Continuous Low-Level Heat Therapy: What Works, What Doesn’t

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A professional athlete recently signed a 3-year deal with a company that produces a product to treat low back pain. This is not surprising, because low back pain is the leading cause of disability in adults younger than 45 years, followed closely by headache. Eighty percent of the population will suffer from low back pain at some point in their lives, and the pain lasts up to 6 weeks in 80–90% of cases.

Athletic trainers and therapists use a variety of tools to treat low back pain (LBP), including exercise, oral analgesics, and modalities such as ultrasound, short-wave diathermy, cryotherapy, and topical heat. Application of heat in the form of whirlpool baths or silicate-gel hot packs is commonly used to relieve pain and muscle spasm, increase blood flow, and facilitate tissue healing. Research has shown increases of 3.8 ºC at 1 cm and 0.8 ºC at 3 cm deep in the triceps surae muscle during 20-min silicate-gel hot-pack treatments. The hot pack remains warm for only 20–30 min, however. Also, when the athlete leaves the clinic, these forms of heat are not portable for treatment at home. The capability of a patient to apply a wearable, portable source of topical heat at home will provide the physiological effects of heat for extended periods of time.

Research Proving That Heat Reduces the Symptoms of LBP

Two recent studies published in the Archives of Physical Medicine and Rehabilitation give credence to the effects of portable continuous low-level heat therapy (ThermaCare® Heatwrap™, Procter & Gamble, Cincinnati, OH). Dependent variables were pain, muscle stiffness, lateral trunk flexibility, and a disability questionnaire. Independent variables were a wearable heat wrap (ThermaCare Heatwrap; TCHW), an unheated back wrap, oral analgesic (ibuprofen 200 mg, two tablets, three times daily for 3 days), and oral placebo. The wraps were worn directly on the skin for one 8-hr period each day. The TCHW was the only treatment that produced a significant decrease in pain, muscle stiffness, and disability and increased lateral trunk flexion.

The researchers repeated the study with the same independent variables but added quality of sleep as an additional dependent variable. This time the TCHW was worn directly on the skin for 8 hr during the night but not during the day. Again, the TCHW was the only treatment that produced a significant decrease in pain, muscle stiffness, and disability and increased lateral trunk flexion and quality of sleep. Sleep disturbance is a prevalent complaint in those who have LBP, with reports of impaired sleep affecting up to 70% of patients with chronic LBP. Sleep is essential to physical and emotional health and plays a strong role in recovery from illness and injury.
The TCHW produces average skin temperatures of 40 ºC, but who cares what happens to the skin! Does it produce heat in the muscle, and if so, how does it compare with similar products?

We recently completed two studies\textsuperscript{14,15} comparing the muscle-heating rates of five over-the-counter products in 36 college-age participants. The products tested were two capsicum plasters—the Back Plaster (Johnson & Johnson, Skillman, NJ) and the ABC Warme-Pflaster (Beiersdorf, Hamburg, Germany)—the Mentholatum® Pain Patch (MPP; Orchard Park, NY), the Icy-Hot® Pain Patch (IHPP; Chattem, Inc, Chattanooga, TN), and the TCHW. A sterile thermocouple was inserted 1.5–2 cm deep into the paraspinal muscles of each participant at the third lumbar level (Figure 1). All thermocouples were connected to an Isothermex computer that recorded temperature every minute. After a baseline measurement was recorded, one of the five heat products was applied to the lumbosacral region (Figure 2). Each participant remained in either a prone or a side-lying position throughout the 120-min treatment. For analysis, temperature data from the Isothermex were input to a customized software program.

Only the TCHW penetrated the skin and produced any significant increase in muscle temperature. At 2-cm depth, the TCHW raised paraspinal muscle temperature 1.1 ºC, whereas the two capsicum plasters increased muscle temperature only 0.2 and 0.08 ºC.\textsuperscript{14} At 1.5-cm depth, the TCHW raised the paraspinal muscle temperature 2.7º C, whereas the MPP and the IHPP increased muscle temperature only 0.3 and 0.5 ºC, respectively.\textsuperscript{15}

**Discussion**

As can be seen from the results of our research and that of others, the TCHW actually increases not only skin temperature but also temperature of underlying muscles. This increased heat leads to a reduction of pain and muscle spasm and increased range of motion. The TCHW is portable and can be worn while one sleeps.

Commercial electric heating pads should not be used overnight. Skin burns are a major safety concern because electric heating pads often produce temperatures exceeding the threshold for tissue damage (45º C).\textsuperscript{16} Several factors contribute to burns, including blurred processing of pain stimuli during sleep, increased pressure on the skin, and inhibition of skin blood flow and heat dissipation.\textsuperscript{17} Despite the known risks, more than 1,500 burns caused by electric heating pads are treated in emergency rooms each year.\textsuperscript{18} In contrast to these concerns, overnight use of a continuous, low-level heat wrap directly on the skin has been shown to be safe.

![Figure 1](image1.png)  **Figure 1** Thermocouple inserted into paraspinal muscles (center) and the two surface probes.

![Figure 2](image2.png)  **Figure 2** The ThermaCare® Heatwrap\textsuperscript{®} was applied over the paraspinal muscles, where intramuscular and skin temperatures were measured for 2 hr. (It produced the highest temperatures of the five products we researched.)