



## Review Article

### Effect of heavy-load eccentric calf muscle training as a rehabilitation protocol in soccer players with persistent Achilles tendinosis

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#### ABSTRACT

**Background:** All of the studies included in the analysis developed scales to assess a variety of outcomes, including tenderness, patient experience, return to sport, degree of improvement, and physical activity engagement.

**Method:** In terms of training principles such as assets, repetitions, and frequency of performance, differences in technique between researches implementing the Heavy Load Eccentric Calf Muscle (HLECM) training regimen were rather minor. Some studies implemented the HLECM routine gradually throughout the first few weeks or reduced the frequency from twice daily (180 repetitions) to once daily (90 repetitions). The HLECM training procedure progressions could have been more diverse.

**Results:** HLECM has received a lot of attention as a therapy for Achilles Tendinosis (AT). Despite the fact that the results are difficult to comprehend, a significant decrease in agony and an increase in work was observed following HLECM training in all studies examined here.

## Introduction

On the subject of soccer injury prevention, there is a lot of evidence available in the writing. The viability of HLECM preparation instruments is unknown. They are, however, encouraged by the prospect of making the ligament more 'load-safe' and reversing the pathophysiological alterations that occur during this state.<sup>1,2</sup> Following HLECM preparation, further studies have revealed a reduction in ligament size and auxiliary abnormalities, an increase in collagen amalgamation, and a decrease in neo-vessel ingrowth inside the Achilles ligament.<sup>3</sup>

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### **Physiotherapy anticipation of soccer wounds**

In soccer, physiotherapy plays an important role in preventing wounds and fierceness wounds through effective healing programs.<sup>4</sup> Essential avoidance, optional anticipation, and tertiary anticipation are the three levels of wound counteraction.<sup>5</sup> The term 'essential degree of anticipation' refers to specific mechanisms that are used to prevent harm or illness. All soccer players, for example, are required to wear shin guards. Hawkins and Fuller (2016) found that all of the players in the UK wore shin pads and did calm down activities after serious matches, however, none of the participants in the study agreed throughout the preparation.<sup>6</sup> Fifty-three players reported that the training staff did not encourage them to use shin cushions during training or relax afterward.

### **Investigation of HLECM Protocol**

Alfredson et al. (2016) created a novel eccentric training protocol that has now been widely used in other studies. This study compared the efficacy of HLECM training to a variety of other conservative Achilles Tendonitis treatments could be due to a variety of factors, such as the outcome measures used, participant compliance levels, and differences in HLECM protocol methodology, including training principles.<sup>7</sup>

### **Outcome measures**

When research populations change and multiple outcome measures are used, comparison of results across studies can be difficult. Previously, the research used just a visual analog scale (VAS) for pain and, in some situations, an interview method to determine satisfaction and return to sport.<sup>8</sup> This latter method may be influenced by the therapist-tolerant relationship, especially if the interviewer is also participating in the study.<sup>7</sup>

### **Methodological variations**

In terms of training principles such as assets, repetitions, and frequency of performance, differences in technique between studies using the HLECM training regimen were rather minor. In some studies, the HLECM schedule was gradually implemented throughout the first several weeks or the frequency was dropped from twice a day (180 repetitions) to once a day (90 repetitions).<sup>9-12</sup> The HLECM training protocol's progressions were probably more diversified. The study did not specify how much weight was added to each participant's backpack, only that the exercises should continue to be unpleasant.<sup>7</sup>

### **Muscle activity**

In the investigation, the edge of knee flexion required to promote soleus muscle activation during HLECM training was not identified.<sup>7</sup> The electrical activity of the soleus muscle has been studied at various knee joint angles, and the results show that it is highest from 40° to 90° flexion.<sup>13</sup> This is assumed to be due to the occurrence of active insufficiency, which causes a comparable suppression of gastrocnemius activity in this position.<sup>13</sup> Other research, on the other hand, has shown that the soleus muscle's Electromyography (EMG) activity remains constant despite changes in knee and ankle joint angles.<sup>14</sup> The knee-flexion angle is more than 90° in the bent-knee condition of HLECM training. As a result, it appears that the gastrocnemius would remain active and not reach the point of functional insufficiency during this state. It's unclear whether bending the knee during HLECM training preferentially targets the soleus muscle in patients with Achilles tendon (AT).<sup>7</sup>

While there was a trend in the bent-knee condition for increased relative soleus activity and decreased relative gastrocnemius activity, the difference between the conditions was not statistically significant. In persons without Achilles tendon pain, the knee-flexion angle employed during HLECM training is likely insufficient to block gastrocnemius activity and preferentially target soleus.<sup>15</sup>

Eccentric exercise has been shown to improve tendon structure, which historically was considered a mechanism for improvement in some persons with Achilles tendinopathy.<sup>16</sup>

The quality and key findings of the research are outlined in Table 1 to determine what conclusions may be drawn currently.

Table 1: Key findings of the reviewed study

Participants Mean ageDuration	Intervention	Outcome Measures	Results
Group 1: N=22 48.1 yrs. 18months Group 2:N=22 48.4 yrs. 23 months	Group 1: HLECM training Group 2: heel raises, step-ups, skipping and sidejumps	Pain VAS Patient satisfaction- method unclear	Eccentric training significantly better than concentric training( $p < 0.002$ )
N= 44 46 yrs, 5.5 months Group 1: N=16 Group 2: N=13 Group 3: N=15	Group 1: HLECM training+gradual increase of reps/ straight knee Group 2: Dorsi-flexion night splint 12 weeks Group 3: HLECM training +dorsi- flexion splint	FAOS Likert scale for physical activity Likert scale for difficult during sport	There were no statistically significant differences between groups on any outcome measure. In all groups, there was a significant improvement on the FAOS pain subscale.
Group 1: N= 25 48.1 yrs. 10.9 months Group 2: N= 25 51.2 yrs. 12.5 months Group 3: N= 25 46.4 yrs. 9.2 months	Group 1: HLECM training+ gradual increase from 1x10 reps day 1 to 3x15 reps at day 14 Group 2: 3 sessions once a week over maximal area of tenderness Group 3: medication, stretching, training modification, ergonomic advice	VISA-A Likert scale for degree of improvement Pain scale Pain pressure threshold and tenderness US tendon diameter Success of treatment = 1 or 2 on an improvement scale	There was no significant difference in the outcome metrics between the Shockwave treatment and Eccentric groups. Eccentric and shockwave therapy had significantly superior outcomes than the wait-and- see group ( $P < 0.001$ ). All outcome indicators except tendon diameter improved significantly in the Eccentric and Shock wave therapy groups ( $P < 0.001$ ).
Group 1: N=34 44.1 yrs. 33.7 months Group 2: N=36 45.1 yrs. 27.7 months	Group 1: HLECM training Group 2: HLECM training+ Dorsi- flexion night splint 12 weeks	VISA-A Patient satisfaction rating of poor, fair, good, excellent Treatment success = good or excellent	No significant difference between Eccentric and Night splint groups in all outcome measures Significant increase in VISA-A score in Eccentric and Night Splint groups Tol et al. (2006)

N=45 Group 1: 41 yrs. 26 months Group 2: 31 yrs. 31 months	Group 1: HLECM protocol + gradual increase reps avoid pain, included concentric exercise. Group 2: 5x 30 second calf stretch daily	KOOS questionnaire  Tenderness US thickness tendon	No significant difference between Eccentric and Stretching groups in any outcome measures Norregaard et al. (2007)
Group1: N=15 33 yrs. Group2: N=5 32 yrs.	Group 1: HLECM+ reps performed oncedaily Group 2: cryotherapy and relative rest	Blood flow through capillaries Saturation of tissue with oxygen (SO <sub>2</sub> ) Pressure exerted after capillary venous filling (rHb) VAS for pain	There were no significant differences in flow or SO <sub>2</sub> levels across groups. Only the eccentric group had a significant drop in rHb (p<0.05). Pain was significantly reduced in the eccentric group only (p<0.05). Knobloch et al. (2007)
Group 1: N=37 42.5 yrs. 7.4 months Group 2: N=35 42.6 yrs. 7.3 months Group 3: N=28 43 yrs. 7.0 months	Group 1: HLECM training Group 2: Air Heel brace worndaily for 12 weeks Group 3: HLECM trainingand Air Heel brace	FAOSHind footscale US tendondiameter measure Pain VAS	No significant difference between groups in any outcome measures Significant decrease in AOFAS scoreall groups(p<0.0001) Petersen et al. (2007)
n = 32 (16 per group) Exp mean age: 20.14 ± 1.84; Comp mean age: 20.40 ± 1.27 Primary diagnosis: Achilles tendinopathy	Exp: 3 × 15 repetitions per exercise; 50 min/session; 3 days/week; 8 weeks total Comp: 3 × 15 repetitions per concentric strengthening exercise; 5 × 10" hold per stretch; 50 min/session; 3 days/week; 8 weeks total	Eccentric exercise Concentric exercise VAS for pain	Eccentric: 36.38 ± 8.51, 8.0 ± 5.39 * Concentric: 29.0 ± 16.02, 22.50 ± 7.52  Statistically significant changes between eccentric and concentric group in favor of eccentric. Yu et al. (2013)
<b>Reference Key:</b> RCT = randomized controlled trial, QRT = quasi-randomized trial, N = participant number, US = ultrasound, reps=repetitions, FAOS= foot and ankle outcome scale, VISA-A= Victorian Institute of Sport Assessment-Achilles, KOO = knee injury and osteoarthritis outcome score. Reps= Repetitions, Exp-experimental group, Comp= comparison group			

## Discussion

The use of HLECM as an AT therapy has been widely concentrated. Although the outcomes are difficult to comprehend, a significant decrease in agony and an increase in work were observed following HLECM preparation in all experiments examined here. In any event, none of the examinations were replicated.<sup>7</sup> The adequacy of HLECM preparation has been demonstrated to be comparable to shockwave treatment, extending, supporting, or late-night bracing. In any event, it is superior to concentric preparation. Heavy eccentric calf training is currently advocated for as the gold standard for treatment of mid-portion Achilles tendinopathy.<sup>17, 18</sup>

Advantages and disadvantages of HLECM: Although not always obvious, eccentric muscle contractions are an integral part of most movements during daily or sports activities. Skeletal muscles contract eccentrically to support the weight of the body against gravity and to absorb shock or to store elastic recoil energy in preparation for concentric (or accelerating) contractions.<sup>19</sup> Eccentric exercise may be effective in treating Achilles tendinopathy in part because of its effect on pain sensitivity. There is no strong evidence to suggest that eccentric exercise is harmful.

### Conclusion

Eccentric exercise has been linked to clinical improvements in pain and function in Achilles tendinopathy patients. Regardless of the available evidence that eccentrics are effective, other options may be equally effective. To optimize outcomes, proper load modification and exercise recommendations for patients with Achilles tendinopathy necessitate systematic clinical thinking and the combination of patient values.

### Abbreviations

HLECM: Heavy Load Eccentric Calf Muscle, AT: Achilles Tendinopathy, Reps= Repetitions, VAS: Visual Analogue Scale for pain, EMG: Electromyography, VISA-A: The Victorian Institute of Sports Assessment self-administered Achilles questionnaire

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### Conflicts of Interest

The author declares that there are no conflicts of interest relevant to this article.

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