

# **Diathermy: The ideal therapeutic heating modality**

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## **Highlights**

- Therapeutic heat can increase circulation, accelerate healing, control pain, and increase soft tissue extensibility.
- Therapeutic heat benefits patients with healing tissues, pain, and those with restrictions in joint or soft tissue mobility.
- Diathermy is the only way to heat large deep areas.
- The ReBound technology, using sleeves containing inductive coils, provides the most evenly distributed deep heat.

## **What is therapeutic heating?**

Therapeutic heating is the heating of a person or body part to achieve a therapeutic benefit. Therapeutic heating is also known as therapeutic warming and as thermotherapy. Therapeutic heating raises tissue temperature to above 104 °F (38 °C) but below 113 °F (45 °C) to safely optimize physiologic benefits.

## **What are the physiological benefits of therapeutic heating?**

Therapeutic heating influences hemodynamic, metabolic and neuromuscular processes and increases the extensibility of soft tissues.

Therapeutic heating causes *vasodilation* in the heated tissue, thus increasing the rate of blood flow to increase the delivery of oxygen and nutrient and the removal of waste products. Therapeutic heating causes vasodilation by stimulating thermoreceptors that directly cause vascular smooth muscle relaxation and indirectly activate local spinal cord reflexes. In addition, therapeutic heating promotes vasodilation by increasing the release of chemical mediators of inflammation and the release of nitrous oxide. (Kellog, 1999; Minson, 2001)

In addition to the effects of heat on vasodilation therapeutic heating *increases the rate of enzymatic biological reactions*, which increases the rate of cellular biochemical reactions. Heat also increases the dissociation of oxygen from hemoglobin in the blood increasing the delivery of oxygen to the tissues. These metabolic effects may both supplement the impact of vasodilation on accelerating tissue healing.

Therapeutic heating *increases nerve conduction velocity*, which may contribute to the reduced pain perception that occurs in response to increasing tissue temperature. In

addition, heat increases the firing rate of type 1b fibers from Golgi tendon organs which may contribute to a reduction in firing of alpha motor neurons and thus a reduction in muscle spasm. (Fischer, 1999) Several studies also demonstrate that therapeutic heat can relieve pain, (Ahmed, 2009; Shakoor, 2008; Cetin 2008) likely as a result of gating by thermoreceptor activation and indirectly due to reduced ischemia as a result of vasodilation.

The most common reason clinicians apply therapeutic heating is to *increase soft tissue extensibility* before stretching. When heat is applied before stretching the increase in tissue length is greater, tissues maintain greater increase in length, less force is needed and the risk of tissue injury is reduced. (Draper, 2004; Robertson, 2005)

### **What kinds of conditions can benefit from therapeutic heating?**

Therapeutic heating benefits conditions where increased circulation and metabolic rate, reduced pain and increased soft tissue extensibility will help achieve the goals of treatment. These conditions are primarily healing tissues, pain and reduced range of motion.

Therapeutic heating *promotes tissue healing* by increasing circulation, increasing metabolic rate and increasing oxygen-hemoglobin dissociation. Increased circulation brings more oxygen and nutrients to an area and accelerates removal of waste products. Increased metabolic rate accelerates chemical reactions involved in tissue healing and increased oxygen-hemoglobin dissociation increases oxygen delivery to the tissues. Although, in general, heating should be avoided during acute inflammation as further vasodilation and accelerated enzymatic activity can prolong and exaggerate the acute inflammatory reaction, when applied after the acute inflammatory phase has resolved, therapeutic heating can enhance tissue healing after injury.

Therapeutic heating *reduces pain* by activating thermoreceptors to block the perception of pain and by promoting vasodilation in relatively ischemic tissues.

Therapeutic heating contributes to *increasing range of motion* by increasing soft tissue extensibility. A number of studies demonstrate that range of motion increases more diathermy is applied before stretching than with stretching alone. (Draper, 2004; Peres, 2002; Robertson, 2005).

### **How does diathermy compare to other therapeutic heating modalities such as hot packs and ultrasound?**

Diathermy is the only physical agent that *heats deep large areas*. This is in contrast hot packs and paraffin wax that only increase superficial temperature and ultrasound that only heats small deep areas.

Hot packs and paraffin wax provide superficial heating of the skin and the first millimeters of subcutaneous tissue. They do not increase temperature to the depth of

most muscles and they therefore have minimal effect on skeletal muscle blood flow or extensibility. In contrast, diathermy has been shown to increase deep tissue temperature (Garrett, 2000; Mitchell, 2008; Draper, 1999; Goats 1989) including the temperature of muscles. This deep extensive heating is optimal for treating large areas of deep tissue as are commonly involved after injury, with musculoskeletal pain complaints and when there is decreased joint range of motion or muscle length.

### **Special Features of ReBound Diathermy**

ReBound provides deep, even heating to large areas using shortwave diathermy delivered by inductive coils embedded in garments. This technology optimizes the comfort, safety and effectiveness of diathermy treatment.

Diathermy can be applied with shortwaves or microwaves. ReBound is the only device to use 13.56 MHz frequency shortwaves for diathermy. This frequency produces much more even heating than microwave diathermy.

Shortwave diathermy can be applied with capacitive plates or with inductive coils. Although both of these heat deep large areas, capacitive plates deliver more heat superficially than deeply and they particularly heat adipose tissue (fat) rather than muscle. In contrast, the inductive coils used with the ReBound shortwave diathermy device deliver deep heat to large areas with the most even and effective distribution. (Leitgeb, 2010) In addition, the ReBound back and shoulder garments optimize delivery to areas where circumferential wrapping is not possible and the extremity garments, which place coils circumferentially around a limb, provide the most even deep heating.

### **Summary**

Therapeutic heating causes vasodilation, increases the rate of enzymatic biological reactions, increases nerve conduction velocity, and increases soft tissue extensibility. These physiologic effects underlie the benefits of therapeutic heating for promoting tissue healing, reducing pain and increasing range of motion. Diathermy is the only physical agent that heats deep large areas. The unique ReBound technology, using 13.56 MHz shortwave diathermy delivered by inductive coils embedded in garments, optimizes the comfort, safety and effectiveness of deep therapeutic heating.

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