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Original article

Sensory characteristics of chronic non-specific low back pain: A subgroup investigation<sup>☆</sup>Peter O'Sullivan<sup>\*</sup>, Robert Waller, Anthony Wright, Joseph Gardner, Richard Johnston, Carly Payne, Aedin Shannon, Brendan Ware, Anne Smith

School of Physiotherapy &amp; Exercise Science, Curtin University, GPO Box 1987, Perth, WA 6845, Australia

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## ABSTRACT

It has been proposed that patients with chronic non-specific low back pain (CNSLBP) can be broadly classified based on clinical features that represent either predominantly a mechanical pain (MP) or non-mechanical pain (NMP) profile. The aim of this study was to establish if patients with CNSLBP who report features of NMP demonstrate differences in pain thresholds compared to those who report MP characteristics and pain-free controls. This study was a cross-sectional design investigating whether pressure pain threshold (PPT) and/or cold pain threshold (CPT) at three anatomical locations differed between patients with mechanical CNSLBP ( $n = 17$ ) versus non-mechanical CNSLBP ( $n = 19$ ) and healthy controls ( $n = 19$ ) whilst controlling for confounders. The results of this study provide evidence of increased CPT at the wrist in the NMP profile group compared to both the MP profile and control subjects, when controlling for gender, sleep and depression (NMP versus MP group Odds Ratio (OR): 18.4, 95% confidence interval (CI): 2.5–133.1,  $p = 0.004$ ). There was no evidence of lowered PPT at any site after adjustment for confounding factors. Those with an MP profile had similar pain thresholds to pain-free controls, whereas the NMP profile group demonstrated elevated CPT's consistent with central amplification of pain. These findings may represent different pain mechanisms associated with these patient profiles and may have implications for targeted management.

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## 1. Introduction

Patients with chronic non-specific low back pain (CNSLBP) pose a complex diagnostic and management challenge. Classification systems (CS) that identify mechanisms that underlie the pain disorder have been advocated in clinical practice in order to better target interventions (O'Sullivan, 2012a, 2005; Woolf, 2011). The Quebec Task Force CS (Spitzer, 1987) whilst differentiating specific pathology and radicular pain from CNSLBP, does not further differentiate subjects with CNSLBP (Dankaerts et al., 2006). A recent review of clinical CS's for CNSLBP concluded that a limitation of the majority of CS's is that they do not consider underlying pain mechanisms and focus largely on biomechanical assessment (Karayannis et al., 2012).

A multidimensional CS system for LBP has been proposed that at the first level triages people with LBP to identify red flag disorders

and specific pathology from non-specific LBP (Fig. 1). Once identified, CNSLBP disorders are further differentiated on the basis of their pain characteristic's reflecting a spectrum from either 'mechanical pain' (MP) to 'non-mechanical pain' (NMP) (Fig. 1). This is based on routine clinical examination of the patient's reported pain characteristics linked to aggravating and easing factors and pain responses to movement and loading tests (O'Sullivan, 2005, 2012b; Vibe Fersum et al., 2009, 2012). While it is acknowledged that for some patients there may be a mixed pain profile for others the clinical distinction is clear. It is postulated that these groups may have different underlying neurophysiological mechanisms, where pain in the MP group is related to processes of peripheral sensitisation and some degree of activity dependent central sensitisation, whereas pain in the NMP group is related to more extensive changes in central pain processing. Other dimensions such as pain type, psychosocial, lifestyle, and movement related factors as well as pain comorbidities are also considered in the CS (O'Sullivan, 2005, 2012b; Vibe Fersum et al., 2009). Although this CS has previously been shown to have good inter-rater reliability for identification of aspects of the CS related to movement and psychological profiles (Vibe Fersum et al., 2009), no pain sensitivity (PS) testing

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<sup>\*</sup> Corresponding author. Tel.: +61 8 9266 3629; fax: +61 8 9266 3699.

E-mail address: [p.osullivan@curtin.edu.au](mailto:p.osullivan@curtin.edu.au) (P. O'Sullivan).

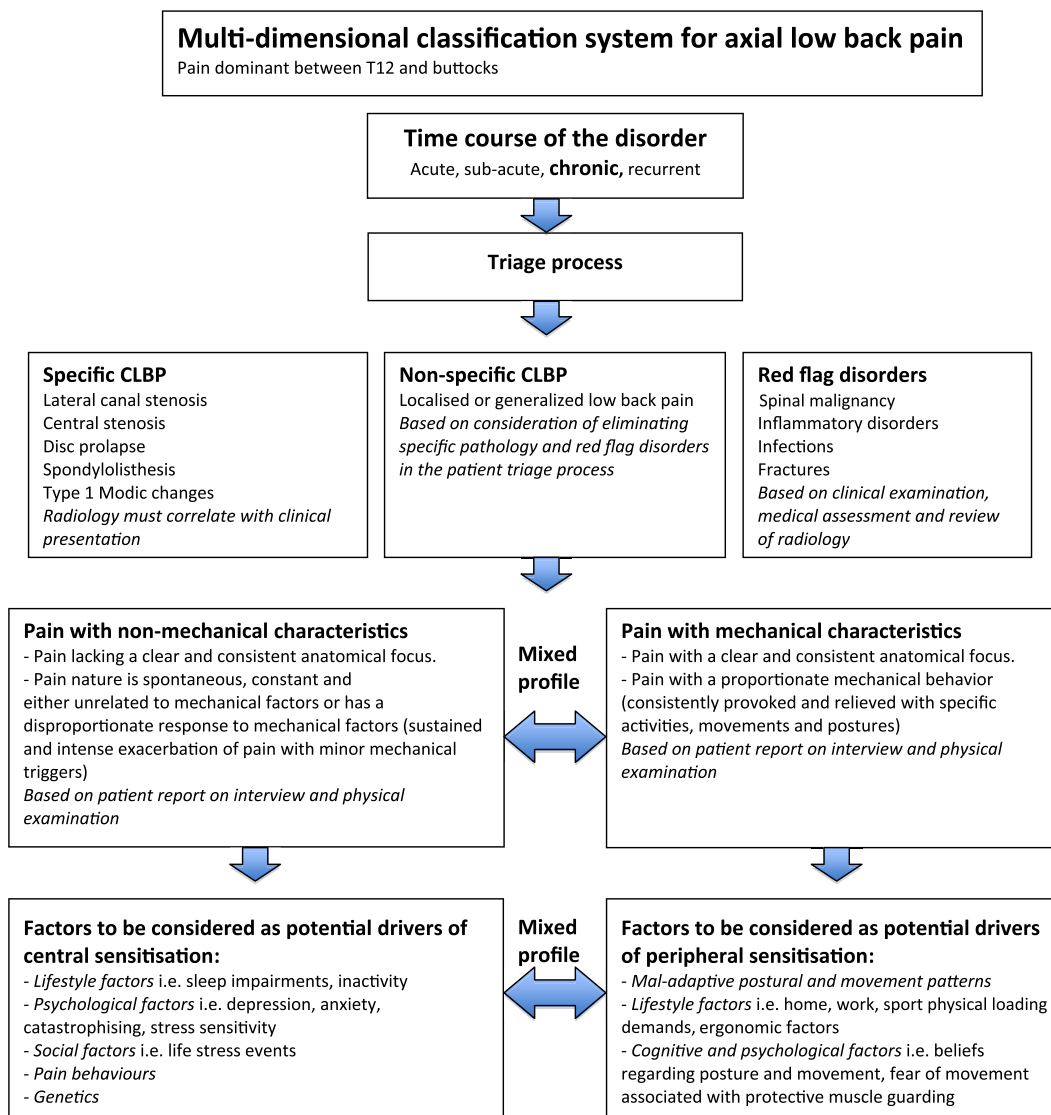


Fig. 1. Multidimensional classification of LBP disorders adapted from O'Sullivan, 2005, 2012b; Vibe Fersum et al., 2009, 2012.

has been conducted to quantify the sensory profiles associated with these pain characteristic profiles.

Both cold hyperalgesia and widespread pressure hyperalgesia are believed to be indicative of central hyperexcitability (Woolf, 2011). Pain Sensitivity testing is used to assess sensory presentations in various pain disorders (Rolke et al., 2006a) however little research has investigated PS in CNSLBP disorders and controversy exists regarding its value in understanding these disorders (Hubsher et al., 2013). A recent narrative review of available literature in CLBP concluded that currently the available research demonstrates mixed results, with some studies documenting reduced pain thresholds suggestive of widespread or extra-segmental hyperalgesia, other studies observe only segmental hyperalgesia and others reporting no hyperalgesia at all (Roussel et al., 2013). Another recent systematic review investigating the relationship between pain thresholds and pain intensity and disability levels in LBP and neck pain patients, concluded that pain thresholds are a poor marker for patients pain and disability levels (Hubsher et al., 2013). The apparent conflict between these findings

may reflect the heterogeneity of subjects in the different studies, with the potential for different pain phenotypes in the CNSCLP population unaccounted for by study design (Giesecke et al., 2004; Roussel et al., 2013).

Both sensory perception and sensory testing are potentially influenced by a number of factors other than pain, such as gender, age, genetics, body composition, sleep and psychosocial factors (Dunn, 1997; O'Sullivan et al., 2008; Leboeuf-Yde et al., 2009; Heffner et al., 2011; Woolf, 2011), highlighting the need to consider these factors when conducting research into PS. While there is limited research investigating whether the presence of CNSLBP is associated with PS changes independent of these factors, a recent study reported that pressure pain threshold (PPT) was most predictive of CNSLBP independent of age, gender, body composition and psychological factors (Neziri et al., 2012). Therefore the primary aim of this study was to investigate whether patients with CNSLBP who report features of NMP demonstrate differences in cold pain threshold (CPT) and PPT compared to those who report MP characteristics and pain-free controls.

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