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Clinical note

I can't find it! Distorted body image and tactile dysfunction in patients with chronic back pain

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Abstract

The conscious sense of our body, or body image, is often taken for granted, but it is disrupted in many clinical states including complex regional pain syndrome and phantom limb pain. Is the same true for chronic back pain? Body image was assessed, via participant drawings, in six patients with chronic back pain and ten healthy controls. Tactile threshold and two-point discrimination threshold (TPD) were assessed in detail. All the patients, and none of the controls, showed disrupted body image of the back. Five patients were unable to clearly delineate the outline of their trunk and stated that they could not "find it". TPD was greatly increased in the same zone as the absence or disruption of body image, but was otherwise similar to controls. The disturbance of body image and decrease in tactile acuity coincided with the normal distribution of pain, although there was no allodynia and there was no relationship between resting pain level and TPD. Tactile threshold was unremarkable for patients and controls. These preliminary data indicate that body image is disrupted, and tactile acuity is decreased, in the area of usual pain, in patients with chronic back pain. This finding raises the possibility that training body image or tactile acuity may help patients in chronic spinal pain, as it has been shown to do in patients with complex regional pain syndrome or phantom limb pain.

Keywords: Chronic pain; Body schema; Two-point discrimination; Cortical reorganisation; Consciousness

1. Introduction

The feeling we have of our own body, its contours and alignment in space, the fact that it is ours, constitutes a fundamental aspect of self-awareness [11]. This physical self-awareness, or body image, depends on internal body maps that are modulated by somatic and proprioceptive input (see [10] for review). Although it is often taken for granted, body image is sometimes disrupted in people with pain disorders such as complex regional pain syndrome [16] and phantom limb pain [7].

The most common chronic painful condition is back pain. Patients with chronic back pain have reduced proprioceptive acuity at the back [3], have a cortical representation of the back that is markedly different to healthy controls [4], and, anecdotally, find subtle movements of their pelvis and back more difficult than people without back pain do. It is not known, however, whether the conscious sense of the back is disrupted in people with chronic back pain. Data from CRPS and phantom limb pain, which show decreased tactile acuity and distorted body image for the affected limb (see [8] and [13] for reviews) suggest body image and tactile acuity might be disrupted in patients with back pain too. This clinical note concerns six patients with chronic back pain, in whom body image and tactile acuity on the back, were assessed in detail.

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Table 1
Patient characteristics

	Age (yrs)/gender	Distribution of pain	Duration since onset (months)	TPD (mm)	TPT (g)	Pain[1 week]	Reported medications
A	36/F	Bilateral	16	47 ± 4	1.4 ± 0.2	48	Paracetamol, amitriptyline
B	29/M	Bilateral	38	49 ± 5	1.2 ± 0.2	60	Fluoxetine (Prozac)
C	54/M	L	42	47 ± 3	1.3 ± 0.3	45	Paracetamol, tramadol
D	39/F	L	60	48 ± 3	1.1 ± 0.3	39	Diclofenac, aspirin
E	58/F	R	37	51 ± 7	1.1 ± 0.2	29	Paracetamol, amitriptyline
F	47/M	R	120	51 ± 6	1.3 ± 0.3	62	None reported
		Control data		47 ± 8	1.2 ± 0.4		

F, female; M, male; L, left; R, right; Pain[1 week], 100 mm VAS in response to: "How would you rate your *average* pain over the last week?" Left anchor, "No pain"; right anchor, "Worst possible pain"; TPD, mean ± SD two-point discrimination threshold; mean ± SD TPT, tactile perception threshold using von Frey hairs. Final row shows control group data.

2. Methods

A consecutive sample of six patients (three females) who satisfied several criteria (had a greater than 12-month history of back pain; had been classified as having 'non-specific spinal pain' because structural and disease factors had been excluded; had been referred for physiotherapy treatment; were unable to voluntarily tilt their pelvis, in the sagittal plane, in standing) participated (Table 1). All spoke English as a first language. All had completed formal education to at least a high school level. Ten patients (five females) of similar age, but who presented for treatment of upper limb pain and had no history of back pain in the last 2 years, also participated as controls.

An approach previously used to investigate the body image relating to the hand and face [9], was used to investigate the body image relating to the trunk. Participants stood in front of a waste-high bench. They were given a line drawing that showed the posterior surface of the back, but with only the top and bottom of the picture drawn (Fig. 1). Participants were given the following instruction: "Concentrate on your back. Add to this drawing by following the outline of your own back as you track it in your mind. Concentrate on where you feel your back to be. Also draw in the vertebra that you can feel. Do this without touching your back. Your drawing should relate to your own sense of your back. Don't draw any part you can't sense. Do not draw what you think your back looks like – draw what it feels like."

On completion of the drawing, patients were asked "What is your pain level right now?" and responded on a 100-mm VAS, anchored at left with "None" and at right with "Worst possible".

Participants then lay prone and an investigator, who was blinded as to whether the participant was a patient or a healthy control participant, measured two-point discrimination threshold (TPD), according to the method described by Moberg [15]. A mechanical calliper with a precision of 1 mm was applied until the very first blanching of the skin appeared around the prongs. Testing commenced with 0 mm between the two points of the calliper, gradually increasing the distance until the subject was able to perceive two points instead of one. The patient was instructed to say 'one', when one point was felt, 'two', when two points were felt. Catch trials verified that patients were not guessing. TPD was assessed bilaterally at 16 levels from the fourth thoracic vertebra to the bottom of the gluteal folds. Three measures were taken at each level on each side. The medial point was 1 cm, 2 cm and 3 cm from the midline, respectively. Level was randomised and counterbalanced and side was alternated until six measures (three each side) were obtained. The average of these three measures at each level was used for analysis. Tactile threshold was tested bilaterally at each level, using von Frey hairs. The average of an ascending series and a descending series was considered the tactile threshold. Level and side was randomised. Tactile threshold and TPD at a given level were considered to be increased if they were more than three standard deviations greater than the average obtained across all levels for that participant.

For patients, a full clinical interview and physical examination was undertaken after data collection was complete.

3. Results

Patient data pertinent to this clinical note, including the duration of symptoms, medications, and pain, are included in Table 1. The distribution of pain is shown in Fig. 1. In the control participants, body image drawings were unremarkable and tactile threshold and TPD were consistent across levels and sides. A different picture emerged from the patient data. While tactile threshold was consistent across the back and similar to the control values, three notable phenomena emerged from the TPD data. First, five out of the six patients found that they couldn't delineate the full extent of their trunk. Without exception, these participants volunteered, verbatim, "I can't find it". Several paused their drawing while they "searched for it" (patients A, D, E and F). Their drawings clearly show where the delineation of the trunk was lost. Two patients (A and F) reported that

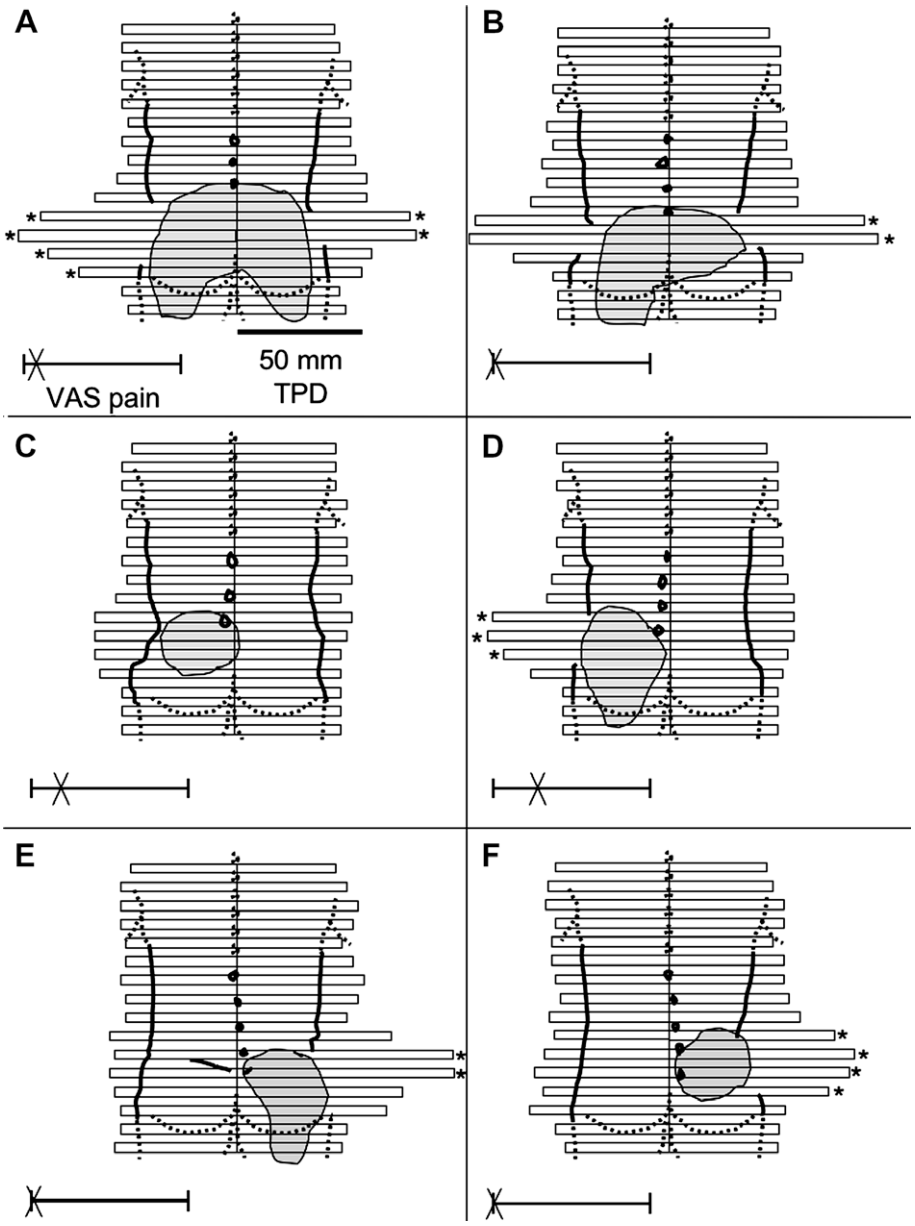

Fig. 1. Patient data: TPD threshold, normal distribution of pain, and body image. Two-point discrimination threshold (TPD) was assessed bilaterally at 16 levels, shown here superimposed over line drawings of the sense of physical self, or body image, of six patients with chronic back pain. Dotted lines formed the template given to patients. Solid lines are those added by the patients. Shaded area shows distribution of pain marked on a body chart by the patient prior to other assessments. Horizontal bars show the TPD threshold at each of 16 levels taken bilaterally. Asterisk denotes different to the mean TPD for that patient by more than three standard deviations. Note missing outlines of the back in the zone of their usual pain in all patients except C. Between drawing, which was done in standing, and measurement of TPD, which was done in prone, patients completed a 100 mm VAS for current pain. Individual patient responses are marked with an X.

"It feels as though it has shrunk". No patients drew all their vertebrae. Missing vertebrae coincided with the level at which the delineation of the trunk outline was lost. Without exception, this missing outline of the body image occurred at the level of, and the side of, the normal distribution of their chronic back pain (Fig. 1). Second, in five patients (A, B, D, E and F), TPD was greater at the side and level of these missing outlines, but it was not greater at any other level and it was, on the whole, similar to the control data (Table 1). Third, when patients did draw their vertebrae, there was a tendency for the vertebrae to be displaced from the midline, toward the painful and/or undelineated side (C–F).

4. Discussion

This cross-sectional investigation in a small group of patients with non-specific back pain, and a comparison

group of healthy controls, demonstrates in patients, disrupted body image and decreased tactile acuity at the level and side of back pain. This is the first investigation of body image in patients with back pain, but there is previous evidence of distortion of body image from patients with CRPS [16] and phantom limb pain [7] and reduced proprioceptive acuity is well established in people with back pain [12,2]. Notably however, CRPS and phantom limb pain patients tend to perceive the painful or phantom limb as being bigger than it really is (or than it should be in the case of phantom limb pain), which seems counter to the pattern observed here in back pain patients. Indeed, the vertebrae were drawn to the affected side of midline and two patients even reported that the part *felt* smaller than it should be.

Why might that be? One factor that seems relevant concerns cortical reorganisation: in CRPS, where the perceived size of the limb is enlarged, its representation in primary sensory cortex is smaller than that of the unaffected limb [14] and in phantom limb pain, the representation of the face invades that of the missing limb, as though the representation of the missing limb has got smaller. Importantly, amputees without phantom limb pain show relatively limited reorganisation [6]. In contrast, in back pain, where the affected area feels smaller or as though it is 'missing', there is a different pattern of cortical reorganisation – the representation of the back is larger than it is in healthy controls [4]. Taken together, these data raise the possibility that S1 representation and perceived size of a body part are inversely related.

The second new finding of this work is that increase in TPD, or decrease in tactile acuity, coincided with the disruption of body image. This would seem intuitively sensible because body image is known to depend on somatic and proprioceptive input (see [10] for review). It is not possible to determine, however, where on the sensory neuraxis the disruption is mediated – peripheral, spinal and cortical mechanisms are all possible (see [13] for review). However, as has been noted [19], TPD threshold depends on lateral inhibition provided by interneurons in S1, so a persistent decrease in TPD necessarily constitutes a shift in the response profile of S1 neurons, regardless of other influences.

That body image depends on sensory input is accepted, but new data suggest that the link may be bi-directional. In healthy volunteers, disrupting the body image of one arm via a perceptual illusion of ownership over an artificial counterpart, reduces blood flow to that limb [17] and, in patients with CRPS, disrupting the body image of the affected limb via visual distortion, modulates pain and, importantly, swelling of that limb (MOSELEY ET AL UNPUBLISHED DATA).

One opportunity that is suggested by the current work is that of targeting tactile acuity and body image as part of treatment for chronic back pain. In phantom limb pain and CRPS, training tactile acuity reduces pain and increases function [5,18] – the same might be true for back pain. A preliminary study of a commercial device in which patients spent 30 min a day discriminating the location of a tactile stimulus to the back found it no better than TENS [1], but there were no tactile acuity or body image data in that study, which leaves the possibility open that selecting patients according to body image or tactile acuity might impart better results. Furthermore, the effect of tactile training for CRPS is enhanced when patients can see the skin of the affected area (Moseley et al., unpublished data) – perhaps this would impart better results too.

In summary, the main findings described in this clinical note are (i) body image of the back was disrupted in these six patients – all but one were unable to clearly delineate the full outline of the trunk and those with unilateral back pain felt the vertebrae to be misplaced toward the disrupted side, (ii) decreased tactile acuity coincided with the disruption of body image, and (iii) both tactile acuity and body image disruption coincided with the normal location of chronic back pain.

Conflicts of interest

There are no conflicts of interest.

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