Effectiveness of Direct Contact Cryotherapy vs Cryo-Compression Units On Decreasing Intramuscular and Skin Tempeatures

Ostrowski J*, Bartoletti M†, Leisinger J†, Purchio A†: *Moravian College, Bethlehem, PA, †Weber State University, Ogden, UT

Context: Previous research has found ice-bags are more effective at lowering intramuscular temperature than other cryotherapy modalities (whirlpool, ice cup). Recent research has demonstrated salted-ice-bags (1/2-tbsp salt) are superior to traditional ice-bags. Limited studies have evaluated intramuscular temperature cooling decreases of ice-bag versus cryo-compression modalities. Objective: Evaluate rate and magnitude of cooling using salted-ice-bags(IB), GameReady(GR), PowerPlay ice-bag(PP-ice), PowerPlay gel-pack(PP-gel) on intramuscular temperature(2cm sub-adipose). Hypotheses: IB will result in faster cooling, greater magnitude of cooling, and longer rewarming times compared to GR (IB>GR); GR>PP-ice; PP-ice>PP-gel. Design: Repeated-measures counterbalanced crossover trial. Setting: University research laboratory. Patients or Other Participants: 12 healthy participants (4males, 8females, age=23.08±1.93 years, height=171.66±9.47 cm, mass=73.67±13.46kg, subcutaneous thickness=0.90±0.35 cm) without compromised circulation or injury were recruited from a volunteer sample at one large Division I university. Interventions: Salted-ice-bag (2000mL cubed-ice, ½tbsp salt) with elastic compression (50mmHg), GameReady (high pressure: 5-75mmHg), PowerPlay (70mmHg) were each applied (counter-balanced order) to the posterior aspect of the non-dominant calf for 30-minutes. Intramuscular temperature was measured via 21-gauge catheter thermocouple (Physitemp Instruments) inserted into medial aspect of calf with widest girth at posterior depth 2.0±0.3cm below subcutaneous fat; thermocouple was attached to Isothermix thermometer. Diagnostic ultrasound(GE Logiq-e) used to measure subcutaneous fat and verify thermocouple placement. Participants underwent each treatment (minimum 4-days, maximum 10-days between). A mixed-model analysis of variance with repeated measures calculated for each dependent variable (cooling, rewarming); pairwise comparisons were examined for significant main effects. Alpha set at a priori=0.05. Main Outcomes Measures: Temperatures were recorded at baseline and every 3 minutes during 30-minute treatment (cooling) and 45-minute rewarming (rewarming). Results: Significant treatment-by-time main effect for cooling ($F_{(3,30)}=6.717, p<.001$, partial $\eta^2=0.440$, observed $\beta=1.000$); IB cooled faster than PP-gel minutes 24-30(all $p<0.05$); no significant differences between any of other modalities at any other time points(all $p>0.05$). Mean intramuscular temperature decrease for IB:6.49±2.56°C, GR:5.24±2.18°C, PP-ice:4.39±2.53°C, PP-gel:2.32±0.93°C. Intramuscular temperature continued to decrease for 45-minutes following modality removal; significant main effects for treatment-by-time during rewarming ($F_{(3,44)}=4.093, p=0.027$, partial $\eta^2=0.760$, observed $\beta=0.911$). Mean continued intramuscular temperature decrease for IB: 2.42±1.71°C, GR: 4.13±2.12°C, PP-ice: 2.29±1.7°C, PP-gel: 1.55±1.41°C. Pairwise comparisons demonstrated significant difference between PP-gel and IB, and PP-gel and GR during rewarming minutes 6-45 (all $p<0.05$); means indicate PP-gel cooled less. Significant difference between PP-ice and IB, and PP-ice and GR from rewarming minutes 30-45 (all $p<0.05$); means indicate PP-ice cooled less. No statistically significant differences between IB and GR (all $p>0.05$). Conclusions: Salted-ice-bag and GameReady were equally effective at decreasing intramuscular temperature 2cm sub-adipose, while PowerPlay with ice bag and PowerPlay with gel pack were not. Differences in compression provided with Salted ice bag (constant elastic compression) and GameReady (intermittent compression) and treatment goals should be considered when making clinical application decisions between the two modalities. Word Count: 448