Improved Quantitative Testing Method and Handheld Device to Assist in Neuropathic Pain Diagnosis

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Technology description

Description

Neuropathic pain is characterized by chronic pain in an area of abnormal somatic sensory functions. This type of disabling, degenerative pain usually is caused by damaged or dysfunctional nerve fibers. Symptoms in an affected region include positive sensory phenomena, such as spontaneous shooting or burning pain; negative sensory phenomena, such as loss of sensation; and paresthesiae, such as tingling. Though it is paradoxical to define pain as both hyper- and hypo-tactile function and therefore sensitivity, it is the presence of both positive and negative somatic sensory phenomena that defines neuropathic pain. Common causes of neuropathic pain include trauma, amputation, diabetes, chemotherapy, shingles, HIV or AIDS, multiple sclerosis, alcoholism and spinal cord injury.
Diagnosis of neuropathic pain is difficult because the spontaneous symptoms cannot be further characterized by physicians in terms of standardized examination and testing. Quantitative sensory testing (QST) is becoming a more common method to diagnose pain-related diseases by determining the sensatory thresholds, including pain, for temperature or mechanical types of stimuli. Previous methods for dermal temperature-based QST include application of or immersion in hot or cold liquids where duration of immersion is measured and exposure to intense light or contact with an ohmic heating element where thresholds are determined. To date, no device has been utilized in point-of-care medicine to assist routine diagnosis and therapy monitoring. However, the development of a method to quantify neuropathic pain is essential to thoroughly investigate mechanisms of the disease and to develop and manage treatment plans.
The new approach utilizes rating of suprathreshold thermal stimuli to detect abnormal sensory perception of pain. Through comparison of a subject’ s rating of stimuli intensity to predetermined response values, a quantitative measurement of the status of the affected area in terms of either deficits or positive sensory phenomena can be used to further develop a sensory map of these abnormalities. This new method provides a comprehensive approach for the diagnosis and classification of neuropathic pain.
The improved system comprises a handheld heating probe, control unit and feedback data point recorder. The heating element, such as a brass capped high power metal film resistor, is applied to an area of skin ranging from one to 10 square centimeters for durations of one to 10 seconds. A

comparator in the heat control unit, comprising a single-crystal microprocessor, then adjusts probe temperature between 32 °C and 50 °C until a target temperature is reached. The heat control unit also incorporates a fail-safe mechanism to ensure patient safety. The feedback recorder records the subject’ s indication of heat sensation and temperature of the probe at specific time intervals. Feedback from several regions of the subject’ s skin then is compared to predetermined values to create a sensory map to aid in diagnosis of neuropathic pain.

Application area

A UW-Madison researcher has developed an improved QST system and method to assist in the research and diagnosis of neuropathic pain and other chronic pain disorders.

Advantages

The device’ s handheld size, safety mechanism and flexibility in testing temperature, area and duration greatly improve the clinical applicability of quantitative sensory analysis. This invention will improve the diagnosis of painful neuropathies and help develop and manage treatment plans for such pain disorders.

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