International Journal of Yoga, Physiotherapy and Physical Education
ISSN: 2456-5067; Impact Factor: RJIF 5.24
Received: 22-01-2019; Accepted: 25-02-2019
www.sportsjournal.in
Volume 4; Issue 2; March 2019; Page No. 24-28

Effectiveness of eccentric wrist extensor training versus triceps strengthening in patients with chronic lateral epicondylitis: A comparative study

Dr. Afrin Sirajuddin Shaikh Mulani[1], Dr. Asmita C Moharkar[2], Dr. Sucheta Golhar[3]
[1] Maharashtra University of Health Sciences, P.E.S. Modern College of Physiotherapy, Pune, Maharashtra, India
[2] Assistant professor, P.E.S. Modern College of Physiotherapy, Pune, Maharashtra, India
[3] Principal, P.E.S. Modern College of Physiotherapy, Pune, Maharashtra, India

Abstract
The purpose of the study was to compare the effect of eccentric wrist extensor exercise and triceps strengthening on pain and functional disability in patients with chronic lateral epicondylitis by the end of 6 weeks. 30 participants (including both male and female subjects) ranging from 30-50 years of age, they were selected on the basis of inclusion and exclusion criteria and were divided into 2 groups by simple random sampling method. The subjects were evaluated before and after 6 week Statistical analysis of the data was done using paired t test within group and unpaired t test between groups, there was statistical difference within pre and post analysis of eccentric wrist extensor exercise on pain and functional disability (p value <0.0001) and pre and post analysis of triceps strengthening exercises on pain (p value <0.003) functional disability (p value <0.005), when comparison was done between the groups eccentric wrist extensor exercise was statistically more effective in reducing pain and functional disability on NPRS and PRTEE as compared to triceps strengthening.

Keywords: chronic lateral epicondylitis, eccentric wrist extensor exercise, triceps strengthening, paired-T test, unpaired-T test

1. Introduction

Lateral Epicondylitis (Le) Or "Tennis Elbow" was first described by Runge in 1873 [1]. Tennis elbow, or lateral epicondylitis, is a common condition that is characterized by pain at the lateral epicondyle, aggravated by resisted muscle contraction of the extensor carpi radialis brevis [2, 3]. It is an injury at the insertion of the extensor carpi radialis brevis and the extensor digitorum. It is characterized by pain at the external aspect of the elbow exacerbated during extension of the elbow with the wrist in flexion or during resisted extension of the wrist with the elbow in extension [1]. Resisted wrist extension and radial deviation preferably with the elbow fully extended will usually cause pain located in the proximal extensor muscle mass. Also, if the fingers are held in flexion and wrist extension resisted, pain may still occur at the elbow [4]. A further clinical test involves stretching the extensor muscles by a full passive wrist flexion with elbow extension and forced pronation [5].

Lateral epicondylitis, commonly referred to as tennis elbow, affects 1% to 3% of the population. It is thought to be an overuse injury, originating in the wrist extensor muscles, rather than an inflammatory problem [6]. The condition is most commonly associated with work-related activities such as cutting meat, plumbing, and working on cars, rather than with playing tennis. Lateral epicondylitis is pain over the bone on the outside of the elbow. The piece of bone that can be felt on the outside of the elbow is called the lateral epicondyle. When the tendons attached to this bone are overused, they can deteriorate and become painful [7].

Lateral epicondylitis is commonly called tennis elbow, but it is not restricted to people who play tennis [8]. It occurs in people who do manual labor with their hands, such as roofers and carpenters. It should be noted that the term "tennis elbow" is inappropriate because tennis players represent only 5 to 10% of cases [9]. The term tendinitis is also inappropriate to describe the chronic presentation of this disease because no histological inflammatory reaction has been found in patients treated surgically for chronic LE. The term tendinosis should be utilized preferentially since it refers to degenerative tendinopathy (angiofibroblastic hyperplasia) as seen in this condition [10].

Researchers are finding that tennis elbow often occurs when a specific muscle in the forearm – the extensor carpi radialis brevis (ECRB) muscle – is damaged. The ECRB helps stabilize the wrist when the elbow is straight [11]. Repetitive stress weakens the ECRB muscle, causing microscopic tears in the muscle's tendon at the point where it attaches to the outside of the elbow. These tears produce inflammation and pain [12].

A patient affected by tennis elbow will complain of pain around the lateral elbow, radiating toward the extensor region [13, 14]. Pain of sudden or gradual onset, is localized to the outer aspect of the elbow. It is aggravated by gripping and heavy use of the arm. At times simple tasts such as carring a shopping bag result in pain. Tenderness is typically localized to the tendinous origin of the extensor carpi radialis brevis at the lateral humeral epicondyle [15]. The pain ranges from an occasional throbbing to severe agony although passive movements are generally pained free [16].

The treatment of tennis elbow aims at reducing pain, increasing strength and improving the quality of life of the patient, while minimising the possible side effects of treatment [17]. A variety of specific treatment strategies have been described over the years, including bracing [18], corticosteroid injections [19], topical nitric oxide patch [20], repetitive low-energy shockwave treatment [21], surgery [22], and isolated eccentric training [23]. Additionally, standard

physical therapy includes wrist extensor stretching, isotonic wrist extensor strengthening, ultrasound, cross-friction massage, heat and ice [24].

Isolated eccentric strength training has been shown to be effective for treating Achilles [25, 26], patella [27] and shoulder tendonopathies [28]. A common factor in the eccentric exercise programs utilized in these studies was that the exercises could be performed at home without the need for expensive equipment or regular physical therapy visits. Recently, isolated eccentric training was also shown to be effective in treating chronic lateral epicondylitis [23]. The eccentric exercise program used in this study proved to be an effective method of treating chronic lateral epicondylitis [29].

Based on evidence of weakness in elbow extensors, we recommend strengthening of triceps play important role in rehabilitation of LE, in conjuction with conventional therapy. The result of the study confirm that triceps strengthening increases the strength of weak elbow extensors (triceps) which found to be significantly weak in individuals with lateral epicondylitis. The triceps strengthening exercise regime not only helped the condition in terms of pain relief, but also strengthening the weakned muscles of elbow. This approach not only reduced pain but also improved upper limb function and ability to work with affected arm in the subjects. Strengthening of triceps decreases the pain by increasing lean muscle mass and increased use of the affected arm. In view, of result obtained triceps strengthening along with conventional therapy should be the approach for individuals with lateral epicondylitis for 100% rehabilitation [30].

2. Methodology

a) Purpose

The purpose of the study was to compare the effect of eccentric wrist extensor exercise and triceps strengthening on pain and functional disability in patients with chronic lateral epicondylitis.

b) Selection of the subjects

30 subjects (including both males and females) ranging from 30 to 50 years having chronic lateral epicondylitis with a positive mills test were included, the subjects were selected by simple random sampling method from in and around Pune city.

c) Procedure

Subjects were divided into two groups, Group A received eccentric wrist extensor exercise and Group B received triceps strengthening exercise. The duration varied from 20 to 30 minutes for both the training techniques.

Exercise protocol for both the groups are as following

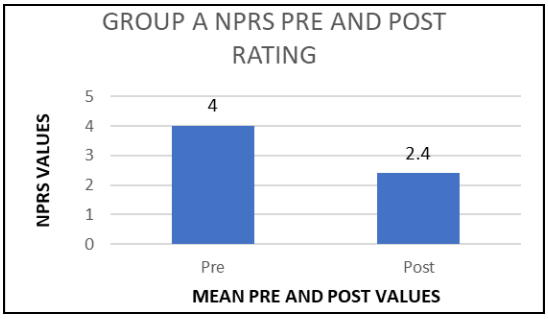
Table 1

Group A	Group B
1. Ultrasound (Pulsed mode /1:1 /3MHz /0.8wats cm^2 for 2 minutes).	1. Ultrasound (Pulsed mode /1:1 /3MHz /0.8wats cm^2 for 2 minutes).
2. Static Stretching for wrist extensors. (hold 30-45sec/rest 30 sec/ 3 sets before and after exercise).	2. Static Stretching for wrist extensors. (hold 30-4 5sec/rest 30 sec/ 3 sets before and after exercise).
3. Eccentric wrist extension with flexbar. (3 sets of 15 repetitions each/30 sec rest period between each set/3 days per week for 4 weeks).	3. Triceps strengthening exercises. Triceps curls.(6 sets of 6 repetitions each/ 2 minutes rest period between each set/2 days per week for 6 weeks).

d) Findings

1. Inter-group numerical pain rating scale comparison

For group A: Eccentric wrist extensor exercise



Graph 1

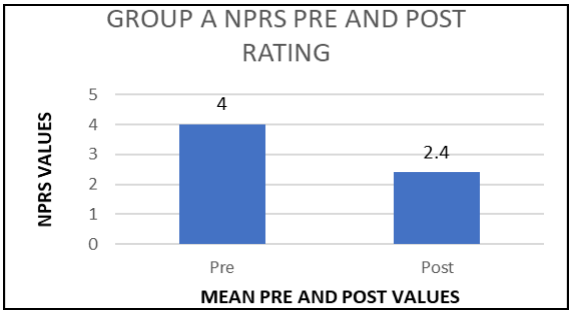
Table 1

	Pre	Post
Mean	4	2.4
STD	1.397	1.296
P VALUE	<0.0001	
T VALUE	5.602	

Extremely significant p-value <0.0001

This shows treatment given in GROUP A is effective in reducing pain in patients with chronic lateral epicondylitis.

For Group B: Triceps Strengthening



Graph 2

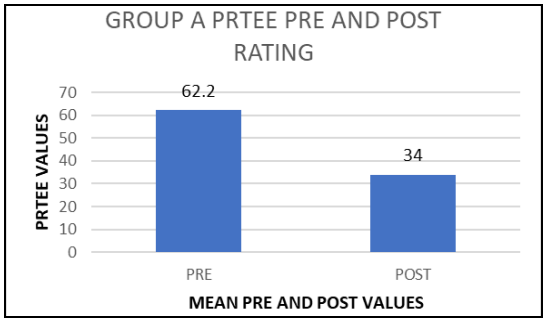
Table 2

	Pre	Post
mean	4.13	2.93
STD	0.7432	1.223
P value	0.003	
T Value	3.674	

Significant p value – 0.003

This shows treatment given in group B is effective in reducing pain in patients with chronic lateral epicondylitis.

2. Inter-Group Patient Rated Tennis Elbow Evaluation Questionnaire Comparison
   For Group A: Eccentric wrist extensor exercise.



Graph 3

Table 3

	PRE	POST
MEAN	62.2	34
STD	10.3	12.28
P Value	<0.0001	
T Value	11.195	

Extremely significant p-value <0.0001

This shows treatment given in GROUP A is effective in reducing functional disability in patients with chronic lateral epicondylitis.
For group B: Triceps strengthening

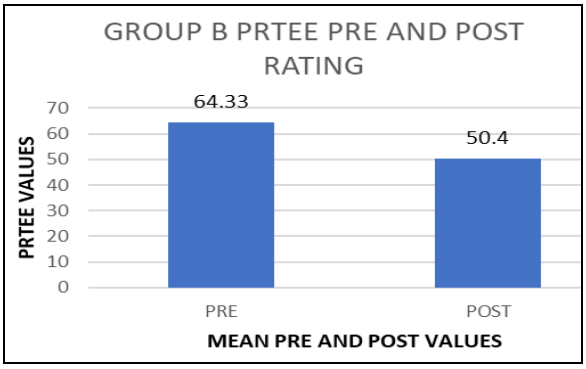


Fig 4

Table 4

	Pre	Post
Mean	64.3	50.4
STD	9.58	15.12
P Value	0.005	
T Value	3.015	

Significant p-value 0.005

This shows treatment given in GROUP B is effective in reducing functional disability in patients with chronic lateral epicondylitis.

3. Inter-group numerical pain rating scale comparison.

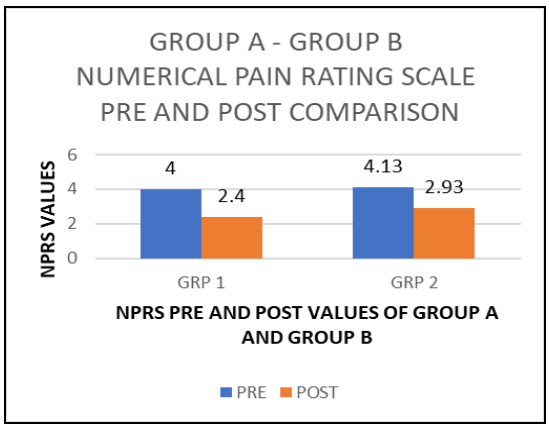


Fig 5

Table 5

	PRE	POST
Mean	1.6	1.2
STD	0.985	1.265
P Value	0.342	
T Value	0.966	

P-Value 0.342 is statistically not significant
BUT, when the mean value of both the groups are compared and graphs are made it shows that GROUP A is more effective in reducing NPRS score post treatment

4. Inter-group patient rated tennis elbow evaluation comparison

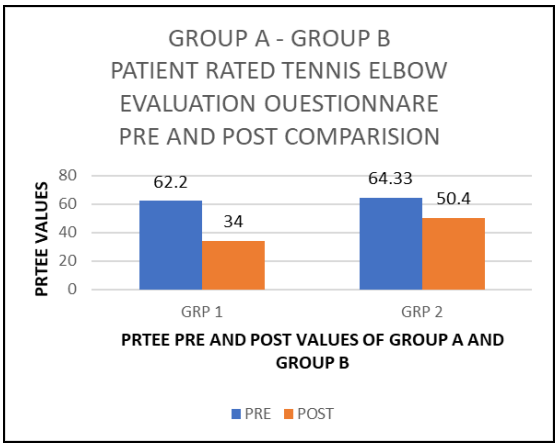


Fig 6

Table 6

	PRE	Post
MEAN	28.3	13.93
STD	9.756	8.852
P Value	<0.0001	
T Value	4.195	

Extremely significant p-value <0.0001

This shows treatment given in GROUP A is more effective in reducing PRTEE score post treatment.

3. Result

After the analysis of data we see that GROUP A (Eccentric wrist extensor exercise) shows statistically significant reduction in pain and functional disability on NPRS and Prtee as compared to Group B (Triceps strengthening).

4. Discussion

The present study was done to see the Effectiveness of Eccentric wrist extensor exercise versus Triceps strengthening in patients with Chronic lateral epicondylitis. In this study total 30 patients of age between 30-50 years were included and divided into two groups with 15 patients in each group. Patients were divided using simple random sampling method. Post treatment pain and functional disability were assessed using Numerical pain rating scale (NPRS) and Patient rated tennis elbow evaluation questionnaire (PRTEE).

When pre and post analysis was done within Group A, we found that Eccentric wrist extensor exercise were effective in reducing pain and functional disability in patients with Chronic lateral epicondylitis. It showed significant statistical improvement in patients since Eccentric training results in tendon strengthening by stimulating mechano-receptors in tenocytes to produce collagen which improves collagen alignment of the tendon and stimulate collagen cross-linkage formation, which improves the tensile strength of the tendon, thus reduces pain and functional disability.

Within Group B, when pre and post analysis was done, we found that triceps strengthening exercise were effective in reducing pain and functional disability in patients with Chronic lateral epicondylitis. It showed significant statistical improvement in patients since triceps strengthening exercise results in increase in the strength of the elbow extensors by increasing the lean muscle mass and improving function of the elbow extensors, which act as fixators of the elbow joint thus improves stability of the joint, which increases the use of the affected arm. This approach not only reduced pain but also improved upper limb function and the ability to work with the affected arm in patients with Chronic lateral epicondylitis. (Meenakshi Vairagade *et al*, 2016) [30]

When both the Groups are compared, we found that Eccentric wrist extensor exercise have been proven to be more effective as compared to the triceps strengthening exercise. It is claimed that Eccentric training results in tendon strengthening by stimulating mechano-receptors in tenocytes to produce collagen, which is probably the key cellular mechanism that determines recovery from tendon injuries. In addition, Eccentric training may induce a response that normalises the high concentratios of glycosaminoglycans, and also improve collagen alignment of the tendon and stimulate collagen cross-linkage formation, both of which improve tensile strength. Ohberg *et al*, believe that, during Eccentric training, the blood flow is stopped in the area of damage and this leads to neovascularisation, the formation of new blood vessels, which improves blood flow and helps in healing in the long term. Hence, this exercise program appears to reduce pain and improve function, reversing the pathology of lateral epicondylitis.(D Stasinopoulos *et al*, 2005) This mechanism of tendon strengthening occurring in Eccentric training is absent in Triceps strengthening exercise where only strengthening of the triceps muscle is focused on, to improve the stability of the elbow joint.

Thus, the overall finding of this study suggest that 4 weeks of Eccentric wrist extensor exercise is more effective in reducing pain and functional disability in patients with Chronic lateral epicondylitis than treatment involving triceps strengthening exercise.

5. Conclusion

Eccentric wrist extensor exercise is more effective in reducing pain and functional disability in patients with Chronic lateral epicondylitis than triceps strengthening exercise.

6. References

1. Can Chiropr J. Assoc. 2011; 55(2):96-106.
2. Allman FL. Tennis Elbow. Etiology, Prevention and Treatment. Clin Orthop. 1975; 3:308-16.
3. Gruchow HW, Pelletier D. An Epidemiologic Study of Tennis Elbow. Incidence, Recurrence, and Effectiveness of Prevention Strategies. Am.J.Sports Med. 1979; 7(4):234-8.
4. Cyriax JH: The pathology and treatment of tennis elbow. J Bone Joint Surg. 18:921-940.
5. Friedlander HL, Reid RL, Cape RF. Tennis elbow. Clin Orthop. 1936; 51:1-16.
6. Newcomer KL, Martinez-Silvestrini JA, Schaefer MP, Gay RE, Arendt KW. Sensitivity of the Patient-rated Forearm Evaluation Questionnaire in lateral epicondylitis. J Hand Ther. 2005; 18(4):400-406. [PubMed]
7. Overend TJ, Wuori-Fearn JL, Kramer JF, Mac Dermid JC. Reliability of a patient-rated forearm evaluation questionnaire for patients with lateral epicondylitis. J Hand Ther. 1999; 12(1):31-37
8. Rompe JD, Overend TJ, Mac Dermid JC. Validation of the Patient-rated Tennis Elbow Evaluation Questionnaire. J Hand Ther. 2007; 20(1):3-10. quiz 11. [PubMed]
9. Cyriax H, Russell G: Textbook of Orthopaedic Medicine, Treatment by Manipulation, Massage and Injection. Ed 9, Vol 2. London: Bailliere Tindall, 1977,.
10. Boisaubert B, Brousse C, Zaoui A, Montigny JP. [Nonsurgical treatment of tennis elbow] Ann Readapt Med Phys. 2004; 47(6):346-355. [PubMed]
11. Bunata RE, Brown DS, Capelo R. Anatomic factors related to the cause of tennis elbow. J Bone Joint Surg Am. 2007; 89:1955-63.
12. Gruchow HW, Pelletier D. An epidemiologic study of tennis elbow. Incidence, recurrence, and effectiveness of prevention strategies. Am J Sports Med. 1979; 7:234-8.
13. Pomerance J. Radiographic analysis of lateral epicondylitis. J Shoulder Elbow Surg. 2002; 11:156-7.
14. Aoki M, Wada T, Isogai S, *et al*. Magnetic resonance imaging findings of refractory tennis elbows and their relationship to surgical treatment. J Shoulder Elbow Surg. 2005; 14:172-7.
15. Regan W, Wold LE, Coonrad R, Morrey BF. Microscopic histopathology of chronic refractory lateral epicondylitis Am J Sports Med. 1992; 20:746-9.
16. Verhaar JA. Tennis elbow. Anatomical, epidemiological and therapeutic aspects. Int Orthop 1994; 18:263-7.

17. Hennig EM, Rosenbauw D, Milani TL. Transfer of tennis racket vibrations onto the human forearm. Med Sci Sports Exerc. 1992; 24:1134-40.
18. Struijs PA, Kerkhoffs GM, Assendelft WJ, Van Dijk CN. Conservative Treatment of Lateral Epicondylitis: Brace Versus Physical Therapy or a Combination of Both-a Randomized Clinical Trial. Am.J.Sports Med. 2004; 32(2):462-9.
19. Bisset L, Beller E, Jull G, Brooks P, Darnell R, Vicenzino B. Mobilisation With Movement and Exercise, Corticosteroid Injection, or Wait and See for Tennis Elbow: Randomised Trial. BMJ. 2006; 333(7575):939.
20. Paoloni JA, Appleyard RC, Nelson J, Murrell GA. Topical Nitric Oxide Application in the Treatment of Chronic Extensor Tendinosis at the Elbow: a Randomized, Double-Blinded, Placebo-Controlled Clinical Trial. Am.J.Sports Med. 2003; 31(6):915-20.
21. Rompe JD, Decking J, Schoellner C, Theis C. Repetitive Low-Energy Shock Wave Treatment for Chronic Lateral Epicondylitis in Tennis Players. Am.J.Sports Med. 2004; 32(3):734-43.
22. Nirschl RP. Lateral Extensor Release for Tennis Elbow. J.Bone Joint Surg.Am. 1994; 76(6):951.
23. Croisier JL, Foidart-Dessalle M, Tinant F, Crielaard JM, Forthomme B. An Isokinetic Eccentric Programme for the Management of Chronic Lateral Epicondylar Tendinopathy. Br. J. Sports Med. 2007; 41(4):269-75.
24. Waugh EJ, Jaglal SB, Davis AM, Tomlinson G, Verrier MC. Factors Associated With Prognosis of Lateral Epicondylitis After 8 Weeks of Physical Therapy. Arch. Phys. Med.Rehabil. 2004;85(2):308-18.
25. Alfredson H, Pietila T, Jonsson P, Lorentzon R. Heavy-Load Eccentric Calf Muscle Training for the Treatment of Chronic Achilles Tendinosis. Am.J Sports Med. 1998; 26(3):360-6.
26. Jonsson P, Alfredson H, Sunding K, Fahlstrom M, Cook J. New Regimen for Eccentric Calf-Muscle Training in Patients With Chronic Insertional Achilles Tendinopathy: Results of a Pilot Study. Br J Sports Med. 2008; 42(9):746-9.
27. Purdam CR, Jonsson P, Alfredson H, Lorentzon R, Cook JL, Khan KMA. Pilot Study of the Eccentric Decline Squat in the Management of Painful Chronic Patellar Tendinopathy. Br J Sports Med. 2004; 38(4):395-7.
28. Jonsson P, Wahlstrom P, Ohberg L, Alfredson H. Eccentric Training in Chronic Painful Impingement Syndrome of the Shoulder: Results of a Pilot Study. Knee. Surg. Sports Traumatol. Arthrosc. 2006; 14(1):76-81.
29. Timothy F. Tyler MSPT, Gregory C, Thomas DPT. Addition of isolated wrist extensor eccentric exercise to standard treatment for chronic lateral epicondylosis: A prospective randomized trial. J Shoulder Elbow Surg. 2010; 19:917-922.
30. Meenakshi Vairagade, Pradeep N Borkar, Tanuja Chhotwani. To study the effect of triceps strengthening in lateral epicondylitis. International Journal of Recent Trends in Science And Technology, ISSN 2277-2812 E-ISSN 2249-8109. 2016; 20(1):77-82.
31. Fozia Bashir, Shibili Nuhmani. Therapeutic management of tennis elbow. Saudi Journal of Sports Medicine. 2015; 15:1.
32. Akram Amro MPH, Ina Diener, Wafa' Omar Bdair Isra' M. Hameda, BPT. The effects of Mulligan mobilisation with movement and taping techniques on pain, grip strength, and function in patients with lateral epicondylitis. Hong Kong Physiotherapy Journal. 2010; 28:19-23.
33. Dharti Vekariya, Bhavesh Jagad. Eccentric exercise in tennis elbow – an Evidence based practice. indian journal SOF Physical Therapy. 2017; 5:1.
34. Angeliki-Nikoletta Stasinaki, Nikolaos Zaras, Spyridon Methenitis, Stavroula Tsitkanou. Triceps Brachii Muscle Strength and Architectural Adaptations with Resistance Training Exercises at Short or Long Fascicle Length. J. Funct. Morphol. Kinesiol. 2018; 3:28 doi: 10.3390/jfmk3020028.