Blood Flow Restriction Training For Intractable Patellar-Femoral Joint Pain: A Service Development.

Alex Boe, Eve Stringer, Jon Priest, Ifan Eirug, Dr Jason Pedley, John Rice.

Background

Patella Femoral Joint Pain (PFJP) is a common condition for which the main treatment is quadricep strength training. However, the high loads of traditional strength training can be too painful to tolerate for some PFJP patients. It has been suggested that weight training with lighter loads while using an inflatable cuff to partially occlude blood flow to the leg, or Blood Flow Restriction Training (BFRT), may be better tolerated and more effective. Therefore, we developed a BFRT service for PFJP patients who could not tolerate standard heavier load training.

Funding and collaboration

We received funding from the CTMUHB R&D department to buy a hand held dynamometer and 4 occlusion cuffs. We applied for and received funding from the CTMUHB Innovation department as part of the SIPS project, and collaborated with Dr Jason Pedley and Mr Ifan Eirug from Cardiff Metropolitan University.

Aims

- Evaluate the efficacy of BFRT on subjective measures of knee health in patients with intractable PFJP using the Knee Injury and Osteoarthritis Outcome Score (KOOS-12).
- Assess the effect of BFRT on isometric quadriceps strength.

Method

We performed a literature review and generated an information sheet and patient consent form with an exclusion criteria to minimise risk (Minniti et al, 2020). Our patient group were those aged 18 to 60 years old who attended MSK outpatient physiotherapy for PFJP that had been present for more than 12 weeks and was not improving with traditional physiotherapy (manual therapy and exercise).

BFRT involved the patient attending the physiotherapy department twice a week, for a six week programme. Our outcome measures of the KOOS-12 questionnaire and quadriceps strength were taken in their first and last sessions. Peak isometric knee extension force was assessed in a seated position at a knee angle of 90 degrees using a handheld dynamometer. We chose quadriceps strength testing as it is a key treatment for PFJP and KOOS-12 as it is a validated score for knee pain.

Each session started with a five-minute warm up on a static bike. The occlusion cuff was then placed around the proximal thigh of the affected leg. The cuff was inflated in the start position of the exercise to be performed to a subjective tightness of 7/10 (but no more than 250mmHG) and remained inflated for all sets of that exercise. It was deflated and re-inflated in the start position of the next exercise. The exercises in each session were a single leg (SL) leg press, SL knee extension and a body weight split squat. To identify training loads, the exercises were performed at approximated 30% of the maximal weight lifted with minimal pain. For each exercise, they performed one set of 30 repetitions, then two sets of 15 repetitions (or to volitional fatigue), with a 30 seconds rest between sets.

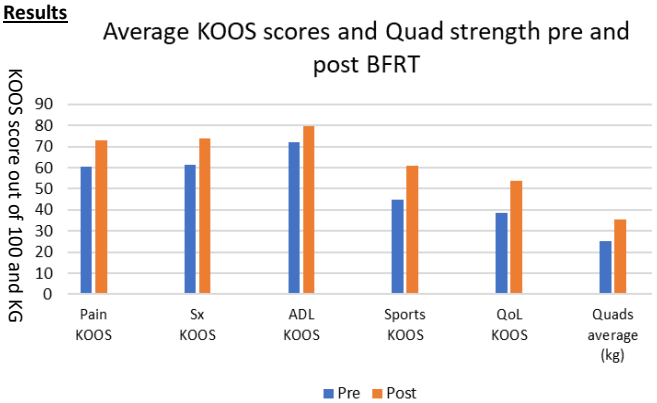
Once they had completed the six week programme, they then continued with usual physiotherapy input and rehabilitation.

Dynamometer testing of quadriceps strength.

Inflating of an occlusion cuff.

Blood flow restriction training during a SL leg press.

Results



	Mean Increase KOOS score/KG	Pooled SD	Effect Size (Cohens *d*)	95% CI	P value
Quadriceps	10.27	6.27	1.64	5.14-15.40	0.005
KOOS Pain	8.89	13.73	0.89	-4.77-22.55	0.15
KOOS Symptoms	7.85	14.67	0.84	-7.95-23.65	0.24
KOOS ADL	5.58	14.86	0.51	-4.96-16.12	0.22
KOOS sports	10.00	25.30	0.63	-7.56-27.56	0.19
KOOS QOL	12.49	20.24	0.74	-8.76-33.74	0.18

Discussion

The number of PFJP patients who received the BFRT was low (n=5). This is likely because clinicians and patients chose to use traditional strengthening exercise if it was tolerated.

We found BFRT meaningfully improved all KOOS subsections (pain, symptoms (Sx), quality of life (QoL), ability to engage in sport and perform activities of daily living (ADLs)), however these improvements did not reach statistical significance.

BFRT had a significant effect on quadriceps strength, with a mean improvement of 10.27kg or 40.6% (p=0.005). These improvements allowed the patients to resume usual physiotherapy, and following this all but one returned to their normal level of activities which included gym based exercise and impact based activities.

Research on the effectiveness of BFRT for PFJP has been limited, with only one good quality RCT investigating the effect of BFRT in PFJP patients found (Giles et al, 2017). These authors found an improvement in ADL function with BFRT compared to standard training, and also found that a sub-group of patients with pain on resisted knee extension had improvement in quadriceps strength greater than the standard training group (Giles et al 2017).

Our patients were typically those who could not tolerate standard loading due to pain, so this may be why our quadricep strength improvements were so large. BFRT has been shown to produce an immediate hypoalgesic effect on knee pain, which may be why PFJP patients with more pain show better results with BFRT (Giles et al, 2017; Korakakis et al, 2018).

Due our positive findings, BFRT is a treatment option that we will continue to use in MSK physiotherapy for intractable PFJP.

References

Constantinou, A. Mamais, I. Papathanasiou, G. Lamnisos, D. Stasinopoulos, D. (2022) 'Comparing hip and knee focused exercises versus hip and knee focused exercises with the use of blood flow restriction training in adults with patellofemoral pain', *European Journal of Physical Rehabilitation Medicine*, 58(2),225-235.

Cuyul-Vásquez, I. Leiva-Sepúlveda, A. Catalán-Medalla, O. Araya-Quintanilla, F. Gutiérrez-Espinoza, H. (2022) 'The addition of blood flow restriction to resistance exercise in individuals with knee pain: a systematic review and meta-analysis', *Brazilian Journal of Physical Therapy*, Nov-Dec;24(6),465-478.

Giles, L. Webster, KE. McClelland, J. Cook, JL. (2017) 'Quadriceps strengthening with and without blood flow restriction in the treatment of patellofemoral pain: a double-blind randomised trial', *British Journal of Sports Medicine*, 51(23),1688-1694.

Korakakis, V. O'Sullivan, K. Whiteley, R. Grantham, B. (2020) Second letter to the Editor about the article 'The addition of blood flow restriction to resistance exercise in individuals with knee pain: a systematic review and meta-analysis', *Brazilian Journal of Physical Therapy*, 24(6),562-564.

Minniti, MC. Statkevich, AP. Kelly, RL. (2020) 'The safety of blood flow restriction training as a therapeutic intervention for patients with musculoskeletal disorders: a systematic review', *The American Journal of Sports Medicine*, 48(7):1773-1785.