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Increased deep pain sensitivity in persistent musculoskeletal pain but not in other musculoskeletal pain states

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HIGHLIGHTS

- Patients with persistent pain demonstrate substantial generalized hypersensitivity.
- This is not the case for patients with acute or regularly recurrent pain.
- Yet, low levels of generalized hypersensitivity may still occur in these patients.

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ABSTRACT

Background: Pressure pain thresholds (PPTs) in a non-painful body area are known to be affected in some chronic pain states. The aim of this study is to investigate PPTs in a pain-free body part in relation to pain persistence and intensity in patients with musculoskeletal pain.
Methods: Patients with musculoskeletal pain were divided into three different pain groups: acute pain (pain duration < 3 months, $n = 38$), regularly recurrent pain (regularly recurrent pain duration > 3 months, $n = 56$), persistent pain (persistent pain duration > 3 months, $n = 52$) and a healthy control group ($n = 51$). PPT measures were conducted over the tibialis anterior muscle on the right leg in all groups.
Results: The persistent pain group showed significantly lower PPTs over the tibialis anterior muscle compared to controls. No significant differences were found between the acute and regularly recurrent pain groups compared to healthy controls. Significant correlations, albeit small, were found between pain intensity and PPTs.
Conclusions: Increased deep pain sensitivity was found in patients with persistent musculoskeletal pain, but not in regularly recurrent pain or in acute pain. Yet, a limitation of the study is that it did not have sufficient power to detect small levels of increased deep pain sensitivity among the latter groups when compared to healthy controls.
Implications: Knowledge about increased general hypersensitivity in persistent musculoskeletal pain could be important in clinical treatment.

1. Introduction

Chronic pain is different from acute pain in that patients with chronic pain typically show a maladaptive response to pain and developed central changes in pain mechanisms [1]. It has been shown that pain thresholds in a non-painful body area could be affected in pain states [2–5]. More specifically, it has been found that pressure pain thresholds (PPTs) are lower in the tibialis anterior muscle in patients with chronic low back pain compared to controls [2]. Furthermore, research has reported an association between long-lasting low back pain and localized as well as generalized lower PPTs [3,4]. Yet, no association has been found between recently developed low-back pain and PPTs [3]. Thus, it appears that deep-tissue hypersensitivity exists in individuals with long-lasting but not short-term low back pain [3]. Lower local and general PPTs, both in frequent episodic tension-type headache and chronic tension-type headache, compared to healthy controls has been

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found in earlier research [5]. However, evidence for lowering of only local PPTs, not general PPTs has been found in other studies examining chronic tension type headache [6,7]. With regard to pain sensitivity in acute pain, PPTs in acute musculoskeletal pain showed localized hyperalgesia but not generalized hyperalgesia [8].

Furthermore, it is not clear if general PPTs are affected in all pain states regardless of pain persistence. Studying generalized hypersensitivity with regard to pain persistence is important, since there is some evidence that generalized hypersensitivity is not present in acute or subacute pain stages [9], but the knowledge about exactly when generalized hypersensitivity develops during a painful experience is lacking. It is also unclear if the pain must be persistent, or if generalized hypersensitivity also develops during long-lasting regularly recurrent pain. In addition, no connection to pain intensity has been considered in previous research.

The aim of the present study was to investigate pressure pain thresholds in a pain-free body area in patients with musculoskeletal pain, and specifically whether such thresholds depend on the persistence, duration, and intensity of pain. It was hypothesized that patients with persistent, long-lasting pain, but not patients with acute or long-lasting regularly recurrent pain, would show substantial generalized deep tissue hypersensitivity. In order to determine the existence of generalized deep tissue hypersensitivity among these pain groups, we used a group of healthy controls as a benchmark. It was further hypothesized that higher perceived pain intensity would predict lower PPTs.

2. Material and methods

2.1. Study population

Patients seeking a physiotherapist at a primary health care facility in southern Sweden for pain in the musculoskeletal system were recruited. Inclusion criteria: musculoskeletal pain and fluency in Swedish. Exclusion criteria: diagnosed cognitive impairment, psychiatric diagnoses except depression as a secondary diagnosis, brain damage, being under 18 years of age, and pain in the L4 dermatome or L5 dermatome region of the lower right leg. The same participants were also asked to participate in a study of cognitive function. Patients (5%) who declined to participate did so due to lack of time or because they did not want to participate in research projects. The current sample consisted of 214 participants (72 males, 129 females), aged 18–80 years. Thirteen patients were excluded due to drug or alcohol abuse or to psychiatric diseases not known to the physiotherapist at the first meeting. This was done when the patient records at the primary health care center were searched for exclusion criteria. Every patient record was searched for exclusion criteria after the first meeting and the patient was asked about exclusion criteria at the first meeting. All participants signed an informed consent form and the study was approved by the regional ethics review board in Linköping (2012/173-31).

All patients were diagnosed according to ICD-10, (Table 1). If the patient fitted into more than one diagnose category, they were placed in the category which resembled the problem for which they were seeking the physiotherapist treatment. Patients were asked whether they experienced pain in more than one body region and the number of affected body parts were noted (Table 2). Patients were divided into three groups according to oral description of their pain history in terms of the pain duration and pain persistence. Patients with acute pain (pain for less than 3 months) were placed in one group, patients with regularly recurrent pain (discrete episodic, regularly recurrent pain, with pain-free periods between, for at least several times a week and at least for 3 months) in another group and patients with persistent pain (persistent pain for at least 3 months) in a third group. The control group consisted of staff at the primary health care center, people accompanying patients to the primary health care center, employees from a private company in the southern part of Sweden, and of former patients who had recovered from acute pain.

Patients were asked for information about current medication. Medications in the group with acute pain consisted of paracetamol, NSAID and opioids. Medications in the group with regularly recurrent pain consisted of paracetamol, NSAID and opioids. Medications in the group with persistent pain consisted of paracetamol, NSAID, opioids, antidepressant drugs, anti-epileptics, sleeping drugs, muscular relaxants and folic acid analogues. Pain-relieving medication in the acute pain group was used temporarily, in the regularly recurrent pain group sporadically since these patients did not have constant pain signaling. In the persistent pain group, the pain-relieving medications were used continually, since these patients experienced constant pain signaling.

2.2. Instruments

A Visual Analogue Scale (VAS) ranging from 0 (no pain) to 10 (the worst imaginable pain) was used to measure pain intensity [10]. A manual Somedic algometer (Somedic AB, Sweden) with a tip size area of 1 cm^2 was used to measure PPTs. All PPTs were assessed with an application rate of 30 kPa/s.

2.3. Protocol

Two different experienced physiotherapists diagnosed, treated and tested the patients. Both physiotherapists had earlier experience of measuring PPTs with a manual algometer. All patients were examined and diagnosed before the PPT measurement. During the PPT measurement patients were asked to lie down on an examiner's bench with no clothing on the lower part of the right leg. When in supine position, the participant was asked to estimate his/her pain intensity on VAS. After this, three consecutive PPT measurements were conducted over the middle part of the right tibialis anterior muscle belly. The patients held a signal button connected to the Somedic algometer in their dominant hand and pressed the button when the perceived pressure turned into a painful sensation. When the button was pressed, the PPT measurement was interrupted. If no painful sensation had been induced by 1500 kPa pressure, the measurement was interrupted and this was considered as a missing value. A mean value of the three PPTs was calculated and later used in statistical analyses.

3. Results

We first analyzed whether the PPTs were normally distributed. This was not the case and thus the PPTs were log-transformed. After transformation of data, the variable followed a normal distribution, allowing us to use parametric tests in our subsequent analyses. Also, the PPTs met the assumption of homogeneity of variance among the different pain groups. Descriptive statistics and (untransformed) PPTs for the healthy control, acute pain, regularly recurrent pain, and the persistent pain groups appear in Table 2 and Fig. 1, respectively.

3.1. PPTs

In order to test our first hypothesis that patients with persistent, long-lasting pain, but not patients with acute or long-lasting regularly recurrent pain, would show substantial generalized deep tissue hypersensitivity, we performed three planned comparisons where each pain group was compared to healthy controls. Because the gender distribution across the four pain groups was uneven and because we found that gender was significantly related to