Complementary Therapies in Clinical Practice 23 (2016) 26–29

Contents lists available at ScienceDirect

Complementary Therapies in Clinical Practice

journal homepage: www.elsevier.com/locate/ctcp

# Horseback riding therapy in addition to conventional rehabilitation program decreases spasticity in children with cerebral palsy: A small sample study

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ARTICLE INFO

*Article history:*
Received 18 September 2015
Received in revised form
2 February 2016
Accepted 11 February 2016
Presented at: 3rd Medical Rehabilitation Congress (Tıbbi Rehabilitasyon Kongresi) 15–18 November 2012, Ankara, PS-064, Turkey.

*Keywords:*
Horseback riding therapy
Cerebral palsy
Spasticity

ABSTRACT

*Objective:* To evaluate the short-term effects of horseback riding therapy in addition to a conventional rehabilitation program in children with cerebral palsy.
*Methods:* Nine children receiving horseback riding therapy in addition to conventional rehabilitation (Group 1) and seven children receiving conventional rehabilitation alone (Group 2) were assessed at baseline and 5 weeks later. Assessed were: modified functional reach test (MFRT), hip abduction angle, the Ashworth Scale for hip adductor muscle spasticity, knee distance test, and the Gross Motor Function Classification System (GMFCS).
*Results:* The percentage change in hip adductor spasticity on the Ashworth Scale was 22% in Group 1 and 0% in Group 2 (significant difference; $p = 0.016$). Comparison of changes on the MFRT, GMFCS, knee distance test and hip abduction angle showed that the differences between Groups 1 and 2 were not significant.
*Conclusions:* In these children, horseback riding therapy in addition to conventional rehabilitation resulted in significant improvement in adductor spasticity on short-term follow-up.


## 1. Introduction

Cerebral palsy (CP) is a group of disorders related to the development of movement and posture resulting in limitations in activity, mainly attributed to non-progressive disturbances occurring in the fetal or infant brain [1]. Various types of therapeutic horseback riding have been used in individuals with CP. For example, hippotherapy applied by licensed health professionals using multidimensional movement of the horse may be beneficial in the improvement of gait and balance in children with CP [2].

A meta-analysis of randomized controlled studies indicated that short-term hippotherapy reduced asymmetrical activity of hip adductor muscles [3]. Also, that postural control in children with spastic CP and in individuals with a gross motor function classification system (GMFCS) score $\leq 5$ improves with hippotherapy, although long-term hippotherapy or therapeutic riding showed no significant improvement in gross motor function measures [3]. Another systematic review reported (weakly) significant improvement in gross motor function in children with spastic CP, GMFCS level I–III and aged $\geq$4 years, with hippotherapy or therapeutic horseback riding. The authors also reported a significant effect of hippotherapy or therapeutic horseback riding when applied in 45-min sessions once a week for 8–10 weeks [4].

Hippotherapy simulators have also been studied. Short-term benefit in sitting balance, especially in children with a greater degree of disability, has been reported [5], as well as improvement in postural control in sitting position [6]. Also, hippotherapy applied by licensed health professionals was reported to improve walking speed, stride length, pelvic kinematics, and dimensions D (standing) and E (walking, running, jumping) of the Gross Motor Function Measure-88 (GMFM-88) [2]. Hippotherapy is reported to have a positive effect on the functional motor performance of children with CP [7]. A decrease in energy expenditure during walking and a

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http://dx.doi.org/10.1016/j.ctcp.2016.02.002
1744-3881/

significant increase in scores on dimension E (walking, running, and jumping) of the GMFM have also been reported [8].

The aim of the present study was to evaluate the effect of horseback riding therapy in addition to a conventional rehabilitation program on gross motor function, balance, hip abduction angle, and spasticity of hip adductors in children with CP.

### 1.1. Participants and methods

This study was approved by the local Ethical Committee of the Ankara Physical Medicine and Rehabilitation Training and Research Hospital (Sept 2012. B.10.04. ISM.4.06.23.34.904.02/4245).

Recruited for the study were consecutive children diagnosed with CP who were hospitalized for rehabilitation and received horseback riding therapy in addition to conventional rehabilitation (intervention: Group 1, n = 9) and children with CP who received conventional rehabilitation only (controls: Group 2, n = 7). Both groups were assessed at baseline and again at 5-weeks follow-up by the same physician.

Excluded from the study were children aged ≤4 years, those unable to maintain sitting balance or with hip dislocation, and children who received antispastic drugs or injection of botulinum toxin during the treatment period.

All included patients received the conventional rehabilitation program 5 days a week during the 5-week study period. This program comprised range of motion exercises, progressive resistive strengthening, posture exercises, neurophysiological exercises, balance and coordination training, ambulation training, orthotic and ambulation aid training, stretching, and heat and electrical stimulation, according to the requirements of each child.

In addition, the 9 children in Group 1 received horseback riding therapy consisting of horseback riding plus therapist-directed exercises while the horse was stationary, two times a week (in 30-min sessions) for 5 weeks. The parent(s) of the children in this group accompanied their child during each riding session as observers.

#### 1.1.1. Baseline measurements

All children were assessed before and after the 5-week treatment period by means of the modified functional reach test (MFRT), hip abduction angle, hip adductor muscle spasticity, and the GMFCS.

Age, gender, height, weight, and body mass index were recorded. Motor status of the children was assessed with the GMFCS, a standardized and reliable method to evaluate the severity of limitation in gross motor function. The GMFCS also allows to classify children with CP into five categories according to the characteristics of motor function based on self-initiated movement [9–11].

Balance was tested with the MFRT, which is a reliable and valid tool for children with CP [11]. The test was performed with a leveled yardstick mounted on the wall at the height of the patient's acromion level, while sitting in a chair with hips and knees positioned at 90 degrees of flexion; measure was taken from the distal end of the third metacarpal. Reach was measured forward, as well as on the left and right sides.

Goniometric measurement of hip abduction was performed for both hips. The knee distance test and the Ashworth Scale were used for assessment of spasticity [12].

#### 1.1.2. Statistical analysis

The sample size was estimated using G*power version 3.1, taking into account an agreement of ≥0.80 and an estimation error of ≤0.20. Based on these conditions a sample of at least 6 patients per group was required.

The Wilcoxon signed-rank test was used to compare changes within the groups before and after treatment. The percentage change between pre- and post-treatment data for both groups was calculated as: 100 × [(posttreatment − pretreatment)/pretreatment]. The Mann-Whitney U-test was used to compare group means and he percentage change between Group 1 and Group 2.

Data were analyzed using SPSS for Windows version 16.0. The level of statistical significance was set at $p < 0.05$.

### 1.2. Results

This study included 16 children with CP: 9 males (56%) and 7 females (44%) with a mean age of 7.5 ± 1.7 years. Of these, 9 children received horseback riding therapy in addition to conventional rehabilitation (Group 1) and seven received conventional rehabilitation alone (Group 2). The groups were homogenous with regard to age, gender, weight, pre-treatment values of the GMFCS, knee distance test, the MFRT, and values on hip adductor spasticity.

Values recorded pre- and post-treatment were compared within and between the groups.

In Group 1, the MFRT forward/right/left showed significant improvement after treatment [median values of MFRT forward before treatment 7 and after treatment 11 ($p = 0.011$); MFRT right before treatment 5 and after treatment 9 ($p = 0.008$); MFRT left before treatment 4 and after treatment 9 ($p = 0.007$)]. In Group 2 (controls), MFRT right improved whereas MFRT forward and left showed no improvement after treatment [median values of MFRT forward before treatment 10.5 and after treatment 10.5 ($p = 0.345$); MFRT right before treatment 7.2 and after treatment 11 ($p = 0.042$); MFRT left before treatment 9 and after treatment 11.6 ($p = 0.080$)].

In Group 1, values on the Ashworth Scale for hip adduction showed significant improvement (median hip adductor spasticity before treatment 2 and after treatment 1; $p = 0.025$). In Group 2 there was no improvement in hip adductor spasticity after treatment (median hip adductor spasticity before *and* after treatment 1; $p = 1.000$). Values on the knee distance test showed greater improvement in patients in Group 1 than in the control group; however, the difference between the groups in the pre- and post-treatment values was not significant (Table 1).

Neither the hip abduction angle (right/left) nor the GMFCS showed significant improvement in either of the groups after treatment (Table 1).

The percentage change in hip adductor spasticity on the Ashworth Scale was 22% in Group 1 compared with 0% in Group 2 (significant difference; $p = 0.016$). There were no significant differences between the groups on the MFRT, knee distance test, and hip abduction angles for right/left hips (Table 2).

### 1.3. Discussion

This study demonstrates the beneficial effect of horseback riding therapy on hip adductor spasticity when applied in addition to conventional rehabilitation in children with CP.

Another study on hippotherapy (comprising therapy 2 × per week for 4 weeks) was found to be useful on the short term to reduce spasticity in spinal cord injured individuals with AIS classification A and B; the greatest improvement in tetraplegics or paraplegics was observed in those with highest scores on the Ashworth Scale [13]. Another study reported a lack of improvement in individuals with multiple sclerosis after therapeutic riding [14]. The present study shows a positive effect of horseback riding therapy in addition to conventional rehabilitation program on hip adductor spasticity in children with CP.

Although Group 1 showed a significant improvement in balance scores post-treatment, the difference in percentage change between the two groups was not significant; however, this may be due to the small sample.