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Observational study

Pain provocation following sagittal plane repeated movements in people with chronic low back pain: Associations with pain sensitivity and psychological profiles

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HIGHLIGHTS

- Provocative pain responses to repeated bending are heterogeneous in CLBP.
- Bidirectional pain increases were associated with greater pain sensitivity.
- No increase in pain was associated with low psychological questionnaire scores.

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ABSTRACT

Background and aims: Provocative pain responses following standardised protocols of repeated sagittal plane spinal bending have not been reported in people with chronic low back pain (CLBP). Potential differing pain responses to movement likely reflect complex sensorimotor interactions influenced by physical, psychological and neurophysiological factors. To date, it is unknown whether provocative pain responses following repeated bending are associated with different pain sensitivity and psychological profiles. Therefore the first aim of this study was to determine whether data-driven subgroups with different, clinically-important pain responses following repeated movement exist in a large CLBP cohort, specifically using a standardised protocol of repeated sagittal plane spinal bending. The second aim was to determine if the resultant pain responses following repeated movement were associated with pain and disability, pain sensitivity and psychological factors.

Methods: Clinically-important (≥2-points, 11-point numeric rating scale) changes in pain intensity following repeated forward/backward bending were examined. Participants with different provocative pain responses to forward and backward bending were profiled on age, sex, pain sensitivity, psychological variables, pain characteristics and disability.

Results: Three groups with differing provocative pain responses following repeated movements were derived: (i) no clinically-important increased pain in either direction ($n = 144$, 49.0%), (ii) increased pain with repeated bending in one direction only (unidirectional, $n = 112$, 38.1%), (iii) increased pain with repeated bending in both directions (bidirectional, $n = 38$, 12.9%). After adjusting for psychological profile, age and sex, for the group with bidirectional pain provocation responses following repeated spinal bending, higher pressure and thermal pain sensitivity were demonstrated, while for the group with no increase in pain, better cognitive and affective psychological questionnaire scores were evident. However, these associations between provocative pain responses following movement and pain sensitivity and psychological profiles were weak.

Conclusions: Provocative pain responses following repeated movements in people with CLBP appear heterogeneous, and are weakly associated with pain sensitivity and psychological profiles.

Implications: To date, suboptimal outcomes in studies examining exercise interventions targeting directional, movement-based subgroups in people with CLBP may reflect limited consideration of broader multidimensional clinical profiles associated with LBP.

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This article describes heterogeneous provocative pain responses following repeated spinal bending, and their associated pain sensitivity and psychological profiles, in people with CLBP. These findings may help facilitate targeted management.
For people with no increase in pain, the lack of pain provocation following repeated spinal bending, in combination with a favourable psychological profile, suggests this subgroup may have fewer barriers to functional rehabilitation. In contrast, those with pain provoked by both forward and backward bending may require specific interventions targeting increased pain sensitivity and negative psychological cognitions and affect, as these may be may be important barriers to functional rehabilitation.

1. Introduction

Clinicians commonly evaluate pain responses to repeated movement in people with chronic low back pain (CLBP), particularly sagittal plane spinal bending [1]. It has been reported that for some individuals, pain is not influenced by repeated movement, for some there is a unidirectional (UD) response to either repeated forward or backward bending, and for others there is a bidirectional (BD) response to both repeated flexion and extension [2–5].

The classification of subgroups within the population of people with CLBP is a research priority, which may facilitate targeted management strategies and improved treatment outcomes [6,7]. CLBP classification systems may be described as: (1) based upon clinical opinion, (2) based on theoretical models derived from experimental observation, (3) purely data driven [8]. The majority of movement-based classification systems [1,9,10] can be considered to be in the first two of these categories. While heterogeneous pain responses to a standardised protocol of directional repeated movements have been demonstrated [2], subgrouping based upon such movements is based upon clinical assessment underpinned by a theoretical model [1] and therefore cannot be regarded as purely data driven [8]. To date, the majority of studies examining pain responses to repeated movements have also involved samples including, or exclusively made up of, people with acute LBP +/− leg pain [11–18].

Potential differing pain responses to movement, such as those described above, likely reflect complex sensorimotor interactions influenced by physical, psychological and neurophysiological factors as highlighted in recent literature [19,20]. Investigations in people with CLBP support this premise. For example, in people with CLBP demonstrating pain provocation with repeated lifting, pain intensity has been positively associated with kinesiophobia, catastrophizing and depression [21]. People with CLBP reporting "disproportionate" pain responses to spinal movement, demonstrated greater pressure and cold pain sensitivity and higher levels of psychological distress than people with CLBP and "proportionate" pain responses [22]. Another study examining repeated lifting in people with CLBP demonstrated increasing pain intensity and pressure pain sensitivity over 25 repetitions [23].

Previously we have utilised data-driven methods to derive subgroups based upon pain sensitivity [24] and psychological factors [25] in the same CLBP cohort. Data-driven subgrouping involves statistical (broadly defined as the systematic organisation of numerical data) subgroup derivation, and does not rely upon clinical opinion or underlying theoretical models, but allows data collected from people with CLBP "speak for itself" [8].

Therefore the first aim of this study was to determine whether data-driven subgroups with different, clinically-important pain responses following repeated movement exist in a large CLBP cohort, specifically using a standardised protocol of repeated sagittal plane spinal bending. The second aim was to determine if the resultant pain responses following repeated movement were associated with pain and disability, pain sensitivity and psychological factors. To date these concepts have not been specifically investigated in the literature. This knowledge would provide increased insight to factors underlying pain responses to repeated movement in CLBP, which may enhance more specific targeted management.

2. Materials and methods

This research was approved by the Human Research Ethics Committees of Curtin University, Royal Perth Hospital, and Sir Charles Gairdner Hospital, Western Australia. All participants gave written, informed consent.

This cross-sectional study involved people with CLBP ($n = 294$, 57.1% female; median age 50 years), recruited via multimedia advertisements circulated throughout metropolitan and regional Western Australia (77.6%), and from private metropolitan physiotherapy clinics (20.1%), public metropolitan hospitals (1.4%); and private metropolitan pain management and general practice clinics (1.0%), between November 2012 and January 2014.

Participants contacted one researcher (MR) and were sent an inclusion/exclusion criteria questionnaire. Ambiguous responses were clarified by telephone.

Inclusion criteria were: aged 18–70 years; LBP > 3-months duration; ≥2-points on a numeric rating scale (NRS) (0–10) for pain intensity (past week); ≥5-points on the Roland Morris Disability Questionnaire (RMDQ) [26]; at least 60% LBP on the question [27]: "Which situation describes your pain over the past 4 weeks the best? 100% of the pain in the low back; 80% of the pain in the low back and 20% in the leg(s); 60% of the pain in the low back and 40% in the leg(s)", etc.

Exclusion criteria were: previous extensive spinal surgery (>single-level fusion/discectomy), spinal surgery within the past six-months, serious spinal pathology (cancer, inflammatory arthropathy, etc.), diagnosed neurological disease, bilateral dorsal wrist/hand pain, pregnancy, inability to understand English.

A total of 586 potential participants contacted the research team, of whom 349 met the inclusion/exclusion criteria. Fifty-five of these potential participants declined completion of the baseline assessment, leaving a sample of 294 included participants.

3. Sagittal plane movement tasks

Participants performed two repeated bending tasks in the following order:

1. Twenty forward spinal bends to pick up a pencil from the floor, and place it back down.
2. Twenty backward spinal bends to view a marker on the ceiling behind them.

Repeated forward bending is a valid and reliable test of pain provocation for people with CLBP [28,29]. Repeated backward bending was included as a common component of the examination