Effect of therapeutic exercises augmented by kinesio tap in treatment of scoliosis in adolescent females

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ABSTRACT

Background: Scoliosis is a lateral curvature of the spine**.** It is the most common deformity in adolescent females **.**Kinesio Taping is a method used for treatment ofvarious musculo-skeletal conditions.

Purpose : to detect the effect of therapeutic exercises augmented by kinesio tap in treatment of scoliosis in adolescent females

Subjects and Methods: Forty adolescent females complain from scoliosis, their ages ranged from 11 to 17 years old, and their BMI was from 15 to 25 kg/m². They were divided randomly into two groups. Group A received therapeutic exercises for scoliosis, while group B received therapeutic exercise in addition to kinesio taping.X ray plain used for measuring of Cobb's angle and present pain intensity (Ppi) for pain assessment before and after treatment.**Results:** There was a significant reduction of Cobb's angle and pain intensity at post treatment at both groups ($p<0.05$). There were significant reduction $p<0.0001$ in Ppi and this significant reduction in favor of group B. There was no significant differences between both groups in Cobb's angle.

Conclusion: Exercises for scoliosis augmented by kinesio taping had a significant effects on reduction of both Cobb's angle and pain intensity.

Keywords: Adolescent females,Kinesio taping, Scoliosis, Therapeutic exercises

INTRODUCTION

Scoliosis deformity is a 3-dimensional oneas the spine laterally sideways and becomes fixed in this unbalanced posture. The mechanical imbalance existing in scoliosis, regardlessof its cause, results in asymmetric loading, which lead to a viciouscycle with an avoidablesusceptibilityincreased with time[1]. Scoliosisdeformity develops at age from 11 to 13 years during the growth period, andit more common in females with a ratio 10 to 1 compared with males[2].

Scoliosisdeformity usuallyappears in the thoracic and the thoracolumberregion of the spine. The curvature of scoliosis may be developed as one curve shaped likeC letter or as two curves shaped like S letter. Causes of scoliosis are usually idiopathic but in some cases it can also be secondary due to different vertebral, connective tissue, and neuromuscular disorders [3].Scoliosis, always associated with rotation of the vertebrae, leads to chest deformity, back pain, ventilatorylimitations, weakness of respiratory muscles, deformities in the shape of the back and the subsequent health-related quality of life impairments[4].

Specific Exercises for treatment of scoliosishave an important role in decreasingprogression of the deformity and improving quality of life in adolescent idiopathic scoliosis (AIS). Patients with curves in the thoracic spine ≤25 degrees and thoracolumbar or lumbar curves ≤20 degrees can effectively treated with exercise alone, whereas patients with thoracic curves of 25–50 degrees and thoracolumbar or lumbar curves of 20–40 degrees need braces application with exerciseprogram[5-7].Idiopathic scoliosis can be categorized as infantile (from birth to 3 yrs), juvenile (from 3 to 11 yrs) and adolescent (≥11 yrs) according to the age of the patient at the onset of the deformity [8].The severity of the scoliosis deformity is usually determined by the angle between the upper and lower limits of the deformity (Cobb's method) [9]. The prevalence of scoliosis among adolescents is ~1–3%, and it frequently involves the thoracic spine[4].

Elastickinesio taping is a recentbandaging technique usually used to return normal function of the muscle, promotevascular and lymphatic flow, decrease pain and/or help the joint misalignment correction[10][11]. The

mechanism of action of kinesio tapping has not yet understood, recent studies have indicated that it may have certain short-term effects on muscle activation and range of motion[12][13]. Deformation caused by mechanical loads as touch, pressure, vibration, stretch, and itch result in stimulation of cutaneous mechanoreceptors which increase nerve impulses. The cutaneous mechanoreceptors activation by an enough stimulus results in local depolarizations that excite nerve impulses along the afferent fiber traveling toward the central nervous system[14][15].

In a previous study, Negrini et al. (2008) reported that exercise had useful effects on the rate of progression of deformity and Cobb angle. They also found actual effects of exercise in decreasing brace prescriptions [16].

The research question for this study: Does 6 weeks of exercises augmented by kinesio taping have useful effects on Cobb's angle and pain intensity in adolescent females with scoliosis?

MATERIALS AND METHODS

Study design

The study design was randomized controlled study conducted in the KafrElsheikhUniversityPhysical therapyout patient clinic.This study was designed to investigate the effect of exercises augmented by kinesio taping in treatment of scoliosis in adolescent females.

Ethical considerations

This study was approved by the Pan African Clinical Trial Registry, under unique identification number for the registry is PACTR201605001634379. The study procedures was in accordance with the ethical standards of the responsible local committee on human experimentation of faculty of physical therapy, Kaferelshiek University. Before participating in the study, the aims of the study were explained orally to all the patients and all patients signed a confirmed consent form before participation in the study.

Sample and Data collection

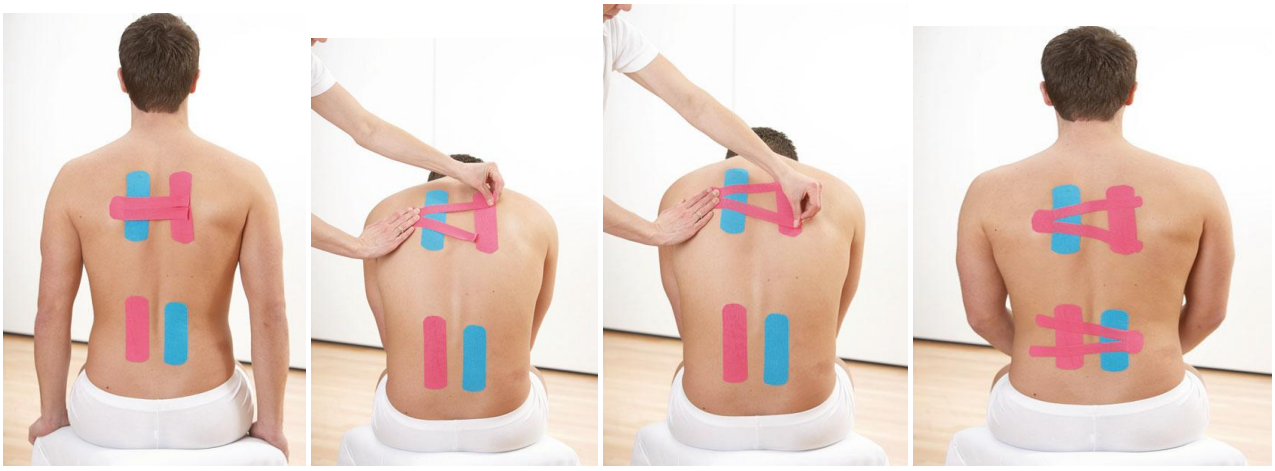
Forty adolescent females complain from scoliosis selected from physical therapy outpatient clinic, kafrElsheikhUniversity hospital, , their ages ranged from 11 to 17 years old, and their BMI was from 15 to 25 kg/m^2, they have-not cardiovascular disorder. They are free from diabetes, hypertension and no history of neurological and leg length discrepancy disorder. They were divided randomly into two groups equal in number (n=20). Group A receive therapeutic exercises for scoliosis while group B receive therapeutic exercise in addition to kinesio taping.

Methods

Assessment of all patients in both groups (A& B) was carried out before and after the treatment program by X ray plain to measuringof Cobb'sangle and present pain intensity(Ppi) for pain assessment.Both groups instructed to perform therapeutic exercise 3 sessions per week for 6 weeks begin in form of stretching exercise to concave side and strengthening exercise for convex side from supine, side and prone lying position by therapist and instruction to repeat exercises as home routine.Patients only in group B received kinesio taping techniques. With patient standing and leaning forward to perform maximum flexion of the spine, Alcohol was used to clean skin prior to tape application as skin should be free of oils and lotions then application of kinesio taping techniques.Kinesio taping was applied on the erector spinae muscleas recommended by Kumbrink, (2014)as specific technique for scoliosis[17].

The tape is measured along the length of the vertebral arch with the trunk flexed. The patient is in the erect position when the bases are affixed, and is then requested to bend forwards. The base is confirmedparavertebrally and the tape affixed over the muscles. The tape ends are affixed without tension. The bases of the tonus-increasing muscle applicationslie cranially to the left of the lumbar spine and to the right of the cervical spine respectively. The application is carried out as described in(Fig. 1a). For the functional correction of the lumbar spine, the base lies to the right next to the lumbar spine, for the cervical spine, the base lies to the left next to the cervical spine(Fig1b, c). Fig.1d shows the completed application for the treatment of scoliosis.

The band was maintained for five days then removed and the subject had a rest for 2 days then applied Kinesio tape again.



a **b** **c** **d**

Fig 1(a,b, c, d) Quoted from Kumbrink (2014).

Data analysis

Statistical analysis was conducted using SPSS for windows, version 18 (SPSS, Inc., Chicago, IL). Normality test of data using Shapiro-Wilk test was used, that reflect the data was normally distributed for Cobb's angle, so parametric statistical tests in the form of (paired t test) was used to compare between "pre" and "post" treatment for each group and "unpaired t test" was conducted to compare Cobb's angle between both groups in the “pre” and “post” treatment. While, The dependent variable (present pain intensity) is ordinal variable. Normality test of data using Shapiro-Wilk test was used, that reflect the data was not normally distributed for present pain intensity, so non parametric statistical tests in the form of (Wilcoxon Signed Rank tests) was used to compare between "pre" and "post" treatment for each group and "Mann-Whitney tests" was conducted to compare present pain intensity between both groups in the “pre” and “post” treatment. The alpha level was set at 0.05.

RESULTS

Baseline and demographic data

There were no statistically significant differences (P>0.05) between subjects in both groups concerning age, height, weight, and BMI as presented in Table 1.

Table (1): Physical characteristics of patients in both groups (A&B).

Items	Group A	Group B	Comparison		S
	Mean ± SD	Mean ± SD	t-value	P-value	
Age (yrs)	18.04±1.33	17.84±1.24	0.547	0.587	NS
Body mass (Kg)	63.54±6.99	62±4.1	0.95	0.347	NS
Height (cm)	163.28±3.96	161.84±4.71	1.169	0.248	NS
BMI (Kg/m2)	23.72±1.95	23.61±1.76	0.202	0.841	NS

*SD: standard deviation, P: probability, S: significance, NS: non-significant.

As shown in Table (2) regarding changes inCobb's angle when comparing pre and post treatment there were significant improvement p<0.0001 in both groups when comparing between both groups therewas no significant differences (p>0.05).

Table (2): Mean ±SD, t and P values of Cobb's angle pre and post treatment at both groups.

Cobb's angle	Means ± SD	Means ± SD	Mean difference	% of improvement	t-value	P- value
	Pre test	Post test				
Group A	23.55±7.32	8.2±3.4	15.35	65.18	15.802	0.0001*
Group B	26.45±7.6	9.35±2.75	17.1	64.65	13.455	0.0001*
Mean difference	-2.9	-1.15				
t-value	-1.228	-1.169				
P- value	0.227	0.250				

***Significant level is set at alpha level <0.05**.

The frequency distribution of the present pain intensity scale in the "pre treatment" and the "post treatment" for both groups were presented in Table (3) when comparing between both groups there were significant reduction $p<0.0001$ in Ppi and this significant reduction in favor of group B.

Table (3): The frequency distribution of the present pain intensity scale in pre and post treatment at both groups.

Present pain intensity scale	Group A		Group B	
Frequency distribution	Pre treatment	Post treatment	Pre treatment	Post treatment
No pain	0 (0%)	2 (10%)	0 (0%)	16 (80%)
Mild	1 (5%)	3 (15%)	1 (5%)	4 (20%)
Moderate	7 (35%)	12 (60%)	3 (15%)	0 (20%)
Sever	4 (20%)	3(15%)	7 (35%)	0 (0%)
Intolerable pain	8 (40%)	0 (0%)	9 (45%)	0 (0%)

DISCUSSION

The results of our research revealed that there were significant reduction of Cobb's angle and pain intensity scale at both groups, and there were no significant differences of Cobb's angle between groups.There were significant reduction in pain intensity $p<0.0001$ betweenboth groups and this significant reduction in favor of group B.

Treatment of scoliosis with specific treatment exercises was found to be effective in reducing the progression rate of AIS and improving Cobb's angle, the exercises were also shown to be effective in reducing the need for brace prescription and surgery[18]. The practice of specific exercises for scoliosis regularly also produce advantages in subjects with scoliosis other than decreasing the Cobb's angle, as improving asymmetryof the back, as well as the secondary muscle imbalance and related pain[19].

Kinesio taping is beneficial in improving asymmetries with the musculoskeletal system. As using of Kinesio tape may producechange in the functions of the myofascia and muscle. Also,Kinesio tape stimulates cutaneous mechanoreceptorsat the taped area, and this stimulation affects range of motion,it corrects mis-aligned joints by relieving muscle spasm [20,21]. Circulatory or neurological effects of kinesio taping caused by its elastic propertieswhich are appeared to support and improve joint functions [22].

Kinesio tape diminishes pain due todecrease neurological activation, increases blood and lymph circulation to the taped area by rising fascia and soft tissue, restores function offascia through normalizing muscle tension, and improves muscle function [23-25]. Another explanation can be taken into account is the gate control theory of pain modulation. Kinesio taping has been suggested to stimulate neuromuscular pathways via afferent feedback. Increased afferent stimulus to large-diameter nerve fibers lead to decrease stimulus from the small diameter nerve fibers conducting pain[26].

The results observed in the current study as there was no significant difference between two groups in cobb's angle may be explained by that afferent stimuli generated by kinesio taping may not be strong enough to modulate Cobb's angle of group B more than group A. A possible explanations for these results may be type of tape, as was suggested by Hsieh et al[27], or the technique of application of kinseio taping, or the threshold of stretching the band.

Our results agree with Akbas, et al. (2011) as they investigated the effects of long-term application of kinesio taping on pain, soft tissue flexibility, patella location and functional performance in patients with patellofemoral

pain syndrome. The results indicated that exercise alone or exercise with kinesio taping was not enough to change the location and mobility of the patella, while both methods significantly decreased the pain and increased the flexibility of soft tissues at the end of the six week treatment program. The study also revealed a similar significant increase in functional performance after treatment in both groups [28].

Another study conducted by Parreira et al. (2014) as they using Kinesio Taping associated with therapeutic exercises for people with chronic non-specific low back pain, where one group receivedthe taping, a second group received the tape combined with therapeutic exercises, and a third group received only the therapeutic exercises, the results showed no difference among the groups[29]. These results corroborate with the findings of Parreira et al. (2011) since there was no statistically significant difference of electromyographic characteristics in chronic low back pain patients between the groups that received a taping intervention[30].

Castro-Sánchez et al. (2012) compared the application of Kinesio Taping versus a placebo application to reduce disability and pain in chronic non-specific low back pain, the results were favorable for the Kinesio Taping group for the outcomes pain and disability. The hypothesis for the difference observed might be related to how the taping was applied [31].

Tsai et al, (2010) investigate the therapeutic effects of kinesiotaping on plantar fasciitis, 52 patients with plantar fasciitis were randomly and equally divided into two groups. The patients in the control group received only a traditional physical therapy program daily, the patients in the experimental group received kinesio taping in addition to the same physical therapy program as the control group. It was concluded that the additional treatment with continuous kinesio taping for one week alleviate the pain of plantar fasciitis better than a traditional physical therapy program only[32].

A case reported by Garcia et al 2010 who investigate the use kinesio taping for treatment of myofascial trigger point pain in the shoulder. They reported that kinesio taping contributed to improvement of the patient's symptoms within a few days. Significant improvements in shoulder range of motion were observed after two days of treatment[33].

In contrast, Chen et al. (2007), Cools et al. (2002) and Fu et al. (2008) reported that kinesiotaping had no effect on the excitability of the muscles of healthy persons [34,35,36]. The explanation may be that since normal healthy

adults do not have any pains, reduction of muscle power does not take place, and therefore no change in muscle power is shown in the study given by Cowan et al. (2002) [37].

The limitations for our study may be the tape application technique, type of the tape, the qualified physiotherapist who apply the band for all patient as the difference in application may affect the results, small sample size n(40), recommendations for future research are conducting the same study on a large sample size, use different techniques for kinesio taping, using different physiotherapy scoliosis specific exercises as Schroth's 3- dimensional exercises.

CONCLUSION

Both exercises for scoliosis and exercises augmented by kinesio taping had a significant effects on reduction of Cobb's angle and pain intensity scale, so they will be beneficial modalities for treating scoliosis in adolescent females and decrease need for bracing and surgery.

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