



# Effectiveness of Low-Load Blood Flow Restriction Training in a Patient with an Achilles Tendon Rupture: A Case Report



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## INTRODUCTION

- The Achilles tendon (AT) is the thickest and strongest tendon in the body, yet also the most commonly ruptured.<sup>1</sup> Achilles Tendon Ruptures (ATRs) occur from an acute, high load force of the tendon concentrically or eccentrically.<sup>2</sup>
- ATRs are etiologically multifactorial, although most commonly occur in males aged 30-50 who play recreational sport, likely due to age-related tendinosis and the associated inappropriate organization, metabolism, and/or healing of tissue.<sup>3</sup>
- ATRs may be medically managed surgically or conservatively. Regardless, extensive rehabilitation efforts post-injury are necessary to address physical impairments and disability.
- Rehabilitation efforts emphasize the patients return to pre-injury levels of tendon strength and flexibility to facilitate the transition back to work, recreational, and/or sporting activities.
- AT and calf strength is well correlated to AT reinjury post-ATR, and unfortunately, most patients with an ATR are unable to participate in traditional strength and hypertrophy training, as they are often inappropriate and/or contraindicated while the AT is healing.<sup>4</sup>
- One training methodology, Blood Flow Restriction (BFR) training, is the use of a tourniquet/cuff system inflated during low-load resistance exercise to provide a metabolic stress to elicit similar training adaptations seen during high resistance exercise, primarily musculotendinous strength and hypertrophy.<sup>5</sup>

## Purpose

- The purpose of this case report was to evaluate the effectiveness of including low-load BFR training in a patient with a non-operative, complete ATR.

## CASE DESCRIPTION

- The patient was a 32-year-old Hispanic man who presented to outpatient physical therapy (PT) with a non-operative complete right ATR, which had occurred approximately eighteen weeks prior during a recreational soccer game.
- Patient had gone twelve weeks without medical care after injury, eventually presented to a podiatrist due to continued physical disability. Patient was placed in a boot and non-weight bearing for six weeks, after which he presented to PT weight-bearing as tolerated, still in boot.
- Pt goals were to return to independence with home, work, and community-related activities, although his most desirable long-term goal was a full return to recreational soccer.

## INITIAL EXAMINATION

Measure	Left	Right
<b>AROM</b>		
- PF	- 0 - 37°	- 2 - 28**
- DF	- 0 - 10°	
- INV	- 0 - 30°	- 0 - 20°
- EV	- 0 - 19°	- 0 - 11°
<b>MMT</b>		
- PF	- 5/5	- 3/5*
- DF	- 5/5	- 5/5
- INV	- 5/5	- 4+/5
- EV	- 5/5	- 3+/5
- Knee Flex	- 5/5	- 5/5
- Knee Ext	- 5/5	- 5/5
- Hip Flexion	- 5/5	- 4+/5
- Hip Extension	- 5/5	- 4+/5
- Hip Abduction	- 5/5	- 4/5
<b>Sensation</b>	Intact sensation to light touch and pin prick distal to knee bilaterally.	
<b>Palpation</b>	No atypical findings on left ankle. Right ankle had moderate swelling, particularly along the Achilles tendon, and along the medial and lateral malleoli. Achilles' tendon is significantly taut, and medial/lateral mobilization of tendon in minimal.	
<b>Gait</b>	Patient ambulated with CAM boot on. Patient ambulated with a decreased stance time, step length, and heel strike on right lower extremity. A slight medial heel whip with decreased PF propulsion was noted. Patient also demonstrated slight Trendelenburg pattern during right stance and minimal pelvic rotation bilaterally.	
<b>Outcome Measure</b>	Patient was administered FOTO questionnaire; initial score 58.	

\* Pain

## INTERVENTIONS

- Pt education on AT anatomy, pathophysiology, corresponding impairments, expected prognosis, and PT Plan of Care.
- Soft tissue mobilization, joint mobilization, and manual therapy to reduce edema, improve blood flow, increase soft tissue extensibility, and improve joint arthrokinematics.<sup>6,7</sup>
- Gait training to reintroduce normalized gait pattern and full weight acceptance onto right lower extremity.<sup>8</sup>
- Foot intrinsic muscle exercises for arch stability after immobilization period.<sup>9</sup>
- Progressive, impairment-based approach to address limitations in active range of motion strength, balance, and functional movement.<sup>2</sup>
- Progressive BFR training for strength and hypertrophy adaptations of AT, Gastrocnemius, and Soleus.<sup>10</sup>

## OUTCOMES

- Patient was seen for two sessions weekly for twelve weeks, for a total of twenty-four weeks:
  - Pt demonstrated no asymmetries in strength or range of motion testing with manual muscle testing and goniometry, respectively.<sup>11,12</sup>
  - FOTO score on initial eval 58, increased to 80 on re-eval during week 12.
  - Asymptomatic and without imitations in activities in home and work.
  - No gait deviations, able to perform a single leg squat off a 20-inch box without mechanical compensations ten times.
  - Pt prepared to begin return to sport activities – Running, agility, plyometrics...

## DISCUSSION

- The patient experienced a setback six weeks into PT after a vehicle-related accident. The patient saw his podiatrist, who confirmed on ultrasound that the AT was still intact, and pain and edema likely attributed to scar tissue tearing - PT to continue but to be adjusted via symptoms accordingly. The patient progressed back to previous level of function after one week.
- After the brief adjustment, the patient progressed through rehabilitation without any complications and at initial expected timeline. It is possible that BFR-training aided in the AT morphologic and performance adaptations necessary to recover quickly and perform as he did.

## CONCLUSION

- This case report suggests that BFR training may be an appropriate and useful tool in the rehabilitation of an ATR. Even in the presence of a significant setback, the patient still progressed in home, work, and community-related activities, and was ultimately able to return to sport-specific rehabilitation when initially expected.

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