Effect of kinesio taping in management of postural scoliosis: A randomized controlled study

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Abstract

Aim: Postural scoliosis is a common problem which affects the population especially female subjects. Back pain tends to show the common symptom in scoliotic patients in addition to other functional problems. Purpose of this study aims to investigate the additional effect of Kinesio taping in management postural scoliosis. Material and Method: Thirty patients with postural scoliosis were randomly assigned into two equal groups A and B. Both groups received a traditional physical therapy program. While group A additionally received Kinesio taping. Baseline and post-treatment assessment for the pain severity, pressure pain threshold (PPT) of iliocostalisthoracies and iliocostalislumborum, Cobb's angle, functional disability and back range of motion were measured. Results: Mixed design MANOVA revealed significant improvement in pain and pressure pain threshold of iliocostalisthoracies and iliocostalislumborum of group A than group B ($P < 0.05$). There were significant improvements in pain, pressure pain threshold of iliocostalisthoracies and iliocostalislumborum, functional disability, and back range of motion in both groups ($P<0.05$). While there were no significant differences of the Cobb's angle in both groups or between groups after treatment. Conclusion: adding Kinesio taping to traditional physical therapy program yields improvement in pain, pressure pain threshold of iliocostalisthoracies and iliocostalislumborum on patients with postural scoliosis than traditional physical therapy alone.

Keywords

Kinesio Taping; Postural Scoliosis; Cobb's Angle

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Introduction

Scoliosis is defined as a lateral deviation of the spine from the normal plumb line. Commonly, there is a rotational component and deviation also in the sagittal plane (kyphosis or hyperlordosis) [1]. When scoliosis presents in adults, it is often painful causing emotional problems related to visually impaired esthetics, pain, as well as pulmonary mechanic-related problems [2].

Scoliosis is the most common type of spinal deformity, which occurs approximately 2% to 3% in children ages 10 to 16 years, girls being more at risk for severe progression by a ratio of 3.6 to 1 [3].Traditionally, scoliosis is considered as a painless condition, but in other studies there was a higher incidence of back pain in scoliosis patients and based on questionnaires, small-scale postural scoliosis may create difficulties for carrying out physical activities, so exercise capacity can be reduced, due to decreased mobility of the chest wall and produce functional disabilities [4, 5].

Postural stresses such as in scoliosis are a form of mechanical muscle stress that has been considered to be a cause of myofascial trigger points (MTP) formation and activation. [6]. The common muscles can be affected by a trigger point in scoliosis are the quadratus lumborum and the iliocostalisthoracies, iliocostalislumborum [6,7].

Kinesio Taping (KT) is an elastic tape that can be stretched to 140% of its original length, thereby exerting a constant shearing force on the skin, KT is conceived to be a therapeutic way with the following effects on the musculoskeletal system. It corrects muscle function by stimulation week muscles, reduces pain through neurological suppression, improves blood and lymph circulation; it corrects misaligned joints by retrieving muscle spasm and can contract back to the normal resting position [8].

Taping has been reported to reduce sports injury, osteoarthritis, myofascial pain syndrome, and patellofemoral pain syndrome, as well as pain, swelling and muscle spasms of patients with nervous system disorders, while increasing the range of motion and improving function; It is also; effective in correcting walking pattern and functionality [9].

Kinesio tape, an alternative taping technique, has been used to improve a variety of physiological problems, including the range of motion, based on the functions of the tape and thus has been used to be an effective treatment to restore muscle function and decrease pain [10, 11,9]. Various treatments have been proposed for scoliosis, including surgery, traction, bracing, casting, electrical stimulation, and physical therapy [12]. However, there is lack of studies assessing the effectiveness of adding Kinesio taping in management postural scoliosis, and therefore more studies are needed. The purpose of the study was to investigate the additional effect of Kinesio taping in management postural scoliosis.

Material and Method

The study was designed as a prospective, randomized controlled trial (RCT). In total, 35 patients with postural scoliosis, referred by the same orthopedic surgeons to out-clinic of the faculty of physical therapy, Cairo University, were enrolled and assessed for their eligibility to participate in the study. Their age ranged from 15 to 30 years. Thirty patients with postural scoliosis were randomly assigned into two equal group, by using a shuffled deck of cards (e.g., No. single – group A, No. double – group B). The patients were assigned randomly into two equal groups, group A; received Kinesio taping and therapeutic exercises, Group B; received therapeutic exercises and sham Kinesio taping. No subjects dropped out of the study after randomization. Written informed consent was obtained from all subjects before the baseline evaluation. Ethical approval was obtained from the institutional review board at Faculty of physical therapy, Cairo University before study commencement. The study has followed the Guidelines of Declaration of Helsinki on conduction of human research.

The inclusion criteria were patients who had postural scoliosis, caused by a symmetric muscle weakness (Cobb's angle ranged between (15-30°) at thoracic curve taken after performing Adam forward bending test, a history of back pain for more than 3 months caused by scoliosis and scoliosis with iliocostalisthoricis and iliocostalislumborum muscles affected by trigger points. Patients were excluded if they had a history of previous back surgery, structural idiopathic scoliosis, leg length discrepancy, and other disorders in the vertebral column (prolapsed disc, fracture), a systemic or local regional infection, malignity, neurodermatitis, skin diseases such as eczema or psoriasis, decompensated heart failure; were pregnant; had advanced asthma, epilepsy, intervertebral disc disease, previous surgery (spinal fusion), spinal cord anomalies and tumors, any pathological spinal anomalies, such as spondylolysis, spondylolisthesis and lumbosacral transitional anomalies that could be associated with back pain. All of the evaluation and training procedures were explained before the beginning of the study.

Patients were assessed before, and after the treatment sessions by VAS, Pressure Pain Threshold (PPT) of iliocostalisthoracies and iliocostalislumborum, Oswestery disability questionnaire for functional disability were used based on the work of Fairbank and Pynsent [13]. Schober flexion and extension techniques and lateral flexion from standing position for the range of motion of back right and left side bending [14]. Cobb's angle was measured from standing position (loaded x-ray) [1].

Both groups received traditional physical therapy exercise program, 3 sessions/week for 6 successive weeks. The group B received the same treatment intervention as the group A, with sham Kinesio taping (KT without tension). The same experienced physical therapist carried out the treatment program for both groups (10 years' experience).

Kinesio Taping: Application of a mechanical correction technique, to provide stimuli in which the body will adjust to increase tension in the skin. For the posterior superior region, begin by placing the base of the Kinesio Y strip (approximately 6-8 inches) two inches below the area to be treated, with no tension. With one hand, hold the base to ensure no tension was added. The patient moved into back flexion with rotation in the opposite direction of the desired correction, apply light to moderate, tension (25-50% of available) to the tails of the Kinesio Y strip, the "recoil" action of the tails will provide the stimulus to the skin.

Application of a fascia correction technique to provide a deeper stimulus to reduce tension within the layers of the tissue, with tension on the base. Begin with a Kinesio Y strip of approx-

imately 6-8 inches. Place the base medial to the area to be treated, with no tension. With one hand, hold the base to ensure no tension is added, have the patient move into back flexion with rotation in the opposite direction of the desired correction. Apply light tension (25% of available) to the tails of the Kinesio Y strip, with an oscillating motion. Move the band on the base along the Kinesio Y strip and initiate adherence to the skin. In both techniques, the authors initiate glue activation before any further patient movement [11]. For the posterior lower region, the technique applications were repeated, except the motions was reversed to provide stimulus in an opposite direction. The desired effect is to "unwind" the spine**.** The Kinesio Taping was applied and changed every five days [11].

Exercise program: It consisted of stretching and strengthening exercises program three sessions per week for successive six weeks [15].

Stretching exercises: The main aim of these exercises was to shift the apex of the curve to the midline and passively over correct the curve for 30 seconds stretching, 3 repetitions, 3 sets. This was through three positions.1- Patient prone: with stabilization at the iliac crest on the side of the concavity. The patient was asked to reach toward the knee with the arm on the convex side of the curve while stretching the opposite arm up and overhead. 2- Patient kneel-sitting (to stabilize the lumbar curve): patient leaned forward, so the abdomen rests on the anterior thighs stabilize the patient at the iliac crest, arms are stretched overhead bilaterally finally the patient laterally bent the trunk away from the concavity. 3- Patient side-lying on the convex side: From two positions, first the patient was in side-lying with a rolled towel at the apex of the convexity; the lumbar spine is stabilized. The second was side-lying over the edge of a mat table to stretch tight structures of a right thoracic scoliosis with stabilization of the pelvis.

Strengthening Exercises for back and trunk musculature on the convex side of the curve: The patient performed the following steps in the same order owing to progress the difficulty. 1); Patient side-lying on the concave side of the curve with stabilization at the iliac crest with a lower arm across the chest, have the patient de-rotate the trunk, lifts up the head and shoulders (lateral trunk bending), and slide the top arm down to the knee. 2); Patient side-lying: progress the difficulty of the above-mentioned exercise by having the patient clasp hands behind the head and then laterally flex the trunk against gravity. 3); Patient crock lying: Anterior pelvic tilt with the press against the mat table with shoulder and buttock. 4); from prone position: Raise head, shoulder, and both lower limbs upward. The exercise was lasting for 6 to 10 second for 10 repetitions.

Statistical analysis

All statistical measures were performed through the Statistical Package for Social Studies (SPSS) version 22 for windows. Before final analysis, data were screened for normality assumption and presence of extreme scores. This exploration was done as a pre-requisite for parametric calculation of the analysis of difference and analysis of relationship measures. To determine the similarity between the groups at baseline, subject age, height, and body weight were compared using independent t-tests.

The current test involved two independent variables. The first one was the (tested group); between subjects factor which had two levels (Group A receiving Kinesio taping with traditional physical therapy program & Group B receiving sham Kinesio taping with traditional physical therapy program). The second one was the (training periods); the within-subject factor which had two levels (pre and post). In addition, this test involved nine tested dependent variables (VAS, PPT for iliocostalisthoricise and iliocostalislamborum, Cobb's angle, Oswestry and ROM of flexion, extension, right bending, and left bending). Accordingly, 2×2 Mixed design MANOVA was used to compare the tested variables of interest at different tested groups and training periods. The MANOVAs were conducted with the initial alpha level set at 0.05.

Results

Baseline and demographic data: As indicated by the independent t-test, there were no statistically significant differences (P>0.05) between subjects in both groups concerning age, weight, and height (Table 1).

Table 1. Demographic characteristics of both groups:

	Group A	Group B	Comparison	
	Mean ± SD	Mean ± SD	t-value	P-value
Age (years)	29.33±6.94	29.06±6.01	0.112	0.911
Height (cm)	165.8±7.43	165.6±8.21	0.54	0.593
Weight (kg)	70.4±8.8	68.66±8.76	0.07	0.945

Statistical analysis using mixed design MANOVA analyzed thirty patients assigned into two equal groups. It revealed that there were significant within-subject (F = 127.999, p = 0.000) and treatment*time (F= 9.222, p = 0.000) but there were no significant effects between subject (F = 2.359, p = 0.053). Table (2) present descriptive statistic and multiple pairwise comparison tests (Post hoc tests) for theVAS, PPT for iliocostalisthoricise and iliocostalislamborum, Cobb's angle. In the same context, the multiple pair wise comparison tests revealed that there were significant decreases (p <0.05) in VAS in the post-treatment condition compared with the pre-treatment one in both groups. However, there were significant increases (p <0.05) in PPT for (iliocostalisthoricise and iliocostalislamborum) in the post-test condition compared with the pre-test one in both groups. There was no significant difference in Cobb's angle between pre and post-treatment for both groups.

Regarding between-subject effects multiple pairwise comparisons revealed that there were significant decreases (p < 0.05) in VAS, with significant increase (p < 0.05) in PPT for (iliocostalisthoricise and iliocostalislamborum) in group A compared with group B, with no significant differences in Cobb's angle between both groups (p > 0.05). While Table (3) present descriptive statistic and multiple pairwise comparison tests (Post hoc tests) for the Oswestry and ROM of flexion, extension, right bending, and left bending for both groups at different measuring periods. In the same context, the multiple pair wise comparison tests revealed that there were significant decreases (p <0.05) in Oswestry and ROM of right bending and left bending in the post-treatment condition compared with the pre-treatment one in both groups. However, there were significant increases

Table 2. Descriptive statistics and multiple pairwise comparison tests (Post hoc tests) for the VAS, PPT for iliocostalisthoricise and iliocostalislamborum, Cobb's angle for both groups at different measuring periods.

	Group A		Group B	
Variables	Pre	Post	Pre	Post
VAS	7.4 (1.88)	1.86 (0.74)	7 (1.55)	2.6 (1.05)
PPT for (iliocostalisthoricise)	1.62 (0.77)	3.26 (1.01)	1.42 (0.64)	2.07 (0.67)
PPT for (iliocostalislamborum	1.68 (0.67)	3.33 (0.88)	1.38 (0.49)	2.04 (0.46)
Cobb's angle	22.2 (3.44)	22.5 (3.4)	23.33 (3.75)	23.33 (3.75)

Within groups (Pre Vs. post)				
p-value	VAS	PPT for (iliocostalisthoricise)	PPT for (iliocostalislamborum)	Cobb's angle
Group A	0.000*	0.000*	0.000*	0.168
Group B	0.000*	0.000*	0.00*	0.999
Between groups (group A Vs. group B)				
p-value	VAS	PPT for (iliocostalisthoricise)	PPT for (iliocostalislamborum)	Cobb's angle
Pre treatment	0.531	0.433	0.166	0.396
Post treatment	0.036*	0.001*	0.0001*	0.549

VAS: Visual Analogue Scale, PPT: Pressure Pain Threshold.
*The mean difference is significant at the alpha level (p< 0.05).

Table 3. Descriptive statistic and multiple pairwise comparison tests (Post hoc tests) for the Oswestry and ROM of flexion, extension, right bending, and left bending for both groups at different measuring periods.

	Group A		Group B	
Variables	Pre	Post	Pre	Post
Oswestry	35, 6(14, 21)	15, 93(5,83)	28, 33(12,23)	14, 93(4.26)
ROM of trunk flexion	8, 73(1, 79)	10, 68(1,68)	9,6(1,45)	11,(1,45)
ROM of trunk extension	4.93 (1.16)	6.86 (1.24)	5.46 (0.99)	6.8 (0.94)
ROM of right bending	42.13 (2.89)	39.53 (2.41)	42.26 (2.91)	41.06 (2.76)
ROM of left bending	42.06 (2.49)	40.13 (2.35)	42.33 (3.03)	41.6 (2.92)

Within groups (Pre Vs. post)					
p-value	Oswestry	ROM of trunk flexion	ROM of trunk extension	ROM of right bending	ROM of left bending
Group A	0.0001*	0.0001*	0.0001*	0.0001*	0.0001*
Group B	0.0001*	0.0001*	0.0001*	0.0001*	0.0001*
Between groups (group A Vs. group B)					
p-value	Oswestry	ROM of trunk flexion	ROM of trunk extension	ROM of right bending	ROM of left bending
Pre treatment	0.145	0.157	0.187	0.901	0.795
Post treatment	0.596	0.374	0.87	0.117	0.141

*The mean difference is significant at the alpha level (p< 0.05)

(p <0.05) in ROM of flexion and extension in the post-test condition compared with the pre-test one in both groups. Regarding between-subject effects, multiple pairwise comparisons revealed that there were significant no significant differences in Oswestry and ROM of flexion, extension, right bending, and left bending between both groups (p > 0.05).

Discussion

This study demonstrated the additional effect of Kinesio taping in the management of postural scoliosis. The results showed an obvious pain reduction, increase PPT for iliocostalisthoricise and iliocostalislamborum, improve in functional disability, and back range of motion with no change in Cobb's angle after six weeks of treatment for both groups. However, the group A that receiving Kinesio taping in addition to traditional physiotherapy program had higher improvement in pain and PPT for iliocostalisthoricise and iliocostalislamborum compared with the group B that receiving traditional physiotherapy program.

These results come in agreement with Castro-Sanchez et al. [16] as they stated that people with back pain who received Kinesio taping had achieved a significantly greater reduction in disability and improvement of functional endurance of the trunk muscles. The results also come in agreement with Kase and Garcia [10,11] who stated that Kinesio taping produce a convolution area which may increase the flow of blood and lymphatic fluids due to a lifting effect, which creates a wider space between the skin and the muscle and interstitial space. The possible increase in blood circulation is theorized to affect muscle functions and improve functional disabilities [17].

In addition, the decrease in pain level may be explained through the study done by Paolini et al. [8]and Deleo[18] who said that the cutaneous stretch stimulation provided by Kinesio taping may interfere with the transmission of mechanical and painful stimuli, delivering afferent stimuli that facilitate pain inhibitory mechanisms (gate control theory) and pain reduction. Pain relief was also confirmed by research done by Gonz´alez-Iglesias et al., [19] who achieve pain-relief effects of KT applications in patients with acute whiplash injury. Research results confirm the positive influence of KT on the decrease in pain perception resulting in a lower intake of painkilling tablets. [20]

Studies of the therapeutic value of Kinesio tape have yielded evidence of significant improvements in range of motion and reduction of pain. A case reported by Garcia-M et al. [21] addressed the use Kinesio tape for treatment of myofascial trigger point pain in the shoulder. The authors reported that Kinesio tape contributed to the resolution of the patient's symptoms within a few days. Significant improvements in shoulder range of motion were observed after two days of treatment.

About back range of motion, there was marked increase of back (flexion, extension, right side bending and left side bending after treatment of patients by application of Kinesio tape and exercises there was an improvement of the range of motion, which was confirmed by some studies which have found that Kinesio tape, an alternative taping technique, has been theorized to improve a variety of physiological problems, including the range of motion, based on the functions of the tape [10, 11, 22, 9, 17, 12].

The increase in the active range of motion of back could be explained by two theories which may aid in understanding this finding. One theory is that Kinesio taping increases blood circulation in the taped area [17], and this physiological change may affect the muscle and myofascial functions after the application of Kinesio tape. An additional theory is that Kinesio tape stimulates cutaneous mechanoreceptors at the taped area, and this stimulation may affect the ROM.

In spite of the marked effect of adding Kinesio tape to the traditional exercise program there was an effect of these exercises in the improvement of functional disabilities and back range of motion in addition of relieving pain in group B which could be explained through the following;

Physical exercises prevent or reduce functional disabilities of the scoliotic patients this could explain the marked decrease of functional disability post-treatment of the traditional program in both groups. This is confirmed by work done by Rainville et al. [26] who said that the most obvious benefit of exercise is its ability to improve and maintain musculoskeletal and cardiovascular function, exercise may be useful for improving back function for patients with mechanical low back pain.

Both flexion and extension exercises programs were found to be effective in reducing functional disability in chronic mechanical low back pain patients supporting the finding of Hansen et al. [27]. Low back pain can produce reflex muscle inhibition for paraspinal muscles to prevent movement and protect the structures so, strengthening of these muscles reduces pain and improve function, as reported by Rissanen et al.[28] who found that impairment of trunk strength, flexibility and endurance are present in many people with back pain, these impairment results in part from long-term inhibition of movement and physical inactivity that results in neurological and physiological changes in the spine. These changes include weakness of the paraspinal musculature with selective loss of type tow muscle fibers, shortening of muscles and connective tissue of the spinal region.

The marked increase of these ranges could be explained via the work done by Rainville et al. [26] who found that stretching exercises can be used to eliminate impaired flexibility and restore normal trunk range of motion. In order to be successful, stretching must be performed at the patient's physiological end range and therefore within the range of motion that may induce back discomfort. Useful motions to assess include back flexion, extension, and side bending. Three sessions of stretching per week improve flexibility, but even greater gains in flexibility are made with five times per week. After flexibility had been increased, one session of stretching per week is enough to maintain the increases.

Cobb [25] asserted that physical exercises are beneficial when practiced in order to improve the muscle strength, tone, vital capacity, the range of motion and posture of the scoliotic subject. Knowledge emerging from scientific research data according to the review of literature which confirms the validity of these assertions. Multiple studies have documented the efficacy of stretching for improving trunk flexibility deficits and range of motion in patients with chronic back pain, with the average improvement of about 20% noted. Long-term compliance with a therapeutic stretching has been documented and is generally high [29, 30, 28].

Strengthening exercises were more effective in improving back muscle strength, pain relief, functional ability, physical improvement, and range of motion in patients with chronic mechanical low back pain through the evaluation of many previous randomized control trial studies [33]. Moffett et al. [33] demonstrated significantly fewer sick days at one year follow- up for subject with low back pain randomized to an exercise program that included strengthening and stretching exercises as compared with traditional general practitioner management. Taimela et al. [34] found that exercises decrease back pain and the recurrences of persistent pain occurred significantly less frequently among those who had maintained regular exercise habits after the treatment than those who had been physically inactive. On the contrary Bendix et al. [35] found that exercises had no effect on reducing back pain after performing a study and concluded that low - intensity exercise may have less effect on back pain. And this has been supported by Hansen et al. [36] who noted that no post-treatment differences in back pain after performing the exercise.

Concerning the Cobb's angle in both groups (experimental A, control B), there was no improvement recorded between pre and post-assessment. This result comes in agreement with Weinstein et al. [37], who stated that no definite evidence has shown that physical therapy or bracing reduces the risk of curve progression, corrects the existing deformity, or decrease the need for surgery. Ferraro et al. [38] concluded that exercise therapy performed for 30 minutes/day for a mean period of 2years as compared with exercise therapy performed for just 10 minutes daily, for mild scoliotic patients slowed or even halted the progression of both the curves and the humps. But in such mild functional scoliosis, one can't rule out the possibilities that specific systematic exercises would gradually correct the curve in its postural component.

On the contrary, Scheier[39]who have suggested that it is even possible that the improved biomechanics of the spine secondary to exercise therapy might have a corrective effect on the growth. Lenssincket al. [40] published a systematic review of all conservative interventions in the treatment of adolescent idiopathic scoliosis and concluded that the effectiveness of exercise therapy in reducing the curve progression is not yet established but might be promising. Simon and Harchad [41] perform a literature review for assessing exercise therapy in adolescent idiopathic scoliosis and found that many studies reported "significant" changes in the Cobb angle after treatment, which were actually of small magnitude and did not take into account the reported inter or intra-observer error rate. These studies had poor statistical analysis and did not report whether the small improvements noted were maintained in the long term.

There are some limitations of this study. First, the lack of a strictly recorded, dose-specific home-exercise program maintained during treatment. Secondly, the effect of the rehabilitation program on the participants' psychological parameters such as quality of life was not examined. In conclusion, this study shows that an additional Kinesio taping to traditional physical therapy program yields improvement in pain, pressure pain threshold of iliocostalisthoracies and iliocostalislumborum on patients with postural scoliosis than traditional physical therapy alone.

Competing interests

The authors declare that they have no competing interests.

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