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Effect of PNF Resistive Gait Training and Agility Training in Gait and QOL on Post-Stroke Survivors: A Comparative Study

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ABSTRACT

INTRODUCTION: Proprioceptive neuromuscular facilitation (PNF) is an integrated approach that treats an individual as a whole person, rather than merely focusing on a body segment[5]. Methods of improving stroke patients' gait function include proprioceptive neuromuscular facilitation (PNF). This method stimulates proprioceptive organs in muscles and tendons to improve functions,

OBJECTIVE:- To find out the Effect of PNF Gait Resistance Training and Agility Training on Gait and QOL on CVA Survivors .

HYPOTHESIS

- To improve gait using PNF resistive gait training
- To improve gait using Agility Training
- To compare the effect of PNF and agility on gait parameters
- To evaluate and compare the effect of PNF resistive gait training and Agility Training on QOL

DESIGN: Pre test and post test experimental study.

PARTICIPANTS: a total of 60 number of (20 in each group) subjects were recruited from Swami vivekanda national institute of rehabilitation Training and Research according to the inclusion and exclusion criteria. Subjects were recruited with convenient sampling in three different groups after getting the consent form

MAIN OUTCOME MEASURES:

- Gait Parameters:
- Cadence
- Step Length
- Stride Length
- Velocity
- WHO QOL BREF

RESULTS:

there was a significant difference between p<0.09stride.p<0.11cadence.p<0.06 step.p<0.07velocity. Cadence stride velocity in post to pre group comparison which shows there is effect of agility as well as pnf training. But agility group and pnf group shows same value, ANOVA of difference of pre and post transferred score of WHOQOL domains of all 3 groups. The PNF group has shown good difference in all domains and it has been statistically proven to be significant (Sig=0.00). The agility also has good effect on QOL as can be seen in the mean scores, the effect is slightly lesser than PNF but it is still better than conventional therapy alone. Conventional therapy though it has positive effect on QOL, the effect are minimal when compared to PNF and Agility.

CONCLUSIONS: Both PNF gait resistive training and agility training are effective compared to conventional therapy in improving gait in post stroke survivors. Although the outcome of this study suggested that both therapeutic approaches were effective on gait parameters, better results were attained in the group who received PNF gait resistive training. Thus my hypothesis proved.

Keywords: *Stroke, Proprioceptive neuromuscular facilitation. Agility training, Gait parameters, Quality of life*

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INTRODUCTION

Various gait training programs have been used for clients with stroke and in those studies there is a positive correlation between QOL and Gait i.e., QOL improves as gait improves[3].

After stroke, individuals typically demonstrate reduced walking speed, decreased stride length and cadence, as well as temporal asymmetry. A systematic review of ambulatory people after stroke reported mean walking speeds ranging from 0.4 to 0.8 m/s, compared with 1.0 to 1.2 m/s in healthy, older adults. Previous studies have also reported mean stride lengths ranging from 0.50 to 0.64 m in people after stroke, compared with 1.1 to 1.4 m in healthy, older adults, and mean cadence of 50 to 63 steps/minute, compared with 102 to 114 steps/minute in healthy, older adults. Temporal symmetry of the affected leg to the non-affected leg is reported as ranging from 0.40 to 0.64, where 1.00 is symmetrical.8,9 In summary, walking parameters in ambulatory people after stroke are approximately half of the values expected in older, able-bodied adults[2].

Proprioceptive neuromuscular facilitation (PNF) is an integrated approach that treats an individual as a whole person, rather than merely focusing on a body segment[5]. Methods of improving stroke patients' gait function include proprioceptive neuromuscular facilitation (PNF). This method stimulates proprioceptive organs in muscles and tendons to improve functions, increase muscle strength, flexibility, and balance, and increase coordination and thus this method is effective for training motor units to react maximally Thus far in studies of PNF in hemiplegic patients, PNF lower extremity patterns have been used to show improvement in step lengths, walking time, and walking speed[4].

Agility refers to the ability to start, stop, and change direction quickly while maintaining proper posture. Therefore, agility training is a type of exercise training that incorporates short bursts of movement that involve changes of direction. Agility training usually incorporates exercises such as cone drill and/or ladder drills in which the exerciser has to complete different movement patterns or foot patterns fast as possible. An example of a drill used to enhance agility is the L.E.F.T. (Lower Extremity Functional Test) drill. (National Academy of Sports Medicine) Agility training techniques involve quick stops and starts, cutting and turning, and changes in direction[5].

Agility training as an intervention for improving balance and lower extremity functional test**,** and for reducing falls has been studied. But Agility training as an intervention for improving gait in stroke has never been studied/applied. PNF resisted gait training has been effective in amputees and Parkinson's. Its effect on gait in stroke has not been attempted. QOL is an important goal for rehabilitation professional and it is widely known that QOL is very much linked to gait in CVA survivors[6].

Since both the training methods have been found to be effective for improving gait but there are no studies done to compare their effects. This study will attempt to compare the effect of PNF gait Resistance Training and Agility Training on Gait and QOL on CVA Survivors.

AIM AND OBJECTIVE

AIM: To find out the Effect of PNF Gait Resistance Training and Agility Training on Gait and QOL on CVA Survivors.

OBJECTIVE:

- To improve gait using PNF resistive gait training
- To improve gait using Agility Training
- To compare the effect of PNF and agility on gait parameters
- To evaluate and compare the effect of PNF resistive gait training and Agility Training on QOL

HYPOTHESIS

NULL HYPOTHESIS

- PNF gait resistance training and Agility training has an equal effect.

ALTERNATIVE HYPOTHSIS

- PNF gait resistance training has more effect than agility training.
- Agility training has more effect than PNF gait resistance training.

METHODOLOGY

STUDY SETTING: This study was conducted at Department of occupational Therapy SV.NIRTAR

STUDY POPULATION: Stroke population

DURATION: 30 minutes session for 4weeks

SAMPLE SIZE: a total of 60 number of (20 in each group) subjects were recruited from Swami vivekanda national institute of rehabilitation Training and Research according to the inclusion and exclusion criteria.

GROUP 1- 20 Subjects- PNF resistive gait training along with conventional therapy.

GROUP 2- 20 Subjects- Agility training along with conventional therapy

GROUP 3- 20 Subjects- Conventional therapy alone.

STUDY DESIGN: Pre-Post experimental Study

SAMPLING: Subjects were recruited with convenient sampling in three different groups after getting the consent form.

INCLUSION CRITERIA:

- Brunnstrom Stage of Recovery 3-4 in lower extremity
- Both Male and female
- Age 30-45
- Within one year of onset
- Ability to stand at least for 30sec without displacement of foot
- Able to walk, with or without an assistive device, for a minimum of 10 meters and have an activity tolerance of 60 minutes with rest intervals

EXCLUSION CRITERIA:

- Medically unstable
- Neurological conditions not related to stroke (e.g. Parkinson's disease)

- Severe musculoskeletal conditions (e.g. recent joint replacement surgery, amputation)
- Psychological conditions associated with stroke

[Conventional therapy which is provided to group 3 is adequate as decided clinically.]

[All the groups received conventional therapy without any interference to their session of therapy]

OUTCOME MEASURE

Gait Parameters:

- Cadence

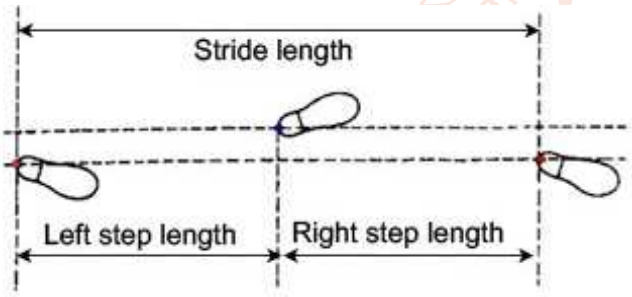
Cadence is the rate at which a person walk, expressed in steps per minute. The average cadence is 100 - 115 steps/min. Thus, if you let your character take 10 steps in 156 to 180 frames (using 30 frames/sec), the character's cadence is within a normal range.

- Step Length

Step length is the distance between the heel contact point of one foot and that of the other foot.

- Stride Length

Stride length is the distance between the successive heel contact points of the same foot.



- Velocity

Distance covered/ time, measured in CM/minutes

WHO QOL BREF

The WHOQOLBREF was developed to provide a short form quality of life assessment that looks at Domain level profiles, using data from the pilot WHOQOL assessment and all available data from the Field Trial Version of the WHOQOL-100. The WHOQOL-BREF contains a total of 26 questions. It's a self-report questionnaire that contains 26 item and addressing 4 domains of QOL: physical health (7iteams), psychological health (6 items) social relationship (3iteams) and environment (8 items). It is possible to derive four domain scores. Those items are rated on a 5 point Likert scale to determine raw score items The four domain scores denote an individual's perception of quality of life in each particular domain. Domain scores are scaled in a positive direction (i.e. higher scores denote higher quality of life). The mean score of items within each domain is used to calculate the domain score. Mean scores are then multiplied by 4 in order to make domain scores comparable with the scores used in the WHOQOL-100. The WHOQOL-BREF is available in 19 different languages. It has shown good content validity and test retest reliability. Sensitivity to change is currently being assessed. Domain scores produced by the WHOQOL-BREF have been shown to correlate at around 0.9. Designed for many population including stroke and mental health of age range from 16year - 65 yr and above.

(WHOQOL-BREF December 1996 PROGRAMME ON MENTAL HEALTH WORLD HEALTH ORGANIZATION GENEVA)

PROCEDURE

The subjects were first screened according to the inclusion and exclusion criteria and Brunnstrom stages of lower extremity, and the ones fulfilling the criteria were recruited for the study. The subjects were explained about the study and a signed written informed consent was obtained from the participants. The subject were then allocated to the three groups using convenient sampling.

Intervention Strategies:

Group 1: PNF Gait training.

Group 2: Agility training

Group 3: Conventional therapy

Treatment for group 1: PNF Gait Training:

The PNF gait training program of 20 patients were conducted for 30 minutes a session, 5 days a week, for 4 weeks. Four main PNF techniques are used during gait training resistance, approximation, slow reversal and rhythmic stabilization during weight bearing activity.

Treatment for Group 2: Agility Training:

Agility training program of 20 patients were conducted for 30 minutes a session, 5 days a week, for 4 weeks. The training included standing in various postures (e.g. tandem or feet apart, one foot stance, and weight-shifting), walking with various challenges (e.g. different step lengths and speeds, tandem walking, of eight walking, side stepping, crossover stepping, and stepping over obstacles), sit-to-stand movements, and standing perturbations (i.e. instructor pushing participant in a controlled manner to destabilize balance and elicit postural reflexes).

Treatment for group 3: Conventional group

Conventional therapy activities for gait training included weight bearing, foot mapping, sit to stand, balance training, ergo meter, object crossing, step climbing, and walking facilitation.

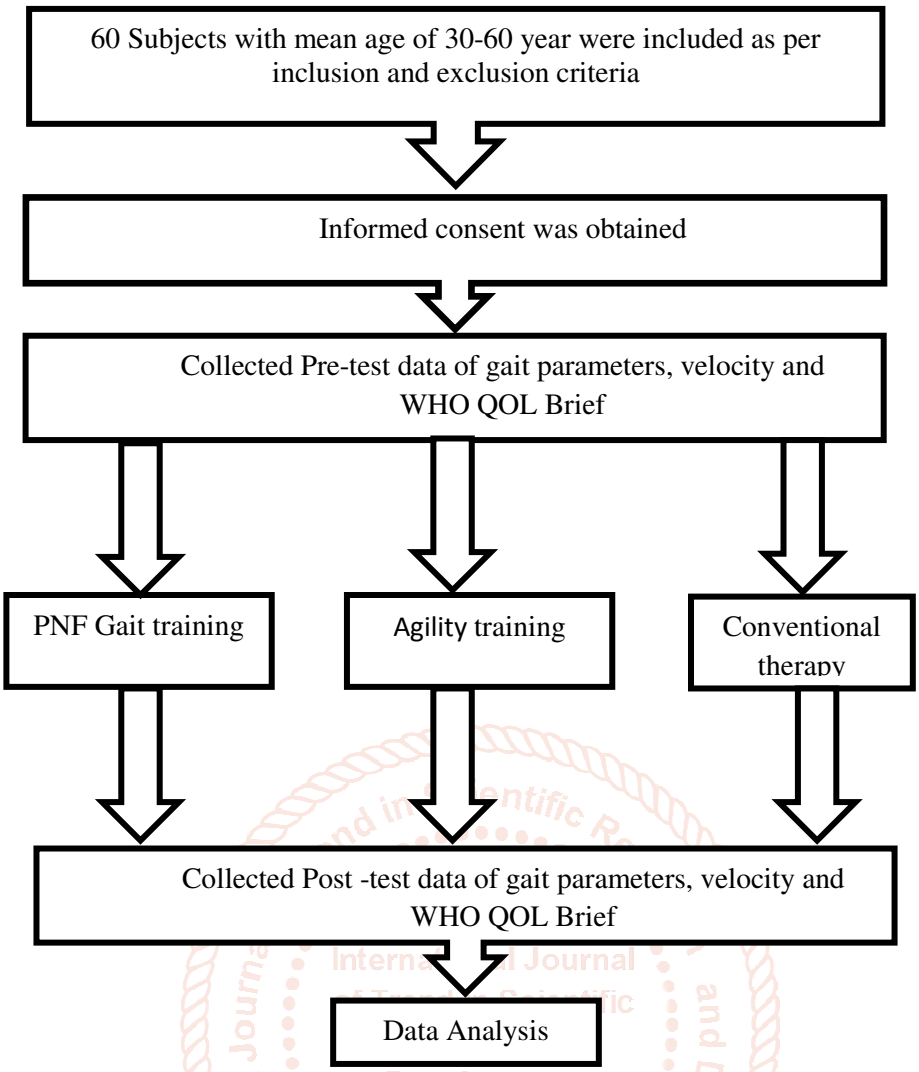
Therapy in all the departments at SVNIRTAR as decided clinically.

[All the groups received conventional therapy without any interference to their session of therapy]

PRTOTOCOL

The subjects were first screened according to inclusion and exclusion criteria and the one fulfilling the criteria of the study were selected. The attendances of the patient were approached with the proposal of the study and the aims and the methods of the study were explained. Those who were willing to participate were invited to join the study and were asked to sign the consent form.

[All the groups received conventional therapy without any interference to their session of therapy]



DATA ANALYSIS AND RESULTS

60 persons diagnosed to have stroke with a mean age of were recruited for the study using convenient sampling. The SPSS 23 was used for analysis; the data of all subjects were collected using WHOQOL, gait parameters (step length, stride length, cadence) and velocity. Each assessment was reassessed at the end of 4 weeks intervention.

The data was analysed using paired t-test to know if there is significant difference between the means of pre post data within the groups. ANOVA was used to analyse whether there are significant differences between these three groups. However, it calculates the value of H, which represented significance difference between the groups.

Table 1 Descriptive Statistics

N (Total Number of subjects)	60
Age	45.01+ 8.45 (Mean + SD)
Sex	47:13 (Male : Female)
Diagnosis (Affected Side)	31:29 (Right : Left)
Marital status	54:6 (Married : Single)
Duration of illness (in months)	5.61+ 2.81 (Mean + SD)

Table 1 presents the descriptive statistics of the demographic data. The mean age of the subjects was 45.01. There were 47 male and 13 female subjects who participated in the study. The side of the body affected was almost similar (31 Right and 29 left). The mean duration of illness was 5.61 months.

Table 2 Mean and Standard Deviation of Brainstorm recovers stage used in the study:

Outcome measure	PNF Group (N=20)		Agility Group (N=20)		Conventional Group (N=20)	
	Mean test score	Std.Dev	Mean test score	Std.Dev	Mean test score	Std.Dev
BRS-LE	3.7	0.4701	3.65	0.489	3.7	0.4701

Table 2 presents the mean and SD of the BRS-LL score for all three groups. It can be noted that the mean is similar for all three groups which suggest that the distribution of patients were uniform and that they have almost similar BRS levels.

Table 3 Descriptive statistics of Gait Parameters

Outcome measure	PNF Group (N=20)				Agility Group (N=20)				Conventional Group (N=20)			
	Mean test score		Std.Dev		Mean test score		Std.Dev		Mean test score		Std.Dev	
	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test
Stride Length	56.9	86.25	14.13	14.55	55.9	72.85	6.02	9.51	60.5	63.7	13.14	7.41
Step Length - Right	30.05	43.7	6.67	7.80	28.6	35.35	4.79	5.72	30.65	32.6	6.50	6.36
Step Length - Left	26.85	42.55	9.53	8.27	27.3	37.35	5.26	4.88	29.85	31.1	7.86	7.41
Cadence	72.3	97.95	10.48	9.1	69.15	81.45	16.98	17.0	76.35	80.15	16.90	16.37
Velocity	34.6	70.52	11.02	14.49	32.35	49.60	9.21	12.82	39.74	43.49	15.25	15.53

Table 4:

WHO-QOL	PNF Group (N=20)				Agility Group (N=20)				Conventional Group (N=20)			
	Mean test score		Std.Dev		Mean test score		Std.Dev		Mean test score		Std.Dev	
	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test	Pre test	Post test
Domain 1 (Pjysical health)	40.9	77.2	1.765	6.109	33.65	50.7	7.506	7.719	44.15	52.35	10.09	8.418
Domain 2 (Psychological health)	37.35	77.1	7.013	5.250	41.95	57.05	14.88	12.10	47.95	57.85	14.75	10.81
Domain 3 (Social Relationship)	58.35	85.1	23.92	18.42	53.5	70.35	18.84	19.20	63.1	70.85	16.93	15.81
Domain 4 (Environment)	55.35	77.9	8.656	9.936	23.35	58.85	1.755	5.742	55.15	62.2	9.482	8.805

Table 4 shows the mean and SD of the pre and post transferred score of WHOQOL domains of PNG, Agility and Control Groups. Graph 5 gives a visual representation of the same. It can be seen that all the domains of WHOQOL has shown considerable improvements in all three groups, with PNF group showing the highest, followed by agility and finally control. This shows that PNF resisted gait training has a very positive effect on QOL.

Table 5: Comparison of difference of pre and post transferred score of GAIT parameters and ANOVA

GAIT PARAMETERS	Groups	Mean	Variance	Significance
ADANCE	PNF	25.65	50.13421	0.00
	Agility	12.3	11.37895	
	Control	3.8	6.8	
RIGHT STEP	PNF	13.65	25.60789	.00
	Agility	6.9	7.463158	
	Control	1.95	3.207895	
LEFT STEP	PNF	15.7	41.48421	0.00
	Agility	10.05	26.89211	
	Control	1.25	2.092105	
STRIDE	PNF	29.35	73.92368	0.00
	Agility	16.95	39.41842	
	Control	3.2	4.8	
VELOCITY	PNF	35.91667	83.65039	
	Agility	17.25125	29.28146	
	Control	3.7485	3.041731	

Table 6: Comparison of difference of pre and post transferred score of WHOQOL Domains and ANOVA

WHOQOL	Groups	Mean	Variance	Significance
Domain 1	PNF	36.3	33.8	0.00
	Agility	17.05	52.05	
	Control	8.2	47.11579	
Domain 2	PNF	39.75	34.092	0.00
	Agility	15.1	110.72	
	Control	9.9	111.25	

Domain 3	PNF	26.75	245.46	0.00
	Agility	16.85	142.134	
	Control	7.75	74.092	
Domain 4	PNF	22.55	48.786	0.00
	Agility	9.15	18.45	
	Control	7.05	12.892	

Table 6 shows the results of ANOVA of difference of pre and post transferred score of WHOQOL domains of all 3 groups. The PNF group has shown good difference in all domains and it has been statistically proven to be significant (Sig=0.00). The agility also has good effect on QOL as can be seen in the mean scores, the effect is slightly lesser than PNF but it is still better than conventional therapy alone. Conventional therapy though it has positive effect on QOL, the effect are minimal when compared to PNF and Agility.

DISCUSSION

The study aimed to study the effect of PNF resisted gait training, agility training, and conventional therapy for a 4 week period on gait in stroke survivors. Findings suggests that both PNF gait resistive training and agility training are effective compared to conventional therapy in improving gait in post stroke survivors.

The results of this study indicate that both PNF resisted gait training and agility training were more effective than conventional therapy alone. PNF resisted gait training was the most effective as it showed the greatest difference in all of the gait parameters when compared to the other groups. Akosile et al. in their study had shown that PNF training improves gait speed and functional ambulation. Park S, in his study has concluded that PNF training improves gait parameters.

Though agility was not as effective as PNF, it still had better results when compared to conventional therapy. Minjeong and Shaughnessy had studied the effect of exercise based rehabilitation on balance and gait, they concluded that exercise based programs are better than gait oriented programs. Although agility training as a treatment for stroke is not widely studied, its effect on gait in other population like OA and amputees have shown that it is an effective modality for gait training.

The effect of PNF, agility training and conventional therapy on QOL has also been studied, the results indicate that QOL does improve when using the 3 training programs. PNF has been the most effective in improving QOL, followed by agility and lastly conventional therapy. Improvement in gait parameters have shown to have a positive effect on QOL. Since PNF training produced the best results in gait parameters in this study, hence the most improvement in QOL was also was exhibited by this. Park and Kim in their study concluded that improvement in gait parameters is related to the QOL in stroke patients.

The results of this study suggest that PNF resisted gait training and agility training are effective in improving gait parameters thereby improving QOL in patients with stroke. PNF has been the most effective. The agility training as a model of intervention is very rarely used in stroke population. This study has shown that it has a significant effect on gait parameters and QOL. The agility training model for gait and balance training has been very successful in many other conditions and this study has shown it also effective for stroke population. This has opened a completely new avenue to be explored so that it can be an effective addition to the gait training arsenal in stroke population.

CONCLUSION

n this clinical trial, our findings suggests that both PNF gait resistive training and agility training are effective compared to conventional therapy in improving gait in post stroke survivors. Although the outcome of this study suggested that both therapeutic approaches were effective on gait parameters, better results were attained in the group who received PNF gait resistive training. Thus my hypothesis proved. Traditional gait training programs are also valuable in reaching a functional gait pattern, but if it is supported by PNF techniques, better results will be attained in rehabilitation

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