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Effect of taping techniques on pain and grip strength in patients with lateral epicondylitis

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Abstract

Lateral epicondylitis (LE), is one of the most common causes of elbow and forearm pain encountered in clinical practice. Different treatment modalities have been described in the literatures, including different taping techniques. Previous studies have been investigated only the short term effects of different taping techniques on pain and grip strength in patients with LE without any complementary physical therapy program. So the purpose of this study was to investigate the long term effect of kinesio taping (KT) and diamond taping on pain and grip strength in patients with LE. Forty patients having LE of their dominant arm were randomly assigned into two equal groups. Group A received the supervised exercise program plus "Y pattern technique" KT while group B received the supervised exercise program plus "diamond taping technique. Pain intensity level at the lateral aspect of the elbow was evaluated by Visual Analogue Scale while the hand grip strength was evaluated by JAMAR dynamometer. All measurements were recorded at baseline and after four weeks intervention. Student t-test revealed that, both groups significantly improved post treatment as P = 0.001, while there was no significant difference (P>0.05) between both groups following four weeks of treatment in regarding to the measured outcomes. Athletic tape was equally effective to the KT in gaining long term benefits in LE. Both taping techniques used in the present study were equally effective in pain reduction and improving hand grip strength in patients with LE.

Keywords: Taping, pain, grip strength, lateral epicondylitis

Introduction

Lateral epicondylitis (LE) or tennis elbow, is one of the most common causes of elbow and forearm pain encountered in clinical practice commonly associated with resistant wrist or finger extension and gripping activities. It is a degenerative or failed healing tendon response characterized by pain at the lateral epicondyle aggravated by resisted muscle contraction of the extensor carpi radialis brevis (ECRB), increased presence of fibroblasts, vascular hyperplasia and disorganized collagen in the origin of the ECRB which is the most commonly affected structure [1,2]. It is generally a work related or sport related pain disorder usually caused by excessive quick, monotonous, repetitive eccentric contractions and gripping activities of the wrist [3]. The dominant arm is commonly affected, with a prevalence of 1–3% in the general population.

Although LE occurs at all ages, the peak prevalence of LE is between 30 and 60 years of age. The proportion of those afflicted by LE is not influenced by the sex of the patient, but the disorder appears to be of longer duration and severity in females [4].

Different treatment modalities have been described, including orthotics, non-steroidal anti-inflammatory drugs, steroid injections, manual therapy, ultrasound therapy, laser therapy, extracorporeal shockwave therapy, acupuncture and taping [5,6].

McConnell has proposed the application of diamond taping (non-elastic taping) procedure as a means of alleviating pain, improving muscle function, and restoring functional movement patterns in musculoskeletal conditions, by minimizing the aggravation of symptoms during the performance of therapeutic exercise, the use of a taping technique may facilitate the compliance to exercise rehabilitation programs [7].

Also, kinesio taping (KT) that used elastic taping procedure has been used as both a therapeutic and performance enhancement tool in different musculoskeletal conditions [8,9]. Previous studies have been investigated only the short-term effects of different taping techniques on pain and grip strength in patients with LE without any complementary physical therapy program [10-18].

Within the available literature there no published study investigated the long-term effect of KT and diamond taping in conjunction with complementary physical therapy program in the treatment of LE. So, the purpose of this study was to investigate the long term effect of KT and diamond taping on pain and grip strength in patients with LE.

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Material and Methods

Participants

Forty patients, their age was ranged from (20 - 50) years, having lateral epicondylitis of their dominant arm, diagnosed by orthopedic physicians were recruited for the study from outpatient physical therapy clinics in Cairo University hospitals. The eligible patients should have pain experienced over the lateral epicondyle in at least one of the following tests: resisted static contraction of wrist extensors or passive stretching of the wrist extensors, first time unilateral LE for greater than 6 weeks and the patient had not been previously treated [10-12].

Patients were excluded if they had dominant hand fracture through the last year, neuromuscular diseases, rheumatoid or degenerative diseases of the dominant hand, any upper-limb neurological abnormalities, allergies to adhesive tape, previous surgery to elbow and/or congenital or acquired deformities of the elbow [10-12]. All participants signed a consent form approved by the ethical committee of the Faculty of Physical Therapy, Cairo University, before the beginning of the study.

All patients considered eligible for the study performed a KT allergy test before randomization. The test consisted of sticking a small piece of KT to the upper one third of the posterolateral surface of the forearm and leaving it for 24 hours. The patients who developed an allergic reaction to the tape were asked to remove it immediately and excluded from the study [19]. The research design was randomized, single-blinded clinical trial. Randomization was performed by a statistician who was blinded to the study treatment and procedures' details. It was performed simply by adding a specific identification number for each patient. A SPSS program (version 20) was used to randomly assign the patients into two equal groups (n = 20). Outcome measures

Pain intensity

Visual Analogue Scale (VAS) was used to measure pain intensity level at the lateral aspect of the elbow pre and post treatment. It consists of a 10-cm straight line anchored at one end by a label such as "no pain" and at the other end by a label such as "the worst pain ". The patient was instructed to simply mark the line to indicate the present pain intensity and the provider then measures the length of the line to the mark on the scale. It was reported as valid and reliable tool for pain assessment [20,21].

Hand grip strength

The JAMAR dynamometer was used to measure hand grip strength pre and post treatment. It allows simple and quick readings of hand grip strength, which is measured in kilograms/force [13]. Patient was asked to sit on an adjustable chair which was adjusted so that the back was straight, with the knee and hip in 90° of flexion with the feet on the floor. The shoulder was in 15° abduction, the elbow in 90° flexion, forearm and wrist in neutral position. The patient was instructed to grip the handle of the dynamometer with maximum effort for 3 seconds. After each trial, the equip¬ment was reset by zero button. Three trials were performed with a one-minute rest break between each trial. The three values were recorded and the average was taken as the maximum hand grip strength [14, 22]. The JAMAR dynamometer was reported as a valid and reliable tool for measurement of hand grip strength [23-25]. Procedures

All patients were treated with the supervised exercise program which consisted of static stretching of the extensor carpi radialis brevis followed by eccentric strengthening of the wrist extensors. Static stretching was performed in the seated position with elbow extension, forearm pronation, and wrist flexion with ulnar deviation. The stretching force was applied according to the patient tolerance. This stretch position was held for duration of 30-45 seconds and was performed 3 times before and 3 times after the eccentric exercise portion of the treatment for a total of 6 repetitions. There was a 30-second rest interval between each bouts of stretching [26]. Eccentric strengthening exercise was performed in the seated position with the elbow supported on the bed in full extension, forearm in pronation, wrist in extended position (as high as possible) and the hand hanging over the edge of the bed. The patients were asked to flex their wrist slowly until full flexion is achieved, and then using the contralateral hand to return to the starting position. Patients were instructed to continue with the exercise even if they experience mild pain. However, they were instructed to stop the exercise if the pain becomes disabling. They had performed three sets of 10 repetitions at each treatment session, with at least 1 min rest interval between each set. When a patient was able to perform the eccentric exercises without experiencing any minor pain or discomfort, the load is increased using free weights based on the patients 10 repetition maximum [27]. The treatment program was given for three sessions per week in alternative days for three weeks.

Patients in group A received the supervised exercise program plus "Y pattern technique" KT. Curetape (Tape Concept Ltd., Larnaca, Cyprus) with a width of 5 cm and 0.5 mm thickness was used in the present study. Prior to KT application, the skin of the forearm was cleaned with alcohol swab to ensure that it is free of lotions and oils, excessive hair must be shaved for the best results and less pain when removing the tape. Before applying the tape, the length of tape was measured from the lateral epicondyle of the humerus to the styloid process of the radius and the obtained value was considered as the length of the required KT strip [15]. A roll of tape was cut into a strip and then cut down the middle of the strip to produce 2 tails or a "Y-strip. The base of the Y strip was placed near the region of the radial styloid process with no added tension and rubbed in place to initiate glue adhesion. The first strip was applied along the inferior (ventral) aspect of the common wrist extensor muscle group to the lateral epicondyle of the humerus with paper-off tension. The second strip was applied along the superior (dorsal) aspect of the common wrist extensor muscle group to meet the first strip at the lateral epicondyle of the humerus with paper-off tension. The Y strip was applied with the patient's forearm in full pronation, elbow in extension and wrist in extension with ulnar deviation [17,28].

Patients in group B received the supervised exercise program plus "diamond (athletic) taping technique" which consisted of 4 pieces of approximately 80 to 100 mm long, 3.8 cm wide, non-elastic, adhesive sports tapes (Premium quality zinc oxide tapes). These tapes were laid on the skin distally to proximally in a diamond shape, while simultaneously applying a traction force on the soft tissues towards the lateral epicondyle and perpendicular to the line of the tape. The strips overlapped at their ends and were

secured with an additional 4 tape strips. The tapes were applied in sitting with the elbow in a slightly flexed position [10, 12]. Patients

in both groups were instructed to leave the tape in place for 5 days. It was re-applied again at the beginning of the next week for three weeks.

Statistical analysis

Data analysis was performed by SPSS (Version 20) for Windows. Descriptive statistics including the mean and standard deviation was used to describe general characteristics of subjects and outcome variables. Student-t-test was used to determine significant differences between groups. The P-value < 0.05 was taken as significant.

Results

Participants characteristics of both groups presented in Table 1. There were no significant differences between both groups regarding age, weight, height, body mass index (BMI) and duration of onset as (P>0.05). Paired t-test revealed that, all measured outcomes significantly improved post treatment for both groups as P = 0.001.

While unpaired t-test revealed that, there was no significant difference between both groups post treatment in the all measured outcomes as P> 0.05 as shown in table (2).

The percentage of improvement in the hand grip strength for group A was 51.22% while for group B was 50.27% and the percentage of reduction of pain intensity for group A was 75.58%, while for group B was 72.69%.

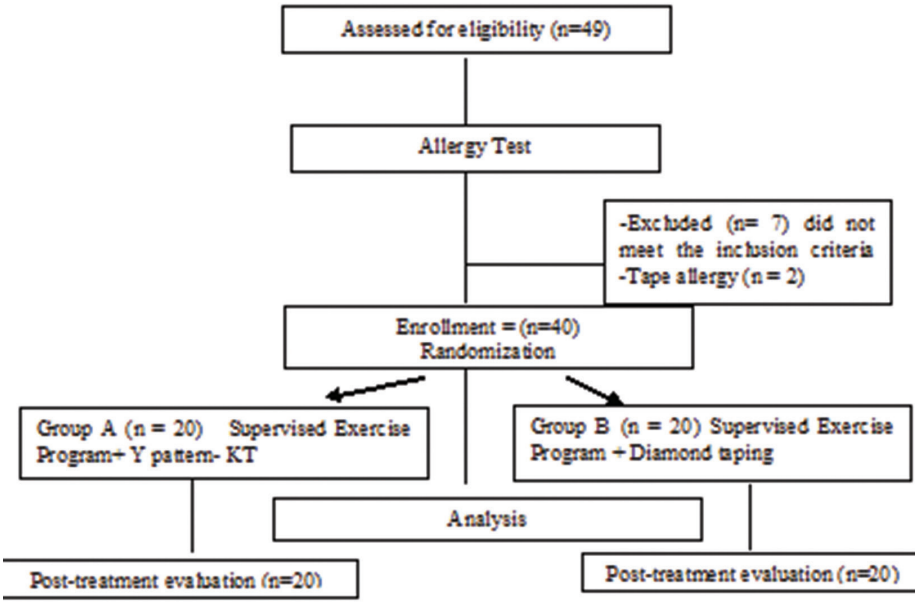

Figure 1. Participants flowchart

Table 1. Demographic characteristics of participants.

General Characteristics	Group (A) Mean ± SD	Group (B) Mean ± SD	P-value
Age (year)	35.29 ± 2.65	34.95 ± 2.55	0.681
Weight (Kg)	80.54 ± 5.31	79.96 ± 4.95	0.722
Height (cm)	171.25 ±7.33	172.15 ± 6.95	0.692
Body mass index(Kg/m2)	27.46 ± 1.85	26.98 ± 1.76	0.405
Duration of onset (weeks)	6.32 ± 0.75	6.41 ± 0.56	0.669
Gender (Male/Female)	(11/9)	(11/9)	-------
Dominant side (Rt. /LT.)	(18/2)	(19/1)	-------

SD: Standard deviation, P> 0.05 Non-significant

Table 2. Comparing mean values for the measured outcomes for both groups

Parameter	Pre-treatment			Post-treatment		
	Group (A) Mean ± SD	Group (B) Mean ± SD	P-value	Group (A) Mean ± SD	Group (B) Mean ± SD	P-value
Hand grip strength (Kg/force)	28.27 ± 2.84	29.16 ± 2.99	0.340	42.75 ± 3.52	43.82 ± 3.64	0.350
Pain intensity (VAS)	5.12 ± 0.96	4.98 ± 0.85	0.628	1.25 ± 0.21	1.36 ± 0.24	0.131

SD: Standard Deviation, P> 0.05 Non-significant.

Discussion

The purpose of this study was to investigate the long term effect of KT and diamond taping on pain and grip strength in patients with LE. The results of the current study revealed that, there was a statistical significant increase in hand grip strength post treatment for both groups and also there was a statistical significant reduction in pain intensity post treatment for both groups. Furthermore, there was no statistical significant difference between both groups under investigation regarding to the measured outcomes. There were no statistical significance difference between Y pattern technique of KT and diamond taping technique used in the current study on hand grip strength and pain intensity. The present study demonstrated that both KT as well as diamond taping decreased pain and improved hand grip strength after 4 weeks of application in patients with LE.

Our findings were in agreement with the previous studies which involving diamond taping for lateral epicondylalgia by Shamsoddini and Hollisaz [10], and Vicenzino et al., [12]. Also, Goel et al., concluded that, athletic tape and KT equally effective in gaining short term benefits in lateral epicondylalgia [11]. The study investigated only the short term effect of taping without using a conventional physical therapy program.

The precise mechanisms underlying the effect of taping on musculoskeletal pain are not yet clear. The decrease in pain after diamond taping can be attributed to a direct mechanical effect on the muscles of the forearm [11]. A possible model of the mechanism of action for diamond taping in LE relates to its neurophysiologic effects on the nervous system, particularly the nociceptive system. In this neurophysiological model the tape may exert an effect on pain by primarily altering pain perception, either locally at the elbow by inhibiting nociceptors, facilitating large afferent fiber input into the spinal cord and/or possibly by stimulating endogenous processes of pain inhibition

[12,30]. The decrease in pain after KT can be attributed to the reduction in mechanical stress on free nerve endings within the fascia through fascia unloading. The application of KT created convulsions on the skin which increased the interstitial spaces between the sheets of fascia [19]. The cutaneous stretch stimulation provided by KT interferes with the transmission of mechanical and painful stimuli leading to pain reduction [31].

The significant increase in the grip strength occurred because diamond shaped taping technique dispersed stresses generated by muscle contraction, thereby reduced protective pain- related inhibition and allowed the subject to contract more forcefully [29]. Also, KT reduced over stretching of the muscle, leading to overall increase in muscle performance. Moreover, the reduction in pain increased grip strength [6].

Taping over the skin constantly stimulates cutaneous mechanoreceptors, thus providing more sensory signals to the central nervous system for information integration, thus facilitating contraction of inactive muscles. In addition, reduction of motor neuron threshold induced by cutaneous stimulation would influence the recruitment of the motor unit, which can facilitate muscle contraction, and ultimately improve muscle strength [15,17].

Conclusion

Athletic tape was equally effective to the KT in gaining long term benefits in LE. Both taping techniques used in the present study were equally effective in pain reduction and improving hand grip strength. Our study recommended the use of both athletic taping and KT in conjunction with the conventional physical therapy program in the management of patients with LE.

Conflict of interest

We certify that there is no conflict of interest with any financial organization regarding the material discussed in the manuscript.

Ethical clearance

We certify that this study involving human subjects is in accordance with Helsinky declaration of 1975 as revised in 2008.

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