

ORIGINAL RESEARCH

CLINICAL OUTCOMES OF THE ADDITION OF ECCENTRICS FOR REHABILITATION OF PREVIOUSLY FAILED TREATMENTS OF GOLFERS ELBOW

Timothy F. Tyler, MS, PT, ATC^{1,2}Stephen J. Nicholas, MD²Brandon M. Schmitt, DPT, ATC²Michael Mullaney, DPT¹Daniel E. Hogan, MS¹

ABSTRACT

Introduction and Purpose: Eccentric training of the wrist extensors has been shown to be effective in treating chronic lateral epicondylitis. However, its efficacy in the treatment of medial epicondylitis has yet to be demonstrated. The objective of this study was to assess the effectiveness of a novel eccentric wrist flexor exercise added to standard treatment for chronic medial epicondylitis in patients who did not respond to previous therapeutic interventions for this disorder.

Number of Subjects: 20

Materials/Methods: Patients (13 men, 7 women; age 49 ± 12 yr) with chronic medial epicondylitis who had failed previous treatment for this disorder (physical therapy 7, cortisone injection 7, PRP 1, NSAIDS 15) were prescribed isolated eccentrics in addition to wrist stretching, ultrasound, cross-friction massage, heat and ice. The specific isolated eccentric wrist flexor strengthening exercise performed by the patients involved twisting a rubber bar (Flexbar, Hygenic Corporation, Akron OH) with concentric wrist flexion of the noninvolved arm and releasing the twist by eccentrically contracting the wrist flexors of the involved arm (3×15 twice daily). A DASH questionnaire was recorded at baseline and again after the treatment period. Treating clinicians were blinded to baseline DASH scores. Treatment effect was assessed using paired t-test. Based on previous work it was estimated that with a sample of 20 patients there would be 80% power to detect a 13 point improvement in DASH scores ($p < .05$).

Results: The pathology was in the dominant arm of 18 patients and recurrent in 10. Primary symptomatic activities were golf (14), tennis (2), basketball (1), weight lifting (1), and general activities of daily living (2). There was a significant improvement in outcomes following the addition of isolated eccentrics (Pre DASH 34.7 ± 16.2 vs. Post DASH 7.9 ± 11.1 , $p < .001$). For the 18 patients involved in sports, the sports module of the DASH score improved from 73.9 ± 28.9 to 13.2 ± 25.0 , $p < .001$. Physical therapy visits ranged from 1-22 with an average of 12 ± 6 and, average treatment duration of 6.1 ± 2.5 wks (range 1-10). Home exercise program compliance was recorded for each subject (15 full, 3 mostly, 1 occasionally, 1 none).

Conclusions: The outcome measure for chronic medial epicondylitis was markedly improved with the addition of an eccentric wrist flexor exercise to standard physical therapy. Given the inconsistent outcomes for patients previously treated with chronic medial epicondylitis the addition of isolated eccentrics seems warranted based on the results of this study.

Clinical Relevance: This novel exercise, using an inexpensive rubber bar, provides a practical means of adding isolated eccentric training to the treatment of chronic medial epicondylitis.

Level of Evidence: 2b

Keywords: Eccentric exercise, failed treatment, medial epicondylitis

CORRESPONDING AUTHOR

Timothy F. Tyler, MS, PT, ATC

The Nicholas Institute of Sports Medicine

Athletic Trauma @ Lenox Hill Hospital

Phone: (914) 723-6987

Fax: (914) 723-7546

E-mail: shoulderpt@yahoo.com

¹ The Nicholas Institute of Sports Medicine and Athletic Trauma
New York, NY USA

² Pro Sports Physical Therapy of Westchester Scarsdale, NY USA

The North Shore/Long Island Jewish Health System
Institutional Review Board approved of this study protocol.

INTRODUCTION

Golfers elbow, or medial epicondylitis, is a common condition that is characterized by pain at the medial epicondyle, aggravated by resisted muscle contraction of the wrist flexors and supinator. The estimated annual incidence in the military population for medial epicondylitis is 1% versus 3% for the same condition occurring on the lateral side.^{1,2} A variety of specific treatment strategies have been described over the years, including electrophysical modalities,³ corticosteroid injections,⁴ exercise therapy and mobilization,⁵ low level laser therapy⁶ repetitive low-energy shock-wave treatment,⁷ autologous blood injection,⁸ and isolated eccentric training.⁹ Typically, physical therapy interventions include wrist flexor stretching, isotonic wrist flexor strengthening, ultrasound, cross-friction massage, heat and ice. Isolated eccentric strength training has been shown to be effective for treating achilles,^{10,11} patella,¹² shoulder tendonopathies¹³ and lateral epicondylitis.^{14,15} 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 using an inexpensive rubber bar called a flexbar to perform an exercise named the Tyler Twist in a recent current concepts article.^{15,16} The purpose of this study was to assess the efficacy of a novel eccentric wrist flexor strengthening exercise called the Reverse Tyler Twist¹⁵ added to standard physical therapy interventions for chronic medial epicondylitis cases that were unresponsive to previous therapeutic interventions.

Materials and Methods

Twenty patients with chronic medial epicondylitis participated in the study (n = 20, 13 men, 7 women; age 49 ± 12 yr). Eighteen of these patients participated in competitive athletics. Patients were included and classified as having chronic medial epicondylitis if they were diagnosed with medial epicondylitis symptoms for greater than 6 weeks. Medial epicondylitis was diagnosed using the following tests: (1) pain on palpation at the medial epicondyle, (2) pain on resisted wrist flexion, and (3) pain on medial side of forearm. Subjects needed to test positive on all 3 tests to be included in the study.

Patients with a history of fracture, dislocation, surgery, medial epicondylar avulsion, osteochondritis dissecans or osteochondrosis of capitellum or radial head, olecranon apophysitis, cubital tunnel syndrome, flexor pronator strain, ulnar collateral ligament strain, and ulnar neuritis were excluded.¹ All patients had failed various previous treatments for this pathology. Seven patients had prior physical therapy, seven patients had a corticosteroid injection one patient had a platelet-rich plasma injection, and 15 patients had taken non-steroidal anti-inflammatory medications. Two patients developed medial epicondylitis from playing tennis, 14 from golf, one during weight training, 1 from basketball, and two were attributable to activities of daily living. All subjects gave written informed consent and the protocol was approved by an North Shore/Long Island Jewish Health System Institutional Review Board.

Physical Therapy Treatment

All patients received self wrist flexor stretching five times for 30 seconds, ultrasound 3.3 Mhz, 1.2 W/cm² 50% duty cycle for five minutes, cross friction massage over most painful area for five minutes, 15 minutes of heat prior to the treatment and 15 minutes of ice following their physical therapy visits.¹⁵ Additionally, all patients performed the isolated eccentric contractions of the wrist flexors, as described below.

The isolated eccentric strengthening exercise was performed using a rubber bar (Thera-Band® FlexBar, The Hygenic Corporation, Akron OH) that was twisted using wrist flexion of the uninvolved limb and slowly allowed to untwist with eccentric wrist flexion by the involved limb (Figs. 1A-E (Supplemental File 1)). Each eccentric wrist flexor contraction lasted approximately 5 seconds (i.e. slow release). Both upper extremities were reset for the subsequent repetitions. A 60 second rest period was timed between each set of 15 repetitions. Three sets of 15 repetitions were performed daily. Intensity was increased by giving the patient a thicker (greater resistance) rubber bar if the patient reported that they no longer experienced discomfort during the exercise. The eccentric strengthening and stretching exercises were also prescribed as a home exercise program. The home exercise program consisted of three sets of isolated eccentric exercises. Self-stretching consisted of three 30-second wrist flexor stretches.

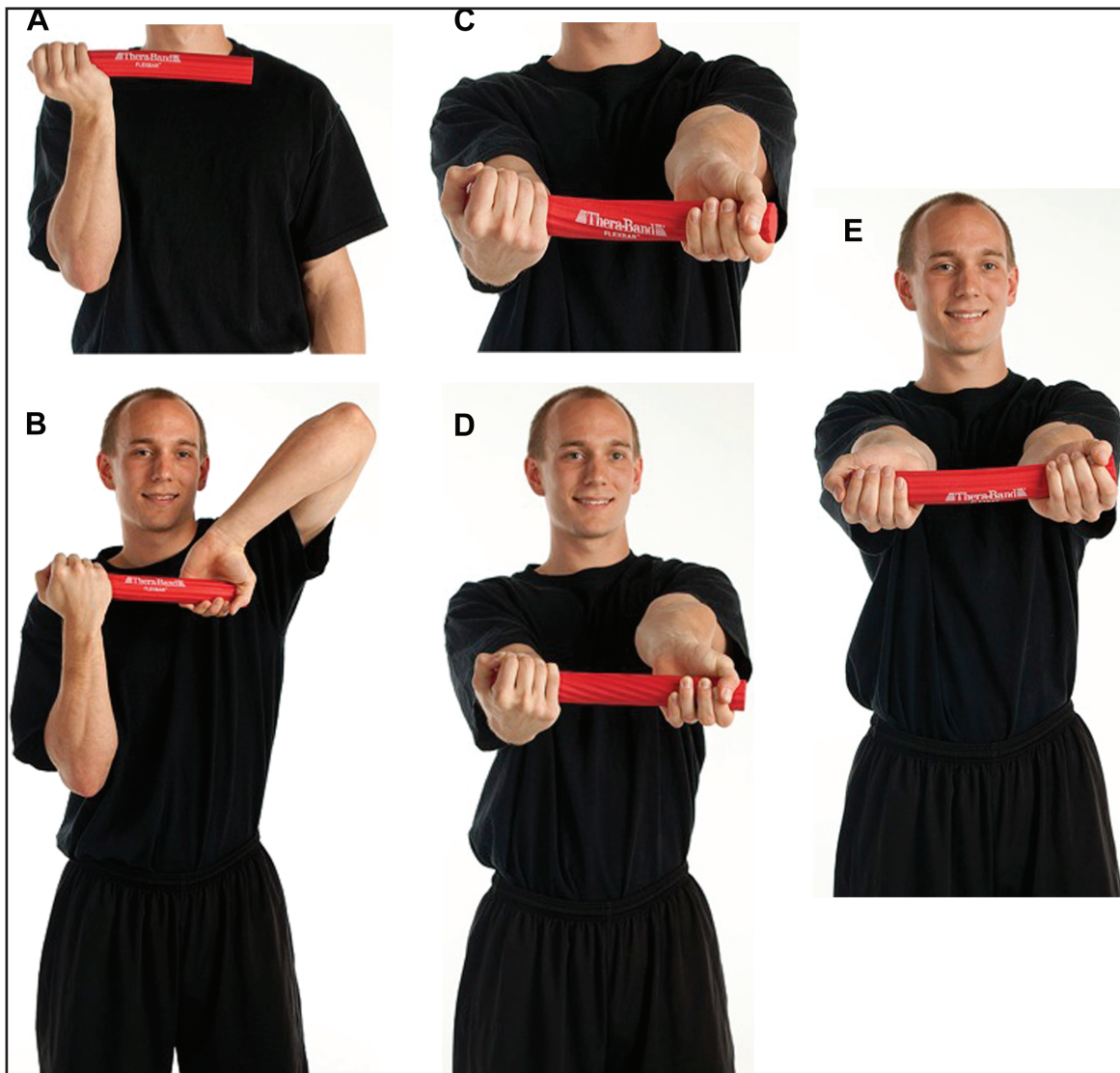


Figure 1. A: Rubber bar held in involved (right) hand in maximum wrist flexion.
 B: Other end of rubber bar grasped by noninvolved (left) hand.
 C: Rubber bar twisted by flexing the noninvolved wrist while holding the involved wrist in flexion.
 D: Arms brought in front of body with elbows in extension while maintaining twist in rubber bar by holding with noninvolved wrist in full flexion and the involved wrist in full flexion.
 E: Rubber bar slowly untwisted by allowing involved wrist to move into extension, slowly, approximately a five second release, i.e. eccentric contraction of the involved wrist extensors.
 Note: Supplemental File 1 on the IJSPT website is a Video that demonstrates this exercise.

Isolated eccentric exercises were performed until discomfort was achieved twice a day every day in which the subject did not receive physical therapy and compliance was recorded. Treatments were continued until patients had resolution of symptoms or were referred back to their physician with continued symptoms.

Outcome Measures

The Disability of Arm, Shoulder, and Hand Questionnaire (DASH) was used to determine the degree

of patient reported disability caused by the medial epicondylitis. In addition, athletes were asked to fill out the Sports module of the DASH. The DASH questionnaire and Sports module of the DASH were completed prior to and after the treatment period.

Pre- and post-treatment outcome measures included the DASH and a compliance log which were recorded by the same physical therapist, who was blinded to the patient's pre treatment scores. The compliance log was self-reported by the patient indicating the

days per week they completed their home exercise program and categorized as either full (everyday), mostly (5-7 days), occasionally (1-4 days), or not compliant (0 days).

Statistics

Paired t-tests were used to examine the effect of eccentric training on all dependent variables. Results are reported as mean \pm SD. Based on previous work^{8,15} it was estimated that 20 patients would be sufficient to detect a 40% improvement in DASH score at $P < 0.05$ with 80% power.

RESULTS

Overall, DASH scores improved from 34.7 ± 16.2 to 7.9 ± 11.1 , $p < .001$. For the 18 athletes Sport DASH scores improved from 73.9 ± 28.9 to 13.2 ± 25.0 , $p < .001$. Home exercise program compliance was recorded for each subject 15 full, 3 mostly, 1 occasionally, 1 none. Follow-up DASH scores were 22 and 39 for the two non-compliant patients. The number of physical therapy visits averaged 12 ± 6 or duration of treatment 6.1 ± 2.5 wks.

DISCUSSION

The eccentric exercise program introduced in this study appears to be an effective method of treating chronic medial epicondylitis. DASH scores and Sports module of the DASH were markedly improved with the addition of an eccentric wrist flexor exercise to standard physical therapy interventions. This novel exercise, using an inexpensive rubber bar, provides a practical means of adding isolated eccentric training to the treatment of chronic medial epicondylitis. A prescription of 3 sets of 15 repetitions daily for approximately 6 weeks appeared to be an effective treatment in the majority of patients who had already failed a previous intervention for this disorder.

There are many different approaches to the treatment of chronic medial epicondylitis, such as electrophysical modalities,³ corticosteroid injections,⁴ exercise therapy and mobilization,⁵ low level laser therapy,⁶ repetitive low-energy shockwave treatment,⁷ autologous blood injection.⁸ These are commonly provided independently from or as part of standard physical therapy care. Compared to isolated eccentric strength training, treatments such as low-

level laser therapy, shockwave therapy, corticosteroid injections or autologous blood injection, require direct medical supervision and in some cases have significant side effects. While the efficacy of isolated eccentric training for the treatment of tendinopathies in various joints has been clearly established¹⁰⁻¹⁵ the additional benefit of this treatment for medial epicondylitis is that it can be performed as part of a home program and it does not involve continued medical supervision. Not only does this provide a cost benefit, but treatment dosage is not limited by the patient having to come to a clinic or needing direct supervision.

With respect to eccentric training for chronic medial epicondylitis, The authors' of the current study are unaware of a single study examining the effect of eccentric training for medial epicondylitis. However, for lateral epicondylitis, Croisier et al¹⁴ and Tyler et al¹⁵ were able to show significant improvements using isokinetic eccentric wrist extensor training and a home eccentric flexbar program, respectively. The subjects in these studies were not ones that had failed previous treatments, unlike those enrolled in the current study. Due to the lack of incidence and prevalence of this pathology the authors' chose not to design a prospective randomized trial as has been utilized in lateral epicondylitis studies. A limitation of the current study is that the effectiveness of the treatment cannot be attributed directly to the use of eccentric strengthening because there was no control group and other treatment techniques were being used simultaneously. Other limitations include the patient population included various mechanisms of injury; and that the failed treatments were from many different clinicians using multiple treatment methods.

The use of patients who have failed a previous treatment intervention represents what is often encountered in clinical practice and may even be considered a "quasi control". A limitation of the present study may be the small sample size. However, based on previous work^{8,15} it was estimated that 20 patients would be sufficient to detect a 40% improvement in DASH score at $p < 0.05$ with 80% power and this number of enrolled patients was achieved.

The average duration of treatment was approximately six weeks with the average number of physical ther-

apy visits being 12. It remains to be seen if isolated eccentrics alone without the addition of supervised physical therapy has the same clinical effects. Additionally, given that the follow-up period was only six weeks after the initiation of treatment and that medial epicondylitis has a high recurrence rate, the current results should be viewed as evidence for short-term efficacy of the addition of eccentric strengthening to a traditional physical therapy intervention. It remains to be determined if this treatment approach provides similar efficacy in the long term.

A search of the literature revealed a paucity of quality studies examining the efficacy of treatments for medial epicondyle tendinopathy. In two published systematic reviews attempting to examine treatment effectiveness of interventions for medial epicondylitis their authors found no studies meeting their inclusion criteria.^{3,5} A combination of dry needling and ultrasound guided autologous blood injection has been shown to decrease pain measured by visual analog scale (VAS) and modified Nirschl scores, but had a small sample size of 20 similar to the current study.⁸ There is some evidence to suggest the use of low level laser therapy in the treatment of medial epicondylitis.⁶ Low level energy shock wave therapy for the treatment of chronic medial tendinopathy was found to offer poor results⁷ and there were long term benefits reported from a local injection of methylprednisolone.⁴ Given the inconsistent outcomes for patients previously treated with chronic medial epicondylitis the addition of isolated eccentrics seems promising based on the results of the current study.

CONCLUSION

In conclusion, these data provide further evidence for the efficacy of eccentric training for tendinopathies. The outcome measure for chronic medial epicondylitis was markedly improved with the addition of an eccentric wrist flexor exercise to standard physical therapy interventions. Given the inconsistent outcomes for patients previously treated with chronic medial epicondylitis the addition of isolated eccentrics seems warranted based on the results of this study. This novel exercise, using an inexpensive rubber bar, provides a practical means of adding iso-

lated eccentric training to the treatment interventions for chronic medial epicondylitis.

REFERENCES

1. Shiri R, Viikari-Juntura E. Lateral and medial epicondylitis: role of occupational factors. *Best Pract Res Clin Rheumatol*. 2011;25(1):43-57.
2. Wolf JM, Mountcastle S, Burks R, Sturdivant RX, Owens BD. Epidemiology of lateral and medial epicondylitis in a military population. *Mil Med*. 2010;175(5):336-9.
3. Dingemans R, Randsdorp M, Koes BW et al. Evidence for the effectiveness of electrophysical modalities for treatment of medial and lateral epicondylitis: a systematic review. *Br J Sports Med* 2013; 0;1-10.
4. Stahl S, Kaufman T. The efficacy of an injection of steroids for medial epicondylitis. A prospective study of sixty elbows. *J Bone Joint Surg Am*. 1997;79(11):1648-52.
5. Hoogvliet P, Randsdorp MS, Dingemans R et al. Does effectiveness of exercise therapy and mobilisation techniques offer guidance for treatment of lateral and medial epicondylitis? A systematic review. *Br J Sports Med*. 2013 47: 1112-1119.
6. Simunovic Z, Trobonjaca T, Trobonjaca Z. Treatment of medial and lateral epicondylitis--tennis and golfer's elbow--with low level laser therapy: a multicenter double blind, placebo-controlled clinical study on 324 patients. *J Clin Laser Med Surg*. 1998;16(3):145-51.
7. Kricshek O, Hopf C, Nafe B, Rompe JD. Shock-wave therapy for tennis and golfer's elbow--1 year follow-up. *Arch Orthop Trauma Surg*. 1999; 119(1-2):62-6.
8. Suresh SP, Ali KE, Jones H, et al. Medial epicondylitis: is ultrasound guided autologous blood injection an effective treatment? *Br J Sports Med*. 2006;40(11):935-9
9. Woodley BL, Newsham-West RJ, Baxter GD. Chronic Tendinopathy: Effectiveness of Eccentric Exercise. *Br J Sports Med*. 2007;41(4):188-98.
10. Alfredson, H., Pietila, T., Jonsson, P., and Lorentzon, R. Heavy-Load Eccentric Calf Muscle Training for the Treatment of Chronic Achilles Tendinosis. *Am J Sports Med*. 1998;26(3):360-6.
11. Jonsson, P., Alfredson, H., Sunding, K., Fahlstrom, M., and 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.
12. Purdam, C. R., Jonsson, P., Alfredson, H., Lorentzon, R., Cook, J. L., and Khan, K. M. A Pilot Study of the

-
- Eccentric Decline Squat in the Management of Painful Chronic Patellar Tendinopathy. *Br J Sports Med.* 2004;38(4):395-7.
13. Jonsson, P., Wahlstrom, P., Ohberg, L., and 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.
14. Croisier, J. L., Foidart-Dessalle, M., Tinant, F., Crielaard, J. M., and Forthomme, B. An Isokinetic Eccentric Programme for the Management of Chronic Lateral Epicondylar Tendinopathy. *Br J Sports Med.* 2007;41(4):269-75.
15. Tyler TF, Thomas GC, Nicholas SJ, McHugh MP. Addition of isolated wrist extensor eccentric exercise to standard treatment for chronic lateral epicondylosis: A prospective randomized trial. *J Shoulder Elbow Surg.* 2010;19(6):917-22.
16. Ellenbecker TS, Nirschl R, Renstrom P. Current concepts in examination and treatment of elbow tendon injury. *Sports Health.* 2013;5(2):186-94.