e-ISSN 1980-5918
Fisioter. Mov., Curitiba, v.30, Suppl 1, 2017

DOI: http://dx.doi.org/10.1590/1980-5918.030.S01.AR06

Effects of kinesiology taping in children with cerebral palsy: a systematic review

Os efeitos do Kinesiotaping em crianças com Paralisia Cerebral: Uma revisão sistemática

Ricardo Rodrigues de Sousa Junior, Priscila de Lima, Josiele Neves da Silva, Daniela Virgínia Vaz*

Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, MG, Brazil

Abstract

Introduction: Cerebral Palsy is a group of non-progressive movement and posture disorders. There are many rehabilitation methods for children and adolescents with these disorders. Kinesiology Taping(KT) is becoming a popular as an option of rehabilitation method for these children. **Objective:** The aim of this systematic review is to summarize evidence regarding the methods of Kinesiology Taping use in children and adolescents with Cerebral Palsy and its effects. **Materials:** A search of scientific papers in the databases Medline, Scielo and PEDro was conducted with no data or language restriction. For this search the keywords "Kinesio taping", "Kinesiology Taping", "Taping", and "Bandages" combined with "Cerebral Palsy" were used. The search was conducted between May of 2015 and November of 2016. **Results:** Eleven studies were included in the review, six were randomized controlled clinical trials, four were quasi-experimental studies, and one was a case study. In general, the studies followed the guidelines proposed by the Kinesiology Taping creator; they used corrective techniques and muscle contraction facilitation/inhibition techniques. Results varied according to techniques used and outcomes chosen. **Conclusion:** There is strong to insufficient evidence of KT effects in motor function related outcomes. Stronger quality level studies are necessary to support use of KT in clinical practice.

Keywords: Cerebral Palsy. Bandages. Motor Activity. Rehabilitation.

* RRSJR: BS, email: rickrsjr@yahoo.com.br
PL: BS, email: priscila.limaufmg@yahoo.com.br
JNS: BS, email: josi.nevesilva@gmail.com
DVV: PhD, email: danielavvaz@gmail.com

Resumo

Introdução: *A Paralisia Cerebral é definida como um grupo de distúrbios não progressivos de movimento e de postura. Existem diferentes métodos de reabilitação para crianças e adolescentes com Paralisia Cerebral. Dentre eles, o uso do Kinesio Taping vem se tornando comum.* ***Objetivo:*** *O objetivo da presente revisão sistemática é sumarizar evidências relativas a métodos de aplicação do Kinesio Taping e seus efeitos em crianças e adolescentes com Paralisia Cerebral.* ***Métodos:*** *Foi realizada uma busca da literatura científica nas bases de dados Medline, Scielo e PEDro sem restrição de idioma. Para esta pesquisa foram utilizadas as palavras-chave "Kinesio taping", "Kinesiology Taping", "Taping" e "Bandages" combinadas à "Cerebral Palsy". A busca aconteceu entre Maio de 2015 a Novembro de 2016.* ***Resultados:*** *Foram selecionados onze estudos, sendo seis ensaios clínicos controlados e aleatorizados, quatro ensaios clínicos não controlados e um estudo de caso. Os estudos no geral seguem os modelos de aplicação do taping propostos pelo criador da técnica, utilizando técnicas corretivas e técnicas de facilitação/inibição da contração muscular. Há pobre evidência de efeitos e estes variam com os métodos de aplicação utilizados e os desfechos escolhidos.* ***Conclusão:*** *Há evidência forte a insuficiente quanto aos efeitos do KT desfechos relacionados às funções motoras. São necessários estudos com maior qualidade metodológica para justificar o uso do KT na prática clínica.*

Palavras Chave: *Paralisia Cerebral. Bandagens. Atividade motora. Reabilitação.*

Introduction

Cerebral Palsy (CP) is a group of non progressive disorders of movement and posture that result from injury to immature brain [1, 2]. CP can be classified as spastic, dyskinetic, ataxic, hypotonic, or mixed, based on clinical presentation and area or nervous system injury. CP covers a diverse spectrum of impairments, which affect primary reflexes and muscle tone, muscle strength, motor coordination, postural control, and acquisition of motor milestones [3].

The impairments caused by CP may affect children's lives in many ways. According to the International Classification of Functioning (ICF), functional manifestations of a health condition are classified in different domains: body functions and structures, activity, and participation [4]. In conjunction with the impairments in body functions and structures typical of each type of CP, children often have difficulties in performing activities such as sitting, walking, going up and down stairs, using the bathroom, and dressing. These limitations may restrict the child's participation in school, sports, social, cultural, recreational contexts [5 - 7].

There are many physical therapy intervention techniques for children with CP [8]. Lately, Kinesiology Taping (KT) is becoming a popular treatment option [6]. KT consists in using an elastic, anti-allergic taping which may be stretched 130 to 140% of its original length [9]. The objectives applying KT are to facilitate or inhibit muscle contraction, stabilize joints, and promote postural alignment through stimulation of mechanoreceptors in the skin [6, 9, 10]. The physiological mechanisms behind purported effects of KT are not well defined. According to KT proponents, stimulation of skin mechanoreceptors can influence motor unit to produce "facilitation" or "inhibition" of muscle contraction, depending on the tape direction and tension [11 - 14]. The stimulation produced by the taping may add to or augment the voluntary control and coordination of children and adolescents with CP [3, 6, 15].

Given the recently increased popularity of KT and the lack of systematization of its effects, the aim of this study is to review and summarize the techniques of KT application and their effects in children and adolescents with Cerebral Palsy.

Methods

A search of scientific publications on the databases Medline, Scielo, and PEDro was conducted without language or date restriction, between May of 2015 and November 25th of 2016. The keywords "kinesio taping", "kinesiology taping", "taping" and "bandages" combined with "cerebral palsy" were used. The search was conducted by one investigator that identified relevant candidate studies based on their title and abstract. Two other investigators conducted a second round of selection among candidate studies based on the inclusion/exclusion criteria. The final selection was decided by consensus between both investigators, using a third one in case of divergence.

No review protocols were found in the searched databases. The studies included in this review were clinical trials and case studies that investigated the effects of KT on motor function for children and adolescents with CP. Clinical trials and case studies in adults and children with neurological dysfunctions other than CP were excluded. Studies that did not investigate the effects of KT related with motor function outcomes were also excluded.

The data about the methods, participants, and results was extracted by one investigator and checked by a second investigator. Subsequently, trials were rated for quality using the Physiotherapy Evidence Database-PEDro scale (ranging from 0 to 10 points) [16]. No meta-analysis was conducted due the heterogeneity of the studies.

Results

Study Characteristics

A total of 108 studies were found on the databases. After applying the inclusion/exclusion criteria, a number of 11 studies were selected by the investigators. Details of the selection process are shown in the figure I in a PRISMA flow diagram [17].

The description of KT intervention used by the studies is detailed in the table 1. Table 2 lists the patient characteristics, measurement instruments, and outcomes.

Six of the eleven selected studies were randomized controlled trials (RCT). Four of these studies were graded 6/10 [18 - 21], and two were graded in 5/10 [22, 23] according to the PEDro scale. Four studies were quasi-experimental designs [24 - 27], and one was a case study [28].

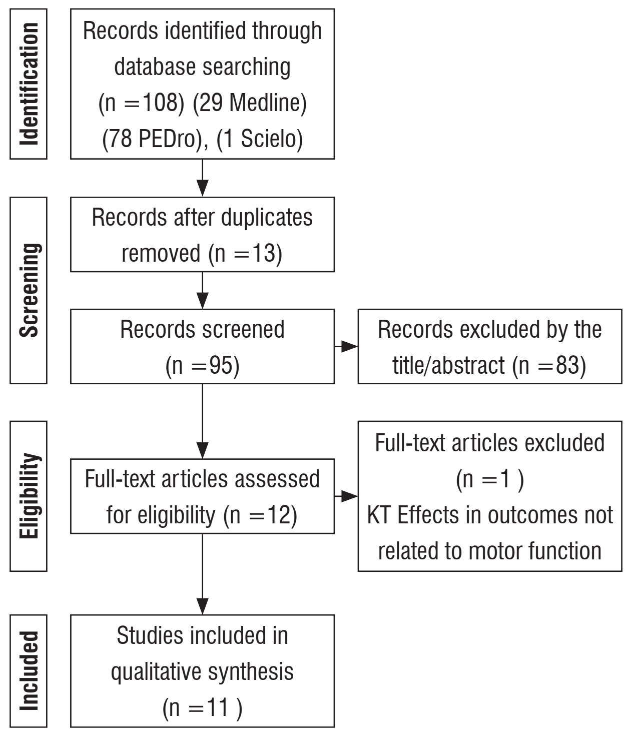

Figure 1 - PRISMA Flow Diagram

Table 1 - Intervention Characteristics

Author/ Year	Methodology Type	Technique Objective	KT Local and Direction	Intervention Temporal Aspects
Almeida *et al* 2007	Quasi-experimental study	To change gait pattern	Distal part of the leg to the metatarsals-direction: not reported Calcaneus-direction: longitudinal Transverse plantar arch-direction: lateral to medial	Frequency: 1 day/ week Duration: 3 days Total time: 3 months
Camerota *et al*2013	Case Study	To transfer the taping mechanical effect on the skin to the muscles	Left palm-direction not reported Shoulder anterior and posterior region-direction: not reported	Frequency: 2 days/week Duration: 3 days, 1 day of rest Total time: 20 days
Costa *et al* 2013	Quasi-experimental study	To promote changes in balance performance and mobility	Quadriceps and tibialis anterior muscles-direction: origin to muscle insertion	Frequency: Once Duration: During task execution Total time: Time of task execution

(To be continued)

(Conclusion)

Table 1 - Intervention Characteristics

Author/ Year	Methodology Type	Technique Objective	KT Local and Direction	Intervention Temporal Aspects
Footer *et al* 2006	Randomized controlled trial	To promote changes in gross motor function	Erector spinae muscles-direction: muscle origin to muscle insertion Lower trapezius-direction: muscle insertion to muscle origin	Frequency: 2 days/week Duration:2 to 5 days in a week Total Time: 12 weeks
Ghalwash *et al* 2012	Randomized controlled trial	To control genu recurvatum in mobility tasks	Posterior region of the knee-direction: not reported	Frequency: 3 days/week Duration: During physical therapy Total time: 12 weeks
Iosa *et al* 2010	Quasi experimental study	To limit movements that can cause instability, contracture and joint deformities	Ankle-direction: not reported	Frequency: 1 day/week Duration: One day in a week Total time: 24 weeks
Kara *et al* 2014	Randomized controlled trial	To promote a better muscle gross motor function, and functional independence	Upper extremity and lower extremity without detailed description-direction: not reported	Frequency: 2 days/week Duration:3 days Total time: 12 weeks
Karabay *et al* 2016	Randomized controlled Trial	To promote changes in sitting posture and trunk control	Acromioclavicular joint to T12 vertebrae-direction: Lateral to medial, obliquely	Frequency: 3-4 days/week Duration: 2-3 days in a week Total Time: 4 weeks
Keklicek *et al* 2015	Randomized controlled trial	To increase dexterity by correcting excessive thumb adduction	Thenar eminence in the thumb extension portion- direction: from the anterior third of the wrist to the posterior third	Frequency: Once Duration: During test execution Total time: Time of test execution
Mazzone *et al* 2011	Quasi-experimental study	To increase upper extremity function	Thumb- direction: proximal to distal (trapezius-metacarpal to interphalangeal joint) Upper extremity- direction: Base of the thumb dorsally to the medium third of the humerus	Frequency: 1 day/week Duration: 6 days Total time: 10 months
Simsek *et al* 2011	Randomized controlled trial	To promote changes in the sitting posture, gross motor function and functional independence level	Erector spinae muscles S1 to C7- direction: muscle insertion to origin in children with hypertonic trunk, and muscle origin to insertion n in children with hypotonic trunk	Frequency: 2 days/week Duration: 3 days Total time: 12 weeks

Table 2 - Patient Characteristics, Outcome Measures, and Main Results

Author/ Year	Number of Patients and Age	Outcome measures	Main Results
Almeida *et al* 2007	7 (6.71±1.25)	Kinematic analysis during gait. (Movement analysis software) Muscle activity of tibialis anterior and triceps surae (Electromyography)	Statistic significant increase in ankle dorsiflexion during heel strike after intervention. No statistic significant changes in muscle activity.
Camerota *et al* 2013	1 (17)	Kinematic analysis and ROM during a reaching task (Movement analysis software)	Increased range of motion and less time to perform the task after intervention.
Costa *et al* 2013	4 (10.25±1.4)	Kinematic analysis and performance of sitting to stand task (Movement analysis software, Timed Up and Go Test) Balance (PBS*)	Statistic significant improvements in the sitting to stand time and in the dynamic activities of the PBS* after intervention.
Footer *et al* 2006	KT group: 9 (6.5±2.7) Control group: 9 (5.5±1.9)	Gross motor function (GMFM**-88).	No statistic significant improvements compared to the control group.

(To be continued)

(Conclusion)

Table 2 - Patient Characteristics, Outcome Measures, and Main Results

Author/ Year	Number of Patients and Age	Outcome measures	Main Results
Ghalwash *et al* 2012	KT group: 7 (6.19±0.59) Control group: 7 (6.26±0.28)	Gross motor function (GMFM-88 D and E) Knee alignment in the sagittal plane (Movement analysis software	No statistic significant improvements compared to the control group.
Iosa *et al* 2010	8 (4.7±3)	Passive range of motion (goniometry) Spasticity (Ashworth Scale) Gross Motor Function (GMFM**)	No statistic significant improvements after intervention.
Kara *et al* 2014	KT group: 15 (9±2.25) Control group: 15 (9.58±3)	Gross Motor Function (GMFM, BOTMP***) Agility (10x5m sprint test) Muscle Power (Muscle Power Sprint test) Functional Independence (WeeFIM)	Statistic significant improvements in the functional independence scores, muscle power, gross motor function (BOTMP) compared to the control group. No statistic significant improvements in the GMFM scores.
Karabay *et al* 2016	KT group: 19 (6.5±2.3) Control group: 19 (5.7±2.4) Control group: 19 (5.9±2.0)	Sitting position (GMFM sitting dimension) Kyphosis levels (Radiographic kyphotic angle)	Statistic significant improvements in all outcome measures in both experimental groups compared to the control group.
Keklicek *et al* 2015	KT group: 15 (7.9±2.84) / 15 (8.13±8.87) Control group = 15 (8.2±8.73)	Manual dexterity (The Nine Hole Peg Test)	Statistic significant improvements in manual dexterity compared to the control group
Mazzone *et al* 2011	16 (3±2)	Upper Extremity Function (Melbourne Assessment)	Statistic significant improvements in the upper extremity function after intervention
Simsek *et al* 2011	KT group = 15 (8.27+3.43) Control group = 15 (6.87+2.10)	Gross Motor Function (GMFM) Functional Independence (WeeFIM) Sitting Posture (SAS****)	Statistic significant improvements in sitting posture compared to the control group. No statistic significant changes in the gross motor function and functional independence compared to the control group.

* PBS-Pediatric Balance Scale
**GMFM- Gross Motor Funcional Measure
*** BOTMP – Bruininks-Oseretsky Test of Motor Proficiency
**** SAS-Sitting Assessment Scale

Patient Characteristics

All studies reported patient's age, which varied between 3 and 17 years old, and CP type. Spastic CP was the most frequent diagnostic group. Six studies classified the level of motor function of the patients with the the Gross Motor Function Classification System (GMFCS) [16, 17, 19, 20, 22, 25]. GMFCS levels vary from 1 to 5 based on the child's functional limitations and use of orthotics, with 1 corresponding to the higher motor function level and 5 to the lower [29]. One third of the patients were classified at level I, one third at levels II and III, and one third at levels IV and V. No studies investigated the relation between KT effects and GMFCS levels.

Intervention Characteristics

Intervention characteristics were heterogeneous. In seven studies KT interventions lasted twelve weeks or more [18, 19, 20, 22, 25, 26] and in one study the intervention lasted less than three weeks (28). Two studies analyzed the immediate effects of KT application [23, 24]. Four studies with longer interventions had statistically significant results [18, 22, 25, 26] two of these studies being RCTs [18, 22]. One RCT study showed positive effects after 4 weeks of taping [21]. In eight studies, KT application was associated with physical therapy sessions [18, 19, 21, 22, 23, 25, 27, 28] with four of them showing statistically significant results [18, 21, 22, 24] (three RCTs) [18, 21, 27].

All the studies reported place of application. The studies by Costa [24], Footer [20], Ghalwash [19], Keklicek [23], Mazzone [25], Simsek [22] and Almeida [26] et al. specifically reported the application technique, including tape shape, application direction, and tension.

The KT direction is believed to be important with regards to desired effects of muscle contraction facilitation or inhibition [10, 30, 31]. KT application direction, however, was mentioned in six studies [20, 22 - 26]. When facilitation of muscle contraction for better movement performance is desired, the tape should be applied from the muscle origin to its insertion [30, 31]. Six studies used this method in order to facilitate thumb abduction and fingers extension [25], dorsiflexion and knee extension [24], digit extension [26], and trunk extension [20, 22]. To avoid excessive contraction of a muscle, the opposite direction of application (insertion to origin) is indicated [30, 3]. One study applied the KT over the erector spinae muscles with the objective of inhibit excessive trunk extension in children with hypertonic trunk [22].

Some application techniques aim to correct joint position and segment posture, presumably via feedback from mechanoreceptors [31]. Cutaneous stimulation from the tape would act as augmented sensorial information, allowing the children to actively correct their posture [9, 31]. Some of the reviewed studies reported this KT technique [18, 19, 23, 25, 26]. Mazzone et al. [25] taped the upper extremity in a spiral pattern from the base of the thumb to the humerus, in order to favor wrist extension and forearm pronation. Kara et al. [18] taped the wrist in a "buttonhole" shape, in order to promote extension. Keklicek et al. [23] taped the wrist obliquely from the ventral to the dorsal aspect in order to promote extension. The application also intended to stabilize the trapezio-metacarpal joint by promoting abduction and extension of the thumb. Ghalwash et al. [19] taped posteriorly the knee joint, aiming to reduce knee hyperextension. Almeida et al. [26] intended to promote calcaneal eversion and ankle dorsiflexion.

KT tension is also argued to be essential to the success of the technique [9, 10, 31]. Nevertheless, only two studies [22, 24] reported this aspect of the application. When the KT is stretched, the tension in the taping varies according to original length deformation from "none", to "very light (0-15%), to light (25%), to moderate (50%), to severe (75%) to complete (100%) [31]. For example, a 5 cm stretch in a 20 cm tape would correspond to light tension. Both studies used light tension in order to facilitate muscle contraction.

In spite of the purported connection between aspects of KT application (shape, direction and tension) and physiological effects (muscle contraction, muscle relaxation, postural change) there is very poor documentation for the fundamental tenets of the technique in children with CP. Of the eleven reviewed studies, only one used electromyography to investigate muscle activation but did not report appropriate comparisons before and after taping [26]. Explanations for possible effects of KT on other aspects motor function is limited by the unavailability of scientific evidence supporting its basic principles.

The Effects of KT interventions on the ICF domains

Studies included in the review assessed outcomes at different levels of the ICF, including body functions and structures and activity performance.

Range of Motion

In four studies, one of which was an RTC [19], interventions intended to increase joint range of motion (ROM) [19, 26 - 28]. Two studies analyzed ROM in functional activities (gait, and reaching forward) [26, 28]. A significant increase in dorsiflexion was found during gait, after the taping was tape was applied for twelve weeks with corrective techniques distally in the leg, over the calcaneus, transverse plantar arch, and dorsum of the foot. No control group for comparison was available, however. An increase in shoulder flexion and elbow extension was found during reaching forward in a case study in which KT was applied for three weeks over the shoulder [28]. Two other studies (including the RTC) measured the effects of KT on isolated knee and ankle ROM and found no significant effects [19, 27].

Balance

Costa et al. [24] aimed in to improve the static and dynamic balance in four children with CP with the application of facilitatory KT on the tibialis anterior and quadriceps. The taping was applied while the child performed the Time Up and Go (TUG) and Pediatric Balance Scale (PBS) tests. There were statically significant improvements in the dynamic activities of the PBS were observed after intervention, but conclusive support for this effect is limited by lack of a control group.

Gait

Almeida et al. [26] used the KT with intention of favoring eversion with dorsiflexion and correcting equinus during gait. An increase in dorsiflexion at heel strike was observed after three months of taping, but not immediately after application. Authors attribute the change in heel strike at three months to facilitation of tibialis anterior and inhibition of the triceps surae activity, but report no comparisons of muscle electromyographic levels between assessments. Additionally, no control group was available to support attribution any effects to the taping intervention.

Gross Motor Function

Six studies analyzed the KT effect in gross motor function of children with CP [18, 19, 21, 22, 20, 27] with only not being RCT [27] All studies analyzed the gross motor function using the Gross Motor Function Measure (GMFM). No statically significant changes in gross motor function after the KT interventions were seen in four of the RTCs [18 - 20, 22]. Only one RCT showed positive changes in gross motor function after taping obliquely the trunk of children, in order to improve sitting position and decrease the kyphotic angle [21]. However, no overall gross motor function data was provided, only the GMFM sitting subset. Kara et al (18) included taping for the upper extremity in their twelve weeks intervention protocol, and detected a significant improvement in the gross motor sub-score of the Bruininks-Oseretsky Test of Motor Proficiency (BOTMP), which includes upper extremity activities, unlike the GMFM [32 - 34].

Sitting and Sit to Stand

Two RTC (21, 22) assessed the sitting posture using the Sitting Assessment Scale (SAS), and the sitting dimesion of GMFM. Simsek et al. [20, 22] taped erector spinae muscles while Karabay et al. [21] taped the superior trapezius muscle; both in facilitation techniques. Authors suggest that the KT intervention can increase the muscle control in the sitting posture, but muscle contraction levels were not measured in the studies.

Costa et al. [24] wanted to assess the performance during the sitting to stand task. KT was applied to facilitate muscle contraction the lower extremity. There were statistically significant results in the Timed Up and Go (TUG) test. The quasi-experimental study showed better post intervention scores. According to the authors the positive results was due an increase of knee extension and ankle dorsiflexion ROM, measured by movement analysis software.

Upper Extremity Function

Three studies [23, 25, 28] one being an RTC [23] intended to improve upper extremity function with the KT intervention. One study detected statistically significant improvements in reaching and manipulation activities with the Melbourne Assessment after two periods of five months of KT to promote thumb abduction, wrist extension, forearm pronation and shoulder external rotation [25]. Better fine manual dexterity in the adapted version for children of the Nine Hole Peg Test was detected immediately after taping to correct thumb adduction [23]. A case study reported better kinematic parameters for reaching after fifteen days of KT applied to the upper extremity. Details of the rationale and objectives of the application technique, however, were not reported [28].

Functional Independence

Two RCT studies used the WeeFIM to assess functional independence after KT interventions [18, 22]. The WeeFIM contains domains of self care, sphincter control, transfers, locomotion, communication and cognition [35, 36]. Kara et al. [18] reported significant improvements in the self-care domain compared to the control group after twelve weeks of KT intervention, in order to improve gross motor function. The taping was applied over the upper extremity (scapula, forearm and wrist) and lower (hip, knee and ankle) extremity, using facilitation and corrective techniques. No statistic significant improvements were seen in functional independence in the study of Simsek et al. [22], comparing to the control group after twelve weeks of intervention. The study aimed to make changes in the sitting posture applying the taping over the trunk.

Discussion

This review aimed to summarize the current evidence of the effects of KT in children with CP. There was heterogeneity in the population studied, with varying GMFCS level, type of CP, and age. The studies available were of poor to moderate quality in general. The levels of evidence of the outcomes presented were classified basing on the PEDro Scale in five different levels: strong evidence, moderate evidence, limited evidence, indicative findings, and no or insufficient evidence [37, 38].

There is strong evidence of positive effects of KT on the sitting position and moderate evidence of positive effects of KT on upper extremity function. There are insufficient evidences of the effects of KT on other outcomes related to motor function as gait pattern, gross motor function, balance and range of motion.

Despite the positive results founded in four RCT, two on upper extremity function, and two on sitting posture. None of these studies used sham tape as the control intervention. These effects therefore could be due to placebo effects of taping. The findings of this review are in general agreement with other systematic reviews [39 - 41] which reported no substantial evidence for the treatment efficacy of KT. Most studies investigating the clinical effects of KT technique on children with CP (and other populations as well) are low quality and report unsubstantial results. Additionally, it is also necessary to consider the fact that the fundamental assumptions of KT, that is, it´s supposed effect on muscle activation levels usually do not get tested.

Conclusion

There is strong evidence of positive effects of KT on the sitting posture using facilitation techniques; and moderate evidence of positive KT effects of KT on upper extremity function through positioning techniques. However, most of the results of this review suggest insufficient evidence about the effects of KT in children and adolescents with Cerebral Palsy. Stronger quality level studies are necessary to support use of KT in clinical practice.

References

1. Miranda ERAB, Palmieri MD, Assumpção RMC, Yamada HH, Rancan DR, Fucs PMMB. Idade óssea na paralisia cerebral. Acta Ortop Bras. 2013;21(6):336-9.
2. Rosenbaum P, Paneth N, Leviton A, Goldstein M, Bax M. A report: the definition and classification of cerebral palsy. Dev Med and Child Neurol.2007;49:8-14.
3. Cury VCR, Brandao MB. Reabilitação em Paralisia Cerebral. Rio de Janeiro: MedBook; 2011.
4. Sampaio RF, Luz MT. Human functioning and disability: exploring the scope the World Health Organization's international classification. Cad Saude Publica. 2009;25(3):475-83.
5. Beckung E, Hagberg G. Neuroimpairments, activitiy limitations, and participation restrictions in children with cerebral palsy. Dev Med and Child Neurol. 2002;44(5):309-17.
6. Santos AN. Efeito do Kinesiotaping em Crianças com Paralisia Cerebral [dissertation]. São Carlos, SP: Universidade Federal de São Carlos; 2015.
7. Campbell SK, Palisano RJ. Physical therapy for children. Philadelphia: Elsevier Saunders; 2006.
8. Novak I, Mcintyre S, Morgan C, Campbell L, Dark Leigha, Morton N, et al. A systematic review of interventions for children with cerebral palsy: state of the evidence. Dev Med and Child Neurol. 2013;55(10):885-910.
9. Kase K. Illustrated kinesio taping. Albuquerque, NM: Ken´i-Kai; 2003.

10. Artioli DP, Bertolini G. Kinesio taping: application and results on pain: systematic review. Fisioter Pesqui. 2014; 21(1):94-9

11. Wong OMH, Cheung RTH, Li RCT. Isokinetic knee function in healthy subjects with and without Kinesio taping. Phys Ther Sport. 2012;13(4):255-8.

12. Halseth T, McChesney JW, Debeliso M, Vaughn R, Lien J. The Effects of Kinesio™ Taping on proprioception at the ankle. J Sports Sci Med. 2004;3(1):1-7.

13. Tamburella F, Scivoletto G, Molinari M. Somatosensory inputs by application of KinesioTaping effects on spasticity, balance, and gait in chronic spinal cord injury. Front Hum Neurosci. 2014;8:367.

14. Callaghan MJ, McKie S, Richardson P, Oldham JA. Effects of patellar taping on activity during knee joint proprioception test using functional magnetic resonance imaging. Phys Ther. 2012;92(6):821-30.

15. Yasukawa A, Patel P, Sisung C. Pilot study: investigating the effects of kinesio taping in an acute pediatric rehabilitation setting. A J Occup Ther. 2006;60(1):104-7.

16. Maher CG, Sherrington C, Herbert RD, Moseley AM, Elkins M. Reliability of the PEDro scale for rating quality of randomized controlled trials. J A Phys Ther Assoc. 2003;83(8):713-21.

17. Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. PLoS Med. 2009;6(7):e1000097.

18. Kara OK, Uysal SA, Turker D, Karayazgan S, Gunel MK, Baltaci G. The effects of kinesio Taping on body functions and activity in unilateral spastic cerebral palsy: a single-blind randomized controlled trial. Dev Med And Child Neurol. 2015;57(1):81-8.

19. Ghalwash AM, El-Shennawy SAW, Abd-Elwahab MS. Efficacy of adhesive taping in controlling genu recurvatum in diplegic children: A pilot study. Egyp J Med Human Gen. 2013;14(2):183-8.

20. Footer CB. The effects of therapeutic taping on gross motor function in children with cerebral palsy. Pediatr Phys Ther. 2006;18(4); 245-52.

21. Karabay I, Dogan A, Ekiz T, Koseoglu BF, Ersoz M. Training postural control and sitting in children with cerebral palsy: Kinesio taping vs. neuromuscular electrical stimulation. Complement Ther Clin Pract. 2016;24:67-72.

22. Simsek TS, Turkucuoglu B, Çokal N, Ustumbas G, Simsek IE. The effects of kinesio taping on sitting posture, functional independence and gross motor function in children with cerebral palsy. Disabil Rehabil. 2011;33(21-22):2058-63

23. Keklicek H, Uygur F, Yakut Y. Effects Of Taping The Hand In Children With Cerebral Palsy. J Hand Ther. 2015;28(1):27-33.

24. Costa CSN, Rodrigues FS, Leal FM, Rocha NACF. Pilot study: investigating the effects of kinesio taping on functional activities in children with cerebral palsy. Dev Neurorehabil. 2013;16(2):121-8.

25. Mazzone S, Serafini A, Iosa M, Aliberti N, Gobbetti T, Paolucci S, et al. Functional taping applied to upper limb of children with hemiplegic cerebral palsy: a pilot study. Neuropediatrics. 2011;42(6):249-53.

26. Almeida A, Gonçalves P, Silva MA, Machado L. O efeito da aplicação de ligaduras funcionais no padrão de marcha e controlo postural em crianças hemiplégicas espásticas por paralisia cerebral. Rev Port Cien Desp. 2007;7(1):48-58.

27. Iosa M, Morelli D, Nanni MV, Veredice C, Marro T, Medici A, et al. Functional Taping: A Promising Technique for Children With Cerebral Palsy. Dev Med Child Neurol. 2010;52(6):587-9.

28. Camerota F, Galli M, Cimolin V, Celletti C, Ancillao A, Blow D, et al. Neuromuscular taping for the upper limb in cerebral palsy: a case study in a patient with hemiplegia. Dev Neurorehabil. 2014;17(4):384-7.

29. Palisano R, Rosenbaum P, Walter S, Russel D, Wood E, Galuppi B. Gross motor function classification system (GMFCS). Dev Med Child Neurol. 1997;39:214-23.

30. Jaraczewska E, Long C. Kinesio taping in stroke: improving functional use of the upper extremity in hemiplegia. Top Stroke Rehabil. 2006;13(3):31-42.

31. Kase K, Martin P, Yasukawa A. Kinesiotaping in pediatrics: fundamentals and whole body taping. Albuquerque, NM: Kinesio Taping Association; 2006.

32. Russel DJ, Rosenbaum PL, Cadman DT, Gowland C, Hardy S, Jarvis S. The gross motor function measure. Dev Med Child Neurol. 1989;31(3):341-52.

33. Bruininks R. Bruininks-Oseretsky test of motor proficiency: examiner`s manual. Circle Pines, MN: American Guidance Service; 1978

34. Duger T, Bumin G, Uyanik M, Aki E, Kayihan H. The assessment of Bruininks-Oseretsky test of motor proficiency in children. Pediatr Rehabil. 1999;3(3):125-31.

35. Ottenbacher KJ, Msall ME, Lyon NR, Granger CV, Braun S. Interrater agreement and stability of the Functional Independence Measure for Children(WeeFIM): use in children with developmental disabilities. Arch Phys Med Rehabil. 1997;78(12):1309-15.

36. Sanders JO, McConnell SL, King R, Lanford A, Montpetit K, Gates P, et al. A prospective evaluation of the WeeFIM in patients with cerebral palsy undergoing orthopaedic surgery. J Pediatr Ortho. 2006;26(4):542-6.

37. Van Peppen RP, Kwakkel G, Wood-Dauphinee S, Hendriks HJ, Van der Wees PJ, Dekker J. The impact of physical therapy on functional outcomes after stroke: what's the evidence? Clin Rehabil. 2004;18(8):833-62.

38. Arantes NF, Vaz DV, Mancini MC, Pereira MSDC, Pinto FP, Pinto TPS. Efeitos da estimulação elétrica funcional nos músculos do punho e dedos em indivíduos hemiparéticos: Uma revisão sistemática da literatura. Rev Bras Fisioter. 2007;11(6):419-27.

39. Kalron A, Bar-Sela S. A systematic review of the effectiveness of Kinesio Taping. Eur J Phys Rehabil Med. 2013;49(5):699-709.

40. Morris D, Jones D, Ryan H, Ryan CG. The clinical effects of Kinesio Tex Taping: A systematic review. Physiother Theory Pract. 2013;29(4):259-70.

41. Parreira PTCS, Costa LCM, Hespanhol Jr LC, Lopes AD, Costa LOP. Current evidence does not support the use of Kinesio Taping in clinical practice: a systematic review. J Physiother. 2014;60(1):31-9.

Received on 04/09/2016
Recebido em 09/04/2016

Approved on 05/12/2017
Aprovado em 12/05/2017