Somatosensory Rehabilitation of Neuropathic Pain

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Worldwide, 450 million people suffer from chronic neuropathic pain. This pain is spontaneous, disrupting sleep, unresponsive to many drugs and often without clear anatomical etiology. This pain forces people to consult many medical doctors or therapists, without relief. Most treatments focus on coping with pain without reducing it. The International Association for the Study of Pain (IASP) defines neuropathic pain as: "pain caused by a lesion or disease of the somatosensory nervous system".

The dysfunction of the somatosensory system may allow opportunities for treating this complex painful problem. Claude J Spicher, Occupational Therapist and Certified Hand Therapist Switzerland, developed a method to evaluate, diagnose and treat neuropathic pain. The Somatosensory Rehabilitation of pain Method (SRM) can change and reduce neuropathic pain, using the neuroplasticity of the somatosensory nervous system. This article presents an overview of this method.

Neuroscience foundations for SRM

We all know that nociception is vital for the survival of the human being, alerting us to potential tissue damage or other threatening conditions. If the resulting pain perception is out of proportion to the tissue damage, is not resolved with normal healing, or is not associated with visible tissue damage, it could probably be neuropathic pain. Finnerup et al. (2016) proposed an algorithm for diagnosing neuropathic pain. In summary:

1. If the patient's history suggests that the pain may be related to a neurological lesion or disease and not to other causes such as inflammation or non-neural tissue damage and if the pain distribution is neuro-anatomically related, this may possibly be neuropathic pain.
2. If the pain is associated with sensory signs, such as "tingling", "numbness", "radiating", "dull" or "tugging" in the same neuro-anatomically distribution, this may probably be neuropathic pain.
3. If a diagnostic test confirms a lesion or disease of the somatosensory nervous system explaining the pain, the neuropathic condition is definite. (Finnerup et al., 2016).

The article from Finnerup however does not describe diagnostic tests for neuropathic pain. The SRM is descibes a series of useful, patient friendly, non-invasive tests.

Somatosensory nervous system

The somatosensory cortices in the brain are responsible for processing somatosensory information from the skin and soft tissues, such as the touch, temperature, pain and vibro-tactile senses. A lesion, due to trauma, entrapment, metabolic dysfunction or biochemical injury (Woolf & Manion, 1999) can affect the peripheral nerves and thus the somatosensory nervous system. Multiple studies in animal models of nerve injury demonstrate immune and histochemical changes of the nerve resulting in excitatory activity of the peripheral and central nervous system in the brain as a pain sensation. (Schmid et al, 2013; Calvo et al, 2015).

This means that a cutaneous nerve branch lesion, in the periphery, can induce spontaneous pain signals through the somatosensory nervous system, including but not limited to a phenomenon in which a simple touch is perceived as painful (Spicher et al., 2017).

Clinical anatomy

The cutaneous nerves form a very complex network just below the skin. Across the body, the 240 cutaneous nerve branches are therefore vulnerable to trauma and may consequently get injured (Spicher et al., 2020 Mar). Trauma, surgery, inflammation, nerve compression, polyneuropathy or any damage of the skin can damage the sensory nerve branches generating neuropathic pain. An atlas of clinical anatomy was composed on the basis of 3133 aesthesiographies mapping the partial loss of sensitivity in people suffering from neuropathic pain, to help identify the lesion of involved cutaneous nerve branches (Spicher et al, 2020 Mar).

Diagnosing neuropathic pain

McGill Pain Questionnaire

In the SRM the McGill Pain Questionnaire (MPQ) is used during treatment to describe and evaluate pain (Melzack. 1975). The MPQ consists of a list of qualifiers that allows patients to describe their unique pain phenomena and assesses the intensity of each of these qualifiers (Spicher, 2006; Spicher et al., 2020 Jan).

The patient is asked to choose the most appropriate qualifiers to describe her/his perception of pain and to quantify the intensity of each sub-group of qualifiers (i.e. from 0-5).

The total score, ranging from 0-100, can differentiate sensory pain from affective pain. Sensory pain is somatic pain (soma body) and affective pain is semantic pain (sema meaning). The qualifiers may also give preliminary indications about the type of neuropathic pain suffered by the patient, including tactile hypo-aesthesia (spontaneous neuropathic pain) or static mechanical allodynia (SMA) (touched-evoked neuropathic pain).

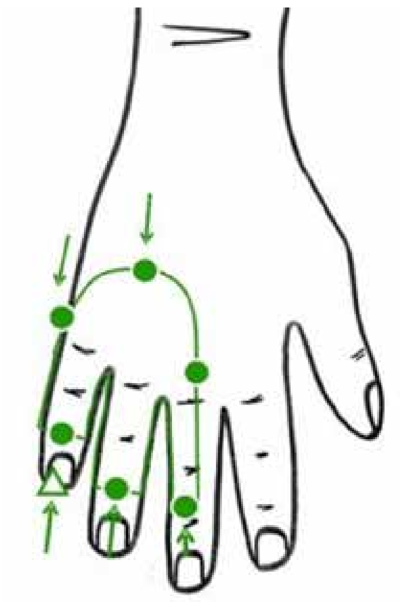
To diagnose neuropathic pain, the SRM assesses the sensitivity of the skin. Two different types of changes are distinguished. Tactile hypo-aesthesia, partial loss of sensitivity, and SMA: "pain due to a stimulus that does not normally provoke pain" (IASP 2011). Both types are diagnosed in different ways.

Diagnosing Hypo-aesthesia

If you presume the person is experiencing tactile hypo-aesthesia, the affected area is examined with an aesthesiometer in order to reveal the hypo-aesthetic territory. This is carefully mapped, following an established protocol. The boundaries of the hypo-aesthetic territory are drawn on an image of the affected body part. This map is called an aesthesiography (Spicher & Kohut, 2001).

This is the first clinical examination record of the SRM (Fig. 1). In the middle of the delineated territory, the degree of hypo-aesthesia is determined by the pressure perception threshold (PPT) using the different sizes of aesthesiometers from the Semmes-Weinstein monofilaments and by the static 2-point discrimination value. The effect of sensory re-education (Dellon, 2000) is measured by repeating the PPT and the static 2-point discrimination test.

Figure 1



Aesthesiography at 0.4-gram of the tactile hypo-aesthesia territory of the right dorsal branch of the ulnar nerve (7 February 2020). This aesthesiography delineates the area on which the stimulus is not detected. The points marked are the first point at which the patient cannot feel. The arrows indicate the axis on which the stimulus was applied ie, from normal sensation to no feeling. The triangle indicates the point from which measures were taken.

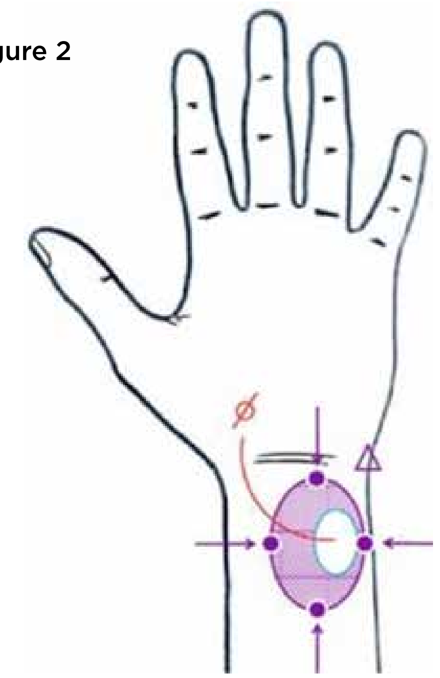
Diagnosing SMA

Allodynography

If you suspect that the patient suffers from SMA, the Visual Analogue Scale (VAS) is used to measure the pain intensity. As soon as the patient perceives change in intensity he/she must say STOP. Patients who have been in pain for a very long time get used to perceiving pain and it is difficult to map the problem if you don't explain clearly what you expect from the patient. The code used is: green when the pain at rest stays similar despite the application of the 15.0-gram stimulus, orange when the discomfort increases and red when the stimulus is perceived as painful.

With a 15.0-gram monofilament the boundaries of the painful skin are carefully mapped, always following the same procedure. The points where the patient tells you STOP are drawn on an image of the affected body part. This map is called an allodynography (Fig. 2). This is a new procedure for objective clinical examination of static mechanical allodynia (Packham et al., 2020 January).

Figure 2



15.0-gram - successive allodynographies for the left palmar branch of ulnar nerve of the left hand;
d0=first day of assessment
(16 July2013);
d19=19th day of treatment;
d58= 58th day of treatment
(Létourneau, 2014)

Rainbow pain scale

The rainbow pain scale (Spicher, 2006; Spicher et al., 2020 Jan) is a procedure used to determine the severity of the SMA. This test passes through the seven colours of the rainbow, going from red to violet, each color corresponding to increasing force levels (0.03–15.0 gram) using the monofilaments (Spicher et al., 2008).

This third clinical examination of the SRM demonstrates a significant 'inter-rater' and 'test-re-test' reliability (Packham et al., 2020 March).

By mapping the aesthesiography and allodynography, the pain becomes visual, instead of only being felt by the person. Patients are usually astonished by the accuracy of the drawing, which corresponds to the portion of skin where they experience neuropathic pain. During treatment, the changes of sensitivity on the Rainbow Pain Scale are used to evaluate the progress, even if the pain intensity remains consistent for the patient (Fig. 2).

Somatosensory rehabilitation

Once it is determined whether the patient has hypo-aesthesia or SMA, the patient receives a specific home program with exercises.

If the patient has spontaneous neuropathic pain, the exercises are performed in the hypo-aesthetic territory (Fig. 1). By 'waking' the skin, pain is 'put to sleep'.

With SMA, the skin cannot be rehabilitated in the painful territory as this provokes the pain. The patient is advised to avoid touching the painful area as much as possible. A Distant Vibrotactile Counter Stimulation (DVCS) is used to provide comfortable tactile stimuli.

To be effective, the patient needs to perform these sensory exercises 8 times a day, keeping two things in mind: exercises must always be perceived as comfortable, and it is important to focus on the stimulation, because it is an active relearning process. This can be compared with learning a foreign language or learning how to play an instrument. It needs determination, patience and a lot of engaged practice. Education and adherence are essential for successful somatosensory rehabilitation.

Continuing evaluation

By repeating the same diagnostic neuropathic pain tests, the progress can be monitored. A decrease in the PPT and static 2-point discrimination value means that the hypo-aesthesia is regressing.

Gradual shrinking of the allodynic territory is an indicator of SMA improvement, accompanied by decreasing rainbow pain values. When SMA resolves, one may find underlying hypo-aesthesia which has to be treated accordingly to prevent SMA from reappearing.

Conclusion

Pain is always a discomforting and disabling limitation for participation in daily life activities. By decreasing pain the person will experience increased participation. Somatosensory rehabilitation is a method for diagnosing and treating neuropathic pain originating from dysfunction of the somatosensory nervous system. The pain is carefully mapped by looking for areas of abnormal sensitivity of the skin.

The treatment, relying on the neuroplasticity of the somatosensory nervous system, is performed by patients themselves. The possibility to evaluate even the smallest change helps to encourage the patient to continue with the exercises. The treatment is tailored to fit the individual, but cannot be done without effort of the patient. Patience, activity modification and exercises are essential for success.

Finally, the 2c level of evidence-based practice - to treat Complex Regional Pain Syndrome of the upper extremity with SRM (cohort n=48) – suggests that this method may be an alternative to other conservative treatments (Packham et al., 2018). As to medical malpractice in nerve injury (Krauss et al., 2020), rehabilitation of neuropathic pain should emphasize the patient-clinician communication.

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