



“A Study to Compare the Effect of Water Walking Performed at Different Water Depths on Walking Capacity in Spastic Diplegic Cerebral Palsy: Comparative Study”

¹Dr. Ankit Katharani, ²Dr. Nidhi Katharani, ³Dr. Rahul Chhatlani, ⁴Dr Pooja Vora,

¹(PT), PhD scholar, Department of Physiotherapy, P P Savani University, Surat –Gujarat, India.

²(PT), Assistant Professor, PhD Scholar, Faculty of Physiotherapy, Marwadi University, Rajkot –Gujarat, India.

³(PT), Assistant Professor, PhD Scholar, Faculty of Physiotherapy, Marwadi University, Rajkot –Gujarat, India.

⁴(PT), Assistant Professor, Faculty of Physiotherapy, Marwadi University, Rajkot –Gujarat, India.

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KEYWORDS

Spastic Diplegic Cerebral Palsy,

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ABSTRACT:

INTRODUCTION: CP is a neurological non-progressive static disorder of the brain that results from brain insult or injury during any of the antenatal, perinatal and postnatal stages. Spastic diplegia (SD) is a motor impairment in the upper extremities as well as the lower extremities, even though the upper extremities less affected than the lower one. Aquatic therapy includes buoyancy, hydrostatic pressure, and hydrodynamic force which may allow children with Spastic Diplegic Cerebral Palsy to exercise in the water with more freedom than on land. Water viscosity also offers resistance, which is often used in aqua therapy programs.

OBJECTIVE: To compare the effect of water walking performed at different depths (i.e. Nipple Level & ASIS Level) on walking capacity in Spastic Diplegic Cerebral Palsy.

METHOD: A total of 40 Subjects were Included in Study according to Selection Criteria. They were divided into 2 groups, 20 Subjects in each group, in group A, water walking performed at water depth at nipple level and in group B, water walking performed at water depth at ASIS level. The walking capacity was assessed with One Minute Walk Test. Outcome Measures were taken on day 1 and after 6 weeks.

RESULTS: Within group analysis was done to check the effectiveness in both the groups. Pre and post data in group A & Group B were analysed using Paired T-Test for 1 Minute walk test. Between group analysis was performed to compare the effect of both groups. Data was analysed using Un-Paired T-Test for 1 Minute walk test. In within group comparison water walking at nipple level as well as ASIS level shows improvement in walking capacity of spastic cerebral palsy. More improvement was found within Water Walking Performed at Water Depth at Nipple Level.

CONCLUSION: Water walking performed at water depth at nipple level showed significantly more improvement in walking capacity than water walking performed at water depth at ASIS level. Water walking can be included as form of exercise for improving walking capacity of the spastic diplegic cerebral palsy children's.

1. Introduction

Cerebral palsy (CP) is a well-recognized neurodevelopmental condition beginning in early

childhood & persisting through the lifespan.¹ Cerebral palsy (CP) defines as a group of disorders which affects posture and movement, which leads to activity limitation. It is known to non-progressive neurological conditions



that happened in the early state of infant brain or fetal. The motor disorders of CP are often associated with the symptoms of higher mental functions like communication, sensation, perception, cognition and behaviour changes, and other problems related to musculoskeletal problems.²

Spastic diplegia (SD) is a motor impairment in the upper extremities as well as the lower extremities, even though the upper extremities less affected than the lower one. Marked weakness in the trunk and hypertonia of the extremities are seen.³ The spastic CP type is described by exaggerated deep tendon reflexes, increased muscle tone, muscle weakness, and gait affection. Nearly 70–77% of CP cases were spastic CP.⁴

There are various physical therapy approaches used for children with Cerebral Palsy like Sensory Integration, NDT, strength training, functional physical therapy, electrical stimulation, water-based (aquatic) exercises. Water-based (aquatic) exercises are one of the physical therapy interventions used for kids with Cerebral Palsy. Postural strength improves by decreasing the effect of the gravitational force by using water; facilitating the Cerebral Palsy child to exercise more smoothly than on land.⁵⁻⁹

Water-based (aquatic) therapy exercises are more suitable for Cerebral Palsy children because of the unique properties of water and it may be further attention-grabbing and inspiring for kids than land-based exercises. Buoyancy creates water-based (aquatic) therapy stress-free for kids who have moderate to severe limitations in mobility to move in the water linked with moving and exercising on land. For kids who have minor mobility limitations, buoyancy enhanced joint configuration during walking and movements that are challenging on land, such as hopping, running and jumping with hardly any influence on joints. Walking in the water stand to water resistance which may help in strengthening muscles as well as aerobic exercises. Subsequently, oxygen cost for walking in water has been superior to on land for adolescents.¹

Water walking can be performed at different depths such as Nipple level & ASIS level but there are few literatures comparing effect of water walking performed at different heights. So, the aim of this study is to evaluate the effect of water walking on Spastic Diplegic Cerebral Palsy and to standardize the appropriate depth of water walking for

improvement of walking capacity in a patient with Spastic Diplegic Cerebral Palsy.

2. Objectives

To compare the effect of water walking performed at different depths (i.e. Nipple Level & ASIS Level) on walking capacity in Spastic Diplegic Cerebral Palsy.

3. Methods

Forty patients were selected according to selection criteria by convenient sampling. Detailed procedure was explained to parents in their own language and Institutionally approved Inform Consent was taken from the parents, who were willing to allow their child to participate. These subjects divided into 2 groups, group A & B (20 Subjects in each group).

Subjects were selected based on below mentioned criteria

Inclusion Criteria¹⁰ –

- Pre-Diagnosed Spastic cerebral palsy, aged 6 to 10 years.
- Both Gender (Male & Female)
- Able to follow simple verbal instructions
- Gross Motor Function Classification System levels of I to III
- Willing to participate

Exclusion Criteria¹⁰ –

- Receiving botulinum toxin injection
- Hospitalization in the last six months
- Cardiovascular and respiratory dysfunction
- Severe renal disease
- Open wounds & Skin infections
- Bowel or bladder dysfunction
- Water and airborne infections or diseases
- Uncontrolled seizures

Treatment protocol of group A & B was 10 minutes poolside exercises including warming-up, active ROM exercises, and stretching. 25 minutes of walking in the water at a water depth of Nipple Level for group A & at ASIS level for group B and 5 minutes of cool-down (such as slow walking).

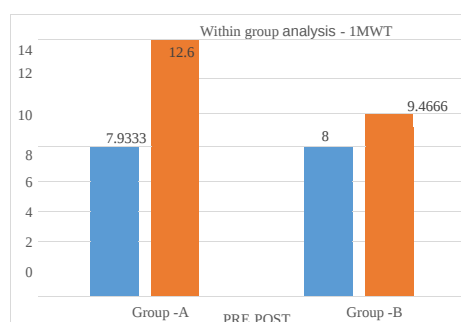
Patients were evaluated for walking capacity 1 Minute Walk Test on Day 1 & After 6 weeks.



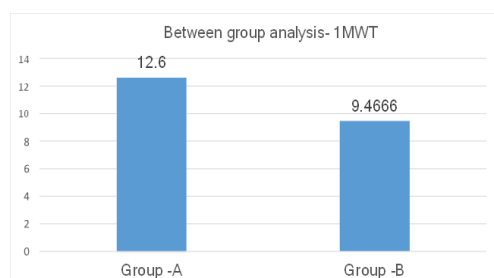
4. Results

Statistical Package for Social Sciences (SPSS) version 21.0 for windows was used for statistical analysis. Microsoft excel was used to create graphs. Measuring variables of the pretreatment mean values in both groups showed non-significant differences, these findings demonstrated the homogeneity between both groups before starting the study. Within group analysis was done to check the effectiveness in both the groups. Pre and post data in group A & Group B were analysed using Paired T-Test for 1 Minute walk test. Between group analysis was performed to compare the effect of both groups. Data was analysed using Un- Paired T-Test for 1 Minute walk test.

Graph 1 shows within group pre & post comparison analysis for 1MWT



Graph 2 shows between group A & B analysis 1MWT



In within group comparison water walking at nipple level as well as ASIS level shows improvement in walking capacity of spastic cerebral palsy. More improvement was found within Water Walking Performed at Water Depth at Nipple Level.

5. Discussion

Our results showed that water walking at nipple level as well as ASIS level shows improvement in walking capacity of spastic cerebral palsy. This is because of the unique properties of water that may reduce risks associated with joint loading, and may allow a child to engage more easily in aerobic activity than land-based exercise. The resistive forces of buoyancy and viscous drag which permits a variety of aerobic and strengthening activities on lower extremities that can be easily modified to accommodate the full range of motor abilities of children with CP.¹⁰

Our findings are consistent with Saeid Fatorehchy et al who concluded that water-based program increases functional balance on a paediatric balance scale and walking capacity on 1-minute walk test in kids with cerebral palsy.¹⁰

By reducing joint compression, providing three-dimensional resistance, and dampening perceived pain, immersed strengthening exercises may be safely initiated earlier in the rehabilitation program than traditional land strengthening exercises. Both manual and mechanical immersed strengthening exercises typically can be done in waist-depth water. However, some mechanical strengthening exercises may also be performed in deep water. Frequently, immersion alters the mechanics of active motion. For example, the vertical forces of buoyancy support the immersed upper extremity and alter the muscular demands on the shoulder girdle.

After an intervention, the post average means of 1-Minute Walk Test in group A and group B were 12.60 meters/minute and 9.46 meters/minute, respectively. More improvement was found within Water Walking Performed at Water Depth at Nipple Level. It is because of the difference in the level of immersion. Immersion improves balance abilities by increasing proprioceptive input to the immersed body and provides it with greater body alignment and stability.¹¹ Sensory feedback may also increase, thus increases the sensory output to the muscles to contract to stabilize postural alignment because resistance to movement through a viscous fluid like water is more significant than resistance through the air.

Concerning the depth of immersion, the greater it is, the weaker it will be the ground reaction force (GRF) in the



vertical plane. However, the GRF in the anterior-posterior plane will be greater as the depth of immersion increases, as more force is required to move the body forward against water resistance. So that strength also improves more with increased immersion.¹²

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