



Medical Infrared Thermography in back pain osteopathic management

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ABSTRACT

Objectives: The objective of this study was to provide proof-of-concept for the use of Medical Infrared Thermography to verify both diagnosis and osteopathic management accuracy in back pain.

Methods: A 50-year-old woman with acute back pain syndrome volunteered to participate in this study.

Results: Prior the treatment, thermal image reveals that in a sagittal plane, the inflammation extends from vertebra D8 to L3 with a maximum inflammation between vertebrae D10 to L1. Post-treatment, Medical Infrared Thermography only shows a slight inflammation along the lumbar furrow that does not induce pain in the patient.

Conclusion: Medical Infrared Thermography has made it possible to scientifically support the osteopathic approach to back pain, both in the initial diagnostic phase and in the validation phase of treatment effectiveness.

1. Introduction

Medical Infrared Thermography (MIT) is based on a detailed investigation of skin and superficial tissue temperatures by recording infrared radiation emitted by the body.¹ Healthy humans have a high degree thermal symmetry in terms of both magnitude and pattern in the same regions in contralateral parts of the body.² For this reason, the observation of skin thermal asymmetry should be considered as a warning signal, which may highlight the presence of inflammatory or musculoskeletal pathologies inducing abnormal vascularization.³ Literature is abundant for dealing with the potential role of MIT for diagnosing and treatment monitoring in medicine.^{1–4} This powerful non-invasive and easy-to-handle tool has a broad application spectrum and can be used in occupational medicine to diagnose symptoms,^{5–7} in stroke rehabilitation treatment,⁸ in symptoms from Raynaud's phenomenon,⁹ in diabetic neuropathy,¹⁰ renal transplantation,¹¹ gynecology,¹² dentistry¹³ to name a few. MIT can also be incorporated into routine clinical practice such as the implementation of interventional surgical procedures.¹⁴ MIT has also been shown to be useful as a diagnostic tool in the differential diagnosis of neuromusculoskeletal injuries affecting a variety of tissues including bones, joints, cartilage, ligaments, tendons, muscles and others soft tissues.¹⁵ In medical units, a limitation of the use of MIT is the necessity for a temperature-controlled room in which to conduct the tests.¹⁶

However, it should be pointed out that for other types of pathologies

such as breast cancer, medical infrared thermography is highly controversial as a reliable diagnosis tool in cancerous tumor detection from abnormal thermal patterns.¹⁷ Breast thermography alone cannot replace mammography in the detection of malignancy.

Among musculoskeletal pathologies, back pain is a common concern. Back pain most commonly results from injury to the muscle, disc, nerve, ligament or facet joints with subsequent inflammation. The French health authorities estimate that 80% of French people will suffer from back pain at least once in their life. Every pain syndrome has an inflammatory profile consisting of the inflammatory mediators that are present in the pain syndrome.¹⁸ Moreover, the most common factor known to affect skin temperature and indicate abnormalities is inflammation in the subcutaneous/underlying tissues.¹ Thus, the previous syllogism makes it possible to establish the postulate that back pain should be highlighted by means of MIT. The benefits are twofold: on the one hand, it enables the practitioner's diagnosis to be confirmed by precisely locating the area of pain and, on the other hand, it enables the effectiveness of the treatment applied to be verified a posteriori.

Back problems in most cases typically respond to nonsurgical treatments and depending on the pain level and chronicity of the pathology, two treatment routes can be proposed to the patient: drug, or non-medicinal one. Several drugs can be proposed for the treatment of acute or chronic back pain. The most common are painkillers, which aim to reduce pain, non-steroidal anti-inflammatory drugs, which aim to reduce associated inflammation, and muscle relaxants. Because of

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philosophical convictions leading to use a therapy considered more natural and to avoid of side effects of drugs, the use of alternative or complementary therapies in addition to conventional medicine is more and more frequent in industrialized countries. In case of back pain management, alternative medicines fall into three subgroups including mind-body medicine,^{19,20} manipulative and body-based practices involving manipulation or movement of body parts,^{21,22} and natural products.²³

Several studies have shown that among hands-on care, osteopathic manipulative treatment (OMT) had a significant effect on pain relief and functional status.^{24–26} OMT has shown the same clinical results in patients with subacute back pain as standard medical care²⁷ with a level of pain reduction persisting for at least three months after manipulation.²² Osteopathic models and manipulative technique have traditionally emphasized tissue and biomechanical mechanisms, but this emphasis is misplaced given the paucity of clinical evidence for these effects.²⁸

Thus, this study provides proof-of-concept for the use of medical thermal imaging to verify both diagnosis and osteopathic management accuracy in back pain. To the authors' knowledge, this is the first study showing the interest of MIT in osteopathic manipulative treatment of back pain.

2. Case report

A 50-year-old mother of 2 (height, 165 cm; weight, 56 kg; Body Mass Index, 20.5 kg/m²) with acute back pain syndrome volunteered to participate in this study on the role osteopathic treatment could play in relieving her pain. This patient has had a history of chronic joint pain and low back pain since 2007. The etiology of her pathology seems to be directly linked to her professional activity. The patient daily works as a cleaning woman in a factory and numerous investigations have shown that cleaners are at risk of developing musculoskeletal disorders of the back as a result of their work^{29,30} due to many repetitive trunk rotation postures in coronal, transverse and sagittal planes. It should be noted that the patient does not suffer from any gastrointestinal disorders that could contribute to back pain. In September 2012, the patient underwent a bone scan that revealed no scintigraphic abnormalities suggesting sacroilitis or progressive rheumatic pathology. In addition, the patient has no disc herniation or other intervertebral disc disease.

From the beginning of her musculoskeletal disorders, the patient was followed by a rheumatologist who prescribed background treatment against all its pains. But she had difficulty with this drug treatment, which caused side effects such as heart palpitations, decreased sleep and quality of life, feeling of blocked hands due to a hyper-fixation of the wrists and acute hip pain. Suffering from hip, and for the past five years, the patient has opted for a daily background treatment of Piascledine[®], a drug indicated as a symptomatic treatment (pain and functional discomfort) with delayed effect of osteoarthritis of the hip, which she can supplement with NSAIDs-nonsteroidal anti-inflammatory drugs during seizures. For the past two years the patient has started a therapy with osteopathic treatment, the results of which are very satisfactory. She follows this treatment three to four times a year when seizures occur. After osteopathic manipulation, the pain persists for another day or two and then disappears completely until the onset of the next acute pain attack three or four months later, which manifests itself without apparent triggering factors. The corresponding medical treatment timeline of the patient is shown on Fig. 1.

3. Method

The patient provided consent for publication of his case and signed an informed-consent form. The protocol and all the procedures were carried out in accordance with the Helsinki Declaration with the approval of the local ethics committee. The patient contacted her

osteopath for back pain manipulative treatment at home she received in addition to the anti-inflammatory treatment she usually takes during her seizures. The patient herself describes her pain as mechanical and non-inflammatory. When the osteopath arrived at the patient's home, she was asked to stand upright in her underwear for five minutes so as to avoid any bias in skin temperatures due to the wearing of clothing (see Fig. 2). Medical thermal imaging of the patient's back has been taken just before treatment (see Fig. 3). For this purpose, an IR FLIR SC620 camera (FLIR Systems, Wilsonville, OR), having a high resolution pixel detector of 640 × 480 pixels for greater accuracy and higher resolution, has been used.

4. Back pain diagnosis

Sometimes patients complain of pain that they find it difficult to locate precisely, especially in case of diffuse pain. Fig. 3 illustrates how powerful thermal imaging is in accurately diagnosing pain location as a complement to visual or palpable analysis. Above all, what emerges is an abnormal asymmetrical spreading distribution of the skin's temperature, making it possible to locate the painful areas perfectly.

In a more anatomically detailed way, the thermal image shows that in a sagittal plane, the inflammation extends from vertebrae D8 (just above the bra tie) to L3. The maximum inflammation is between vertebrae D10 to L1.

This area of the back is especially susceptible to painful strains because it bears the weight of the upper body and is heavily involved in the moving process. The paravertebral muscles on both sides throughout the spine develop pathological abnormalities evidenced by thermal imaging. Paravertebral muscles are highly inflamed bilaterally, even if it seems a little more important on the right. For example, the maximum temperature reaches 35.5 °C in the right side while the surrounding healthy skin tissues present a normal temperature around 33.0 °C. The abnormal temperatures can also be due to inflammation of deeper serratus posterior inferior left and right muscles (from D10 to L3) acting as a supporting structure for the lower back.

5. Discussion

As a complement of the medical thermal imaging, an initial visual examination of the patient in standing position (Fig. 2) by the practitioner shows a counterclockwise rotation of the pelvis around a vertical axis in the transverse plane, meaning a right ilium anterior rotation and a left posterior ilium one. Consequently, as a compensation process, the lumbar vertebrae are tilted to the left and rotated in opposite direction to that of the pelvis, which implies significant stretching of the iliopsoas deep muscle connecting these two skeletal structures to the right side. Adapted to this, the osteopathic manipulation treatment consists of the release of the iliopsoas muscle tension, which is the deepest muscle of the core connecting the 12th thoracic vertebrae to the 5 lumbar ones through the pelvis.

The different successive stages of the osteopathic manipulation process are illustrated in Fig. 3. In a synthetic way, during 45 min, the practitioner will successively relax the iliopsoas muscle, acting in conjunction with the spinal muscles to support the lumbar spine, by putting the patient in a lying position with her knees raised (Fig. 3a). Thereafter, the practitioner is concerned with relaxing the diaphragm muscle and releasing the colon, which may be responsible for low back pain (Fig. 4b, c). Indeed, the diaphragm muscle having attachments to both dorsal (D7–D12) and lumbar (L1–L3) vertebrae, back pain can alter its stability and mobility. Moreover, when the colon gets really bad located (backed up for example) the lower back can experience increased pressure resulting in back pain. Fig. 4c shows the release of the ileocecal junction connecting the end of the small intestine (the ileum) with the beginning of the ascending colon (cecum), the first step in manual treatment of the entire colon. Indeed, the colon attaches to the lumbar vertebrae through various fixations, including theoldt fascia which

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