Journal of Yoga & Physical Therapy
ISSN: 2157-7595

Ortega-Castillo et al., J Yoga Phys Ther 2014, 5:3
DOI: 10.4172/2157-7595.1000193

Short Communication Open Access

A Systematic, Critical Review of the Literature to Evaluate the Effectiveness of the Eccentric Training in Symptomatic Upper Limb Tendinopathies

Miguel Ortega-Castillo, Ivan Medina-Porqueres* and Raquel Cantero-Tellez

Department of Physical Therapy, Faculty of Health Sciences, University of Malaga, Malaga, Spain

Abstract

Objective: This systematic review aims to determine the effect of eccentric training in the management of upper limb tendinopathies.

Method: A computer-assisted literature search of medical, sport Discus, Physiotherapy Evidence Database (Pedro), and CINAHL databases was conducted. Pedro scale was employed to assess methodological quality. Inclusion criteria were well specified.

Results: After selection 12 studies satisfied the eligibility criteria with an average of 6/10 based on the Pedro score. In 11 studies, pain decreased significantly with eccentric. Strength was assessed in 9 studies; within-group evaluations show that strength significantly improved in the eccentric-group in 7 studies, whereas inter-group changes were only significantly better in the eccentric-group in 3 studies for all the parameters and in 2 studies for some of the parameters.

Conclusion: Effectiveness of eccentric training compared with other forms of treatment remains questionable. Studies demonstrated that eccentric training may reduce pain and improve strength in upper limb tendinopathies.

Keywords: Tendon; Overuse injury; Eccentric training; Systematic review

Introduction

The term tendinopathy refers to a general primary disorder of the tendon, associated with overuse in and around it, in the absence of histopathological findings. Since inflammation is absent or minimal in biopsy specimens, the descriptive term 'tendinitis' (implying an inflammatory process) should be used only when a histological confirmation is available [1]. More than 30% of injuries related to sports activity arise from or have an element of tendinopathy. On the other hand, tendinopathy is not restricted to athletes, affecting also sedentary population. Between 1 and 3% of the general population suffer upper extremity tendinopathies being 2 to 3.5 times more frequent in people over the age of 40, particularly if playing tennis more than 2 hours per day [2]. The risk of tendinopathy is related to occupational or sporting activity as well as the number of repetitions, strength and exposure time.

The risk increases when high strength, repetitions or exposure to vibrations during repetitive work are combined [3]. According to the current evidence regarding conservative treatment, only a few randomized controlled trials (RCTs) have been performed providing clinical evidence supporting their use; thus, the ideal treatment for tendinopathy remains unclear [4]. The management of tendinopathies should include early functional treatments, rather than rest and immobilization, but there is not enough scientific evidence to support the application of conservative treatment such as ultrasound (US), iontophoresis with NSAIDs, deep transverse friction massage (DTFM), or acupuncture for treating tendinopathy [3,5-7]. Nevertheless, in some studies these treatments show positive effects in the reduction of pain or improving the function of patients with tendinopathies (e.g., lateral epicondylitis) [3,8-10].

Other therapies, including extracorporeal shock wave therapy (ESWT), glyceril trinitrate patch, and injection of substances such as autologous blood, corticosteroid, prolotherapy, or platelet-rich plasma (PRP), may be considered if patients do not respond to the mentioned treatments and remain limited significantly in function or activity due to pain [11].

Exercise programmes incorporating eccentric muscle activity are becoming increasingly popular as they are considered to provide a more effective treatment than other forms of exercise therapy [1,12]. Some studies proposed the used of eccentric training for promoting collagen fibre cross-linkage formation within the tendon, thereby facilitating tendon remodelling [13].The objective of this systematic review was to determine the effect of eccentric training in the management of upper limb tendinopathies and to make recommendations for future research.

Materials and Method

The study protocol followed Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA) guidelines [14]. The protocol was prospectively registered in PROSPERO, registration number CRD42014009952 [15]. A systematic, computerised search was performed using MEDLINE, SPORT Discus, CINAHL and Physiotherapy Evidence Database (PEDro) to gather information relating to the treatment of upper extremity tendinopathies with eccentric training in physically active adults. Study details were extracted and organized into (Table 1 (Included as supplementary data)) with the synopsis of the selected studies: pathology, duration of symptoms, intervention, outcome, post-treatment follow-up and

***Corresponding author:** Ivan Medina-Porqueres, Department of Physical Therapy, Faculty of Health Sciences, University of Malaga, Malaga, Spain, Tel: 951 952 858; Fax: 951 952 864; E-mail: imp@uma.es.

Received July 13, 2015; **Accepted** July 14, 2015; **Published** July 20, 2015

Citation: Ortega-Castillo M, Medina-Porqueres I, Cantero-Tellez R (2015) A Systematic, Critical Review of the Literature to Evaluate the Effectiveness of the Eccentric Training in Symptomatic Upper Limb Tendinopathies. J Yoga Phys Ther 5: 193. doi:10.4172/2157-7595.1000193

Copyright: © 2015 Ortega-Castillo M, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

PEDro score. Two authors (MOC and IMP) independently searched the databases using following key words in all relevant combinations: *tendon, tendinopathy, exercise, eccentric, training*. All titles and abstracts retrieved were read to assess their relevance. Studies were filtered depending on the following criteria: studies in English or Spanish; adult participants with clinical diagnosis of tendinopathy; studies design was RCT; results regarding pain or strength were assessed; and eccentric exercise was employed to treat upper extremity tendinopathies. No limits were included concerning the year of publication [1,2,5-7].

The methodological quality of each selected study was assessed independently by two reviewers (MOC, IMP) using the PEDro criteria [1]. Two authors (MOC and IMP) independently extracted data from the selected studies regarding: (i) authors; (ii) sample size; (iii) location of tendinopathy; (iv) treatment group; (v) control group; (vi) outcome measure; (vii) previous treatments; (viii) PEDro score; and (ix) the variables in the eccentric exercise protocol, such as description of the exercise, sets, repetitions, time of rest, progression of the intensity and frequency per week. Other information obtained included group sizes and socio-demographic data (age, gender), length of symptoms, dominance according to tendinopathy, previous treatments, and follow-up post treatment. Any discrepancies were resolved through discussion until consensus was reached.

Results and Discussion

Figure 1 reports the number of full-text studies retrieved and the number of studies excluded. Exclusion criteria included: tendinopathies were not treated (n=1); participants were cadavers (n=1); participants were non-human (n=1); eccentric work was not mentioned for the treatment of tendinopathies (n=1); RCT design was not respected (n=2).The mean PEDro score for the 12 studies was 6/10, with a range from 3 to 8.Consideringthat the intervention of eccentric exercise does not allow for blinding of the participant or therapist, these scores are relatively good. Blinding of the assessors and concealed allocation were two other criteria that were poorly reported in most of the selected studies. Thus, the highest achievable score was 8/10.

The two reviewers had initial agreement on 112 out of 120 criteria (k=0,861), and reached consensus on all criteria. After selection criteria were applied, 12 studies satisfied the eligibility criteria with a total of 668 participants with clinical diagnoses of epicondylar tendinopathy (n=355) or shoulder impingement (n=191). The average number of participants in each trial was 55.6 (range from 20 to 120; eccentric group mean=25.9; control group mean=28.1) and the mean duration of symptoms at baseline ranged from 1 to 156 months [1]. (Table 1) gathers the results of the 12 studies included in this systematic revision.

Functional status was assessed in 9 studies, with the TEFS (Tennis Elbow Function Scale), DASH (Disabilities of the Arm, Shoulder and Hand) questionnaire, SPADI, or SDQ (Shoulder Disability Questionnaire). Results provide us that 7 studies improved the functionality of the participants in the eccentric-group, and 2 studies had non-significant changes in that group; in terms of inter-group changes, in 2 studies were moderately and significantly better in the non-eccentric group. In 3 studies there were not significant differences, and in 4 studies they were significantly better in the eccentric-group. Pain was assessed in all of them using the VAS (Visual Analogue Scale), except in one study, in which SPADI (Shoulder Pain and Disability Index) scale was employed. In 11studies, pain decreased significantly in the group where eccentric work was employed as therapeutic modality ($p<0.05$); in the remaining study, no significant improvement within14 group was found in the eccentric-group ($p=0.71$). Regarding inter-group changes, in 2 studies 37,41 were significantly better for the non-eccentric group.

In 7 studies, significant differences were not registered between groups; in 5 studies changes were significantly better in the eccentric-group. Strength was assessed differently in 9 studies. Tyler assessed it in various forms: during wrist extension, middle-finger extension and in combination [16]. Significant within-group improvements were observed in the eccentric-group during wrist extension and combination strength ($p<0.05$), but not during middle-finger extension ($p>0.05$); in terms of inter-group changes, they were only significantly

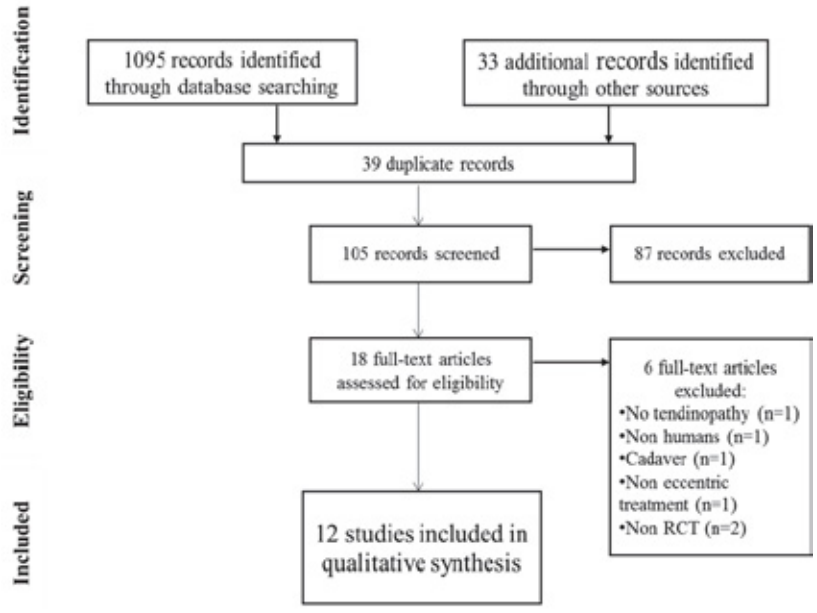

Figure 1: Flow chart of the Selection Process according to PRISMA Statement. According to: *Moher D, Liberati A, Tetzlaff J, Altman DG. & PRISMA Group. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. Int J Surg Lond Engl 2010; 8: 336-41.*

better in the eccentric-group during combined strength (p=0.01), not having differences during wrist and middle-finger extension.

The changes found by Peterson were significantly better in the eccentric-group, both within-group and intergroup (p<0.05). Svernlöv32 found also improvements significantly better in the eccentric group, both within-group and inter-group (p<0.01 and p<0.05, respectively). When did not find significant differences between groups. Other 2 studies evaluated the isometric strength. Maenhout found significant within-group changes in the eccentric-1group (p<0.05); in terms of inter-group changes, no significant differences were observed, except in isometric strength at 90º of shoulder abduction, where changes were significantly better in the eccentric-group (p=0.033) [17]. Struyf did not find any within-group changes and nor inter-group. The most common treatment protocol among these studies was established by Alfredson et al., which consisted of 3 sets of 15 repetitions performed twice daily. Most authors of the selected articles did not deviate much from Alfredson´s protocol.

There is strong evidence supporting the role of eccentric training in treating patients with epicondylar tendinopathy and shoulder impingement. Paralelly, there is strong evidence that eccentric training can produce improvements for the outcomes pain, functional status and strength in most of the studies. In terms of methodological quality, it was generally adequate.

Evaluators blinding was generally accomplished, with only 2 studies in which the blinding was not respected, and other 2 studies in which both blinding and evaluator independence were not referred. Regarding PEDRo score, only 2 studies scoring less than 5 points [18,19].

Regarding the post-treatment follow-up, 7 studies did not perform it, complicating the collection of long-term results. Nagrale developed a 4-weeks follow-up, and Martinez-Silvestrini developed a 6-weeks study with no post-treatment follow-up; despite both groups improved significantly, no inter-group changes were found, probably due to the short duration of the study period [20]. All of this, together with the characteristic "vicious cycle" of the tendon injury, may limit considerably the collection of faithful and closer information to the tendinopathy reality [21].

According to the number of included participants, Wen and Viswas did not estimatePreviously the sample size and Struyf included participants, although a minimum of 46participants was estimated as necessary to be significant [22].Other aspects, such as the supervision of home programmes or the lack of general agreement with respect to inclusion and exclusion criteria may lessen the validity of the studies. Svernlöv, Viswas, Söderberg and Nagrale set the pain at palpation of the epicondyleas an inclusion criteria; the individual participantivity in palpation skills may have lead the inclusion process to error [23].

The failure to accurately report exercise protocols and the substantial variation in exercise parameters made it difficult to assess the effectiveness of each study's ability to isolate an eccentric exercise component and provide a progressive muscle stimulus. There is still a controversy in the literature for the ideal parameters of the eccentric training protocols. The number of sets and repetitions, as well as the number of sessions per week and the resting time between sets, vary from one study to another. In a similar vein, eccentric treatment is combined with other therapeutic modalities in most of the studies, such as13 stretching, massage, ultrasound, orthotic devices, etc. Consequently, the attempt to isolate the results and evaluate only the effect of the eccentric training becomes complicated.

We can conclude that eccentric training is effective for upper limb tendinopathies, but its superiority against other methods is not totally clear. The lack of general agreement regarding inclusion and exclusion criteria may have lessens the validity of the studies. Long term studies and longer follow-up periods become imperative, as well as more studies with supervised exercises programmes [24]. Eccentric exercise seems to be a useful treatment for upper extremity tendinopathies, but whether it is more or less effective than other forms of therapeutic exercise is unclear. The lack of general agreement regarding inclusion and exclusion criteria, adherence to home treatment or dosage exercise does not allow us to make a conclusion about the effectiveness of eccentric training.

Conflicts of Interest and Funding

No actual or potential conflict of interest exists and no external financial 1support was sought or received for the conduction of this review.

References

1. Rees JD, Wolman RL, Wilson A (2009) Eccentric exercises; why do they work, what are the problems and how can we improve them? Br J Sports Med 43: 242-246.
2. Scott A, Ashe MC (2006) Common tendinopathies in the upper and lower extremities. Curr Sports Med Rep 5: 233-241.
3. Andres BM, Murrell GA (2008) Treatment of tendinopathy: What works, what does not, and what is on the horizon. Clin Orthop Relat Res 466: 1539-1554.
4. Skjong CC, Meininger AK, Ho SS (2012) Tendinopathy treatment: Where is the evidence? Clin Sports Med 31: 329-350.
5. Frizziero A, Trainito S, Oliva F, Nicoli Aldini N, Masiero S, et al. (2014) The role of eccentric exercise in sport injuries rehabilitation. Br Med Bull 110: 47-75.
6. Brosseau L, Casimiro L, Milne S, Robinson V, Shea B, et al. (2002) Deep transverse friction massage for treating tendinitis. Cochrane Database Syst Rev 4: CD003528.
7. Green S, Buchbinder R, Hetrick S (2005) Acupuncture for shoulder pain. Cochrane Database Syst Rev: CD005319.
8. Rees JD, Wilson AM, Wolman RL (2006) Current concepts in the management of tendon disorders. Rheumatology (Oxford) 45: 508-521.
9. Fournier PE, Rappoport G (2005) [Tendinopathy: Physiopathology and conservative treatment]. Rev Med Suisse 1: 1840-1842, 1845-6.
10. Hennessy MS, Molloy AP, Sturdee SW (2007) Noninsertional Achilles tendinopathy. Foot Ankle Clin 12: 617-641.
11. Murtaugh B, Ihm JM (2013) Eccentric training for the treatment of tendinopathies. Curr Sports Med Rep 12: 175-182.
12. Lombardi I Jr, Magri AG, Fleury AM, Da Silva AC, Natour J, et al. (2008) Progressive resistance training in patients with shoulder impingement syndrome: a randomized controlled trial. Arthritis Rheum 59: 615-622.
13. Kaux JF, Forthomme B, Goff CL, Crielaard JM, Croisier JL, et al.(2011) Current opinions on tendinopathy. J Sports Sci Med 10: 238-253.
14. Moher D, Liberati A, Tetzlaff J, Altman DG; PRISMA Group (2009) Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement Ann intern Med 151:264-269.
15. Ortega-Castillo M, Medina-Porqueres I (2015) Effectiveness of the eccentric exercise therapy in physically active adults with symptomatic shoulder impingement or lateral epicondylar tendinopathy: A systematic review. J Sci Med Sport.
16. Tyler TF, Thomas GC, Nicholas SJ, McHugh MP (2010) Addition of isolated wrist extensor eccentric exercise to standard treatment for chronic lateral epicondylosis: a prospective randomized trial. J Shoulder Elbow Surg 19: 917-922.
17. Maenhout AG, Mahieu NN, De Muynck M, De Wilde LF, Cools AM, et al. (2013) Does adding heavy load eccentric training to rehabilitation of patients with unilateral subacromial impingement result in better outcome? A randomized, clinical trial. Knee Surg Sports Traumatol Arthrosc 21: 1158-1167.

18. Svernlöv B, Adolfsson L (2001) Non-operative treatment regime including eccentric training for lateral humeral epicondylalgia. Scand J Med Sci Sports 11: 328-334.

19. Wen DY, Schultz BJ, Schaal B, Graham ST, Kim BS, et al. (2011) Eccentric strengthening for chronic lateral epicondylosis: A prospective randomized study. Sports Health 3: 500-503.

20. Martinez-Silvestrini JA, Newcomer KL, Gay RE, Schaefer MP (2005) Chronic lateral epicondylitis: Comparative effectiveness of a home exercise program including stretching alone versus stretching supplemented with eccentric or concentric strengthening. J Hand Ther 18: 411-419, quiz 420.

21. Fu SC, Rolf C, Cheuk YC, Lui PP, Chan KM, et al. (2010) Deciphering the pathogenesis of tendinopathy: A three-stages process. Sports Med Arthrosc Rehabil Ther Technol 2: 30.

22. Holmgren T, Björnsson Hallgren H, Öberg B, Adolfsson L, Johansson K, et al.(2012) Effect of specific exercise strategy on need for surgery in patients with subacromial impingement syndrome: Randomized controlled study. BMJ 344: e787.

23. Söderberg J, Grooten WJ, Ang BO (2012) Effects of eccentric training on hand strength in subjects with lateral epicondylalgia: A randomized-controlled trial. Scand J Med Sci Sports 22: 797-803.

24. Viswas R, Ramachandran R, Korde Anantkumar P (2012) Comparison of effectiveness of supervised exercise program and Cyriax physiotherapy in patients with tennis elbow (lateral epicondylitis): A randomized clinical trial. ScientificWorldJournal 2012: 939645.