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## Comparison of effects of eccentric training, eccentric-concentric training, and eccentric-concentric training combined with isometric contraction in the treatment of lateral elbow tendinopathy

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## ABSTRACT

*Study Design:* RCT.*Introduction:* Lateral elbow tendinopathy is a common clinical condition. eccentric exercises. eccentric-concentric loading and, isometric exercises are indicated to reduce and manage tendon pain.*Purpose of the Study:* To compare the effectiveness of eccentric training, eccentric-concentric training, and eccentric-concentric training combined with isometric contraction in the treatment of lateral elbow tendinopathy.*Methods:* A randomized clinical trial was carried out in a rheumatology and rehabilitation center. A group of 34 patients with lateral elbow tendinopathy was randomly allocated to Group A ( $n = 11$ ) who underwent eccentric training, Group B had eccentric-concentric and Group C who had eccentric-concentric and isometric training. All patients received 5 treatments per week for 4 weeks. Pain was evaluated using a visual analog scale and function using a visual analog scale and pain-free grip strength at the end of the 4-week course of treatment (week 4) and 1 month (week 8) after the end of treatment.*Results:* The eccentric-concentric training combined with isometric contractions produced the largest effect in the reduction of pain and improvement of function at the end of the treatment ( $P < .05$ ) and at any of the follow-up time points ( $P < .05$ ).*Conclusion:* The eccentric-concentric training combined with isometric contractions was the most effective treatment. Future well-designed studies are needed to confirm the results of the present trial.*Level of evidence:* III.

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## Introduction

Lateral elbow tendinopathy (LET) seems to be the most appropriate term to use in clinical practice because all the other terms, such as lateral epicondylitis, lateral epicondylalgia, lateral epicondylitis, and/or tennis elbow, make reference to inappropriate etiologic, anatomic, and pathophysiologic terms.<sup>1</sup> LET is one of the most common lesions of the arm work-related or sport-related pain disorder. The condition is usually defined as a syndrome of pain in the area of the lateral epicondyle,<sup>2</sup> which may be degenerative rather than inflammatory.<sup>3</sup> Hence, the increased presence of

fibroblasts, vascular hyperplasia, proteoglycans, and glycosaminoglycans together with disorganized and immature collagen may all take place in the absence of inflammatory cells.<sup>4</sup> The most commonly affected structure is the origin of the extensor carpi radialis brevis.<sup>4</sup> The dominant arm is commonly affected, peak prevalence of LET is between 30 and 60 years,<sup>2,5</sup> and disorder appears to be of longer duration and severity in women.<sup>3,6</sup>

The main complaints of patients with LET are pain and decreased function,<sup>2,3</sup> both of which may affect daily activities. Diagnosis is simple, and a therapist should be able to reproduce this pain in at least 1 of 3 ways: (1) digital palpation on the facet of the lateral epicondyle, (2) resisted wrist extension and/or resisted middle-finger extension with the elbow in extension, and (3) by getting the patient to grip an object.<sup>2,3,5</sup>

Although the signs and symptoms of LET are clear and its diagnosis is easy, to date, no ideal treatment has emerged. Many clinicians advocate a conservative approach as the treatment of choice for LET.<sup>2,3,7,8</sup> Physiotherapy is a conservative treatment that

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is usually recommended for LET patients.<sup>2–9</sup> A wide array of physiotherapy treatments have been recommended for the management of LET.<sup>10–14</sup> These treatments have different theoretical mechanisms of action, but all have the same aim, to reduce pain and improve function. Such a variety of treatment options suggests that the optimal treatment strategy is not known, and more research is needed to discover the most effective treatment in patients with LET.<sup>10–14</sup>

One of the most common physiotherapy treatments for LET is an exercise program.<sup>2–14</sup> One consisting of eccentric exercises has shown good clinical results in LET<sup>15</sup> and in conditions similar to LET in clinical behavior and histopathologic appearance, such as patellar and Achilles tendinopathy.<sup>16</sup> Such an exercise program is used as the first treatment option for our patients with LET.<sup>9,17</sup>

Malliaras et al<sup>18</sup> concluded that clinicians should consider eccentric-concentric loading alongside or instead of eccentric loading in tendinopathy.<sup>16</sup> A pilot trial showed that an exercise program, consisting of isotonic strengthening, including eccentric, had reduced the pain in patients with rotator cuff tendinopathy at the end of the treatment and 3 months after the end of treatment. Recently, isometric exercises are indicated to reduce and manage tendon pain.<sup>19–21</sup> LET is often related to forceful grip activities requiring isometric contraction of the wrist flexors and extensors.<sup>22</sup> Perhaps isometric contractions would be more beneficial than eccentric ones in lateral epicondylitis.<sup>22</sup> A case study showed that the combination of eccentric training with isometric contraction had positive effects in LET.<sup>20</sup>

To our knowledge, there have been no studies to compare the effectiveness of the previously reported exercise programs for the management of LET. Therefore, the aim of the present article was to make a comparison of the effects of an eccentric training, an eccentric-concentric training, and an eccentric-concentric training combined with isometric contraction on pain and function in patients experiencing LET.

## Methods

A randomized controlled monocentric trial was conducted in a clinical setting over 12 months to assess the effectiveness of an eccentric training, an eccentric-concentric training, and an eccentric-concentric training combined with isometric contraction. A parallel-group design was used because crossover designs are limited in situations where patients are cured by the intervention and do not have the opportunity to receive the other treatments after crossover.<sup>23</sup> Two investigators were involved in the study: (1) a doctor (IS) who evaluated the patients to confirm the LET diagnosis, performed all baseline and follow-up assessments, and gained informed consent and (2) a physiotherapist, the primary investigator (DS), who administered the treatments. All assessments were conducted by IS who was blind to the patients' therapy group. IS interviewed each patient to ascertain baseline demographic and clinical characteristics, including patient name, sex, age, duration of symptoms, previous treatment, occupation, affected arm, and dominant arm.

Patients older than 18 years who were experiencing lateral elbow pain were examined and evaluated in a private rehabilitation center located in Athens between January 2011 and October 2011. All patients who lived in Athens, Greece, were native speakers of Greek and were either self-referred or referred by their physician or physiotherapist.

Patients were included in the study if, at the time of presentation, they had been evaluated as having clinically diagnosed LET for at least 4 weeks. Patients were included in the trial if they reported pain on the facet of the lateral epicondyle when palpated, less pain

during resistance supination with the elbow in 90° of flexion rather than in full extension, and pain in at least 2 of the following 4 tests<sup>7</sup>:

1. Tomsen test (resisted wrist extension)
2. Resisted middle finger test
3. Mill's test (full passive flexion of the wrist)
4. Handgrip dynamometer test.

Patients were excluded from the study if they had 1 or more of the following conditions: (a) dysfunction in the shoulder, neck (radiculopathy), and/or thoracic region; (b) local or generalized arthritis; (c) neurologic deficit; (d) radial nerve entrapment; (e) limitations in arm functions; (f) the affected elbow had been operated on; and (g) had received any conservative treatment for the management of LET in the 4 weeks before entering the study.<sup>24–27</sup>

All patients received a written explanation of the trial before entry into the study. All patients gave signed informed consent to participate in the study. The study was approved by the Topical Research Ethics Committee, and access to patients was authorized by the manager of the private rehabilitation center.

The patients were randomly allocated to 3 groups by drawing lots. Patients in group A were treated with eccentric training, patients in group B were treated with eccentric-concentric training, and patients in group C were received an eccentric-concentric training combined with isometric contraction.

All patients were instructed to use their arm during the course of the study but to avoid activities that irritated the elbow, such as grasping, lifting, knitting, handwriting, driving a car, and using a screwdriver. They were also told to refrain from taking anti-inflammatory drugs throughout the course of the study. Patient compliance with this request was monitored using a treatment diary.

Communication and interaction (verbal and nonverbal) between the therapist and patient was kept to a minimum, and behaviors sometimes used by therapists to facilitate positive treatment outcomes were purposefully avoided. For example, patients were given no indication of the potentially beneficial effects of the treatments or any feedback on their performance in the preapplication and postapplication measurements.<sup>28</sup>

In the eccentric training group (group A), eccentric exercises of the wrist extensors were performed with the elbow on the bed in full extension, forearm in pronation, wrist in an extended position (as high as possible), and hand hanging over the edge of the bed

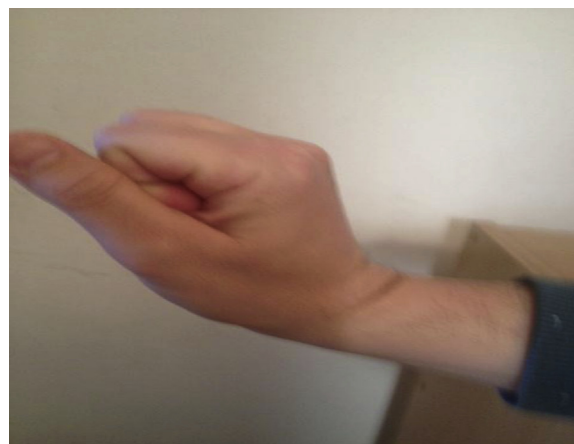


Fig. 1. The starting position.

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