



Efficacy of Task Oriented Training vs. Group Circuit Training Programme to Improve Functional Mobility in Children with Cerebral Palsy

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Authors' contributions

This work was carried out in collaboration among all authors. Authors SB and DN have contributed in conception and design of the work. Authors SN, SS and PS have contributed in data collection and supervising the treatment protocol. Draft analysis and interpretation of the data was done by authors SN and SS. Final revision of the article was done by all authors.

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ABSTRACT

Introduction: Cerebral palsy (CP) refers to a group of non-progressive neurological disorders that appear in infancy or early childhood. Since CP in children causes structural and functional changes in the neuromusculoskeletal system they are mostly presented with motor disorders, sensory disturbances which leads to impairment in functional mobility, several physical rehabilitation techniques benefited the children with CP in improving their physical health and mental wellbeing. The aim of the study is to analyse the effectiveness of group circuit training and task oriented training on functional mobility in children with cerebral palsy.

Materials and Methods: This study design is a comparative study design and was done in physiotherapy OP department in KGH hospital, RK mission cerebral palsy clinic in Visakhapatnam.

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Based on the inclusion and exclusion criteria a study sample of 30 subjects was selected. The subjects were allocated into two groups through random sampling method, group A(n=15) received Task oriented training along with conventional physiotherapy, and group B(n=15) received circuit training along with conventional physiotherapy 3 sessions/week for 5 weeks for 30-40 minutes. Functional mobility was assessed by using the outcome measures GMFM 88 scale and TUG test. **Results:** The findings of the study revealed improved clinical outcomes in both groups. There was a statistical significance difference between the circuit training group and task oriented training in all the outcome variables at ($P<0.05$). **Conclusion:** The study concluded that there was improvement in functional mobility in both groups. However the task oriented training was more effective than circuit training in improving the functional mobility in children with cerebral palsy.

Keywords: Cerebral palsy; circuit training; task oriented training; functional mobility.

1. INTRODUCTION

Cerebral palsy is considered as a group of disorders of movement and postural development results into limitation of activity that are attributed to non-progressive disturbances occurred in the developing foetal or infant brain [1,2]. The prevalence of cerebral palsy in India was 2.95 per 1000 children and it is similar to the global estimates [3]. Based on the predominant motor syndrome, clinically cerebral palsy is classified into spastic hemiplegia, spastic diplegia, spastic quadriplegia, extra pyramidal and dyskinetic. 35% of the children with CP have spastic diplegia and it is the most common clinical phenotype.

Spastic diplegia is characterized by a pyramidal motor syndrome, predominantly in the lower limbs commonly due to perinatal hypoxic-ischemic insult causing lesions in the white matter adjacent to the lateral ventricles of the brain [4]. Injuries in these regions causes motor impairment, problems of perception, cognition, attention and memory and other higher brain functions which restricts the cerebral palsy children from participating in their daily activities. One of the main goal of physical rehabilitation techniques in children with cerebral palsy is improvement of functional mobility [5].

Circuit training is a physical conditioning method in which a child with cerebral palsy works out through a chain of exercise stations designed to improve muscle strength and endurance, helps in improving motor control, ability of balance and prevent somatic dysfunction associated with lack of mobility. Studies shows improvement in Static and dynamic motor functions such as standing, walking, jumping and running abilities of children with spastic CP.

Task oriented training is an effective intervention to improve functional motor skills that can improve the movement necessary for activities of daily living through experience and learning of new and specified tasks in the training programme. Hence the therapeutic interventions for cerebral palsy children should include goal directed functional activities which can reduce the degree of disability and motivates the cp children to do their activities of daily living easily [6-8].

The aim of the study is to analyse the effects of circuit training and task oriented training programme on functional mobility in cerebral palsy children with spastic diplegia. The results of the study provides an effective and reliable treatment training programme.

2. MATERIALS AND METHODOS

A total of thirty cerebral palsy children diagnosed with spastic diplegia were recruited in this study. They were randomly allocated into group A Task oriented training and conventional physiotherapy (n=15) and group B Circuit training and conventional physiotherapy (n=15). Inclusion criteria were Cerebral palsy children with age 6 to 12 years, Diagnosed with spastic diplegia, Children who have good balance in sitting position and the ability to walk with or without the help of assistive devices and ability to follow verbal instructions. Exclusion criteria were children who undergone Surgical procedure, Taken Botox injection during or before 6 months prior to study, Unable to sit, cannot follow verbal instructions, cognitive impairment and with medical conditions that contra indicates exercising.

Informed consent was obtained from the parents of all the subjects before participation in the

study. Both groups received approximately 30-40 minutes of training programme, 3 times a week for 5 weeks. Totally each group received 15 sessions of training.

2.1 Outcome Measures

Mobility function was measured by using Gross motor function measure (GMFM) and The Timed “up and go” test (TUG).

2.1.1 GMFM-88 scale

The GMFM is a 88 item scores grouped into five domains: 1. LYING and rolling, 2. SITTING, 3. CRAWLING and kneeling, 4. STANDING, 5. WALKING RUNNING and JUMPING. The score of every dimension is presented in the form of percentage of the maximum score for that dimension and the total score is obtained by averaging the percentage scores across the measured dimensions. The validity and reliability of the GMFM for use in children with cerebral palsy has been established by several researchers. The GMFM has a good inter rater (ICC=0.99) and intra-rate (ICC=0.99) reliability. Administering the GMFM-88 may take approximately 45 to 60 minutes, depending on the ability of the child and the child’s level of the cooperation [9].

2.1.2 TUG test

The timed up and go (TUG) test measures the functional and basic mobility by assessing the performance of cerebral palsy children. It has an excellent inter rater (ICC=0.99) intra rate (ICC=0.99) reliability and it’s a valid and reliable measure in children [10].

2.2 Interventions

2.2.1 Task oriented training (group A)

The task-oriented training consisted of activities similar to those the child performs during daily activities.

1. Sitting on a table and reaching in different directions for objects located beyond arm’s length to promote loading of the legs and activation of the leg muscles.
2. Sit to stand from various chair heights to strengthen the lower limb muscles.

3. Stepping forward, backward and sideways onto blocks of various heights.
4. Heel lifts in standing to strengthen the plantar flexor muscles.
5. Standing with base of support constrained with feet in parallel and tandem conditions reaching for objects, including down to the floor, to improve standing balance.
6. Standing up from chair: Walking a short distance and returning to the chair to promote a smooth transition between the two tasks.
7. Walk and carry small weights not greater than 1kg depending on the age of the child.
8. Walking over various surfaces and obstacles.
9. Walking over slopes and stairs.
10. Kicking ball.
11. Alternate stepping on to low risers.
12. Partial squats, toe rises.
13. Speed walking.
14. Tandem walking.
15. Sudden stops and turns during walking.
16. Single leg stance. Exercises were performed intensively to an individualized three sets of ten repetitions.

Each child progressed by increasing the number of repetitions and by increasing the difficulty like decreasing seat height at sit to stand/reducing speed of movement.

2.2.2 Circuit training (group B)

Exercise protocol of Circuit training of closed and open kinematic chain exercises for 15 sessions. The exercise stations were randomly allocated to children. Participants were trained at each station for two to ten min (depending on the task) and transferred to the next station following completion of each exercise in order to reduce neuromuscular detraining effects and boredom of the exercise station.

2.2.3 Conventional physiotherapy

Both groups received conventional physiotherapy along with their respective training programmes. It consists of stretching, Progressive resistance exercises, Neuro developmental techniques, Gait training, and Mat activities.

Table 1. Circuit training

Circuit station	Frequency per week	Duration	Equipment used	Repetition
Warm up	2	5 min	Stretching, free exercises	
Treadmill walking	2	10 min	Treadmill without inclination	Walk interspersed with rest periods gradually to attain APMHR
Standing balance	2	3 min	Wall support	10
Walking up and down ramp	2	5 min	Inclined ramp	10
Step up and down	2	3 min	Stairs	10
Sit to stand	2	3min	Chair	5
Seated row	2	3min	Row machine	5
Leg ergometer	2	3 min	Stationary Cycle	-
Cool down	2	5 min	Stretching, free exercises	

3. RESULTS

Data were analysed using SPSS, independent paired t test for the pre and post-test result of both the variables have been calculated. Significant differences were found between pre and post intervention in all the variables at ($P < 0.05$). Mean difference was used to compare between the groups. Analyses of change in the scores indicate that the group A has performed better than the group B after the training programme.

4. DISCUSSION

There is a growing body of evidence that supports task-oriented and circuit training programmes are beneficial for children with cerebral palsy. The study hypothesised that 5 weeks of task oriented training and Circuit training when appropriately followed would improve the motor function of children with spastic diplegic cerebral palsy as measured on GMFM and TUG. The results of task oriented training indicate that it has significantly improved standing and walking performance as measured by GMFM and TUG. The GMFM change scores in both groups indicate improved capabilities in performance of gross motor scales as well as an indicator of change in mobility function. Improvement in standing and walking scores following circuit training with tasks such as treadmill, step up and sit to stand is clinically and

functionally relevant. Application of task specific therapy programme improved capabilities and level of independence in performance of activities of daily living additionally both task specific and circuit training showed improvements in GMFM and TUG scores.

Since optimal training needs to be task specific, in the current study task-specific training was a key feature of the intervention in the task oriented group. The intervention activities used in the task oriented group were designed to mimic how lower limb muscles are used in everyday activities taking into consideration normal biomechanics, strength balance and lower limb function. Improvements in the mobility function may be related to the specificity of training used in this study. The activities used were similar to those that the participants used in everyday tasks and play and thus might have been beneficial in motivating the children. The exercise regimen employed in the current study might have increased strength and coordination of lower limb muscles and improved trunk balance and strength leading to an improvement in weight-bearing functional tasks. This, in turn might increase the quality of life in these children which needs further investigation. One of the major challenges in the management of children with cerebral palsy is enhancing motivation to practise throughout the day. The motivation to participate in activities is closely linked to improvement in acquisition of motor abilities.

Table 2. Showing the mean, standard deviation, mean difference and p value both experimental (group-A) and control (group-B) groups

Variables	Score				Change		Scores P-value
	Group A		Group-B		Group-A	Group-B	
	Pre	Post	Pre	Post	Pre-post	Pre-post	
GMFM	46.80 ± 3.590	64.40 ± 3.582	48.67 ± 3.244	55.13 ± 3.563	17.6	6.46	0.000
TUG	20.53 ± 2.356	16.07 ± 2.052	21.00 ± 1.852	17.60 ± 1.724	4.46	3.4	0.035

5. CONCLUSION

There is growing body of evidence that supports task oriented training as being beneficial to children with cerebral palsy. Evidence from the present study suggest that task oriented and Circuit (strength) training is beneficial to improve functional mobility in children with Cerebral Palsy. The principle of specificity of learning states that learning is optimized by practice that approximates the target skill. In Circuit training the focus is on repetitive practice of task specific training of everyday motor tasks. This study findings indicate that task oriented training significantly improved standing and walking performances as measured by GMFM and TUG test. The circuit training programme employed in the current study as well as the task oriented training resulted in significant improvement in Gross motor function in standing, walking and functional mobility. The group nature of intervention potentially allows a greater amount of therapy to be provided to patients for the same cost.

6. LIMITATIONS AND SUGGESTIONS

The size of the sample was small in both groups. Further research with larger sample must be conducted.

No measures of impairment were taken in this study because the purpose of this study was to determine improvement in functions that are meaningful to the children and their families. It might be prudent to collect data on measures of impairment and relate it to improvement in function to further understand the mechanism through which to training might work. No long term follow up measures were performed in the study.

Balance impairments, grade of spasticity, and gait deviations were not measured which is another major limitation of the current study. However, the study population did not report any history of falls or any other adverse effects impeding activities of daily living or requiring any other therapy/medical attention during the intervention period. Improvements in muscle strength following the functional training were not measured in the current study but future studies should document strength pre- and post-intervention using isokinetic or hand-held dynamometers.

Future trials should attempt to relate the improvement in functional performance following circuit training with other variables such as gait velocity, grade of spasticity, and balance impairment.

Further studies could also implement circuit training regimen with an increase in number of sessions per week and also the total duration of therapy for more than 6 weeks. Despite limitations the results provide an Evidence based recommendation potential benefits of training for children with CP. Further studies with a larger sample and longer post intervention follow up are necessary to document the long term effects of participation in the to training in CP population.

CONSENT

Informed consent was obtained from the parents of all the subjects before participation in the study.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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