



The Efficacy Of McConnell's Taping Versus Sham Taping Along With Concentric And Eccentric Strength Training Of Wrist Extensors In Lateral Epicondylalgia-Double Blinded Randomized Clinical Trial

Madhuripu Pattali ¹ Jazeel N M ¹ Sreejisha P K ¹ Riyas Basheer K B ¹

¹Assistant Professor, Sree Anjaneya College of Paramedical Sciences,
Malabar Medical College Hospital & Research Centre,
Calicut-673323

Corresponding Author:

Madhuripu Pattali

Assistant Professor, Sree Anjaneya College of Paramedical Sciences,
Malabar Medical College Hospital & Research Centre,
Calicut-673323

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

ABSTRACT

Background and objective: Lateral epicondylalgia (tennis elbow) is a pathological state of the wrist extensor muscles at their origin on the lateral humeral epicondyle. It is a musculoskeletal pain dysfunction typically due to excessive quick, monotonous, repetitive eccentric contractions and gripping activities of the wrist. The study aims in comparing the effectiveness of Mc Connell's diamond Taping Technique along with concentric and eccentric strength training for wrist extensors and sham taping along with concentric and eccentric strength training for wrist extensors in reducing pain and to improving grip strength in patients with lateral epicondylalgia.

Design: Double blinded comparative study

Materials and methods: 30 patients with sub-acute lateral epicondylalgia are included in the study. They are randomly divided into two different groups. Group A: 15 (Subjects receiving Mc Connell's diamond taping technique along with concentric and eccentric strength training of wrist extensors) and Group B:15(Subjects receiving sham taping and along With concentric and eccentric strength training of wrist extensors)

Results: There was a significant decrease in pain and improvement in hand function and grip strength ($p < 0.001$) in patients with lateral epicondylalgia who received McConnell's taping with Concentric and Eccentric Strength Training of wrist extensors when comparing with patients who received sham tapping Concentric and Eccentric Strength Training of wrist extensors..

Keywords: lateral epicondylalgia, tennis elbow, concentric strength training, eccentric strength training, McConnell's taping.

INTRODUCTION

Lateral epicondylalgia as the name implies is a condition characterized by pain over the lateral epicondyle. Classically clinicians use the terms tennis elbow and lateral epicondylitis when referring to traumatic types of affectation, since these terms convey the extrinsic and intrinsic incidents that might explain the mechanical occurrence of this condition. The condition first known as tennis elbow has been recognized for over a century. Pain, tenderness over the lateral epicondyle, exaggerated by resisted wrist extension and passive wrist flexion, and impaired grip strength are major concern by the patients. Although many

tennis players may experience this condition, most cases are associated with work-related activities or have no obvious precipitating event. Lateral epicondylalgia affects 1–3% of the population.¹ It has been described as an overuse injury² only 5% of all patients seen are recreational tennis players. Hutchinson et al. found that the incidence and prevalence in male championship tennis players between the ages of 16 and 18 years was 0.3% and 1.2%, respectively.³

Dr. Nirschl's studies consistently demonstrated that the affected tendon (usually the extensor carpi radialis brevis tendon) was characterized by a dense

population of fibroblasts, disorganized and immature collagen and an absence of inflammatory cells. These findings are considered characteristic of a degenerative process, which he called angiofibroblastic hyperplasia, now commonly known as tendinosis. Further histopathological and magnetic resonance imaging studies have revealed similar histological features and have confirmed the absence of an inflammatory process. Recently, a study using an in vivo micro dialysis technique demonstrated normal levels of E2 Prostaglandin, a biochemical marker of inflammation, in extensor carpi radialis brevis tendons of patients with chronic lateral epicondylar pain.⁴ Histopathological examination of similar chronic tendon conditions (Achilles, rotator cuff, and patellar tendinopathies) provide further support for the tendinosis-degenerative non inflammatory paradigm for chronic overuse tendon injuries.⁵

The term epicondylalgia reinforces the perception that this is a complex state with potentially numerous patho-physiological mechanisms and underlying source of pain. It reinforces the need to conduct thorough clinical assessments on each and every patient to identify, as best as possible, the contributing source of pain in order to provide optimal management strategies. And, it reinforces the need to pursue ongoing research to elucidate the underlying patho-etiology and develop new and innovative treatment options that reflect evolving evidence. Embracing this new terminology is an important step in moving beyond the traditional perspective towards a progressive approach to understanding and managing this perplexing condition.⁶ Pathomechanically anatomic studies confirm that the extensor carpi radialis brevis is under maximum tension when contracting while the forearm is pronated, the wrist flexed and ulna deviated. The head of radius rotates anteriorly against the extensor carpi radialis brevis tendon during pronation, where a bursa is frequently located and this may explain why individual experience pain at the head of radius. Second, some tennis players who have played seriously for many years have increased muscle bulk of their extensor muscle considerably but may have lost flexibility.⁷

This study aims to empirically examine the efficacy of McConnell's taping over sham taping along

with concentric and eccentric strength training of wrist extensors in patients with lateral epicondylalgia. In the presence of so many conflicting evidences clinical decision making becomes tough & arbitrary. There is a need for more studies aimed at exploring the efficacy of this approach to standardize the treatment based on scientific evidences; this led to think of doing such a study.

METHODOLOGY

This is a double blinded randomized controlled trial done in private medical college hospital on 30 subjects with sub acute lateral epicondylalgia clinically diagnosed with orthopedician. The total duration of the study was six months with two weeks intervention for each subject. The subjects were selected based upon following criterias; Both the males and females of age between 20 to 40 years, resisted middle finger extension producing typical pain on lateral epicondyle, Cozens test positive, Local tenderness on palpation on lateral epicondyle. The exclusion criteria includes allergies to adhesive tape, all extraneous causes like shoulder and cervical involvement, recent trauma /surgery around elbow, history of immobilizations of elbow, neurological impairment like stroke and head injury, history of rheumatoid arthritis, Steroid Injection.

The subjects were screened based on the selection criteria and signified their voluntary decision to participate. Demographic data was obtained from the subjects. 30 subjects of lateral epicondylalgia are included in the study that fulfills the selection criteria after thorough physical objective evaluation, clinical reasoning process with special test. All the patients were found to be unilateral complains and they were divided into group A and group B using simple random technique.

The subjects with Mc Connell's taping were advised to attend the physiotherapy department, preferably in the morning session every day for application of tape. They were also advised to remove the tape at the end of the day. The subjects were positioned in supine lying with elbow in full extension. The taping techniques used were Mc Connell's taping.

The subjects with sham taping were advised to

attend the physiotherapy department, preferably in the morning session every day for application of tape. They were also advised to remove the tape at the end of the day. The subjects were positioned in supine lying with elbow in full extension. The placebo tape was applied directly over the elbow



Figure 1. Subject with McConnell's Taping

Both the groups were given Concentric and Eccentric Strength Training of wrist extensors with resistance band. The strengthening exercises were performed in a seated position, with the elbow flexed, the forearm resting on the thigh, and the hand extending beyond the edge of the thigh to allow full wrist motion during exercise. The resistance band was held by the handle and fixed on the floor with the ipsilateral foot. Concentric exercise was performed with the forearm in pronation by moving slowly from full passive wrist flexion to full wrist extension. The eccentric exercise was performed by slowly lowering from full wrist extension to full wrist flexion. Subjects in the strengthening (concentric and eccentric) groups performed three sets of ten repetitions once daily, with two to five minutes of rest between sets. The appropriate resistance band (light, medium, or heavy) was determined by a ten-repetition trial.

The length of the resistance band was adjusted so that it was somewhat difficult to perform ten repetitions. During the initial trial, the length of the resistance band was marked with a permanent ink marker to avoid variability of resistance between exercise sessions. Empirically, a lighter resistance band was tried on smaller subjects or those with more pronounced pain. Subjects who had severe pain with the use of the lightest resistance band were instructed to perform the exercises without the resistance band and to begin using the lightest resistance band one week later if the pain was not

worse. Subjects were instructed to increase the resistance in the band when they could perform three sets easily and without a notable increase in pain. The resistance was increased by shortening the band in 1-inch increments from the initial length mark.



Figure 2. Subject with Sham Taping

Intervention to both the groups was given for 14 sittings and post treatment assessment was taken after 14 sittings in each groups. Visual Analog Scale (VAS), patient rated tennis elbow evaluation (PRTEE) and dynamometry were used as outcome measure to assess the baseline values and the progression.

Statistical Analysis: Data was analyzed using SPSS 20.0. The normality of the collected data was established using Shapiro Wilk test and it was found to be that the data doesn't follow normal distribution. The demographic characteristics were summarized as median and inter quartile range. Within group pre and post intervention differences was analyzed using Wilcoxon signed rank test and for between group comparison Mann-Whitney u test was used. To minimize type I error, p-value of <0.05 were considered to be statistically significant

RESULTS

The figure 3 & 4 shows the age group and gender distribution of both the interventional and control group. It is expressed in percentage for better interpretation of participants included in the study.

The table 1 shows analysis of pain score by Wilcoxon signed rank test for VAS in Group A and Group B tested before and after the intervention. For Group A the median and IQR for VAS before intervention is 7 & (6.2, 7.4) and after intervention is

3 & (2.5, 3.5) with p value being less than 0.001 shows that there is statistically significant reduction in pain after intervention. For Group B the median and IQR for VAS before intervention is 7 & (6, 7) and after intervention is 5 & (4, 5) with p value being less than 0.001 shows that there is statistically significant reduction in pain after intervention.

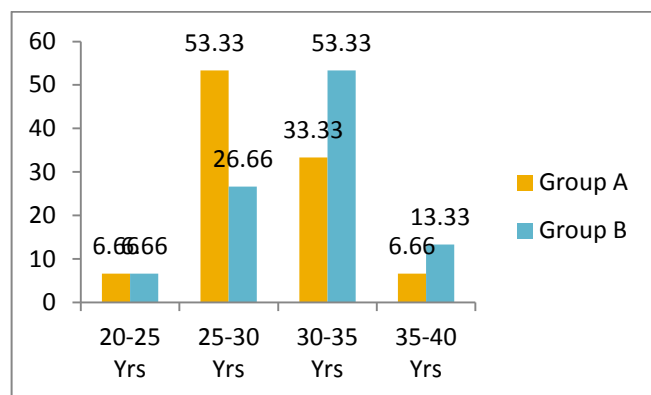


Figure 3. Age distribution of the subjects in both groups (in percentage)

The table 2 shows hand function analysis by Wilcoxon signed rank test for PRTEE in both the groups. For Group A the median and IQR for PRTEE before intervention is 36 & (35, 38) and after intervention is 25 & (25, 28) with p value being less than 0.001 shows that there is statistically significant improvement in hand function after intervention. For Group B the median and IQR for PRTEE before intervention is 38 & (35, 39) and after intervention is 36 & (34, 37) with p value being less than 0.001 shows that there is statistically significant improvement in hand function after intervention.

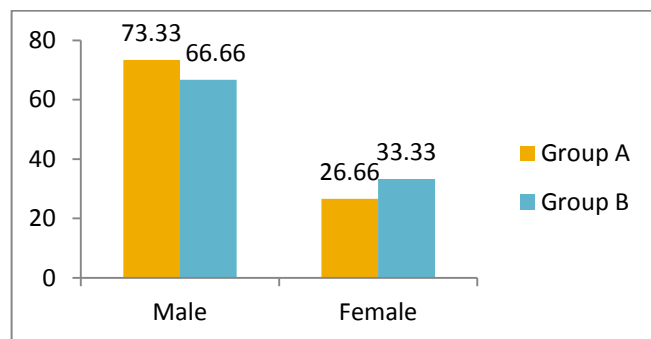


Figure 4. Gender distribution of the subjects in both groups (in Percentage)

Table 1. Intra group analysis of pain by using visual analog scale

Group	VAS Score	Median	IQR	P value
A – McConnell Taping	Pre Intervention	7	6.2, 7.4	<0.001
	Post Intervention	3	2.5, 3.5	<0.001
B – Sham Taping	Pre Intervention	7	6, 7	<0.001
	Post Intervention	5	4, 5	<0.001

Table 2. Intra group analysis of hand function by using PRTEE

Group	PRTEE Score	Median	IQR	P value
A – McConnell Taping	Pre Intervention	36	35, 38	<0.001
	Post Intervention	25	25, 28	<0.001
B – Sham Taping	Pre Intervention	38	35, 39	<0.001
	Post Intervention	36	34, 37	<0.001

The table 3 shows grip strength analysis by Wilcoxon signed rank test for dynamometry in both the groups. For Group A the median and IQR for grip strength before intervention is 43 & (42, 46) and after intervention is 52 & (50, 57) with p value being less than 0.001 shows that there is statistically significant improvement in grip strength after intervention. For Group B the median and IQR for grip strength before intervention is 45 & (42, 49) and after intervention is 48 & (45, 50) with p value being less than 0.0001 shows that there is statistically significant improvement in grip strength after intervention.

The table 4 shows inter group of median rank difference between pre and post intervention value of VAS, PRTEE and grip strength in group A is 3.6, 10, 9 respectively and in group B is 1.4, 2, 3 respectively and difference between them is

statistically significant by Mann Whitney U test ($U < 0.001$).

Table 3. Intra group analysis of grip strength by using dynamometry

Group	Grip Strength (kg)	Median	IQR	P value
A – McConnell Taping	Pre Intervention	43	42, 46	<0.001
	Post Intervention	52	50, 57	<0.001
B – Sham Taping	Pre Intervention	45	42, 49	<0.001
	Post Intervention	48	45, 50	<0.001

Table 4. Inter group analysis of VAS, PRTEE & grip strength by using Mann Whitney U Test

Variables	Group	Median Rank	U value
VAS Difference	A – McConnell Taping	3.6	<0.001
	B – Sham Taping	1.4	
PRTEE Difference	A – McConnell Taping	10	<0.001
	B – Sham Taping	2	
Grip Strength Difference	A – McConnell Taping	9	<0.001
	B – Sham Taping	3	

DISCUSSION

In the present study, a combined method of Mc Connell's diamond elbow taping along with concentric and eccentric strengthening of wrist extensors was found to be more effective than sham taping along with concentric and eccentric strengthening. The efficiency of such a novel approach can be attributed to the changes in possible pathomechanics and healing physiology of exercise. In epicondylalgia, due to the resulting

angiofibroblastic hyperplasia, this abrasive force aggravate which in turn causes abnormal tension over the site of the tendon which already packed with nociceptors within the scar tissues. As observed by Cyriax (1936) the scar tissue which is in tension is stretched during elbow and wrist movement which causes pain resulting in weakness and difficulty in performing forearm and hand function.⁸

McConnell's taping is a deloading procedure, where soft tissues are drawn in towards the area of pain at lateral epicondyle.⁹ Concentric and eccentric strengthening which has been already demonstrated to be effective in improving pain and function parameters of tendinopathy showed similar effect in the present study. The improvement in pain, strength and function parameters of present studies can be attributed to the following reason. According to Alfredson (2000), concentric and eccentric exercises may be associated with changes in metabolism of undefined substances in tendon causing alteration in tendon pain perception. He observed that during concentric and eccentric exercise cycle there was a temporary halting of blood flow within the tendon neo-vessels. He suggested this blood flow interruption may damage both neo-vessels and accompanying nerves, leading to both normalization of tendon vasculature and reduction in pain levels. This was demonstrated as reduced pain levels in visual analogue scale.¹⁰

It is often suggested that a failure of improvement in grip strength following concentric and eccentric regimes may be that the subjects are exercising through pain and can often result in higher drop rate. There is often contradicting opinion regarding whether to perform the exercise with or without pain (Silvestrini et al 2005). But certain studies have demonstrated high dropout rates if subjects exercise to pain. In the present study due to the application of Mc Connell's diamond taping, local tension over the muscle origin was inhibited and normal gliding of tendon was facilitated. This can be the reason for better tolerance the patient exhibited with regard to concentric and eccentric training.

The primary impairment in lateral epicondylalgia is a deficit in grip strength which is predominantly due to pain and its consequences on motor functions. In the

present study the combined effect of both McConnell's taping and eccentric strength training reduce the subject's perception of pain which in turn manifested as increased grip strength. According to Smidt et al patients with lateral epicondylalgia try to avoid pain and rarely challenge their maximal grip. Functional ability may be therefore determined by their pain free capabilities. Pain and disuse of arm have important role in worsening the agonist and antagonist muscle function resulting in overall reduction in muscle performance of involved arm. The reduction of pain following combined protocol of taping and concentric and eccentric strength training gives the patient confidence to use the upper extremities in daily activities. This was evident in the form of improved scores in combined.¹¹

The present study demonstrated that exercising with reduced pain can provide a better outcome and better patient participation than exercising through pain. So combining a deloading technique like McConnell's diamond taping can provide a valuable adjunct to concentric and eccentric strength training protocol in rehabilitation of individuals with lateral epicondylalgia.

CONCLUSION

The purpose of the study was to find the efficacy of McConnell's taping technique along with concentric and eccentric strength training in lateral epicondylalgia. It was found that the group which received a combined protocol of McConnell's taping technique along with and concentric and eccentric strength training improved to a greater extend when compared to the group which received a protocol of sham taping along with concentric and eccentric strength training.

With McConnell's taping technique there is a reduction in the nociceptive stimulation which helped the subjects to exercise painlessly thereby improving grip strength, pain and hand function. Concentric and eccentric strength training causes increase in tension generating capacity of muscle by neural response (2-3 weeks), which is attributed to motor learning, improved coordination, increased rate and synchronization of firing of motor unit. Thus McConnell's diamond taping technique was found to be a valuable adjunct to concentric and

eccentric strength training which helped in the painless performance of concentric and eccentric exercise and this combined approach can be incorporated in clinical practice following further trials.

Acknowledgement

We extend our cordial thanks to all the physiotherapist, interns and subjects who associated with this study in implementing the exercise programs, assessing the outcome measures.

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