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Si ^b j aVi ^dc dc 7Yj a h



Matthew Aitken SPT
Sophia Di Camillo SPT
Holly Hilbrandt SPT
Christine Kiefer SPT

Peter Leininger PT, PhD, Board-Certified
Clinical Specialist in Orthopedic Physical Therapy

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Background

Blood Flow Restriction Therapy

Neuromuscular Electrical Stimulation

Purpose

Methods

Results

Conclusions

Clinical Relevance



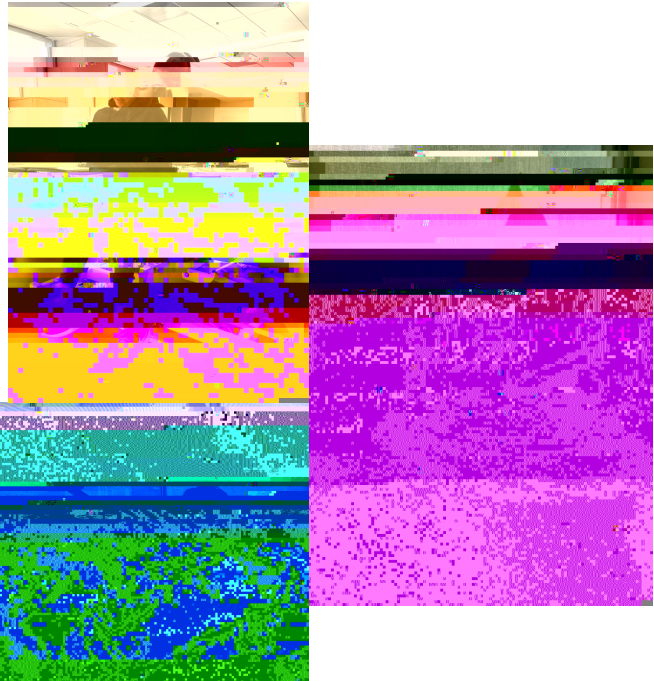
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Definition

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



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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

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ProQuest Central

PubMed

CINAHL

ScienceDirect

SZVgX] B^b ↑h

Humans

Peer-reviewed

English

Years 2009-2019



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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

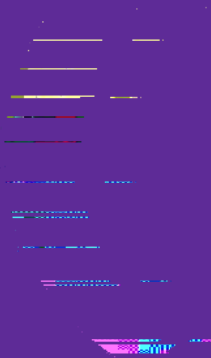


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ARTICLE	MINOR SCALE SCORE*
Gorgey ³	20/24
Slyz ⁵	20/24
Natsume ²	19/24
Andrade ⁴	16/24

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

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Four studies were included

MINOR Scale scores ranged from 16-20 (avg: 18.75)

Samples varied from 7 to 20 subjects²⁻⁵ (n=44) who were either untrained, recreationally active, or individuals with incomplete SCI



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BFR+NMES protocol was performed 2-5 times a week (10-32 minutes/session) for 2 or 6 weeks²⁻⁵

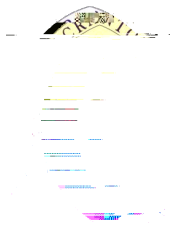
One study used upper extremity³ and three used the lower extremity^{2,4,5}

BFR inflation levels varied from 100 mmHg, 30% greater than resting systolic pressure, or 220mmHg²⁻⁵

NMES frequency ranged from 20-100Hz and pulse from 400-450ms²⁻⁵

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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 voluntarossa heel oss sec achine-



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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

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9dcXaj h^dch

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



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Peter Leininger PT, PhD, Board-Certified Clinical Specialist in Orthopedic Physical Therapy

Tracey Collins PT, PhD, MBA, Board-Certified Clinical Specialist in Geriatric Physical Therapy

Renée Hakim PT, PhD, Board-Certified Clinical Specialist in Neurologic Physical Therapy

The University of Scranton DPT Faculty, Staff, and Students



Gj Zhi ^ dch5