

Effects of Eccentric Tyler Twist Extensor-Strengthening Exercises in Lateral Epicondylitis

Rimsha Jalil¹, Lal Gul Khan², Muhammad Faheem Afzal³

¹Physical Therapist, Cina medical center, Rawalpindi

²Consultant Physical Therapist, OPC Center, Rafay Medical Complex, Rawalpindi

³Associate Professor, PSRD Rehabilitation, College of Rehabilitation Sciences, Lahore, Pakistan

Author's Contribution

²Conception and design,

³Collection and assembly of

data, ^{1,2,3}Analysis and

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article, ⁴Critical revision of the

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Address of Correspondence

Rimsha Jalil

rimshajalil97@gmail.com

ORCID: 0009-0006-4407-9373

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A B S T R A C T

Background: Lateral epicondylitis, commonly known as tennis elbow, is characterized by pain and functional limitations at the elbow due to overuse. This study focuses on evaluating the effects of Tyler twist wrist extensor-strengthening exercises, aiming to provide insights into an effective intervention for this condition.

Objective: This study aimed to determine the effects of Tyler twist wrist extensor strengthening exercises on pain, disability, and grip strength in patients with lateral epicondylitis.

Methodology: A randomized controlled trial was conducted at Cina Medical Center Rawalpindi from February 2022 to January 2023. Fifty-two participants meeting the inclusion criteria were assigned to either Group A or Group B. Group A received eccentric Tyler twist exercises in addition to conventional physiotherapy, while Group B received conventional physiotherapy alone. Pain, functional disability, and grip strength were assessed at baseline, the second week, and the fourth week. Data was analyzed with SPSS version 25. Demographics and descriptive data is presented in form of percentages, frequencies and mean + SD. Normality of the data is determined via Shapiro Wilk Test. We applied mixed-way ANOVA to find the interaction between two groups.

Results: Within-group analysis demonstrated a significant improvement in pain, functional disability, and grip strength for both groups (p -value < 0.01). Between-group analysis revealed a significant difference in pain, functional disability, and grip strength.

Conclusion: The addition of eccentric Tyler twist exercises to conventional therapy showed a statistically significant difference in terms of pain, functional disability, and grip strength in patients with lateral epicondylitis.

Keywords: Extensor Carpi Radialis Brevis, Lateral Epicondylitis.

Introduction

Lateral epicondylitis, commonly known as tennis elbow, is a painful condition that affects the lateral part of the elbow and causes a loss of function.¹ It is an overuse injury characterized by chronic symptomatic degeneration of the Extensor Carpi Radialis Brevis (ECRB) tendon at the attachment area of the humeral epicondyle.² Although the name suggests a connection to tennis, this condition can occur in individuals who engage in repetitive wrist extension, radial deviation, and forearm supination, regardless of their

involvement in tennis or any specific sport. Lateral epicondylitis is not limited to athletes but can also affect people in various professions such as carpenters, drivers, students, and computer workers, who perform repetitive activities involving the wrist extensor tendons.³

Historically, lateral epicondylitis has been referred to as "tendinitis," implying the presence of an acute inflammatory process. However, recent research has shown a lack of acute inflammatory markers in patients with tennis elbow, leading to the use of terms like "tendinosis" or "tendinopathy" to better reflect the chronic nature of the condition.⁴ The histological

findings of lateral epicondylitis reveal granulation tissue, micro-rupture, an abundance of fibroblasts, unstructured collagen, vascular hyperplasia, and a lack of inflammatory cells within the tissue.⁵

Notably, repetitive use of wrist extensors can precipitate the onset of lateral epicondylitis, a prevalent overuse injury characterized by pain and tenderness, primarily localized to the lateral epicondyle. The Extensor Carpi Radialis Brevis (ECRB) tendon emerges as a focal point in this condition, often undergoing degeneration due to the strain imposed by recurrent wrist and elbow activities.⁶

Tennis elbow is associated with various symptoms, including pain, weakness in grip strength, and reduced flexibility. Individuals with tennis elbow often experience pain during activities that involve gripping, lifting, or repetitive wrist movements. These symptoms can significantly impact the daily activities and quality of life of individuals affected by the condition. While tennis players are commonly associated with tennis elbow, it is essential to recognize that this condition can affect anyone who engages in repetitive wrist extensor activities.⁷

The prevalence of lateral epicondylitis varies among different populations. Recent insights, gleaned from a 2019 systematic review, illuminate its prevalence, unveiling a rate of 1-3% in the general population and a heightened 7% prevalence among manual workers, with a gender-neutral distribution.⁸ Although tennis elbow can occur at any age, it is more commonly observed in individuals between 30 and 50 years old.⁹ Previous reports from different countries have indicated a prevalence range of 2-14% in the working population, and only 5% of people with lateral epicondylitis attribute their injury to tennis. This injury is not exclusive to tennis players but affects individuals in various occupations that involve repetitive wrist and elbow activities.¹⁰

The exact pathophysiology of lateral epicondylitis is not fully understood, but it is believed to involve a combination of factors. The condition is thought to result from a degenerative process primarily affecting the ECRB tendon and other extensor tendons. Motor impairment, altered pain perception, and local tendon injury contribute to the development of lateral epicondylitis. Tendons can easily stretch in response to gradually increasing forces, leading to tendinosis characterized by multiple microtears within the tendons.¹¹

The etiology of lateral epicondylitis is attributed to hyaline degeneration of the ECRB tendon due to repetitive microtrauma, rather than inflammation as previously believed. Overuse and repetitive stress lead to the accumulation of microtrauma, causing collagen disorganization and disarray

within the tendon. The excessive loads transmitted to the tendon result in collagen fiber disruption and subsequent pain.¹² Although the exact cause of this condition remains unclear, several risk factors have been identified, including age, sex, occupation, smoking, and genetic predisposition.¹³

The diagnosis of lateral epicondylitis is typically made based on the patient's history and physical examination findings. Medical professionals may perform various tests, such as the Cozen test, Mill's test, or resisted wrist extension test, to elicit pain and evaluate the specific tendon involved. Imaging studies like ultrasound or magnetic resonance imaging (MRI) are not routinely required for diagnosis but can be helpful in cases where the diagnosis is uncertain or to rule out other conditions with similar symptoms.¹⁴

The management of lateral epicondylitis involves a multimodal approach, which includes conservative treatments such as activity modification, physical therapy, nonsteroidal anti-inflammatory drugs (NSAIDs), bracing, and corticosteroid injections. Rest and avoidance of activities that exacerbate symptoms are crucial in the initial phase of treatment. Physical therapy plays a vital role in the rehabilitation process by focusing on pain relief, strengthening exercises, stretching, and improving functional activities. NSAIDs can provide short-term pain relief, while bracing and corticosteroid injections may be considered in cases where conservative treatments fail to provide adequate relief.¹⁵ Noteworthy among these interventions is the distinctive role of the Tyler Twist exercise, a gem in the rehabilitative toolkit. The literature underscores its efficacy in promoting strength, flexibility, and functional restoration, adding a nuanced layer to our comprehension of lateral epicondylitis management.²³

Surgical intervention is usually reserved for patients who have not responded to conservative treatment after a reasonable period. Common surgical procedures for lateral epicondylitis include open release surgery and arthroscopic techniques. Surgical intervention aims to remove the degenerative tissue, release tension on the tendon, and promote tissue healing.¹⁶

In conclusion, lateral epicondylitis, or tennis elbow, is a common overuse injury that affects the extensor tendons of the forearm. Although it is often associated with tennis players, it can occur in individuals from various occupations and age groups who engage in repetitive wrist extensor activities. The condition is characterized by degeneration and microtrauma of the extensor tendons, leading to pain, weakness, and functional limitations.¹⁷ A multimodal approach involving conservative treatments, physical therapy, and, in some cases, surgical intervention can help manage this condition effectively. Early

diagnosis and appropriate interventions are essential for minimizing pain and restoring function in individuals with lateral epicondylitis.¹⁸

Methodology

This study included total 52 participants, which were divided into two groups, 26 each. This research employed a Randomized Controlled Trial (RCT) format, comparing an experimental group (Tyler Twist Wrist Extensor Strengthening + Conventional Therapy) with a control group (Conventional Therapy). The RCT is registered as NCT05696327. Ethical approval for this study was obtained from the Research Ethical Committee/Riphah international university, with Ref# Riphah/RCRS/REC/01222 before commencing in January 2022. Data collection spanned a year, concluding with analysis in January 2023 at the Cina Medical Center Rawalpindi, following necessary approvals.

Participants meeting following criteria were included in the study: Both genders (male and female), Age between 20yrs-40yrs, Tenderness on palpation over the lateral epicondyle of humerus, Pain with gripping, Pain with resisted wrist extension, clinically diagnosed patients of lateral epicondylitis who did not take any kind of physiotherapy treatment and positive cozen test. Participants meeting following criteria were excluded from the study: Cervical spine disorder, Peripheral neuropathy, Previous Fracture/ trauma or surgery to the elbow region, Steroid injections in last 6 months, Tumor or wound and any other systemic/autoimmune disorders or congenital anomalies. Non-probability Purposive sampling technique was used and randomization was done using the sealed envelope method.

Following tools had been used for the 'Pre' & 'Post' assessment of patients during the Study:

For pain-free grip strength assessment, the patient's arm is positioned comfortably with the shoulder adducted and neutrally rotated, the elbow flexed to 90 degrees.²⁰, the forearm in a neutral position, and the wrist in slight extension and ulnar deviation. The patient is instructed to squeeze as tightly as possible for 3-5 seconds, with multiple trials and an average of three repetitions recorded. A brief pause is provided between trials to prevent muscle fatigue. Hand-held dynamometers have been shown to have excellent internal validity and reliability, with reported values of 0.31-0.69 in the upper extremities.²²

Patient Rated Tennis Elbow Evaluation (PRTEE) questionnaire was used in clinical settings to assess pain and disability in patients with lateral epicondylitis. It consists of two parts: Part one focuses on pain, with a score range of 0-50, while Part two assesses functional activities, with a score range

of 0-50. Each part has specific items with corresponding scores. The total score, ranging from 0 to 100, is obtained by dividing the sum by two. The PRTEE has shown good correlation with other assessment tools, and recent studies have reported excellent internal consistency and reliability¹⁷; Activities subscale = 0.93; function usual activities == 0.85.⁹

After taking approval from Riphah ethical committee, individuals meeting the inclusion criteria were divided into two groups: Experimental and Control. The Experimental group underwent a 4-week intervention consisting of Tyler twist exercises in addition to conventional physiotherapy, with a frequency of 3 sessions per week. The Control group received conventional therapy, including deep friction massage, ultrasound, wrist extensor stretching, and isotonic wrist extensor strengthening.²⁴ Outcome measures were assessed using the PRTEE questionnaire and a dynamometer.

Conventional physical therapy was given to both groups. Patients in Group A were given Tyler twist exercises with conventional physical therapy. Tyler Twist exercises, aim to strengthen the wrist extensor muscles and patients typically grasp a FlexBar and twist it, engaging the wrist extensors to promote strength and flexibility in the affected area. Patients participating in the study were carefully guided through a 5-step exercise protocol. The exercise regimen involved performing 3 sets of 15 repetitions. Each repetition consisted of a 15-second contraction, followed by a recommended 20-second rest period. This treatment protocol has been designed to be implemented thrice a week for a duration of 4 weeks, with each session lasting approximately 20 minutes.²⁵ While group B received only conventional physiotherapy. Interventions were given thrice a week for 4 weeks. Data was analyzed with SPSS version 25. Demographics and descriptive data is presented in form of percentages, frequencies and mean + SD. Normality of the data is determined via Shapiro Wilk Test. We applied mixed-way ANOVA to find the interaction between two groups.

Riphah International University Ethical Committee approved the current study. BASR and permission from Cina medical center Rawalpindi was taken for data collection. Participants signed the informed consent and they were made aware about their treatment protocols. Ethical values during study were considered on priority.

Results

Variable normality was assessed using the Shapiro-Wilk test ($\alpha=0.05$). PRTEE Pain, PRTEE Functional Disability (Specific Activities), PRTEE Functional Disability (Usual Activities), PRTEE Functional Disability Total, and Grip Strength showed non-parametric distribution ($p<0.05$), while PRTEE

Total Score exhibited a parametric distribution ($p>0.05$). The study included 52 participants equally divided into Group A and Group B, with gender distribution of approximately 50% male and 50% female. Group A had a mean age of 31.26 ± 4.97 years, consisting of students (15.4%), tennis players (3.8%), housewives (38.5%), and drivers (42.3%). Group B had a mean age of 30.57 ± 5.91 years, with students (26.9%), tennis players (19.2%), housewives (26.9%), and drivers (26.9%). The study maintained a high participant retention rate throughout its duration. The robust engagement and commitment of all participants were crucial in ensuring the completeness of the data. This commitment from the participants contributed to the reliability of the study's results.

The two-way mixed ANOVA revealed significant findings for PRTEE Pain (time: $p<.001$, interaction: $p<.001$, treatment group: $p<0.00$).

Table I: Demographic, occupational details and mean age between groups.

Variable	Student	Tennis player	Housewife	Driver	
N	Group A	4(15.4%)	1(3.8%)	10(38.5%)	11(42.3%)
	Group B	7(26.9%)	5(19.2%)	7(26.9%)	7(26.9%)
Variable	Groups		Frequency (%)		
Gender	Group A		Female = 12 (46.2%)		
			Male = 14 (53.8%)		
	Group B		Female = 13 (50%)		
			Male = 13 (50%)		
Variable	Groups		Mean \pm SD		
Age	Group A		31.26 \pm 4.97		
	Group B		30.57 \pm 5.91		

For Functional Disability Specific Activities, there was a significant main effect of time ($p<.001$), but the interaction between time and group was not significant ($p=0.36$). There was a significant effect of treatment group ($p<0.003$).

Regarding Functional Disability Usual Activities, there was a significant main effect of time ($p<.001$) and a significant interaction between time and group ($p<.001$). There was also

a significant effect of treatment group ($p<0.00$).

For Grip Strength, significant results were observed with a significant main effect of time ($p<.001$), significant interaction between time and group ($p<.001$), and a significant effect of treatment group ($p<0.002$).

Finally, for PRTEE Total, significant results were found including a significant main effect of time ($p<.001$), significant interaction between time and group ($p<.005$), and a significant effect of treatment group ($p=0.00$).

The within-group analysis using repeated measures ANOVA, both Group A and Group B showed significant improvements in PRTEE Total over time ($p \leq 0.001$). Group A had a decrease in mean \pm SD from 40.80 ± 3.17 at baseline to 14.19 ± 2.36 at the end of the 4th week. Group B had a decrease from 41.84 ± 3.84 to 18.26 ± 3.57 during the same period.

Discussion

This study primarily aimed to study and compare the effects of eccentric tyler twist extensor strengthening exercises in lateral epicondylitis. The objective of this study was to determine the effects of Eccentric Tyler Twist Extensor Strengthening exercises on Pain, Functional Limitation and Grip Strength in Patients with lateral epicondylitis. While there is a body of research examining interventions for lateral epicondylitis, this study represents the attempt to directly compare the efficacy of the Tyler Twist exercise with

Table III: Repeated measure ANOVA for within group.

Variable	Group A (Tyler Twist Exercise)			Group B (Conventional Therapy)	
	Mean \pm SD	P value	Mean \pm SD	P value	
PRTEE Total	Baseline	40.80 \pm 3.17	≤ 0.001	41.84 \pm 3.84	≤ 0.001
	At the end of 2 nd week	28.53 \pm 4.45	≤ 0.001	32.53 \pm 4.48	≤ 0.001
	At the end of 4 th week	14.19 \pm 2.36	≤ 0.001	18.26 \pm 3.57	≤ 0.001

Table II: Mixed way ANOVA Time, Treatment group and Interaction effect.

Variables	Time Effect			Treatment Effect			Interaction Effect		
	F-value	η^2	p-value	F-value	η^2	p-value	F-value	η^2	p-value
PRTEE Pain	16375.2 (1,50)	0.97	<.001***	14.13 (1,50)	0.22	<0.001***	7.809 (1,50)	0.13	0.001
Functional.Disability_Specific. Activities	1131.7 (1,50)	0.95	<.001***	9.58 (1,50)	0.16	0.003	0.83 (1,50)	0.07	0.36
Functional.Disability_Usual. Activities	1896.5 (1,50)	0.97	<.001***	24.01 (1,50)	0.32	<0.001***	10.38 (1,50)	0.17	<0.001***
PRTEE_Functional.Disability	2005.4 (1,50)	0.97	<.001***	24.35 (1,50)	0.32	<0.001***	3.18 (1,50)	0.06	0.08
Grip.Strength	232.9 (1,50)	0.82	<.001***	3.39 (1,50)	0.06	0.002	48.67 (1,50)	0.49	0.001**
PRTEE_Total	3318.3 (1,42)	0.98	<.001***	33.37 (1,42)	0.39	<0.001***	8.5 (1,42)	0.14	0.005

conventional therapy within a 4-week timeframe, utilizing outcome measures such as PRTEE and hand-held dynamometry.

The Tyler twist experimental group participants showed superior statistical difference (≤ 0.001) in improving pain, functional ability and grip strength as compared to the control group. These results are in accordance with a study conducted previously which reported that the eccentric strengthening exercises combined with standard physiotherapy treatment had been shown to improve grip strength, decrease pain and disability in patients with lateral epicondylitis.¹⁹

Within group analysis of PRTEE total (Pain and Functional disability) score showed statistically significant results at baseline, 2nd and at 4th week. Both groups had improved score in decreasing pain and functional limitation, however Group A (Tyler twist exercise) was comparatively more effective than Conventional therapy (Group B) stating a more improved pattern of pain intensity and functional limitation (p value ≤ 0.001). Similarly, between group analysis of PRTEE Total (Pain and Functional disability) score showed that both groups reported improvements in pain and functional limitation, however Group A (Tyler twist group) was more effective Group B (conventional group) with a p value ≤ 0.001 . A similar study was conducted by Ardiana et al (2015), concluded that the eccentric exercise group showed statistically significant results in PRTEE total score (pain and functional disability both) because the subjects adherence rate to the treatment programme was satisfactory and a low rate of loss to follow up.²⁰ A case control study conducted previously which included flex bar exercises against resistance exercises also reported marked improvement in pain and disability scores and concluded that eccentric exercises play a major role in lateral epicondylitis patients.²¹

Within group and between group analysis of both Group A (Tyler twist exercise) and Group B (Conventional therapy) for Grip strength shows statistically significant results (≤ 0.001 i.e. < 0.05) because grip strength was improved in both groups. However, Group A (Tyler twist group) reflected a more remarkable pattern of effect regarding grip strength. Timothy conducted a study; which included Tyler twist exercises to treat lateral epicondylitis in combination with standard physiotherapy. As per results, initially patients had marked weakness in grip strength but post treatment outcomes showed that the eccentric group participants had improvement in grip strength and the standard treatment group did not show any apparent improvement. However, the study limitation was a small sample size as they only included 21 participants and it was recommended to commence a study in future with a large

sample size for more accurate results. Also the therapy visits were less for both groups. Moreover, the study also used different tools for measuring pain and disability.²²

The present study has been completed in a 4 week program and patients were also instructed properly so that they can perform the Tyler exercises at home without any supervision. In addition, the present study used a single tool to measure pain and disability both at the same time, which is the strength of this research.

Limitation of study To validly support the effectiveness of intervention, it was a plan of adding Jamar dynamometer to assess the grip strength but due to lack of funding and its unavailability in Pakistan, we could not achieve desired outcomes.

Recommendations Lateral epicondylitis has high recurrence rate and it remains to be determined if the Tyler twist exercises provide similar efficacy in the long term or not. A future research needs to be conducted to provide evidence on follow up. Clinicians should use Tyler twist exercises as an evidence based treatment and should be aware of this exercise.

Conclusion

Tyler Twist exercises with standard physiotherapy demonstrated significant improvements in pain, functional limitation, and grip strength among patients with lateral epicondylitis. The use of flexible bands for Tyler Twist exercises offers a practical and cost-effective treatment option, providing excellent results. These exercises can be easily incorporated into a home-based plan, eliminating the need for continuous supervision.

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