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Case Report

The Management of Lateral Elbow Tendinopathy using Tendon Neuroplastic Training: A Case Report

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Abstract

Background: Good clinical results have been shown by eccentric exercises in Lateral Elbow Tendinopathy (LET). However, eccentric training is not enough for patients managed tendinopathy. The aim of the present case report is to present the effect of an exercise programme consisting of Tendon Neuroplastic Training (TNT) of wrist extensors, static stretching exercises of wrist extensors, isometric of wrist extensors, concentric – eccentric training of wrist extensors and strengthening of supinator, rotator cuff and scapula muscles exercises on pain and disability in a patient experiencing LET.

Case Report: A patient with right unilateral LET for 9 months participated part in the present case study. The patient followed the above recommended exercise program five times per week for 4 weeks. The programme was individualized on the basis of the patient's description of pain experienced during the procedure. Outcome measures were pain and function, using a visual analogue scale, the Patient-Rated Tennis Elbow Evaluation and the pain-free grip strength. The evaluation of the patient occurred at baseline, at week 4 (end of treatment), and at week 8 (1 month after the end of treatment. There was a decline in pain and a rise in function in all evaluations.

Conclusion: The results of the present trial suggest that a novel exercise program as described in the present trial can produce significant improvements in terms of pain and disability in LET.

Keywords: Lateral Elbow Tendinopathy; Tendon Neuroplastic Training; Eccentric; Isometric; Supinator

Introduction

Physiotherapy, electrotherapeutic and non-electrotherapeutic modalities, is a conservative treatment that is usually recommended for Lateral Elbow Tendinopathy (LET) patients [1]. Eccentric training of the injured tendon (Extensor Carpi Radialis Brevis (ECRB) for LET) is combined with static stretching exercises of the injured tendon in the treatment of tendinopathies [2]. Clinicians should consider eccentric-concentric loading in tendinopathy alongside or instead of eccentric loading [3]. Isometric exercises are recommended to manage and reduce tendon pain [4]. The exercise program should include exercises for supinator strengthening [5], rotator cuff and scapular muscles strengthening [6]. Tendon neuroplastic training (TNT) combines isometric or isotonic strength training with an externally-paced audio or visual cue [7].

Based on the above, it is possible to combine static stretching exercises, TNT, concentric-eccentric training and isometric with strengthening of rotator cuff and scapula muscles exercises and supinator for the management of LET. The effectiveness of the above recommended exercise program in the management of LET has not been investigated by studies. Therefore, the objective of the present report is to find out the effect of an exercise programme consisting of static stretching exercises, TNT, concentric-eccentric training and isometric with strengthening of rotator cuff and scapula muscles exercises and supinator on disability and pain in a patient experiencing LET.

Case Report

History

Mr. B., a 42- year-old male complained of pain in the lateral aspect of his right elbow, of his non-dominant hand. With his finger pointed the site of pain, which was about four cm distally to the lateral epicondyle of the humerus on the facet of the lateral epicondyle. He worked in pc about twelve hours per day. He experienced pain after working at the beginning which he could tolerate. Later, he experienced pain during the activity, which he could not tolerate and had to abandon the activity. When he stopped activity, the pain reduced within one and a half hour. GP prescribed NSAIDs. He had not any any improvement and his GP recommended him to follow physiotherapy. He complained of pain for about nine months. He was able to sleep, but he felt a severe pain in gripping objects. During gripping, the pain was unbearable. He did not complain of crepitus, swelling, paraesthesia, stiffness, cervical pain or locking. He did not have any previous problems in the peripheral joints or ιν the spine. He did not have diabetes, epilepsy or cancer and none in his family did. He did not take any medications at the time of assessment and did not have any operation in the past.

Examination findings

The movements of the elbow joint, which were tested, were extension and flexion both under resistance and passively. The passive movements were with full range of motion, normal end feel and pain free. The resisted movements were with full power (meaning 5 on the Oxford scale) and pain free.

The movements of the proximal radioulnar, which were tested, were pronation and supination. These movements were tested both under resistance and passively. The passive movements were with full range of motion normal end feel and pain free. The resisted movements were with full power (meaning 5 on the Oxford scale) and pain free.

The movements of the wrist joint which were tested were extension and flexion. These movements were tested both under resistance and passively.

Passive movements: The extension of the wrist with the elbow in extension was with full range of motion, normal end feel and pain free. The wrist flexion with the elbow in extension was full range of motion with normal end feel but slightly painful on the facet of the lateral epicondyle.

Resisted movements: The flexion of the wrist with the elbow in extension with full power (meaning 5 on the Oxford scale) and pain free. In the extension of the wrist with the elbow in extension the power was 3 on the Oxford scale and there was pain over the facet of the lateral epicondyle of the humerus, 9/10 on the VAS.

Resisted extension of the middle finger was painful (9/10 on the VAS) on the facet and the power was 3 on the Oxford scale.

The reported pain of the patient in the handgrip dynamometer test was 9/10 on the VAS.

The pain was reproduced by palpation over the common extensor tendon on the facet of the lateral epicondyle of the humerus.

Procedure

A supervised exercise programme was followed by the patient consisting of TNT, static stretching exercises of the extensors muscles of the wrist, isometric training of the wrist extensors and slow progressive concentric - eccentric training of the wrist extensors. The elbow was on the table in extension, the forearm in pronation, the wrist in extension (as high as possible), and the hand hanging over the edge of the table. From this position, patient flexed his wrist and then returned to the starting position (extension). An isometric contraction of wrist extensors was performed in the starting position by the patient. The patient performed the eccentric – concentric contraction when the isometric contraction completed and so on. The exercise involved isolated wrist extension and flexion paced to an external audio/visual cue on the patients' smartphone (ProMetronome; http://eumlab.com/ pro-metronome/). The patient was to listen to the sound and track the movement of the metronome with his eyes, as pacing to these types of external cues has been shown to modulate corticospinal excitability [8]. The pace of the metronome was set to 6 beats per minute such that each beat was ten seconds apart. This allowed a ten second isometric, eccentric and concentric phase, 30 seconds totally.

Three sets of 15 repetitions of slow progressive exercises (eccentric, concentric and isometric respectively) of the wrist extensors at each treatment session were performed, with 1-min rest interval between each set. Patient was told to complete with the exercise even if he experienced mild pain. However, he was advised to stop the training if the pain became disabling. The disabling and mild pain were monitored asking the patient to rate the pain on VAS before and after treatment. Disabling pain was defines above 8 on VAS whereas mild pain was defined below 4 on VAS [2]. The load was increased using free weights when patient was able to perform the exercises without experiencing any discomfort or minor pain.

The static stretching exercises were applied as reported in previous trials [2,9]. In addition, the rotator cuff and scapular muscles were strengthened as reported in previous trials [10]. Finally, the

patient performed strengthening exercises of the supinator as described in a previous trial [11].

The patient followed the supervised exercise programme five times a week for 4 weeks and was individualized on the basis of the patient's description of pain experienced during the procedure. The patient was instructed to use his arm during the course of the trial but to avoid activities that irritated the elbow such as knitting, grasping, lifting, using a screwdriver, handwriting and driving a car. He was also advised to refrain from taking anti-inflammatory drugs throughout the course of the trial. A treatment diary was used to monitor Patient compliance with this request.

Interaction (verbal and non-verbal) and communication between the clinician and patient was kept to a minimum, and behaviours sometimes used by therapists to facilitate positive treatment outcomes were purposefully avoided.

Function and pain were measured in the present study. The patient was evaluated at week 0 (baseline), at week 4 (end of treatment) and at week 8 (1 month after the end of treatment). Pain and function were measured on a visual analogue scale (VAS), a valid and sensitive approach of the VAS [12]. In addition, pain-free grip strength was used to measure function as described in previous trial [13]. Finally, pain and function were measured using the Patient-Rated Tennis Elbow Evaluation (PRTEE). The PRTEE questionnaire, provides a very quick (it takes less than 5 min to complete), easy, and standardized quantitative description of pain and functional disability in patients with LET. It has been translated and culturally adapted into Greek [14].

Results

Pain on VAS was 9, function on VAS was 3, pain-free grip strength was 22 lb and the score of the PRTEE questionnaire was 88 at the initial evaluation. At the end of the treatment (week 4), there was a decline in pain on VAS of 9 units, a rise in function on VAS of 7 units, a rise in pain-free grip strength of 42 units and a decline in the score of the PRTEE questionnaire of 80 units. At week 8, the pain on VAS was 0, function on VAS was 10, the pain-free grip strength was 72 lb and the score of the PRTEE questionnaire was 6 (Table 1).

	Pain (cm)	Function (cm)	Pain-free grip strength (lb)	PRTEE questionnaire
Week 0	9	3	22	88
Week 4	0	10	64	8
Week 8	0	10	72	6

Table 1: Pain, function, pain-free grip strength and PRTEE questionnaire over the 24 h before each evaluation.

Discussion

The present study has looked at the effect of an exercise program consisting of TNT of wrist extensors, static stretching exercises of wrist extensors, isometric of wrist extensors, concentric – eccentric training of wrist extensors and strengthening of supinator, rotator cuff and scapula muscles exercises in a patient experiencing LET and its findings have demonstrated significant improvements in terms of pain and disability. The results obtained from this case study are novel; as to date, similar studies have not been conducted.

The eccentric training of the injured tendon was first proposed by Alfredson., *et al*. [15]. Clinicians should consider eccentric-concentric loading as described by Malliaras and his colleagues (2013) [3]. LET unlike Achilles tendinopathy is often related to forceful grip activities requiring isometric contraction, which would be more beneficial than eccentric contraction in LET [16]. Short-duration isometric contractions are as effective as longer duration contractions for relieving tendinopathy pain [17]. Based mainly on clinical experience, rotator cuff, scapular muscles and supinator weakness in LET patients is commonly addressed as increasing pain, and decreasing hand - grip strength and functional ability. Using rotator cuff, scapular muscles and supinator, strengthening loading, usual motion might have been returned, resulting in resolution of pain with actions and a return to painless gripping for the patient. Recent evidence suggests that the central nervous system may play a role in the management of tendinopathy [18]. TNT is proposed to address the central nervous system component of tendinopathy [7]. Compared to other conservative therapies, TNT addresses the motor control deficits present in tendinopathy [7]. Stretching may strengthen the tendon or make it more resistant to strain and increase the range of motion of the relevant joint [19,20]. In addition, stretching may also be contributed with a "lengthening" of the muscle-tendon unit, orientation of the new collagen fibres and subsequently less stress exerted during joint movement [15].

Although the positive effects of such an exercise programme in LET have been reported in the present study, its study design limits the generalization of these results. Future well-designed trials are needed to confirm the results of this case report establishing the effectiveness of such an exercise program in the management of LET. In addition, the long-term effects (6 months or more after the end of treatment) of these treatments are needed to investigate as well as structural changes in the tendons related to the treatment interventions. Further research is needed to establish the cost-effectiveness of such treatment, because reduced cost is an important issue for the recommendation of any given treatment and the possible mechanism of action of this treatment approach. Finally,

further research in needed to find out the combination of the above exercise program with IASTM and 448 kHz capacitive resistive monopolar radiofrequency.

Conclusion

The exercise programme, consisting of TNT of wrist extensors, static stretching exercises of wrist extensors, isometric of wrist extensors, concentric – eccentric training of wrist extensors and strengthening of supinator, rotator cuff and scapula muscles exercises, had reduced the pain and improved the function in a patient with LET at the end of the treatment and at one month follow-up. Further well-designed trials to confirm the results of the present case study are needed.

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