



THE EFFECT OF POSTURAL KINESIOTAPING IN THE TREATMENT OF THORACIC KYPHOSIS

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Received: 3rd August, 2018.

Accepted: 3rd November, 2018.

ABSTRACT

Purpose: The purpose of this study is to find out whether postural kinesio taping (KT) contributes to decreasing kyphosis angle in adolescents who have increased thoracic kyphosis. Within this context, our purpose was to contribute to treatment of thoracic kyphosis as an additional method.

Material and Method: 50 adolescents between 10 and 18 years of age who referred to Orthopedics and Traumatology Polyclinic and who were diagnosed with thoracic kyphosis after required examinations participated in the study voluntarily. The patients were randomly grouped in two. One of the groups was exercise group (Ex), while the other was both exercise and taping (Ex-KT) group. At the beginning of the study, thoracic kyphosis values of all the patients in the study were measured by an orthopedist based on Cobb method. The groups consisted of 25 patients. Consent was taken from all participants with pediatric informed consent form. The same exercises were given to both groups. The patients were asked to make two types of exercises daily. The first exercise was 20 body hyperextensions in prone position. The second exercise was a rhythmic swimming movement done as if diving into the water and coming out of the water. This swimming movement would be done 5 minutes each day. The exercises were followed daily under the supervision of a physiotherapist. Only these exercises were given to Ex group. After Ex-KT group made the exercises, KT was applied on their upper backs. KT application was renewed each week. The participants were referred to the orthopedist again for measurement following a 6-week program. Final measurement results the orthopedist conducted with Cobb method were compared with the first measurement results.

Results: No statistically significant difference was found between the average pre-treatment and post-treatment kyphosis degrees of males and females in the Ex group ($p > 0,05$). Statistically significant difference was found between the average pre-treatment and post-treatment kyphosis degrees of males and females in the Ex-KT group ($p < 0,05$).

Conclusion: In the present study, it was found that KT technique had positive results in terms of decreasing increased thoracic kyphosis. We are of the opinion that it will be useful to apply KT technique with other treatment protocols in the treatment of increased thoracic kyphosis. We believe that the results of this study will be a reference for future studies. We are of the opinion that studies with longer periods of time should be conducted to have a clear idea about the effects of KT on thoracic kyphosis.

Key Words: Kinesio taping, Thoracic kyphosis, Cobb method

Level of evidence: Retrospective clinical study, Level III

INTRODUCTION

Kyphosis is the forward curving that occurs mostly in the thoracic area as a result of the increase of convexity of column vertebrae from posterior. In kyphosis, there is shortening on the anterior column of column vertebrae and increase in the posterior column. Kyphosis, which is a posture disorder, is excessive curvature

of the thoracic area in the spine. In a healthy person, there is a normal kyphosis angulation in the thoracic and sacral areas in the sagittal plane. Since the sacral area is more stable, pathological conditions generally occur in the thoracic area ^(10,14,20). It is of primary importance to decide whether the kyphosis is pathological or not. Patients generally refer to clinics

by complaining about their physical appearance. Pain and neurological problems are other complaints of the patients^(19,27). Radiological examinations are of primary importance in kyphosis assessment. Physiological kyphosis of column vertebrae should not be ignored depending on the age⁽³⁾.

Kyphosis of the thoracic area is thought to develop due to higher posterior edges of vertebra forms as a result of the natural curve from fetal period⁽³⁾. Physiological thoracic kyphosis is necessary for cardiopulmonary system organs to work in harmony⁽¹¹⁾. The degree of thoracic kyphosis is determined according to Cobb measurement method. According to Cobb method, the value of the angle that the straight lines which intersect each of the parallel lines passing from superior end plate of T1 to inferior end plate of T12 gives the thoracic kyphosis angle. Some researchers have chosen the upper point in different ways from T2 to T5 as the reference point^(7,9,17). The value of physiological kyphosis is between 20° and 40° and with advancing age, it is accepted as normal up to 50°^(17,23).

While kyphosis can develop after a trauma, it can also occur depending on congenital developmental anomalies. Degenerative disc diseases, inflammatory diseases, infectious reasons, muscular and neuromuscular diseases, muscular dystrophy, spinal muscular atrophy, myelomeningocele, neurofibromatosis, vertebra fractures, Paget's disease and spinal vertebra tumors can be listed among kyphosis etiologies⁽²⁾.

Thoracic kyphosis can result from bad position of trunk, congenital kyphosis, Scheuermann kyphosis, paralytic kyphosis, and due to developmental and metabolic reasons⁽²⁾. Scheuermann kyphosis is the type of kyphosis which was first defined by Danish radiologist Holger Werfel Scheuermann. It is the rigid kyphosis mostly seen in young adults as a result of the osteochondritis of the secondary ossification centers. Scheuermann stated that due to being a rigid deformity, the kyphosis deformity that occurred was differentiated from postural kyphosis and was a different clinical picture^(4,26). In Scheuermann kyphosis, a kyphotic deformity of 75° and higher, presence of progressive deformity, cardiopulmonary problems, pain, progressive neurological deficit and cosmetic disorders are accepted as surgical treatment indications⁽¹⁾.

Kinesiology Taping technique was developed in 1973 by Dr. Kenzo Kase. Kinesiology Taping has recently begun to be used as a method to support treatment in physiotherapy, orthopedics and sports injury. Kinesiology Taping technique can be used for supporting the painful tissue, providing ease to move and for protection. It is frequently used by athletes to decrease the myofascial tension of the muscle. It is also used for many purposes in orthopedic and neurological cases⁽⁵⁻

^{6,8,18)}. The objective of this study is to find out whether postural kinesio taping (KT) contributes to decrease in kyphosis angle in adolescents who have increased thoracic kyphosis. In this regard, we wanted to contribute to the thoracic kyphosis treatment protocol as an additional method.

MATERIAL AND METHOD

50 adolescent patients between 10 and 19 years of age who referred to Medical Center Orthopedics and Traumatology Polyclinic and who were diagnosed with thoracic kyphosis after required examinations participated in the study voluntarily. *The study was conducted with permission numbered 2015/89 from Malatya Clinical Researches Ethical Board.*

The patients were randomly grouped in two as exercise (Ex) group and exercise and kinesio taping (Ex-KT) group. At the beginning of the study, thoracic kyphosis values of all the patients in the study were measured by an orthopedist based on Cobb method. The groups consisted of 25 people. Consent was taken from the parents of all participants in the study with pediatric informed consent form. The patients whose anamnesis included spine surgery, osteoporosis, cardiac arrhythmia, scoliosis, gibosity, musculoskeletal deformities, and the patients who were physically disabled, who were doing sport professionally or as an amateur, those who had vertebral fracture and those who were allergic to KT material were excluded from the study. During the study, 3 patients from the Ex group and 2 patients from the Ex-KT group discontinued the study for various reasons. New participants were included in the study in place of these participants in line with the criteria. X-Rays of individuals in both groups were taken for control both before and after the study and their kyphosis degrees were measured by an orthopedist with Cobb method. All Ex-KT group patients were informed about taping. Patient information forms which included the demographic information of the participants, kyphosis type, anamnesis and family history were filled in.

Treatment

The same exercises were given to both groups. There were two types of exercises the patients were asked to make daily. The first exercise was a rhythmic swimming movement done as if diving into the water and coming out of the water. In this rhythmic swimming movement, the patient's head, arms and the body starting from the upper part of T4 level would hang from outside the bed and thus the arms and the upper body would become lower than the lower extremities and diving move would be made. While doing this rhythmic swimming move, the patients' arms would be positioned forward and

downward while the head would get in between the arms (Figure-1.a).

After this diving position, the shoulder would be retracted with head hyperextension and body hyperextension, the elbows would be flexed and the arms would be adjacent to the body as much as possible, fingers adjoined and the patient would get up behind until the palms would look down. The exercise of diving into the water and coming out of water would be done for five minutes each day in the form of a rhythmical swimming move (Figure-1.b).

For patients who could not complete this 5 minute period without stopping, breaks were made and these resting times were decreased from the total time. The second exercise was 20 body hyperextensions in two sets while in prone position. The point that the patients had to pay attention to during body hypertension was to have maximum hyperextension while getting up and getting minimum support from the arms (Figure-1.c).

The exercises were followed daily under the supervision of a physiotherapist. Only these exercises were made in the Ex group, as treatment. In the Ex-KT group, KT was applied on the back following the same exercises. Taping started from C6 spine level, continued paravertebrally until T12 level and ended at T12 level obliquely from the acromion line in the form of V. While taping, the patients were asked to keep an upright position as much as possible and to keep the head low to the back (Figure-2).



Figure-1. Back exercises given to groups; **a:** Diving to water, **b:** Rising from water, **c:** Body hyperextension exercise

The tapes had zero stress on both ends and about 40 % stress in the middle parts. Taping was not taken off for four days. After day four, it was taken off and the skin was rested for two days. Taping application was repeated on day 7. The patients were told that KT was water-resistant, thus, they could easily have bath and they were also told the situations that they had to take care of. The tapes of patients which went bad or which wore off somehow were renewed during the week. The patients in the Ex-KT group were followed for six weeks. At the end of six weeks, X-rays of all patients were taken again and the final kyphosis degrees were measured by the same orthopedist with Cobb method. Final measurement results the orthopedist conducted with Cobb method were compared with the first measurement results.



Figure-2. Kinesio taping

Statistical Analysis

Shapiro-Wilk test was conducted to find out if the data were normally distributed and it was found that the data did not have a normal distribution. Wilcoxon analysis was conducted on the data to assess the pre-treatment and post-treatment kyphosis degrees. Median and min and max values were given for the data which were not normally distributed. $p < 0.05$ was considered as statistically significant. IBM SPSS Statistics 22.0 program was used for analysis.

RESULTS

29 females (16 in the Ex group, 13 in the Ex-KT group) and 21 males (9 in the Ex group, 123 in the Ex-KT group) participated in the study. Among the girls, the median value of the ages of children was 14 years in the Ex group and 15 years

in the Ex-KT group; the median value of the boys was 14 years both in the Ex group and in the Ex-KT group. Among the girls, the median value of the heights of children was 164.5 cm in the Ex group and 160 cm in the Ex-KT group; the median value of the boys was 164 cm in the Ex group and 167 cm in the Ex-KT group. Among the girls, the median value of the mass of children was 74 kg in the Ex group and 52 kg in the Ex-KT group; the median value of the boys was 50 kg in the Ex group and 56.5 kg in the Ex-KT group. Among the girls, the median value of the BMI of children was 20.76 kg/m² in the Ex group and 19.57 kg/m² in the Ex-KT group; the median value of the boys was 19.37 kg/m² in the Ex group and 19.05 kg/m² in the Ex-KT group (Table-1).

In girls in Ex group, pre-treatment kyphosis degree median value was 63.5°, while post-treatment kyphosis degree median value was 63°. In girls in Ex-KT group, pre-treatment kyphosis degree median value was 62°, while post-treatment kyphosis degree median value was 57°. In boys in Ex group, pre-treatment kyphosis degree median value was 60°, while post-treatment kyphosis degree median value was 57.5°. According to the results of Wilcoxon analysis conducted, statistically significant difference was found in Ex-KT group

between pre-treatment and post-treatment kyphosis degrees of both girls and boys ($p < 0.05$), (Table-2).

When females and males were assessed under one group, pre-treatment kyphosis degree median value was 63° in Ex group, while post-treatment kyphosis degree median value was 64°. Pre-treatment kyphosis degree median value was 62° in Ex-KT group, while post-treatment kyphosis degree median value was 57°. According to Wilcoxon analysis results, statistically significant difference was found between pre-treatment and post-treatment kyphosis degrees in Ex-KT group ($p < 0.05$), (Table-3).

DISCUSSION

In patients with Scheuermann and postural kyphosis, conservative treatment is considered initially. Several practices such as physiotherapy, medical treatment, exercise treatment, orthosis and corset are applied in combination. In cases who do not respond to conservative treatment and whose kyphosis degrees increase (Cobb >75°), surgical treatment is considered appropriate. In literature review, there are few KT practices for the treatment of thoracic kyphosis. We are of the opinion that this study will make up this deficiency in the literature.

Table-1. Median (min-max) values of age, height, weight and BMI in girls and boys in Ex and Ex-KT groups.

Variable	Females		Males		P value
	Ex (n=16)	Ex-KT (n=13)	Ex (n=9)	Ex-KT (n=12)	
Age	14 (12-18)	15 (11-18)	14 (10-18)	14 (10-18)	0.804
Height (cm)	164.5 (158-175)	160 (152-171)	164 (155-180)	167 (125-185)	0.168
Mass (kg)	74 (42-74)	52 (36-69)	50 (40-65)	56.5 (22-74)	0.193
BMI	20.8 (15.67-26.53)	19.6 (14.98-26.95)	19.4 (15.63-20.81)	19.1 (12.89-22.84)	0.290

Table-2. Changes in pre-treatment and post-treatment kyphosis values of boys and girls and Wilcoxon analysis results

Group	Females			Males		
	pre-treatment	post-treatment	p	pre-treatment	post-treatment	p
Ex	63.5° (46° -81°)	63° (35° -71°)	0.315	60° (41° -71°)	67° (43° -77°)	0.573
Ex-KT	62° (52° -75°)	57° (44° -67°)	0.023	64° (54° -78°)	57.5° (43° -74°)	0.012

Table-3. Changes in pre-treatment and post-treatment kyphosis degrees of all children and Wilcoxon analysis results

Group	pre-treatment	post-treatment	p
Ex	63° (41° -81°)	64° (35° -77°)	0.782
Ex-KT	62° (52° -78°)	57° (43° -74°)	0.001

Greig et al. divided 15 patients with osteoporotic vertebral fractures into three groups as KT, placebo taping and no taping. Thoracic kyphosis angles were repeated before test and before application. Body muscle electromyography activity was measured during three different static standing positions and the balance parameters from strength platform were

examined. KT application was found to have a statistically significant effect on thoracic kyphosis; however, it was not found to be associated with EMG measurements or balance parameters. Greig et al. thought that the mechanic balance provided by taping was responsible for the muscle activity not to change although thoracic kyphosis decreased ⁽¹³⁾.

Sastre et al. used FED (fixation-elongation-derotation) device on 30 patients with Scheuermann kyphosis ⁽²¹⁾. This device has been designed 3-D in a way to apply a force up to 100 kg from the apex point and to force the vertebra to a smooth line with adverse effect mechanism for abnormal curvatures. In the same study, they recommended home exercises to patients in order to maintain lumbar area flexibility. Following a 4-month-long treatment and follow-up, they observed that the initial average value of the thoracic angle decreased to 45° from 53° with FED device and that backache due to thoracic hyperkyphosis was found to disappear. As shown by this study, the results of which are similar to our results, we are of the opinion that the reason why both FED device and KF decreased hyperkyphosis is that they increased proprioceptive sense development and bodily awareness. In addition, the fact that FED device is more costs in terms of application makes our study more advantageous. Still, further studies are needed to advocate the thought that thoracic hyperkyphosis and vertebral deformities can be fixed with postural awareness and postural education.

Weiss et al. applied kyphologic brace orthosis to patients with Scheuermann kyphosis and found positive results ⁽²⁵⁾. In this study which included patients who had been getting orthosis treatment and physiotherapy for a period of a long time such as 20 months, thoracic kyphosis values were examined and compared with pre-treatment values. The fact that thoracic kyphosis values were observed in a longer period than our study can show that this study is more advantageous than ours; however, we believe that KT is a much more advantageous method in terms of ease of use and comfort.

In a study conducted with Milwaukee orthosis in patients with Scheuermann kyphosis, the orthosis was found to decrease thoracic kyphosis during its period of use ⁽¹⁵⁾. While Milwaukee brace gave positive results, the ease of use that KT material has brings it one step ahead of orthosis.

While assessing patients with thoracic hyperkyphosis before treatment, the other sagittal curvatures of the vertebra should also be examined. Flexibility of lumbar extensor, hip flexor and hamstring muscles are primary factors that affect the posture of the vertebra. Thus, since there are many factors affecting the balance of the body and the development of the vertebra, these points should be taken into consideration during the treatment. In patients with Scheuermann kyphosis,

the shortness of knee flexor muscles, which are called the hamstring muscle group, is thought to influence the thoracic kyphosis and vertebra biomechanics negatively ⁽¹⁶⁾. Thus, we believe that extension exercises to lumbar extensor muscles and hamstring muscles should always be among exercises applied in the treatment of thoracic hyperkyphosis treatment. The fact that the head positions of patients with thoracic hyperkyphosis are bent forward is thought to cause an increase in the degree of kyphosis ⁽²⁸⁾. In this study, the patients were told that they had to pay attention to their head positions as much as possible in their daily lives in order to increase their postural awareness.

In patients with postural hyperkyphosis, there are studies which state that even only exercise can be enough to fix increased kyphosis ⁽²²⁾. In a study about yoga, postural exercises were found to decrease hyperkyphosis ⁽¹²⁾. These studies bring forward the idea that exercises should be varied and they should be presented to patients as an alternative.

The results of our study show that combining KT technique with exercises in the treatment of Scheuermann kyphosis or postural kyphosis causes positive results in the treatment. It was observed clearly that KT technique was effective on increased thoracic kyphosis. However, since the development of vertebra still continues in adolescence, we believe that the results of KT practice should be observed in a longer period. We are of the opinion that our study will be a reference to future studies.

Conflicts of Interest and Source of Funding: None declared.

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