Musculoskeletal Science and Practice 33 (2018) 61–66

Contents lists available at ScienceDirect

Musculoskeletal Science and Practice

journal homepage: www.elsevier.com/locate/msksp

Original article

Tactile acuity is reduced in people with chronic neck pain

Daniel S. Harvie[a,b,c,d,*], Grace Edmond-Hank[c], Ashley D. Smith[a,b]

[a] Recover Injury Research Centre, NHMRC Centre of Research Excellence in Recovery Following Road Traffic Injuries, University of Queensland, Brisbane, Australia
[b] School of Allied Health Sciences, Griffith University, Gold Coast, Australia
[c] Menzies Health Institute QLD, Griffith University, Gold Coast, Australia
[d] Bond Institute for Health & Sport, Bond University, Robina, Australia

ARTICLE INFO

Keywords:
Tactile acuity
Musculoskeletal pain
Neck pain
Chronic pain
Whiplash
Two-point discrimination
Somatosensory precision

ABSTRACT

Background: Tactile acuity deficits have been demonstrated in a range of persistent pain conditions and may reflect underlying cortical re-organisation.
Objective: This study aimed to determine whether tactile acuity is impaired in people with chronic neck pain relative to controls, and whether deficits relate to pain location, duration and intensity.
Methods: In this cross-sectional study, 20 people with chronic neck pain (5 idiopathic neck pain; 15 whiplash-associated disorder) and 20 pain-free controls underwent two-point discrimination (TPD) testing at the neck, back and arm, and point-to-point (PTP) and graphesthesia tests of tactile acuity at the neck and arm.
Results: Linear mixed effects models demonstrated a significant group*body region interaction for TPD, Graphesthesia and PTP tests ($Ps < 0.001$), with post hoc tests showing impaired TPD in people with neck pain relative to controls at the neck, low back, and arm ($P \leq 0.001$). Graphesthesia and PTP was also impaired at the neck ($P < 0.001$) but not the arm ($P \geq 0.48$). TPD correlated with intensity and duration of pain (Pearson's $r = 0.48$, $P < 0.05$; Pearson's $r = 0.77$, $P < 0.01$). There was no sig difference between the two neck pain groups for any tactile acuity measure (TPD: $P = 0.054$; Graphesthesia; $P = 0.67$; Point to Point: $P = 0.77$), however, low power limited confidence in this comparison.
Conclusion: People with chronic neck pain demonstrated tactile acuity deficits in painful and non-painful regions when measured using the TPD test, with the magnitude of deficits appearing greatest at the neck. The study also revealed a positive relationship between TPD and pain intensity/duration, further supporting the main study finding.

1. Introduction

The precise ability to sense touch, known as tactile acuity, appears to be reduced in some chronic pain conditions (Catley et al., 2014). Since these impairments are not the result of diminished tactile detection (Moseley, 2008; Wand et al., 2010) or transmission (van Rijn et al., 2009), deficits are thought to be a manifestation of altered somatosensory processing. This is supported by the observation that tactile acuity deficits coincide with changes in functional organisation of the somatosensory (S1) cortex, observable using functional Magnetic Resonance Imaging (fMRI), in a range of chronic pain conditions, including: complex regional pain syndrome (Juottonen et al., 2002), carpal tunnel syndrome (Tecchio et al., 2002), phantom limb pain (Flor et al., 1995), and low back pain (Flor et al., 1997). Since tactile acuity depends on somatosensory function, tactile acuity tests such as the two-point discrimination test (TPD) are purported to provide a window into S1 function. Early studies suggest tactile training approaches might normalize S1 reorganization, and reduce pain (Flor et al., 2001; Moseley et al., 2008a; Pleger et al., 2005), which has driven further interest in tactile acuity testing which in the future may be useful to identifying patients appropriate for such treatment.

To date, tactile acuity and cortical reorganization has only been examined in a limited number of conditions (Catley et al., 2014). No studies to date have investigated tactile acuity in people with chronic neck pain (CNP), which is surprising given that CNP stands as one of the greatest causes of disability world-wide (Vos et al., 2015), and a need to investigate tactile acuity at the neck has been recently been highlighted (Luedtke and Adamczyk, 2017). Investigating signs of central adaptation is also of particular interest given the limited evidence to support the assumption that tissue damage or disease causes chronic neck pain. For example, tissue abnormalities often blamed for pain occur at similar rates in people without pain (Anderson et al., 2012; Jensen et al., 1994). Notwithstanding the limitations of imaging techniques, tissue factors at best provide an incomplete picture of the cause of ongoing

* Corresponding author. Bond University, Robina, QLD 4226, Australia.
E-mail address: dharvie@bond.edu.au (D.S. Harvie).

https://doi.org/10.1016/j.msksp.2017.11.009
Received 11 August 2017; Received in revised form 2 November 2017; Accepted 18 November 2017

neck pain (Curatolo et al., 2011). Notably, while central adaptations may be implicated across chronic neck pain conditions, whiplash associated disorder (WAD) have frequently been associated with greater signs of central dysfunction relative to idiopathic neck pain (Scott et al., 2005).

We aimed to determine whether tactile acuity is impaired in people with CNP relative to controls, whether deficits are localised to the painful body region, and whether deficits relate to duration and intensity of pain. We also aimed to investigate if tactile acuity was influenced by the origin of neck pain (e.g. whiplash injury vs. idiopathic onset). We hypothesised that tactile acuity would be impaired in people with CNP, only at the site of pain, and that deficits would correlate with pain intensity and duration, and be greater in WAD. Further, we conducted these investigations using a range of tactile acuity testing methods, since distinct tests are likely to involve distinct central and peripheral mechanisms.

2. Methods

2.1. Participants

People with CNP were recruited through a database within the Recover Injury Research Centre and through a local physiotherapy practice between June and December 2016. An age and gender matched control (± 5 years) was recruited for each CNP participant using word of mouth and campus media. All participants were between the ages of 18–65 years. Participants with daily, chronic (> 3 months) idiopathic or traumatic neck pain were eligible for inclusion in the study. Allocation to WAD or idiopathic CNP subgroup was made by a physiotherapist based on the history of the presenting complaint and whether the onset was insidious/non-traumatic (idiopathic) or involving a traumatic whiplash-type mechanism (WAD). People with potential neurological deficit (symptoms or signs) were excluded, including those with head injuries, strokes and diabetes. Co-morbid musculoskeletal complaints including lower back and hand pain were recorded and accounted for in statistical analyses. Control group participants were excluded on the basis of history of chronic pain, current pain, or presence of neurological disorder or neurological symptoms/signs such as dysesthesia. Age, height and weight were collected as these factors are purported to have a small impact on tactile acuity (Lourens, 2014; Falling and Mani, 2016). Duration of pain was self-reported and average intensity of pain over the last week was quantified using the visual analogue scale within the McGill pain questionnaire (Melzack, 1987) and the Neck Disability Index was used to categorise disability as mild (< 28%), moderate (30–48%), severe (50–68%) or complete (> 70%) (Vernon and Mior, 1991). Ethics approval was granted by the Griffith University Human Research Ethics Committee (2016/168). All data was collected in Recover Injury Research laboratory and Allsports physiotherapy clinic between June and October of 2016 by a trained research assistant who was blind to study aims and hypotheses, but not to group allocation.

2.2. Procedures

Participants lay prone on a height adjustable treatment table, with their neck, low back and arm exposed. A pen was used to mark the anatomical reference points for the tests on the participant's dominant side (Fig. 1). If the participant did not have neck pain on their dominant side, testing was performed on the painful side (n = 5). Tests were performed by the same examiner (research assistant) in a standardised order (TPD, PTP then Graphesthesia).

2.2.1. Two-point discrimination

TPD was assessed using an established protocol (Catley et al., 2013). Briefly, a sliding two-point Vernier Calliper (Fig. 1) with digital measurement was placed under its own weight on the participant's skin, to provide two simultaneous tactile stimuli. For the spinal measures, the caliper was aligned vertically 15 mm lateral to the spinous processes of C7 or L4 in the neck and low back respectively. At the arm, the caliper was aligned with the long axis of the dorsal forearm 15 mm proximal to the wrist joint-line. Assessment commenced with the two-points at a 20 mm separation, and was increased by 2 mm increments until the participant reported feeling two points of contact. If two distinct points were perceived in three consecutive trials this value was recorded. A series of three ascending and descending assessments were performed, with the mean of the six values used for analyses. TPD has been shown to have excellent intra-rater reliability at the neck (ICC = 0.85)[23].

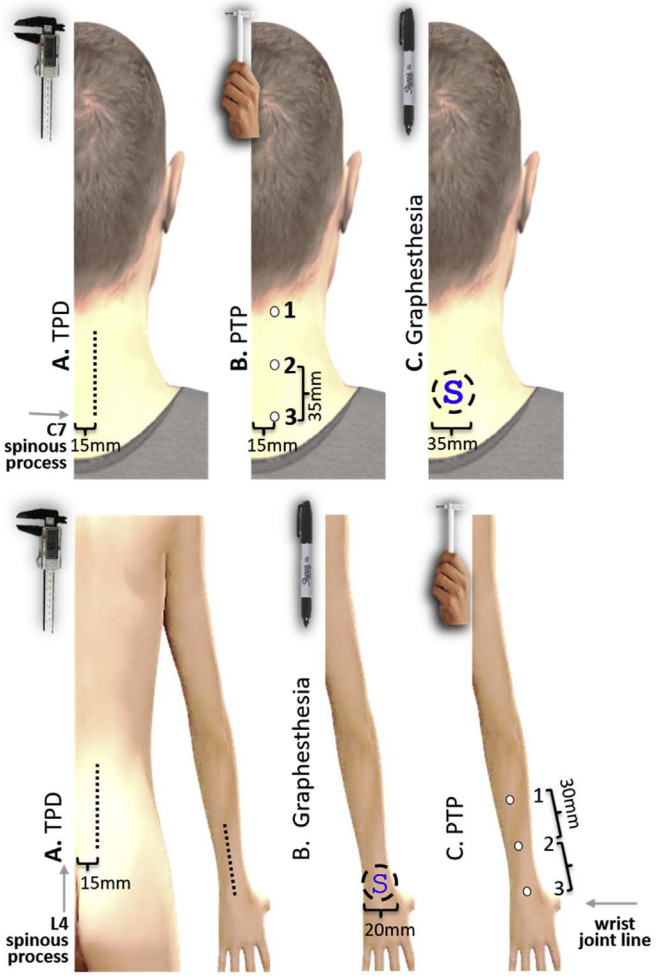

Fig. 1. Visual representation of the location and equipment for each tactile acuity test at each location. The tools depicted represent the Vernier Digital Sliding Caliper, Von Frey filament and fine tipped pen.

2.2.2. Point-to-point

A testing protocol designed for assessment of PTP in the lumbar spine was previously adapted for use in the cervical region (Adamczyk et al., 2016). The methodology adapted for the cervical region and used in this study was previously described and shown to have good intra-rater reliability (ICC = 0.60) (Harvie et al., 2017). Participants held a fine tip pen in their dominant hand positioned in contact with their occiput. A Von-Frey filament (6.45 g) was applied by the experimenter for 1 s per trial three-times at each of the three locations in pre-randomised order (Fig. 1). Participants were instructed to use the pen tip to mark the location of perceived touch as accurately as possible. The score for each trial was the absolute error (mm) between the actual and perceived point of touch, measured using a mechanical sliding calliper. The mean of nine trials entered the analysis. For the forearm,