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Training postural control and sitting in children with cerebral palsy: Kinesio taping vs. neuromuscular electrical stimulation

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ABSTRACT

Objective: To elucidate the effects of Kinesio Taping (KT) in addition to neurodevelopmental therapy (NDT) on posture and sitting, and to compare the effects of KT and neuromuscular electrical stimulation (NMES).
Materials-methods: Seventy-five children were randomized into control, KT, and NMES groups. NDT was applied to all children 4 times a week for 4 weeks. In addition, KT and NMES were applied to KT and NMES groups, respectively. Sitting subset of Gross Motor Function Measure (GMFM) and kyphosis levels of the groups were analyzed by two way mixed ANOVA.
Results: GMFM and kyphosis values improved significantly in all groups (all $p < 0.01$), yet change levels were more prominent in the KT and NMES groups than the control group. Moreover, NMES group showed better improvement.
Conclusion: KT or NMES application for four weeks in addition to NDT is effective on improving kyphosis and sitting. Besides, NMES is more effective than KT.

1. Introduction

Posture and sitting problems are common in children with cerebral palsy (CP). Pelvis and trunk controls are imperative for sitting/mobility, the development of upper extremity, pulmonary functions, and activities of daily living (ADL) (i.e. eating, drinking, and writing) [1,2]. In this regard, it is getting more considerable to improve sitting and posture in CP children.

Until now, various rehabilitative interventions such as neurodevelopmental therapy (NDT), hippotherapy (riding on a horse with the help of a therapists), and horse back-riding have been developed for improving sitting ability and posture in children with CP [3–6]. Neuromuscular electrical stimulation (NMES) has been studied previously and it was found to be effective on sitting and posture in CP children as well. NMES has some advantages (noninvasive, improves muscle re-education and proprioception). Yet, challenges in accurate placement of surface electrodes, isolation of a specific muscle, sensory tolerance, skin reactions -particularly long-term use of electrodes- and discomfort are the disadvantages [7]. On the other hand, Kinesio Taping (KT) method is an alternative therapy developed by Kenzo Kase in 1973. Kase reported that KT facilitates circulation, improves tissue alignment, corrects muscle function, and provides positional stimuli [8]. KT is commonly used in rehabilitation settings due to its several advantages (ease of application, comfortable, no restriction in range of motion and ADL, provides mechanical support). Temporary skin reaction is the only side effect of KT application [9].

Concerning the effects of KT on sitting and posture in children with CP in the pertinent literature, the data is limited and scarce. Şimşek et al. [10] have reported that KT has been effective on sitting, yet not on functional and motor parameters. In a pilot study, immediate effects of KT have been studied whereby neuromuscular taping seems to be effective on dynamic activities, but not in static activities [11]. Moreover, Kaya Kara et al. [12] have reported that KT increases proprioceptive feedback, gross motor function, and ADL in CP children. Previous studies focused on the combination of different modalities to achieve better functional status in CP children. However, to the best of our knowledge, effects of KT in addition to NDT have not been studied yet. We hypothesized that children who received KT plus NDT would show better trunk and postural control compared with children who received NDT only. Therefore, the objective of this study was to elucidate the effects of

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KT in addition to NDT on posture and trunk control. In addition we aimed to compare the effects of KT and NMES on postural trunk control.

2. Materials-methods

2.1. Participants

Local Ethics Committee approved the study protocol and informed consent was obtained from the parents' of the children.

A total of 75 children with spastic diplegic CP (involvement of the lower extremities) were included in this study. Inclusion criteria were spastic diplegic CP with kyphosis and sitting problem, and cooperative. The exclusion criteria were; concomitance of hip contracture, scoliosis, hip dislocation, severe spasticity (Modified Ashworth 3–4), previous history of hip or spinal surgery, hypersensitivity reaction to KT, and severe cognitive disorders.

2.2. Procedure & randomization

The children were allocated into three groups by using block randomization according to the order of their hospitalization as the following; Control, KT, and NMES groups. Hospitalization of the children was independent from evaluators. NDT was applied to all children for four weeks five times a day. In addition, KT was applied to KT group and NMES was applied to NMES group in addition to NDT (Flow diagram).

2.3. Measurements

Sitting balance was evaluated by sitting subset of Gross Motor Function Measure (GMFM) [13,14]. Kyphotic angles were evaluated according to the lateral radiographs of the children by using Cobb method. The upper and lower margins of the T3 and T12 vertebrae, respectively were marked with the horizontal lines, and the vertical line which originates from the horizontal lines were intersected. The resultant angle features to the kyphotic angle [6]. X-rays were evaluated by a proficient physiatrist and by the same person.

Fig. 1. Picture shows the Kinesio Taping method.

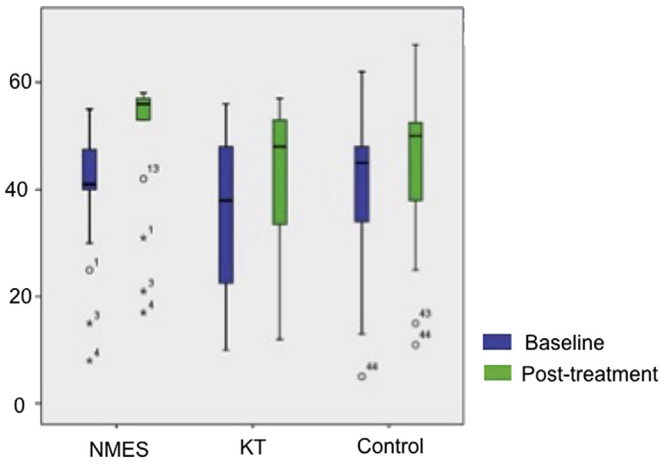

Fig. 2. Boxplot graph of GMFM levels before and after the intervention.

2.4. Interventions

2.4.1. Neuro-developmental therapy

Bobath therapy was administered for NDT. The Bobath concept is an approach for the neurological rehabilitation by facilitating of normal postural reactions and movements. Treatment sessions lasted 75 min and each child received 4 times per week for 4 weeks. NDT was administered by three different pediatric physiotherapists. All therapists had approximately five years experience in our pediatric rehabilitation center.

2.5. Neuromuscular electrical stimulation

Two-channel self-adapting multimodal electrostimulator

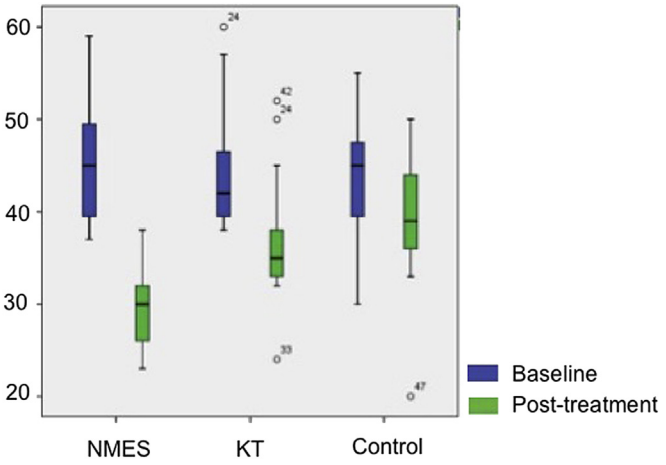

Fig. 3. Boxplot graph of kyphosis values before and after the intervention.