Title:

Cryotherapy in Sport: A Warm Reception for the Translation of Evidence into Applied Practice.

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Short Communication:

Precise mechanisms behind cryotherapy applications for acute sport injury management are complex and remain to be fully elucidated due to multiple factors affecting 'optimal' application in sporting contexts. Consequently, debate in the literature surrounding the efficacy of cryotherapy for sport injury management is evident and ongoing. Despite the common application of cryotherapy and understanding of the mechanisms underpinning cooling available, confusion still exists in terms of the translation of underpinning mechanisms into optimal protocols advantageous to the athlete in an applied setting. Recently Long and Jutte (2020) raised concerns regarding unverified claims on the negative comments against the use of cryotherapy in sport and health settings for acute soft-tissue injury. In the field of sports medicine and performance, practitioners should be cautious of unverified claims without consideration of best practice; more importantly however, this raises the need for sustained, real-world implementation of translational knowledge into applied settings which is lacking despite many robust and excellent studies available on the topic of cryotherapy application in sport. The successful act of bridging the gap between academia/science (research) and practice is recently acknowledged by Owoeye et al, (2020) highlighting the importance of *'theory-driven translational research'* to guide applied and current practices. Although high-quality research in the generalised topic of cryotherapy aim to reduce subsequent scepticism amongst practitioners influenced by weak, unverified or outdated approaches, methodological designs in *'discovery research'* that reflect current applications, encompass multi-measures and acknowledge several mechanisms of cryotherapy should be implemented which will consequently support translation of research findings successfully, whether for or against its use in acute injury management.

This leads on to highlight the current perspectives on contemporary cryotherapy applications are evolving and include recently published acronyms such as 'PEACE & LOVE' (Dubois and Esculier, 2020) (Table 1), whereby the suggestion of removing cryotherapy from acute injury management is presented. Alternatively, Long and Jutte (2020) recommend cryotherapy as part of treatment protocol based on grounded physiological evidence yet refer only to the historical acronym of 'RICES' for practitioners to follow in terms of justification for cryotherapy application. As the authors suggest, there is a clear need to clarify 21st century attacks on cryotherapy due to confusion amongst practitioners and therefore it seems pertinent to acknowledge the progressions of 'RICES' to 'PRICE', 'POLICE' and most recently 'PEACE & LOVE' acronyms (see full summary in Table 1) to provide a transparent

presentation of contemporary approaches for / against its use in acute injury management. The latter acronym of PEACE & LOVE (table 1) is suggested as a continuum of acute sport injury (PEACE) and rehabilitation (LOVE) management (Dubois and Esculier, 2020), yet not mentioned in the work by Long and Jutte (2020). Interestingly, Long and Jutte (2020) cite a robust evidence base supporting the use of cryotherapy to control the inflammatory process that occurs as a result of soft tissue injury. In contrast, Dubious and Esculier, (2020) suggest that there is no strong evidence base to provision this approach. Importantly, these studies draw opposing conclusions in relation to the efficacy of cryotherapy on inflammatory response, yet consequently the evidence cited in both pieces of work questions the conclusions drawn. The elimination of cryotherapy ('ice') completely from acute sports injury management requires further investigation and contradicts earlier literature supporting the justification of ice within acronyms such as POLICE based on cold-induced analgesia (Bleakley et al, 2012). It is known that cooling has a beneficial effect on the perception of pain through the slowing of neural conductance velocity, with sensory neurons effected ahead of motor neurons contraindications on functional movement are secondary to the reduction of perceived pain (White & Wells, 2013). Hence it is important to note the surrounding benefits of such modality in an applied practice situation for pain management alone following sport injury. Yet, the many acronyms presented in the literature only aid to the confusion in practice and this editorial hope to stimulate the development of new research that rigorously examines such recommendations to provide clarity on understanding and accuracy of credible evidenced-based literature which influences applied practice.

[*Table 1 Near Here]*

Table 1. Progression and explanation of acronym development which incorporate cryotherapy (in local form 'ice') for acute injury management and accompanying reference for summary.

ACRONYM	EXPLANATION	SUPPORTING REFERENCE
ICE	Ice, Compression and Elevation	Bleakley et al, (2012).
RICE	Rest, Ice, Compression, Elevation	Bleakley et al, (2012).

RICES	Rest, Ice, Compression, Elevation and Stabilisation	Long and Jutte, (2020).
PRICE	Protection, Rest, Ice, Compression and Elevation.	Bleakley et al, (2011).
POLICE	Protection, Optimal Loading, Ice, Compression and Elevation	Bleakley et al, (2012).
PEACE & LOVE	Protection, Elevation, Avoid Anti-Inflammatories, Compression, Education & Load, Optimism, Vascularisation and Exercise.	Dubois and Esculier, (2020).

Discrepancies in the role of cooling for sport injury make it difficult for practitioners to apply optimal applications in sport. Some approaches in studies may inhibit the translational delivery of findings into practice perhaps due to methods not representative of an applied performance nature. Furthermore, several variables, such as dose-response or periodisation of cooling for example which influence optimal sports injury mechanisms still require clarity. Peer-reviewed research reflecting contemporary cryotherapeutic approaches that challenge outdated concepts are important to develop modern-day practices and are required to bridge the gap between academia (research) and applied practice. The consideration of practices only becoming 'evidenced based' may relate to methodologies in translational research which truly reflect current applied approaches and, as suggested by Owoeye et al, (2020), are executed through context-specific dissemination and implementation study design. Mechanisms behind cryotherapy include physiological, biomechanical, biochemical and psychological wellbeing responses and consequently play a part in optimal applications/protocol designs of such therapeutic modalities and should be investigated in synthesis. Conceptual approaches in cryotherapy research design considering ecological context and best translation of findings to key audiences is supported.

Optimal applications of cryotherapeutic modalities in sport are important to ensure maximum physiological benefit for injury and competitive advantage for performance. Holistic, multifactorial approaches to sports injury management and recovery are welcomed, however if sports practitioners are encouraged to base their justification for therapeutic modality use on the best available evidence, then further research to support or refute contemporary approaches are warranted. Long and Jutte (2020) provide a relevant argument in support of cryotherapy, yet alternatively Dubois and Esculier, (2020) provide constructive challenges to historical approaches for the optimal 'timing' of cryotherapy for acute sport injury management.

Contention however, between whether the use of cryotherapy 'does or doesn't work' is a simplistic and disputed approach as to its many positive beneficial mechanisms which are advantageous to the athlete. For the development of optimal cryotherapeutic protocols for sport injury, rehabilitation or recovery, methodological design of future studies incorporating biomechanical, biochemical, physiological and psychological mechanisms which reflect current multi-measures of performance and the examination of contemporary modalities with analysis which reflects individual response to interventions may provide more effective transfer of contemporary knowledge into applied practice due to the resemblance of current cryotherapy use in sport.

References

1. Long, BC., and Jutte, LS. (2020). 21st Century attacks on cryotherapy in sports health care – clinician beware. *Athl Train Sports Health Care.* 12(3):99-101.
2. Bleakley, CM., Glasgow, P., and MacAuley DC. (2012). PRICE needs updating, should we call the POLICE. *Br J Sports Med.* 46(4):220-221.
3. Dubois, B., and Esculier, J-F. (2020). Soft-tissue injuries simple need PEACE and LOVE. *Br J Sports Med.* 54(2):3-5.
4. Bleakley, CM., Glasgow, PD., Philips, P., for the Association of Chartered Physiotherapists in Sports and Exercise Medicine (ACPSM). Guidelines on the Management of Acute Soft Tissue Injury Using Protection Rest Ice Compression and Elevation. London: ACPSM, 2011:15–21.
5. Owoeye, OBA., Rauvola, RS., and Brownson, RC. (2020). Dissemination and implementation research in sports and exercise medicine and sports physical therapy: translating evidence to practice and policy. *BMJ Open Sport & Ex Med.* 6:e000974.
6. White, GE., and Wells, GD. (2013). Cold-water immersion and other forms of cryotherapy: physiological changes potentially affecting recovery from high-intensity exercise. *Extreme Physiol Med.* 2(1):26.

Table Captions

Table 1. Progression and explanation of acronym development which incorporate cryotherapy (in local form 'ice') for acute injury management and accompanying reference for summary.