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THE EFFECT OF KINESIOLOGIC TAPING ON HAND FUNCTION IN CHILDREN WITH CEREBRAL PALSY

SEREBRAL PALSİLİ ÇOCUKLARDA KİNEZYOLOJİK BANTLAMANIN EL FONKSİYONU ÜZERİNE ETKİSİ

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Abstract

Objective: To research the effect of kinesiologic taping (KT), applied to the wrist dorsiflexor muscle group using a facilitating (muscle strengthening) technique, on the hand function of children with unilateral cerebral palsy (CP) at its early stages and independent of exercise.
Methods: The study tests 20 patients who have been diagnosed with unilateral CP. KT, was applied to the plegic aspect of the dorsiflexor muscle group on the wrists and fingers of all subjects. Patients were evaluated in terms of age, gender, dominant hand. Hand function was evaluated by the Jebsen Hand Function Test (JHFT). The hand function of the patients was evaluated at three time points: before the KT; immediately after the application with KT in situ; and immediately after the KT was removed.
Results: The assessment of the patients' ability to perform activities such as turning pages, carrying small objects, eating simultaneously, stacking backgammon pieces on top of each other, moving light-large objects and heavy-large objects, before the KT and after the KT was applied showed a significant stastistical difference (p<0.05 for all parameters). The results of the patients before the KT was applied and after it was removed did not show a statistical significant difference (p>0.05 for all parameters).
Conclusion: It is thought that the application of KT to the wrist dorsiflexor and finger extensor muscle groups of children with unilateral CP contributes to the improvement of hand functions. There is a need for long term follow-up studies to see the long-term effect the KT.

Keywords: *Cerebral palsy, kinesiologic taping, upper extremity rehabilitation, occupational therapy.*

Öz

Amaç: Bu çalışmada unilateral (tek taraflı) tutulumu olan serebral palsi (SP)'li çocuklarda el bileği dorsi fleksör kas grubuna fasilitasyon tekniğiyle (kas güçlendirmeye yönelik) uygulanan kinezyolojik bantlamanın (KB) egzersizden bağımsız olarak el fonksiyonları üzerindeki erken etkilerinin araştırılması amaçlanmıştır.
Yöntem: Çalışmaya unilateral SP tanısı almış toplam 20 hasta dahil edildi. Tüm hastaların plejik taraf el bileği dorsi fleksör ve parmak ekstansörlerine yönelik kinezyolojik bantlama yapıldı. Hastalar yaş, cinsiyet, dominant el açısından değerlendirildi. Hastaların el fonksiyonları Jebsen Taylor El Fonksiyon Testi (JTEFT) ile değerlendirildi. Hastaların el fonksiyonu; kinezyolojik bantlamadan önce, kinezyolojik bant uyguladıktan hemen sonra ve kinezyolojik bant çıkarıldıktan sonra üç ayrı zamanda olacak şekilde değerlendirildi.
Bulgular: Hastaların kinezyolojik bantlama öncesi ve kinezyolojik bantlamadan sonra yapılan değerlendirmesinde sayfa çevirme, küçük objeleri taşıma, yemek yeme, tavla pulu üst üste dizme, hafif-büyük nesneleri ve ağır-büyük nesneleri taşıma aktivitelerinde istatistiksel olarak anlamlı fark saptandı (tüm parametreler için p<0,05). Hastaların KB uygulanmadan önceki ve bant çıkarıldıktan sonraki sonuçlarında ise istatistiksel olarak anlamlı bir fark saptanmadı (p>0,05).
Sonuç: Unilateral SP'li çocukların el bileği dorsi fleksör ve parmak ekstansör kas grubuna KB uygulamasının el fonksiyonlarını geliştirmeye katkısı olduğu düşünülmektedir. KB'nin uzun vadede etkisini görmek için daha uzun süreli takip çalışmalarına ihtiyaç vardır.

Anahtar Kelimeler: *Serebral palsi, kinezyolojik bantlama, üst ekstremite rehabilitasyonu, iş ve uğraşı terapisi.*

Introduction

In cerebral palsy (CP), one of the leading causes of childhood disability, muscle weakness and sensory problems substantially contribute to functional deficiency caused by abnormal posture of the upper limbs and muscle tone pathologies. Hands lose their ability to identify the physical characteristics of objects, especially as a result of the loss of the proprioception and stereognosis senses. This negatively affects the grasp function of the hands. The limitation of reach activities of the upper limbs and grasp and release activities of the hands can inhibit basic functions, such as playing games and socialization, thereby causing social isolation in addition to limiting the basic daily life activities of children with CP.[1]

The kinesiology taping (KT) technique, which was developed in 1973, has been commonly used as an auxiliary therapy method especially in the prevention, treatment and rehabilitation of sports injuries.[2,3] Recently it has been used, in addition to the conventional therapy, in diseases requiring neurologic rehabilitation. There are reports in the literature of the effects of KT on the spasticity, gait and upper limb functions in patients with stroke.[3,4] Although the exact mechanism of action is not known, it is thought that it may have positive effects on spasticity, gait pattern and functional activities due to its regulatory effects on muscle tone.[2] Moreover, there is evidence that KT contributes to improvement of proprioceptive sense as a result of stimulation of proprioception and mechanoreceptors through the skin[3,5] and supports muscle activity in application via a facilitation technique.[6,7] It has been reported that KT applied in combination with conventional therapy may increase improvement of functional activities.[2,7] In the current literature, different results are reported on the effectiveness of the tape in studies with KT.[8-9] There are limited studies in the literature that investigated the efficacy of the KT technique on upper limb functions in children with CP.[10-12]

This study aimed to primarily investigate the early effects, independent of exercise, of KT applied with facilitation technique (directed to muscle strengthening) to the wrist dorsi-flexor muscle group on hand functions in children with unilateral CP.

Methods

Subjects and Participants

Twenty patients, aged from 5 to 12 years who met the inclusion criteria, diagnosed with unilateral CP, were selected for the study from a total of 29 patients who were receiving occupational therapy following a diagnosis of CP. Inclusion criteria were: Stable clinical status, 5-12 years old, without upper extremity passive range of motion limitation, receiving neurodevelopmental rehabilitation programme regularly, sufficient cognitive level to understand to follow the directions of the testing protocols. Exclusion criteria were: patients who had severe cognitive dysfunction or do not have cognitive function sufficient to communicate; had severe spasticity in the upper limbs (2 or higher according to the Modified Ashworth Scale); had sensory impairment or static deformity; and those who had insufficient body balance to maintain a sitting posture for half an hour. All patients who were included in the study were evaluated by a physical therapy and rehabilitation specialist. Patients were evaluated in terms of age, gender, dominant hand. Ethical approval for the study was granted by the ethical committee of our hospital (KAEK 2014/319).

KT was applied to the plegic side of the patients. Two purposes were taken into consideration in the KT application: 1. Increasing wrist dorsiflexion 2. Increasing the active finger extantion and thumb extantion. Before performing KT, skin sensitivity test was performed by applying a square piece of tape (5*2.5 cm) on the back and left for 24 hours, then it was removed and the reaction of the skin to the tape was observed. The patients were taught to perform the specified exercises accompanied by KT. KT application was done by the same physiotherapist who has a KT application certificate.

KT applied as follows: from origin of extensor digitorum combines muscle (extensor carpi ulnaris, extensor digiti minimi, extensor carpi radialis longus and brevis) to distal interphalangeal (DIP) joint of fingers; and from origin of extensor and abductor pollicis longus to interphalengeal joint of thumb. Tension of tape was 30%. Purpose of KT application in these manners was to improve the function of muscles and joint re-alignment (correction the wrist flexion and thumb in palm deformities). The photos of the KT application are shown in Figure 1,2,3,4.

The hand function of the patients was evaluated at three time points: before the KT; immediately after the application with KT in situ; and immediately after the KT was removed. Hand function was assessed using the Jebsen-Taylor Hand function test (JTHFT). Evaluations were carried out on a laboratory table during which the positions of all test objects on the table were marked. The subjects were positioned so as to sit up straight on a height-adjustable chair, facing the table. The height of the chair were adjusted to ensure that the child's forearm is parallel with the surface of the table.

Since most of the patients were illiterate, the writing activity element of the JTHFT was not evaluated. The time taken to conduct the six activities of the JTHFT tested were recorded (in seconds).

Statistical Analysis

The statistical analysis of the data was carried out with mean±standard deviation (SD) and Wilcoxon tests using SPSS 12.0 for Windows software. The statistical significance level was set at $p<0.05$. For effect size = 0.80; $\alpha = 0.05$, Power ($1-\beta$) = 0.90, we performed a power analysis using G*Power 3.1.9.4 and calculated the sample size as 19.

Results

The mean age of the patients included in the study was 8.3±4.1 years. Eight (40%) were female and 12 (60%) were male. The dominant hand was the right hand in 13 (65%) and left in seven (35%). In the evaluations made before the KT and immediately after the application with tape in situ statistically significant differences were found in terms of turning pages, picking up small objects, simultaneous feeding, stacking checkers, picking up large-light objects and and picking up large heavy objects ($p<0.05$ for all parameters). The results from the evaluations made before the KT and immediately after the application are shown in table 1. When the results from the evaluations made before the KT and immediately after the KT was removed were compared, no statistically significant differences were found ($p<0.05$ for all parameters) (see Table 2).

Figure 1. Before KT

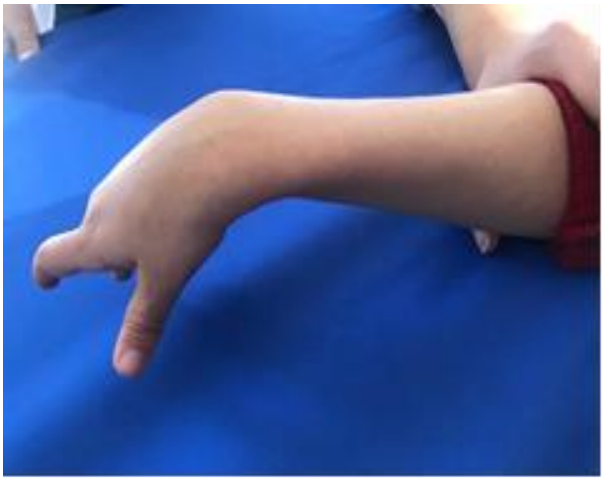

Figure 2. Before KT

Figure 3. After KT

Figure 4. After KT

Table 1. The JTFT results of the patient's before and after taping (while patient with tape)

	Pre-taping Mean ± SD	Post-taping (with KT) Mean ± SD	*p**
Page turning (sec)	147.2+26.6	104.1+20.3	**0.000**
Lifting small objects (sec)	239.5+33.1	184.3+30.4	**0.005**
Feeding (sec)	300.9+25.5	209.5+29.8	**0.001**
Stacking checkers (sec)	192.0+32.7	112.6+22.1	**0.001**
Lifting light cans (sec)	142.2+30.3	109.8+25.6	**0.003**
Lifting heavy cans (sec)	231.1+34.3	193.3+34.7	**0.006**

*p**: value of intragroup comparison pre and post taping (with KT)

Table 2. The JTHFT results of the patient's before and after taping (after the tape has been removed)

	Pre-taping Mean ± SD	Post-taping (without KT) Mean ± SD	*p***
Page turning (sec)	147.2+26.6	159.1+29.5	0.259
Lifting small objects (sec)	239.5+33.1	241.7+33.3	0.383
Feeding (sec)	300.9+25.5	300.8+25.6	0.960
Stacking checkers (sec)	192.0+32.7	194.2+32.9	0.392
Lifting light cans (sec)	142.2+30.3	154.2+33.1	0.231
Lifting heavy cans (sec)	231.1+34.3	229.4+34.5	0.298

*p***: value of intragroup comparison pre and post taping (without KT)

Discussion

The KT technique was developed based on a taping method similar to the structural characteristics and elasticity of human skin without restricting joint movement.[13] In the pediatric rehabilitation group, the area of use of KT consists of CP, brachial plexus damage, torticollis, hypotonia, brain tumors, myelomeningocele and various neurological disorders that affect sitting balance such as strokes, spinal cord injuries and traumatic brain injuries. In practice, the aim is to ensure smooth postural pattern, to support weak muscle groups and to control hypotonic or hypertonic muscle groups, thereby improving the functional levels of the patients. It is remarkable that KT has been used in children with CP especially to improve postural control. It is suggested that when used in conjunction with established treatment modalities for these children, this approach may improve voluntary control and coordination of upper limbs by positively affecting the cutaneous receptors of the sensorimotor system.[2] As in all rehabilitation practice, therapy methods that improve functionality for patients have been increasingly used in CP rehabilitation.

This study investigated the acute effect, independent from exercise, of KT applied for muscle strengthening on hand functions in children with CP.

Studies are ongoing to demonstrate the efficacy of KT technique in pediatric age groups. Yasukawa *et al.*[3] evaluated upper limb functions using the "Melbourne Upper Limb Functional Assessment" test in a pilot study that investigated the efficacy of KT applied to upper limbs in 15 children attending a rehabilitation program due to a range of different diagnoses including encephalitis, brain tumor, cerebrovascular accident, traumatic brain injury and spinal cord injury. KT was intended to support weak muscles, to support joint stability and to functionally support the arms and hands by helping with limb posture. It was reported that in general the scores improved over time and assessment scores obtained after taping were significantly improved compared to those obtained before taping. In another study conducted by Moghaddam *et al.*[13], hand function of 26 children with spastic diplegic CP were examined and the effects of KT technique, when applied in combination with exercise, were evaluated. The authors applied the KT method to the wrists of the patients in the study group in addition to occupational therapy. They reported significant improvement in hand function of the exercise and KT group.

Similarly to these two reports, we found statistically significant improvement in hand functions according to all JTHFT measures in the evaluation made immediately after the taping and with the tape in situ, compared to that made before the taping. When the results from the evaluations made before the taping and immediately after the tape was removed were compared, no differences were found in any of the parameters. The small number of patients and lack of a control group were considered to be the limitations of the study.

In this study, KT applied with facilitation technique was found to contribute to improvement of hand functions independently from exercise.

Conclusion

We believe that KT technique, within the scope of an occupational therapy program for upper limb rehabilitation in children with CP, may be a supportive therapy option with respect to functional gain. However, controlled studies using larger study groups are warranted in which taping and exercise are applied in combination.

Disclosure

No funding was received for this research. Authors declare that they have nothing to disclose.

This study was presented as a Poster at the 3rd Medical Rehabilitation Congress.

Conflict of Interest

None declared.

Compliance with Ethical Statement

Ethics Committee approval for this research was obtained from the Clinical Research Ethics Committee University of Kocaeli (dated December 12, 2014 No:23/8).

Author Contributions

Ç.Ç, I.S, M.İ: The hypothesis of the study; Ç.Ç, I.S, M.İ, N.D:The Study desing: Ç.Ç, I.S, M.İ: Project development; Ç.Ç, I.S, M.İ, N.D: Literature search; Ç.Ç, I.S, M.İ, N.D, B.S, E.D: Analysis; Ç.Ç, I.S, M.İ, B.S: Manuscript writing; N.D, B.S, E.D: Critical review.

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