International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979; Impact Factor: RJIF 5.72
Received: 05-11-2018; Accepted: 08-12-2018
www.allsubjectjournal.com
Volume 6; Issue 1; January 2019; Page No. 26-30

Effect of relaxing technique of kinesio taping on muscle function in infant with congenital muscular Torticollis

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Abstract

Background and purpose: Congenital muscular torticollis which is a common pediatric musculoskeletal abnormality, leads to an imbalance of muscle functions of head and neck muscles. Kinesio taping is a therapeutic tool used with increasing frequency within musculoskeletal rehabilitation. So, the purpose of this study was to determine the effect of kinesio taping on muscle functions around the head and neck in infant with congenital torticollis.

Materials and Methods: Thirty infants (14 boys and 16 girls) whose age was ranged from 3 to 9 months selected from Abo - Elresh teaching hospital, They had congenital muscular torticollis without any palpable mass in sternocleidomastoid muscle. The infants were randomly and equally assigned into two groups; (control and study). In control group;the infants received specially designed physical therapy program for 30-45 minutes, three times per week, for three months. While in study group; Kinesio taping was applied on affected sternocleidomastoid muscle using relaxaing technique in addition to the same specially designed physical therapy program. The range of motion and muscle function of neck were assessed by Arthrodial protractor and muscle function scale respectively before and after eight weeks of treatment. Results: there is a significant difference in range of motion and muscle function when comparing the mean values between both groups after treatment, with favor to study group

Conclusion: it was concluded that Kinesio tape should be adjunct to physical therapy program in infants with congenital torticollis.

Keywords: congenital torticollis- physical therapy- kinesio tape–infants

1. Introduction

Congenital muscular torticollis is one of the most common musculoskeletal abnormalities, that is a result of shortening of the sternocleidomastoid muscle (SCM), which leads to an imbalance of muscle function around the neck [1]. While the SCM may be the primary muscle involved, secondary shortening of other cervical muscles such as scalenes, levator scapulae, or upper trapezius occurs. CMT is usually noted in the first 2 to 3 weeks after birth, with a reported incidence of 0.4% to 1.9%.45 [2].

The etiology of CMT is uncertain it is postulated that fetal position abnormalities, intrauterine or perinatal compartment syndrome and birth trauma ensuing a difficult delivery embody the main causes [3]. Other possible causes encountered are hereditary and venous or arterial occlusion which may create fibrous tissue within the sternocleidomastoid [4]. Infants with CMT have a higher incidence of breech presentations [5] and associated congenital musculoskeletal diagnoses, such as hip dysplasia and foot deformities [5-6]. Developmental Dysplasia of the Hip (DDH) with a coexistence rate estimated as high as 14.9% [7]. Other coincident lesions less frequently recorded include tibial torsion, clubfoot, calcaneovalgus foot, flexible pes planus, metatarsus adductus, and hallux valgus [8].

CMT may be divided into three groups based upon presentation: 1st group; infants with sternomastoid tumor, there are limitations in range of motion (ROM) and a palpable, intramuscular, fibrotic mass (fibromatosis colli) in the affected sternocleidomastoid (SCM) muscle; 2nd group; infants with muscular torticollis, there are limitations in active and passive cervical ROM because of contracture of the SCM; and the 3rd group ; infants with postural torticollis, at which there is clinical presentation of CMT without the presence of tumor or passive ROM restrictions [9-10]. The typical clinical presentation found in persistent lateral flexion of head and neck toward the involved side with the chin rotated toward the contralateral shoulder, orbital dystopia (the eye on the unaffected side is higher up), and dental malocclusion (the lower mid line is deviated to the affected side) causing a unilateral cross bite [9, 11]. Facial asymmetry and plagiocephaly (flattening of the skull) often develop secondary to the persistent asymmetric positioning of the head. Almost 20% of cases of torticollis involve a more serious underlying condition, such as atlantoaxial rotary instability, hemi vertebrae, cervical subluxation, posterior fossa tumors, Chiari malformations, ocular and vestibular abnormalities, and Grisel syndrome related to recurrent nasopharyngea infection [2, 12].

The early rehabilitative intervention for normal muscle function around the neck is generally recognized to be beneficial in infants with congenital muscular torticollis, that aim to achieve symmetrical head position by improving the

extensibility and strength of the affected SCM muscle, normal range of motion, and balance muscle function around the neck in an effort to reduce the likelihood for secondary impairments associated with prolonged positional asymmetry of the head, including permanent loss in neck mobility, deformational plagiocephaly, scoliosis, and other compensatory structural asymmetries [13-15]. The most appropriate clinical intervention plan to achieve this therapeutic outcome, however, has been less clear in clinical practice and research [14, 16].

Initial management of infant with congenital muscular torticollis in an is always conservative, and consists of physical therapy exercises program conducted by parents and physiotherapists two to four times per day. If the infant′s head tilt is equal to or greater than six degrees, then use orthosis (a cervical, tubular brace/collar after four months of re-evaluation, or use other adjunct therapies as Botulinium Toxin injection. Surgical intervention may be recommended if this approach does not resolve the torticollis within one year [17].

Kinesio tape which is a new application of adhesive elastic taping can be stretched up to 120-140 %of its original length, was designed by Kenzo Kase [18]. It may facilitate or inhibit muscle function via cutaneous stimulation according to the applied technique. In the last few years, the use of kinesio taping has become increasingly popular in rehabilitation programs as an adjunct in the treatment in spite of the insufficient scientific evidence about its efficacy.it may be beneficial to balance muscle function around neck of infants with congenital muscular torticollis [19-20].

Although kinesio taping is recommended as a complementary therapy in clinical practice guideline of physical therapy management of congenital muscular torticollis published in 2013 by the Section on Pediatrics of the American Physical Therapy Association; However scientific evidence is insufficient to conclude that taping augments physical therapy interventions. Rare randomized controlled clinical trials could be found in the literature investigating the clinical effects of kinesio tape tchnique on all cervical range of motion, muscle function and craniofacial deformity development [18] Therefore; the aim of this study is to determine the effects of kinesio tape technique on cervical range of motion and muscle function around the neck in the treatment of congenital muscular torticollis in addition to therapeutic exercises.

Methodology

Thirty Infants with congenital muscular torticollis (14 boys and 16 girls) aged from 3 to 9 months, who were selected from the outpatient clinic of Abo Elresh hospital, Cairo university hospitals. The infants with congenital anomalies of the cervical spine, ocular anomalies, and benign paroxysmal torticollis, or with medical complications, including neurological complications that would interfere with treatment program were excluded. The parents of selected infant signed on a written informed consent which was received from the physical therapy ethical committee, physical therapy faculty, Cairo University as approval to participate in the study.

The infants were randomly assigned into two groups; Control group (exercise group), and study group (exercise + kinesio taping applied on the un affected side). The randomization was performed by using closed envelopes that contained a message stating whether the patient would be in control or study group, each parent chose. Range of motion in lateral flexion and rotation of the neck, and muscle function were assessed at pretreatment, and post treatment.

Cervical range of motion

Rotation and lateral flexion were measured in degrees with a baseline large joint (arthrodial) protractor, which is valid and reliable in measurements of cervical ROM [21], both affected and unaffected sides were measured. The infant was placed in supine position with the shoulders stabilized. The head was hanging off the edge of the examination table and it was supported in neutral position, so that neck could be rotated and moved freely in all directions. Built-in stabilizer bubble on the protractor helped to ensure accurate measurements, also an appendicular line on the protractor was placed next to the infant′s shoulders [22].

Muscle function of the lateral flexor muscles of the neck

It was evaluated by using the Muscle Function Scale (MFS), has high intra-rater and inter-rater reliability (kappa>0.9; ICC>0.9), and a 6-degree scale with scores from 0 to 5 (table 1) [23]. The infant was held vertically around the trunk then lowered to the horizontal position without any support of the head in front of a mirror. The head position of the infant formed by lateral head righting reflex was observed and holding his or her head on one level for at least 5 seconds to obtain the score for that level; otherwise, a score at next level below was noted. Scores were estimated for both sides according to the head position in relation to the horizontal line

Table 1: scores of the MFS

0	head held below the horizontal line
1	head held slightly over the horizontal line
2	head held on the horizontal line
3	head held high over the horizontal line but less than 45°
4	head held high over the horizontal line and more than 45°
5	head held very high over the horizontal

Physical therapy program

The infants in both groups received physical therapy exercise for 30-45minutes per day, three times a week, eight weeks. It included gentle massage and myofacial release to contracted SCM, Passive stretching to lateral flexion and rotation with infants in the prone position, in the lateral position supported with a pillow during feeding, carrying, and playing controlling posture in strollers, swings or car seats. Each session consisted of three repetitions of fifteen manual stretches of the tight muscle with a gentle force sustained for 1 second and a rest period of 10 seconds in between [15]. Strengthening to opposite side through active rotation exercises as head and trunk righting. It should be preceded by stretching [24].

Kinesio Tape

It was applied to the infants of study group by using relaxation technique. Skin sensitivity test was made before application of taping, by cleaning the skin of the treated area free from any lotions, and applying a square piece of kinesio tape (2x1 inch) over superior aspect of trapezius. After 24 hours, kinesio taping was applied to infants who didn't develop an allergic reaction to the tape. Before started taping, the skin was cleaned to be free of oils. Participants were performed kinesiology taping on supine position. The neck was rotated to the opposite side and laterally flexed toward the same side.'I' strip was applied from insertion to origin;

mastoid process to sternoclavicular joint on the affected side with 10-15 % tension using muscle-relaxing technique. The kinesio tape worn for four days per week and removed for day then applied again. Therefore; infants had kinesio taping applied a total of 6 times during an 8-weeks treatment period.
Home program
The parents of both groups were taught how to carry out:

- Positioning the infants with the head inclined towards the affected side during breast or bottle-feeding;
- Environmental adaptations by positioning patients and objects to encourage the correct movement/position of the head.
- Performing passive cervical rotation and lateral flexion could be when infants were asleep or awake depending on compliance.
- Active movements were encouraged during playtime by showing infant's toys or attracting their attention with sounds or lights.

Statistical analysis
Statistical analysis was carried out with SPSS for Windows version 16.0. In this study, the mean, standard deviation and standard error were calculated for all variables in both groups. Dependent and Independent "T" test, and Mann–Whitney test was used also to compare the ROM and muscle function respectively pre and post treatment. The level of significance for all statistical tests was set at $p < 0.05$.

Results
The demographic features of infants participated in this study (table 2) there were insignificant differences between both groups, so the groups were homogenous. After treatment program, the mean of ROM of lateral flexion to affected side were21.67± 4.5 degrees for control group and 27.67±4.17for study group. The mean of ROM of lateral flexion to non-affected side were 30±5.3degrees for control group and 37±4.14for study group. The mean of ROM of neck rotation to affected side were 33.67±3.87degrees for control group and 38±5.61for study group, the mean of ROM of neck rotation to non-affected side were 39.67±5.5degrees for control group and 44.67±2.97for study group. The median score of muscle function scale
Were 3 for control group and 4 for study group? There was improvement in both ROM and muscle function in infants of both groups when comparing pre and post mean values $p < 0.05$(table 3-4)

Table 2: The demographic and clinical features of three groups

	Control group	Study group	P value
Age (months)	5.9 ± 3.2	6.3 ± 2.4	0.919
Sex (female/male)	9/6	7/8	0.316
Affected side (right/left)	6/5	4/8	0.560

Table 3: Comparison of cervical range of motion within and between groups

		mean ± SD(degrees)		MD	t-value	P value
		pre	post			
Lateral flexion to affected side	Control group	22.67±4.95	30±5.3	8	9.8	0.000
	Study group	23.67±3.09	37±4.14	13.33	7.39	0.000
	MD t-value p-value	1 0.56 0.579	6.33 3.65 0.001			
Lateral flexion to non-affected side	Control group	15±3.78	21.67± 4.5	6.67	10.58	0.000
	Study group	15.67±3.2	27.67±4.17	12	11.22	0.000
	MD t-value p-value	0.67 0.52 0.606	6 3.79 0.001			
Neck rotation of affected side	Control group	26.33±2.97	33.67±3.87	7.34	8.88	0.000
	Study group	24.33±4.17	38±5.61	13.67	8.27	0.000
	MD t-value p-value	2 1.51 0.143	4.33 2.65 0.015			
Neck rotation of non-affected side	Control group	30.67±4.17	39.67±5.5	9	6.44	0.000
	Study group	30.87±3.76	44.67±2.97	13.8	18.86	0.000
	MD t-value p-value	0.2 0.14 0.891	5 3.1 0.005			

Table 4: Comparison of muscle function scale between and within groups.

	Mean ±SD		MD	Z-value	P value
	pre	post			
Control group	1	3	2	23.13	0.000
Study group	1.5	4	2.5	12.13	0.000
MD	0.5	1			
u-value	217.5	164.5			
P-value	0.547	0.005			

Discussion
This study aimed to determine the effects of using relaxing method of kinesio taping technique in addition to physical therapy exercises on cervical range of motion (lateral flexion and rotation), muscle function of lateral flexors of the neck in infants with congenital muscular torticollis. Each group showed improvements after 8 weeks of treatment in all the outcome measurements, which might be because of physical therapy program. These outcomes agreed with the report of the American Physical Therapy Association (APTA) in the fall of 2013, the Section on Pediatrics concerning the treatment of CMT to date‘ Physical therapy management of CMT: an evidence- based clinical practice guideline’ [25].
The physical therapy program included passive stretching which is currently the most common treatment for congenital muscular torticollis. It help in lengthening the contracted

sternocleidomastoid muscle, Staheli [26] reported that 90% of congenital muscular torticollis cases resolve with stretching exercises, Many authors reported that passive stretching is a very effective intervention for congenital muscular torticollis [27]. While others as Karmel-Ross and Lepp [28] reported irritability in patients with torticollis as a response to pain resulting from a perinatal or intrauterine compartment syndrome. And Cheng *et al*. [29] also reported that "snapping" of the sternocleidomastoid muscle during manual stretching, although rare, might signify a partial or complete rupture of this muscle,

The mean change of muscle function of neck muscles might be due to strengthening exercises and positioning which promote strength of the unaffected side of the sternocleidomastoid muscle and elongating the posterior fibers of the affected side of the sternocleidomastoid muscle. Any action help to draw their attention were positioned at the affected side to encourage normal orientation of head in a different position. Rahlin [27] reported on Tscharnuter Akademie for Movement Organization (TAMO) a therapeutic approach based on the dynamic theories of motor control, which was applied to infants with congenital muscular torticollis, to inhibit abnormal movements and to facilitate normal movements through sensory inputs. The concepts of dynamic perception theory that have proven clinically important to TAMO therapy include, 1) the functional coupling between the individual and the environment, 2) the active pick-up of task-specific information (various sensory stimuli), and 3) the functional coupling between perception and action (postural control).

The influences in range of motion and muscle function sometimes was result from. Also strengthening exercise and positioning are preferable than passive stretching exercises this is supported by Taylor and Norton [30] advocated a program to increase active range of motion and positioning to improve passive range of motion and avoiding pain and resistance with good to excellent outcomes in 96% of children.

The improvement in mean values of post treatment measurements result from good adherence of parents to physical therapy program as Emery [31] reported on a series of 100 patients with congenital muscular torticollis before the age of 2 years, and the patients were treated with a defined home program of stretching and active positioning stimulation. However, trained therapists were not used, that one repetition of end range passive stretch per session, held for 30 s, four sessions per day is the most effective. These parameters are recommended when designing a home exercise program for infants with CMT, and as a more frequent treatment is most likely to yield faster results [32].

According to the findings of this study, the relaxation technique of kinesio taping provided a higher benefit to exercise therapy in range of motion of head and neck and muscle function of lateral flexors of the neck of infants than exercises only., that might be due to inhibition of contraction of shortened SCM muscle as Kinesio taping which was proposed by Kenzo Kase to inhibit neck muscles contraction and provide midline orientation of the head in hence; increase in lateral flexion and rotation which reflect on muscle strength and function. Ohman *et al*, [1] have proposed that kinesiology taping may be beneficial to balance muscle function around neck of infants with congenital muscular torticollis. Because the muscle-relaxing technique had been found out to be most effective in the previously conducted retrospective study, only muscle-relaxing technique was used in the randomized study in which healthy infants with and without tape. There theories proposed to explain the reported functional effects of KT the main of them are increased blood and lymphatic fluid circulation in the taped area due to a lifting effect, which creates a wider space between the skin and the muscle and interstitial space [33]. An additional theory is that KT may apply pressure or continual stretching of the skin within the taped area, and this external activation of cutaneous mechanoreceptors would activate modulatory mechanisms within the central nervous system demonstrated as an increase in muscle excitability [33-34]. The KT is approach improving sensorimotor development has been proposed as a possible effective alternative to manual muscle stretching for the early treatment of infants with CMT Such an approach would take advantage of neural mechanisms of inhibition of contracted SCM to improve flexibility of the affected SCM muscle through active movements without pain or snapping [35]. the effect of KT on improving sensorimotor synchronization is Also likely associated with variations the neuro-anatomical constraints determining the control of voluntary movement [36].

The post treatment measurements controversy with application of KT on affected SCM muscle. Lee H [37] that kinesio tape promote strength of weakened muscle which in infants with CMT is non-affected SCM, also Bravi R *et al*, [36] the effect of KT on improving sensorimotor synchronization is Independent of direction of application or amount of tension.

Our study had some limitations that should be recognized. The small number of patients in the study and duration of the treatment relatively short follow-up time compared with the spontaneous recovery. This leads difficulty in detecting if the improvements are results of interventions or spontaneous healing. Further studies to investigate the effect of applying kinesiology taping alone on treatment duration, on a large sample size and on different application techniques.

Conclusion

The relaxing maneuver of kinesio taping adding more effect to exercise therapy than exercise alone on cervical range of motion and muscle function of lateral flexors of head and neck muscles, so it is recommended in adjunction with physical therapy program for treatment postural and muscular torticollis in infants less than nine months.

Acknowledgements:

The authors would like to thank all the parents and infants who participated in this study.

Conflict of interest

The author declares that there is no conflict of interest.

Funding

This research received no specific grant from any funding Agency in the public, or commercial

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