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Research Article

Effect of Taping on Pain, Grip Strength, and Function in Deskbound Workers with Lateral Epicondylalgia

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Abstract

Background and objectives: Lateral Epicondylalgia (LE) affects 1% to 3% of the adult population, peak incidence between the age 45 years and 54 years. Intensive use of a mouse device, and keyboard, are the main risk factors for LE in computer workers. Diamond taping technique has been shown to reduce pain and improve grip strength in LE up to 30 minutes post-taping. To date, no documented evidence exists on outcomes after 30 minutes post-taping in deskbound workers. Therefore we aim to find out the outcomes after taping in deskbound workers with LE and if the effects last up to 8 hours, which is the usual working hour per day for deskbound workers.

Methods: This Single group Pre-test Post-test Experimental study was done on deskbound workers with lateral Epicondylalgia who were selected by convenient sampling method. A total of 16 deskbound workers with LE, mean age of 39.75 ± 4.40 were included after a written consent. Pain, grip strength and functional status were determined before taping. After the application of diamond tape, the outcome measures were assessed three times; immediately after taping, at 30 minutes and 8 hours post-taping.

Results: In subjects with LE, the pain reduced and the grip strength and functional performance improved at 30 minutes and 8 hours post-taping (p value<0.01).

Conclusion: The diamond taping may be useful for reducing pain and improving grip strength and functional performance, at 30 minutes and 8 hours after taping in subjects with LE. However, there was no significant improvement in all outcomes immediately post-taping.

Keywords: Elbow; Tendinopathy; Tennis elbow; Pain; Grip strength; Physiotherapy

Introduction

Lateral Epicondylalgia (LE), epicondylitis or Tennis elbow is one of the most common lesions of the arm, affecting the common wrist extensor tendon at the lateral epicondyle of the humerus [1]. It is a chronic overuse injury, characterized by pain and tenderness over the lateral epicondyle of the humerus and pain on resisted extension of the wrist, middle finger, or both [2,3]. This disorder challenges the clinician daily, as it is an injury that is difficult to treat, is prone to recurrent bouts, and may last for several weeks or months [4].

The lateral epicondylalgia or lateral epicondylitis, commonly referred to as "tennis elbow" occurs in vast proportion of people who do not play tennis; those with manually intensive occupations or those who use vibratory tools may have an increased risk [5-7]. In desktop workers, the repetitive action of typing on the computer keyboard and mouse can often result in painful symptoms in the elbow, such as a aching pain [8-10]. The chance of developing Lateral epicondylalgia due to repetitive strain has increased with the increasing use of computers [11,12]. This disorder has a major impact on the individual's social and professional life and challenge to the society and the healthcare industry [13,14].

The prevalence of lateral epicondylalgia in the general population has been reported to range from 1% to 3% in adults, with men and women being affected equally [1,7]. It is most prevalent in the fifth decade of life, with peak occurrence between the 45 years and 54 years of age [1,15]. The repetitive contractions of the muscle lead to irritation and partial tear of the involved musculature [16,17]. This risk is increased by prolonged typing hours without break, uncomfortable seating and poorly arranged workspace. Rigorous use of a mouse device, and keyboard, are the main risk factors for forearm pain in computer workers. Some of the high risk factors for onset of LE are high job demands, time pressure to meet targets, and female gender [9,11].

The problem may be perceived in the beginning as mild pain or tiredness during the working day. The tiredness slowly changes into pain which becomes progressively persistent [6]. The pathologic process of lateral epicondylalgia was described as inflammatory in the beginning; however, the recent consensus is that microtrauma initiates a degenerative process. It is a degenerative or failed healing tendon response characterized by the increased presence of fibroblasts, vascular hyperplasia, and disorganized collagen in the origin of the extensor carpi radialis brevis, the most commonly affected structure, usually caused by excessive quick, monotonous, repetitive eccentric contractions and gripping activities of the wrist [4,18].

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Upto 95% of cases recover without surgery, by non-operative methods of treatment including physical therapy, activity modification, non-steroidal anti-inflammatory drugs, and injections [1]. A wide range of physical therapy approaches have been discussed in the literature; among these, Diamond taping, a technique proposed by McConnell has shown positive results in the management of LE [7,19-21]. This taping technique unloads the painful structures, thereby minimizing the aggravation of the symptoms, allowing treatment to be directed at improving the functional performance of the patient.

The application of Diamond tape has been shown to improve pain-free grip strength both immediately and 30 minutes after application in subjects with chronic lateral epicondylalgia, thereby facilitating the rehabilitation program with improved grip strength and wrist extension muscle force [7,20,21]. The effect of Diamond taping has been established in treatment of LE up to 30 minutes to facilitate pain free rehabilitation. To date, there is no literature on the use of Diamond taping techniques in deskbound workers with lateral epicondylalgia and the outcomes after 30 minutes.

Hence we intend to find out if pain, grip strength and function improves with Diamond taping for LE in deskbound workers, whose work involves use of keyboard and mouse, at 0 minutes, 30 minutes and 8 hours, in view of the fact that 30 minutes of pain reduction at elbow may be needed for the physiotherapy strengthening program and 8 hours is the normal working duration for a deskbound employee.

Methods

Design overview

This Single group Pre-test Post-test Experimental study was done on deskbound workers with lateral epicondylalgia who were selected by convenient sampling method, in which the outcome assessor was blinded to the baseline assessment of the subjects.

Setting and participants

The study was carried out in the Physiotherapy outpatient unit of Christian Medical College, Vellore, Tamilnadu, India in between January 2017 and June 2017. The deskbound workers, whose work involves use of keyboard and mouse, referred for physiotherapy for LE were assessed for eligibility, and a written consent was obtained by the principal investigator in their vernacular language. Deskbound workers diagnosed with LE by the Orthopaedician at Christian Medical College, Vellore, with pain for more than 1 week, between the age 30 years and 50 years of both genders with positive Cozen's and Mill's test were considered to be eligible for inclusion [22]. Subjects with past skin reaction associated with the use of adhesive tape, acute trauma, fractures, elbow subluxation /dislocation, upper limb neurological abnormalities, recent steroid injections (<6 weeks), metastatic lesion, arthritis, intake of psychotherapeutic drugs were excluded from the study. Approval for the study was obtained from the Institutional Review board (Research and ethics committee) of the Christian Medical College, Vellore.

Intervention

The diamond taping technique was used in which 4 pieces of approximately 80 mm to 100 mm long, 3.8 cm wide, non-elastic, rigid tapes (Leukotapes) were used [20]. The subjects were made to sit in a chair with the elbow in slightly flexed position. First the under wrap or hypoallergenic tape was applied. The hypoallergenic tape was applied on the skin distally to proximally in a diamond shape, while simultaneously applying a tractional 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. Inelastic Leukotape was then secured over the hypoallergenic tape. The shape of this taping technique (diamond) is used here to differentiate the technique from other taping techniques of the elbow (Figure 1) [7,20,21].

Figure 1: Diamond Taping applied on a person with Lateral Epicondylalgia.

Measurement instruments and outcome measures

The participant's data sheet included demographic data, pain assessment and outcome measures. A pre-taping assessment was done. Pain was assessed using Visual Analogue Scale (VAS), grip strength was measured using a hand-held dynamometer and Tennis Elbow Function Scale (TEFS) questionnaire was then administered to assess functional status. Three post-taping assessment were done. Pain, grip strength and functional performance were assessed immediately post taping (0 minutes), at 30 minutes and 8 hours after taping. The description of each scale is given below.

Visual analogue scale

It is a 10 cm horizontal line marked "no pain" at 0 cm and "worst pain" at 10 cm. The patients were asked to mark a point upon it which will best describe their pain and the corresponding number was recorded. VAS assessment tool has been found to be valid and a reliable method of measuring patients perceived pain [23,24].

Hand held dynamometer

The grip strength was defined as the amount of force generated with an isometric contraction using a hand held dynamometer, with the upper limb in a standardized position [20,25]. In supine lying position, the shoulder of the subject was internally rotated, forearm pronated, elbow fully extended and palm of the hand flat on the plinth and adjacent to the subject's side. The shoulder was slightly abducted to position the dynamometer handles between the hand and body. They were then instructed to gradually increase their grip force to their maximum power while maintaining the standardized position, and the physiotherapist recorded the grip strength in pounds [26,27].

Tennis Elbow Function Scale (TEFS) questionnaire

The functional status of the subject was assessed using Tennis Elbow Function Scale (TEFS) [28], which is a measure of pain-related elbow function. The subjects were instructed to perform a set of task that could be difficult due to the underlying problem and were informed to accordingly rate the intensity of their pain. Higher scores indicate greater levels of disability. The TEFS assessment tool is a reliable, valid and responsive measure considered suitable for evaluating function in patients with LE.

Statistical analysis

The pain, grip strength and functional status before and after the application of the Diamond taping were averaged and used in subsequent analysis. Statistical analysis was done using Wilcoxon Signed Rank test to compare the significance between the pre and post taping scores of the three components separately. The analysis was done using SPSS version 18.0

Results

A total of 16 subjects with a mean age of 39.75 ± 4.4 years participated in the study after a written consent. Majority of the subjects were females (75%) in this study and all the 16 subjects had LE on their dominant side with a mean duration of pain for 21.5 weeks (range 3 to 75). The demographic characteristics of the participants and the baseline scores are shown in Table 1. The mean pain intensity of the participants was 6.81 ± 1.64 out of 10 in the VAS before taping.

Table 1: Demographic characteristics and outcomes of participants at baseline (N=16).

Participants characteristics		Initial assessment
Age	N= 16	39.75 ± 4.40
Gender	Female	12(75)
	Male	4(25)
Dominance	Dominant limb	16(100)
	Non-dominant limb	0(0)
Duration of Pain in weeks	Median (range)	21.5(3-75)
Baseline scores (Pre-Taping):		
Pain	VAS	6.81 ± 1.64
Grip Strength	Hand held dynamometer	22.06 ± 7.61
Functional Status	TEFS	25.56 ± 7.95

VAS: Visual Analogue Scale; TEFS: Tennis Elbow Function Scale
Categorical variables are expressed as number (%), continuous variables are expressed as mean ± SD.

Diamond taping was applied after the baseline data was collected. The effect of Diamond taping was measured using VAS, Grip strength and TEFS, at 0 minutes, 30 minutes and 8 hours after taping and the mean scores are shown in Table 2.

Table 2: (Mean ± SD) pain (VAS), grip strength (Pounds) and Funtion (TEFS) at the 4 measurement times (pre-taping [baseline], 0 minutes post-taping, 30 minutes post-taping and 8 hours post-taping).

Outcomes	Pre-taping (Baseline)	Post-taping (0 Minutes)	Post-taping (30 minutes)	Post-taping (8 hours)
Pain (VAS)	6.81 ± 1.64	6.06 ± 2.14	5.31 ± 1.74	4.44 ± 1.54
Grip Strength (Pounds)	22.06 ± 7.61	21.88 ± 7.89	25.13 ± 8.67	25.81 ± 8.56
Function (TEFS)	25.56 ± 7.95	25.19 ± 7.90	23.00 ± 7.78	17.19 ± 7.19

The mean pain before taping (Baseline) and post-taping (0 minutes) was 6.81 ± 1.64 and 6.06 ± 2.14 respectively, with no significant reduction immediately following taping (p value=0.016). Equally, there was no significant improvement in grip strength or functional outcome immediately following taping (p value=0.944 and 0.180 respectively). However the pain reduced significantly at 30 minutes and 8 hours post-taping (p value=0.005 and 0.001 respectively) (Figure 2).

The reduction of pain from 30 minutes to 8 hours post-taping was not significant (p value=0.034), which shows that the reduction in pain was maintained for 8 hours (Table 3).

The follow-up tests for grip strength at 30 minutes and 8 hours post-taping showed similar improvements (p value=0.006 and 0.001 respectively). The grip strength remained unchanged from 30 minutes (25.13 ± 8.67) to 8 hours (25.81 ± 8.56) (p value=0.494).

The functional status improved significantly at 30 minutes and 8 hours as observed in the other outcomes (p value=0.004 and 0.001 respectively). From 30 minutes to 8 hours the score improved significantly (p value=0.001) unlike the pain and grip (p value=0.034, 0.494 respectively).

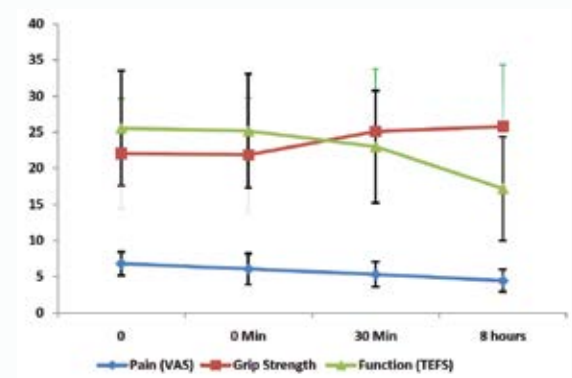

Figure 2: Mean ± SD by Baseline and Post Taping time for PAIN (VAS), Grip Strength and Function (TEFS).

Table 3: Pre- post comparison of pain (VAS), grip strength (Pounds) and Function (TEFS) at the 4 measurement times (pre-taping [baseline], 0 minutes post-taping, 30 minutes post-taping and 8 hours post-taping) using Wilcoxon Signed Rank Test.

	Pain (VAS)	Grip Strength (Pounds)	Function (TEFS)
Pre-taping (Baseline)-Post-taping (0 Min)	0.016	0.944	0.18
Pre-taping (Baseline)-After 30 minutes-Post-taping (30 Minutes)	0.005*	0.006*	0.004*
Pre-taping (Baseline)-Post-taping (8 hours)	0.001*	0.001*	0.001*
Post-taping (30 Minutes)-Post-taping (8 hours)	0.034	0.494	0.001*

*Statistically significant (P value<0.01).

Discussion

Intensive use of a mouse device, and keyboard, in deskbound workers result in pain and tenderness at the lateral epicondyle of the humerus due to repetitive strain [7-10]. Diamond taping technique has been shown to reduce pain and improve grip strength in LE up to 30 minutes post-taping [7,20,21]. To date, there are no documented evidence on the use of taping techniques in deskbound workers with lateral epicondylalgia and the outcomes after 30 minutes. Hence in this study we aimed to find out the effectiveness of diamond taping for deskbound workers with Lateral Epicondylalgia on pain, grip strength and functional ability, immediately (0 minutes), half an hour (30 minutes) and 8 hours post-taping.

A total of 16 subjects, (12 women and 4 men), with a mean age of 39.75 ± 4.4 years participated in the study, all of whom were deskbound workers with LE on their dominant arm (Table 1). Seventy-five percent of the study population was females, which supports the previous findings showing women at increased risk for developing LE [9,11].

Our data showed that the pain, grip strength and functional status did not improve immediately (0 minutes) after diamond taping (p value>0.01). However the subsequent assessments at 30 minutes and 8 hours showed significant reduction in pain, and improvement in

grip strength and functional status (p value<0.01), when compared to the baseline assessment. There was no significant difference in pain and grip strength between 30 minutes and 8 hours post-taping. (p value>0.01) On the other hand, the functional status (TEFS score) improved significantly at 8 hours when compared to outcomes at 30 minutes post-taping (p value<0.01). This shows that there was progressive improvement in the functional performance of the patient throughout the day.

A few studies have reported the immediate effect of Diamond taping in LE [21], has shown significant reduction in pain (VAS) score, and improved wrist extension isometric grip strength immediately following diamond taping for lateral epicondylitis. Another study has shown significant improvement in Pain-free grip strength and Pressure pain threshold immediately after diamond taping [20]. Although there was no significant improvement in outcomes at 0 minutes, the diamond tape in our study may have influenced pain perception, to a sufficient degree at 30 minutes and 8 hours, to allow the participants to demonstrate significant improvement in grip strength and functional status. Besides, the outcomes may have improved before 30 minutes as found by Shamsoddini and Hollisaz [7] in their study, which showed positive effects on outcomes within 5 minutes to 10 minutes post-taping.

At 30 minutes and 8 hours, there was significant reduction in pain, and improvement in grip strength and functional status (p value<0.01), when compared to the baseline assessment (Table 3). Similar improvements in pain-free grip strength and pressure pain threshold at 30 minutes, has been demonstrated by Vicenzino B et al. [20], supporting our findings. However, our study was the first of its kind to evaluate the outcomes at 8 hours post-taping, which is of particular importance to deskbound workers as their regular working time is 8 hours in a day.

A potential clinical implication of these findings is that the diamond tape reduces the pain by unloading the painful structures, thereby facilitating compliance to movement and function [19,20], within 30 minutes of application, which is maintained till 8 hours. The mechanism of pain relief, post-taping in LE relates to its neurophysiologic effects on the nervous system, particularly the nociceptive system. In this model, Diamond tape primarily, facilitates large afferent fiber input into the spinal cord altering pain perception, either locally at the elbow by inhibiting nociceptors and/or possibly by stimulating endogenous processes of pain inhibition [20,21].

There were some limitations in this study; first, the time when the symptoms improved was not documented; second, the number of working days lost to sickness was not assessed as the persons we treated were from other states of India as well; third, there was no control group or randomization in this study, as we included only those who were deskbound workers which resulted in a small sample of participants; fourth, the outcomes were not compared with the unaffected side as the baseline.

Since, 8 hours is the normal working duration for a deskbound employee, this treatment may produce a major impact on the number of working days lost due to lateral epicondylalgia. Hence, substantiation with randomized control trial including time taken for symptoms to improve, the number of working days lost to sickness, and comparison with the normal side may be warranted in the future studies.

Conclusion

The results from this study suggest that the diamond taping method may be useful for reducing pain and improving grip strength and functional performance, at 30 minutes and 8 hours after taping in subjects with LE.

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