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A Comparative Study between the Upper Trunk and Lower Trunk Proprioceptive Neuromuscular Facilitation Techniques on Improving Postural Control in Hemiplegic Patients

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Abstract- A Study To Compare Upper Trunk And Lower Trunk Proprioceptive Neuromuscular Facilitation Techniques On Improving Postural Control In Hemiplegic Patients. The result showed that lower trunk and upper trunk PNF technique both were effective to improve postural control in hemiplegic patients. But, lower trunk PNF technique was more effective than upper trunk PNF technique to improve postural control in hemiplegic patients.

Key words: Trunk PNF, postural control, Hemiplegia.

I. Introduction

The brain is unique organ, in the brain the neurons depend on continuous blood supply because metabolism is exclusively aerobic. If the brain is deprived of blood, consciousness is lost within seconds and permanent damage occurs within minutes. According to WHO stroke can be defined as “rapidly developed clinical sign of focal disturbance of cerebral function of presumed

vascular origin and of more than 24 hours duration.”¹ It affects 7,00,000 individuals in each year, about 5,00,000 are new stroke and 2,00,000 are recurrent stroke. There are an estimation of 5,40,000 stroke survivors. The prevalence of stroke in India is 84-262 per 1,00,000 population in rural India and 334-424 out of 10,00,000 population in cities. The focal neurological deficits resulting from the stroke is a reflection of size and the location of the lesion and the amount of the collateral blood flow. The clinical symptom varies according to involvement of specific arteries and anatomical structures. Clinically a variety of deficits are possible including changes in the level of consciousness and impairment of sensory, motor, cognitive, perceptual, language, bowel & bladder function. In which loss of motor control leads to multi-directionally impaired trunk muscle strength which has a potential to affect functional activities.² Conventional trunk exercise aimed at improving sitting balance and selective trunk movement have a beneficial effect on the selective performance of the trunk after stroke.³ PNF is a method of facilitating the response of neuromuscular mechanism through the stimulation of proprioceptors. The PNF procedures help the patients to gain efficient motor function in stroke.⁴

The original goal of technique is to lay down gross motor patterns within CNS. The diagonal mass movement patterns in PNF resemble normal motor activity. A reduction in truncal tone can be promoted by PNF trunk pattern (chopping and lifting) that emphasize rotation movement of trunk. PNF programs may be appropriate for improving trunk muscle endurance, strength and trunk mobility.^{5,6,7.}

The purpose of this study was to investigate the comparative efficacy of the upper trunk PNF and lower trunk PNF in improving postural control in people with hemiplegic. Specifically, we hypothesized that individuals who participate in the experimental group – II (lower trunk PNF technique) would have significantly improved postural control compared with participants in a experimental group – I (upper trunk PNF technique) and participants in a control group (conventional physiotherapy).

II. Method

This experimental study was conducted in the C.U.Shah physiotherapy college and patients were recruited from neurology physiotherapy department. Hemiplegic patients with 40 to 65 year of age, Both male and female, who have Trunk control scale score >48 and who were medically stable and able to understand and follow simple verbal instructions were screened for eligibility for the study. were included in the study. Patients were excluded if they had a neurological disease affecting postural control other than a stroke, such as for instance a cerebellar disease, Parkinson’s disease and/or a vestibular lesion; musculoskeletal disorders such as low backache, arthritis or degenerative diseases of the lower limbs affecting motor performance, Any previous musculoskeletal problems to trunk and shoulder Minimum mental score <20, any Sensory deficit subjects, Medically unstable patient.

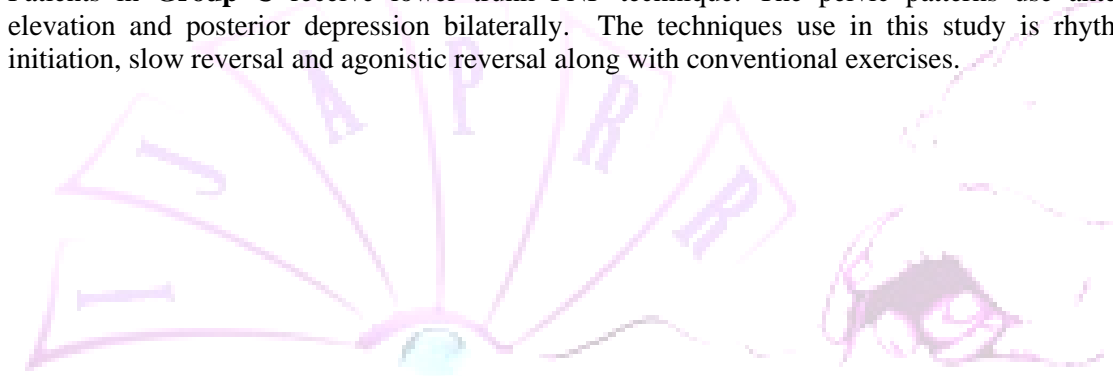
The patients included in the study were randomly assigned to receive upper trunk PNF technique (experimental group -I) , lower trunk PNF technique (experimental group -II) or conventional physiotherapy (control group) through the systemic randomised allocation sampling techniques.

The Trunk Impairment Scale (TIS), Trunk control test (TCT) and the functional independence measurers (FIM) were the outcomes used to measure trunk control and postural control in hemiplegic patients.^{20,21,22,23.}

The study protocol was approved by the Ethics and Scientific Committee of the Institution, saurashtra University, India and written informed consent was obtained from all the patients whose active participation was sought.

III. Intervention

The participants of all groups receive treatment for 30 minutes, once in a day, 5 days per week for 4 weeks. Patients in **Group A** receive conventional exercise such as selective stretching exercises, muscle-strengthening exercises, bridging, unilateral bridging and trunk rotation in crook lying position exercises were given. Patients in **Group B** receive upper trunk PNF technique: Bilateral upper extremity pattern for upper trunk chopping and lifting pattern with rhythmic initiation, slow reversal and agonistic reversal along with conventional exercises. Patients in **Group C** receive lower trunk PNF technique: The pelvic patterns use anterior elevation and posterior depression bilaterally. The techniques use in this study is rhythmic initiation, slow reversal and agonistic reversal along with conventional exercises.



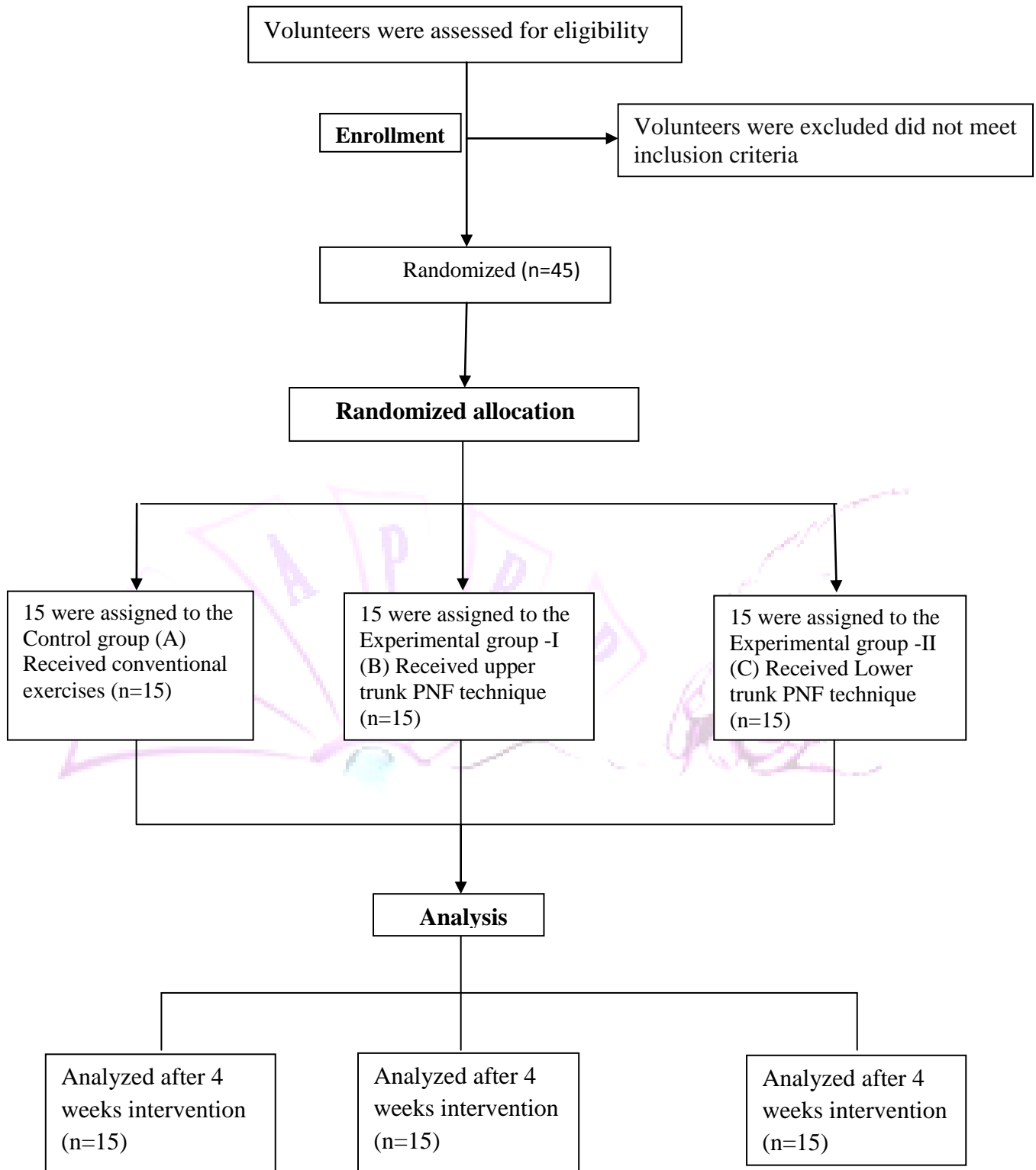


Figure 1. Flow chart of the study.

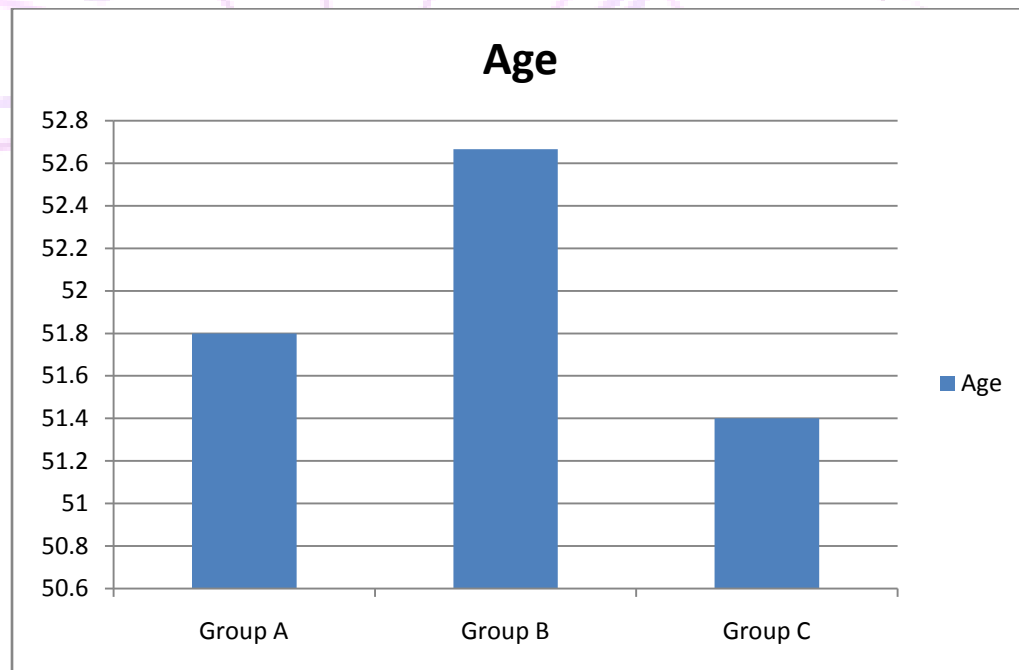
IV. Result

All statistical analysis was done using 16.0 software for windows. Descriptive analysis was used to obtain mean and standard deviations. Kolmogorov smirnov test was used for data normality test which was found to be normally distributed in all the variables. Intergroup comparison of Trunk control test, Trunk impairment score and Functional independence measures score was done using one way ANOVA. Intra group comparison of Trunk control test, Trunk impairment score and Functional independence measures score was done using t-test (paired sample Test). Further, bonferroni post hoc analysis was performed for multiple inter- group comparison. Confidence interval were set at 95%, $p= 0.005$ for all the analysis.

• **Table no 1: Age distribution of group A, B & Group C**

Group	N	Mean	Std. Deviation	Std. Error	Sig.
A	15	51.8000	5.00286	1.29173	0.760
B	15	52.6667	4.27061	1.10267	
C	15	51.4000	4.99714	1.29026	
Total	45	51.9556	4.69020	.69917	

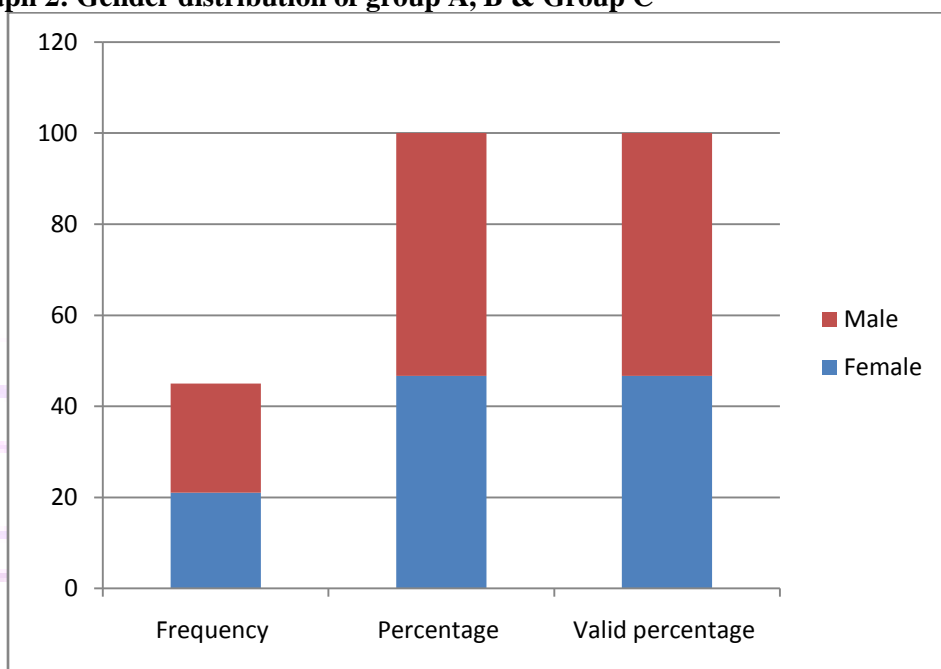
• **Graph 1: Age distribution of group A, B & Group C**



• **Table 2: Gender distribution of group A, B & Group C**

	Frequency	Percentage	Valid percentage
Female	21	46.67	46.67
Male	24	53.33	53.33
Total	45	100.0	100.0

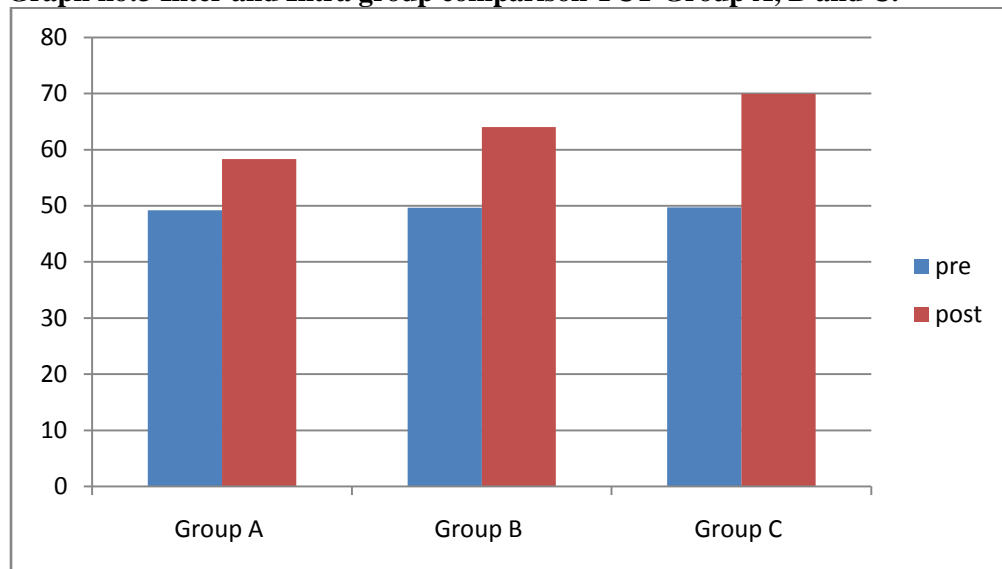
• **Graph 2: Gender distribution of group A, B & Group C**



• **Table no:3 Inter and Intra group comparison TCT Group A, B and C.**

Group	Pre test value		Post test value		95% confidence of the Interval difference		P value (Intra)
	Mean	SD	Mean	SD	Lower	Upper	
Group A	49.2	1.166	58.33	1.074	-10.018	-8.248	0.000
Group B	49.67	1.299	64.06	0.771	-15.055	-13.744	0.000
Group C	49.73	1.289	69.99	1.011	-21.030	-18.836	0.000
P Value (Inter)	0.477		0.000				

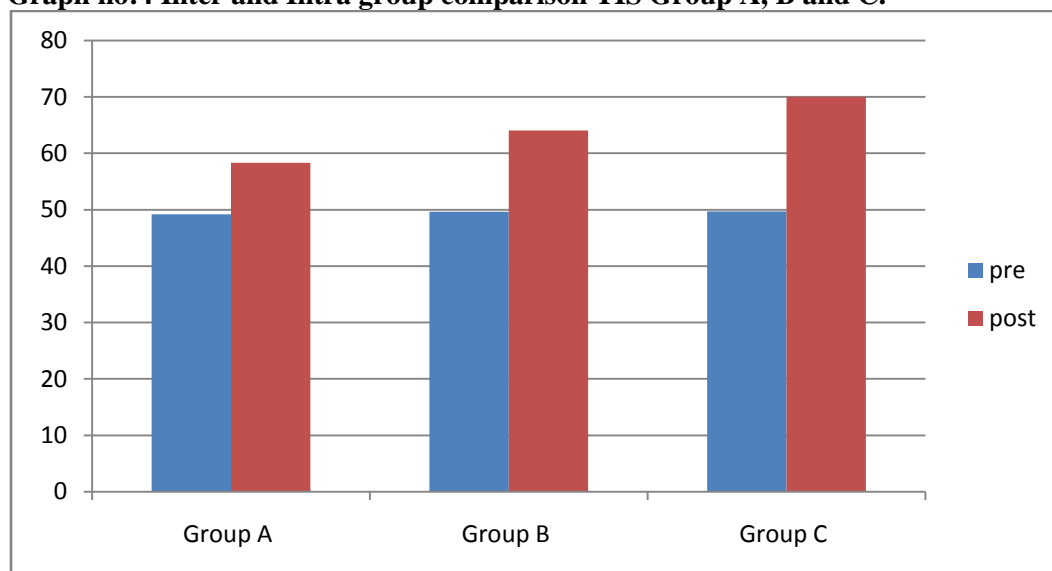
- **Graph no:3 Inter and Intra group comparison TCT Group A, B and C.**



- **Table no:4 Inter and Intra group comparison TIS Group A, B and C.**

Group	Pre test value		Post test value		95% confidence interval of the difference		P value (Intra)
	Mean	SD	Mean	SD	Lower	Upper	
Group A	10.6	1.083	14.2	0.748	-4.348	-2.851	0.000
Group B	10.73	1.289	15.86	0.805	-5.681	-4.584	0.000
Group C	10.06	1.236	18.2	0.748	-8.884	-7.382	0.000
P Value (Inter)	0.312		0.000				

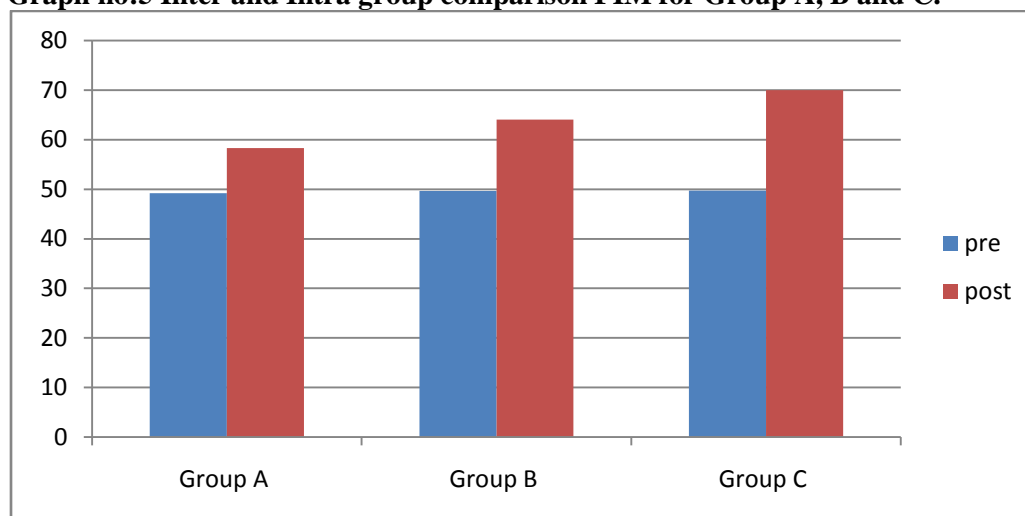
- **Graph no:4 Inter and Intra group comparison TIS Group A, B and C.**



- **Table no:5 Inter and Intra group comparison FIM for Group A, B and C.**

Group	Pre test value		Post test value		95% confidence Interval of the difference		P value (Intra)
	Mean	SD	Mean	SD	Lower	Upper	
Group A	54.46	0.884	60.66	1.0166	-7.042	-5.357	0.000
Group B	53.8	1.166	64.46	0.884	-11.440	-9.892	0.000
Group C	54.133	1.024	72.53	1.087	-18.858	-17.941	0.000
P Value (Inter)	0.243		0.000				

- **Graph no:5 Inter and Intra group comparison FIM for Group A, B and C.**



- **Table no:6 Multiple comparison for mean of difference of TCT between Group A, B and C.**

Dependent variable	Groups	Mean Difference (I-J)	Std. Error	Sig.	Dependent variable	95% Confidence Interval	
						Lower Bound	Upper Bound
POST TCT	A	B	-5.733*	.363	.000	-6.639	-4.827
		C	-11.333*		.000	-12.239	-10.427
	B	A	5.733*		.000	4.827	6.639
		C	-5.600*		.000	-6.506	-4.693
	C	A	11.333*		.000	10.427	12.239
		B	5.600*		.000	4.693	6.506

- **Table no:7 Multiple comparison for mean of difference of TIS between Group A, B and C.**

Dependent variable	Groups	Mean Difference (I-J)	Std. Error	Sig.	Dependent variable	95% Confidence Interval	
						Lower Bound	Upper Bound
POST TIS	A	B	-1.66667*	.290	.000	-2.3904	-.9429
		C	-4.00000*		.000	-4.7237	-3.2763
	B	A	1.66667*		.000	.9429	2.3904
		C	-2.33333*		.000	-3.0571	-1.6096
	C	A	4.00000*		.000	3.2763	4.7237
		B	2.33333*		.000	1.6096	3.0571

- **Table no:8 Multiple comparison for mean of difference of FIM between Group A, B and C.**

Dependent variable	Groups	Mean Difference (I-J)	Std. Error	Sig.	Dependent variable	95% Confidence Interval	
						Lower Bound	Upper Bound
POST FIM	A	B	-3.80000*	.377	.000	-4.7404	-2.8596
		C	-11.86667*		.000	-12.8071	-10.9262
	B	A	3.80000*		.000	2.8596	4.7404
		C	-8.06667*		.000	-9.0071	-7.1262
	C	A	11.86667*		.000	10.9262	12.8071
		B	8.06667*		.000	7.1262	9.0071

V. Discussion

Stroke is defined as “rapidly developed clinical sign of focal disturbance of cerebral function of presumed vascular origin and of more than 24 hours duration.”¹ It affects 7,00,000 individuals in each year, about 5,00,000 are new stroke and 2,00,000 are recurrent stroke. The prevalence of stroke in India is 84-262 per 1,00,000 population in rural India and 334-424 out of 10,00,000 population in cities. In this study effort were made to compare the effectiveness of upper trunk PNF versus lower trunk PNF on improving postural control in hemiplegic patient. The study was conducted on forty -five subjects with mean age of 51.95+-4.69 with hemiplegia. The patient were randomly divided into three groups with the help of

systemic randomized allocation; Group A was conventional physiotherapy Group B upper trunk PNF along with conventional physiotherapy and Group C lower trunk PNF along with conventional physiotherapy with mean age (mean \pm SD) 51.80 \pm 5.0, 52.66 \pm 4.27, 51.40 \pm 4.99 of respectively.

Outcome measures included TCT, TIS and FIM were measured prior to the treatment and at the end of 30 days of treatment. After that for finding the inter group comparison of pre treatment score of TCT, TIS and FIM the ANOVA was used. The result of inter group comparison of pre treatment score shows p value is > 0.05 . It shows that there is no significant difference between the pre treatment scores of TCT, TIS and FIM. Hence it proves that the group are homogenous.(table no 3, 4, & 5 and graph no 3,4 & 5). For proving the improvement of individual group, intra group comparison of pre and post treatment scores of TCT, TIS and FIM was done by using paired t-test and intra group comparison score shows a significant improvement ($p < 0.005$) in each groups.(table no 6,7,& 8 and graph no 6,7,& 8).

The 1st objective of the present study was to find out the effect of conventional trunk exercise program to improve postural control in hemiplegic participants. The p value is < 0.05 for TCT, TIS and FIM score indicating that there is a significant difference between pre and post treatment scores in group A. So, null hypothesis h_01 is rejected and alternative h_11 is accepted.

The 2nd objective of the present study was to find out the effect of upper trunk PNF technique to improve postural control in hemiplegic participants. The p value is < 0.05 for TCT, TIS and FIM score indicating that there is a significant difference between pre and post treatment scores in group B. So, null hypothesis h_02 is rejected and alternative h_12 is accepted.

The 3rd objective of the present study was to find out the effect of lower trunk PNF technique to improve postural control in hemiplegic participants. The p value is < 0.05 for TCT, TIS and FIM score indicating that there is a significant difference between pre and post treatment scores in group C. So, null hypothesis h_03 is rejected and alternative h_13 is accepted. During the 4th week of duration, all the three treatment intervention were associated with substantial improvement in patient reported symptoms. There was tendency for two experimental groups to perform better than the control group in almost all the patient rated outcomes. To prove 4th objective of the present study multiple comparison were done by post hoc analysis test to justify the intergroup difference for each outcome measures. The result of post hoc analysis suggested that after 4 week of intervention, lower trunk PNF technique produce greater improvement in all three outcome measures (TCT, TIS and FIM) than upper trunk PNF technique and conventional trunk exercise program group.

Post hoc for TCT suggested that lower trunk PNF technique group($p = 0.000$) and upper trunk PNF technique group (0.000) groups involved better than control group and significant difference ($p = 0.000$) between lower trunk PNF and upper trunk PNF technique group.

When Post hoc was done for TIS, it suggested that lower trunk PNF technique group($p = 0.000$) and upper trunk PNF technique group (0.000) groups involved better than control group and significant difference ($p = 0.000$) between lower trunk PNF and upper trunk PNF technique group.

Post hoc was done for FIM, it suggested that lower trunk PNF technique group($p = 0.000$) and upper trunk PNF technique group (0.000) groups involved better than control group and significant difference ($p = 0.000$) between lower trunk PNF and upper trunk PNF technique group.

So null hypothesis h_0 rejected and h_1 accepted. This means that lower trunk PNF technique is more effective than upper trunk PNF technique and conventional trunk exercise program.

Ruth dickstein,¹⁷ has found that PNF treatment group showed improvement in muscle tone related to use of facilitation techniques

Susan bennet and james l karnes¹⁸ who found that spiral and diagonal mass movement patterns in PNF resembling normal activity were designed to address problems such as weakness, lack of stability.

N kofotolis¹⁹ et al who have found that static and dynamic PNF program may be appropriate for improving trunk mobility, the positive effect could be attributed to the nature of PNF exercise which used all the muscle action type (eccentric, concentric and isometric) through the progressively increased ROM thus demonstrate gain in muscle strength and endurance.

Wang Ry has found that subject with hemiplegia of short duration, gait speed and cadence improved immediately after session of PNF technique for pelvis and lower trunk¹⁹.

VI. Conclusion

In our study, we found that lower trunk and upper trunk PNF technique both were effective to improve postural control in hemiplegic patients. But, lower trunk PNF technique was more effective than upper trunk PNF technique to improve postural control in hemiplegic patients.

VII. Reference

1. patrica a. dowine: cash textbook of neurology for physiotherapy.chapter-9 clinical aspects of stroke,(1993) fourth edition, pg 240-41,272-87.
2. ryerson s. bylnn, brown da, wong ra ,hidler jm “ altered trunk position sense and it’s relation to balance functions in people post stroke.”j neural phy ther,2008 mar,32(1):14-20.
3. geert verheyden, luc vereeck, steven truijen “additional exercises improve trunk performance:a pilot randomized controlled trial” neurorehabilitation and neural repair 2009:23:281.
4. susan s elder, dominiek beckerd, “pnf in practice, an illustrated guide.” chapter 10 pattern of facilitation for trunk, 2nd revised edition, 2000 springer-verlag, pg 1-15, 227-49.
5. nick kofotolis, and eleftherios kellis “effect of two four weeks proprioceptive neuromuscular facilitation program on muscle edurance, flexibility and functional performance in women with chronic low back pain” phy pher, vol 86, no.7, july 2006, pp 10001-101.
6. ruth dickstein, thomas pillar, rachal shaham “stroke rehabilitation ,there exercise therapy approaches.” physical therapy, volume 66/ number 8,august 1986.

7. marko munih, pavla obreza sega, "pnf in combination with electrical stimulation: combined treatment in comparison to each treatment alone." *international neuromodulation society*(2004):vo17:48-55.
8. Ray Yau Wang " Effect Of Proprioceptive Neuromuscular Facilitation On The Gait Of Patients With Hemiplegia Of Long And Short Duration " *Phys Ther*, 1994,vol 74,no.12.Pp.1108-1115.
9. Peggy R True, "Pelvic Exercise And Gait In Hemiplegia." *Phys Ther* 69:18-26,1989.
10. Kazumi Kawahira Atsuko Ogata And Noayuki Tanaka," Addition Of Intensive Repetition Of The Facilitation Exercise To Multi-disciplinary Rehabilitation Promotes Motor Functional Recovery Of The Hemiplegic Lower Limb" *J Rehabil Med* 2004:36:159-164.
11. Sylvie Messier Bourbonnais D, Desrosiers J, Roy Y."Dynamic Analysis Of Trunk Flexion After Stroke". *Arch Phys Med Rehabil* 2004:85:1619-24.
12. Verheyden Gt, "Trunk Rehabilitation After Stroke :A Pilot Randomized Controlled Trial" *Neurorehabil Neural Repair*.2006 Mar-apr:23(3):281-6.
13. Verheyden G, Vereeck L, Truijen S, troch M, Herregodis I, 'Trunk Performance After Stroke And The Relationship With Balance, Gait And Functional Ability' *clin Rehabil*,2006 May,20(5):451-8.
14. dr. akosile department of medical rehabilitation, college of health sciences, nnamdi azikiwe university," pnf is recommended as an effective treatment for functional ambulatory gains in stroke rehabilitation. *journal of the nigeria society of physiotherapy – vols. 18 & 19 (2011)*.
15. dildip khalan, r. m. singaravelan, and subhash m. khatri," pelvic proprioceptive neuromuscular facilitation technique is effective on facilitating trunk movement in hemiparetic stroke patients" *issn: 2279-0853, isbn: 2279-0861.volume 3, issue 6 (jan.-feb. 2013), pp 29-37*.
16. dr. nivruti rgu of health sciences " a comparative study to find the effectiveness of pnf versus conventional trunk exercises to improve trunk control in recovery stage hemiplegic patient" *kshema/e c/335 /2008*.
17. Ruth dickstein, Thomas pillar ,Rachal shaham "stroke rehabilitation, three exercise therapy approaches." *physical Therapy*, volume 66/number 8,August 1986.
18. Susan E Bennet, james I karnes, "neurological disabilities; assesment and management"chapter 4 theoretical approaches to treatment, lippincott-raven publisher 1998.pg 75-76.
19. wang ry effect of PNF on the gait patients with hemiplegia of long and short duration" *phy ther*. 1994 Dec 74(12) 1108-15.

20. Verheyden G, Nieuwboer A, Mertin J, Preger R, Kiekens C and De Weerd W. The trunk impairment scale: a new tool to measure motor impairment of the trunk after stroke. *Clin Rehabil* 2004; 18: 326–334.
21. Verheyden G, Nieuwboer A, Feys H, Thijs V, Vaes K and De Weerd W. Discriminant ability of the Trunk Impairment Scale: a comparison between stroke patients 718 *Clinical Rehabilitation* 25(8) and healthy individuals. *Disabil Rehabil* 2005; 27: 1023–1028.
22. Parlak demir y, yildinm SA. Reliability and validity of trunk control test in patients with neuromuscular diseases. *Physiotherapy pract* -2015 Epub 2014 aug 6.
23. Shu –chen Hsiao, Assessing Reliability and validity of the Chinese version of FIM on stroke patients. Kaohsiung university

