

Effectiveness of Floor Exercises Versus Ball Exercises on Spinal Mobility in Spastic Diplegia (CP)

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Abstract

Background: The objective of this study was to compare the effectiveness between floor exercises and ball exercises on spinal stability in spastic diplegia (cp)

Introduction: Cerebral palsy (CP) is a static, non-progressive complaint caused by brain personality or injury in the antenatal, perinatal, and postnatal time period, is the major experimental disability affecting function in children. Voluntary movements are directly affected by weak torso control and causes abnormal motion patterns. Activation of core muscle forms an important part of stabilization of spines and vertebral alignment during bearing weight. The main gait pattern is its 'scissor gait' pattern.

Methodology: It was an experimental study design of children between 3-8 years of age with sample size of 30 individuals. They were divided by certain inclusion and exclusion criteria. Group A was given floor exercises and group B was given ball exercises. They were evaluated pre and post by TUG and PBS using t test, t and p values.

Results: This research evaluated data characteristics such as (age, gender, height, scales) were represented as percentage, mean and standard deviation and the significance across two study groups was analysed using t-test (paired and unpaired). The mean, standard deviation and significance were calculated

Conclusion: In our study , it was found that after receiving 6 weeks of floor exercises and ball exercises , TUG and PBS score have been significantly improved in group B than group A. Throughout the study, the Swiss ball is found to be an effective tool for improving trunk muscle activity, strengthening the trunk core muscles and improving stability in upright positions, along with allowing freedom of movement in upper limbs.

Keywords: Cerebral Palsy, Spastic Cerebral Palsy, floor exercises, Mat exercises.

Introduction

Spastic diplegia comes under the category of cerebral palsy. Cerebral palsy (CP) is a static, non-

progressive complaint caused by brain personality or injury in the antenatal, perinatal and postnatal time period, is the major experimental disability affecting function in children. It's categorized by the

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incapability to typically control motor function and it has the implicit to have an effect on the overall developmental of a child by affecting the child's capability to explore, speak, learn and become independent. The first step is to understand the description of CP and how to make the opinion. These are of various categories in which spastic diplegia is taken into the research topic. Spastic diplegia is particular type of lesion damage inhibit the proper development of upper motors neuron's function, impacting the motor cortex, the rudimentary ganglia and the corticospinal tract. Nerve receptors in the spine leading to affected muscles come to duty by absorbing the gammas aminos butyrics acid (GABA), an amino acid which regulates the muscle tone in humans. Without GABA immersion to those particular nerve rootlets, affected nerves constantly fire the communication for their corresponding muscles to permanently, strictly contract and the muscles get permanently hypertonic.¹

Spastic diplegia is as a matter of fact is a chronic condition. Contrary to conditions that may show parallel consequences, spastic diplegia is completely congenital. Effects like poisonous effects, Traumatic Brain Injury (TBI), meningitis, encephalitis and drowning will never cause spastic diplegia or CP generally. However, some common causes included are Periventricular leukomalacia abrupt in-womb deficiency oxygen - delivery through umbilical cord which can lead to early birth which fundamentally risk the child developing any type of CP. And, some maternity infections as rubella can cause spastic diplegia. Spastic diplegia can be diagnosed by various methods either as in scales, grades, functional and balance abilities. Certain manifestation along with observation can also help in identifying the spastic diplegia. The main gait pattern is its 'scissor gait' pattern²

Voluntary movements are directly affected by weak torso control and causes abnormal motion patterns. Activation of core muscle forms an important part of stabilization of spines and vertebral alignment during bearing weight. For spastic diplegia with floor exercises, exercises were given to back extensors and to abdominals with large and stable base of support. Subsequently, in 1963 Swiss ball came into consideration as an effectual support.³

Need for the study

This study gives details regarding differences regarding effectiveness between floor exercises and ball exercises for spinal stability in children accompanied by spastic diplegia.

Aim

To evaluate the effectiveness between ball exercises and floor exercises upon spinal stability in spastic diplegic children.

Objectives:

1. To assess the effect of floor exercises upon spinal balance in spastic diplegia
2. To evaluate the effect of ball exercises upon spinal balance in spastic diplegia.
3. To compare the effectiveness between floors and balls exercises in spastic diplegic condition.

Hypothesis:

- Null hypothesis- there is no significant effects in the difference of effects between floors and balls exercises upon spinal stability for spastic diplegic children.
- Alternate hypothesis- there is significant effects in the difference of effects between floors and ball exercises upon spinal stability for spastic diplegic children.

Methodology

Study Design: Experimental study design

Study Population & Sample: Children between age of 3 to 8 years with sample size of 30 individuals^{9,4}

Place of Data Collection: Reborn Physiotherapy and Neuro Rehabilitation Clinic, Indirapuram.

Sampling Method : non-probability sampling.

Sample Size: 30 individuals⁴

Selection Criteria:

- (a) Inclusion Criteria:
- Children diagnosed with spastic diplegia (CP) between 3-8 years of age group⁹
 - Includes all gender patients.

- Gross Motor Functions Classifications Scale between 1-3.⁴

b) Exclusion Criteria:

- Children with injuries or any open wounds
- Non ambulatory children
- Patients with risk of serious side effects as fever, asthma.
- Patient with any cognitive and visual impairments.

Outcome Measures:

Independent variable: Balance, stability

Dependent Variable:

- Modified timed up and go test (TUG)
- Paediatric balance scale (PBS)

Instruments Required:

- Consent form
- Assessment charts
- Questionnaire
- Goniometer
- inch tape
- chair
- assistive devices and
- Swiss ball.

Group Allocation: 30 spastic diplegic children were split into two groups. Group A will adhere to floor exercises protocol and Group B will adhere to ball exercises protocol for 6 weeks.

Procedure:

Group A and B were given exercise program. The exercises were performed by group A and group B accordingly for 45 minutes once a day 3 times a week. All the children will be assessed before the beginning and after completion of the program. This study will be a short-term study of 6 weeks.

Following exercises were included in the program:

Group-A⁶

The repetitions and holds were administered per session,

- Sit to stand and stand to sit [20 repetitions]
- Retrieving objects from the floor [2 repetitions]
- One leg standing [5 minutes hold]
- Alternate one leg standing [5 minutes hold]
- Half kneeling [3 minutes hold]
- Kneeling [3 minutes hold]
- Walking supported [20 steps]
- Standing supported [5 minutes]
- Squatting [5minutes hold]

Group-B

The repetitions and holds were administered per session,

- Bouncing [relaxation]
- Row your boat (sitting) [20 repetitions]
- Sitting rolling [10 repetitions]
- Supine rocking forward and backward [20 repetitions]
- Supine side rocking [20 repetitions]
- Supine rolling [10 repetitions]
- Tummy time with gentle rocking side to side [20 repetitions]
- Prone flipped over (forward and backward) [20 repetitions]
- Prone rolling [10 repetitions]
- Prone side rolling [20 repetitions]
- Prone on hands[5minutes hold]
- Supine to sitting [10 repetitions]

Data analysis

Data analysis of this study showed that the followings changes in the scoring of TUG and PBS afore and after the exercise therapy program with t test and p value.

Result and Observation

This research was conducted with a total of 30 participants composed of 22 Males and 8 Females. The qualitative and quantitative data characteristics such as (age, gender, height, scales) were represented as percentage, mean and standard deviation and the significance across two study groups was analysed using t-test (paired and unpaired).

The mean, standard deviation and significance were calculated along with their graphical representations.

Table 1: Gender distribution

Gender	Total Count(n)	Total Percentage (%)
Male	22	73
Female	8	27

Table 2: Representing variables of the sample groups

Variable	Group A Mean ± SD	Group B Mean ± SD
Age	4.06 ±0.98	4.66 ±1.24
Height	109 ±15.6	111 ±15.4

Table 3: Group A and B Values for TUG

TUG	Group A		Group B	
	Pre	Post	Pre	Post
Mean	16.06	15	23.46	22.4
SD	3.45	3.44	3.09	2.31

SD = standard deviation

TUG = Timed UP and GO Test

PBS = Pediatric Balance Scale

Table 4: Group A and B Values for PBS

PBS	Group A		Group B	
	Pre	Post	Pre	Post
Mean	29.9	31.6	15.46	17.33
SD	9.85	8.72	3.34	3.37

Table 5: Within Group Pre and Post Comparison of Measurements

Variables	Group	t-Stat	t-Critical	P value	Significance
TUG	A (Pre-post)	4.29	1.76	0.0007	Significant
	B (Pre-post)	-5.13	1.761	0.0001	Significant
PBS	A (Pre-post)	2.21	1.76	0.04	Significant
	B (Pre-post)	4.00	1.76	0.013	Significant

Table 6: Between Group Comparison Of Measurements

Variables	T-Stat	T-Critical	P value	Significance
TUG (Pre A- Pre B)	-5.96	2.048	0.04	Significant
TUG (Post A -Post B)	-6.63	2.059		
PBS (Pre A-Pre B)	5.20	2.10	0.0007	Significant
PBS (Post A- Post B)	5.73	2.100		

P< 0.05 is considered significant

Discussion

This study was done to compare the effectiveness of the Effectiveness of floor exercises versus floor exercises on spinal stability for spastic diplegia (CP). In our study , we discovered that after receiving 6 weeks of floor exercises and ball exercises , TUG and PBS score have been significantly improved in group B than group A. Throughout the study, the Swiss ball is found to be an effective tool for improving trunk muscle activity, strengthening the trunk core muscles and improving stability in upright positions,

along with allowing freedom of movement in upper limbs There are various studies which have shown the effectiveness of the ball exercise on core stability. Cherraa’s Institute of Health and Sciences 2019 added that Swiss ball training requires you to concentrate and shift your weight on the ball so that you maintain stability, something that is not possible with traditional weight training exercises. Furthermore the interpretations are in conformity with the previous studies¹¹ Postural control when balancing over a Swiss ball involves adjusting the movement program to maintain stability, while maintaining the overall posture strategy. Ball training

improves nervous system function, which enhances functional strength. Although the movement patterns of the Swiss ball and floor groups appeared similar, underlying neuroadaptations such as increased nervous system activation, more efficient neuromuscular recruitment patterns, improved motor unit synchronization, decreased inhibitory neuronal reflexes, and nociceptive feedback may be quite different.

Strength of the Study:

The results of this study not only provide evidence of the validity of effectiveness of Swiss ball and floor exercises but also suggest an alternative approach to improve the spinal stability for children with spastic diplegia (CP).

Limitations of the Study

The above study has following limitations:

- Sample size was small
- Unequal male and female ratio
- The study was limited to age group (3-8 years)

Conclusion

After a 6 week protocol period, the children in group A (floor exercises) and group B (Swiss ball) exercises group have shown improvement with the outcome measures. But I'm comparison with both the groups mean differences in TUG, PBS's pre and post between both groups A and B, the Swiss ball group was found to be better with greater mean difference. Hence the present study held revealed that there is improvement in spinal stability with Swiss ball can be selected as the treatment of choice for the physiotherapist to effectively improve spinal muscle strength in Spastic diplegic children.

Ethical clearance: Obtained Institutional ethical committee of Amity university Uttar Pradesh committee.

Source of funding: Self

Conflict of Interest: Nil

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