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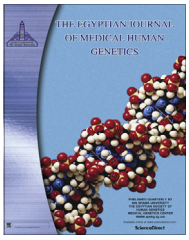

ORIGINAL ARTICLE

Shock wave therapy for spastic plantar flexor muscles in hemiplegic cerebral palsy children

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KEYWORDS

Shock wave therapy;
Spasticity;
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H/M ratio

Abstract *Background:* The spastic motor type is the most common form of cerebral palsy (CP). Spastic equines foot is the most frequent deformity in ambulated children with CP. Shock wave therapy on spastic muscles of the upper limb in stroke patients provided a significant reduction in muscle tone.

Aim: The present study aimed to investigate the efficiency of shock wave therapy on spastic planter flexor muscles and its relation to the gait in spastic hemiplegic cerebral palsy children.

Methods: Thirty spastic hemiplegic cerebral palsy children from both sexes participated in this study. They were divided randomly into two groups of equal number: Group I (control) included 15 children (6 boys and 9 girls), with mean 5.83 ± 0.34 years, received the therapeutic exercises program only. Group II (study) included 15 children (6 boys and 9 girls), with mean age 5.75 ± 0.51 years, received the same therapeutic exercises program which was given to the control group, in addition to shock wave therapy for 1 week (3 session/week).

Results: Comparing the pre and post treatment mean values of the Hoffman reflex/Motor response (H/M) ratio and gait variables, revealed statistically significant differences in these variables in the study group.

Conclusion: The shock wave therapy is effective in the treatment of hypertonic muscles which help those children to become more independent and participate in everyday activities.

1. Introduction

Cerebral palsy (CP) is a non progressive permanent neurological disorder resulting from a lesion in the undeveloped brain. It has an effect on motor and postural development and grounds sensory disorders and learning disability [1]. CP affects between 1.5 and 2.5 per 1000 live births and is thought to be the most common cause of severe physical disability in childhood [2,3]. The spastic motor type is the most common form of CP [4].

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Spasticity is one of motor disorders that may affect cerebral palsy children. It is characterized by hyperexcitability of the stretch reflex that leads to a velocity dependent enlarge in tonic stretch reflexes with exaggerated tendon jerks [5]. The contraction of the spastic muscle groups will cause skeletal deformities that limit the patient's activity [6]. Spastic equines foot is the most frequent deformity in ambulated children with CP [1].

Therefore, treatment of spasticity plays a significant role in the management of patients with CP. Conservative interventions of spasticity may include passive stretching [7,8], serial plastering [9,10], splints [11,12], pharmacologic treatment [13–16], and botulinum toxin [17–21].

Shock waves are defined as a series of single sonic pulses with high peak pressure (100 MPa), fast pressure rise (< 10 ns) and short duration (10 μs). Different studies and clinical experiments have established the value of shock waves in the treatment of tendinitis calcarea of the shoulder [22,23], epicondylitis [24], plantar fascitis [25], and several tendon diseases, particularly in athletes [26].

A single, active treatment of shock wave therapy on spastic muscles of the upper limb in stroke patients provided a significant reduction in muscle tone. This effect lasted up to 12 weeks after therapy with a particular significant effect on the finger flexors muscle tone [27].

This study aimed to investigate the efficiency of shock wave therapy on spastic planter flexor muscles and its relation to the gait in spastic hemiplegic cerebral palsy children.

2. Subjects and methods

2.1. Subjects

Thirty spastic hemiplegic cerebral palsy children from both sexes participated in this study. They were recruited from the outpatient clinic of the Faculty of Physical Therapy, Cairo University, Abu El Rich Hospital and the Institute of Neuromotor System-Imbaba in the period from January to August 2014. Their age ranged from 5 to 7 years old. They were divided randomly into two groups of equal number: Group I (control) included 15 children (6 boys and 9 girls), with mean 5.83 ± 0.34 years, received the therapeutic exercises program only. Group II (study) included 15 children (6 boys and 9 girls), with mean age 5.75 ± 0.51 years, received the same therapeutic exercises program which was given to the control group, in addition to shock wave therapy for 1 week (3 session/week).

The subjects were selected according to the following criteria:

1. Spasticity grades ranged from 1 to 2 according to modified Ashwarth scale [28,29].
2. IQ level not less than 70% which is the borderline in Wechsler's intelligence classification scale [30] in order to understand and follow orders.
3. All subjects were free from any fixed deformity of both lower limbs.
4. All subjects were able to stand with support.
5. All subjects did not have visual or hearing defects.

The study was approved by an Ethics Committee of the Cairo University. Child's parents were provided with a Volunteer Information Sheet and written consent informing them about the purpose of the study, its benefits and inherent risks and their committee with regard to time and money.

2.2. Instrumentations

2.2.1. For evaluation

2.2.1.1. Modified Ashwarth scale. Computerized electromyography (EMG) apparatus: Neuroscreen plus version 1.59 produced by Toennies, a division of Erich Jaeger GmbH, Germany; 1998 was used to determine H/M ratio.

2.2.1.2. 3D gait analysis system

Data were collected through the use of: Opto-electronic motion analysis system with a force plate unit which was used to measure movements or excursions of the ankle joint.

2.2.2. For treatment

The control group received the therapeutic exercises program only.

The study group received the same therapeutic exercises program which was given to the control group, in addition to shock wave therapy for 1 week (3 sessions/week).

2.2.2.1. Shock wave instrumentation. Extracorporeal shock wave therapy (ESWT) was applied by using the Orthospec (Medispec Ltd, Germantown, MD) portable ESWT device that is approved for distribution and is used in the United States by the FDA. It is connected to electrical main supply 115/230 V, single phase 60/50 Hz and 10/5A was used for creating therapeutic shockwaves. The portable shockwave generator targets the shockwaves to a 35 mm diameter therapy zone that enables shockwaves of sufficient energy to be delivered to the tissues in a single therapeutic session.

2.3. Methods and procedures

H/M ratio and gait measurements were evaluated for each subject before and at the 4th week after shock wave treatment.

2.3.1. For evaluation

2.3.1.1. Spasticity evaluation. Modified Ashworth scale was used [28,29]. The degree of spasticity was evaluated by passive movement for both limbs while the child was completely relaxed, lying supine on a mat with the head in mid position. The test was repeated 3 times and the mean record was taken to refer accurately to the degree of spasticity to select CP children having 1,2 grades.

2.3.1.2. H/M ratio measurement. This measurement was held in a quiet room to avoid any changes in the reflex value. It was obtained from triceps soleus muscles [31].

Setting up the child for recording:

- Sites of stimulating and recording electrodes were cleaned by rubbing the skin using alcohol.
- The procedure was repeated until the skin became slightly red to ensure removing of the degenerated cells and lowering the skin resistance.
- Precautions were taken to avoid irritation especially at the stimulating site.