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

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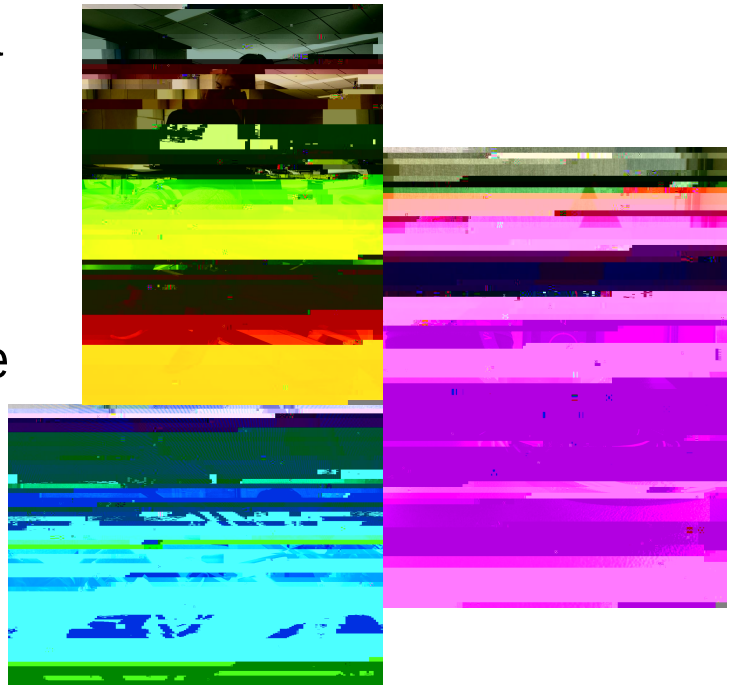
- Definition
  - The application of external pressure via tourniquets in order to occlude venous outflow while maintaining arterial inflow[1]
- Goal: achieving greater strength gains while lifing lighter loads[1]
- Effective and safe approach to stimulate muscle hypertrophy & strength gains in various clinical populations[1-5]



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- Definition
  - Electrical currents applied through the skin to evoke muscle contractions[2]
- E ective in development of hypertrophy during prolonged periods of immobilization, through promotion of muscle protein synthesis[5]
- Published studies have investigated synergistic e ects of BFR and NMES on muscle strength and hypertrophy
  - *No consensus* on outcomes of both interventions used concurrently[2-5]

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- ProQuest Central
- PubMed
- CINAHL
- ScienceDirect

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- 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 subjects[2-5] (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 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 mmHg[2-5]
- NMES frequency ranged from 20-100 Hz and pulse from 400-450 ms[2-5]

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Study	Outcome Measures
Gorgey[3]	- Cross sectional areas of ECRL and EDC via ultrasound - Wrist extensor strength via Biodex Isokinetic Dynamometer - Hand grip - Grasp-release test
Slyz[5]	- Mean di erences 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]	- Quad muscle thickness via ultrasound and thigh circumference using tape measure - Isometric and isokinetic strength via Biodex system dynamometer
Andrade[4]	- Unilateral isometric strength assessment via heel raise machine - 3 trials of 5 second maximal voluntarossea heeĨ oss sec achine -

Mfz Hjoejoht

- No adverse e ects were reported in any of the four studies[2-5]
- One study noted a *statistically significant increase* in muscle strength, but *not* muscle mass[5]
- 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 di erence* with use of BFR + NMES[4]

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- 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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