Contrast bathing – a brief summary of the evidence

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Historical background

The therapeutic use of water has a long history dating back to ancient cultures. Water therapies were classified in traditional medicine as:

- Hydrotherapy – techniques involving therapeutic bathing and using water;
- Balneotherapy – therapeutic bathing in medicinal and thermal springs; and
- Thalassotherapy – therapeutic bathing in the sea and using marine products[1].

Hydrotherapy has become the most popular of the water therapies. Hahn, Oertel, Priessnitz, Rausse and Kneipp developed the use of water cures in Europe in the eighteenth and nineteenth century[2]. Hydrotherapy has been advocated using a number of variations including, Kniepp baths, Schlenz baths, Sitz baths and Stanger baths. A variety of disorders were recorded as being treated and aided by such bathing including fibromyalgia[3], osteoarthritis[4], insomnia[5] and rheumatoid arthritis[6,7].

A later development was the galvanic bath, which was introduced by Sere and further developed by Stanger[2]. Galvanic baths were constructed with electrodes and a low voltage direct current (DC) circuit. The electromagnetic field produced was claimed to contribute to improved circulation in the periphery of the body and promoting "detoxification"[8].

Physical therapies continue to recommend a derivation of water cures, most commonly in the form of "contrast bathing", using repeated application of, or immersion in, hot/warm water and cold water. Scientific literature now describes this as "contrast water immersion" or "contrast therapy". In clinical practice, contrast therapy/immersion is recommended to treat symptoms associated with local inflammation and the response to tissue trauma. A more recent use for contrast therapy has been to aid the signs and symptoms of delayed muscle soreness, particularly in athletes[9].

Physiological mechanism

It has been suggested for some time that contrast therapy produces a cycle of local vasoconstriction and vasodilation resulting in a "pumping effect" to facilitate the removal of oedema by venous and lymphatic removal. Controversy still exists regarding this theory[10,11]; concern that adequate deep tissue vasoconstriction fails to occur has led to an amendment to the ratio of heat and cold application or immersion used to produce a therapeutic benefit[11].

Current theories suggest that oedema is removed because the constriction increases the intraluminal pressure in the blood vessel, causing the fluid to move with the valves in the veins, thereby preventing backflow of the fluid[12]. This would produce a beneficial effect of minimising the influence of oedema accumulation while the healing process takes place.

The majority of research in this area has focused on the isolated use of heat or cold and the vascular pumping theory has had little specific investigation and is currently not well supported by evidence. Denegar suggests that the limited duration of heat and cold application (three minutes and one minute) would be insufficient to effect deep blood flow and to produce a pumping action. Lymph capillaries do not have muscular walls and would be unable to effect a pumping mechanism, and the intrinsic contraction in blood vessel walls contributes in a limited way to lymphatic flow[13].

Contrast therapy does, however, produce some therapeutic benefits: Coffey *et al.* investigated the use of contrast water immersion (CWI) after exercise and showed that post-exercise lactate was lowered and the subjective perception of recovery improved[14]. Morton, in turn, demonstrated that CWI significantly increased the hastening of plasma lactate decrease during recovery after intense anaerobic exercise[15].

Physiological effects

A growing body of research has been built looking at the physiological effects of contrast therapy. Changes in arterial blood flow in response to contrast therapy have been measured by a number of researchers using a variety of techniques. Fiscus *et al.* used strain gauge plethysmography to measure blood flow in the lower limb[16]. This study used four minutes warm water immersion to one minute cold water immersion, over a period of 20 minutes, and produced a significant fluctuation of lower leg blood flow. Decrease in blood flow occurred during the change from warm to cold; increase in blood flow occurred during the change from cold to warm; this effect reduced during successive immersions. A growing number of studies have taken place in the past decade; the variables measured and the physiological effects produced in a small number of recent studies are summarised in the table below.

Study author(s)	**Number of participants in study**	**Physiological process measured**	**Intervention time ratio (heat to cold)**	**Total duration of intervention**	**Effect produced**
Myrer *et al.* (1997)[17]	9 men, 7 women	Subcutaneous and intramuscular muscle temperatures	1:1 (5 minutes heat and cold repeated twice)	20 minutes	Cutaneous circulation only affected
Coffey *et al.* (2004)[14]	14 men	Blood lactate concentration and blood pH	2:1	15 minutes	Lowers post-exercise lactate
Fiscus *et al.* (2005)[16]	24 men	Arterial blood flow in the lower leg	4:1	20 minutes	Unclear
Morton. (2006)[15]	6 men, 5	Blood lactate concentration	4:1	30 minutes	Hastens reduction of plasma lactate

	women				decrease after exercise
Hamlin MJ. (2007)[18]	20 men	Blood lactate concentration and repeated sprint performance	3:1	12 minutes	Decreases blood lactate concentration; little effect on subsequent repetitive sprint performance (1 hour later)
Vaile JM *et al.* (2007)[19]	Athletes: 4 male, 9 female	Creatine kinase concentration, perceived pain, thigh volume, isometric squat strength and weighted jump squat performance	2:1	15 minutes	Smaller reduction and faster restoration of strength and power measured by isometric force and jump squat performance. Thigh volume was significantly less. No significant difference was found in perceived pain and creatine kinase levels
French *et al.* (2008)[20]	26 men	Limb girth (mid-thigh and mid-calf), range of motion, lower body power, speed and agility, whole body strength, soreness (using a visual analogue scale) and serum creatine kinase and myoglobin levels	3:1	Not disclosed	Creatine kinase and myoglobin levels were elevated; soreness fell transiently and mid-thigh girth increased - no other significant recovery effects noted

Contraindications and adverse events

Adverse events recorded with this treatment intervention have been notably lacking in the literature. Common exclusion criteria for participants in clinical trials involving CWI include open wounds, poorly controlled epilepsy, infected wounds, hypertension, fear of water and diabetes[6,21]. In situations where CWI is undertaken using shared facilities known carriers of methicillin resistant *Staphylococcus aureus* (MRSA) are also excluded from participation[6].

CWI has demonstrated physiological and beneficial therapeutic effects. The mechanism of action requires further research, and the “dose” required in terms of application or immersion time, as with so many other physical therapy interventions, also requires further investigation.

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