Exploring effects of cryotherapy modalities on pain, muscle strength and joint position in healthy participants with experimentally induced knee pain

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Purpose:

In the current guidelines for acute injury management 'optimal loading' has been introduced to facilitate early activity to optimise recovery. Although studies have identified potential adverse effects on muscle performance and knee joint repositioning following ice, evidence supports the use of cryotherapy to provide short-term pain relief. Cryotherapy interventions which can provide short-term pain relief, yet minimise adverse effects, would allow early activity with a lower risk of injury. This study utilised a targeted compressive-cryotherapy approach on experimentally induced knee pain in healthy participants and explored the effects on muscle strength and joint position sense.

Methods:

Ten healthy participants (7 females, 3 males; 32.9 ± 11.6 years) were induced with experimental knee pain using capsaicin cream (0.075%). Topical capsaicin is a common experimental pain method and was applied to the participant's skin on the medial aspect of the non-dominant knee. A randomised crossover design was adopted, exploring two 20-minute cryotherapy interventions, (1) ice (wetted: 400g cubed ice, 400ml water) and (2) Swellaway (10°C, 50mmHg compression), during separate testing sessions. Four outcome measures were explored: i) participant-reported numerical pain rating scale (NPRS), ii) pressure pain threshold (PPT), iii) quadriceps muscle strength and iv) joint position sense (JPS). These outcomes were recorded at four time points: pre-capsaicin cream application (T1), post-capsaicin (T2), post-cooling intervention (T3) and 20-minutes post-cooling (T4). Repeated measures ANOVAs (3x2) with post-hoc pairwise comparisons were used to assess change in outcomes between time points.

Results:

Complete pain relief (≥93% pain reduction) was achieved immediately post-cooling in 7 participants for Swellaway and in 4 participants for ice. Participant NPRS was reduced by 100% (Swellaway) and 91% (ice) 20-minutes post-cooling. No statistically significant differences were found in short-term pain relief between interventions. Significant increases in PPT were found between post-capsaicin and post-cooling (27% increase) and between post-capsaicin and 20-minutes post-cooling (20% increase) following Swellaway. No significant differences were found in PPT between any time points following ice.

Ice reduced quadriceps strength by 13% immediately post-cooling. Swellaway had a negligible effect on muscle strength immediately post-cooling (+0.3%). The strength deficit post ice was almost double the percentage reduction (6%) associated with clinically important functional deficits in people with knee osteoarthritis. Significant increases were found in range of motion (ROM) in the coronal plane following ice, which indicates increased instability (adduction/abduction). Despite not

being statistically significant, a trend of increased instability (14%) in the transverse plane ROM 20-minutes post-cooling was most apparent following the ice (p=0.053).

Conclusion(s):

Targeted compressive-cryotherapy has the potential to achieve short-term pain relief, as demonstrated on healthy participants with experimentally induced knee pain. The results suggest a targeted approach can also minimise the negative effects on muscle strength, dynamic stability and knee joint repositioning, which may traditionally have discouraged early optimal loading post cryotherapy. This would allow individuals to return to weight-bearing rehabilitation exercises earlier, at a lower risk of re-injury post-intervention.

Impact:

Clinicians could consider utilising targeted compressive-cryotherapy to provide a short-term pain relief and minimise the reported adverse effects following cryotherapy, facilitating early weight-bearing rehabilitation.

Keywords

Cryotherapy, Compression, Rehabilitation

Funding acknowledgments

This research was carried out as part of a Knowledge Transfer Partnership between Manchester Metropolitan University, University of Central Lancashire and Swellaway.