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# Blood Flow Restriction Training (BFRT): Definition, Historical Context and Development

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**ABSTRACT:** Muscle weakness commonly occurs in a variety of conditions and pathologies. High load resistance training has been shown to be the most successful means in improving muscular strength and obtaining muscle hypertrophy. However, in certain populations that require muscle strengthening, eg individuals with chronic pain or post-operative patients, high load and high intensity exercises may not be clinically appropriate. Conditions that result in loss of muscle mass such as cancer, Human Immunodeficiency Virus (HIV), diabetes and COPD could potentially benefit from muscle strengthening and muscle hypertrophy but cannot tolerate high intensity/ loaded exercises.<sup>[1][2][3][4][5][6]</sup>

Blood Flow Restriction (BFR) training is a technique that combines low intensity exercise with blood flow occlusion that produces similar results to high intensity training. It has been used in the gym setting for some time but it is gaining popularity in clinical settings.

**KEYWORDS:** blood, flow, restriction, training, development, history, context

## I. INTRODUCTION

BFR training was initially developed in the 1960s in Japan and known as KAATSU training.<sup>[9]</sup> It involves the application of a pneumatic cuff (tourniquet) proximally to the muscle that is being trained. It can be applied to either the upper or lower limb. The cuff is then inflated to a specific pressure with the aim of obtaining partial arterial and complete venous occlusion. The patient is then asked to perform resistance exercises at a low intensity of 20-30% of 1 repetition max (1RM), with high repetitions per set (15-30) and short rest intervals between sets (30 seconds)<sup>[10]</sup>

### BFR and Strength Training

#### Understanding the Physiology of Muscle Hypertrophy

Muscle hypertrophy is the increase in diameter of the muscle as well as an increase of the protein content within the fibres. An increase in cross-sectional area of the muscle directly correlates with an increase in strength.<sup>[11]</sup>

Muscle tension and metabolic stress are the two primary factors responsible for muscle hypertrophy.

### Mechanical Tension and Metabolic Stress

When a muscle is placed under mechanical stress, the concentration of anabolic hormone levels increase. The activation of myogenic stem cells and the elevated anabolic hormones result in protein metabolism and as such muscle hypertrophy can occur.<sup>[12][13]</sup>

Release of hormones, hypoxia and cell swelling occur when a muscle is under metabolic stress.<sup>[14]</sup> These factors are all part of the anabolism of muscle tissue.

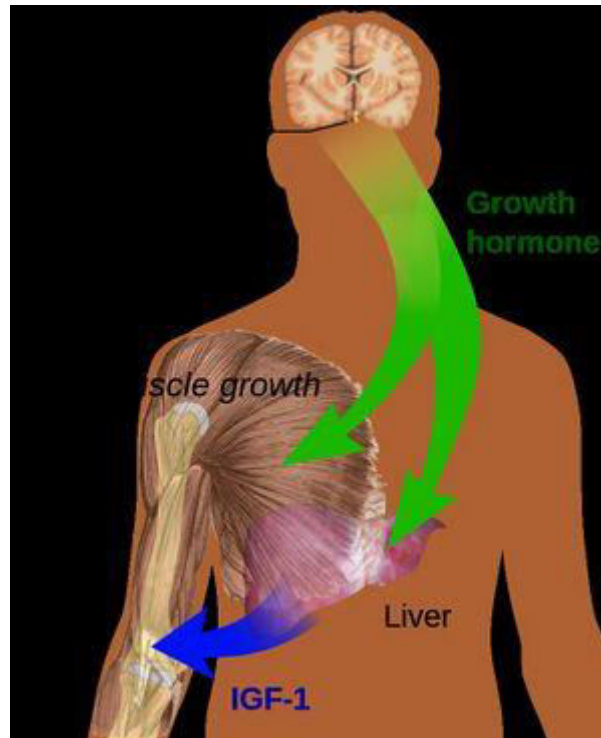
### Activation of myogenic stem cells



### Myogenesis

Myogenic stem cells (satellite cells), are found between the basal lamina and plasma membrane of myofibres. They are normally inactive and become activated in response to muscle injury or increased muscle tension. These cells are responsible for both repair of damaged muscle fibres and also the growth of the fibres themselves<sup>[11]</sup>.

### Release of hormones



### HGH function

Any exercise, resistance or aerobic, brings about a significant increase in human growth hormone (HGH). Insulin-like growth factor and growth hormone are responsible for increased collagen synthesis after exercise and aids muscle recovery. Growth hormone itself does not directly cause muscle hypertrophy but it aids muscle recovery and thereby potentially facilitates the muscle strengthening process.<sup>[15]</sup> The accumulation of lactate and hydrogen ions (eg in hypoxic training) further increases the release of growth hormone.<sup>[13]</sup>

High intensity training has been shown to down regulate myostatin and thereby provide an environment for muscle hypertrophy to occur.<sup>[12]</sup> Myostatin controls and inhibits cell growth in muscle tissue. It needs to be essentially shut down for muscle hypertrophy to occur. [1,2,3]

### Hypoxia

Resistance training results in the compression of blood vessels within the muscles being trained. This causes an hypoxic environment due to a reduction in oxygen delivery to the muscle. As a result of the hypoxia hypoxia-inducible factor (HIF-1 $\alpha$ ) is activated. This leads to an increase in anaerobic lactic metabolism and the production of lactate.<sup>[14]</sup>

### Cell Swelling

When there is blood pooling and an accumulation of metabolites cell swelling occurs. This swelling within the cells causes an anabolic reaction and results in muscle hypertrophy.<sup>[16]</sup> The cell swelling may actually cause mechanical tension which will then activate the myogenic stem cells as discussed above.

### Effects of Blood Flow Restriction on Muscle Strength

The aim of BFR training is to mimic the effects of high intensity exercise by recreating a hypoxic environment using a cuff. The cuff is placed proximally to the muscle being exercised and low intensity exercises can then be performed. Because the outflow of blood is limited using the cuff capillary blood that has a low oxygen content collects and there is an increase in protons and lactic acid, the same physiological adaptations to the muscle (eg release of hormones, hypoxia and cell swelling) will take place during the BFR training and low intensity exercise as would occur with high intensity exercise.<sup>[16]</sup>

- Low intensity BFR training results in greater muscle circumference when compared with normal low intensity exercise. (1)
- Low intensity BFR (LI-BFR) results in an increase in the water content of the muscle cells (cell swelling).<sup>[16]</sup> It also speeds up the recruitment of fast-twitch muscle fibres.<sup>[17]</sup> It is also hypothesized that once the cuff is removed a hyperemia (excess of blood in the blood vessels) will form and this will cause further cell swelling.<sup>[10]</sup>
- Short duration, low intensity BFR training of around 4-6 weeks has been shown to cause a 10-20% increase in muscle strength. These increases were similar to gains obtained as a result of high-intensity exercise without BFR.<sup>[17]</sup>

A study comparing (1) high intensity, (2) low intensity, (3) high and low intensity with BFR and (4) low intensity with BFR. While all 4 exercise regimes produced increases in torque, muscle activations and muscle endurance over a 6 week period - the high intensity (group 1) and BFR (groups 3 and 4) produced the greatest effect size and were comparable to each other.<sup>[18]</sup>

### Equipment

#### BFR Cuff

BFR requires a tourniquet to be placed on a limb. The cuff needs to be tightened to a specific pressure that occludes venous flow while still allowing arterial flow whilst exercises are being performed.

Simple pieces of equipment such as surgical tubing or elastic straps have been used in gym settings to achieve this result.<sup>[19]</sup> These are not advisable as you are unable to monitor the amount of blood flow occlusion. A thin diameter may also cause too much local pressure and result in tissue damage.

#### BFR Cuff Width

A wide cuff is preferred in the correct application of BFR. 10-12cm cuffs are generally used. A wide cuff of 15cm may be best to allow for even restriction. Modern cuffs are shaped to fit the natural contour of the arm or thigh with a proximal to distal narrowing. There are also specific upper and lower limb cuffs that allow for better fitment.<sup>[20]</sup>

#### BFR Cuff Material

BFR cuffs can be made from either elastic or nylon. The narrower cuffs are normally elastic and the wider nylon. With elastic cuffs there is an initial pressure even before the cuff is inflated and this results in a different ability to restrict blood flow as compared with nylon cuffs.<sup>[21]</sup>

Elastic cuffs have been shown to provide a significantly greater arterial occlusion pressure as opposed to nylon cuffs.<sup>[22]</sup>

#### BFR Cuff Pressure

Different blood flow restriction cuff pressure prescription methods:[20]

1. a standard pressure (used for all patients) for e.g. 180 mmHg;
2. a pressure relative to the patient's systolic blood pressure, for e.g. 1.2- or 1.5-fold greater than systolic blood pressure;
3. a pressure relative to the patient's thigh circumference.

It is the safest to use a pressure specific to each individual patient, because different pressures occlude the amount of blood flow for all individuals under the same conditions.<sup>[20]</sup>



A Doppler ultrasound or plethysmography can be used to determine the blood flow to the limb. The cuff is inflated to a specific pressure where the arterial blood flow is completely occluded. This known as limb occlusion pressure (LOP) or arterial occlusion pressure (AOP). The cuff pressure is then calculated as a percentage of the LOP, normally between 40%-80%.

Using this method is preferable as it ensures patients are exercising at the correct pressure for them and the type of cuff being used. It is safer and makes sure that they are exercising at optimal pressures, not too high to cause tissue damage and also not too low to be ineffective.<sup>[20]</sup>

The pressure of the cuff depends upon the width of the cuff as well as the size of the limb on which the cuff is applied.

The key to BFR is that the pressure needs to be high enough to occlude venous return and allow blood pooling but needs to be low enough to maintain the arterial inflow<sup>[23]</sup> Perceived wrap tightness, on a scale of 0-10 has also been used to conduct BFR training. Wilson et al (2013) found that a perceived wrap tightness of 7 out of 10 resulted in total venous occlusion but still allowed arterial inflow.<sup>[24][25]</sup>

#### Clinical Application

BFR has been used in athletes and recreational training to obtain muscle hypertrophy. It can also be used in clinical populations that cannot perform high intensity exercises because of the stage of their condition or pathology involved.<sup>[26]</sup>

Examples of BFR training in the clinic:[4,5,6]

#### Procedure

Upper Limb: The tourniquet is placed on the upper arm. The cuff is inflated to restrict 50% of the arterial blood flow and 100% of the venous flow.

Lower limb: The tourniquet is placed on the upper thigh. The cuff is inflated to restrict 80% of the arterial blood flow and 100% of the venous flow. With the cuff inflated to the correct pressure normal exercises are performed at about 20-30% of 1RM.

#### Exercise Prescription

Exercise prescription for BFR varies, this is dependent on whether it is being applied during resistance training (BFR-RE), aerobic training (BFR-AE) or passively without exercise (P-BFR)<sup>[30]</sup>



Guidelines	
Frequency	2–3 times a week (>3 weeks) or 1–2 times per day (1–3 weeks)
Load	20–40% 1RM
Restriction time	5–10 min per exercise (reperfusion between exercises)
Type	Small and large muscle groups (arms and legs/uni or bilateral)
Sets	2–4
Cuff	5 (small), 10 or 12 (medium), 17 or 18 cm (large)
Repetitions Pressure	(75 reps) – 30 × 15 × 15 × 15, or sets to failure 40–80% AOP
Rest between sets	30–60 s
Restriction form	Continuous or intermittent
Execution speed	1–2 s (concentric and eccentric)
Execution	Until concentric failure or when planned rep scheme is completed

Model of exercise prescription with BFR-RE<sup>[30]</sup>

BFR-RE (resistance training)

Guidelines	
Frequency	2–3 times a week (>3 weeks) or 1–2 times per day (1–3 weeks)
Intensity	<50% VO <sub>2</sub> max or HRR
Restriction time	5–20 min per exercise
Type	Small and large muscle groups (arms and legs / uni or bilateral)
Sets Pressure	Continuous or intervals 40–80% AOP
Cuff	5 cm (small), 10 or 12 cm (medium), 17 or 18 cm (large)
Exercise mode	Cycling or walking

Model of exercise prescription with BFR-AE<sup>[30]</sup>

For optimal results, resistance training should ideally be done 2-4 times per week. In theory, strength training with BFR can be done daily, however, this may not be the best long term strategy and training 1-2 times per day should only be done for shorter time periods of 1-3 weeks. BFR-RE is typically a single joint exercise modality for strength training.<sup>[30]</sup>

Muscle hypertrophy can be observed during BFR-RE within a 3 week period but most studies advocate for longer training durations of more than 3 weeks.

A load of 20-40% 1RM has been shown to produce consistent muscle adaptations for BFR-RE.

- The most commonly used training volume in literature is 75 repetitions across 4 sets (30, 15, 15, 15).
- Rest periods between sets are normally about 30-60 seconds.
- It is important to keep the cuff inflated during the rest periods to capture the metabolites. Intermittent pressure can be applied however this is not as effective as continuous.<sup>[30]</sup>

Guidelines	
Frequency	1-2 times per day (duration of bed rest/immobilization)
Restriction time	5 min intervals
Type	Small and large muscle groups (arms and legs/uni or bilateral)
Sets	3-5
Cuff	5 (small), 10 or 12 (medium), 17 or 18 (large)
Rest between sets	3-5 min Uncertain – higher pressure may be needed
Pressure	(70-100% AOP)
Restriction form	Continuous

#### Model of Exercise Prescription with P-BFR<sup>[30]</sup>

The amount of pressure needed to occlude blood flow in the limb depends on the limb size, underlying soft tissue, cuff width and device used. The arterial occlusion pressure applied is dependent on whether it is an upper or lower limb and should be between 40%-80%.<sup>[30]</sup>

#### BFR-AE (aerobic training)

BFR can be applied during aerobic exercise and in research has normally been applied during walking or cycling. It is somewhat more difficult to maintain cuff pressures and literature lacks standardization of cuff pressures during BFR-AE.<sup>[30]</sup> Also, there is limited evidence that BFR training improves aerobic capacity and performance in trained athletes.<sup>[31]</sup>

#### P-BFR (passively without exercise)[7,8,9]

Passively applied BFR (i.e. BFR is applied and no exercise is performed) has not been widely researched. However, it has shown positive results in reducing muscle atrophy post ACL surgery. The studies conducted did not use standardised pressures and some pressures used were high enough to possibly completely occlude blood flow, which poses safety risks. P-BFR could potentially be beneficial in postoperative patients however more research is needed in this field.<sup>[30]</sup>

#### Side Effects

Reported side effects while performing BFR exercises are fainting and dizziness, numbness, pain and discomfort, delayed onset muscle soreness<sup>[32]</sup>.

#### Contraindications

All patients should be assessed for the risks and contraindications to tourniquet use before BFR application.

- Patients possibly at risk of adverse reactions are those with poor circulatory system, obesity, diabetes, arterial calcification, sickle cell trait, severe hypertension, or renal compromise<sup>[33]</sup>.
- Potential contraindications to consider are venous thromboembolism, peripheral vascular compromise, sickle cell anemia, extremity infection, lymphadenectomy, cancer or tumor, extremity with dialysis access,

acidosis, open fracture, increased intracranial pressure vascular grafts, or medications known to increase clotting risk<sup>[13]</sup>.

#### Safety Implications

Safety implications around BFR are conflicting. Safety concerns are mainly around the formation of venous thromboembolism (deep vein thrombosis and pulmonary embolism) and muscle damage.<sup>[20]</sup> Different safety concerns and implications are discussed below:

#### Blood hemostasis and BFR

Blood has the ability to clot through various systems of coagulation. Blood coagulation is kept in check in part by the fibrinolytic system. Fibrinolysis can help prevent the progression of a blood clot into a venous thromboembolism.

A systematic review conducted by da Cunha Nascimento et al in 2019 examined the long and short term effects on blood hemostasis (the balance between fibrinolysis and coagulation). It concluded that more research needs to be conducted in the field before definitive guidelines can be given.<sup>[34]</sup>

In this review, they raised concerns about the following

- Adverse effects were not always reported
- The level of prior training of subjects was not indicated which makes a significant difference in physiological response
- Pressures applied in studies were extremely variable with different methods of occlusion as well as criteria of occlusion
- Most studies were conducted on a short-term basis and long term responses were not measured
- The studies focused on healthy subjects and not subjects with risk for thromboembolic disorders, impaired fibrinolysis, diabetes and obesity

Their final conclusion on the safety of BFR was as such:<sup>[34]</sup>

“Thus practitioners must consider the evidence available and ask

1. If the client is sufficiently similar to the subjects in the studies you have examined
2. Does the treatment have a clinically relevant benefit that outweighs the potential risk?
3. Is another treatment available that would provide greater results?”<sup>[34]</sup>

<sup>[35]</sup>

#### Muscle Damage

In general, it is well established that unaccustomed exercise results in muscle damage and delayed onset muscle soreness (DOMS), especially if the exercise involves a large number of eccentric actions. DOMS is normal after unaccustomed exercise, including after LL-BFR training, and should subside within 24–72 hours<sup>[10,11,12]</sup>.

High-load Resistance exercise in any form can result in muscle damage. Excessive breakdown of striated muscle is known as exertional rhabdomyolysis and can result in organ damage.<sup>[30]</sup> The incidence of rhabdomyolysis from BFR-RE is very low at approximately 0,07%-0,2%. This seems to be similar to the occurrence of rhabdomyolysis during normal high load resistance training. There is concern that even with low-load BFR, the increased metabolic stress may trigger rhabdomyolysis but the incidence levels are so low the current evidence does not suggest there is increased risk of rhabdomyolysis during BFR-RE compared to other forms of resistance exercise.<sup>[30]</sup> However, a recent systematic review analyzing the evidence about muscle damage after resistance training sessions with blood flow restriction suggests that the use of BFR at high loads of training until muscle failure leads to marked levels of muscle damage, and should be avoided. The findings emphasizes that the magnitude of the muscle damage seems to be attenuated after a first session of resistance training with BFR, demonstrating a protective load effect through this type of exercise. Therefore, professionals can use a principle of progressive overload in structuring resistance training with BFR programs in clinical contexts.<sup>[36]</sup>

#### Use of Tourniquets

By using the 3rd generation system the risk of tourniquet complication is very low, ranging from 0.04% to 0.8%. However, there is an inherent risk to tourniquet use. Some of the common complications<sup>[13]</sup> are:

- Nerve injury: Mechanical compression and neural ischemia play an important role.<sup>[37]</sup> Nerve injury can range from mild transient loss of function to irreversible damage and paralysis.
- Skin injury



- Tourniquet pain
- Chemical Burns
- Respiratory, Cardiovascular, Cerebral circulatory and hematological effects caused by prolonged ischemia
- Temperature changes

BFR training can be viewed as an emerging clinical modality to achieve physiological adaptations for individuals who cannot safely tolerate high muscular tension exercise or those who cannot produce volitional muscle activity. However, continued research is needed to establish parameters for safe application prior to widespread clinical adoption<sup>[7]</sup>. "Health care professionals must also make sure they have the proper training and are using the correct BFR equipment and pressure prescription techniques to ensure their patients' safety."<sup>[20]</sup>

## II. DISCUSSION

Blood flow restriction training, is a training method that involves use of a pneumatic cuff (like the ones a doctor uses to take blood pressure) to alter the blood flow into your limbs while you perform certain exercises. This style of training was actually discovered in the 70's by a man, Dr. Yoshiaki Sato, who had a full leg cast on after breaking his leg. For the 6 weeks that he had the cast on, he practised blood flow restriction training on his leg above the cast 2-3 times a day, and when the cast came off, he had maintained much of his muscle mass. By restricting blood flow on the limb using a cuff, we can reduce the amount of blood flowing out of the limb, but still allow blood to flow in. When we combine this with very light exercise/loading – such as lifting a light weight or even pedalling a bike, metabolites (what your muscles produce when they work) build up in the limb. This is beneficial, as BFRT “tricks” your body into believing it is working harder than it actually is due to the presence of the metabolites. In a rehabilitation setting such as at our Complete Physio clinics, this is vitally important as it allows us to achieve muscle strength/growth while not stressing damaged or vulnerable tissues (e.g. An arthritic knee, fractured ankle or post-surgical or an ACL) but still get significant benefits.

Normally we would have to wait for these tissues to heal before being able to load them to achieve these benefits. BFRT achieves these benefits by

- Increased release of Growth Hormone and lactate which drives muscle growth
- Increased Type II (a.k.a fast-twitch) muscle fibre activation which means increased muscle growth.
- Increased vascularisation of the tissue (i.e. more blood vessels) meaning your muscles are able to receive more oxygen. This improves cardiorespiratory performance and also means you recover from exercise quicker
- Increase heart rate which means there is a cardiovascular “cardio” training effect as well as the strength training effect[13,14,15]

The 3 main populations we use BFR on in the clinic are;

Post-operative patients

Patient following an ACL reconstruction, Achilles repairs, knee replacements and many other operations. We want to get the muscles around the area working and strong quickly, but this is difficult without being able to put too much force through the area.

By using BFRT we can use low load, protecting the vulnerable area, but still significantly train the muscles around it. Injured athletes (of all levels)

If you have an injured athlete and want to minimise time out of your sport, BFRT is a great tool.

While an athlete is injured and can't put high force through the injured area, we can use BFR to get high training effect at low load meaning we protect the injured area but still keep it strong.

Older deconditioned people – especially those with ARTHRITIS

Blood flow restriction training is great for getting the muscles around arthritic hips or knees strong, but without causing joint pain.

BFRT is also ideal for your patients who have lost strength in their legs and struggle now to raise from a chair, or maybe a falls risk.

In both these groups of people, BFRT gets great muscle training benefits at low loads – meaning we won't be irritating your arthritic joint.

Even just wearing the cuff at low pressure without exercise can be of benefit to those of very low strength or currently unable to move

But there are some people that cannot use BFRT, here's a list of common things (not all things) that may exclude someone from being able to use BFRT

- History of cardiac or vascular health issues
- Severe varicose veins
- Pregnancy
- Active infection
- Wounds

Your physiotherapist will ask you many questions about your health prior to any BFRT to assess if it is appropriate for you.

### III. RESULTS

The muscle fibres are basically of 3 types, namely Type I, Type IIa and Type IIb. The Type I are slow twitch fibres require an aerobic environment and get recruited during initial phases of exercise although they fatigue easily. They are used during endurance activities. The type IIa fibres are fast twitch fibres requiring anaerobic environment and come into action on moderate work out. Their fatigue rate is moderate. While type IIb fibres are fast twitch glycolytic muscle fibres recruited in short distance, high intensity activity. Normally, in strength training the Type IIb fibres are recruited at termination of the work-out and are mainly responsible for the muscle hypertrophy. But when practiced along with blood flow restriction the Type IIb fibres get early recruited due to an anaerobic environment and result in hypertrophy much earlier than anticipated. The supra-physiological benefits of exercise with BFR may be partially explained by the proliferation of satellite cells within connective tissue responsible for regeneration and growth [4]. Hence, BFRT is a very effective and efficient way of strength training in both the population, healthy and diseased.

BFRT in the recent years have been a highlight for its implications in combination with strength training used in patients for limb salvage and volumetric muscle loss in service members. Musculoskeletal conditions (MSK) are the most prevalent conditions clinically responsible for Muscular Weakness (MW) [8]. These conditions irrespective of being acute or chronic resulting from immobilization due to fractures or ligament tears may lead to muscle atrophy.[16,17,18]

#### 1. BFRT in ACL Reconstruction

Apart from the healthy population suffering from conditions, there are athletic population that are more prone to ACL tears or menisci tears, which may be life turning as they may have a hard time going back to vigorous training post reconstructive surgery. There is atrophy of muscles around the knee; especially knee extensor muscle accompanied by reduced muscle strength is early post-operative period. Prevention of muscle atrophy and early recovery of muscle strength have been reported to be associated with an early return to athletic activities [9].

#### 2. BFRT in Knee Osteoarthritis (OA)

Degenerative effects like loss of strength, reduced function, loss of muscle mass and difficulty in Quality of Life (QoL) seen in Osteoarthritis (OA) [10]. When correlated with increasing age of population more than 250 million adults globally are affected. MW is the most common complain which is seen not only in the affected population but even in the healthy population, mostly in elderly population. The etiology behind it may be sarcopenia (loss of physical function due to decrease in muscle mass, strength, vascular function due to decrease bone mineral density that occurs with ageing) [10].

#### 3. BFRT in Rheumatoid Arthritis (RA)

Auto-immune disease such as Rheumatoid Arthritis (RA) result in reduced muscle strength and mass when progressively loaded and patients suffering have a poor QoL. Due to chronic inflammation, physiologically there is acceleration in cellular catabolism which further lead to loss of muscle mass and dysfunction in muscular activity [5].

#### 4. BFRT in post-operative patients

In post-operative patient rehabilitation BFRT plays a crucial role. Literature has proven that post-fracture cast removal application of BFRT can alone augment the recovery of patient when used in an intermittent way (5 sets of 5 minutes inflation of cuff and 3 minutes deflation of cuff) [11]. To attenuate disuse atrophy during periods of chronic muscular unloading BFRT can be applied [12]. An aggressive approach for early rehabilitation is to perform BFRT twice daily for faster recovery.

#### 5. BFRT in Diabetes Mellitus (DM) patients

DM is a collection of a variety of other pathologies one of the major symptom may be vascular complications, mitochondrial function alteration in several tissues, including skeletal muscles corresponding to MW [13]. Preservation of muscle function is essential for metabolic health especially in individuals with Type 2 DM, a group of patients who are affected by increased cardiovascular risk and exacerbated progression of sarcopenia because diminished muscle mass and function are reduced glucose disposal capacity. Hence, exercise became the only treatment option available for treating the root cause [19].

### IV. CONCLUSION

This review throws light on the emerging importance of BFRT that has not been explored much. The utility of BFRT has been depicted in some recent studies. BFRT is a strength training program that helps patients to gain strength and attain hypertrophy of the muscles. Even in cases of amputations, BFRT may play a significant role to reach up to the level of prosthesis for better quality of life. The muscle strength and muscle cross-section are inter-linked and both play a crucial role in muscle reconditioning. The atrophy of muscles majorly depends on the loading and un-loading. Resistance training is the intervention of choice solely. The guidelines of ACSM states that for optimum strength training a weight of 70 per cent of 1 RM is required to note hypertrophy. Although new researches on the same have concluded that instead of the conservative intervention BFRT is enough to observe noticeable hypertrophy in all the population, healthy or athletic or bed-ridden patients. BFRT has various implications and is a novel strength training protocol creating windows for a new generation of physical therapy.[20]

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