



What's on your recovery menu? (Part 3)

This edition we continue with the “wearable recovery” theme.

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COMPRESSION THERAPY:

Most sports recovery devices or other performance aids are typically developed as an evolutionary step from established medical interventions. Indeed, applying compression to affected limbs of patients suffering from venous or lymphatic insufficiency has been a treatment mainstay for decades.

For example, applying a “static” graded compression garment to the legs, with the greater compression around the ankle (subsequently decreasing further up the leg), promotes venous return and lymph flow, and mitigates phlebitis, thrombosis, and a host of other venous and lymphatic diseases.

Compression garments eventually filtered through to the sport and exercise arena during the past 20 years or so, with the objective of accelerating recovery via a number of blood and lymph flow induced mechanisms.

Subsequently, recent advances have been made to (theoretically) increase the magnitude and effectiveness of the static compression garments by combining graded compression with a “dynamic” peristaltic pulsing feature.

Here we take a look at the scientific evidence and the practical relevance of a popular dynamic compression device.



NORMATEC

www.normatecrecovery.com

Normatec claims to be the leader in rapid recovery for athletes. Comprising compressive pulsating sleeves for legs, arms and hip, the Normatec website describes features including; (a) pulsing action that mimics the muscle pumping action of the limbs on fluid and metabolite clearance after exercise; (b) pressure gradients that prevent fluids from traveling in the wrong direction; (c) sequential pulsing across limb segments between compression cycles.

So, what does the peer-reviewed research say about this novel recovery device?

In the first study, nine female dancers volunteered to undergo peristaltic pulse dynamic compression (PPDC) treatment via the Normatec device (Sands et al., 2014), to determine if treatment could increase the range of motion (ROM) during a front split manoeuvre. Most athletes undertake a vast range of stretching techniques prior to and following training in order to maintain/improve the elastic properties of their limbs – particularly dancers and gymnasts. The rationale of this study was to quantify anecdotal evidence from dancers that their ROM was improving with PPDC treatment.

After volunteers were familiarised, they were randomised into experimental (PPDC, 15min, 70mmHg) and control (application of Normatec leg sleeves, 15min, without compression or pulsation) conditions, in a crossover design, with each set of trials separated by 1-5 days. Leg split flexibility was assessed on both legs. The PPDC trials increased right and left leg ROM by 25.3% and 33.3% respectively, compared to pre-trial baseline measures. The control trials increased right and left leg ROM by 12.2% and 1.0% respectively.

The authors postulate that the short-term rapid changes in ROM may be linked to thixotropic properties of muscle

or a state of least resistance within key muscle architecture composites.

A second study, also by Sands and colleagues (2015), investigated the effects of PPDC treatment on pressure to pain thresholds in elite athletes. The rationale of the study was the inclusion of accelerating blood and lymph flow to mitigate training-induced muscle micro-trauma and swelling.

Twenty-four elite athletes (male = 12; female = 12, including weightlifting, wrestling; triathlon; track cycling; gymnastics, modern pentathlon, & shooting) from the USA Olympic Training Centre, Colorado Springs, volunteered to participate in the study. Athletes were randomised equally into either PPDC or control groups. The experimental group underwent PPDC treatment (15min, 70mmHg) on both legs following morning and afternoon training sessions, with the control group fitted with the leg sleeves for the same duration without compression or pulsation. Pressure to pain threshold (PPT) measurements were conducted via a manual algometer, after the morning and afternoon practice sessions. The experimental group's PPT threshold improved after PPDC treatment, persisting for the remainder of the day. No changes were found in the control group. The authors postulated that PPDC treatment reduced muscle tenderness, primarily via increased lymphatic drainage and subsequent accelerated clearance of muscle damage induced inflammatory debris.

A third study by Martin and colleagues (2015) investigated the effects of PPDC treatment on peripheral conduit and resistance arterial function in healthy non-athlete individuals. The authors hypothesised that the unique nature of compartmentalised external compression would improve vascular function in the compressed lower limbs and also in the non-compressed upper limbs. Twenty young healthy volunteers (males = 12; females = 8) participated in the study and were randomly assigned (in a cross-over design), to experimental or sham treatments. Unlike the aforementioned studies, the experimental protocol consisted of 1hr PPDC at 70mmHg. Ultrasound of the brachial and popliteal arteries was used to determine PPDC or sham induced flow-mediated dilation (FMD). Forearm and calf blood flow was evaluated via the venous occlusion plethysmography method, pre and post PPDC.

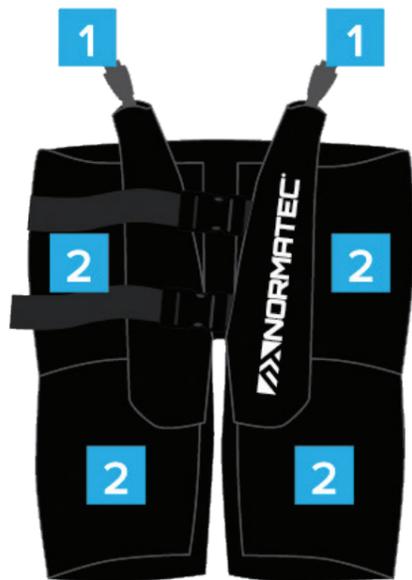
Following 1hr of PPDC, calf blood flow increased significantly by 9%. However, there was no change in forearm blood

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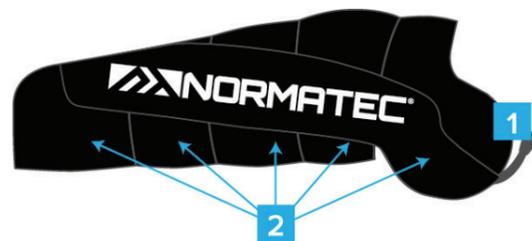
TRAINING TOOLBOX

PERFORMANCE



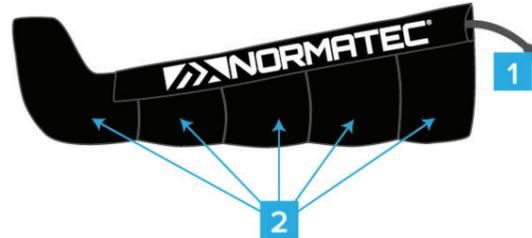
NORMATEC HIP ATTACHMENT

1. Normatec quick release connector.
2. Normatec compression zones.



NORMATEC ARM ATTACHMENT

1. Normatec quick release connector.
2. Normatec compression zones.



NORMATEC LEG ATTACHMENT

1. Normatec quick release connector.
2. Normatec compression zones.

flow. Furthermore, flow-mediated dilation significantly increased in the popliteal artery and brachial artery following PPDC and compared to the sham treatment. The authors postulated that the improved vasodilatory capacity observed across the compressed lower limbs might facilitate enhanced nutrient delivery and subsequent metabolite clearance. In conclusion, the findings made within this study are indicative of PPDC mediated improvements in both peripheral conduit and resistance artery blood flow.

CONSIDERATIONS AND TAKE HOME MESSAGE FOR TRIATHLETES

Applying Normatec's unique PPDC characteristics to the legs of athletes and non-athletes induced a number of interesting responses. However, the direct effects of acute PPDC on athletic performance was not assessed and is unknown. The mechanisms of reduced soreness or tenderness were not evaluated, however, when considering the improvements in both peripheral conduit and resistance artery blood flow in the third study, it is reasonable to assume similar responses in young (18-40 yrs age) healthy athletes, and may explain one part of the multiple mechanistic puzzle. Lymph flow was not directly measured during any of the above studies, but considering the operational PPDC characteristics, it is logical to assume there is some effect on lymph flow and subsequent modulation of interstitial fluid and inflammatory debris.

Reducing muscle soreness or tenderness after training would theoretically assist athletes who regularly undertake multiple training sessions across any one day. One could argue that athletes who experience regular feelings of "readiness" to train may also gain a psychological advantage. However, the scenario here is very similar, in principle, to the application of electrical stimulation therapy discussed in last month's editorial. Firstly, the accumulative effects of multiple PPDC application to regularly trained limbs (over weeks, months or years) is currently unknown. Periodic training-induced muscle micro-trauma does provide an opportunity for muscles to adapt over time, by way of changes to muscle architecture and subsequent resilience. Chronic application of PPDC (as with other chronic use of recovery modalities such as ice, non-steroidal anti-inflammatory medication, electrical stimulation, et al.) may limit an athlete's ability to capitalise on important muscle and psychological adaptations. More research is required to better understand the long-term effects of PPDC treatment. In the meantime, triathletes interested in experiencing Normatec's effects on recovery should consider treatment plans strategically, particularly at the start of a recovery phase following a phase of heavy training; and around important races, as a part of acute pre-race preparation and post-race recovery.

Next edition we will focus attention on the new age of training metrics derived from wearable devices and nanotechnology. 

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