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"COMPARISION BETWEEN ANTERIOR AND POSTERIOR WALKER ON GAIT PARAMETERS AND PHYSIOLOGICAL COST INDEX IN CHILDREN WITH SPASTIC DIPLEGIC CEREBRAL PALSY"

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ABSTRACT To make children who may lose some basic skills to accomplish walking or may have delayed in walking development is a very important issue. Gait in these children may exhibit the following characteristics: poor motor control, poor balance, muscle strength insufficiently, and muscle incoordination.

The purpose of this study was to compare gait pattern and energy consumption in children with spastic diplegic CP, when using anterior and PWs, and to determine which walker should be recommended as a walking aid for these children.

Twenty spastic diplegic cerebral palsied children, of average age 7 to 14 years, were enrolled in this study. Before assessment, they had all received a practice period to familiarize themselves with both types of walker. Gait characteristics were evaluated by making them walk on the paper with ink applied on foot, and energy expenditure was determined by taking their resting and final heart rate they were using the walkers. The oxygen consumption rate was significantly lower whilst using the PW, as was the oxygen cost. Walking speed and cadence on gait analysis showed no significant difference between the walker types.

The conclusion of this study was step length, stride length and step width were significantly different for the two walkers. Flexion angles of the trunk, hip and knee were better using a PW. Gait analysis data and oxygen consumption measurements indicated that the PW has more advantages in terms of upright positioning and energy conservation than the AW. In clinic, we should adapt the walkers according to different goals and different abilities of users.

KEYWORDS : CP, anterior and PW, step length, stride length , oxygen cost index

INTRODUCTION

CP is described as group of permanent disorder of development of movement and posture, causing activity limitation, that are attributed to non –progressive disturbances occurring in developing fetal or infant brain. The motor disorder of CP is often accompanied by disturbances of sensation, perception, cognition, communication and behavior by epilepsy and secondary musculoskeletal problems.[1]

Spasticity in CP mainly hampers voluntary movements but sometimes can be helpful for weight bearing or support.[1] Extensor tone in the limbs helps standing, preserves muscle bulk and bone density.[9]

Mass contraction in the antagonist muscle causes difficulty in movement; posture becomes abnormal in sitting and during transfer activities, this Inhibits muscle growth, and leads to contractures. Lower limb involvement is mostly seen at the ankle join. Gait in CP children is characterized by excessive muscle co-contraction, altered joint, but may sometime be helpful for the weak children kinematics, and a lack of postural reactions. In CP children, gait is characterized by short stride length, step length, excessive hip adduction and internal rotation, and ankle plantar flexion, speed and endurance. [6]

Most of the children with CP have difficulty while walking independently because of impaired postural control, abnormal muscle tone and pathological muscular coordination[12] . It is often prescribed for assisting and providing the stability necessary for ambulation. Assisted walking may not only improve the growing child mobility but also make a difference in their ability to explore the environment and interact with their peers.[11] Two types of walkers, anterior and posterior have been advocated for CP in clinic.[11]Traditionally AW has been used as a walking aid. In AW the frame and handgrip bar is in front of the child.[11] The PW is designed in such way that its frame is positioned behind the child and handgrip by the side of the body.[11] CP patient showed higher heart rate and slow walking speed when walking with assistive devices, which means that a high physiological workload was sustained during ambulation by these children.[11]

People with lower extremity handicap, measuring heart rate has been suggested as a direct method of estimating energy expenditure because it is linearly related to the rate of oxygen uptake from resting state to sub -maximal load.[13]. During walking, greater oxygen demand is created in the muscle. Increased oxygen demand induces sympathetic stimulation of the heart, which increases cardiac output. Cardiac output and heart rate are linearly related (except for a plateau effect of cardiac output at maximal heart rates). Greater oxygen demand in the muscle and greater cardiac output result in higher oxygen consumption. These relationships among oxygen consumption, cardiac output, and heart rate support investigation regarding whether PCI can be useful as an index of oxygen cost in a clinical setting.[14]

$$PCI = \frac{WHR - RHR}{SPEED(m/min)}$$

(WHR:-Walking heart rate, RHR:-Resting heart rate)
children with CP had 6 times higher values of PCI and it is more in children with crouch gait walking.[15]

NEED FOR STUDY

Many children with CP have difficulty in walking independently because of impaired postural control; abnormal muscle tone and pathological muscular coordination. Walker are frequently prescribed to these children which provide additional stability required for ambulation. Traditionally, AW have been used as a walking aid. However, a child using AW has tendency to lean forward while pushing the walker. The PW is sparely used and it is designed to be positioned behind the child because it facilitates more upright posture. Extremely high rates and slow walking speed were recorded in the children with CP during ambulation with walking aids. Therefore, information about energy expenditure during ambulation with walker will provide additional data with respect to which device should be used on daily basis by children with CP.[13] This study will contribute towards planning appropriate ambulatory device for CP children which will reduce the energy expenditure and improve gait parameters.

AIM AND OBJECTIVES

AIM

- To find the effect of posterior and AW on gait parameter and oxygen consumption rate in children with spastic diplegic CP

OBJECTIVES

- To determine the effect of AW on gait parameter.
- To determine the effect of PW on gait parameter
- To determine the effect of PW on energy expenditure.
- To determine the effect of AW on energy expenditure.

MATERIAL AND METHODOLOGY

Participants were selected from OPD from Padmshree D.Y. Patil college of physiotherapy, Pune, between ages ranged from 7-14 years. Total 20 participants were selected for this study. Participants were screened using proforma relevant to inclusion and exclusion criteria.

Inclusion criteria

1. Clinically diagnosed spastic diplegic CP,
2. Follow simple verbal command.
3. Able to walk independently indoor and outdoor,
4. Able to walk with walker for 5 Minutes
5. Patients having 1_+ grade of Spasticity in upper limb (Modified Ashworth scale)

Exclusion criteria

1. Patient having any injury that impairs walking,
2. History of any surgery for past 6 months in lower limb and back
3. Patient having contracture that affects dynamic balance.

Anterior Walker **Posterior Walker**

Procedure

Patient who fulfilled the inclusion criteria were taken up for the study. The purpose of the study and procedure was explained to subjects and written consent taken.

All children were tested in their own clinic where they were made to walk. Children were given trial walk, once with AW (Group A) and PW (Group B) each walker in random order to make them accommodate with the walkers .Before starting procedure resting heart rate were taken and it was documented as pretest score. Children walked with each walker for 5 minute at their self-selected comfortable speed for 4 minute on level floor which was used as testing area. Child walked on paper for last 1 minute with ink applied on the foot. After the end of 5 minutes, heart rate was taken and documented as post test score.

OUTCOME MEASURES

1) STRIDE LENGTH
2) STEP LENGTH
3) CADENCE
4) STEP WIDTH
5) PULSE RATE
6) TIME
7) DISTANCE

Statistical Analysis And Result

The data was analyzed using Paired and Unpaired t –test .

Mean standard deviation and standard error was carried out for both the groups.

Graph 1 And Table 1 : Comparison Between Anterior And Pw

1) Right And Left Side Stride Length

2) Right And Left Side Step Length

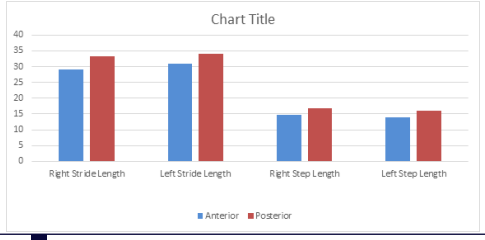

TABLE: 1

	AW	PW	t-value	P -value
Right Stride Length	29.025	33.166	3.59	0.002
Left Stride Length	30.83	34.1	2.29	0.003
Right Step Length	14.6	16.84	1.732	0.002
Left Step Length	13.92	15.93	1.974	0.004

Graph 2 And Table 2:-comparison Between Anterior And Pw For Step Width, Distance, Speed & Pulse Rate (pre & Post)

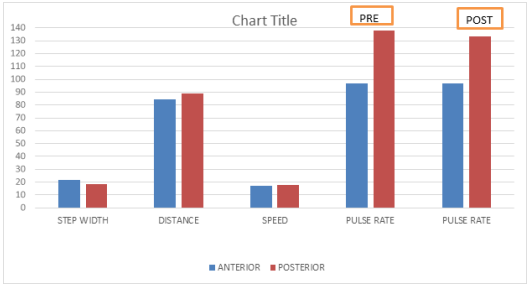

TABLE 2

	AW	PW	t-value	P -value
Step width	21.67	18.22	3.741	0.002
speed	84.26	88.78	1.248	0.22
Distance	16.85	17.75	0.514	0.51
	Pulse rate (Pre)	Pulse Post	t-value	P-value
AW	96.95	138.1	37.527	0.001
PW	96.95	133.1	30.57	0.002

Graph 3 And Table 3: Comparison Between Anterior And Pw For Pci

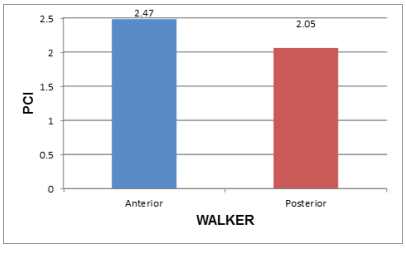

TABLE 3:

	AW	PW	t-value	P -value
PCI	2.47	2.05	3.35	0.003

DISCUSSION

Comparative study of anterior and PW on gait parameters and PCI showed statistically significant improvement in right and left stride length, right and left step length, step width, and PCI with PW. Speed and distance also showed improvement but it was not statistically significant.

This study shows that there was increase in stride length while walking with PW. [16]Use of PW causes center of mass to fall within the base of support which causes co-contraction of trunk and knee muscles and activation of hip extensors so that hip knee angle becomes better and proper foot contact is achieved. [12].

This study shows that there is increase in step length when child walk with PW. He is more upright, posture is well controlled whereas in AW child keeps his center of mass anterior which is out of the base of support and there is less co activation in back extensors and flexors, hip-knee angle is less and foot is in plantar flexion because of this step length is less with AW. [13]

This study shows step width is decreasing with PW than AW[18]. The decrease in stride length and step length with PW allows child to walk with narrow base of support with PW than Aw[12]

.

PW gives more stability to neurological involved children[21]. There is increase in step length and stride length so they covered more distance and there is increase in speed.

When child walk with posterior his gait is approaching towards normal

so in PW the pulse rate is less than AW[12] The PCI was decreased by PW than AW[14]. As there is increase in stride length, step length decrease in step width because of this, gait approaches towards normal and child need less energy while walking[19]

Walking speed was not significantly different for the walker type in our study might be age is one of the factor. Age was between (7-14) whereas the children in other study were younger(2-10years) although there was tendency to walk faster with the PW . Average walking speed varied in the studies of Levangie et al (1989) Logan et al (1990) and Greiner et al (1993). Cerebral palsied patients showed higher heart rates and low walking speeds when walking with assistive devices[19]. which means that a high physiologic workload was sustained during ambulation by these children.

It should be borne in mind that ambulation with walking aids must be incorporated into daily life. To encourage walker, use for longer durations, reduced energy expenditure is desirable. Therefore, energy conservation is a major issue when choosing a walking aid.
In summary, the present study suggests that PW improves the gait parameter and PCI. These data provide more scientific evidence to support the beneficial effect of PW over AW.

CONCLUSION

This study shows that PW shows significant effect on gait parameter and oxygen consumption than AW in children with Spastic Diplegic CP

STUDY LIMITATION

Limitation of this study was children become very conscious while walking on the paper.
In this study less sample size were taken.

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