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Multipurpose CP Walker

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Abstract:

BACKGROUND

CP children have difficulties in walking independently because of poor muscle strength, abnormal muscle tone, or poor postural control. They often be prescribed with walkers to help stability and support when ambulation, especially spastic diplegic CP. Cp walkers are improving independent mobility, reduce disability, delay functional decline, and decrease the burden of care.The aim and objective of multipurpose CP walker is to capable completing basic function such as; standing, walking and sitting and prevent scissoring gait.

PURPOSE

Multipurpose CP walker is low cost, easy design and fabrication, higher strength, better sitting arrangement, and easy manoeuvrability. An adjustable height and handle provides extra support in order to enhance stability for walking walker allows the upper extrimities to develop reaction forces and moments at the handles in order to improve stability. sitting facility available which is decrease fatigue.

METHODOLOGY

The design of a cp walker consists of four rollator wheel, two square frames and a straight handle with height adjustment. There are two stainless steel pipes which are proximally connected with square frame and distally connected with another big square frame. There is an another stainless steel pipe which is proximally attach to the handle and distally to the square frame. There are four caster wheels (2" diameter) attached to the corner of big square frame for base of support. A seat is attached to upper square frame. This design resists unwanted rolling when the user applies his weight to the walker.

RESULT

This walker provides extra support in order to enhance stability for walking. Patients using cp walkers have reported improved confidence and feelings of safety, resulting in increased activity levels and independence. Tempero-spatial parameters were calculated with or without using walker with two patients. The study shows the improvement of velocity and cadence in both patients by using walker. Step length and stride length was reduced with walker .With the help of seat and middle rod, it prevent the unwanted scissoring gait.

CONCLUSION

A plausible design was achieved that fulfilled the objectives in the problem statement.The final concept was selected,by means of an appropriate selection process, from series of three **concepts**

Key words-CP,,Gait,Walker,stability

I. INTRODUCTION

Introduction

cerebral palsy (CP) is primarily a neuromotor disorder that affects the development of movement, muscle tone and posture (1-3). The underlying pathophysiology is an injury to the developing brain in the prenatal through neonatal period (1-3). Although the initial neuropathologic lesion is non-progressive, children with CP may develop a range of secondary conditions over time that will variably affect their functional abilities (4,5).
Positioning children with CP seated on a chair not only increases the possibility for being upright and an opportunity to practice head and trunk control but also reduces further secondary deformities(6). The main purpose of the seating system for these children is to provide postural support for head, trunk and pelvis stability during sitting(7). Nevertheless, common commercial chairs cannot fulfill these requirements. Most commercial chairs have no backrest or armrest and are often oversized for children with disability. Sitting on these chairs thus results in less trunk support and pelvic instability which reduces the children's ability to perform activities during sitting. Increasing the stability of the hips while seated assists with trunk and head control, leading to a more beneficial position during functional activities(8). While specially designed chairs are often expensive and thus may not be purchased for every child, mostly in families with socioeconomic problems. Using a special, adapted chair may help children with CP to control their posture while sitting(6). An easily adaptive chair has been developed from recycled materials such as paper boxes and plastic bottles(9).

Walking capability is one of the intervention objectives in children with CP. To achieve functional walking, infants require appropriate muscle strength, nerve innervation, good endurance, and less fatigue [10]. Walking is more effortful for children with CP than it is for their non-disabled peers due to weakness, lack of coordination between muscle groups, flexed posture, poor balance, and altered muscle tone [11]. Walking devices improve performance, stability, and posture. Posterior walkers (PW) were created in the 1980s to facilitate an upright walking stance [12]. For more active CP children, support walkers are a division of assistive devices that may enable non-ambulant infants with disabilities to walk on their own and promote improvements in mobility, autonomy, participation, and social function [13]. Support walkers are described as instruments that allow mobility for infants who need more aid than that supplied by handheld walkers, including some level of trunk, pelvic, and/or head support [14].

Support walkers may give non-ambulant infants the opportunity to walk independently in a challenging context, such as at school. Variations in the level of participation in school activities among children with or without CP have been evidenced [15]. These observations highlight the need to promote an intervention approach aimed at overcoming learning and environmental barriers to support inclusive education [16].

Many CP children have difficulties in walking independently because of poor muscle strength, abnormal muscle tone, or poor postural control. They often be prescribed with walkers to help stability and support when ambulation, especially spastic diplegic CP. Their cerebral motor cortices have damage and their four limbs are all involved, but the legs more affected than the arms. They have some specific characteristics: increased muscle tone, abnormal motor pattern, joints contracture due to small range of motion, insufficient muscle strength of lower extremity and trunk. In ambulation, they may need some assistive devices to help them. Cp walkers are improving independent mobility, reduce disability, delay functional decline, and decrease the burden of care. Patients using cp walkers have reported improved confidence and feelings of safety, resulting in increased activity levels and independence.

Need for the study-

There is no enough study regarding the effect of multiactivity walker in respect to ambulation. To assess the balance, coordination, gait pattern, energy expenditure, the study has been carried out.

Cp walker:

To use a cp walker, a child will need to have some semblance of upper body strength and co-ordination, because of the walker's design. Walkers are a highly useful mobility device because they can be adjusted to accommodate a child's height, and they generally fit through doorways and store easily at home or in a vehicle.

Fig-2 child cp walker

AIM AND OBJECTIVE

The aim of this project is to provide a multifunctional cp walkers facilitating mobility without any hindrance and prevent scissoring gait.

OBJECTIVE;

The main objective of his project is to design a multifunctional cp walker capable completing basic function such as; standing, walking and sitting .Also the walker is design to a cp patient with in 6years child, easily walking without anyone's help.

DESIGN CONCEPT:

The project consists of two parts, design and manufacturing. For the design part, there are several stages included which are literature search, developing several concepts, evaluating each concept based on advantages and disadvantages, approving the best concept, completing analysis and assessing the final design. In order to accomplished the manufacturing of the chosen design the following was done, which are detail drawing material selections, material orderings, manufacturing parts, parts assembly and final analysis.

The design of a cp walker consists of four rollator wheel, two square frames and a straight handle with height adjustment. There are two stainless steel pipes which are proximally connected with square frame and distally connected with another big square frame. There is an another stainless steel pipe which is proximally attach to the handle and distally to the square frame. There are four caster wheels (2" diameter) attached to the corner of big square frame for base of support. A seat is attached to upper square frame. This design resists unwanted rolling when the user applies his weight to the walker. This walker is designed to be used with a square frame outside of the patient trunk.

Inclusion criteria were as follows:

- ❖ Spastic diplegic cp child, with in the age of 2 to 6 year.
- ❖ Patients with poor balance and co-ordination.
- ❖ Be able to walk independently with a walker.
- ❖ Be able to understand verbal command.
- ❖ Poor trunk control.

Exclusion criteria were as follows:

- ❖ Children walk with less support.
- ❖ Children with profound developmental retardation.
- ❖ Lack of motivation to move.

FABRICATION PROCEDURE:

Fig-3.1:-TOP SQUARE FRAME WITH SITTING FACILITY

Fig-3.2:- BASE SQUARE FRAME WITH FOUR WHEELS

Fig-3.3:-Uni directional wheel

Fig-3.4:- Straight handl

FIG-3.5: Thumb nuts

Component attachment or assembly:

The height of cp walker is adjusted. Telescopic bars of the cp walker were adjusted to match the measurement taken on the patient (i.e greater trochanter to floor).There are 3 vertical bars. Two veritical bars are proximally connected with square frame and distally connected with another big square frame.Another vertical bar is proximally attached to handle and distally attached to the big square frame.A larger pipe is attached to the distal square frame from anterior bar to posterior bar to prevent scissoring gait.A seat is attached to the upper square frame for provide sitting facility and reduce fatigue.The seat height is adjusted from 16”- 22” The handle height is adjusted from 22”- 26”.

Fig:3.6:- TOP VIEW OF WALKER

Fig:3.7:-ANTERIOR VIEW OF WALKER

Fig:3.8:- POSTERIOR VIEW OF WALKER

Fig:3.9:- SIDE VIEW OF WALKER **CASE STUDY**

Patient-1 a 4 year spastic diplegic CP child was unable to sit and stand was trialed with this chair .another patient 4.6 year diplegic cp was also trialed with the same

PATIENT’SITTING AND STANDING POSTION

Fig:4.1

Fig:-4.2

PATIENT TRAIL DURING WALKING

GAIT PARAMETERS	Patient-1		Patient-2	
	WITHOUT WALKER	WITH WALKER	WITHOUT WALKER	WITH WALKER
Velocity (meter/Second)	0 (indepenently) 0.16(with assistance)	0.33	0(independently) 0.10(with resistance)	0.26
Cadence (steps/minutes)	65(with assistance)	76	51(with assistance)	69
Step length (cm)	28cm	25cm	25cm	22cm
Stride length (cm)	36cm	32cm	30cm	26cm

Fig:4.3 Fig:4.4

PATIENT'S SITTING AND STANDING POSITION

Fig:4.6 Fig:-4.7

PATIENT TRAIL DURING WALKING

Fig:4:7 Fig:4:8

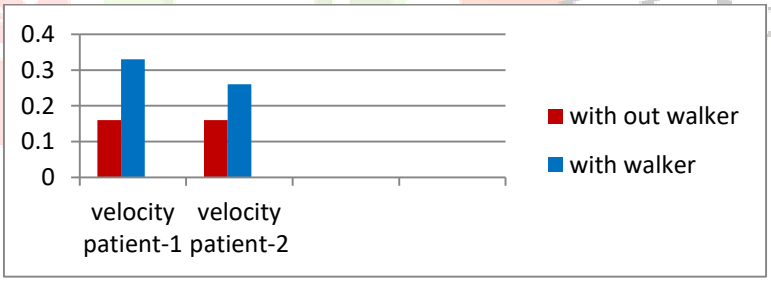
Table 1 comparision of gait parameters

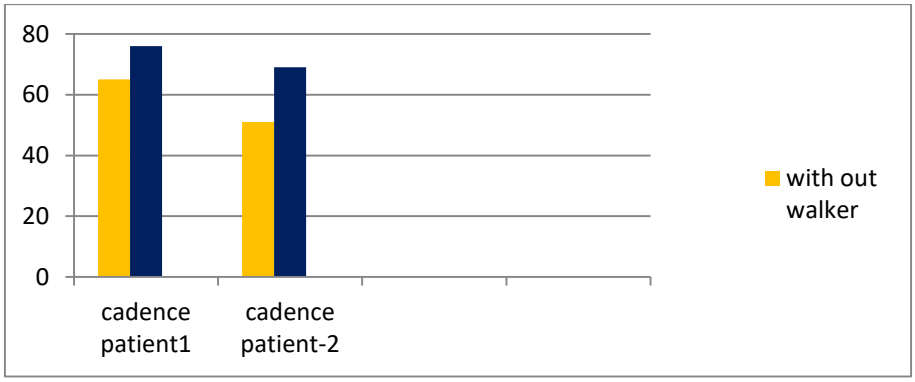
RESULT

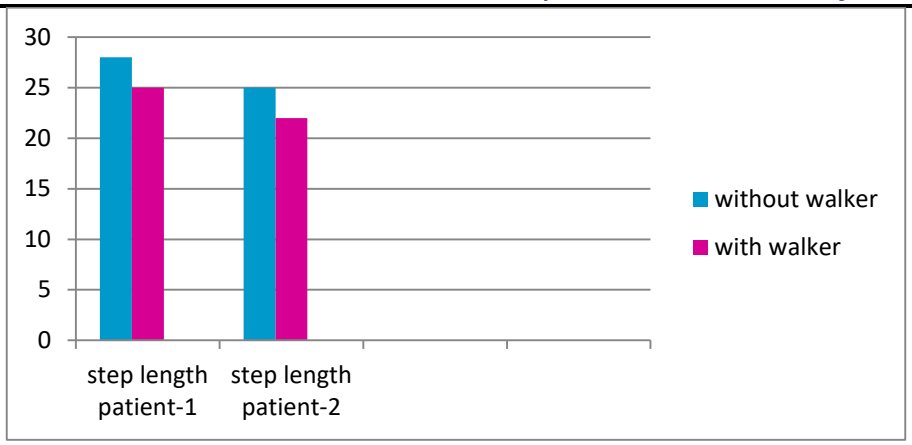
Results are show in table 1 . This walker provides extra support in order to enhance stability for walking. Patients using cp walkers have reported improved confidence and feelings of safety, resulting in increased activity levels and independence.

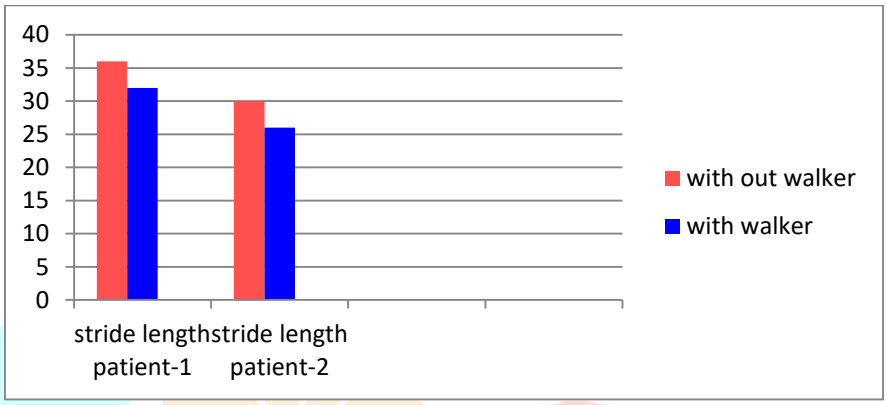
TABLE-1

Tempero-spatial parameters were calculated with or without using walker with two patients. The study shows the improvement of velocity and cadence in both patients by using walker. Step length and stride length was reduced with walker that means it mimic near to the normal gait with the help of seat and middle rod, it prevent the unwanted scissoring gait.









DISCUSSION

This device requires good balance and great strength of the upper extrimities. It is prescribed for 2-6 year cp patient. An adjustable height and handle provides extra support in order to enhance stability for walking. Advantages and dis-advantages are associated wih the use of a walker and should be considered when prescribing a walker as a assistive device for any patient. It gives maximum base of support to the patient with in which the user's center of mass can move without losing stability. In this walker ,sitting facility available which is decrease fatigue. This walker prevent scissoring gait and also provide easy and safe walking with out any one's help.

Another biomechanical advantage is that the walker allows the upper extrimities to develop reaction forces and moments at the handles in order to improve stability.Our study involved 2 spastic diplegic patients in a narrow range of ages. The strict inclusion criteria adopted in our study might have yielded more reliable result.childrens stride and step length were found to be shorter when they used walker.velocoty and cadence increase,when the children walk with walker.

Cerebral palsied patients showed higher heart rates and low walking speeds when walking with assistive devices,which means that a high physiological 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, a reduced energy expenditure is desirable.Therefore, energy conservation is a major issue when choosing a walking aid.Disadvantages of this walker is slow and awkward gait,creats bad posture and walking habits, limited to indoor use in most cases.It is best indicated for cp patient who are confused or who have an unsafe gait because of poor balance and early gait training.

CONCLUSION

Here in, I am trying to ascertain the implication of assistive device for spastic diplegic cp child. In this paper, I proposed the mechanical design of cp walker. A plausible design was achieved that fulfilled the objectives in the problem statement.The final concept was selected,by means of an appropriate selection process, from series of three concepts.

i) Concept 1 -Utilized for indipendent walk.

ii) Concept 2-Sitting facility is available.

iii) Concept 3-Utlized adjustable handle and seat height.

The requirements of the pediatrics and the different able also considered vigorously.

The design is going to modify for future perspective of material, technology and ease of acces

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