

The Effects of Blood Flow Restriction Therapy Combined with Neuromuscular Electrical Stimulation on Adults



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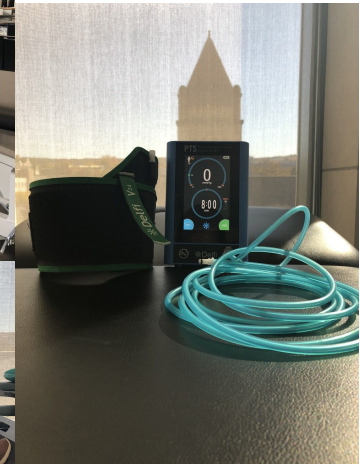
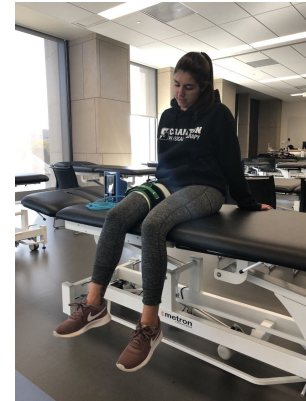
Overview

- Background
 - Blood Flow Restriction Therapy
 - Neuromuscular Electrical Stimulation
- Purpose
- Methods
- Results
- Conclusions
- Clinical Relevance



Blood Flow Restriction (BFR) Therapy

- **Definition**
 - The application of external pressure via tourniquets in order to occlude venous outflow while maintaining arterial inflow¹
- **Goal:** achieving greater strength gains while lifting lighter loads¹
- Effective and safe approach to stimulate muscle hypertrophy & strength gains in various clinical populations¹⁻⁵





Neuromuscular Electrical Stimulation

- **Definition**
 - Electrical currents applied through the skin to evoke muscle contractions²
- Effective in development of hypertrophy during prolonged periods of immobilization, through promotion of muscle protein synthesis⁵
- Published studies have investigated **synergistic effects** of BFR and NMES on muscle strength and hypertrophy
 - *No consensus* on outcomes of both interventions used concurrently²⁻⁵



Purpose

The purpose of this systematic review was to determine the effects of Blood Flow Restriction (BFR) therapy in conjunction with Neuromuscular Electrical Stimulation (NMES) on muscle hypertrophy and strength in adults.

Methods





Search Engines

- ProQuest Central
- PubMed
- CINAHL
- ScienceDirect

Search Limits

- Humans
- Peer-reviewed
- English
- Years 2009-2019



Search Terms

("blood flow restriction" **OR** "BFR")

AND

("NMES" **OR** "neuromuscular electrical stimulation")

AND

(strength **OR** hypertrophy)



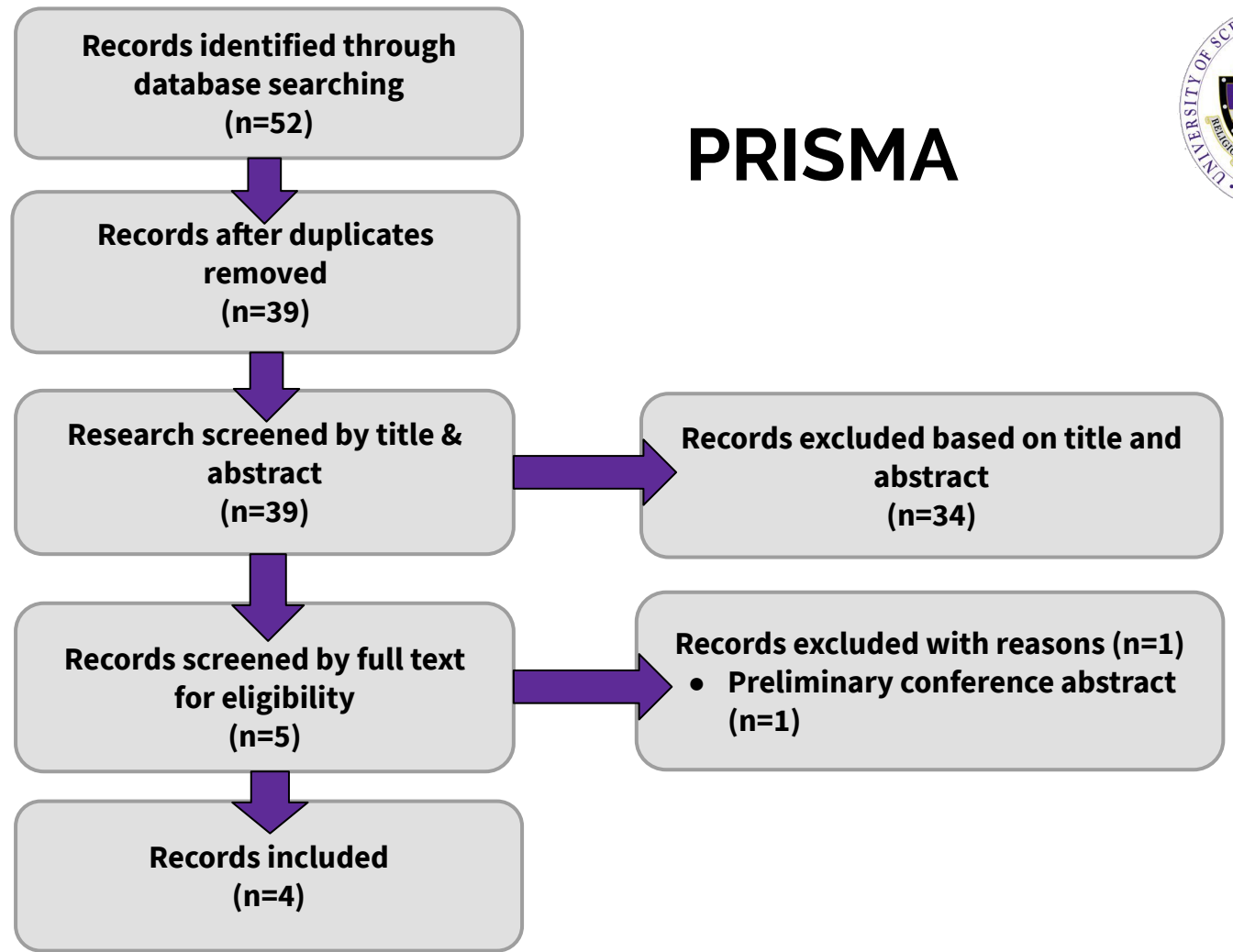
Selection Criteria

- Male or Female
- Adults 18+
- Intervention
 - Must include **BFR+NMES** with or without co-intervention
- Outcomes
 - Must include **muscle thickness** and **isometric strength**
- Study design
 - Any design



PRISMA

Identification
Screening
Eligibility
Screening





Quality Assessment

ARTICLE	MINOR SCALE SCORE*
Gorgey ³	20/24
Slyz ⁵	20/24
Natsume ²	19/24
Andrade ⁴	16/24

*Ideal score is 16 for non-comparative studies and 24 for comparative studies

Results





Results

- **Four** studies were included
- MINOR Scale scores ranged from **16-20** (avg: 18.75)
- Samples varied from **7 to 20 subjects**²⁻⁵ (n=44) who were either **untrained, recreationally active,** or **individuals with incomplete SCI**



Results

- BFR+NMES protocol was performed **2-5 times a week** (10-32 minutes/session) for **2 or 6 weeks**²⁻⁵
- One study used **upper extremity**³ and three used the **lower extremity**^{2,4,5}
- BFR inflation levels **varied** from 100 mmHg, 30% greater than resting systolic pressure, or 220 mmHg²⁻⁵
- NMES **frequency** ranged from 20-100 Hz and **pulse** from 400-450 ms²⁻⁵



Outcomes

Study	Outcome Measures
Gorgey ³	<ul style="list-style-type: none">- Cross sectional areas of ECRL and EDC via ultrasound- Wrist extensor strength via Biodex Isokinetic Dynamometer- Hand grip- Grasp-release test
Slyz ⁵	<ul style="list-style-type: none">- Mean differences in quadriceps muscle mass via DEXA scan- Isometric quadriceps strength measured via custom-designed leg strain measurement device with high-sensitivity strength gauge
Natsume ²	<ul style="list-style-type: none">- Quad muscle thickness via ultrasound and thigh circumference using tape measure- Isometric and isokinetic strength via Biodex system dynamometer
Andrade ⁴	<ul style="list-style-type: none">- Unilateral isometric strength assessment via heel raise machine- 3 trials of 5 second maximal voluntary isometric contraction- Muscle thickness via ultrasound



Key Findings

- No adverse effects were reported in any of the four studies²⁻⁵
- One study noted a *statistically significant increase* in muscle strength, but *not* muscle mass⁵
- Two studies found *statistically significant increases* in the primary outcomes of muscle thickness [(P<0.0014)²; (P=0.003)³] and isometric strength [(P<0.054)²; (P=0.048)³]
- One study found *no statistical difference* with use of BFR + NMES⁴

Conclusions & Clinical Relevance





Conclusions

- There was **low to moderate** evidence that BFR+NMES increases muscle hypertrophy and strength
- **Limitations**
 - Small sample size
 - Varying parameters regarding BFR and NMES protocols, populations, and muscle groups
 - Inconsistent primary outcome measures
- **Future Research**
 - Needed to formally assess and outline most effective protocols for BFR+NMES



Clinical Relevance

- Used *alone*: **both** BFR and NMES have demonstrated beneficial therapeutic effects in an array of medical conditions^{1,6}
- BFR+NMES is **safe** and **feasible**
- BFR+NMES is **more beneficial** than solely one or the other
- Consider use of BFR+NMES with patients with **significant muscle weakness** and **atrophy**



References

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Questions?