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The effect of chronic low back pain on tactile suppression during back movements



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ABSTRACT

The aim of the present study was to examine whether tactile suppression, the phenomenon whereby tactile perception is suppressed during movement, would occur in the context of back movements. Of particular interest, it was investigated if tactile suppression in the back would be attenuated in those suffering from chronic low back pain. Individuals with chronic low back pain ($N = 30$) and a matched control group ($N = 24$) detected tactile stimuli on three possible locations (back, arm, chest) while performing a back or arm movement, or no movement. We hypothesized that the movements would induce tactile suppression, and that this effect would be largest for low-intense stimuli on the moving body part. We further hypothesized that, during back movements, tactile suppression on the back would be less pronounced in the chronic low back pain group than in the control group. The results showed the expected general tactile suppression effects. The hypothesis of back-specific attenuation of tactile suppression in the chronic low back pain group was not supported. However, back-specific tactile suppression in the chronic low back pain group was less pronounced in those who performed the back movements more slowly.

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1. Introduction

Many functional behaviors such as, for example, standing up from a chair, or lifting a shopping bag, involve back movements. The adequate performance of these goal-directed behaviors requires the brain to selectively filter out the vast majority of potentially distracting tactile inputs that are associated with the execution of such movements (Bays & Wolpert, 2007; Gallace, Zeeden, Röder, & Spence, 2010). As an example of such a filtering mechanism just take the phenomenon of tactile suppression, which refers to the intriguing observation that voluntary movement results in reduced levels of somatosensation (Chapman & Beauchamp, 2006). Tactile suppression has been well documented in studies showing that the execution of a movement attenuates the detection of light, near-threshold tactile stimuli, particularly when delivered to the moving body part (Chapman & Beauchamp, 2006; Juravle, Deubel, & Spence, 2011; Juravle, Deubel, Tan, & Spence, 2010; Juravle, McGlone, & Spence, 2013; Juravle & Spence, 2011; Post, Zompa, & Chapman, 1994; Voss, Ingram, Wolpert, & Haggard, 2008; Williams & Chapman, 2000, 2002; Williams, Shenasa, & Chapman, 1998). Whereas tactile suppression has typically been demonstrated for those movements involving the fingers or the hands, a recent study also showed that back movements result in an attenuation of the detection of tactile stimuli administered to the back (Van Hulle, Juravle, Spence, Crombez, & Van Damme, 2013).

Whereas there has been some debate about the precise mechanisms underlying tactile suppression – most likely a combination of the descending motor command blocking the neural afferent pathway on the one hand, and the sensory feedback resulting from the movement on the other hand – it is commonly agreed that the suppression of tactile perception during a movement task may play an important functional role, namely filtering out task-irrelevant tactile information (Juravle et al., 2011, 2013). However, for certain individuals as, for example, chronic low back pain sufferers, tactile input to the back may be more relevant than for others, because they consider it a signal of potential bodily threat (Crombez, Eccleston, Baeyens, Van Houdenhove, & Van den Broeck, 1999; Peters, Vlaeyen, & Kunnen, 2002). Chronic pain patients have been hypothesized to be characterized by heightened attention to bodily sensations signaling potential threat, often referred to as hypervigilance (Chapman, 1986; Crombez, Van Damme, & Eccleston, 2005; Rollman, 2009; Vlaeyen & Linton, 2000). Hypervigilance has been argued to be a dynamic process that occurs when the fear system is activated, and when the individual's current goal is to escape or avoid pain or bodily threat (Crombez et al., 2005; Eccleston & Crombez, 1999; Legrain et al., 2009; Van Damme, Legrain, Vogt, & Crombez, 2010). Monitoring and avoiding potential bodily threats may be a prominent concern for chronic back pain sufferers when they have to perform a back movement (Crombez, Vervaet, Lysens, Baeyens, & Eelen, 1998). It has been shown that movements repeatedly associated with pain may elicit fear (Meulders, Vansteenwegen, & Vlaeyen, 2011; Meulders & Vlaeyen, 2011). Furthermore, the induction of bodily threat has been shown to result in enhanced attention to the threatened body part (Van Damme, Crombez, & Lorenz, 2007; Van Damme, Gallace, Spence, Crombez, & Moseley, 2009; Van Damme & Legrain, 2012; Vanden Bulcke, Van Damme, Durnez, & Crombez, 2013). If a similar threat-induced attentional effect were to occur during the performance of a back movement in those suffering from chronic low back pain, one might hypothesize this to result in less successful tactile suppression in the back region. Moreover, a recent study revealed that tactile suppression during back movements in healthy individuals was significantly reduced when the participants' attention was experimentally manipulated to the stimulated location (Van Hulle et al., 2013).

The aim of the present study was therefore to examine the idea of reduced tactile suppression during back movements in chronic low back pain sufferers. A group of individuals with chronic low back pain and a matched control group had to try and detect the presence (vs. absence) of individually calibrated tactile stimuli on three possible locations on the body (back, arm, or chest) while performing either a back movement, an arm movement, or else no movement at all. In line with previous work (Juravle et al., 2011; Van Hulle et al., 2013), we hypothesized that back (arm) movements would result in tactile suppression at the back (arm). Of particular interest, we also hypothesized that tactile suppression in the back during back movements would be less pronounced in the chronic low back pain group than in the control group. Because the experience of bodily threat in the chronic low back pain

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