THE IMMEDIATE EFFECTS OF A 20 MINUTE CRUSHED ICE APPLICATION ON KNEE JOINT POSITION SENSE DURING A SMALL KNEE BEND

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Background

The effect of cryotherapy on joint position sense (JPS) presents conflicting debates (1,2) as to whether individuals are at an increased risk of injury when returning to play following cryotherapy application at the lower limb. Commonly applied for the acute management of soft tissue injuries (1,3), crushed ice as a form of cryotherapy induces analgesia due to physiological changes when skin surface temperature (T_{sk}) reaches between 10-15°C (1,4,5,6). Anecdotal evidence suggests crushed ice is applied for the facilitation of joint movement during rehabilitation therefore subjecting athletes to exercise immediately after cryotherapeutic exposures. Furthermore many athletes in contact and non-contact sports return to the field of play post exposure to cryotherapy modalities. Although, minimal consensus can be derived from the literature (2,7) as to whether joint stability and position sense is affected by cryotherapy.

Purpose

It is undecided in the literature as to the immediate affect on JPS cryotherapy application induces. If JPS is affected, particularly at the knee this has implications on the application and exposure of players to bouts of cryotherapy during competitive play. Therefore this study investigated the effects of a 20 minute application of crushed ice at the knee on knee JPS immediately post removal, during a small knee bend.

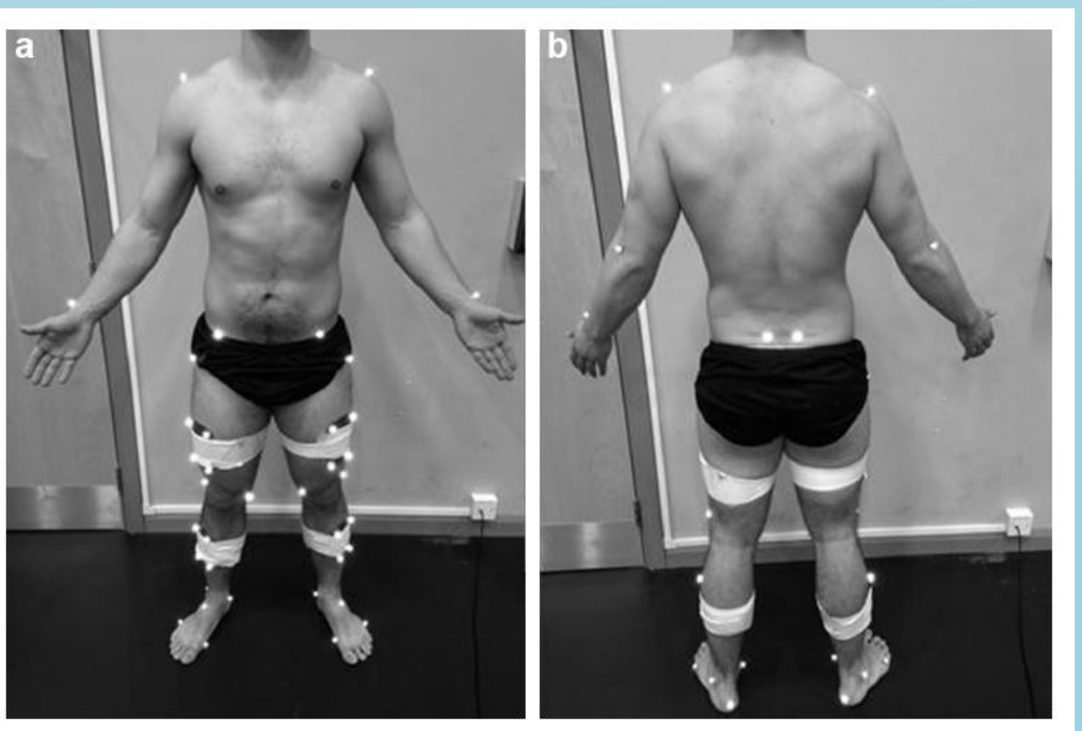

Figure 1. Anatomical landmarks for marker placement (a) anterior view and (b) posterior view.

Materials and Method

This study followed a single group, pre-test-post-test design with 11 healthy male participants. Average age 21.3±1.7 years, body mass 83.5±32.5 kg and height 182±12.8 cm. Using three-dimensional motion analysis (Qualisys Medical AB Gothenburg, Sweden), kinematics of the knee was measured during a weight bearing functional task (small knee bend) pre and immediately post cryotherapy intervention. The target angle of 45° was held for 5s supporting previous methodologies (3,8,9) and limb position awareness (3). Testing was carried out on the participants non-dominant limb, known to be the most likely for knee injury to occur (10). Anatomical markers were applied (Figure 1.) Two anatomical markers were removed at the lateral and medial epicondyles of the knee prior to 800g of crushed ice was applied to the anterior aspect of the knee for the clinically relevant time of 20 minutes (11).

T_{sk} cooling was measured via a digital thermometer over the anterior and medial aspect of the knee pre and immediately post.

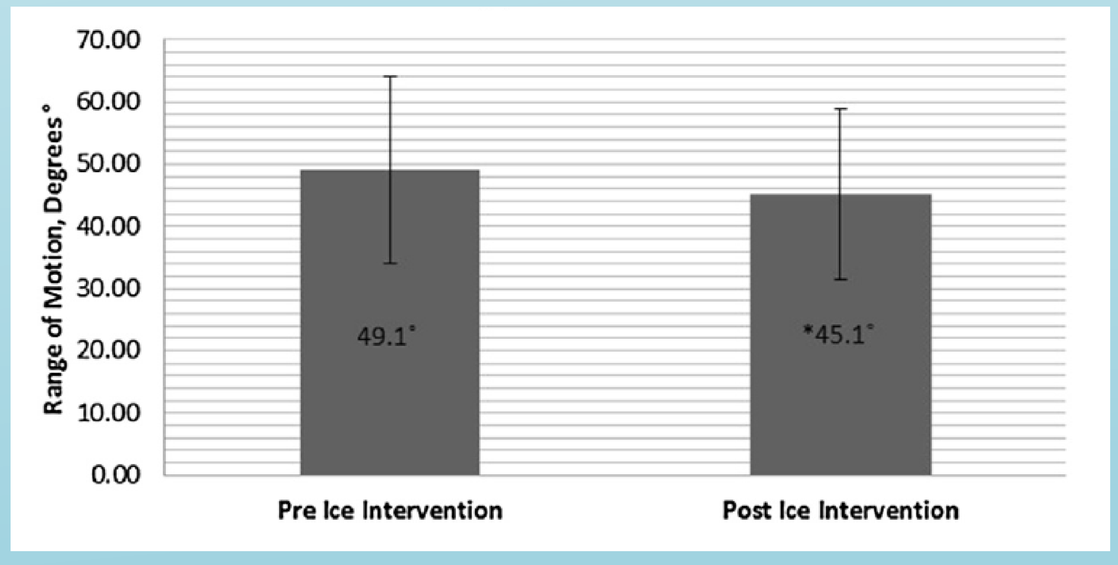

Figure 2. knee joint flexion during a SKB (sagittal plane), pre and immediately post intervention.

Results

Significant reduction in the ability to accurately replicate knee joint flexion in the sagittal plane (P=.035) (Figure 2) and an increase in valgus shift in the coronal (P=.011) plane during the descent eccentric loading phase of a small knee bend following intervention was noted, supporting earlier research (12,13,14). T_{sk} demonstrated significant reduction post cryotherapy intervention (P=.001). Immediately post cryotherapy application average T_{sk} was recorded at 13.4°C ±2.9 reflecting a T_{sk} response to within the desired therapeutic range.

Conclusion

A 20-minute application of crushed ice to the non-dominant knee has an adverse effect on knee joint repositioning. In particular the accurate reproduction of knee flexion and reduced varus control during eccentric loading of an SKB following ice application. This may be due to reduced sensitivity of JPS, with the assumption of a reduced discharge rate of slow adapting mechanoreceptors during exposure to cryotherapy or an increase in joint stiffness. Team doctors, clinicians, and therapists should consider these findings when deciding to return an athlete to functional weight bearing tasks immediately following ice application at the knee, due to the potential increase risk of injury. Consideration should address potential risk of ACL or medial complex injury in sport. Further research is required however to understand any potential delayed effects on JPS after a period of time post cryotherapy removal. At what period of time JPS returns to baseline levels remains to be investigated.

References

1. Bleakley, et al (2012). 2. Costello & Donnelly (2010).3. Costello & Donelly (2011). 4. Knight & Draper (2013). 5. Jutte et al, (2001). 6. Bugaj (1975). 7. Bleakley & Costello (2013). 8. Costello, Algar & Donnelly (2012). 9. Olsson et al, (2004). 10. Krajnc, et al (2010). 11. Janwantakul (2009). 12. Ribeiro et al (2013). 13. Surenkok et al (2008). 14. Uchio et al (2003).