

# Effect of Proprioceptive Neuromuscular Facilitation on Basic Motor Skills in Children with Down Syndrome

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## ABSTRACT

**Objective:** Trisomy 21 is a genetic disorder occurs in 92% individuals. Majority of the skeletal abnormalities are associated with it. Therefore the study had been planned with an aim to determine the effect of PNF on basic motor skills in child Down syndrome children.

**Methods:** The study design was quasi-experimental. 22 children were included on inclusion & exclusion criteria. The data was collected from Rising Sun Institute for Special Children Lahore Group A was treated with conventional physical therapy whereas Group B were treated with PNF technique and conventional physical therapy. Pre-assessment was done by using GMFM. Each subject received 36 treatment sessions with 03 sessions per week. The session continued for 30 minutes for both groups. Post treatment reading for Gross Motor Function Measure was recorded after the end of 12 weeks. The collected data analyzed by using Statistical Package for Social Software (SPSS).

**Results:** It showed that across the group comparison shows both treatments which are applied to both groups shows good results as their mean difference values show it and their P value are not significant. Results also showed that within the group comparison PNF has better results on group B patients as per their mean difference values show it and their p values are significant.

**Conclusion:** The study concluded that the PNF technique has better effect in Down syndrome children as compared to conventional physical therapy treatment in children on gross motor skills like standing, walking, running jumping

**Keywords:** Down syndrome (DS), Proprioceptive Neuromuscular Facilitation (PNF), Gross Motor Function Measure (GMFM).

## INTRODUCTION

Down syndrome (DS), is the most frequent and best-known chromosomal condition and is also known as trisomy 21. The etiology of this genetic condition in 92% of the cases is chromosomal (chromosome 21) non-disjunction during meiosis otherwise translocation or <sup>1, 2</sup>. Around 0.1% of live births are thought to have range of co-morbidities that can affect all of the body's systems as well as the nervous system<sup>3</sup>. Cognitive difficulties, unusual facial features, low stature, and hypotonia are frequent traits. Common characteristics include cognitive impairments, distinctive facial features, short stature, and hypotonia. Along with low muscle tone, ligamentous laxity, and excessive flexibility, the natural history of people with DS frequently includes delays in gross motor development as well as the emergence of abnormal secondary patterns of alignment and movement at the foot, ankle, knee, and hip <sup>1</sup>. The frequency of DS at birth varies significantly across industrialised and developing nations. The birth prevalence varies, even within industrialised nations, according to the mean maternal age, the practise of antenatal DS diagnosis, and the decision to terminate affected pregnancies. In the United States, 1 in 733 live births have DS, compared to 1 in 449 in the UAE and 1 in 300 in Pakistan. The primary contributing factor to the increased incidence of DS in less developed nations like Pakistan and the United Arab Emirates appears to be older maternal age at conception <sup>2</sup>. The early transformation from a limited movement repertoire to the sophisticated control of complex motor actions is challenging for infants diagnosed with Down syndrome (DS). Infants with DS reach motor milestones more slowly than average. Given that motor development has been linked to social, cognitive, and language development, these delays are particularly alarming <sup>3</sup>. Previous literature have been reported with NDT intervention, conventional physical therapy treatment on gross motor skills in Down syndrome <sup>4</sup>. Rebound therapy and its effects on the muscle is physiologically result is the decrease of tone in the neurological impairments. <sup>5</sup> In a Scientific Journal of Education, Sports, and Health written that the PNF method were established for enhancing the muscle working for power, regularized mobility and muscle strength.<sup>6</sup>

The literature gap is present on motor developmental skills by using PNF technique in Down's syndrome because previous studies have been reported with NDT intervention, conventional physical therapy treatment on gross motor skills in down syndrome. There is no combine comparison of PNF with Conventional physical therapy treatment. Therefore this study is conducted to determine the effects of proprioceptive neuromuscular facilitation on basic motor skills in children with Down syndrome.

## MATERIAL & METHOD

A Quasi Experimental Trial study design was used. The data was collected from Rising Sun Institute for Special Children (Mugulpura and DHA campus). This was conducted in 4 months after the approval of synopsis. Twenty (22) Sample size (11 in each group) was calculated by G power analysis software version 3.1.9.2 by taking effect size 1.55 from previous research with 0.80 power and  $\alpha$  0.05 <sup>7</sup>. Non-probability Convenience sampling technique was used. The study enrolled diagnosed down syndrome children with age between 3-7 years and scoring of Gross Motor Function Measure on first three dimensions (lying-rolling, sitting and crawling) out of 5 dimensions and Down syndrome children with stable neurological conditions. <sup>8</sup>.The participants with Red flags signs (tumor, fracture, metabolic disease, recurrent dislocations, subluxation, visual impairments and cardio-respiratory alteration), Down syndrome's children with anatomical deficits, not fulfilling the scoring of Gross Motor Function Measure on first three dimensions (lying-rolling, sitting and crawling) out of 5 dimensions, no autism and clinically undiagnosed were excluded.

The outcome was measured using Gross Motor Function Measure (GMFM-88) The scoring key is meant to be general guideline. However, most of the items have specific descriptors for each score. The 0 means doesn't initiate 1 means initiate. 2 means partially complete and 3 means complete. There are five levels in this tool. These levels are about milestones e.g.; Level 1 is for lying and rolling, level 2 is for sitting, Level 3 is for crawling and kneeling, Level 4 is for standing and level 5 is for walking.<sup>9</sup>. The allocation of participants was done by alternate way method that 1st patient in Group A and 2nd patient in group B and so on. All 22 members were given a total of 36 treatment trials for 12 weeks,

comprising of 03 treatments per week. The session was continued for 30 minutes for both groups. The group A received Conventional physical therapy treatment includes mattress activities, gym ball activities and trampoline activities While group B received PNF technique with conventional physical therapy treatment). Gym ball activities included superman position, hand crawls and trunk extension were done with 5 reps within 5 mints<sup>10</sup> Mattress activities included bridging for 5 reps for 5mints and crook lying in sitting hold for 2mints and trampoline activities 10jumps within 8mints<sup>11</sup> Proprioceptive Neuromuscular Facilitation technique in which rhythmic stabilization was done with

high kneeling and Unilateral high kneeling for 11 mint.11 reps within 11mints.<sup>8</sup>

## RESULTS

Results showed that across the group comparison shows both treatments which are applied to both groups shows good results as per their mean difference values show it and their P value are not significant. Results also showed that within the group comparison PNF has better results on group B patients as per their mean difference values show it and their p-values are significant

Table # 1: Comparison of study variables across the group and within group

Variable	Study Groups		Mean difference	P-Values
	Conventional treatment (A)	PNF(B)		
	Mean $\pm$ SD	Mean $\pm$ SD		
Age				
Pre standing	75.91 $\pm$ 15.50	77.09 $\pm$ 18.47	1.18	0.870
Post standing	78.73 $\pm$ 14.83	85.73 $\pm$ 12.82	7	0.250
Mean difference	2.81	8.63		
P-value	0.01	0.010		
Pre walking, running and jumping	52.00 $\pm$ 14.38	49.91 $\pm$ 11.90	2.09	0.710
Post walking, running and jumping	54.55 $\pm$ 13.06	68.36 $\pm$ 13.06	13.81	0.020
Mean difference	2.54	18.45		
P-value	0.001	0.010		
Pretest GMFM total score	85.36 $\pm$ 5.90	85.00 $\pm$ 6.19	0.36	0.880
Posttest GMFM total score	86.64 $\pm$ 5.46	90.73 $\pm$ 4.90	4.09	0.790
Mean difference	1.27	5.72		
P-value	0.001	0.001		

GMFM; Gross motor function measure

The table no. 1 shows that the mean of the age in study group A was 5.09 $\pm$ 1.13 and the mean of age in study group B was 4.90 $\pm$ 0.94. The maximum age in group A was 7 and minimum age was 4. The maximum age in group B was 6 and minimum age was 3. Within the group comparison GMFM score is improved in group B and showed significant difference ( $p \leq 0.05$ ). Across the group comparison both treatments which applied to group A and group B shows good results as their mean values are showing this but their p-values are nit significant

## DISCUSSION

Major goal of rehabilitation in Down syndrome is enhancement of functional ability by improving the motor skills either gross or fine. Early in life, the emphasis is on improving motor abilities and preventing the emergence of maladaptive compensatory movement patterns, depending on individual presentation. The main purpose of the GMFM-88 scale was to assess changes in gross motor function. Its ability to produce outcome scores that represent how much of an activity a kid can complete rather than how well the activity is performed gives this tool its distinctiveness<sup>12</sup>. Deigo et al, 2004<sup>13</sup> report Massage therapy two times/week for 30 min in 2 months were given to patients. Measuring Instrument for motor development and muscle tone was Developmental programming for infants and young children scale. Significant gains in the development of gross and fine motor skills were seen as a result of the intervention. In addition, the tone of the limbs also improved (less hypotonia) significantly. But Massage therapy is still debatable because some researches did not support massage therapy in Down Syndrome children. The current study PNF has more impact in developing of gross motor skills in down syndrome children.<sup>14</sup>. Current study concludes that the PNF technique has better effects in down syndrome children as compared to conventional physical therapy treatment in down syndrome children on gross motor skills like standing, walking, running and jumping. Chelms et al, 2010<sup>15</sup>, they studied that proprioceptive neuromuscular-facilitation techniques with physical therapy exercises were used for improving the muscle strength, the stability, the controlled mobility and ability. The current study revealed that literature gap is present as there is no specific literature in comparison with conventional physical therapy and

PNF. Aly & Abonour, 2018<sup>16</sup> reported the results of RCT with Interventional group with giving treatment of conventional PT programme and core-stability exercises and Three times/ weeks 45–60 min 8 weeks Balance (postural stability) -Biodex balance system. After the intervention, the IG participants' anteroposterior, mediolateral, and general stability indices were significantly lower than those of the CG participants. The three stability indices significantly decreased in both groups post-treatment compared to pre-treatment. González-Agüero et al. 2010<sup>17</sup> did experiment and gave Conditioning and jumping training to interventional group. The sessions were given to participants two times/weeks 25 min in 21 weeks Bone mineral density, pubertal development and anthropometric measurements –Control were given no intervention. Increases were seen in the IG's total and hip bone mineral density as well as total lean mass following the intervention. For total lean mass, it was discovered that time and exercise interacted. Increases in total lean mass, height, and Tanner's stage contributed about 60% to the intervention group's rise in mineral bone total density. This current study revealed that PNF with trampoline jumps helps the participants to achieve the gross motor skills.<sup>18</sup> Results of current study found that PNF has better effects and better posttest values on Gross Motor Function Measure Scale in down syndrome children. Shields et al. 2013<sup>19</sup> did Progressive resistance training in Interventional group in 2 times/week. Control group were given Social activities 1 time/week in 90 mints. Treatment duration was 45–60 min in 10 weeks for interventional group. Results were measured using a weighted box stacking test and a weighted pail carry test. Muscular strength and physical activity were also taken into account. For the purpose of carrying out labour tasks, there was no distinction between the groups. In comparison to the control group, the intervention group had greater muscle strength in both the upper and lower limbs at week 11. Only the lower leg muscles' strength grew at week 24. At week 24, but not at week 11, the IG had considerably higher levels of physical activity.

The study has shown that the PNF technique is more effective in group B as compared to conventional physical therapy treatment in group A in developing the gross motor skills like standing, walking, running, jumping in Down syndrome children. Harris (1981) attempted to lessen the anticipated loss in motor and

mental development by using a neurodevelopmental treatment (NDT) strategy on newborns with DS. Joint approximations, bouncing, resistance to movement to build tone, promotion of righting, equilibrium, and protective responses, and training of suitable movement patterns like rolling, reciprocal crawling, and getting in and out of a sitting position were some of the NDT approaches used.<sup>19</sup> According to her study's findings, there were no appreciable posttest changes between the experimental group and the control group on the Peabody Developmental Motor Scales or the Bayley Scales of Infant Development. Harris did point out that the experimental group greatly outperformed the control group in terms of achieving each patient's treatment goals and movement quality.<sup>19</sup>

Early physical therapy emphasizes improving motor control and coordination to help children reach developmental goals. Regular physiotherapy is often stopped until walking is established (which is frequently delayed by an average of 12–18 months). However, multiple findings in the literature indicate that children with DS start to have orthopedic issues in their early years and would benefit from specialized biomechanical testing and physiotherapy treatment.<sup>20</sup>

## CONCLUSION

The study concludes that the PNF technique has better effect in Down syndrome children as compared to conventional physical therapy treatment in down syndrome children on gross motor skills like standing, walking, running and jumping

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