WWW.IJRPR.COM

International Journal of Research Publication and Reviews
Journal homepage: www.ijrpr.com ISSN 2582-7421

TO COMPARE THE EFFECT OF FRENKEL'S EXERCISE VERSUS PROPRIOCEPTIVE NEURO-MUSCULAR FASCLITATION ON CO-ORDINATION IN CEREBRAL PALSY PATIENTS—A RANDOMIZED CONTROLLED TRIAL

Dr Mohd Shoeb[1], Arun Tiwari[2], Sonam Rai[3], Raghvendra Shukla[4], Puneet tripathi[5]

[1] Assistant Professor, Saaii College, Kanpur, India
[2,3,4,5] BPT Students Saaii College, Kanpur, India

ABSTRACT

Cerebral palsy is a static , non- progressive disorder caused by brain insult in the prenatal , perinatal, and postnatal time period , is the major developmental disability affecting fuction in children.Balance control is needed to keep the body appropriately oriented while performing voluntary activity, during external perturbation, and when the support surface or environment changes. Frenkle's exercise aimed at establishing voluntary control of movement by the use of any part of the sensory mechanism which remained intact, notably sight, sound, touch, to compensate for the loss of kinaesthetic sensation. . PNF stretching is a method of flexibility training that can reduce hypertonus, allowing muscles to relax and lengthen and can be applied to patients of all ages.Study designis A Randomised Comparative Experiment Study.Aimof this study is to Compare the Effect of Frenkel's exercise versus PNF on Coordination in Cerebral palsy patients.Objectiveisto evaluate the efficacy of coordination by Frenkel's exercise and PNF.In this study we recruit 40 spastic diplegic cerebral palsy patient, which will be divided into two equal groups.In first group patients we use PNF technique and In second group patient we use frenkel exercises to improve the co-ordination of CP patients. We provide co-ordination training to the CP patient to improve the co-ordination and Improvements were observed by Balance berg scale to measure out the efficacy of above giving techniques to the CP patients.In this, first we use the Balance Berg scale before the exercise and again use this scale after exercise to measure the efficacy and also find what changes occur before and after by using these scale.We provide 6-week exercise program to the patients to check which one is better (PNF technique and Frenkel's exercise) to improve the co-ordination on the CP patient.At the end of exercise program by comparing both scales pre and post score we found that which technique is more effective.This study reveals that the co-ordination can be improved with the Frenkel's and PNF exercises both in patients with cerebral palsy.As per the result, it has been concluded that Frenkel's and PNF exercises both can be used to treat the co-ordination in Cerebral palsy patients.

Keywords: Cerebral Palsy, Spastic diplegia, Co-ordination, Balance control, Frenkel's exercise, Proprioceptive Neuromuscular fascilitation, Berg Balance Scale.

1. INTRODUCTION

The development of human being starts with motor movements that cause neural development that follows birth. Once the development of motor system is done, the ability of maintaining balance in different positions is gained that leads to neuromuscular coordination. [1]

Cerebral palsy (CP), a static, non-progressive disorder caused by brain insult or injury in the prenatal, perinatal, and postnatal time period, is the major developmental disability affecting function in children. It is characterized by the inability to normally control motor functions, and it has the potential to have an effect on the overall development of a child by affecting the child's ability to explore, speak, learn, and become independent. [2]

CP is classified by the physical symptoms observed, based on the predominant type of motor disorder (spasticity, ataxia, dystonia or choreoathetosis) and the anatomic distribution. Spastic CP is characterized by hypertonic skeletal muscle most commonly resulting from lesions to upper motor neurons located in the primary motor cortex. Ataxia most commonly results from damage to the cerebellum. [3]

WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Individuals with spastic diplegic CP were more involved (greater spasticity, less strength) distally at the ankles compared with the knees. [4]

Postural control deficits have been suggested to be a major component of gait disorders in cerebral palsy (CP). [5]

Children with cerebral palsy (CP) have been reported to have various levels of deficits in balance control, which can be described using the relationship between the body's centre of mass (COM) and the centre of pressure (COP). [6]

The term **"balance control"** refers to a multisystem function that strives to keep the body upright while sitting or standing and while changing posture. Balance control is needed to keep the body appropriately oriented while performing voluntary activity, during external perturbation, and when the support surface or environment changes. Faulty balance control mechanisms may contribute to fall-related injuries, restriction of gait patterns, and decreased mobility. These disabilities lead to loss of functional independence and social isolation. [7]

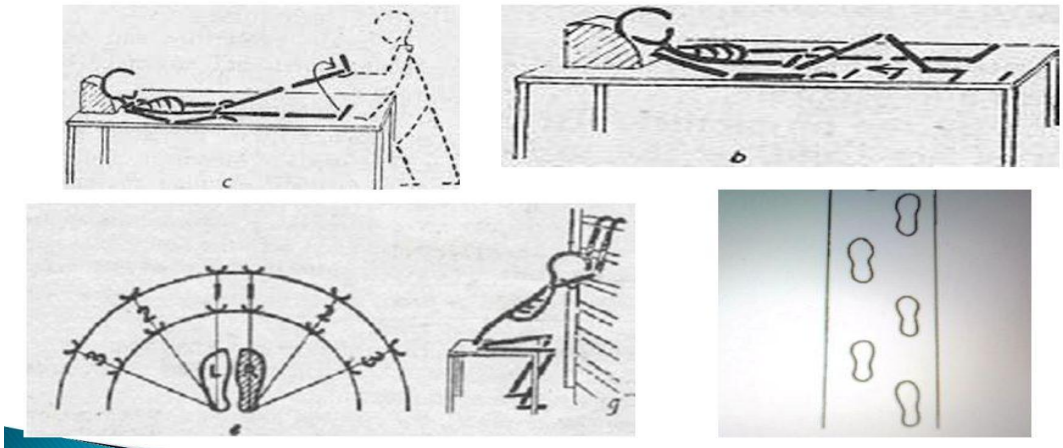
Co-ordination: The correct timing and sequencing of muscle firing combined with the appropriate intensity of muscular contraction leading to the effective initiation, guiding, and grading of movement. It is the basis of smooth , accurate , and efficient movement and occurs at a conscious or automatic level.[8 , 9]

FRENKEL'S EXERCISE: Dr. H.S. Frenkel was medical superintendent of the sanatorium freihof in Switzerland towards the end of the century. He made a special study of tabes dorsalis and devised a method of treating systematic and graduated exercise.

He aimed at establishing voluntary control of movement by the use of any part of the sensory mechanism which remained intact, notably sight, sound; touch, to compensate for the loss of kinaesthetic sensation. The essential being-

- Concentration of attention
- Precision
- Repetition

The ultimate aim is to establish control of movement so that the patient is able and confident in his ability to carry out those activities which are essential for independence in everyday life. [10][11]



PNF: PNF stretching (or proprioceptive muscular facilitation) is one of the most effective forms of flexibility training for increasing range of motion. PNF stretching is a method of flexibility training that can reduce hyper tonus, allowing muscles to relax and lengthen and can be applied to patients of all ages. PNF can be used to supplement daily stretching and these techniques help develop muscular strength and endurance, joint

WWW.IJRPR.COM

International Journal of Research Publication and Reviews
Journal homepage: www.ijrpr.com ISSN 2582-7421

stability, mobility, neuromuscular control and coordination. PNF techniques are as follows: Contract Relax, Hold Relax, Rhythmic Initiation,

TABLE 6.9 Component Motions of PNF Patterns: Upper and Lower Extremities

Joints or Segments	Diagonal 1: Flexion (D_1Flx)	Diagonal 1: Extension (D_1Ext)	Diagonal 2: Flexion (D_2Flx)	Diagonal 2: Extension (D_2Ext)
		UPPER EXTREMITY COMPONENT MOTIONS		
Shoulder	*Flexion-adduction-external rotation*	*Extension-abduction-internal rotation*	*Flexion-abduction-external rotation*	*Extension-adduction-internal rotation*
Scapula	Elevation, abduction, upward rotation	Depression, adduction, downward rotation	Elevation, abduction, upward rotation	Depression, adduction downward rotation
Elbow	Flexion or extension	Flexion or extension	Flexion or extension	Flexion or extension
Forearm	Supination	Pronation	Supination	Pronation
Wrist	Flexion, radial deviation	Extension, ulnar deviation	Extension, radial deviation	Flexion, ulnar deviation
Fingers and thumb	Flexion, adduction	Extension, abduction	Extension, abduction	Flexion, adduction
		LOWER EXTREMITY COMPONENT MOTIONS		
Hip	*Flexion-adduction-external rotation*	*Extension-abduction-internal rotation*	*Flexion-abduction-internal rotation*	*Extension-adduction-external rotation*
Knee	Flexion or extension	Flexion or extension	Flexion or extension	Flexion or extension
Ankle	Dorsiflexion, inversion	Plantarflexion, eversion	Dorsiflexion, eversion	Plantarflexion, inversion
Toes	Extension	Flexion	Extension	Flexion

Rhythmic Stabilization, Slow reversals, Alternating isometrics and Alternating rhythmic stabilization. [12] [13]

2. MATERIAL AND METHODOLOGY

SOURCE OF DATA

- Lala lajpat rai hospital, Kanpur.
- Saaii college of medical science and technology, Kanpur
- Bal Bhawan, Kanpur

INCLUSION CRITERIA

- Ability to maintain a standing position without aid for at least 2 minute.
- Cerebral palsy patients with spastic Diplegia

EXCLUSION CRITERIA

- Uncontrolled epilepsy
- Chorea
- Athetosis
- Vestibular disorder,
- Vertigo,
- Visual disturbance,
- Any orthopedic disease involving lower limb.

WWW.IJRPR.COM

International Journal of Research Publication and Reviews
Journal homepage: www.ijrpr.com ISSN 2582-7421

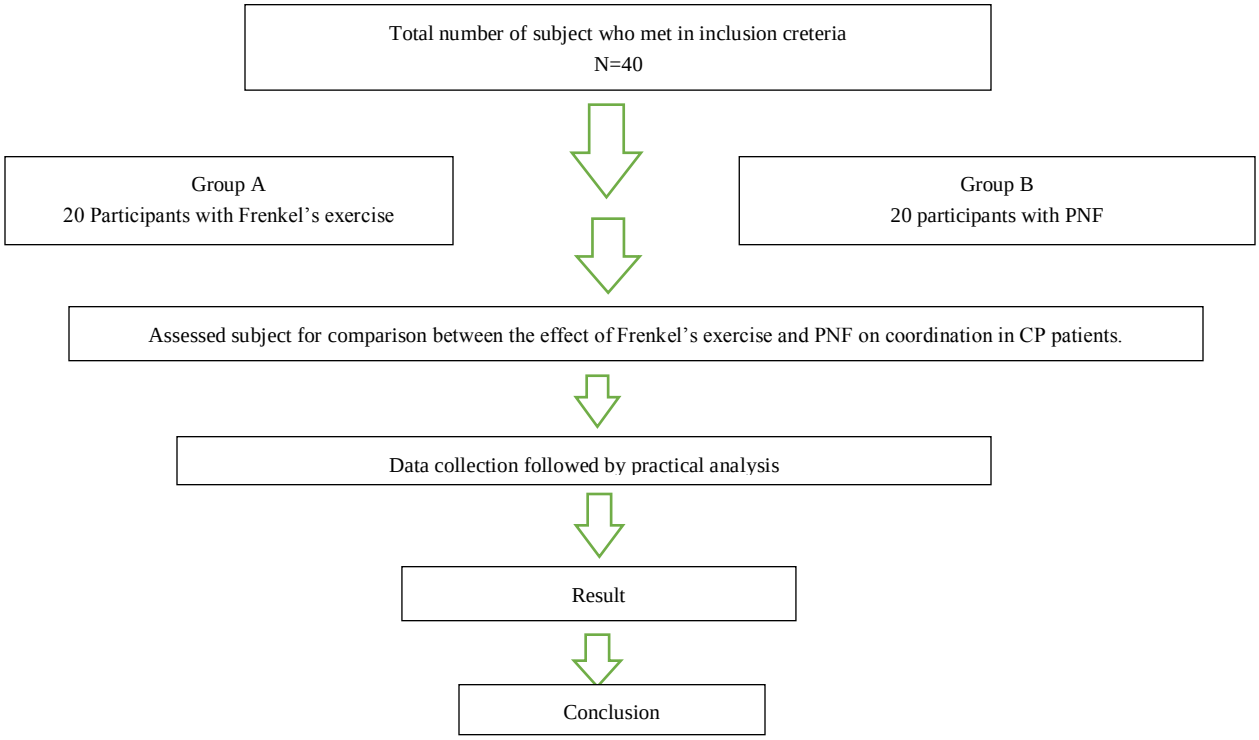
EQUIPMENT AND TOOLS

- Frenkel exercise chart.
- Balance Berg scales.

STUDY TYPE : Randomized control trial
STUDY DESIGN : Comparative study
SAMPLE SIZE : 40 patients
TARGET POPULATION : Spastic Diplegic CP Patients.

3. PROCEDURE

- In this study we recruit 40 spastic diplegic cerebral palsy patients, which will be divided into two equal groups.
- In **first group** patients we use PNF technique and in **second group** patient we use frenkel exercises to improve the co-ordination of CP patients.
- We provide co-ordination training to the CP patient to improve the co-ordination and Improvements were observed by Balance berg scale to measure out the efficacy of above giving techniques to the CP patients.
- In this, first we use the Balance Berg scale before the exercise and again use this scale after exercise to measure the efficacy and also find what changes occur before and after by using these scale.
- We provide **6-week exercise program** to the patients to check which one is better (PNF technique and Frenkel's exercise) to improve the co-ordination on the CP patient.
- At the end of exercise program by comparing both scales pre and post score we found that which technique is more effective.



Flowchart: 1 shows the follow up procedure of research article

WWW.IJRPR.COM

International Journal of Research Publication and Reviews
Journal homepage: www.ijrpr.com ISSN 2582-7421

4. ANALYSIS

Data analysis was done using IBMSPSS Statistics (software package used for statistical analysis 2019 version-26). Descriptive statistics was done to determine the demographic characteristics of the subjects recruited in this study between the groups and the comparison between the groups is done by paired samples t-test.

The average age for Group 1 participants was 6.35 years and the average weight was 14.80 Kg. The participants had an average height of 102.75 cm and correspondingly the average for Group-1 BMI was calculated to be 13.76. This reflects that average participant were in the Under-weight category in Group-1.

Table 1: Showing descriptive data of Group 1: FRENKEL'S

	N	Minimum	Maximum	Mean	Std. Deviation
Age (Years)	20	3	10	6.35	2.346
Weight (Kg)	20	8.00	24.00	14.8000	4.43194
Height (cm)	20	76.00	120.00	102.7500	13.63384
BMI	20	11.40	16.60	13.7600	1.35662

The average age for Group 2 participants was 5.90 years and the average weight was 13.80 Kg. The participants had an average height of 97.75 cm and correspondingly the average for Group-2 BMI was calculated to be 13.93. This reflects that average participant were in the Under-weight category in Group-2.

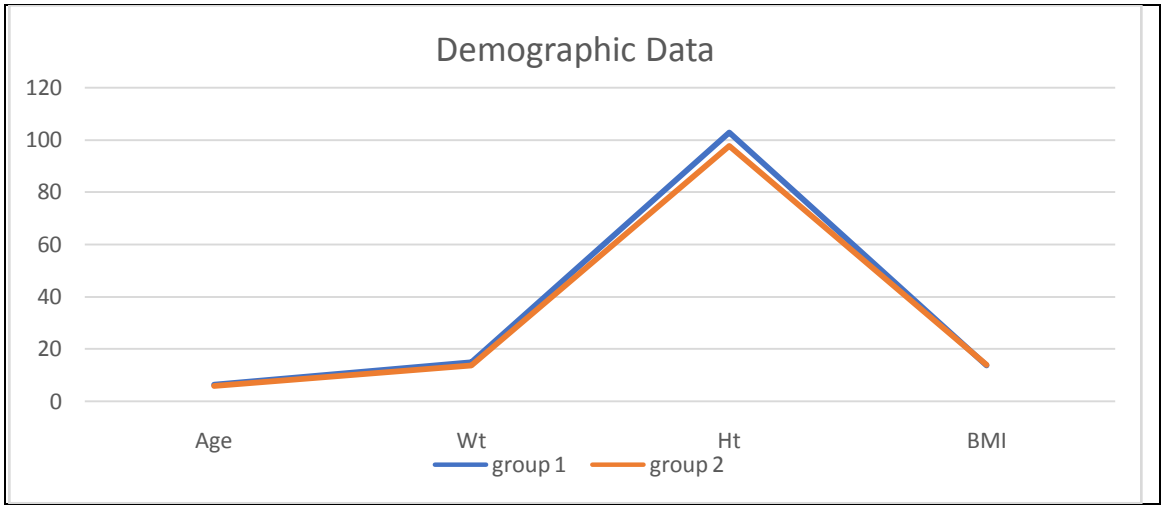
Table 2: Showing descriptive data for Group 2: PNF

	N	Minimum	Maximum	Mean	Std. Deviation
age	20	2	10	5.90	2.532
weight	20	8	22	13.80	4.124
height	20	75	119	97.75	15.075
body mass index	20	12	20	13.93	1.879

WWW.IJRPR.COM

International Journal of Research Publication and Reviews
Journal homepage: www.ijrpr.com ISSN 2582-7421

Graph 1: It shows the variance between Age, Weight, Height and BMI between Group 1 and Group 2.



While analyzing the Group 1 data it has been found that Frenkel's exercise was significant in improving the co-ordination with Mean (±SD) of 2.35 (±0.875). After calculating the t-value was 12.010 with p value of 0.000, which shows that Frenkel's exercises were significant at the 95% confidence level. The table 3 represents the pre and post treatment values of group 1 and group 2 participants and table 4 shows within the group analysis with t value and p value for the group 1 participants.

Table 3: showing the data of Berg Balance Scale rating as pre and post treatment of Group 1 and Group 2.

S. No	GROUP 1		GROUP 2	
	Pre	Post	Pre	Post
1.	18	20	14	16
2.	9	13	15	18
3.	15	18	14	17
4.	11	13	9	11
5.	54	56	11	15
6.	41	45	12	17
7.	48	49	17	20
8.	11	13	22	24
9.	29	32	19	22

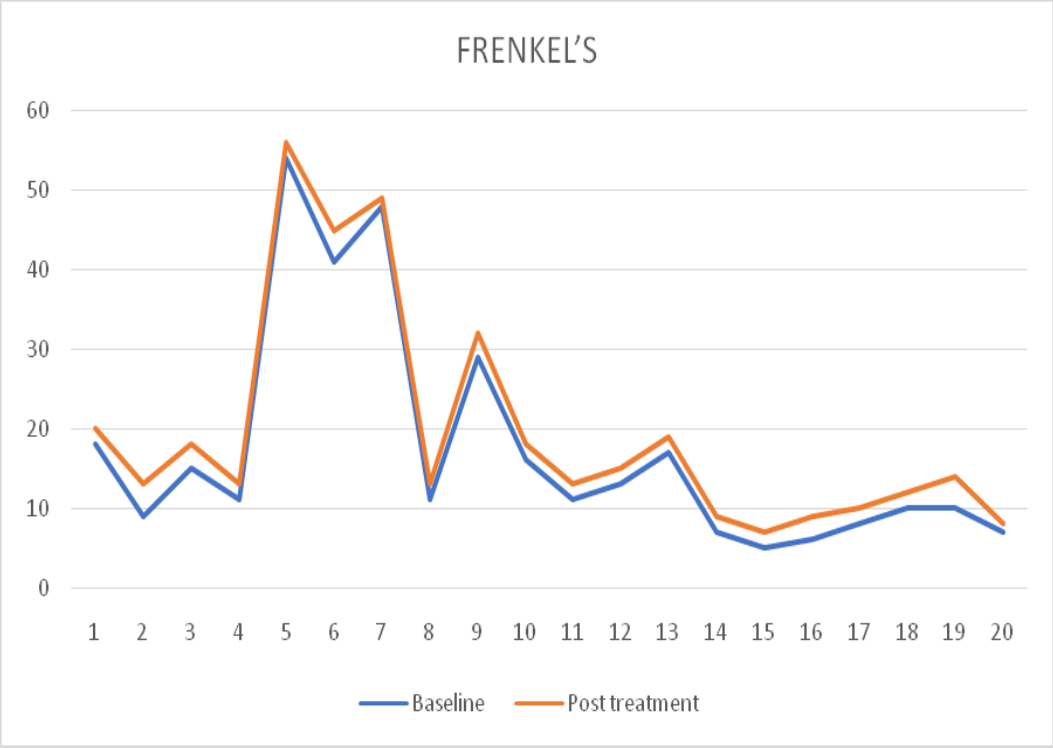
WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

10.	16	18	18	20
11.	11	13	8	9
12.	13	15	11	12
13.	17	19	14	16
14.	7	9	15	17
15.	5	7	16	18
16.	6	9	17	20
17.	8	10	29	32
18.	10	12	16	17
19.	10	14	15	17
20.	7	8	16	18

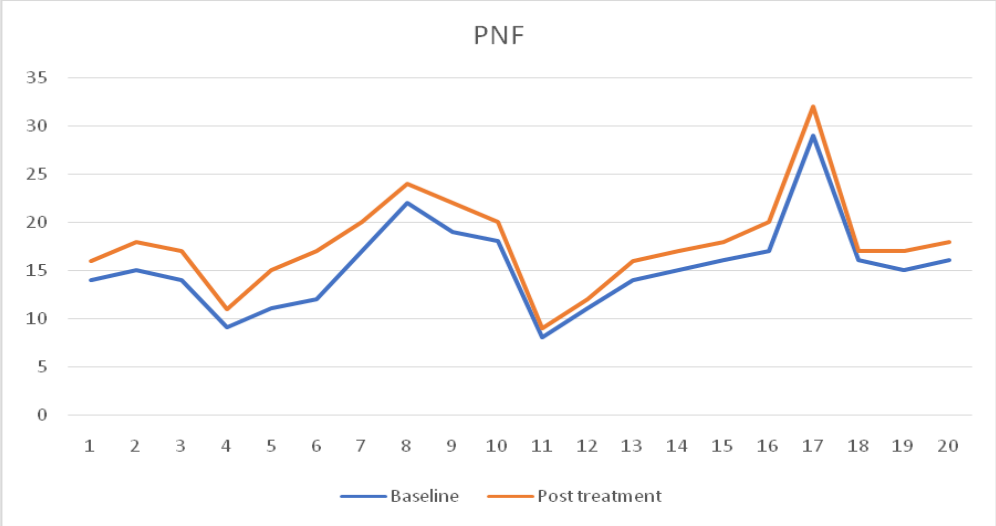
Graph 2: Represents the data of pre and post treatment rating of Bergs Balance Scale rating of Group 1



WWW.IJRPR.COM

International Journal of Research Publication and Reviews
Journal homepage: www.ijrpr.com ISSN 2582-7421

Graph 3: Represents the data of pre and post treatment rating of Bergs Balance Scale rating of Group 2.



While analyzing the Group 2 data it has been found that PNF was significant in improving the co-ordination with Mean (±SD) of 2.40 (±0.995). After calculating the t value was 10.790 and p value was 0.000, which shows that the PNF was significant at the 95% confidence level. The table 3 represents the pre and post treatment values of group 1 and group 2 participants and table 4 shows within the group analysis with t value and p value for the group 1.

Table 4: Showing the pre (baseline) and post-treatment (after 6 weeks) scores for Frenkel's (Group- 1) and PNF (Group-2)

	Mean	**Std. Deviation**	**t-value**	**p value**
Pre- Post (Group 1)	2.35	.875	12.010	.000
Pre- Post (Group 2)	2.40	.995	10.790	.000

The analysis shows that both the treatment groups i.e., Frenkel's and PNF were found effective in improving balance in cerebral palsy patients.A comparison of the mean for both groups was done using paired samples t-testing. The score for the t-value was to be .224 with the p value of .825, hence was found to be non-significant.

Table 4: Showing comparison of the mean between the treatment groups

	t-value	**p-value**

WWW.IJRPR.COM

International Journal of Research Publication and Reviews
Journal homepage: www.ijrpr.com ISSN 2582-7421

Group1- Group2	.224	.825

5. RESULT

This study reveals that the co-ordination can be improved with the Frenkel's and PNF exercises both in patients with cerebral palsy. The significance of the difference in the mean between Pre-Post treatments for the group was checked using a paired sample t-test. For Group-1 the t-value was found to be 12.010 and was significant at the p-value of 0.000 (95% Confidence Interval). Hence the Frenkel's was found to be significant in improving balance in patients with Cerebral palsy. For Group-2 the t-value was found to be 10.790 and was also found to be significant at the p-value of 0.000.Hence the PNF was found to be significant in improving balance in patients with Cerebral palsy.

Thus, both the treatment groups Frenkel'sand PNF were found to be significantly effective in treating co-ordination in Cerebral palsy with 95% confidence interval. Whereas there was no significant difference found between Frenkel's and PNF exercises, hence the null hypothesis is accepted.

6. CONCLUSION

As per the result, it has been concluded that Frenkel's and PNF exercises both can be used to treat the co-ordination in Cerebral palsy patients. While both the treatment protocols were effective, there was slight significant improvement found in group 1 treatment over group 2. Hence it has been concluded that both the treatments can be used for the treatment of balance issue in CP patients.

7. DISCUSSION

The present study was undertaken to determine the efficacy of Frenkel and Proprioceptive neuromuscular fascilitation exercises on co-ordination in cerebral palsy. The study was done on cerebral palsy patients. The pre and post effect of Frenkel and Proprioceptive neuromuscular fascilitation exercises is taken by Berg Balance scale.

The collected data result shows that null hypothesis is rejected and alternate hypothesis is accepted, which means both technique frenkel and PNF is effective in treating co-ordination in cerebral Palsy patient.The study also shows that the average mean of both group concluded that Proprioceptive neuromuscular fascilitation exercises is statistically better than frenkel's exercise.

Dabhi .M, Rakholiya et al suggested that their study concluded that proprioceptive neuromuscular facilitation stretching along with conventional therapy is more effective to improve the balance and gait in spastic diplegic cerebral palsy patients. [14]

Khan .M. S et al suggested that It can be concluded that arm training without using specific balance training could be used as an effective method for improving trunk postural control for children with Spastic diplegic cerebral palsy patient. [15]

Surya, *B M* et al suggested that their study conclusively emphasis that proprioceptive neuromuscular facilitation is more valid for the recovery of functional activities in the patients following spasticity than the stretching. [16]

The current study is very unique in its type, so we can do a lot in future research. This study was conducted for a short period of time and with small sample size; future researchinvolving long time period and larger sample size and compariing of two different interventions is also possible. The result of this study will help the physiotherapist to choose whether which intervention is best for the treatment of coordination in cerebral palsy patient.

WWW.IJRPR.COM

International Journal of Research Publication and Reviews
Journal homepage: www.ijrpr.com ISSN 2582-7421

REFERENCE

- Adnan QA, Rizvi HA, Kumar D, Raja AI, Naqvi R, Ali Y, Comparative Study on the Efficacy of Frenkel's and Balancing Exercise in Patients with Cerebellar Dysfunction. Pak. j. rehabil. 2016;5(2):37-42
- Jones M W,Morgan E.Shelton J E,Thorogoog C, Cerebral palsy : introduction and diagnosis (part I),Journal of Pediatric Health care 21 (3), 146-152,2007
- Williams, J., Hyde, C. & Spittle, A. Developmental Coordination Disorder and Cerebral Palsy: Is There a Continuum?. Curr Dev Disord Rep 1, 118–124 (2014). https://doi.org/10.1007/s40474-014-0009-3
- R.A.Sandy ,Engsberg J.R,Relation between spasticity and strength in individuals with spastic diplegic cerebral palsy, Developmental Medicine and Child Neurology(13 feb. 2007),https://doi.org/10.1111/j.1469-8749.2002.tb00778.x
- Rose.J, Wolff.D.R, Jones.V.K,Bloch.D.A,Oehlert. J.W, Gamble.J.G, Postural Balance In Children with Cerebral Palsy, Developmental Medicine and Child Neurology,13 Feb 2007
- Chu-Fen Chang, Ting-Ming Wang, Wei-Ching Lo, Tung-Wu Lu, Shih-Wun Hong ,Balance Contral During Level Walking In Children With Spastic Diplegic Cerebral Palsy,Biomedical Engineering: Applications, Basis and Communications ,Vol. 23, No. 06, pp. 509-517 (2011).
- Rinalduzzi . S,Trompetto .C,Marinelli .L, Alibardi .A , Missori . P, Fattapposta. F, Pierelli .F , and Curra . A,Balance Dysfunction in Parkinson's Disease, Biomed Research International (2015), Volume 2015 Article ID 434683,
- Schmidt, RA,and Lee, TD :Motor Control and Learning : A Behavioral Emphasis, ed 3. Human Kinetics Pub, Champaign, IL, 1999.
- Schmiz , TJ: Coordination assessment. In O'Sullivan , SB and Schmitz, TJ: Physical Rehabilitation : Assessment and treatment , ed 4. FA Davis, Philadelphia, 2001, p 157.
- The Principles of Exercise Therapy, M Dena Gardiner, Fourth Edition (PB 2005), Frenkel Exercise (page no. 240-241)
- The Principles of Exercise Therapy, M Dena Gardiner, Fourth Edition (PB 2005), Frenkel Exercise (page no. 242)
- Victoria. G. D, Carmen. E V, Alexandru. S, Antoanela. O, Florin. C, Daniel. D, The PNF (Proprioceptive Neuromuscular Facilitation) Stretching Technique - A Brief Review, Science, Movement and health, Vol.III, September 2013, 13(2),623-628.
- K. Carolyn, Colby, Therapeutic Exercise Foundations and Techniques, 5th Edition, 2007, PNF (page no:195)
- [14] Adnan QA, Rizvi HA, Kumar D, Raja AI, Naqvi R, Ali Y. Comparative Study on the Efficacy of Frenkel's and Balancing Exercise in Patients with Cerebellar Dysfunction. Pak. j. rehabil. 2016;5(2):37-42
- Dabhi .M, Rakholiya . S, A Study to Evaluate the Effect of Proprioceptive Neuromuscular Facilitation Stretching on Balance and Gait in Spastic Diplegic Cerebral Palsy: An Interventional Study, Indian Journal of Public Health Research & Development, July 2020, Vol. 11, No. 7
- Khan .M. S, Pettnaik . M and Dr. Mohanty . P,Effect of Arm Movement Without Specific Balance Control Training to Improve Trunk Postural Control in Children with Spastic Diplegic Cerebral Palsy, Asian Journal of Science and Technology Vol.06, Issue, 10, pp. 1907-1913, October, 2015