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## Effect of blood flow restriction training combined with resistance training in alleviating symptoms of early knee osteoarthritis: A single case report

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### Abstract

**Background:** Knee osteoarthritis is a prevalent degenerative joint disease, especially in older adults, marked by stiffness, pain reduced mobility and functional limitations. While resistance training is a standard conservative management approach, high load exercises may aggravate joint symptoms. Blood flow restriction (BFR) Training allows for low load exercises that can induce muscular adaptations compared to traditional strength training. This case report investigates the effect of combining BFR with resistance training in managing early knee OA symptoms.

**Aim:** To assess the effect of blood flow restriction training combined with low-load resistance training in reducing pain, improving range of motion, muscle strength, and functional mobility in a patient with early-stage knee osteoarthritis.

**Methodology:** A 52-year-old female with early-stage right knee osteoarthritis (Grade 2, Kellgren-Lawrence classification) was enrolled. She received BFRT (15 min/session) with 132 mmHg pressure and low-load resistance training (2 kg, 40% 1RM) for 3 sessions/week over 4 weeks. Outcomes assessed at baseline, 2nd week, and 4th week included pain (NRS), function (WOMAC), quadriceps strength (MMT), and range of motion (goniometry). A home exercise program was also prescribed.

**Results: Pain (NRS):** Decreased from 7/10 (activity) and 6/10 (rest) at baseline to 3/10 and 2/10, respectively, at week 4.

**WOMAC Total Score:** Improved from 73/90 at baseline to 35/90 at week 4.

**MMT (Quadriceps):** Improved from Grade 3+ to Grade 5.

**ROM:** Flexion improved from 100° to 130°; extension lag reduced from 10° to 0°.

**Conclusion:** Combining BFRT with resistance training significantly reduced pain, improved functional mobility, muscle strength, and joint range in a patient with early knee OA. It offers a safe, effective alternative to high-load training and can be considered a valuable early intervention strategy. Further studies with larger samples are warranted to confirm these findings.

**Keywords:** Knee osteoarthritis, BFRT, resistance training, physical therapy

### Introduction

Knee osteoarthritis (OA), also known as degenerative joint disease of the knee, is typically the result of wear and tear and progressive loss of articular cartilage. It is most common in the elderly. Knee osteoarthritis can be divided into two types, primary and secondary. Primary osteoarthritis is articular degeneration without any apparent underlying reason. Secondary osteoarthritis is the consequence of either an abnormal concentration of force across the joint as with post-traumatic causes or abnormal articular cartilage, such as rheumatoid arthritis (RA) [2]. Osteoarthritis is typically a progressive disease that may eventually lead to disability. The intensity of the clinical symptoms may vary from each individual. However, they typically become more severe, more frequent, and more debilitating over time [3]. The rate of progression also varies for each individual. Common clinical symptoms include knee pain that is gradual in onset and worse with activity, knee stiffness and swelling, pain after prolonged sitting or resting, and pain that worsens over time [2]. Osteoarthritis affects about 595 million of the population, which is about 7.6% of the population globally in 2020 [4].

**Blood flow restriction training** Blood flow restriction (BFR) is an expanding rehabilitation modality that uses a tourniquet or a sphygmomanometer to reduce arterial inflow and occlude venous outflow in the setting of resistance Training or exercise. BFR represents a way to decrease stress placed on the joints without compromising improvements in strength, whereas for postoperative, injured, or load-compromised individuals BFR represents a way to accelerate recovery and prevent atrophy [5]. Resistance training is any type of physical activity that employs exercise of a muscle, or group of muscles against external resistance with the final goal of improving muscular strength, endurance or power [7]. Resistance exercise (RX) has been shown to be an effective intervention both for decreasing pain and for improving physical function and self-efficacy. RX may restore muscle strength and joint mechanics while improving physical function. RX may also normalize muscle firing patterns and joint biomechanics leading to reductions in joint pain and cartilage degradation [6].

### Objectives

1. To evaluate the impact of BFR training on pain relief, joint function, and muscle strength in patients with early knee OA.
2. To assess the effectiveness of resistance training in improving physical function, reducing pain, and increasing muscle strength in patients with early knee OA.

### Research Methodology

**a) Subject Selection Source:** Knee osteoarthritis participants are screened for eligibility from orthopaedics OPD of UPUMS, Safai. After satisfying inclusion and exclusion criteria, the participants are enrolled in the study.

### b) Subject Selection Criteria

#### Inclusion Criteria

1. Age group: 45 - 70 yrs.
2. Patient with both unilateral and bilateral knee pain.
3. **Patients in early phase:** (Grade 1 and 2), (According to Kellgren Lawrence classification).
4. No contraindication to physical activity or electrical stimulation.
5. Both male and female.

#### Exclusion Criteria

1. Metabolic bone disorders.
2. Use of corticosteroids or local injections for knee OA in past 6 months.
3. Skin diseases.
4. Patient with cardiovascular diseases.
5. Patient with other arthritis like RA.
6. Patients with bony ankyloses.
7. Neuropathic joint diseases.
8. History of trauma.

**Research Design:** A Single case report design with pre and post treatment evaluation to assess the efficacy of Blood flow restriction training and resistance training in alleviating symptoms in early knee osteoarthritis.

### Participant Details

- The subject of this single case study was a 52-year-old female, a homemaker who presented to orthopedics OPD of UPUMS with chief complain of pain over Rt. Knee

from past 10 months. The pain was insidious in onset and progressively worsened over time, accompanied by joint stiffness and noticeable swelling. The symptoms are particularly aggravated during activities involving weight bearing and joint movement, such as stair climbing and prolonged standing and walking, significantly affecting her daily functional mobility and quality of life. In OPD comprehensive clinical and radiological evaluation was done, where she was diagnosed with Knee OA.

- Additionally, there was no history of trauma or any metabolic bone disorder or arthritis like RA and no surgical history related to the affected knee.
- Afterward she was referred to physiotherapy OPD.
- After meeting the inclusion and exclusion criteria and doing the baseline assessment.
- A treatment Plan was explained to her and written consent was obtained.

### Interventions

#### Blood Flow restriction training (BFRT)

- The Patient was given BFRT for 15 mins. The cuff then applied at proximal thigh after measuring the blood pressure of the patient and accordingly we apply pressure according to the (Australian sports commission guidelines).
- The Blood pressure of the patient was 110/80 mmhg. So, the pressure applied was 132 mmhg. And released intermittently between the sets.

#### Resistance training

The Resistance Training given to the patient, after calculating 1 RM of the patient which was 5 kg, so 40 % of 1 RM was 2kg, thus leg extensions with 2 kg wt. cuff in sitting was given (according to Australian sports commission guidelines). A total of 4 sets will be given consecutively as 30, 15, 15 and 15 at an interval of 3 minutes for tissue reperfusion [7].

**Session Frequency:** 3 Sessions per week for 4 weeks [8].

#### Home exercise program

1. Isometric Quadriceps exercise.
2. Dynamic Quadriceps drill with 2 kg weight.
3. Hamstring stretching with theraband.
4. 20 repetitions of each exercise 3 times a day for 4 weeks.

#### Procedure

- Patients diagnosed with early knee osteoarthritis (OA) from Orthopaedics (OPD).
- Baseline assessment.
- Clinical evaluation of patient's knee function using tools such as NRS for pain, the western McMaster universities osteoarthritis index (WOMAC) for physical function and a goniometer for ROM Measurement and Strength from (MMT).
- **Preparation:** Obtain informed consent from the patient, explaining the procedure for intervening Blood flow restriction training, its potential benefits and adverse effects, along with explaining the resistance training procedure.

### Outcome Measures

**Table 1:** Pain intensity: NRS

NRS score	At base line	At 2 <sup>nd</sup> week	At 4 <sup>th</sup> week
0-10	7/10 (activity) 6/10(rest)	5/10(activity) 4/10 (rest)	3/10 (activity), 2/10(rest)

## 2. Functional Disability: WOMAC

(WOMAC) Western Ontarian McMaster Universities Osteoarthritis Index. Is extensively used in clinical practice for pain assessment and functional disability.

**Table 2:** Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

Session no.	Pain subscale score:(0-20)	Stiffness subscale score (0-10)	Physical function score (0-68)	Total WOMAC Score (0-96)
At Baseline	15	8	50	73/90
At 2 <sup>nd</sup> week	10	6	41	57/90
At 4 <sup>th</sup> week	4	3	28	35/90

## 3. Manual Muscle Testing (MMT)

**Table 3:** Quadriceps Strength (Grade 0-5)

MMT	At baseline	At 2 <sup>nd</sup> week	At 4 <sup>th</sup> week
Grade 0-5	Grade 3+	Grade 4	Grade 5

**Table 4:** Range of motion: Goniometer

Movement	Normal Range	At baseline	At 2 <sup>nd</sup> week	At 4 <sup>th</sup> week
Flexion	120°-150°	100°	115°	130°
Extension	0°	10° extn lag	5° extn lag	0°

## Clinical Implications

- Safe alternative to high load training:** BFR allows the use of low load resistance exercises to achieve strength gains and making it suitable for patients who cannot tolerate high mechanical stresses on the knee joint.
- Early intervention strategy:** Incorporating BFR in early-stage Knee OA can slow disease progression and improve joint function, potentially delaying or avoiding surgical interventions like Total knee replacement.
- Enhanced Muscle Activation:** The combination of BFR and resistance training may help target muscle atrophy, especially in the quadriceps, which plays a critical role in knee stabilization and symptom reduction in knee OA.
- Foundation for Further Research:** Encourages Clinicians and researchers to explore BFR as a component in multi-modal treatment strategies for early knee OA and other degenerative joint conditions.

## Results

BFRT with Resistance Training significantly reduced pain and improved function.

Enhances muscle strength with lower training loads.

## Pain (NRS)

Decreased from 7/10 (activity) and 6/10 (rest) at baseline to 3/10 and 2/10, respectively, at week 4.

## WOMAC Total Score

Improved from 73/90 at baseline to 35/90 at week 4.

## MMT (Quadriceps)

Improved from Grade 3+ to Grade 5.

**ROM:** Flexion improved from 100° to 130°; extension lag reduced from 10° to 0°.

## Conclusion

BFRT Combined with Resistance Training is an effective strategy for early OA management, helps in pain reduction, better functional mobility and improved quality of life.

Future research should explore long term benefits and larger populations.

## References

- Hughes L, Paton B, Rosenblatt B, Gissane C, Patterson SD. Blood flow restriction training in clinical musculoskeletal rehabilitation: a systematic review and meta-analysis. *Br J Sports Med.* 2017;51(13):1003-1011. <https://doi.org/10.1136/bjsports-2016-097071>
- Centner C, Wiegel P, Gollhofer A, König D. Effects of blood flow restriction training on muscular strength and hypertrophy in older individuals: A systematic review and meta-analysis. *Sports Med.* 2019;49(1):95-108. <https://doi.org/10.1007/s40279-018-0994-1>
- Waller B, Ogonowska-Slodownik A, Vitor M, Lambeck J, Daly D, Kujala UM, *et al.* Resistance training for knee osteoarthritis. *Cochrane Database Syst Rev.* 2020;2020(7):CD007912. <https://doi.org/10.1002/14651858.CD007912.pub3>
- Ferraz RB, Gualano B, Rodrigues R, Roschel H, Fernandes Cruz AL, Lima FR, *et al.* Benefits of resistance training in patients with knee osteoarthritis: A randomized controlled trial. *Scand J Med Sci Sports.* 2018;28(1):55-63. <https://doi.org/10.1111/sms.12907>
- Tennent DJ, Hyldahl RD, Johnson AE, Hsu JR. Blood flow restriction training after knee surgery: Indications, safety considerations, and postoperative protocol. *Arthrosc Tech.* 2017;6(5):e913-e918. <https://doi.org/10.1016/j.eats.2017.03.006>
- Bennell KL, Hunt MA, Wrigley TV, Lim BW, Hinman RS. Role of muscle strengthening in the management of knee osteoarthritis. *Rheum Dis Clin North Am.* 2008;34(3):731-754.
- Tennent DJ, Hyldahl RD, Johnson AE, Hsu JR. Blood flow restriction training after knee surgery: indications, safety considerations, and postoperative protocol. *JBJS Rev.* 2017;5(10):e10.
- Vaegter HB, Handberg G, Graven-Nielsen T. Similarities between low-frequency electrical stimulation and manual pressure on pain intensity and descending pain control: a randomized cross-over trial. *Eur J Pain.* 2015;19(1):59-66.
- Bijlsma JWJ, Berenbaum F, Laffey FPJG. Osteoarthritis: an update with relevance for clinical practice. *Lancet.* 2011;377(9783):2115-2126.
- Bennell KL, Wrigley TV, Hunt MA, Lim BW, Hinman RS. Role of muscle strengthening in the management of knee osteoarthritis. *Rheum Dis Clin North Am.* 2011;37(1):53-71.