

Effect of Specific Reflex Integration Approach on Primitive Reflexes in Spastic Cerebral Palsy Children

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ABSTRACT

Background: The retained PRs may provide the earliest indication of cerebral palsy with fixed motor deficit consistent with long before any discrete motor signs are present which needs to be integrated for their motor development. Various primitive reflexes are being assessed in CP children but are not treated on basis of the retained reflexes. Hence, the aim was to find the effect of specific reflex integration approach on primitive reflexes in children with spastic cerebral palsy

Methodology: This study was carried out in pediatric physiotherapy department of Krishna hospital, Karad. 40 children (21 males, 19 females) diagnosed with spastic cerebral palsy with the age group 12 to 24 months were included in this study. Six Primitive reflexes were assessed clinically; HINE score were used for clinical neurological examination along with Motor Milestones to explore their motor development. Specific reflex integration approaches were given to the subjects for 4times/week for 6 weeks.

Results: High prevalence of palmar reflex followed by ATNR was observed among all the CP children with 80% and 67% respectively. Statistical analysis was done using paired t test. The Hammersmith Infant Neurological Examination showed significant improvement with the $P < 0.0001$.

Conclusion: The present study provides the evidence to support that there is association of retained primitive reflexes and motor development and supports the use of specific reflex integration approach to integrate primitive reflexes in children with spastic cerebral palsy.

Key Words: Cerebral Palsy, Motor Milestones, Primitive reflexes, Reflex integration, ATNR, Righting reflex.

INTRODUCTION

Cerebral palsy (CP) is defined as a group of permanent disorders of the movement and posture development, leading to activity limitation, which are attributed as non-progressive disturbance that have occurred in the developing fetal or infant brain. The problems associated with

CP are motor disturbances of sensation, perception, cognition, communication and behavior, and by secondary musculoskeletal problems. Secondary Musculoskeletal problems of children with cerebral palsy are spinal deformity, muscle or tendon contracture, shorting, bony malformation, hip dislocations which leads to their

functional deterioration. ^[1] The incidence of CP out of 1000 live birth is 2 to 2.5. ^[2]

Primitive reflexes are the movement patterns which are automatic and they commence during pregnancy and are fully present at birth in term infants. They serve as natural reactions that are responsible for a developmental process which releases a neural circuit for a specific function. It is necessary that primitive reflexes should get integrate for reflex reactions to allow development of natural motor action. ^[3-4] These reflexes are normally present at the time of birth or develop within first weeks of life. Children with normal development of CNS can easily make progress from these primitive reflex patterns as more purposeful action can take their place. As the CNS maturation takes place these reflexes are modified into complex postural reaction and does not appear in the pure form. In infants whose CNS development is impaired, the primitive reflexes are persistent, and may be exaggerated and stereotyped. Deficient maturation of postural mechanism results in such infants adhering to these primitive motor patterns. When used to excess, the patterns become even more inefficient for achieving more complex action. The efforts lead to increase hypertonicity, which in turn makes the postural adaptation even more dysfunctional. ^[5] The primitive reflexes which are considered in diagnostic signs for neurological abnormalities are Moro's, palmar grasp, Rooting, Spinal Gallant, Symmetrical tonic neck reflex and Asymmetrical tonic neck reflex. In cerebral palsy there is persistence of the primitive reflexes which leads to impairment in their motor function. ^[6] Primitive reflexes have been an ignored parameter in treatment of patients with cerebral palsy. Various primitive reflexes are being assessed in CP children but are not treated on basis of the retained reflexes which should have being integrated for their age group. Many physical therapy interventions such as NDT, Sensory integration are used as the choice for treating children with cerebral palsy but there is limited literature which uses specific

reflex integration approach to treat specific reflex which leads to developmental delay in children with cerebral palsy. There are many treatment approaches for cerebral palsy which focuses on balance, trunk control, spasticity, oromotor dysfunction etc. but there is lack of literature which mainly deals with integration of particular reflexes. There is limited study on reflex integration approach in children with Cerebral palsy. Hence we need to evaluate the effect of specific reflex integration approach in spastic CP children.

MATERIALS AND METHODOLOGY

The participants in this study were recruited through consecutive sampling technique, from physiotherapy department of Krishna hospital, Karad. Prior to the commencement of this study institutional ethical committee approval was obtained from KIMSDU. Detailed information about the study was given to guardian of the participants. Written informed consent was obtained from caregivers. 40 subjects (21 Males, 19 Females) diagnosed with spastic cerebral palsy by pediatrician were included depending upon inclusion criteria Cerebral palsy diagnosed by a pediatrician, age between 12 months to 24 months. Exclusion criteria were children with seizure disorder, children with hearing or vision impairment, children with inborn neurological malformation, Children with musculoskeletal and cardio-respiratory disorder. Children with persistent primitive reflexes, both gender. Children were assessed clinically for 6 primitive reflexes i.e. Moro's, Palmar, Spinal Gallant, ATNR, STNR and Body on body righting reflex. 8 Motor milestone were assessed for Head control, Rolling, Voluntary Grasp, Ability to kick, Sitting, Crawling, Standing and Walking based on Hammersmith infant neurological examination second part which consisted motor milestones. HINE was used to assess the neurological status pre and post interventions. Therapeutic approaches were planned depending upon the persistent reflexes. The duration of intervention was

for 4 times per week for 6 weeks, the treatment duration was for 45 minutes per session including 10 minutes warmup and 5 minutes cool down and 30 minutes for the treatment strategies. The warm-up period included stretching of spastic muscle like Tendo-Achilles, hamstring, quadriceps, biceps brachialis. Treatment for specific reflexes to be integrated:

Moro Reflex- The treatment strategies included Vestibular Training (Swiss ball, swing) Vestibular stimulation was given on vestibular ball by slow rhythmic rocking movements, on swing held by the therapist for 15 minutes, Trunk Control exercises (Swiss ball, wedge), Swiss ball weight shifts, Swiss ball prone weight bearing, Visual stimulation (Lights of different color, black and white checker board) Started the light behind an object to be used the child will stare at that object, the object used were contrast, bright objects, light reflecting object (low cost objects were used) in a darkroom. Moved the object through the baby's field of vision (10-12 minutes 4 times/week twice a day)

Palmar Reflex- The treatment strategies included Sensory stimulation (different texture, pressure, taping brushing) Different kind of sensory stimulation were given to the participants like stroking with different texture like cotton, rough textures, silk cloth 2 times/second for 10 times repeated 3 to 5 times and 30 second rest period between strokes from distal to proximal of hand. Weight bearing on hands in different positions, Bimanual hand training (transfer of object from one hand to another) **Spinal**

Gallant Reflex- the treatment strategies included Movement transitions (supine to sit), Sensory stimulation (Stroking, brushing, tapping), Proprioceptive training (Joint compressions) **Asymmetrical Tonic Neck Reflex-** The treatment strategies included Movement Transitions (supine-side-prone-supine, prone head lift, quadruped), Trunk control exercises (Swiss ball), Balance training (balance board, ball), Vestibular stimulation, Visual stimulation. **Symmetrical Tonic Neck Reflex-** The

treatment strategies included Movement transitions (wedge or vestibular ball), Balance training and visual training. Body on body righting reflex- Movement transitions (Supine to side lying, side lying to prone, prone on elbow), Visual Tracking.

Statistical Analysis

Statistical analysis was done using Paired 't' test for analysis of Hammersmith Infant Neurological Examination within the group. Statistical analysis was done using instat software. The data were collected according to demographic variables like age, birth weight, gender, Primitive reflexes and motor milestone which was qualitative data.

RESULTS

A total of 40 children diagnosed with Spastic CP participated in the study, Out of them 21 (52%) were males and 19 (48%) were females. The ages ranged from 12 to 24 months the mean age was 1.63 ± 0.34 months. The birth weight was divided into more than 2500g, between 1500-2499g and less than 1500g the mean birth weight was 2.08 ± 0.46 . The primitive reflexes were assessed clinically and graded as Persistent, Integrated or Absent. Palmar reflex showed highest prevalence among the subjects with 32 (62%) retaining this reflex followed by ATNR and STNR in 67%, Gallant reflexes were retained in 62%, Body on body reflex was present in 63% the Moro's reflex showed the pattern of lower persistence 21(52%), Figure 1. After intervention there was integration of this reflexes to a greater extent except for body on body which showed increase in the no of subject presenting with this reflex. ATNR showed a greater degree of integration followed by Moro's reflex Figure 2. Motor Milestone was observed and interpreted as Achieved or Not achieved, after the therapy subject achieved the motor milestone appropriate to their age but walking was achieved by only 23% Table 1. Pre-interventional Hammersmith Infant Neurological Examination showed the Mean 35.47 ± 9.27 and post-intervention of HINE showed the Mean of 46.62 ± 10.83 . The

intra-group analysis was done using Paired 't' test. The post- interventional analysis showed extremely significant difference

with P value of <0.0001 and t value of 9.221.

Table 1. Comparison between pre and post intervention HINE score.

HINE (Score)	PRE-TEST	POST-TEST
Mean $\pm$ SD	35.47 $\pm$ 9.27	46.62 $\pm$ 10.83
Median	36.50	47.50
P value	<0.0001	
t value	9.221	
Inference	Extremely significant	

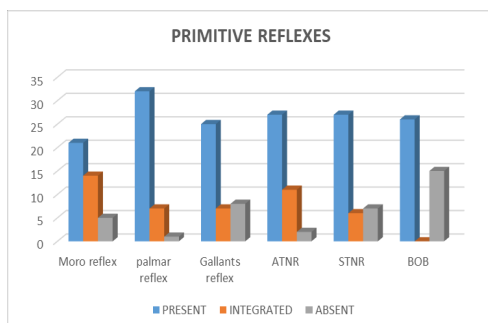


Figure-1 showing pre-interventional Primitive reflexes

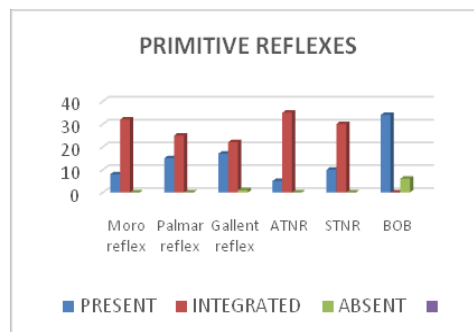


Figure-2 showing post-interventional Primitive reflexes

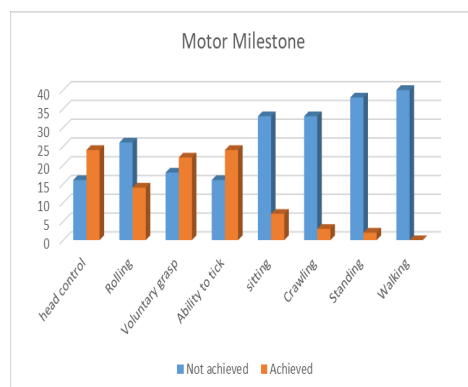


Figure-3 Showing pre-interventional achievement of motor milestones

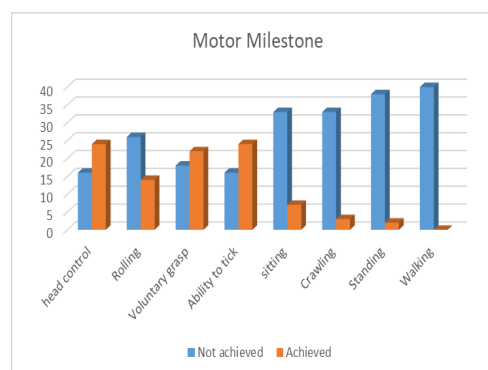


Figure-4 Showing post-interventional achievement of motor milestones

DISCUSSION

Cerebral palsy (CP) is an umbrella term that are group of non-progressive and often changing, motor impairment syndromes secondary to lesion or anomalies of the brain arising in the early stages of development. [7] Primitive reflexes are complex, automatic movement patterns which are brainstem-mediated that starts around 25th week of gestation and are present fully at birth in terms infants and integrates till 1st year of life, when cortical inhibition emerges and when voluntary motor activity takes over. [8-10] When this

primitive reflexes is present beyond the age where they should get integrated it poses some neurological abnormalities.

In this study 40 subjects diagnosed with cerebral palsy were included with the age group between 1 to 2 years of age with the mean age of 1.6325 $\pm$ 0.3489 and with mean Birth weight of 2.0825 which was considered to be low birth weight. The study finding correlates with the available literature that there is prevalence of CP in low birth weight infants. [11]

Various primitive reflex were assessed which are persistent in children

with cerebral palsy children mainly Moro reflex, Palmar reflex, Spinal gallant reflex, Asymmetrical tonic neck reflex, Symmetrical tonic neck reflex and Righting reflex. ^[12] Out of all the reflex assessed there was high prevalence of Palmar reflex followed by ATNR among all the CP children.

Persistence of Moro's reflex can lead to various neurological abnormalities in the children like Vestibular hypersensitivity, Poor eye hand coordination, balance insecurities and visual hypersensitivity. After therapy there was integration of this reflex in CP children. Vestibular stimulation has various effects on the development of brain. This can probably be because of the stimulation of vestibular sensors which are present in the inner ear, and also due to development of sense of position in environment. Visual stimulation also strengthens their neural pathway and facilitates their visual development. ^[13]

Persistent of palmar grasp beyond 3-4 months of age can causes difficulty in releasing object, difficulty in fine motor activity and sensory hypersensitivity. Integration of palmar reflex was seen after the treatment which can be due to sensory stimulation which leads to normalization of muscle tone and specific motor response. Practice of sensory-motor response leads to motor learning. Static weight bearing causes reduced spasticity and improves hand function. ^[14]

Persistence of spinal gallant reflex leads to difficulties like motor function delay, difficulty in sitting, and sensory hypersensitivity. The reflex was integrated after the treatment and the possible reason could be that sensory stimulation provides controlled sensory input mainly proprioceptive, tactile and vestibular system which helps the child to make an adaptive response that integrates the sensations and enhances the organization of brain. Movement therapy and its practice lead to motor learning which results in changes in the central nervous system and allows for production of new motor skills.

Problems associated with the persistence of ATNR are inability in rolling, crawling, balance problem, poor hand-eye coordination, and vestibular issues. Movement transitions like supine to side and side to prone causes dissociated position of head and baby's arm, and with integration of ATNR it is possible for the infant to develop head control in prone position. The possible reason for disappearance of these reflexes can be that sensory- integration causes integration of primitive reflexes, improve balance and improve eye-hand co-ordination. ^[15]

Retained Symmetrical tonic neck reflex causes poor static and active posture, difficulty in crawling, vision problem, difficulty in cross legged sitting. Movement transition mainly prone on elbow, quadruped stretches the upper trunk muscles, provides scapular and Glenohumeral stability gives better visibility of the environment and permits weight shifting necessary to inhibit STNR according to Rood's approach. Righting reflexes were present only in 63% out of all the participants. Infants with under developed labyrinthine- head righting reflexes presents with balance and coordination issues, have trouble with vestibular and proprioceptive system. Vestibular stimulation causes motor and reflex changes. Rolling activates the neck and extraocular muscles all these changes may lead to development of body on body righting reaction in spastic CP children. It can be assumed that specific reflex integration approach causes disappearance of primitive reflexes as it have an positive effect on brain processing and motor response.

Motor milestones were assessed in these subjects with spastic cerebral palsy. These children had significant motor delay from neck control to walking this can be because of Retained primitive reflexes which negatively correlates with the Cozens Bankole Aiyejusunle who states that there is no significant association of retained PRs and Motor development in CP children. ^[16] This possible reason for this could be that

they assessed 15 PRs together and found association with motor milestone from sitting to walking where as in this study only 6 reflexes were assessed and correlated with 8 motor milestone starting from head control to walking and the age group in their study was 18-84 months which was high compared to this study. None of the participants in this study have achieved walking before intervention. Dynamic system theory, the concept of motor learning places less emphasis on the central nervous system by viewing movement as interaction between person, task and the environment according to Jill GZwicker, Susan R Harris. ^[17] The improvement in gross motor function can be explained by above concept of motor learning theory. There was improvement in the motor development this can be due integration of the PRs because of vestibular stimulation given during therapy which causes excitation of antigravity muscle and reciprocal inhibition of flexor muscles and maintenance of muscle tone. ^[18] Vestibular stimulation helps in achieving normal motor development and co-ordination. ^[19] In this study treatment consisted of sensory stimulation which is effective for development of skill and movement. ^[20] All the approaches used during the treatment session have resulted in motor changes through motor learning.

The Hammersmith infant neurologic examination was done in children with spastic CP children who showed significant improvement in the HINE score after the treatment with the p value <0.0001. The possible reason could have been that vestibular stimulation causes normalization of muscle tone and there by improves posture in children with cerebral palsy. Sensory stimulation causes normalization of muscle tone which can cause increase in the score of HINE. The study limitations should be taken into consideration like only spastic cerebral palsy children were included, there was no control group and a primitive reflex grading system was not available.

CONCLUSION

This study provides the evidence to supports the use of specific reflex integration approach to integrate primitive reflexes in children with spastic cerebral palsy and also shows the association of retained primitive reflexes and delayed motor milestones.

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