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Whole Body Cryotherapy vs. Cold Water Immersion

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Abstract

In this country a significant percentage of the population present to clinics with generalized musculoskeletal disorders related to pain. More than one-quarter of Americans (26%) age 20 years and over, or an estimated 76.5 million Americans report a problem with general musculoskeletal disorders related to pain that persisted for more than 24 hours in duration. The treatment for various musculoskeletal disorders related to pain are anti-inflammatory agents or opioid analgesics. Another form of anti-inflammatory /analgesia for such ailments is cold therapy.

The purpose of this literature review is to compare Whole Body Cryotherapy (WBCt) to Cold Water Immersion (CWI) in well-trained, adult athletes of both genders, between the ages of 18 to 60, to determine which treatment provides the better reduction of symptoms. The review of literature focused on WBCt and CWI studies to determine which cold therapy provides faster/better relief of symptoms from musculoskeletal disorders related to pain.

The results showed that average and minimum tissue temperatures were lower ($p<0.05$) immediately after whole body cryotherapy (19.0±0.9℃) compared to cold water immersion (20.5±0.6℃). However, from 10 to 60 min post, the average, minimum and maximum tissue temperatures were lower ($p<0.05$) following the cold water treatment. While WBCt achieves the lower initial tissue temperature, CWI will maintain the overall lower tissue temperature. Based on the results of this literature review, a practitioner can determine if WBCt is a viable application that the clinic/hospital should have readily available for an alternative treatment for various musculoskeletal disorders related to pain.

Introduction

Cryotherapy includes whole body cryotherapy (dry air of −80°C to −110°C for 1–3 min), cold-water immersion (CWI), ice or cold gel pack application, ice massage or any other local or general application of cold for therapeutic purposes. (Meeusen et al. 1986) Although these types of treatments are commonly and ubiquitously used to speed recovery from stressful bouts of exercise, no standard guidelines have been established, and a target temperature for optimal therapeutic effects has yet to be identified (Bleakley et al. 2012, Leeder etal. 2012). This is largely owing to a lack of understanding regarding the mechanisms through which cryotherapy affects recovery from high intensity exercise (Gregson et al. 2011).

Of the many forms of cryotherapy used to this end, CWI is the most popular in the literature and in practice (Bleakley et al. 2012). Several studies have investigated and reviewed the effects of CWI for reducing soreness and speeding the recovery of force-generating capacity by skeletal muscles following stressful bouts of exercise. (Bleakley et al. 2012, Leeder et al. 2012) However, evidence regarding the efficacy of CWI, and cryotherapy in general, to speed recovery remains equivocal. Many reviews have concluded that the high heterogeneity in methodology regarding exercise insult, cold protocol and performance outcomes are responsible for the current lack of agreement in the literature. (Bleakley et al. 2012, Leeder et al. 2012)

Statement of the Problem

An increase in the use and dependency of anti-inflammatory agents and opioid analgesics results in an increase in systemic absorption and breakdown of these medications putting stress on the patient's liver and kidneys. If we can provide a form of relief that does not require systemic absorption and breakdown to provide analgesia, we can help to preserve the patient's liver and kidney function.

Research Question

In patients with generalized musculoskeletal disorders related to pain, is there a significant difference in the efficacy of treatment between whole body cryotherapy (WBCt) versus cold water immersion (CWI)?

Literature Review

Current literature shows that the physiological effects of cold therapy include reductions in pain, inflammation, edema, blood flow, and muscle damage. Since whole body cryotherapy (WBCt) and cold water immersion (CWI) both serve to produce these effects, although in a completely different manner, it would seem that one or the other might be a more effective treatment for musculoskeletal disorders related to these symptoms. In order to determine which modality provides the better relief of symptoms an electronic medical database search was conducted through PubMed, Clinical Key, and the Cochrane Library. The focus of this literature review is to examine studies that placed the participants under various forms of musculoskeletal stress that would induce symptoms of pain, inflammation, edema, blood flow, and muscle spasm and then were treated with either CWI or WBCt.

Ferreira et al. (2010) found that three sessions of WBCt (3 min at −110°C) after EIMD in well-trained runners improved muscle strength, perceived sensation, and also decreased muscle pain. Additionally, five WBCt exposures (3 min at −140 to −190°C) may improve the recovery of peak torque, rate of torque development, squat jump start power, and decreased muscle soreness after damaging exercise, and three sessions of WBCt (3 min at −110°C) following EIMD was effective in reducing the inflammatory response.

Bleakley et al. (2012) found that results for muscle soreness showed statistically significant effects in favor of cold-water immersion after exercise at 24 hour (standardised mean difference (SMD) -0.55, 95% 10 trials), 48 hour (SMD -0.66, 95% 8 trials), 72 hour (SMD -0.93; 95% 4 trials) and 96 hour (SMD -0.58; 95% 5 trials) follow-ups.

Costello et al. (2012) compared WBCt directly to CWI and found that skin temperature was significantly lower ($P<0.05$) immediately after WBC compared to CWI. Although both treatments significantly reduced skin temperature, WBCt elicited a greater decrease compared to CWI. Costello et al. (2012) also reported that however, both modalities display different recovery patterns and average skin temperature after CWI was significantly lower ($P<0.05$) than WBC at 20, 30, 40, 50 and 60 min after treatment.

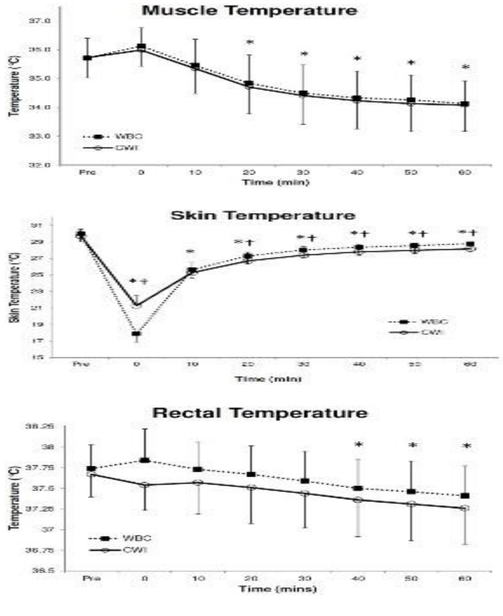
Discussion

The majority of applied studies using cryotherapy for recovery from exercise cite its effectiveness as a by-product of its ability to blunt inflammation through reducing local metabolism and inducing vasoconstriction. Although metabolic rate and blood flow seem to be reliably affected by cold, studies have yet to investigate a dose-dependence of cold on inflammation. Such a variety of methodological approaches to studying cold presents a challenge to drawing reasonable conclusions from a mechanistic point of view.

Lack of temperature data in addition to the wide variety of exercise stress protocols used to study cryotherapy for recovery has resulted in general disagreement with respect to what types of exercise might benefit from cryotherapy and which method of cryotherapy may be the most appropriate. As different types of exercise induce different stress responses, the recovery necessary to attain a pre-exercise state is different. This must be considered in future studies as cold is not likely to affect recovery from all types of exercise uniformly and thus may not be appropriate for all types of exercise.

Although changes in local metabolism, blood flow and edema and systemic changes in cardiovascular, neuromuscular and endocrine function are altered by cryotherapy following stressful exercise, few studies concomitantly study these physiological responses speculated to be mechanistic in the recovery effect of cryotherapy and inflammatory and/or functional outcomes. Thus, although these physiological changes are induced by lowering tissue temperature and may have a role in facilitating recovery from some types of exercise, studies investigating the mechanisms concomitant with functional outcomes are needed to substantiate whether cryotherapy has an effect greater than simply a placebo or subjective improvement in recovery.

Tissue Response



Applicability to PA Practice

In summary, as WBCt incurs significant costs, further research examining the underlying mechanisms and the effects of the treatment on performance recovery following strenuous exercise is warranted. Practitioners are advised that current treatment protocols are based on anecdotal evidence and there is as yet little evidence supporting its efficacy as a modality of recovery. More studies are needed to quantify the effects of WBCt. When deciding whether to prescribe an ice bath or cryotherapy, there are some considerations. Ice baths are more uncomfortable than WBCt. You will need to sit in the ice bath longer to achieve the same effect since the water temperature is warmer than WBCt treatments. (Bleakley et al. 2014)

In contrast, cryotherapy uses very dry, cold air for a much shorter time so subjects do not report much discomfort at all. After WBCt, subjects do not report the joint stiffness typically seen after an ice bath. (Bleakley et al. 2014) However, ice baths are much less expensive; WBCt sessions can range from $55 – $75 per session. A common thread throughout this research is that cold therapy, either CWI or WBCt, does have a positive effect on the perception of recovery. That would make this a viable alternative to the use and dependency of anti-inflammatory agents and opioid analgesics for the treatment of musculoskeletal disorders related to pain. This research has shown that WBCt can provide a form of relief that does not require systemic absorption and breakdown to provide relief, and that we can help to preserve the patient's liver and kidney function throughout their lifespan.

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