

# Blood Flow Restriction Training for the Rehabilitation Patient



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# Learning Objectives

- Understand how both metabolic and mechanical stress can help with muscle hypertrophy
- Define the proper blood flow restriction pressures for both upper and lower extremities
- Explain 3 possible benefits of BFR for your patient population
- Obtain an understanding of contraindications and precautions of BFR

# What is Blood Flow Restriction (BFR)?

- Utilizes inflatable pneumatic cuff to occlude venous blood flow in and out of the exercising limb
- 50-80% restriction
  - 80% in the LE, 50% UE



# Why BFR?

- It has been generally accepted that muscle hypertrophy requires
  - High load training of up to 70% of one rep max or
  - Low loads (30-50% of one rep max) until failure
- New research shows that low load resistance training (20-40% of 1 rep max) combined with BFR can induce gains similar in hypertrophy and strength when compared to traditional strength training/loading without BFR
  - Hypertrophy can be seen in as little as 4 weeks vs 12 weeks
  - ACL study 20% atrophy at 16 weeks vs 9% in BFR group
- In otherwords, metabolic stress can be just as effective as mechanical stress in inducing hypertrophic changes

# Science Behind BFR

- BFR allows for:
  - Recruitment of Type II muscle fibers
    - Limiting oxygen means Type I fibers aren't very active
    - This allows recruitment of Type II muscle fibers that normally require very high intensity
  - Increase in muscle protein synthesis secondary to increases in IGF-1, MTORC-1 and myostatin
    - Increasing protein synthesis with very little muscle damage puts the patient in a great place to build muscle (increased protein synthesis with decreased muscle breakdown = muscle growth)
  - Increase in cellular swelling which may help in muscle fiber recruitment
  - Downregulation of myostatin = increased ability for hypertrophy and decreased fibrosis
  - Increase in growth hormone secretion
    - 170%
    - This increases collagen synthesis which can help with tendon and muscle collagen structure healing

	<b>High intensity (HIT)</b>	<b>(BFR) +low intensity</b>	<b>Low intensity</b>
Training range	65 – 90% %1 RM	20 – 35% 1 RM	20 – 35% 1 RM
Muscle Damage ( <u>Creatine Kinase</u> )	Present	Not significant	Not significant
Lactate production ( <u>mmol</u> )	Similar	Similar	Not present
Neuromuscular (Type II recruitment)	Type II activation near maximal effort	Type II activation at sub max effort	No additional recruitment
Growth Hormone	100 fold increase	1.7 X greater than HIT	No change from baseline
IGF-1	Increase	Significant Increase	No change from baseline
MTOR1C	Increase	Significant Increase	No change from baseline
<u>Myostatin</u>	Down regulation	Down regulation	No change from baseline
Time to adaptation	12 weeks	2 weeks	

# Considerations

- Restriction must be high enough to restrict venous return, but low enough to maintain arterial flow into the muscle
  - 80% in LE
  - 50% UE
  - Must be measured with Doppler ultra-sound
- Consistent readings
- Wider cuff = less chance for nerve damage
- Individualized pressure (Personalized Tourniquet Pressure/PTP)

# Contraindications

- History of DVT
  - Research shows no increased risk of DVT from BFR
- Pregnancy
- High BP
- Cardiac Disease
- Rhabdomyolysis



# Practical Application of BFR for Rehabilitation

- Decreased loads while still gaining a physiological stimulus for muscle adaptation
  - BFR allows us to build muscle strength and size when a person is unable to lift heavy loads
    - Postoperative
      - We can now build strength and hypertrophy in the early phases of recovery and rehab
    - Tendinopathy
      - Increase in growth hormone
    - Elderly
      - Able to build strength with less load

# Practical Application of BFR for Rehabilitation

- Walking and Cycling with BFR
  - Simple walking with BFR has been shown to increase muscle size
    - 5 rounds of 3 minute walks with 1 minute rest in highly trained basketball players
    - 12 sessions
    - 11.6% increase in VO2 max
- Biking with BFR has been shown to improve VO2 max
  - Biking at 40% of VO2 max for 40 minutes (3x/week x 8 weeks)
    - 6.2% increase in VO2 max

# Programming

- 30/15/15/15
  - 60 second rest between exercises
    - Typical ACL Phase I
      - Quad set, SLR, bridges, HS sets, SAQ etc
- Do after dynamic training
- Can be single or multi-joint
- 2-3x/week show greatest benefit
- Nutrition
  - Protein uptake is increased for 90 minutes afterwards







Questions?



# Multiple Choice

Which of these are a contraindication for BFR:

- A. DVT
- B. ACLR
- C. Age
- D. Weight

Which of the following represents the proper occlusion pressure for the LE:

- A. 50%
- B. 10%
- C. 80%
- D. 8%