The Self Reported Aggravating Activities of Chronic Non Specific Low Back Pain Patients Do Not Demonstrate a Consistent Directional Pattern: an observational study.

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ABSTRACT

Question: Do the self-reported aggravating activities of chronic non-specific low back pain patients demonstrate a consistent directional pattern? **Design**: Cross-sectional observational study. **Participants:** 240 chronic non specific low back pain patients. **Outcome measure:** We invited experienced clinicians to classify each of the three self-nominated aggravating activities from the Patient Specific Functional Scale by the direction of lumbar spine movement. Patients were described as demonstrating a directional pattern if all nominated activities moved the spine into the same direction. Analyses were undertaken to determine if the proportion of patients demonstrating a directional pattern was greater than would be expected by chance. **Results**: In some patients, all tasks did move the spine into the same direction, but this proportion did not differ from chance ($p = 0.328$). There were no clinical or demographic differences between those who displayed a directional pattern and those who did not (all $p > 0.05$). **Conclusion**: Using patient self-reported aggravating activities we were unable to demonstrate the existence of a consistent pattern of adverse movement in patients with chronic non-specific low back pain.

INTRODUCTION

Chronic non-specific low back pain is a common and costly health problem (Kent and Keating 2005). Subsequently, there has been considerable research to develop and evaluate effective treatments for patients with this condition. Numerous systematic reviews have synthesised the available evidence for most common interventions (Assendelft et al 2004, Clarke et al 2007, French et al 2006, Furlan et al 2005, Guzmán et al 2002, Hayden et al 2005), and these reviews suggest that current approaches do not provide a substantial, long-term answer to the problem. Clinicians have questioned these results as they feel the findings are at odds with their clinical experience of using these treatments. In trying to explain this perceived discrepancy between clinical trials and clinical practice it is commonly suggested that the chronic non-specific back pain population is a heterogeneous group that contains distinct sub-groups, each reflecting different mechanisms of symptom production (Dankaerts et al 2006b, Delitto 2005, McCarthy et al 2004). It is proposed that in many trials the effects of treatment are "washed out" by the application of a single intervention to a heterogeneous group with diverse treatment needs (McCarthy and Cairns 2005). Therefore, research that does not account for sub-grouping may deliver a diluted estimate of treatment effect (McCarthy et al 2004).

There is a significant amount of data demonstrating improved outcomes when patients with acute low back pain are sub-classified (Brennan et al 2006, Childs et al 2004, Fritz et al 2003), and work continues on refinement of this model (Fritz et al. 2007, Hicks et al. 2005, Hancock et al. 2008). The value of a sub-classification approach is less clear in the chronic population and there is need for further research in this area. Three widely used approaches to sub-classification of chronic low back pain patients are the McKenzie system (McKenzie and May 2003), O'Sullivan's 'clinical instability' model (O'Sullivan 2004) and Sahrmann's

'Movement System Impairment' approach (Sahrmann 2002). Inherent in these three systems is the grouping of patients based on the direction of adverse movement of the spine. Although there are differences in the details of each system and in the explanatory models offered to justify the proposed groups, these approaches all seek to establish directional patterns of aggravating and easing factors and these patterns subsequently inform patient management. Recent research has suggested these models may be reliable (Dankaerts et al 2006b, Kilpikoski et al 2002, van Dillen et al 1998) and in some ways valid (Clare et al 2007, Dankaerts et al 2006a, Hefford 2008, O'Sullivan et al 2006, van Dillen et al 2003). In addition, case studies have suggested promising results when these approaches are used to treat chronic low back pain patients (Dankaerts et al 2007, Harris-Hayes et al 2005, van Dillen et al 2005). However, there remains a lack of high quality evidence indicating that grouping chronic low back pain patients in this way significantly improves outcomes (Clare et al 2004, Machado et al 2006) and further understanding of this approach is required.

Two issues in the process of determining a directional pattern that have not been considered in detail are confirmatory bias and illusory correlation. Confirmatory bias refers to the tendency to look for and attend to evidence that fits with pre-existing expectations and to ignore contradictory information (Klein 2005). Illusory correlation refers to the tendency to perceive a coincidental (or non-existent) relationship as causal (Klein 2005). More specifically for this discussion, when patients are describing the activities that aggravate their problem it is conceivable that directional patterns emerge simply by chance. One method of reducing the influence of confirmatory bias is to ask patients to self-report their aggravating factors, rather than being subjected to an assessment process that may be influenced by the clinician or researcher. The influence of illusory bias can be minimized by using statistical tests to control for chance findings.

Whilst information from the whole clinical examination is used to determine a directional pattern, proponents of these approaches suggest that analysis of patients' self reported aggravating factors is an important component of the process. (Sahrmann 2002, O'Sullivan 2004, May and Donelson 2008). One reasonable prediction is that for an individual patient the most problematic functional tasks should all move the spine in a similar way. To test this prediction we aimed to investigate the presence of a directional pattern in the self-reported aggravating activities of chronic non-specific low back pain patients in a manner that minimized confirmatory bias and accounted for chance. If directional bias is an important feature of chronic low back pain, we hypothesize that its presence in patients self reported aggravating activities should be greater than chance.

METHOD

Design

A cross-sectional observational study was undertaken. The data utilized were collected as part of a randomized controlled trial evaluating physiotherapy care for chronic non-specific low back pain (Ferreira et al 2007). The original project and secondary analysis both received appropriate ethical approval.

Participants

The original study sourced 240 patients from physiotherapy departments at three teaching hospitals in Sydney, Australia. Subjects were included in the trial if they were aged between 18 and 80 years, had experienced non-specific low back pain for a minimum of three months, were currently experiencing symptoms and were able to provide written informed consent. Participants were excluded if they presented with neurological signs, evidence of specific

spinal pathology, or had undergone previous spinal surgery. Baseline demographic, anthropometric and clinical characteristics were collected for all consenting participants.

Outcome measures

At baseline, subjects completed the 1998 version of the Patient Specific Functional Scale, in which participants were required to nominate three important activities that they had trouble with due to their back pain on that day, and to rate the degree of difficulty they had with performing each activity from "0" (unable to perform) to "10" (able to perform at pre-injury level) (Westaway et al 1998). There is evidence that the scale has moderate to excellent reliability, construct validity and sensitivity to change (Chatman et al 1997, Cleland et al 2006, Stratford et al 1995, Westaway et al 1998).

Data reduction

Assigning a direction of movement to aggravating activities: At the point of initial data collection, each of the patients' aggravating activities were recorded verbatim and entered into the dataset in this format. To facilitate analysis of the information self reported activities were extracted and reduced into common themes. Two of the authors undertook this process separately; any discrepancy was resolved by consensus. From a list of 716 reported aggravating activities, 104 unique activities were extracted.

The 104 tasks were classified based on the direction of lumbar spine movement that occurred with the performance of the activity, into flexion, extension or unilateral (side flexion or rotation) loading. To minimize confirmatory bias with this process the tasks were arranged randomly on a single spreadsheet to ensure that when classifying an activity the coder was blinded to the other aggravating activities of a particular patient. To classify each task we first

looked at the suggestions made by clinicians proposing directional subgroups. In numerous publications these authors have suggested aggravating factors associated with each type of directional pattern (McKenzie and May 2003, O'Sullivan 2004, Sahrmann 2002). This information allowed us to classify approximately 20% of the tasks. For the remaining activities, classification was based on clinical experience and informal task observation. There were a small group of activities which we classified as 'undecided' and an additional group of tasks which we felt were unclassifiable in biomechanical terms such as "coping day to day" or "socialising."

There are numerous possible ways to classify the direction of movement of the described tasks. We chose as the final arbiter, the views of clinicians currently using this information to make decisions about the directional pattern of aggravating activities in low back pain patients. A similar process has been used by van Dillen et al., (2006) to validate the classification of patient reported leisure activities. The first step involved sending the results of our initial classification to five post-graduate qualified musculoskeletal physiotherapists familiar with sub-grouping by directional pattern. The clinicians were asked to indicate if they agreed with the allocation of tasks under the headings or, if they disagreed, they were to provide an alternative classification. If at least four out of the five clinicians (80%) agreed on task classification, the task was assigned to that classification. The remaining tasks were re-tabulated and re-sent to the same clinicians. The clinicians were notified that these tasks were those for which no consensus was achieved and were asked to repeat the previous classification process. In the second round of validation if four of the five clinicians agreed on task classification, the task was assigned to that classification. Those that failed to obtain majority agreement were placed under the heading of "cannot classify." At the end of the second round all tasks were either classified by direction or labeled as unclassifiable.

Determining if patients demonstrate a directional pattern: Participants with three classifiable tasks were coded as demonstrating a directional pattern if all tasks moved the lumbar spine in the same direction. This could include all flexion, all extension or all unilateral tasks. Patients that stated less than three classifiable tasks were excluded from the analysis, as they had insufficient information to determine a directional pattern.

Data analysis

Descriptive statistics were used to describe the sample and the directional characteristics of the aggravating factors. Demographic and clinical differences between subjects who did or did not demonstrate directional patterns were explored using the chi-squared test (categorical variables) and t-tests (continuous variables).

The probability of a directional pattern emerging by chance was tested using a chi-squared analysis. As the distribution of flexion, extension and unilateral tasks were not uniform, we calculated the exact probability for a directional pattern emerging by chance for the sample and used this as the expected value in the analysis. We firstly determined the proportion of flexion (69.6%), extension (29.5%) and unilateral directed (0.9%) tasks for the subjects with three classifiable tasks. We then calculated the probability that an individuals' nominated tasks would be into the same direction for activity one, activity two and activity three by chance, based on these proportions (flexion 0.337, extension .026, unilateral .000). The probability of a directional pattern occurring by chance was the addition of the three individual direction specific probabilities (0.337 + 0.026 + .000 = 0.363).

A sensitivity analysis was undertaken, in which a less stringent criteria for a directional pattern was used. Subjects who displayed two task in the same direction that were significantly problematic (0,1 or 2 on the PSFS) and a third task, which was in another direction, but was coded as only slightly problematic (8, 9 or 10 on the PSFS) were additionally classified as demonstrating a directional pattern for this analysis. All analyses were undertaken using SPSS for Windows version 14.0.

RESULTS

Direction of aggravating activities for whole sample

For the whole sample, 58% of tasks moved the lumbar spine into flexion, 26% into extension, 1% into a unilateral direction and 15% of reported aggravating activities could not be classified using this approach. Table 1 lists the four most common tasks under each of these headings.

Baseline characteristics of study group

Subjects with less than three classifiable tasks (n=92) were excluded from further analysis. Participants with three classifiable tasks (n=148) were extracted and separated to form a new dataset. Baseline demographic and clinical characteristics of this cohort can be found in table 2.

Directional pattern of the study group

In this group, 32% displayed a directional pattern; 97% of these demonstrated a flexion pattern, 2% an extension pattern while no subject demonstrated a purely unilateral pattern. There were no significant differences in demographic or clinical parameters between participants who displayed a directional pattern and those who did not ($p>0.05$) (Table 2).

Based on the distribution of tasks within this sample the probability of a directional pattern emerging by chance was 36.3%. The chi-squared analysis indicated that the observed incidence of a directional pattern was no different from what would have been expected by chance (χ^2=0.957, df =1, p=0.328). The sensitivity analysis returned only one additional subject. The analysis with the inclusion of this individual's data also indicated that the observed incidence of a directional pattern was no different from chance (χ^2=0.652, df=1, p=0.419) (Table 3).

DISCUSSION

The aim of this exploratory study was to investigate if the self-reported aggravating activities of chronic non-specific low back pain patients demonstrate a directional pattern. Using a large data set sampled from a well-defined population, we provide evidence that approximately 32% of patients demonstrate such a pattern. However, this percentage is no different from what would be expected by chance. This suggests that a directional pattern of aggravating factors might not be an important feature of chronic non-specific low back pain. The sensitivity analysis reached the same conclusion, further strengthening our findings.

We failed to find any relationship between demographic, anthropometric or clinical variables and the presence of a directional pattern. Though this finding is open to other interpretations, the failure to find any systematic difference between those patients who do and do not demonstrate a directional pattern supports the idea that the appearance of a directional pattern may be the result of chance rather than representing the existence of an important clinical entity.

By using an external validation procedure we have attempted to ensure that the system of assigning directional loading for aggravating activities reflects the reasoning commonly used in clinical practice. The potential influence of confirmatory bias was reduced by using patient self-reports of aggravating factors and ensuring that when coding the direction of movement, the therapists were blind to the other aggravating activities of that patient. We have also controlled for chance with the statistical techniques implemented.

In interpreting these findings, consideration must be given to the limitations of the study. Sub-grouping models that seek to establish a directional pattern employ a process of questioning complimented by clinical testing to classify patients, a procedure which we obviously did not replicate. The sensitivity analysis we undertook attempted to capture some additional reasoning, however, the results of this analysis were the same as the primary analysis. The inclusion of additional clinical testing may change the results presented here. However, proponents of directional sub-grouping emphasize that self reported aggravating factors are an important component of determining a directional pattern (May and Donelson 2008).

In addition, this study was undertaken on a chronic sample with a mean duration of almost nine years. It is possible that the self-reported aggravating activities of a more acute population may demonstrate a directional pattern, though the duration of back pain was not significantly different between subjects who did or did not demonstrate a directional pattern. Finally, the direction of movement assigned to each task is open to different interpretations, we believe, however, that the approach used in this paper was the most satisfactory way available of approaching this issue.

A reasonable prediction of directional sub-grouping is that patients should demonstrate a

directional pattern in their aggravating movements. We were unable to confirm this prediction. While this finding does not invalidate these approaches, it does suggest clinicians and researchers may need to account for the influence of bias and chance when considering the presence of directional patterns in the chronic low back pain population.

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TABLES

Table 1: Examples of the most commonly nominated tasks for each movement direction and the frequency of reporting (N= 716)

Flexion	***Extension***	***Unilateral***	***Unclassifiable***
Vacuuming (11%)	Walking (11%)	Turning over in bed (0.3%)	Housework (1.9%)
Gardening (8.2%)	Standing (4.2%)	Twisting (0.1%)	Cleaning (1.3%)
Bending forward (7.5%)	Ascending stairs (1.9%)	Turning (0.1%)	Sleeping (1.0%)
Lifting (6.7%)	Hanging out washing (1.4%)	Rotating (0.1%)	Getting out of bed (0.7%)

Table 2. Characteristics of study group participants, those with a directional pattern or not, and difference between groups reported either as mean difference (95% CI) or odds ratios (95% CI).

Characteristic	All participants n=148	Groups		Difference between groups
		Directional pattern n=47	No directional pattern n=101	Directional pattern minus no directional pattern
Demographics				
Age *(yr)*, mean (SD)	55.4 (14.5)	55.5 (14.1)	55.4 (14.8)	MD 0.1 (-4.99 to 5.19)
Weight *(kg)*, mean (SD)	74.6 (16.7)	73.9 (19.9)	74.9 (15.0)	MD -1.0 (-6.83 to 4.83)
Height *(m)*, mean (SD)	164.7 (9.2)	165.8 (9.7)	164.1 (9.0)	MD 1.7 (-1.52 to 4.92)
Duration of LBP *(mth)*, mean (SD)	104.7 (119.3)	117.7 (131.3)	98.5 (113.3)	MD 19.2 (-22.42 to 60.82)
Pain *(0 to 10)*, mean (SD)	6.3 (2.0)	6.27 (2.16)	6.38 (1.92)	MD -0.11 (-0.81 to 0.59)
[a]PSFS *(0 to 30)*, mean (SD)	10.7 (4.2)	10.3 (4.2)	10.9 (4.2)	MD -0.6 (-2.07 to 0.87)
[b]RMDQ *(0 to 24)*, mean (SD)	13.6 (5.4)	13.3 (5.8)	13.7 (5.3)	MD -0.4 (-2.31 to 1.51)
Sex *(female)*, n (%)	101 (68)	31 (66)	69 (68)	OR 1.11 (0.53 to 2.32)
Working				
Full time/full duties, n (%)	5 (3.4)	2 (4)	3 (3)	OR 0.69 (0.11 to 4.27)
Part time/full duties, n (%)	4 (2.7)	2 (4)	2 (2)	OR 0.45 (0.06 to 3.33)
Part time/part duties, n (%)	4 (2.7)	1 (2)	3 (3)	OR 1.41 (0.14 to 13.91)
Not working/unemployed, n (%)	116 (78.4)	37 (78)	79 (79)	OR 0.97 (0.42 to 2.26)
Compensation				
Yes, n (%)	7 (4.7)	4 (8)	3 (3)	OR 0.33 (0.07 to 1.53)

[a] PSFS = Patient-Specific Functional Scale. The sum of bothersome (0-10) scores of each task at baseline.
[b] RMDQ = Roland Morris Disability Questionnaire total score at baseline.

Table 3: Results of Chi squared analysis of directional pattern

Primary analysis		Sensitivity analysis	
Expected value (%)	36.3	Expected value (%)	36.3
Actual value (%)	32.4	Actual value (%)	33.1
Chi-Squared	0.957	Chi-Squared	0.652
df	1	df	1
p-value	0.328	p-value	0.419