Use of Blood Flow Restriction Training to Augment Activity-Based Training for a Patient with Chronic Incomplete Spinal Cord Injury: A Case Report

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Introduction & Purpose

Background: Regaining optimal function is a primary goal for individuals who experience a spinal cord injury.[1] Activity-based therapy (ABT) focuses on the retraining of the nervous system to accomplish a motor task. Blood flow restriction training (BFRt) is an emerging mode of training for persons with neurologic conditions. BFRt may promote neuro recovery when paired with ABT.

Introduction:

Purpose: To report on the feasibility of using BFRt to augment ABT and to assess the impact on the level of functional mobility for a person with chronic incomplete spinal cord injury (iSCI).

- BFRt allows individuals to achieve muscular adaptations similar to those seen with high-intensity training, while using significantly lower loads, such as 20–30% of one-repetition maximum. The cuff acts as a partial barricade for the blood to pass through to the limb, which gives an ischemic-like effect. The combination of the two causes metabolic stress on the exercising muscle fibers and encourages hypertrophy and strength in the muscle.

Methodology

Design & Methods: Single-subject case report using pre- and post-testing of functional outcomes. Interventions included BFR training using 40% occlusion pressure, paired with gait training and functional strengthening twice a week for 7 weeks.

Participant: A 27-year-old male status post 2 years of ASIA C T2 iSCI resulting from a fall from a substantial height. Before the initiation of BFRt, the patient had participated in physical therapy across various hospital settings, gaining independence with wheelchair activities while still requiring physical assistance for ambulation and prolonged standing tasks.

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Blood Flow Restriction Training ***can be*** an effective adjunct to activity-based therapy for persons with incomplete spinal cord injuries.

B Strong BFR Training Device

Subject Performing Sit-to-Stand with BFR application

Results

Outcomes:	Baseline Measures: 2/14/2025	Final Measures: 4/4/2025	MDC & MCID Value
Gait speed- 10 meter walk test	0.35 m/s rolling walker and R AFO	0.44 m/s bilateral Lofstrand crutches – w/o AFO*	MDC: 0.10 m/s[3]
6 minute walk test	222 ft. w/ rolling walker and R AFO	427 ft. w/ Lofstrand crutches and w/o AFO*	MDC: 150 ft/45.8m[4]
Timed Up and Go (TUG)	21.39 sec. w/ rolling walker and R AFO	16.23 sec. w/ Lofstrand crutches and w/o AFO's*	MDC: 10.8 sec
Berg Balance Scale	38/56	45/56*	MDC – 2.5 pts
Single Leg Stance- Solid ground	0 sec.	4 sec.	n/a
5x sit to stand: from 22in height *on 4/4 from 20in height	13.91 sec.	9.12 sec.	n/a
Modified Ashworth Scale	3+	2+	n/a
Tardieu Scale- Gastrocnemius	R1- negative 5 degrees R2- 0 degrees	R1- 0 degrees R2- 8 degrees	n/a

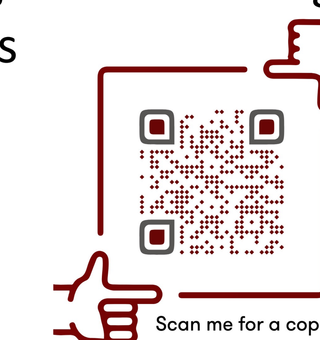
Protocol

Equipment: BFR "B strong" cuff – red cuff size, and manual inflation device. The occlusion pressure was found and confirmed via Doppler at 150mmHg at 40% of occlusion pressure.

Protocol: Seen a total of 4 sessions a week with BFR training intervention performed twice a week on non-consecutive days to allow for proper muscle recovery and patient safety. The red B strong cuff was used and placed on the mid-thigh of their R lower extremity with an occlusion pressure of 60 mmHg. BFR training was performed at the end of the 90-minute session. Exercises performed with the BFR cuff on were sit to stands with a pilates ball between the knees from a 22-inch seat height, following the 30-15-15 repetitions protocol,[2] followed by 2x50 feet ambulation using Loftstrand crutches. Each session was a total of 90 minutes, with 10 minutes at the end of the session under occlusion to perform the exercises. Tolerance was assessed via patient-reported feedback, observation of skin integrity, and observation of patient fatigue.

Discussion & Further Research

- Application of BFR training for a patient with iSCI was feasible and without adverse events. The patient's satisfaction with the outcomes and further continued use of BFR training was positive.
- Patient demonstrated improvements with functional outcome measures and progressed to the least restrictive device.
- Patient discontinued use of baclofen.
- Limitations: It would have been beneficial to measure the strength of muscle groups with strength dynamometry, vs. MMT.
- A larger intervention group with various neurological conditions to explore the application across conditions
- , A conservative approach was taken for occlusion pressure, and the patient was participating in other strengthening interventions



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