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# Low Back Pain Response to Pelvic Tilt Position: An Observational Study of Chiropractic Patients

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**Abstract**

**Objective:** The aim of this study was to look for differences between patients with an increased pain response as compared with those with a decreased pain response.

**Methods:** Data were collected from consecutive new patients with lumbar or lumbopelvic pain in a chiropractic clinic. A pelvic tilt exercise was included in the initial examination, and pain response was noted. Analysis was made of pain and disability severity, as well as symptom location, chronicity, and other characteristics, before and after a course of chiropractic care.

**Results:** Patients with an increased pain response to pelvic tilt (n = 12) had higher levels of pain and disability at baseline than patients without (n = 34). There were no between-group differences in other aspects of their complaints; in age, sex, or body mass; or in the types of care they received (eg, manipulation, stretching, exercise instruction). On the average, both groups of patients showed improvement with chiropractic care, and there was no detectable difference in improvement between groups.

**Conclusions:** This study found that patients experiencing pain in response to a pelvic tilt maneuver may have a poorer precare status than patients with a decreased pain response.


## Introduction

The following report explores a possible role for a common therapeutic exercise, known as the *pelvic tilt*, in the evaluation of patients with low back pain (LBP)

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and radicular thigh and leg pain. The principal author is a practicing chiropractor who has, for many years, recommended the pelvic tilt to patients with lower back pain. He introduced it into his clinical regimen as described by a popular textbook on spinal rehabilitation.[1] The pelvic tilt exercise is performed with the patient supine; the hips are flexed to 45°, knees flexed to 90°; the patient is to then tilt the pelvis posteriorly, flattening the lumbar spine without raising their buttocks off the examining table or floor.[1] Performance of the posterior pelvic tilt maneuver involves some degree of flexion of the lumbar spine with a "flattening," or reduction, of the lumbar lordosis, a motion which can be done voluntarily.[2]

Posterior tilting of the pelvis has been recommended as an exercise for relief of LBP since at least as far back as the 1980s[3,4] and can still occasionally be found in patient education literature and Internet sites. Nor is the concept unique to this exercise; there are many published examples of directional preference—the identification of which positions and movement patterns relieve or aggravate pain—for lumbar flexion, as well as for extension and lateral bending[5–11]—and use of that information for therapeutic decisions.

Posterior tilting of the pelvis also involves contraction of the abdominal muscles[12–15] and has therefore sometimes been associated with core strengthening concepts of using the internal and external oblique and transverse abdominis muscles to impart active stiffness to the spine through their attachments to the thoracolumbar fascia.[16] However, as an exercise, posterior tilting of the pelvis is of fairly low intensity and does not use the abdominal muscles at a level that would strengthen them.[12,13] Variations on the pelvic tilt exercise have been used in other studies. Suputtitada et al[17] found that a sitting version of the exercise relieved LBP in the third trimester of pregnancy. Gürşen and colleagues[18] instructed women who had had cesarean childbirth to perform posterior pelvic tilts along with other exercises and Kinesio Taping. And, in a rehabilitative program for golfers, Shin et al[19] combined "pelvic anterior-posterior" exercises on a gym ball with other exercises and spinal manipulation. It may be worth noting that there are somewhat similar alternatives in which the patient draws in the abdomen in a manner similar to that of the pelvic tilt exercise but without tilting the pelvis or flattening the lumbar spine[20,21]; these include the abdominal drawing-in maneuver[22] or "abdominal hollowing."[12,13] However, abdominal hollowing does not seem to activate the abdominal muscles to the same degree as the pelvic tilt.[12,14]

In the principal author's experience, most patients performing a pelvic tilt maneuver have found some pain relief, and many of those patients seemed to have mechanical LBP with a relatively uncomplicated, favorable response to conservative care. Pain upon performance of the pelvic tilt maneuver was an unexpected finding, and some of those patients also had signs of nerve entrapment or neural adhesions and had less successful responses to conservative care. These individual cases stand out in casual observation but do not make clear whether there is anything beyond an occasional phenomenon.

The aim of this study was to perform a prospectively planned systematic analysis of patient records and look for ways in which patients with an increased pain response to the pelvic tilt are different from patients with a decreased pain response.

## Methods

This study protocol was approved by the Life University Institutional Review Board. Study participants were consecutive new patients presenting to the principal author's clinic who complained of lumbar or lumbopelvic pain. The clinician described the study and asked patients to sign an informed consent form for the use of their information. Each participating patient also completed a Quadruple Visual Analog Scale (QVAS) and a Revised Oswestry Disability Index (RODI). Patients were excluded from the study for late-stage cancer or metastasis to the spine; neuropathy suspected to be related to diabetes, alcoholism, kidney disease, or other systemic illnesses; severe osteoporosis; pain believed to be nonorganic; disability requiring a wheelchair, walker, or leg brace; or any situation dictating emergency referral. Participants who reported a history of multiple incidents of trauma, previous abdominal or spinal surgery, or current pregnancy were excluded on a case-by-case basis if the situation was considered a complication for their LBP.

The principal author included a pelvic tilt maneuver as a part of the initial patient examination. A standardized form was developed to record the pelvic tilt response, age, sex, height, and weight; location, severity, and duration of LBP; whether patients primarily reported pain, paresthesia, or both; and whether the symptoms were only local or radiated into the lower extremity. Additional information collected included symptom characteristics such as stabbing, shooting, burning, achy, or dull; history of

back pain, surgery, or trauma; and whether participants were receiving worker's compensation or disability benefits, or had litigation involving the chief concern. Collection and use of the patients' data were approved by the Life University Institutional Review Board.

All patients received chiropractic adjustment of the spine or pelvis, as felt to be appropriate for their individual cases, either in the form of high-velocity, low-amplitude thrust (manipulative therapy) or with use of an Activator instrument. Some received adjustment of extremity joints, Active Isolated Stretching, or both. Most received some form of exercise instruction: exercises based on core strengthening, such as abdominal curls, bridging (or "pelvic bridges"), abdominal hollowing, or oblique curls; instruction on use of a Rotex machine (Rotex, Opelousas, LA),[23] targeting the rotator muscles of the hips, shoulders, and spine; or activities emphasizing balance and neuromuscular education, such as one-leg standing or standing on a balance board. A few patients received electrical muscle stimulation. Neither the exercise choices nor the other treatment decisions were based specifically on pelvic tilt findings. Because the pelvic tilt was regarded as a novel procedure, treatment decisions were based on more mainstream examination findings.

*End of care*, that is, discharge, was defined as symptom resolution to the patient's satisfaction or other reason for termination of care (eg, number of visits allocated by insurance plan, dissatisfaction with the progress of care, or the treating doctor's decision to refer to another practitioner). At or shortly after the end of care for the entry complaint of LBP, patients were asked to complete another QVAS and RODI. The treating doctor used a postcare standardized form to record any remaining symptoms that had been reported to him, as well as treatment methods and number of weeks of active, conservative care from initial visit to discharge. Actual number of treatment visits was also recorded after examination of individual files.

### Data Analysis

Aside from the principal author, other authors were blinded to patient identities and only received number-coded copies of the handwritten data collection forms. Data were organized in Excel, with all analyses performed in SPSS version 21 (SPSS Inc, Chicago, IL). Statistical significance was set at the level of $\alpha = .05$.

The various demographic, history, and physical examination characteristics were correlated with clinical outcome measures to determine whether positive or negative responses predicted positive or negative clinical outcomes among the various subsets of the participants. Independent-samples *t* tests were used to compare the positive and negative groups for the continuous variables of age, height, weight, and body mass index, and the primary outcome measures of QVAS and RODI scores; the 4 values of the QVAS were averaged together and analyzed as a single variable. The independent-samples Mann-Whitney *U* test, a nonparametric version of the *t* test, was used to look for between-group differences when data were found to be nonnormally distributed. Categorical variables (eg, location of symptoms, symptom duration, symptom type, previous LBP) were analyzed with $\chi^2$ and Fisher exact tests. The locations of symptoms were coded as ordinal scale variables, such that pain in the low back only = 1, pain in the low back and proximal lower extremity = 2, and pain in the low back and distal lower extremity = 3. Symptom duration was treated similarly, such that acute pain (<7 days) = 1, subacute pain (7 days-7 weeks) = 2, and chronic pain (>7 weeks) = 3.

## Results

Over a data collection period of approximately 14 months, there were 48 patients who met the study criteria and agreed to participate; none declined. All data were later excluded for 1 participant who was discovered to have had spinal surgery and another for whom it was discovered that there was open litigation related to a motor vehicle accident. Thus, precare data were analyzed for 46 participants. For 1 participant whose data were otherwise complete, the precare QVAS value for "pain at best" was missing; the value was extrapolated by calculating the average "pain at worst" (8.29) and "pain at best" (2.37) for all participants and then estimating the missing value as $[8 \times (2.37/8.29)] = 2.29$.

### Precare Characteristics According to Positive or Negative Response

Roughly one-fourth of the patients showed a positive response to the test initially. Negative and positive groups were similar in age, sex, height, weight, body mass index, and whether they had had LBP previously (Table 1). However, patients with a positive response were in more pain, according to the QVAS 4-component mean, and had a higher level of disability

**Table 1** Baseline Patient Characteristics for All 46 Eligible Participants

| | Positive Sign, n = 12 | Negative Sign, n = 34 | *P* Value | CI |
|---|---|---|---|---|
| Age, y | 45.8 ± 20.2 | 47.3 ± 13.6 | .77<br>*t* = 0.29 (44) | −11.8 to 9.5 |
| Male/female, n (%) | 4 (33.3)/8 (66.7) | 12 (35.3)/22 (64.7) | .90 | −0.3 to 0.3 |
| Height, in | 66.8 ± 4.8 | 66.7 ± 4.7 | .92<br>*t* = −0.099 (44) | −3.0 to 3.4 |
| Weight, lb | 163.3 ± 32.6 | 174.9 ± 36.4 | .33<br>*t* = 0.98 (44) | −35.6 to 12.4 |
| BMI | 26.4 ± 4.3 | 27.7 ± 5.2 | .42<br>*t* = 0.82 (44) | −4.8 to 2.0 |
| Previous LBP, n (%) | 8 (66.7) | 24 (70.6) | .69 | −0.2 to 0.4 |

Results are expressed as mean ± SD, except where noted as n (%).
*BMI*, body mass index; *CI*, 95% confidence interval; *LBP*, low back pain.

in activities of daily living (Table 2), according to the RODI.

There were no differences in whether one group displayed more tendencies to complain of pain only, paresthesia only, or both pain and paresthesia (Table 3); whether their symptoms were more proximal or distal; or whether symptoms were more acute, subacute, or chronic. A somewhat higher percentage of patients in the positive group described having "shooting" pain, but the difference was not statistically significant. There were no differences between groups for describing symptoms as sharp, burning, achy, cramping, or "other."

**Table 2** Pain and Disability Questionnaires, Expressed as Mean ± SD

| Precare Values, All, N = 46 | Positive Sign, n = 12 | Negative Sign, n = 34 | *P* Value | CI |
|---|---|---|---|---|
| QVAS | 6.0 ± 2.0 | 4.9 ± 1.5 | .04[a]<br>*t* (44) = −2.14 | 0.1 to 2.3 |
| RODI | 55.5 ± 17.7 | 36.1 ± 13.8 | <.001[a]<br>*t* (44) = −3.90 | 9.4 to 29.5 |

| Participants with Postcare Data, n = 30 | | Positive Sign, n = 8 | Negative Sign, n = 22 | Comparisons of Positive Group to Negative Group | |
|---|---|---|---|---|---|
| | | | | *P* Value | CI |
| QVAS | Precare | 6.3 ± 1.9 | 4.8 ± 1.7 | .04[a]<br>*t* (28) = −2.14 | 0.7 to 3.0 |
| | Postcare | 3.6 ± 2.7 | 2.7 ± 1.3 | .40<br>*t* (8.34) = −0.88[†] | −3.1 to 1.4 |
| | Pre-post change | 2.8 ± 2.7 | 2.1 ± 1.6 | .53<br>*t* (9.03) = 0.65[†] | −1.6 to 2.9 |
| | Pre-post (paired samples) | *P* = .02[a]<br>*t* (7) = 2.93<br>95% CI = 0.53-04.9 | *P* < .001[a]<br>*t* (21) = 5.97<br>95% CI = 1.4-2.8 | | |
| RODI | Precare | 55.0 ± 17.3 | 38.7 ± 12.1 | .007[a]<br>*t* (28) = −2.90 | 4.8 to 27.7 |
| | Postcare | 33.0 ± 27.7 | 20.3 ± 12.8 | .25<br>*t* (8.11) = −1.25[†] | −10.6 to 36.1 |
| | Pre-post change | 22.0 ± 29.5 | 18.4 ± 14.3 | .75<br>*t* (8.23) = 0.33[†] | −21.4 to 28.5 |
| | Pre-post (paired samples) | *P* = .07<br>*t* (7) = 2.11<br>95% CI = − 2.7 to 46.7 | *P* < .001[a]<br>*t* (21) = 6.04<br>95% CI = 12.1-24.8 | | |

Postcare data omit 16 participants from the original 46 because postcare data were not available for them. Statistical significance indicated by [a]; unequal variances are indicated by †, as determined by Levene test.
*CI*, confidence interval; *QVAS*, Quadruple Visual Analog Scale; *RODI*, Revised Oswestry Disability Index.

**Table 3** Pretreatment Symptom Descriptions for All 46 Eligible Participants

| Type of Symptom, n (%) | Positive Sign, n = 12 | Negative Sign, n = 34 | *P* Value |
|---|---|---|---|
| Pain only | 8 (66.7) | 19 (55.6) | .85 |
| Paresthesia only | 0 (0.0) | 3 (8.9) | |
| Both pain and paresthesia | 4 (33.3) | 10 (29.4) | |
| Symptom location, n (%) | | | |
| Low back only | 4 (33.3) | 12 (35.3) | .83 |
| LB and prox LE | 4 (33.3) | 12 (35.3) | |
| LB, prox LE, and dist LE | 4 (33.3) | 10 (29.4) | |
| Symptom duration, n (%) | | | |
| Acute (<7 d) | 4 (33.3) | 5 (14.7) | .99 |
| Subacute (7 d-7 wk) | 1 (8.3) | 13 (38.2) | |
| Chronic (>7 wk) | 7 (58.3) | 16 (47.1) | |

| Pain Types, n (%) | | | *P* Value | CI |
|---|---|---|---|---|
| Shooting | 7 (58.3) | 10 (29.4) | .07 | −0.6 to 0.03 |
| Sharp | 9 (75.0) | 21 (61.8) | .41 | −0.4 to 0.2 |
| Burning | 3 (25.0) | 4 (11.8) | .27 | −0.4 to 0.1 |
| Achy | 5 (41.7) | 20 (58.8) | .31 | −0.2 to 0.5 |
| Cramping | 0 (0.00) | 4 (11.8) | .21 | −0.1 to 0.2 |
| Other | 4 (33.3) | 9 (26.5) | .65 | −0.4 to 0.2 |

*CI*, confidence interval; *LB*, lower back; *LE*, lower extremity.

## Postcare Characteristics

Postcare results are reported for 30 patients (Table 2 for QVAS and RODI; Table 4 for other information). Eleven patients did not complete QVAS or RODI questionnaires; most of them had not continued care beyond an initial 1 or 2 office visits. In addition, postcare data were excluded for 1 patient who visited a physical therapist while under care and 4 additional patients whose response to requests for information came more than 4 months after their end of care. Thus, no postcare data are reported for 33% of the positive group and 35% of the negative group. Finally, there were 3 patients (2 in the positive group, 1 in the negative group) who are included in the postcare analysis of QVAS and RODI data but for whom postcare data for symptom location and type were missing.

Patients in the positive group averaged 5.4 office visits as compared with 6.1 visits for the negative patients (Table 4), and those fewer visits stretched out over a slightly longer span of time, 6.1 weeks as compared with 3.9 for the negative group; these differences were not statistically significant (Table 4). Overall, the modes of care received by the groups were similar. Although a higher percentage of the negative group received instruction in exercises and a higher percentage of the positive group received electrical muscle stimulation, these differences were not statistically significant.

Postcare, both groups showed improvements (Table 2). Patients in the positive group continued to

**Table 4** Treatment Descriptions for the 30 Participants With Postcare Data

| Treatment Type, n (%) | Positive Sign, n = 8 | Negative Sign, n = 22 | *P* Value | CI |
|---|---|---|---|---|
| Adjustment | 7 (100) | 23 (100) | 1.00 | – |
| Exercise | 2 (28.6) | 15 (63.6) | .19 | −0.1 to 0.7 |
| Therapy | 4 (57.1) | 18 (77.3) | .34 | −0.2 to 0.5 |
| Electrical muscle stimulation | 3 (42.9) | 3 (13.0) | .12 | −0.6 to 0.1 |
| Duration of care, mean ± SD | | | | |
| No. of visits | 5.4 ± 1.8 | 6.1 ± 3.7 | .58 $t$ (28) = 0.56 | −2.0 to 3.6 |
| No. of weeks | 6.1 ± 5.1 | 4.2 ± 2.4 | .19 $t$ (25.6) = 1.3 | −0.98 to 4.7 |

*CI*, confidence interval; *SD*, standard deviation.

have slightly higher QVAS and RODI scores, on average, than negative group patients. The positive group actually showed somewhat more improvement, with larger changes in pre-post scores for both the QVAS and RODI, even though half of the positive group patients had very little change in outcomes (Fig 1) and 3 of the 8 actually were slightly worse for RODI scores. The overall differences between the groups, however, were not statistically significant.

Posttreatment improvement in types of symptoms (pain or paresthesia) and location of symptoms (proximal or distal) was also measured by coding according to whether patients' symptoms were (1) completely resolved, (2) reduced, or (3) showed no change or felt worse. Few individuals were unchanged or felt worse, in the range of 8% to 17% for the various symptoms and their locations; however, there were no differences between the groups. For those individuals who continued to feel symptoms described as shooting, sharp, burning, achy, or "other," there were no differences between the groups (no patients described themselves as having "cramping" symptoms postcare).

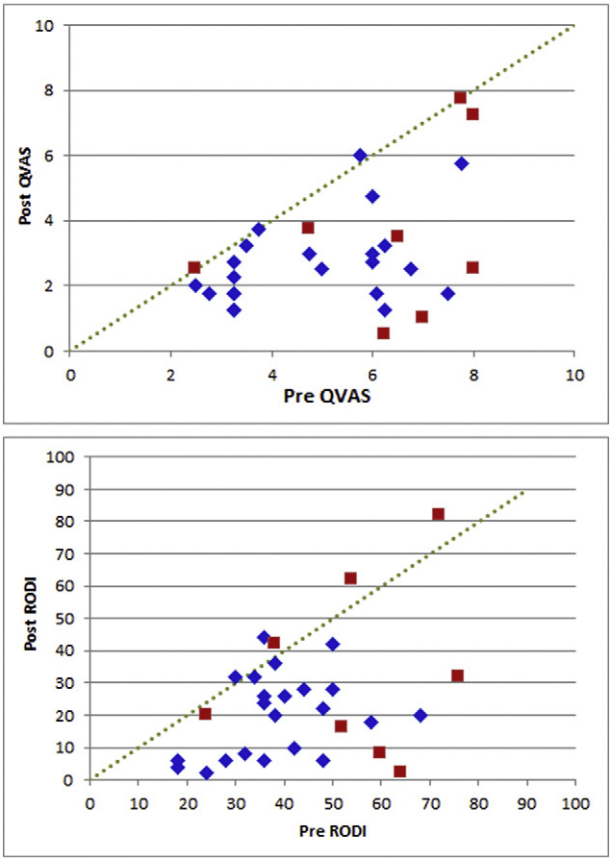


**Fig 1.** Plots of precare and postcare QVAS and RODI scores, including only those participants with postcare data. Negative-sign patients are indicated by diamonds (♦); positive-sign patients are indicated by squares (■). The dotted line marks no change from precare to postcare, such that patient icons below the dotted line indicate improvement.

Several post hoc analyses were done to look for intergroup differences in response to care that may have been obscured by other factors. Thus, responses to care (differences between pre and post QVAS and RODI scores) were compared in combination with baseline values for location, severity, duration, and type of LBP; whether symptoms were local or radiating; history of previous back pain; and characteristics such as stabbing, shooting, burning, achy, or dull. And responses to care were compared in combination with postcare pain characteristics, the various treatment modes, mean numbers of visits, and mean weeks of care. The adjustments for responses to care with combinations of the other variables were made using simple linear regression, generalized mixed linear modeling for repeated measures with multiple random effects, and stepwise variable selection (forward, backward, and combination). However, none of the variable adjustments produced statistically significant effects, and it remained that there were no significant differences between groups for QVAS and RODI improvements for any instances.

There were very few patients who reported a history of previous surgery or notable trauma. Likewise, there were very few receiving worker's compensation or disability benefits, or who were involved in litigation involving the chief concern, as the principal author's practice is primarily managed health care. For those cases, no trend could be seen toward either a positive or negative pelvic tilt response.

## Discussion

This study was an attempt to discover what may be different for patients who experience pain during forward pelvic tilt. We found that a positive sign occurred in about 25% of participants and that these participants had greater precare pain and disability than those in the "negative" group. Increased severity of LBP does not alone explain why some patients find the maneuver uncomfortable—sometimes producing even "wincing" pain—whereas the other patients feel no pain or even find the movement to be a relief. Our investigation of common demographics and pain causes did not, however, provide any clues to satisfy our curiosity about the deeper meaning of the test.

Although, on the average, both groups of patients experienced similar amounts of reduction in pain and increases in function after a course of chiropractic care,

this was not a placebo-controlled or randomized trial, so we cannot claim that improvements in LBP were due to the chiropractic care specifically.

In regard to interpretation of the pelvic tilt response, it is not yet clear from the available information how such findings might be useful. A positive response might suggest the presence of conditions in which flexion causes pain (eg, flexion substantially increases intradiscal pressure[24] and induces strain in the facet joints[25–27]). It is conceivable that, if other examination procedures involving flexion were to cause similar responses, the pelvic tilt maneuver might be more convenient to use for monitoring condition severity. The present study does not provide the information to address such questions.

We are currently involved in a follow-up study using systematic evaluation of diagnostic imaging with patients in a neurosurgery clinic as a way to discover if there are anatomical or degenerative differences between patients who do and do not have increased pain on posterior pelvic tilt.

Finally, although there was no attempt to systematically use the pelvic tilt maneuver findings to guide care in these patients, this is a potentially fruitful area for research. For instance, a positive response might guide the treating doctor away from rehabilitative exercises that involve flexion and toward those that involve extension. Similarly, the adjustment protocols could be directed differently. A comparative trial could be designed using the pelvic tilt maneuver to route patients to 1 of 2 or more treatment groups to evaluate the clinical utility of the test. Additional study of the pelvic tilt maneuver may help determine its usefulness as an examination procedure to help guide treatment decisions.

## Limitations

A major limitation of this present study is that all the patients are from the practice of a single doctor, who is also the principal author. Efforts to recruit additional data collection sites suffered from lack of follow-through. It is important to recognize the possibility of unintentional selection bias. The method of sampling was to include each consecutive LBP patient. Although there was no intentional selection or exclusion, because of hectic times in the office, the principal author missed either getting informed consent or recording a pelvic tilt response on approximately 15% of likely eligible patients (8 patients). Ultimately, the study was underpowered because of the small sample sizes and large amounts of missing posttreatment data; it is possible that some potential differences in posttreatment outcomes were not detected.

The study might have been improved by an analysis of relationships between pelvic tilt response and diagnostic codes but that was not a part of the prestudy plan. A decision was made to not perform a post hoc analysis of diagnoses but rather to direct future efforts to an examination of diagnostic imaging in a new group of patients.

Some may question the use of the RODI. Fairbank, originator of the Oswestry Disability Index (ODI), and Pynsent once criticized the revised form of the Oswestry Disability Index as "not acceptable."[28] Its most obvious departure from the original is in the omission of a question about the effects of LBP on the patient's sex life, but there were also some other changes in wording that may be confusing to some respondents.[28,29] However, the RODI has been used as a primary outcomes measure in other studies of LBP[30,31] and continues to be widely used in chiropractic practice. It might also be noted that a recent study found the RODI to be more responsive than the Bournemouth Questionnaire (but less responsive than the Numerical Rating Scale).[29]

The QVAS and RODI are established outcome measure questionnaires, and therefore, an assumption of this present study is that the information derived from them is dependable. That is less certain for the categorization of patient symptom types, locations, and duration, which might be affected by the manner of questioning by the doctor and depends on the patients' answers to be accurate. Nevertheless, there were no significant differences between the positive and negative groups in these aspects.

## Conclusions

There appear to be significantly greater precare LBP and disability in activities of daily living in patients who experienced pain in performing a pelvic tilt maneuver compared with the patients with decreased pain or no change. The available data suggest that patients experiencing pain in response to a pelvic tilt maneuver may have a poorer precare status than patients with a negative response but do not show that these patients have lesser outcomes from care.

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Funding for this project was provided by Life University. No conflicts of interest were reported for this study.

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