

## Case challenge: Medical Innovation Day

Aarhus, 6 October 2017

BfR Professional is an Aarhus based startup established in 2015 specializing in practical equipment and wearable devices for the highly effective and scientifically proven method of blood flow restriction (hereafter BFR) training.

### **Blood flow restriction (BFR) training**

BFR is a highly effective training method that was originally invented in 1966 by Dr. Yoshiaki Sato who found that during a prolonged meditational position the limited blood flow made his legs turn numb and eventually developed a burning sensation similar to fatiguing muscle exercises.

This led him to do his own experiments by restricting blood flow to the working muscles and later joining forces with Japanese scientists conducting further research before introducing the now patented KAATSU training principle which means “increased pressure” in Japanese.

The KAATSU principle builds on using very expensive patented equipment where pneumatic pressure cuffs are placed on a person’s arms or legs depending on the purpose of the training. The cuffs are then inflated to a specific pressure measured in millimeters of mercury (mmHg) to the point where the venous return of blood flow is restricted while the arterial blood flow remains unrestricted.

The training method is also often referred to as occlusion training, especially in Denmark where the training principle has become increasingly popular both in fitness and rehabilitation efforts.

### **Application of BFR training**

Today hundreds of scientific and peer-reviewed studies have been conducted and published internationally forming a solid foundation for the benefits of BFR training and how a person can experience a significant hypertrophic response similar to heavyweight training using as low as 20-50% of ones 1RM<sup>1</sup> for short durations of time – as low as 5 minutes and maximum 15 minutes.

By only restricting the venous and not the arterial blood flow the blood starts to pool in the muscles causing an increased intramuscular pressure while fatiguing the muscles faster and recruiting more type II muscle fibers than regular training. All in all, research on BFR training has shown to produce favorable muscle and vascular adaptations without any significant side-effects and should be considered as a safe alternative to conventional high-load training.

Naturally, this opens an avenue of potential areas where BFR training is highly applicable for both the average Joe in the gym, professional athletes, and patient groups who are not able to perform heavy duty workouts either due to an injury or post-surgery rehabilitation.

**View appendix 1 for more details on the scientific proven effects of BFR training.**

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<sup>1</sup> The maximum amount of weight a person can lift one time only

## **The Future**

The next step in our journey is creating a digitalized wearable product with the potential to revolutionize the way we do training and rehabilitation following our mission statement for the future product development:

***We create affordable digital health for everyone, everywhere. Rethinking fitness & rehabilitation with innovative wearable sensor technology.***

This is where you come into the picture as we need your inputs to make the most impact and help millions of people regain their physical strength and mobility once again by addressing the following challenges/opportunities:

- 1. What technologies or medical components would you include in a digital product suitable for BFR training?**

*Hint: Technologies that could be taken into consideration:*

*EMG (Electromyogram)*

*NIRS (Near-Infrared Reflectance)*

*Doppler Ultrasound*

- 2. Taking your suggested product design above into consideration what type of data will you be able to collect and who can benefit from that data?**
- 3. Do you see any challenges/barriers to address before introducing this product to hospitals, rehabilitation clinics, and public health institutions in general?**
- 4. What key elements would you recommend we focus on, when communicating the benefits of BFR training to the customers/users?**

## Appendix 1:

### What does the science say about blood flow restriction (BFR) training?

Who may benefit the most from BFR training:

Elderly

Astronauts

Athletes

Rehabilitation

Source: As. Prof. Jeremy Loenneke from University of Mississippi, who is one of the leading researchers on the topic of BFR training, at the Sports Medicine Congress in Copenhagen in February 2017.

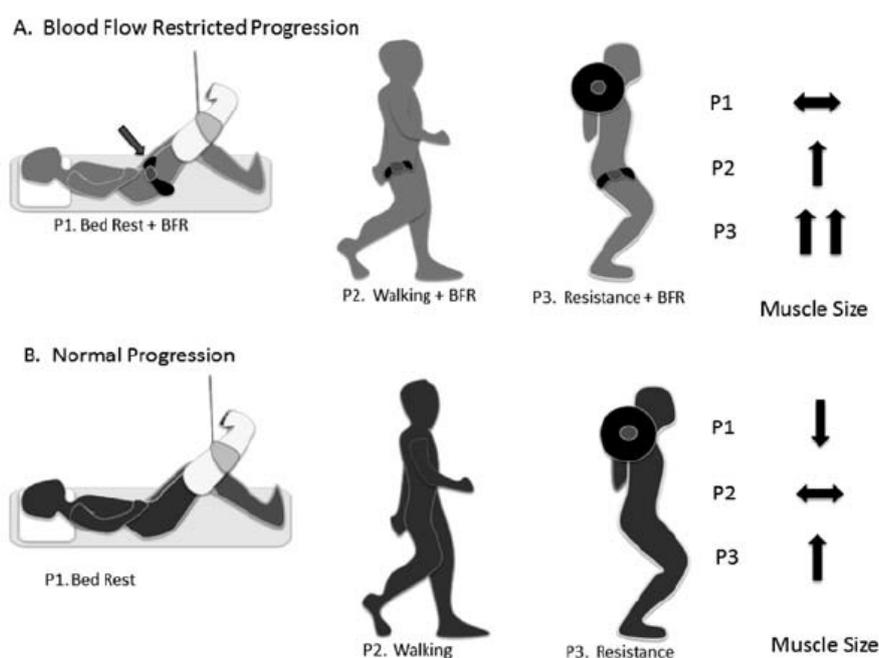


Illustration 1 - Loenneke et. al. (2012) - Blood flow restriction: An evidence based progressive model

In a Danish study from 2012 researchers found an increase of **up to 35-40%** in muscle fiber cross-sectional area in only 3 weeks. The study was conducted with a high frequency protocol of leg extensions until failure with 23 workouts performed over a duration of 3 weeks.

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**Occlusion training could be a paradigm shift within fitness.**

Jakob Nielsen, scientist at  
University of South Denmark (SDU)

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**Substantial muscular hypertrophy can be elicited by use of low-resistance blood flow restricted (BFR) strength training**

Prof. Per Aagard, SDU  
Team Danmark Seminar Presentation (2015)