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Compression Therapy in Sports

What is the Evidence?

An Intriguing Look at Athletic Performance and Recovery

by Joe F. Lau, MD and Steve Elias, MD



Recently there has been growth in compression use in the athletic community. Claims have been made as to the effects of compression stockings on athletic performance or recovery after exercise. The authors themselves have used compression and were intrigued enough to investigate the theory and evidence to support the perceived benefits. We think that vein specialists should be aware of this growing trend and have an understanding of current thinking so that they themselves may better inform their patients when questions arise.

centration gradient caused by venous hypertension, and therefore promotes fluid retention within the capillaries themselves. When properly used and applied in patients with venous hypertension, compression therapy ought to decrease peripheral edema, decrease ambulatory venous pressure, and decrease superficial venous pressure and distension. In theory, the applied extrinsic pressure should also provide increased capillary clearance, and improve venous return from the extremities. (Keep these concepts in mind for our later discussion about the use of compression stockings in sports).

Several lines of evidence support the use of compression therapy in various venous diseases. First, randomized clinical trial data has demonstrated that the regular use of a below-knee graduated compression stocking with 30-40 mmHg compression over two-years following the initial diagnosis of a lower extremity DVT significantly reduced the risk of developing the post-thrombotic syndrome by ~50%.^{1 2} The theory behind this is that compression assists calf muscles to work as pumps to improve venous return and overall blood flow, preventing the onset of venous pooling and the post thrombotic syndrome.

How Compression Works in Venous Diseases

There is a well-established literature base supporting the use of compression therapy in the medical management of several venous diseases, including chronic venous insufficiency, varicose veins, venous ulcerations, and the prevention of post-thrombotic syndrome in patients who have had lower extremity deep venous thromboses. The concept supporting compression is quite straightforward. The application of extrinsic compression—whether achieved by elastic or inelastic wraps, elastic graduated compression stockings, or sequential compression pumps—decreases subcutaneous interstitial pressure within the extremity. This applied physical force reduces the availability of the subcutaneous compartment for transcapillary fluid leakage down its con-

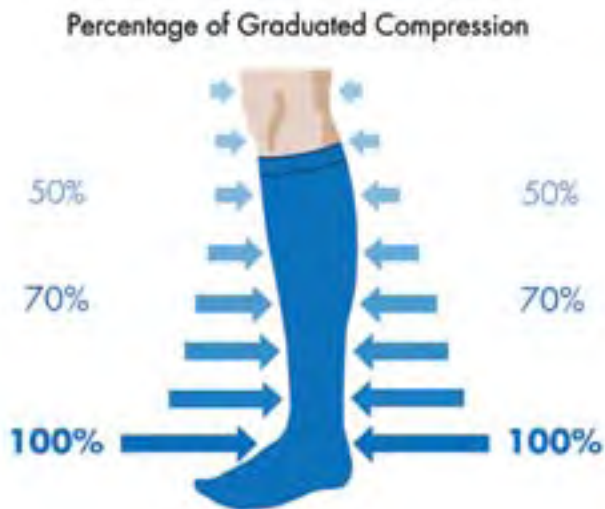


Joe F. Lau, MD

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“...compression therapy improves venous ulcer healing rates when compared to therapy without compression...”

³ Compression stockings counteract the effects that gravitational hydrostatic pressure exerts to pool blood in the lower extremities. Second, with regards to the utility of compression therapy in the treatment of venous ulcers, a recent comprehensive Cochrane database review concluded that compression therapy improves venous ulcer healing rates when compared to therapy without compression. ⁴ Again, the idea is that compression leads to improved blood flow and tissue oxygenation, which should aid in the wound healing process. Supporting this concept, a study performed by Bringard and colleagues showed that compression improved tissue oxygenation in the resting state. ⁵



Using graduated compression is key. The applied compression should be greatest at the malleolar level, and decreases more proximally towards the knee. Also, the amount of compression used should be tailored to the severity of swelling present within the patient. Various classes of graduated compression stockings exist, and are classified by ankle-level pressure within the stocking. In clinical practice, the greater the severity of disease, the higher the compression: Class I (15-20 mmHg of ankle compression) in patients with spider and varicose veins and mild edema attributed to venous insufficiency; Class II (20-30 mmHg) for those with large varicose veins or with moderate levels of edema, or for those who just had surgery for varicose veins or sclerotherapy and; Class III (30-40 mmHg) for severely symptomatic patients with severe edema, or those with complications related to PTS, venous ulcerations, or have chronic lymphedema.

Compression Stockings in Sporting Performance and Recovery: What is the Evidence?

The use of compression therapy to enhance athletic performance during competition and to promote post-event muscle recovery has gained traction within the sporting world over the past several years. Compression stockings of all sorts have become mainstream, and now adorn the upper and lower extremities of some of the world's most famous professional athletes. Also, an increasing number of sporting apparel companies have already positioned themselves to benefit from the trend. The hypothesis behind the use of compression during competition and recovery is that increased venous return and overall blood flow should aid in the clearance of metabolic by-products such as lactate that build up during muscle exertion. Increased clearance should improve recovery time and enhance athletic performance. But is there scientific evidence to support their use, or is this simply a fad that has gotten ahead of itself without merit?

Most of the identified studies were small in scale, and while the results appeared mixed, there were indeed more studies identifying some improvement in performance parameters in those wearing compression. A recent study performed by Ali and colleagues identified no differences in performance or physiologic parameters during a 10-km run between controls and those who wore 18-22 mmHg knee-high compression stockings. However, the majority of those who did wear stockings were less likely to complain of muscle soreness after their run. ⁶ Further, no differences in performance parameters were identified between the levels of compression used, and not surprisingly, runners were more likely to prefer socks with lower (12-15 mmHg) than those with higher compression (18-21 or 23-32 mmHg). ⁷ Note: Knee-high compression stockings in sports typically provide Class I (e.g., socks made by CEP) or Class II compression (Sigvaris).

In contrast, several studies identified improvement in running performance that were tied to corresponding effects on lactate kinetics. ^{8, 9, 10} Indeed, these studies supported earlier work by Berry and colleagues that demonstrated that those wearing compression had lower blood lactate levels following treadmill exercise. ¹¹ The authors suggested that compression may either prevent muscle lactate from escaping into blood, or that it may increase blood flow leading to improved lactate clearance. ¹¹ Furthermore, the beneficial effects seen by compression may be related in an increase in tissue oxygenation in those wearing compression during exercise. ¹²

While randomized controlled data may be lacking (don't expect this anytime soon), there appears to be some data supporting the use of compression in competition and recovery. We imagine that with the exponential use of compression therapy in sports, larger, more carefully designed studies will be forthcoming.

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Insight from Three Professional Athletes

We spoke to three professional athletes to gain a better sense of how compression therapy fits into their vigorous training regimen:

The first person we spoke with was David O'Meara, a personal trainer and fitness coach and a world-renowned inspirational speaker who has a diverse clientele that ranges from Fortune 500 business executives to professional athletes. He has authored several books aimed at self-improvement through sports. His inspirational philosophy, aimed at older athletes, centers on achieving peak performance with fast recovery times while avoiding injury. Mr. O'Meara is known in running circles as the "One Mile Runner," who, incredibly at age 48, is still routinely putting up sub-5 minute miles as a nationally ranked Masters runner. Needless to say, O'Meara spends a lot of time on his feet. He routinely runs up to 30 miles a week in advance of a race. Despite his busy schedule, he also doubles as a tennis instructor, and can spend up to 8 hours on the court. During our conversation, O'Meara

David O'Meara is known as the "One Mile Runner".



"...O'Meara has not sustained an injury since using compression."

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recalled two previous chronic, painful injuries, one involving his Achilles' tendon and the other recurrent plantar fasciitis. Mr. O'Meara started to wear graduated compression stockings about four years ago, using them routinely during and immediately following intense training sessions. He reports that compression provides tautness and "takes the bounce away" in his leg muscles that allow him feel subjectively better during workouts. He is convinced that his recovery times following intense workouts and training sessions have improved. More importantly, he has not sustained an injury since using compression.



Anthony Heygood,
NFL Linebacker.

The second athlete we spoke with is Anthony Heygood, currently a linebacker for the Seattle Seahawks of the National Football League. A stand-out player at Purdue University, he graduated in 2007 with All-Big Ten honorable mention. Mr. Heygood is also another big proponent of incorporating compression into his daily routine. During our conversation, Heygood spoke about the time when he tore his left

Achilles tendon while performing running drills in training camp before the 2010-11 season. In the ensuing months, he underwent aggressive rehabilitation therapy, which would typically last up to four hours per day. Compression therapy was not a part of his routine at the time. Soon after he returned from his injury, Heygood reinjured his left Achilles tendon. During his second stint in rehabilitation therapy, he began wearing compression stockings, and notes a marked improvement in recovery times, strongly believing that their use after intense training sessions have comparatively shortened his recovery time, and has enabled him to stay ahead of schedule in his recovery for the upcoming season.

“During his second stint in rehabilitation therapy, (Heygood) began wearing compression stockings.”

We also spoke with Carl Landry, a power forward for the New Orleans Hornets of the National Basketball Association. Mr. Landry recalls the recurrent right knee injuries he received while playing in college for Purdue, and of the long

“A year ago, Landry started to incorporate compression stockings into his routine.”

rehabilitation needed before he returned to full strength. A year ago, he started to incorporate compression therapy into his routine. After team workouts, Landry would wear his knee-high compression socks for several hours to aid in recovery process. He now believes that a regimen that combines this with a routine that includes stretching, ice baths and hot tubs, and massage therapy works best, and has reported being free of injuries.



Carl Landry, NBA power forward.

Our Take

This has been a fun exercise to examine the evidence supporting the use of compression therapy in venous diseases, and how it's utility has crossed over into competitive sports. We undertook this task because of personal intrigue, as our own experiences with compression during training runs have been positive, although obviously limited, in comparison to the anecdotes provided by professional athletes. The perceived benefits by professional



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athletes (and us) may be just that—perception—but just as **Medicine is both art and science, so is the field of athletics. Most who wear compression report feeling subjectively better, which should ultimately go a long way towards enhancing both athletic performance and recovery. Try them when you exercise and let us know what you think. V**

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Joe F. Lau, MD, PhD is Assistant Professor of Medicine at Hofstra North Shore-Long Island Jewish School of Medicine and Attending in Cardiology and Vascular Medicine, Department of Cardiology, Long Island Jewish Medical Center, New Hyde Park, NY.

Steve Elias is Assistant Professor of Surgery and Director of Columbia Vein Centers at Columbia University Medical Center, New York and Englewood Hospital and Medical Center, Englewood, NJ.