Background

A common practice within clinical and sporting populations for the management of soft tissue injury, cryotherapy is known to induce a multitude of physiological changes (1,2). Reductions in oedema, nerve conduction velocity (3), and tissue metabolism are reported (4,5,6) in addition to changes in joint position sense (JPS) and proprioception (7,8); with exploratory studies demonstrating immediate effects of cryotherapy application on knee joint repositioning, it is the ‘latent’ or ‘delayed’ effects on JPS at the knee however, that are under contenten in the literature (7).

Non-invasive infrared thermal imaging (TI) cameras serve as an accurate method of quantifying skin surface temperature ($T_{sk}$) (9,2,10,11). $T_{sk}$ therapeutic range can be observed using TI, following cryotherapeutic application. A relationship is apparent between $T_{sk}$ and intramuscular temperature ($T_{im}$) cooling whereby a quadratic association occurs (12). $T_{sk}$ continues to cool whilst $T_{im}$ re-warms and therefore poses consideration into the effect on muscle spindle activity and changes in neuromuscular feedback.

Commonly athletes in contact sports, return to the field of play following short cryotherapy applications (1,7). Previous literature proposes an increased risk of injury, with immediate and adaptive adaptations occurring from physiological variations affecting knee joint mechanics following 20 minute exposure of crushed ice at the knee (7). The current study therefore investigated the effects of a 20-minute application of crushed ice at the knee on JPS, over a re-warming period of up to 20-minutes post removal.

Purpose

An earlier exploratory study by Alexander et al (2015) presented changes in the ability to reproduce accurately knee joint position in the sagittal and coronal planes immediately post cryotherapy intervention. It is unknown as to whether noted effects reported in the literature continue longer than only immediately post removal of crushed ice. The significance of the continuation of $T_{sk}$ cooling whilst $T_{im}$ re-warms, may therefore pose consideration into the effect on muscle spindle activity and changes in neuromuscular feedback during a ‘re-warming’ period post cryotherapy removal.

Material and Methods

17 healthy male participants took part in the study performing a functional task (21.8 ± 3.5 years, 81.1 ± 16.5 kg and 177.9 ± 7.9 cm). Using three-dimensional motion analysis (Qualisys Medical AB Gothenburg, Sweden) (Figure 1. (A,B)), kinematics of the knee was measured during a weight bearing functional task (small knee bend) pre and immediately post, 5, 10, 15 and 20 minutes' cryotherapy intervention. The target angle of 45° was held for 5s supporting previous methodologies (2,7,13) and limb position awareness (8) (Figure 1. (C)).

Conclusion

These postulations should be considered by therapists for athletes returning to functional activities or the field of play following cryotherapy exposures at the knee, with an increasing in susceptibility for injury with rotational ROM control increasing during a SKB 20 minutes post removal of cryotherapeutic application. Functional movements including full WB rotational activities therefore may be considered inappropriate following this method of intervention due to the increased risk of injury.

References