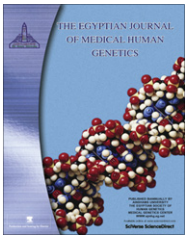
The Egyptian Journal of Medical Human Genetics (2011) **12**, 193–199

Ain Shams University

The Egyptian Journal of Medical Human Genetics

www.ejmhg.eg.net
www.sciencedirect.com



ORIGINAL ARTICLE

Endurance exercises versus treadmill training in improving muscle strength and functional activities in hemiparetic cerebral palsy

Khaled A. Olama *

Department of Physical Therapy for Disturbance of Growth and Development in Children and its Surgery, Faculty of Physical Therapy, Cairo University, Egypt

Received 20 April 2011; accepted 9 July 2011
Available online 12 October 2011

KEYWORDS

Cerebral palsy;
Hemi-paresis;
Muscle weakness;
Treadmill training;
Balance

Abstract Weakness of the sound side in hemiparetic cerebral palsy is one of the serious complications which affect these children. Many children with hemiparetic cerebral palsy have diminished muscle power in the neglected sound side, and the application of strengthening exercises aim to improve the muscle strength and function activities and so may be helpful in the management of such cases. In this study, endurance exercises and treadmill training was conducted to investigate its effect on increasing the strength of the quadriceps femoris and hamstring muscles of the sound side in spastic diaplegic cerebral palsy in comparison to the effect of an endurance exercise program. Thirty spastic hemiparetic children were the sample of this work. There were divided randomly into two equal groups. The ratio of peak torque of quadriceps femoris muscle and the hamstring muscle and balance were measured before and after six months of the application of the treatment program. Group A received the physiotherapy program and treadmill training, while group B received endurance exercise in the form of DeLorme resistance exercise in addition to the same physiotherapy program given to group A. Significant improvement were observed in all measuring variables when comparing the post-treatment results in both groups.

* Address: El-Rehab City, Group 95, Building 12, New Heliopolis, Helwan, Egypt. Tel.: +20 226710780/1103442938.
E-mail address: K_olama@hotmail.com.

Peer review under responsibility of Ain Shams University.
doi:10.1016/j.ejmhg.2011.07.002

ELSEVIER **Production and hosting by Elsevier**

Conclusion: Walking training may be considered as one of the most helpful methods in management of muscle weakness in the sound side and balance in spastic hemiparetic cerebral palsied children.

1. Introduction

Cerebral palsy (CP) describes a group of disorders of posture and movement that occur as a result of a non-progressive disturbance in the developing fetal or infant brain. The neurological disturbance associated with CP is non-progressive, secondary musculoskeletal impairments, pain, and physical fatigue are thought to contribute to changes in motor function in adolescents and adults with CP that may include a decline in walking [1]. Cerebral palsy is the most common cause of disability in childhood and may affect the child on several health dimensions; the motor signs include primary neuromuscular deficits, such as spasticity, muscle weakness and decreased selective motor control, and secondary musculoskeletal problems, such as bony malformations and contractures. Cerebral palsy is often accompanied by disturbances of perception, cognition, communication, and behavior [2]. Cerebral palsied children are characterized by abnormal muscle tone, posture reflexes, or motor development and coordination. There are also bone deformities and contractures. The classical symptoms are spasticity, involuntary movements, unsteady gait, and problems with balance [3]. Hemiplegic cerebral palsy is the most common form of cerebral palsy, affecting up to one person per thousand of live births [4]. Spastic hemiplegia accounts for more than a third of all cases of CP, and the resulting impairments to extremities affect functional independence and quality of life [5]. The term hemiplegic cerebral palsy comprises pathological entities that results in limb weakness on one side of the body. Also in premature infants, the most common cause is periventricular hemorrhagic infarction. In term infant, the underlying causes are often cerebral malformations, cerebral infarction, and intracerebral hemorrhage, the usual concern that brings infants with hemiplegia from birth for a neurological evaluation is delayed crawling or walking [6]. Spastic hemiplegia is characterized by spasticity in the arm and leg on one side of the body and most walk independently but there is wide variation in the function of the affected arm and hand [7].

Children with hemiplegic cerebral palsy compensate for those problems by developing compensatory movement patterns, which allowed to persist and often developed into orthopedic and functional problems, so the goal of physical therapy is to minimize development of these compensatory movement patterns. Therapy is directed towards improvement of the basic motor co-ordination and correction of physical problems commonly associated with this syndrome [8]. Treadmill training was used for children with cerebral palsy to help them to improve balance and build strength of their lower limbs so they could walk earlier and more efficiently than those children who did not receive treadmill training. Some studies showed that treadmill training helped children with cerebral palsy to walk about 101 days earlier than children who did not train by treadmill [9]. Isokinetics has been used in testing and performance enhancement for over 30 years. In 1967, some authors introduced the concept of isokinetic exercise training and rehabilitation. Now, isokinetic testing is a commonly utilized tool for assessment of muscular strength in the orthopedic and sports medicine setting. Isokinetics are frequently chosen because of their inherent patient safety, objectivity, and reproducibility in testing measures. Objective isokinetic testing provides testing the entire lower extremity kinetic chain or performs isolated isokinetic testing [10]. Isokinetic represents a match between mechanically imposed velocity and the subject movement that contacts against a controlled angular velocity. There for, through accommodating resistance the muscle contracts at its maximal capability at all points throughout the range of motion [11]. Endurance exercises are considered as exercises that are done in a time limit of a person's ability to maintain either a specific force or power involving muscular contractions [12]. Several studies have found out that endurance exercises can greatly increase strength in the muscles by adding specific weight training to their programs [13]. Strength development through endurance training is important for the prevention and rehabilitation of injuries and for improving sport performance [14]. Strength is also important for maintenance of functional capacity; with aging or injury, there is catabolic breakdown of the muscle connective tissue, resistance training presents the only natural method to offset such wasting conditions [15]. Resistance exercise is a very common type of endurance training, which can improve the muscle strength and gives a good balance to our bodies [16]. Therefore, the goal of this study was to examine the potential of daily treadmill training in improving muscle strength of the sound side and so, improving function activities in hemiparetic cerebral palsied children.

2. Patients, instrumentation and procedures

2.1. Patients

Thirty hemiparetic cerebral palsied children (12 left and 8 right sides) represented the sample of this study. They were chosen from both sexes (12 males and 8 females), from EI-Nabawy El-Mohandas Institute of Poliomyelitis and Physical Medicine at the area of Imbaba, Giza, Egypt. Their ages ranged from 12 to 15 years ($X'13.73 \pm 0.85$Yr.). They were able to understand any command given to them, with an IQ level within normal range. Children participated in the study were free from any associated disorders other than spasticity. The degree of spasticity was determined according to the modified Ashworth's scale [17] to be within the range of 1^{+} and 2 grades. They were free from any structural changes in the joints of the lower limbs; however there were few degrees of soft tissue tightness. They were able to walk independently with an abnormal gait pattern. The study sample was divided randomly into two groups of equal number (A and B). Double blind evaluation was conducted for each child individually before and after six months of treatment. Group A received a daily designed exercise ther-