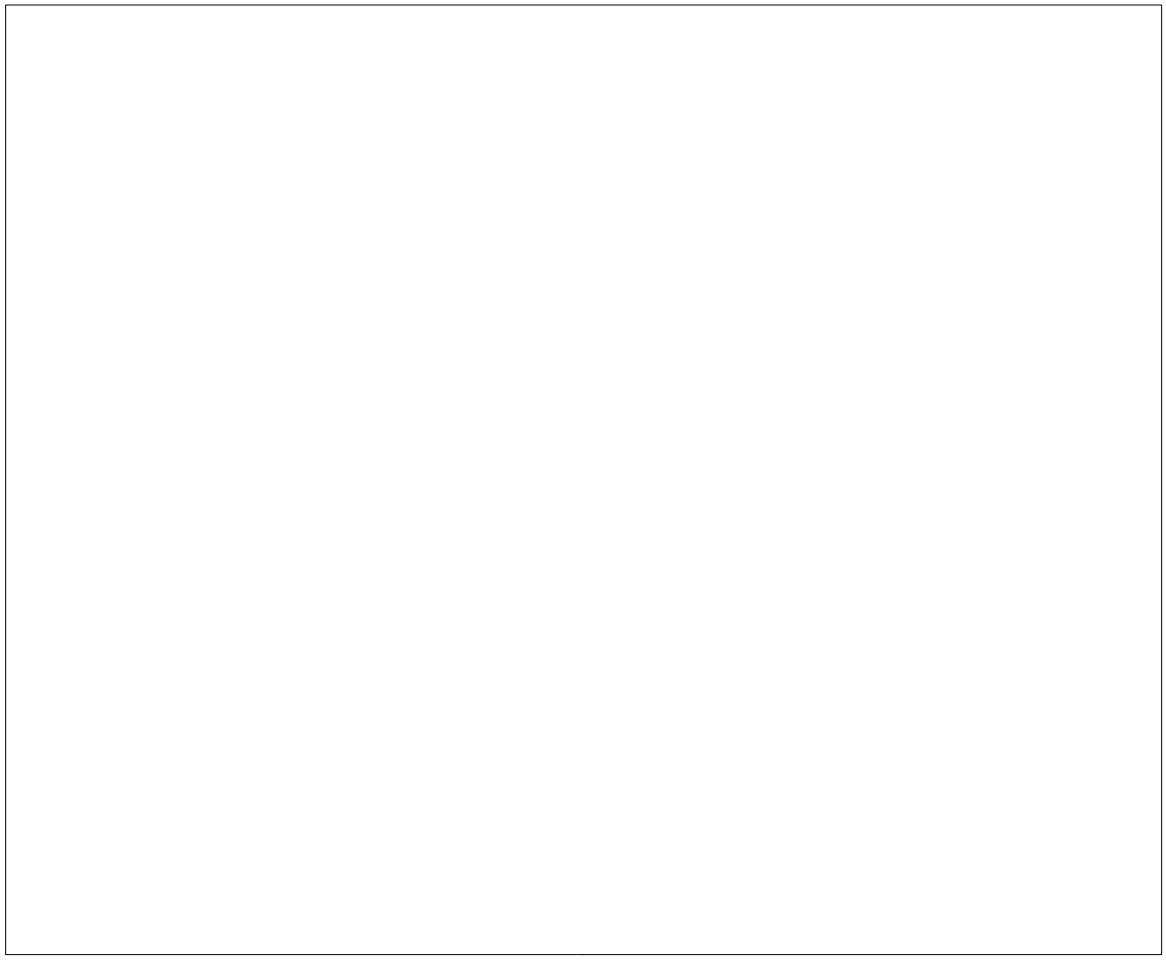
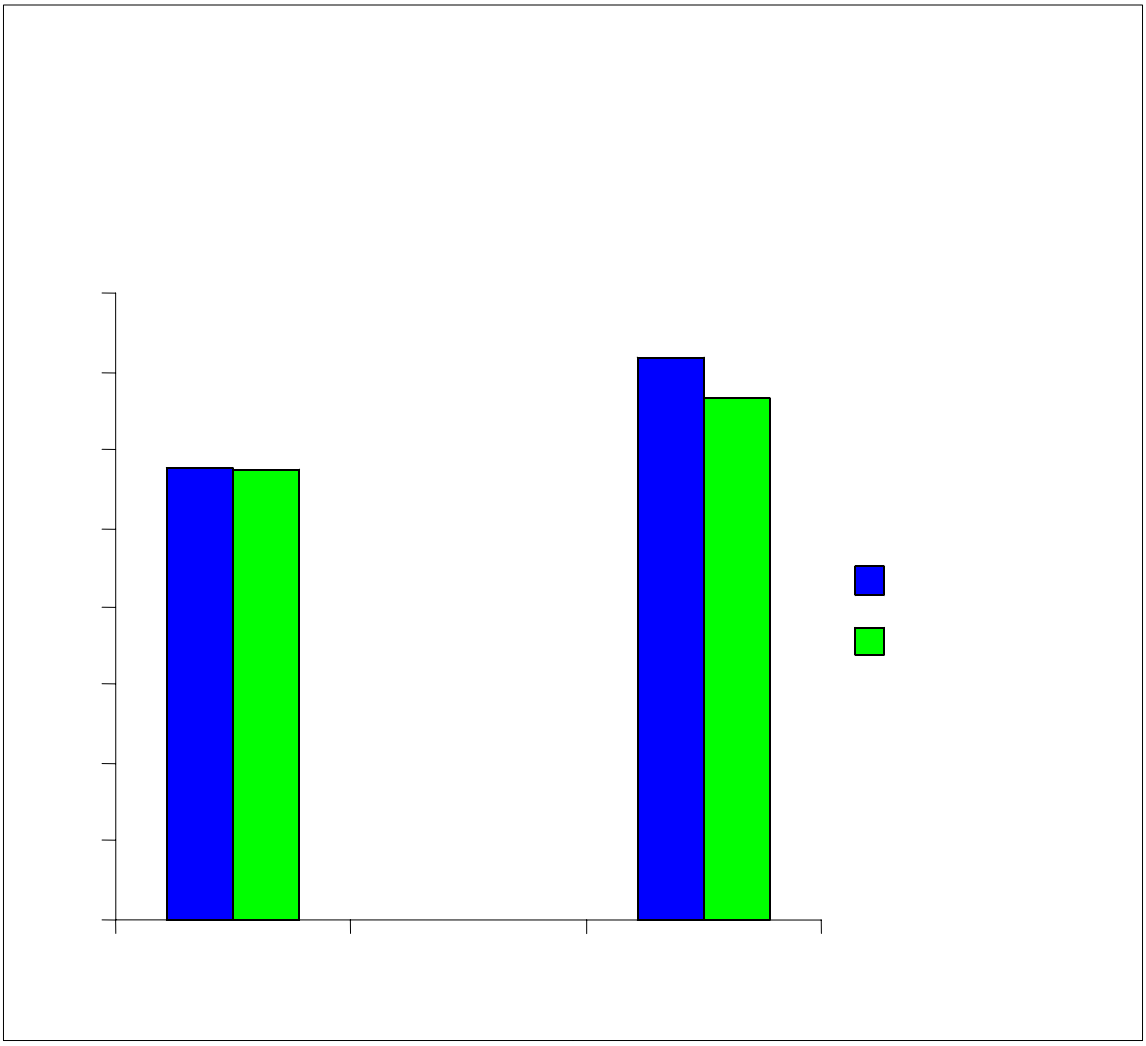


TABLE – III

Shows statistical mean value of cadence

SUBJECT	CADENCE	
	EXPERIMENT	CONTROL
Pretest mean	57.73	57.53
Posttest mean	71.73	66.80
S.D	12.91	12.96

In experimental group cadence mean , pretest value was 57.73 and post test value was 71.73 for 14 degree of freedom at 0.05 level of significance, the 't' table value is 2.145 and 't' calculated value is 10.78 which is greater than 't' value and in control group cadence mean , pretest value was 57.53 and post test value was 66.80 for 14 degree of freedom at 0.05 level of significance, the 't' table value is 2.145 and 't' calculated value is 15.31 statistically significant.



INDEPENDENT ‘t’ TEST

TABLE –IV

Shows statistical post mean value of functional reach test

SUBJECT	FUNCTIONAL REACH TEST	
	EXPERIMENT	CONTROL
Post test mean	10.5	8.53
Independent 't' test	2.052	

The independent 't' test value for functional reach test is 2.052 respectively for 28 degree of freedom at 0.05 level of significance and critical table value is 2.048 therefore there is no significant difference in both the group.

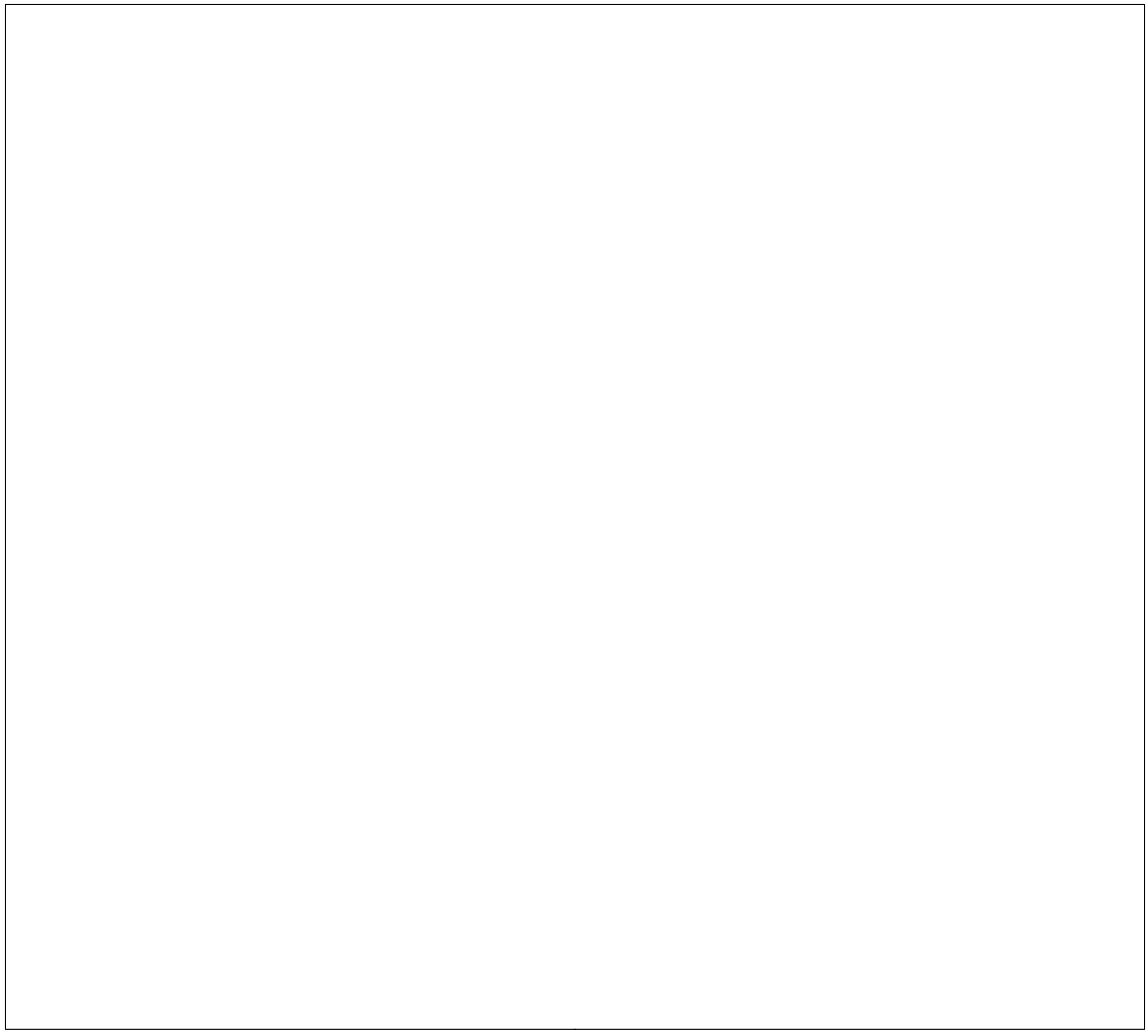


TABLE - V

Shows statistical post mean value of 10 meter walk test

SUBJECT	10 METER WALK TEST	
	EXPERIMENT	CONTROL

Post test mean	47.12	32.23
Independent ‘t’ test	6.23	

The independent ‘t’ test value for 10 meter walk test is 6.23 respectively for 28 degree of freedom at 0.05 level of significance and critical table value is 2.048 therefore there is no significant difference in both the group.

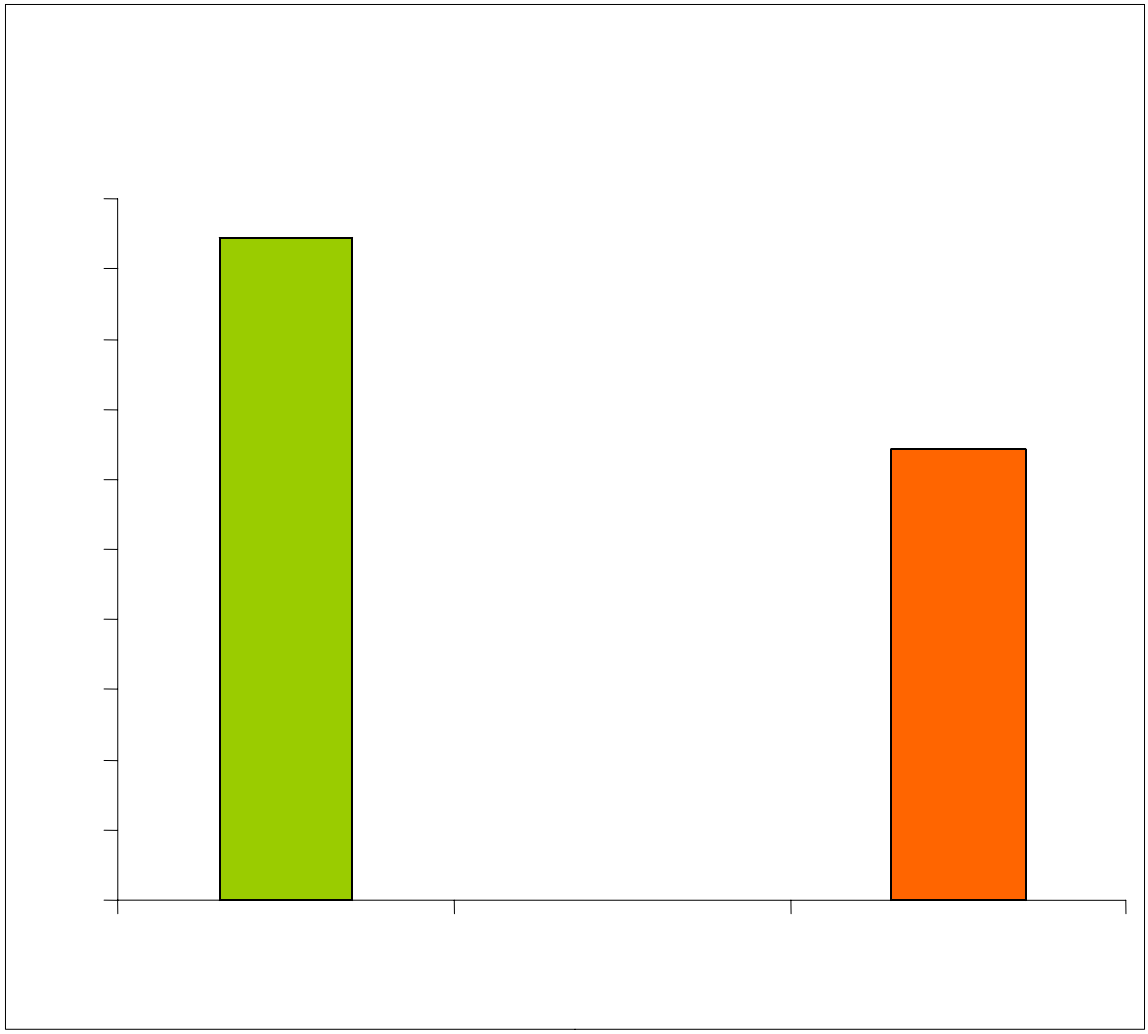
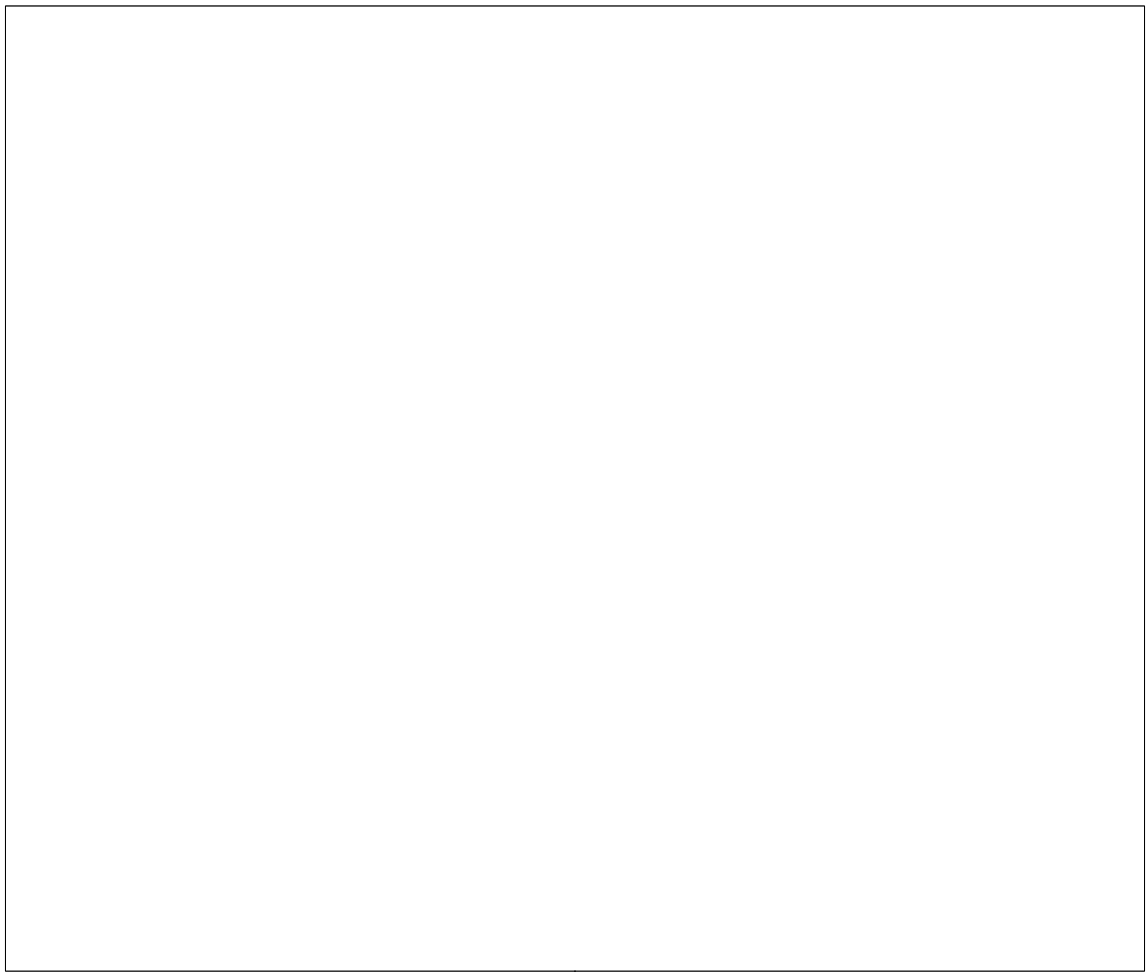


TABLE - VI

Shows statistical post mean value of cadence

SUBJECT	CADENCE	
	EXPERIMENT	CONTROL
Post test mean	71.73	66.8
Independent ‘t’ test	1.043	

The independent ‘t’ test value for cadence is 1.043 respectively for 28 degree of freedom at 0.05 level of significance and critical table value is 2.048 therefore there is no significant difference in both the group.



Results

VI- RESULT

For 10m walk test experimental group mean difference value is 19.47 which is higher than the control group at 0.05 level of significance. For functional reach test experimental mean difference value is 3.93 which is higher than the control group at 0.05 level of significance. For the cadence test experimental group mean difference value is 14.67 which is higher the control group at 0.05 level of significance.

Discussion

VII- DISCUSSION

It was a experimental study extended over a period of 3 months duration in PMR setting of MMHRC a total of 30 stroke participants were randomly allocated, 15 subjects in

control and 15 subjects in experimental group.

The present study demonstrates significant improvement in gait speed, balance, cadence except gait asymmetry.

One of the specific goal of gait training in stroke patients is restoration of gait symmetry. Majority of stroke patients demonstrate asymmetrical gait pattern with less time spent on affected leg during single limb support than normal leg.

In general, when comparing the normal subjects with hemiplegic gait, later demonstrate low balance, gait speed, cadence and high value for gait cycle duration. Many literatures denote that improvement in gait speed is strongly associated with improvement in walking ability in stroke subjects.

The result of this study is concordance with this point of view and also demonstrated significant improvement in cadence, balance in addition to gait speed. The mean difference for gait speed in experimental group was 19.47 and for control group was 5.36. Though this is a small difference, it was a clinically relevant gain. The possible explanation for the significant improvement in gait speed and other walking abilities may be due to combined movement of hip extensor knee flexor and ankle dorsiflexion were repeatedly practiced while walking backwards, which may contribute in breaking the limb synergy pattern and gain in neuromuscular control.

Balance is also found greatly improved. The possible explanation could be, because of

backward walking, visual causes are eliminated. Under this circumstances the subject is enormously forced to cost other system of receptor like proprioception, kinesthestic sense, protective reflex and neuromuscular control were all get recruited to meet the demand thereby balance abilities is greatly enhanced. Therefore this study demonstrates the backward walking with conventional training is an effective approach. Though some studies doubted about the safety of subjects while walking backward, In this study none of the subjects experienced fall. The possible reason may be of graded implementation of backward walking training programme with safe environment.

Suggestion and Limitation

VIII- SUGGESTIONS AND LIMITATIONS

LIMITATIONS:

1 This study was done for a short span.

2 This study was conducted only on males.

3 The study was applied for age group 40-50 years.

4 This study was conducted only in Right MCA stroke patients.

SUGGESTIONS:

1 The study can be done with large number of sample.

2 The study can be conducted for females also.

3 The study can be applied for other age group population.

Conclusion

IX- CONCLUSION

This study concludes that backward walking training demonstrates significant improvement on gait velocity and functional balance in stroke patients.

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Appendix

XI- APPENDIX

APPENDIX I- CONSENT FORM

I have been informed about the procedure and the purpose of the study. I have understood that I have the right to refuse my consent or withdraw it any time during the study without adversely affecting the study.

I am aware that being subjected to this study, I will have to give sometime to this study and this assessment do not interfere with the benefits.

I _____, the Undersigned give my consent to be a participant of the study programme.

Signature of the consent

(Name and Address)

APPENDIX II- ASSESSMENT FORM

NAME :

AGE :

O.P/I.P.NO :

OCCUPATION :

ADDRESS :

DURATION OF ONSET :

DATE OF EVALUVATION

PRE TEST :

POST TEST :

OUTCOME MEASURESS	PRE ASSESSMENT	POST ASSESSMENT
10 METER WALK TEST		
FUNCTIONAL REACH TEST		
CADENCE		

APPENDIX III- Brunnstrom motor recovery stages

STAGE I Recovery from hemiplegia occurs in a stereotyped sequence of events that being with a period of flaccidity immediately following the acute episode .No movement of the limb

can be elicited.

STAGE II As recovery begins, the basic limb synergies or some of their components may appear as associated reactions, or minimal voluntary movement responses may be present. At this time, spasticity begins to develop.

STAGE III The patient gains voluntary control of the movement synergies, although full range of synergy components does not necessarily develop. Spasticity has further increased and may become severe.

STAGE IV Some movement combinations that do not follow the paths of synergy are mastered.First with difficulty,then with more ease, and spasticity begine to decline.

STAGE V If progress continues,more difficult movement combinations are learned as the basic limb synergies lose their dominances over motor acts.

STAGE VI Disappearence of spasticity, individual joint movements become possible and coordination approaches normal. From here on,as the last recovery step,normal motor function is restored,but this last stage is not achieved by all, for the recovery process can plateau at any stage.

APPENDIX IV - 10-Meter Walk Test

This test examines gait speed. Gait speed is important for safe community mobility (e.g. crossing a street before the light changes).

Administering the test:

1. Measure a 10 meter (33 foot) course and mark its ends with tape on the floor.

2. Position the subject approximately 3 feet behind the tape line.

3. Instruct the subject to walk at a comfortable rate until he is approximately 3 feet past the tape line. (Distance before and after the course minimizes the effect of acceleration and deceleration).

4. Repeat 3 times and average the times.

5. Instruct the subject to walk as above, but as fast as possible.

6. Repeat 3 times and average the times.

7. Convert to m/min: divide walking distance of 10 meters by elapsed time, and then multiply by 60.

APPENDIX V- Functional Reach Test

The Functional Reach Test is a quick screening test for balance

Requirements: The patient must be able to stand independently for at least 30 seconds without support, and be able to flex the shoulder to at least 90 degrees.

Equipment and Set up: A yard stick is attached to a wall at about shoulder height. The patient is positioned in front of this so that upon flexing the shoulder to 90 degrees, an initial reading on the yard stick can be taken. The examiner takes a position 5-10 feet away from the patient, viewing the patient from the side.

Instructions: Position the patient close to the wall so that they may reach forward along the length of the yardstick. The patient is instructed stand with feet shoulder distance apart then make a fist and raise the arm up so that it's parallel to the floor. At this time the examiner takes an initial reading on the yard stick, usually spotting the knuckle of the third metacarpal. The patient is instructed to reach forward along the yardstick without moving the feet. Any reaching strategy is allowed but the hand should remain in a fist. The therapist takes a reading on the yardstick of the farthest reach attained by the patient without taking a step.

TABLE – VII

Values of 10 Meter walk test (Experiment group)

S.NO.	PRETEST	POST TEST	D	D^2

1	25.16	42.62	15.46	239
2	32.76	53.17	20.41	416.5
3	20.32	45.23	24.91	620.5
4	28.39	47.20	18.81	353.8
5	37.42	54.76	17.34	300.6
6	29.84	45.87	16.03	257
7	21.66	46.51	24.85	617.5
8	35.86	54.68	18.82	345.1
9	30.91	51.13	21.22	450.3
10	18.23	33.11	14.88	221.4
11	23.17	41.26	18.09	327.2
12	26.09	47.11	21.02	441.8
13	33.55	54.62	21.07	443.9
14	19.69	35.48	15.79	249.3
15	31.74	54.06	22.32	498.1

TABLE – VIII

Values of 10 Meter walk test (Control group)

S.NO.	PRETEST	POST TEST	D	D^2
1	22.17	27.21	5.04	25.4

			4.04	
2	30.15	34.19	5.34	16.3
3	17.09	22.43	3.95	28.5
4	21.79	25.74	4.1	15.6
5	33.85	37.95	3.52	16.81
6	25.83	29.35	3.77	12.4
7	24.69	28.46	5.53	14.2
8	32.72	38.25	7.11	30.6
9	29.01	36.12	8.04	50.5
10	34.97	43.01	4.73	64.6
11	27.99	32.72	7.81	22.4
12	31.33	39.14	7.11	60.9
13	28.18	35.29	5.74	50.5
14	24.88	30.62	4.61	32.9
15	18.36	22.97		21.2

TABLE – IX

Values of Functional reach test (Experiment group)

S.NO.	PRETEST	POST TEST	D	D^2
1	7.4	11.3	3.9	15.2

			0.8	
2	6.2	7	5.4	6.4
3	9	14.2	4.7	29.2
4	4.4	9.1	1.7	22
5	8.3	10	2.6	2.9
6	3.4	6	3	6.8
7	10	13	2.2	9
8	6.2	8.4	7	4.8
9	5	12	3	49
10	7	10	5.1	9
11	4.7	9.8	4.3	26
12	6.4	10.8	6.7	18.5
13	7.9	14.6	4.9	44.9
14	5.2	10.1	3.7	24
15	8	11.7		13.7

TABLE – X

Values of Functional reach test (Control group)

S.NO.	PRETEST	POST TEST	D	D^2
1	4.2	6.1	1.9	3.6

			2.3	
2	7	9.3	0.4	5.3
3	3	3.4	0.9	1.6
4	8.1	7.2	1.8	8.1
5	11.2	13	0.9	3.3
6	5.3	6.2	3	8.1
7	4	7	0.6	9
8	9	8.4	4	3.6
9	10	14	1.2	16
10	8.1	9.3	2.2	1.4
11	3.8	6	1.9	4.8
12	7.9	9.8	0.7	3.6
13	6	6.7	2.7	4.9
14	8.8	11.5	4.3	7.3
15	5.7	10		18.5

TABLE – XI

Values of Cadence (Experiment group)

S.NO.	PRETEST	POST TEST	D	D^2
1	53	71	18	324

			14	
2	71	85	15	196
3	77	92	22	225
4	45	67	16	484
5	78	94	11	256
6	49	60	13	121
7	51	64	8	169
8	47	55	13	64
9	65	78	14	169
10	37	51	12	196
11	68	70	17	144
12	41	58	21	289
13	56	77	10	441
14	66	76	16	100
15	62	78		256

TABLE – XII

Values of Cadence (Control group)

S.NO.	PRETEST	POST TEST	D	D^2
1	56	62	6	36

			13	
2	68	81	13	169
3	62	75	9	169
4	75	84	11	81
5	56	67	9	121
6	79	88	7	81
7	57	64	8	49
8	66	74	12	64
9	46	58	7	144
10	66	73	8	49
11	30	38	11	64
12	42	53	10	121
13	52	62	6	100
14	61	67	9	36
15	47	56		49