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Original article

EFFECTIVENESS OF SPECIALIZED KINESITHERAPY IN CHILDREN WITH SPASTIC HEMIPLEGIC CEREBRAL PALSY.

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SUMMARY

Purpose: The aim of this study was to investigate the effect of Doman-Delacato and Perfetti methods in addition to routine kinesitherapy for children with spastic hemiplegic cerebral palsy (CP).

Material and Methods: 60 children with a spastic hemiplegic CP were randomly divided into two groups – the control group (CG) received routine kinesitherapy method, and the experimental group (EG) received, in addition, specialized neurodevelopmental methods of Doman-Delacato and Perfetti. For children in both groups, kinesitherapy was applied three times a week for 50 min each procedure. Assessment was done using Ashworth Modified Scale, the Holt and Hoskins - Squires Test and GMFM – 88. The study period ran from April 2018 to November 2018. The evaluation was done before and 8 months later. Data were analyzed using GraphPad Prism version 3.0 and SPSS 19.0. The level of significance was accepted as $p<0.05$.

Results: 60 children, 27 girls and 33 boys managed ($\bar{X}$±SD) for EG 4.8±1.3 and for CG 5.06±1.4 were included. Muscle spasticity in EG children decreases much earlier and more than in children in CG. Man Witney criteria show statistically significant differences at the end of the treatment ($p=0,03<\alpha=0,05$). Hottest and GMFM-88 data obtained also received statistically significant differences of t – criteria between initial and final measurements in EG.

Conclusions: EG children improvement is better and occurs much earlier. Therefore, we could assert that our methodology optimizes the treatment of children with CPD and improves their quality of life.

Keywords: neurodevelopment, kinesitherapy, spasticity, palsy

INTRODUCTION

Cerebral Palsy (CP) is one of the most common diseases in pediatric neuropathology. The average frequency for Europe is 2.5 per 1000 newborns. It covers a set of disturbances caused by brain damage before, during or after childbirth [1]. Over the past 40 years, despite the widespread use of fetal monitoring techniques, heart rhythm, and a 5 to 6- times increase in caesarean section, there is no reduction in CP prevalence in developed countries [2, 3].

The treatment begins in the first months of the child's life through the methods of healing exercises. The aim of the treatment is to provide a useful and maximal motor activity to the child and stop the occurrence of muscular contractures [4].

Convulsions, visual and speech impairment are treated successfully with medication and speech therapy. The most important part of the treatment is to maintain a close relationship with the parents and to be trained to conduct a permanent and competent curative exercise at home under the supervision of the professional. The rehabilitation effect is slow but sure. Modern medicine offers great opportunities and additional laser therapy(laser acupuncture) in the treatment of CP and robot-assisted therapy of the new generation [5, 6].

Increasingly in international literature, studies have been conducted over the last decade on the effect of the Kinesio taping method on children with CPD, and the results that report on the effect of its application are good but short-term [7, 8, 9].

The application of physical therapy continuously developed and improved with new approaches to stimulate regeneration processes, brain plasticity and neuronal reorganization [10, 11].

Park EY, and Kim WH, study the effect of certain neurodevelopment methodologies based on physical therapy on muscle strength, spasticity and gross motor skills in children with spastic CP. In conclusion, they report that neurodevelopment methods based on physical therapy are effective and give good results in children with spastic CP [12].

Recent studies about brain plasticity associated with training and adaptation processes that compensate neurological lesions give specialists the opportunity to develop a variety of appropriate methods for treating patients with neurological impairment. Strengthening of the muscles and exercise therapy are known in motor recovery because of brain damage, but the return of a function is highly dependent on neuroplasticity, which is the capacity of the motor cortex to modify the functional organization because of the acquisition of experience. Changes in cortical maps are marked by specific aspects of the proposed stimulus response (motivation, acquiring dexterity) and not merely the result of repetitions and weight training. Dose (number of movements) and intensity (movements per unit time) of the

exercise are important and critical factors in the activation of cortical plasticity [6].

This same theory is based on both the methodologies we include in the present study - Doman-Delacato and Perfetti [13, 14, 15].

MATERIAL AND METHODS

Contingent in this study were 60 children (27 girls and 33 boys) mean age (±SD)94.8±1.3 years for the experimental group (EG) and 5.06±1.4years for the control group (CG), diagnosed with cerebral palsy - spastic hemiparesis. Functional tests and kinesitherapy procedures have been carried out after thoroughly acquainting parents with methodologies and signing a written informed consent. The study methodology includes the following functional tests – the Ashworth test for muscle Spasticity assessment, Holt Test, and GMFM-88.

To the objective study of skeletal muscles, besides the examination, palpation and the methods described above, we also applied the passive examination of the muscle tone through the Ashworth test. In passive flexion and extension of the large upper and lower limb joints, the following assessments are made: 1 - a slight increase in tone or normal resistance at the end of the movement; 2 - a strong increase in tone throughout the volume; 3 - a significant increase over the whole volume; 4 - the limb is fixed in the folded and unfolded position.

When damage to central motor neurons, which is the nature of the CP damage, it is often found that the patient can not contracture a particular muscle but does a movement in which that muscle is not involved. In these cases, it is more appropriate to study muscle activity as part of daily living movements and primary-motor actions. For children with CP for this purpose, we used the Holt and Hoskins - Squires tests.

The GMFM-88 is a standardized research tool designed and validated to measure the change in global motor function over time in children with CP. The point key is intended to be the main guideline where 0 - does not start, 1 - starts, 2 - partially finishes, 3 - ends, NT - not tested.

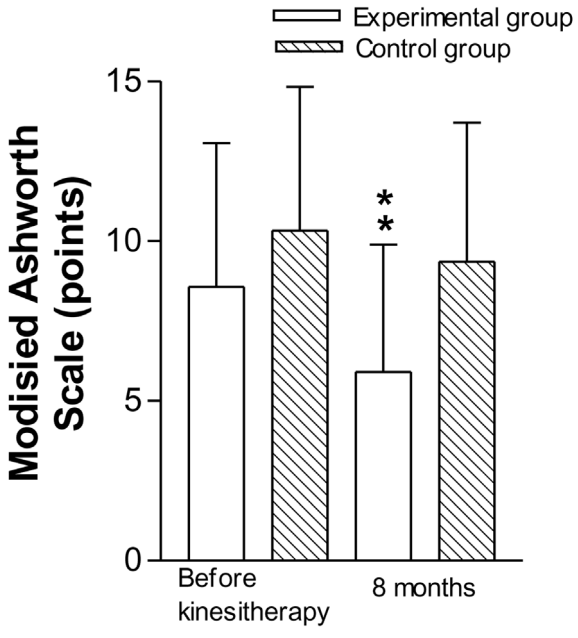
The CG children were given a routine kinesitherapeutic method, three times per week for 50 minutes, including massage, thermal or cryotherapy, stretching, passive, active and post-exercise exercises. The children from the EG except for the above mentioned items included elements of the two neurodevelopmental methods of Doman-Delacato and Perfetti daily, 3-4 times a day, as well as recreational activities 2 times a week (optional - sports, mobile games, dancing, activities of daily living). The study period runs for 18 months, and assessment was done before kinesitherapy and at the end of the therapy.

Data were processed using GraphPad Prism version 3.0 and SPSS 19.0. The statistical methods used in this study were element of descriptive statistics and hypothesis. Wilcoxon test was used for quantitative dependent variables and the Mann-Whitney U-Criteria for independent variables to determine significant differences between the groups. For statistically significant differences, we accept values where $p < 0.05$.

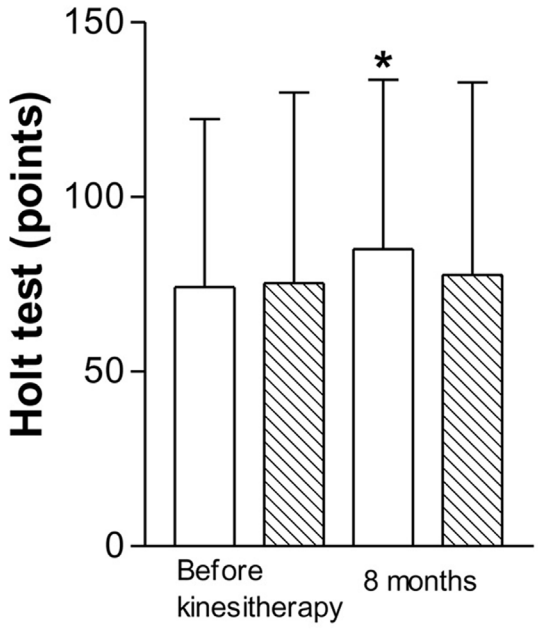
RESULTS

The mean Ashworth test scores at the beginning of the EG study showed 8.57±4.5 and 5.9±4.0 at the end of the period. In CG, the initial results were 10.33±4.5 and at the end of the study period 9.36±4.35 (fig. 1A.). The results from the application of the Man Whitney criteria shows statistically significant differences in final measurements ($p=0.03 < \alpha=0.05$).

Fig. 1. Results of Ashworth Scale (A.) and Holt test (B.) before and after kinesitherapy for control and experimental group (** p<0.03, Mann Withney; * p<0.05, Wilcoxon)



A.

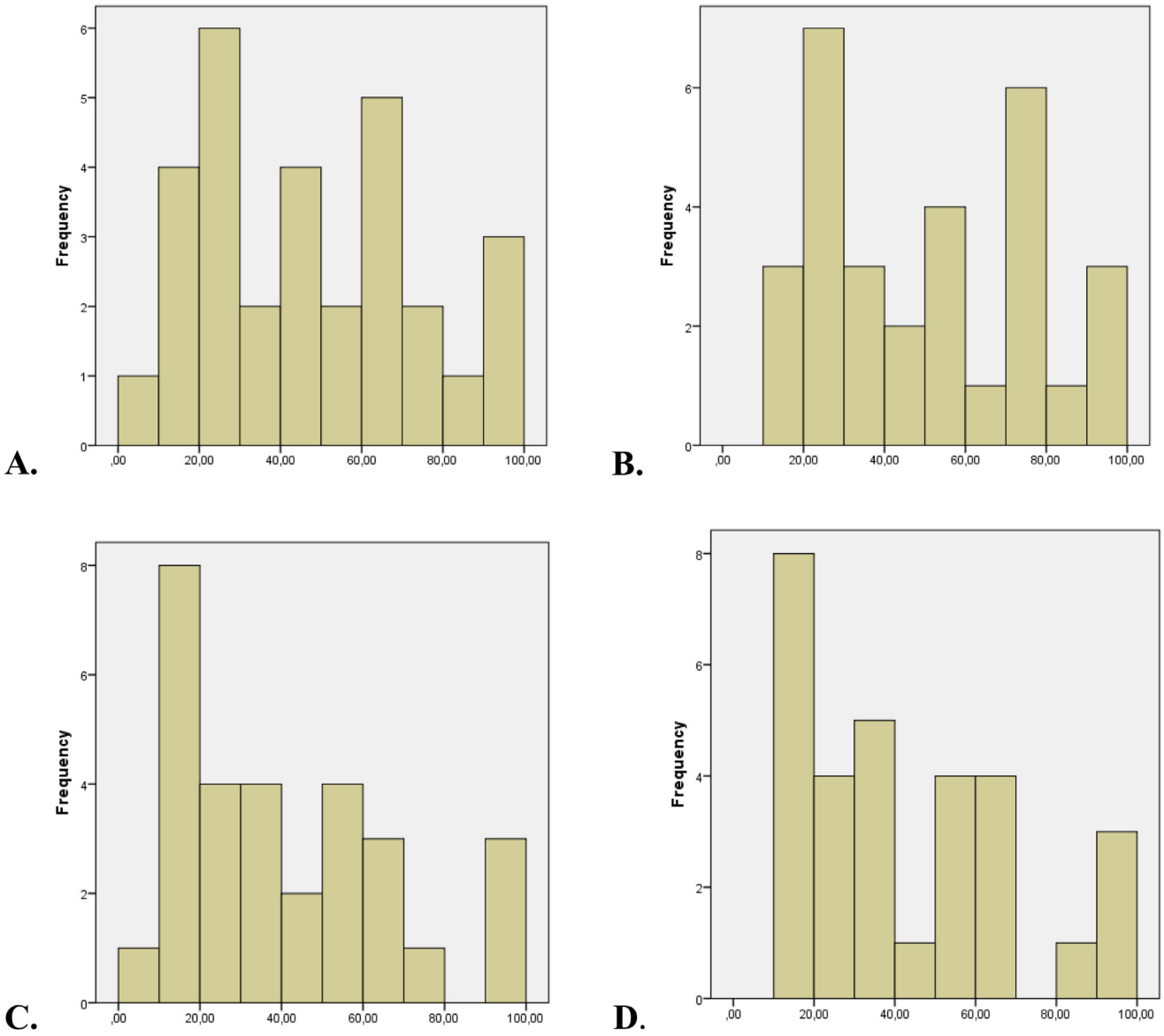


B.

Data from the Holt test for EGin the initial measurements was 74.13±48.2 and at the end reached 85.10±48.4. In CG, the results were 75.26±54.7 at the beginning and 77.66±55.2 at the end of the period. (Fig. 1B.). The results of the t-criterion for dependent samples show statistically significant differences in final measurements ($p < 0.05$).

The results of the GMFM test after we applied the Mann-Whitney criteria indicate that there are no statistically significant differences between EG and CG in both initial and final measurements. However, after analyzing the histograms, it is clear that their structure is the same in the CG, and the dynamics in the small values in EG are clearly visible. This shows that the methodology is more effective for EG and for working with children with low GMFM test scores.

Fig. 2. Histograms of GMFM – 88 for the experimental group – before (A.) and after (B.) application of kinesitherapy and for the control group – before (C.) and after (D.) kinesitherapy



DISCUSSION

One of the leading problems in children with cerebral palsy is the change in muscle tone and, as a result, various orthopedic and functional complications. Spasticity can be described as a disorder of the motor reflex, characterized by a speed-dependent increase in the tonic stretch reflex, with pathologically lively tendon reflexes resulting from hyperexcitability of the muscle stretching reflex [16].

A number of studies have followed the effect of various methods to affect the spastically increased muscle tone in children with cerebral palsy. A significant part of our kinesitherapeutic methodology was aimed precisely at influencing muscle hypertonia in children with this diagnosis, so we and a number of authors believe that this is the leading problem for them [16]. The means we included for influencing hypertension were mainly - passive exercises, massage, stretching, thermotherapy and the specialized methods of Doman-Delacato and Perfetti.

The positive effect of long-term repeated passive exercises on the influence of muscle tone in children with cerebral palsy has been proven. The results show an improvement in active range of motion, muscle spasticity, Times Up-and Go test and 6-Minute walk test. The authors report that repeated passive mobilizations could be effective and reduce spastic hypertension of the lower extremities, resulting in improved gait in such children [17].

In addition, the author's methodology includes specialized massage techniques and thermotherapy, which also have a proven effect on spasticity. Active exercise applied to antagonists of spastic muscle groups reflexively also affects the tone of spastic muscles. Passively and correctly applied stretching, up to the threshold of pleasant tolerable pain, again has a positive effect on hypertension.

The causal relationship between muscle spasticity, muscle strength, gross motor skills and functional capabilities in children with cerebral palsy has been proven. There was a significant direct relationship between muscle spasticity and coarse motility as measured by GMFM, as well as a correlation between muscle strength and gross motility in these children. The relationship between gross motor skills and functional capabilities and Daily Living Activities (DLA)was also reported. Accordingly, muscle spasticity has a large indirect negative effect on gross motor skills and DLA, while muscle strength has a proven positive indirect effect on the same indicators. So we can conclude that it would be more effective for children with cerebral palsy to use activities based on everyday activities than how many activities based on the child's own disability. This would reduce its functional limitations [18].

A number of studies have reported significant improvements in children's gross motor skills following the application of Bobath therapy in their pilot study [19, 20]. The same results were obtained with Tekin et al. in their study on the effectiveness of Bobath neurodevelopmental therapy in improving postural control and balance in children with cerebral palsy. Report statistically significant differences in all indicators between the two study groups [21].

In our study, we noted an improvement in muscle spasticity in children with EG, resulting in improved range of motion in the large joints of the upper and lower limbs and improved global motility, functionality and quality of life of children in this group. In contrast to children in EG, improvements were also reported in those from CG, but without statistically significant differences.

CONCLUSION

The innovative kinesitherapy methodology for children with cerebral palsy developed and performed correctly under the guidance of a specialist and in close collaboration with parents for the implementation of the program at home is more effective than routine kinesitherapy.

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