Posterior walker assisted on gait performance in children with spastic diplegic cerebral palsy

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INTRODUCTION

Walking is an important basic skill for human. And it is also an important index in childhood development. It can increase muscle contraction and range of motion of lower extremities, and enhance trunk control. But some children can't do walking well congenitally or acquired. They may have disability in walking or delay in motor development. Cerebral palsy is a common group in clinic [1].

Cerebral palsy (CP) is a condition characterized by a motor disorder that is usually diagnosed during the early stages of life. Many CP children have difficulties in walking independently because of poor muscle strength, abnormal muscle tone, or poor postural control [1,2]. They often be prescribed with walkers to help stability and support when ambulation, especially spastic diplegic CP [3]. In ambulation, they may need some assistive devices to help them. The prescription of the walkers should be well-considered. The ability and limitation of users, the structures and parameters of the walkers, and the usage of the users to walkers are all should be considered. And it should be quantified and objective. However, it is still decided by subjective views of therapists and physician in clinic. So we can't understand how to match the users' goal with the walker parameters and the users' abilities efficiently and currently. The purpose of this study is to analyze the gait performance of children with spastic diplegic cerebral palsy when these children use posterior walker with different heights.

METHODS

There were four subjects (2 males, 2 females) with the diagnosis of spastic diplegic CP in the study.

The posterior walker with four wheels , the front were limited anterior direction, the back could only roll forwards , used in this study had been modified by adding two handle force transducers. The kinematics data of lower extremity was recorded using Evart 4.6 motion analysis system with a 10 cameras system. The posterior walker were adjusted in five different heights: the standard (N)(the height of great trochanter is equal to the height of walker's handle), one inch higher (H1), two inches higher (H2), one inch lower (L1), and two inches lower (L2). The subjects ought to have at least three effective trails for every height with self-selected comfortable speed in a 7-meters walkway, once with each height in random order. And they would have rested for 10 minutes after every height. The reflective markers on the subjects were attached to the important anatomic locations by the same staff for higher reliability.

There were high heterogeneities between different CP subjects. So, this study would compare the effect in different heights of the same subject. The variables of velocity, cadence, and step length were calculated.

RESULTS AND DISCUSSION

Subject A and D had poor motor control in walking with walker., and subject B and C had good motor control in walking with walker. On gait performance, we could find that the better gait performances of all subjects were the same. (Table 1)

Subject A: had the faster average velocity, longest step length and highest cadence in L1 walker. Subject B: had the faster average velocity, longest step length and highest cadence in H1 walker. Subject C: had the faster average velocity, longest step length and highest cadence in N walker. Subject D: had the faster average velocity, longest step length and highest cadence in H2 walker.

The height of the walker was one of the convenient ways to adjust the walker for different goals or needs and different abilities of users. We could find that the different heights have the different effects for individuals in the study and the standard height that used in clinic wasn't the most suitable height for our subjects, although the regularizations between subjects were unobvious. We could find the suitable height for the subject in different goals.

The grading of subject's criteria and the samples in this study were not good enough, so the results of this study could still not apply to the subjects of spastic diplegic cerebral palsy.

Future works can have more subjects, and the ability of the subject can be more similar and detail to have agreeable results.

REFERENCES

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Table 1: Average velocity (Values=mean ± SD, ^{M} is maximum, ^{m} is minimum)

	A	B	C	D
H2	^{m}27.74±2.89	11.79±1.02	19.89±1.23	^{M}28.91±6.44
H1	43.63±16.34	^{M}14.06±0.70	17.69±0.91	^{m}20.17±1.38
N	40.67±6.62	12.54±2.57	^{M}33.31±1.78	24.04±5.80
L1	^{M}47.53±1.70	10.99±2.47	20.84±2.18	^{m}20.17±6.28
L2	36.69±0.44	^{m}7.71±2.28	^{m}17.64±2.50	22.36±6.50