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Clinical Study

The effect of psychosocial measures of resilience and self-efficacy in patients with neck and lower back pain

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Abstract

BACKGROUND CONTEXT: Psychosocial risk factors may predispose to progression of back and neck pain to chronic pain or disability. Resilience (the ability to recover from stress) and pain self-efficacy (confidence that one can perform daily activities despite pain) are important psychometric properties shown to affect health and illness.

PURPOSE: To examine the relationships among resilience, pain self-efficacy, and disability in spine patients.

DESIGN/SETTING: Prospective, single-center orthopedic spine clinic.

PATIENT SAMPLE: One hundred and ninety five patients in a tertiary spine practice recruited between December 2016 and March 2017.

OUTCOME MEASURES: Self-reported measures: Brief Resilience Scale (BRS), Pain Self-Efficacy Questionnaire 2 (PSEQ-2) Short Form, Neck Disability Index (NDI), and Oswestry Disability Index (ODI).

METHODS: A prospective study was conducted of new patients visiting an orthopedic spine clinic complaining of neck pain or low back pain, with or without radiculopathy. Enrolled patients completed a survey of demographic information, the six-question BRS, the two-question PSEQ-2 Short Form, and NDI or ODI for neck or back pain, respectively. The relationship between BRS and NDI or ODI was examined, and the relationship between PSEQ-2 and NDI or ODI was also examined.

RESULTS: A total of 195 patients were evaluated. After excluding those with incomplete NDI or ODI, 180 patients were included in the analysis (46.1% men [83/180]; mean age 53 [standard deviation: 17] years). 139 (77.2%) subjects complained of low back pain and 41 (22.8%) subjects complained of neck pain. BRS was strongly negatively correlated with NDI ($r = -0.61$, $p < .0001$) and moderately negatively correlated with ODI ($r = -0.34$, $p < .0001$). PSEQ-2 was strongly negatively correlated with NDI ($r = -0.69$, $p < .0001$) and strongly negatively correlated with ODI ($r = -0.62$, $p < .0001$). BRS was moderately positively correlated with PSEQ-2 ($r = 0.36$, $p < .0001$). For the low back pain cohort, the correlation between PSEQ-2 and ODI was significantly greater than the correlation between BRS and ODI ($p = .0003$); this difference was not noted in the neck pain cohort ($p = .34$).

CONCLUSIONS: Low resilience and low pain self-efficacy are both independently associated with greater functional disability in neck and low back pain patients. Spine surgeons may find it useful to incorporate the BRS and PSEQ-2 into preoperative assessment. Future studies should examine the utility of these simple validated questionnaires in predicting response to treatments, including surgical intervention.

Keywords: Back pain; Brief Resilience Scale; Disability; Pain self-efficacy; Resilience; Spine.

FDA device/drug status: Not applicable.

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Introduction

There are well-established psychosocial risk factors for the development and progression of low back and neck pain [1–10]. Resilience is defined as the "ability to bounce back or recover from stress" and has been shown to affect health and illness [11]. Whereas studies on the effect of resilience on musculoskeletal health are limited, resilience has been associated with greater pain acceptance and active coping strategies in patients with chronic spinal pain [12], and has been shown to be a predictor of postoperative outcomes after total shoulder arthroplasty [11].

Pain self-efficacy, like resilience, is an important factor that influences patients' reaction to pain. Pain self-efficacy is defined as "the attitudes and beliefs that people with chronic pain hold to carry out certain daily activities, even in the presence of pain" [13]. Pain self-efficacy has been shown to be an independent predictor of poor recovery 6 months after initial consultation for low back pain [14]. In patients with chronic low back pain, it has been shown to be associated with pain and disability and to be a mediator in the relationship between pain and disability [13].

Although resilience and pain self-efficacy are known to be related to pain perception and outcome, little is known regarding the relationship between these factors and spine-specific patient-reported outcomes. In this investigation, we hypothesized that resilience and pain self-efficacy would be significantly correlated with the Oswestry Disability Index (ODI) and Neck Disability Index (NDI) in patients presenting to the spine surgeon clinic.

Material and methods

A prospective study was conducted of new patients visiting a tertiary orthopedic spine clinic complaining of either neck pain (±arm pain) or lower back pain (±leg pain). Patients were recruited between December 2016 and March 2017 in convenience series. Patients agreeing to participate were considered eligible and enrolled in the study. Subjects were asked to complete a questionnaire consisting of demographic information, self-reported medical history, the Brief Resilience Scale (BRS), the Pain Self-Efficacy Questionnaire 2 (PSEQ-2), and NDI or ODI depending on whether they complained of neck or lower back pain, respectively. Data were collected using REDCap (Vanderbilt University, Nashville, TN, USA). Institutional review board approval was obtained from the affiliated hospital for this study. No funding was obtained for this study.

Outcome variables

Resilience

The BRS was used for this investigation, and consists of six items that are each answered on a five-point Likert scale. The BRS has been shown to have good internal consistency, reliability, and validity with respect to health [15] (Fig. 1). The BRS is scored by converting the five-point Likert scale into a five-point numerical scale ranging from 1 to 5 (numerical scale shown for clarity). Items 1, 3, and 5 are positively worded, and items 2, 4, and 6 are negatively worded; therefore, the three negatively worded items are reverse coded (eg, a four would become a two) as shown in Fig. 1. The mean of the six questions is then calculated. The final BRS score ranges from 1 to 5, with a greater score representing greater resilience [15].

1. **I tend to bounce back quickly after hard times (circle one).**

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
(1)	(2)	(3)	(4)	(5)

2. **I have a hard time making it through stressful events (circle one).**

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
(5)	(4)	(3)	(2)	(1)

3. **It does not take me long to recover from a stressful event (circle one).**

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
(1)	(2)	(3)	(4)	(5)

4. **It is hard for me to snap back when something bad happens (circle one).**

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
(5)	(4)	(3)	(2)	(1)

5. **I usually come through difficult times with little trouble (circle one).**

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
(1)	(2)	(3)	(4)	(5)

6. **I tend to take a long time to get over set-backs in my life (circle one).**

Strongly disagree	Disagree	Neutral	Agree	Strongly agree
(5)	(4)	(3)	(2)	(1)

Fig. 1. Brief Resilience Scale (BRS).

Pain self-efficacy

The PSEQ was developed in patients with low back pain and is the most widely studied measure of pain self-efficacy. The PSEQ has since been validated in multiple clinical populations and translated into numerous languages [13]. The questionnaire consists of 10 items that are each answered on a 0–6 numerical scale [16]. The PSEQ-2 is a short form version that consists of items 8 and 9 from the original PSEQ, and was developed and validated in a population of upper extremity orthopedic patients [17,18] (Fig. 2). The form is scored by summing together the score for each individual item. Therefore, the final PSEQ-2 score ranges from 0 to 12, with a higher score representing greater pain self-efficacy [17].

Functional disability

The ODI and NDI were used to measure disability in low back and neck pain patients, respectively. Each form consists of 10 items that are answered on a six-point Likert scale. Scoring is done by converting the six-point Likert scale into a numerical scale ranging from 0 to 5. The score for each item is then summed together, and the percentage of total possible points is calculated. Therefore, scores range from 0% to 100% disability [19,20].

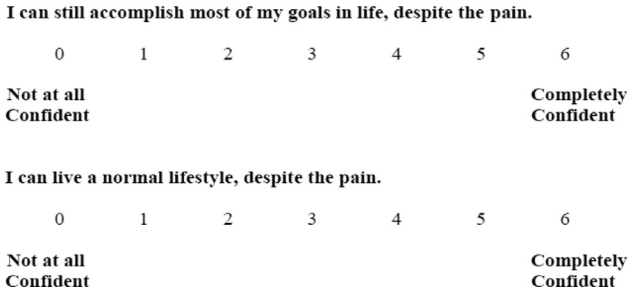

Fig. 2. Pain Self-Efficacy Questionnaire (PSEQ-2) Short Form.

Statistical analysis

For data analyses, questionnaires with greater than one missing response were excluded from that part of the analysis. NDI or ODI questionnaires with only one missing response were included, and the score was calculated as a percentage of total possible points ignoring the missing question. For BRS and PSEQ-2, there were no questionnaires with only one missing response in the analyzed data. Pearson correlation coefficients (r) with p values were calculated between resilience and disability, between pain self-efficacy and disability, and between resilience and pain self-efficacy. Pearson correlation coefficients were considered meaningful if statistically significant and interpreted as noted in Table 1.

The neck and low back pain patients were analyzed as separate cohorts for disability, but were analyzed as a combined cohort for correlations involving baseline characteristics (age and body mass index [BMI]) and for the correlation between BRS and PSEQ-2 scores.

The total sample size required to determine whether the correlation coefficient significantly differs from zero was calculated using the method described by Hulley et al. [22]. Using the parameters $\alpha = 0.05$, $\beta = 0.20$, and expected $r = 0.20$, it was calculated that a total sample size of 194 subjects would be needed.

Fisher's r-to-z transformation was then used to test for significant difference between dependent correlation coefficients within the neck cohort and low back pain cohort. Specifically, the correlation coefficient between BRS and ODI was compared with the correlation coefficient between PSEQ-2 and ODI for the low back pain cohort. The correlation coefficient between BRS and NDI was compared with the correlation coefficient between PSEQ-2 and NDI for the neck pain cohort. Each of these comparisons tested the hypothesis of whether the BRS or the PSEQ-2 was more strongly correlated with disability (ODI or NDI for low back pain or neck pain, respectively).

Statistical analysis was conducted using Microsoft Excel (Microsoft Corporation, Redmond, WA, USA) with the Data Analysis Toolpak and the Quantpsy statistical web utility available on line [23]. For statistical analyses, tests were two-tailed, $p<.05$ was defined as statistically significant, and Bonferroni correction was used to correct the p value for each set of hypotheses. After Bonferroni correction, $p<.006$ was considered significant for the first set of Pearson correlation coefficients (Table 2), and $p<.025$ was considered significant for the post-r-to-z transformation analysis (Table 3).

Table 1
Pearson correlation coefficient interpretation

Magnitude of correlation coefficient (r)	Interpretation* of correlation coefficient (r)
<0.10	No relationship
0.10–0.30	Weak relationship
0.30–0.50	Moderate relationship
>0.50	Strong relationship

* Adapted from Cohen [21].

Table 2
Correlation analysis for resilience, pain self-efficacy, and disability

		n (# of patients)	Pearson correlation coefficient (r)	p value
BRS	NDI	41	−0.61*	<.0001
	ODI	139	−0.34*	<.0001
	Age	175	0.13	.09
	BMI	175	0.12	.10
PSEQ-2	NDI	40	−0.69*	<.0001
	ODI	137	−0.62*	<.0001
	Age	172	0.04	.62
	BMI	172	0.20	.01
BRS	PSEQ-2	177	0.36*	<.0001

BRS, Brief Resilience Scale; BMI, body mass index; NDI, Neck Disability Index; ODI, Oswestry Disability Index; PSEQ-2, Pain Self-Efficacy Questionnaire 2.

* p value<.0001.

Results

A total of 195 patients were evaluated. After excluding those with incomplete NDI or ODI, 180 patients were included in the analysis (Fig. 3). Of this sample (n = 180), 46.1% (83/180) were men and mean (standard deviation) age was 53 (17) years old. A total of 77.2% (139/180) of patients presented with a primary complaint of low back pain and 22.8% (41/180) of patients presented with a primary complaint of neck pain.

BRS was strongly negatively correlated with NDI ($r = -0.61$, $p<.0001$) and moderately negatively correlated

Table 3
Post-Fisher's r-to-z transformation correlation analysis

	Correlation Coefficient *(r)*	p value
BRS|ODI	−0.32	.0003
PSEQ-2|ODI	−0.62	
BRS|NDI	−0.58	.34
PSEQ-2|NDI	−0.69	

BRS, Brief Resilience Scale; NDI, Neck Disability Index; ODI, Oswestry Disability Index; PSEQ-2, Pain Self-Efficacy Questionnaire 2.

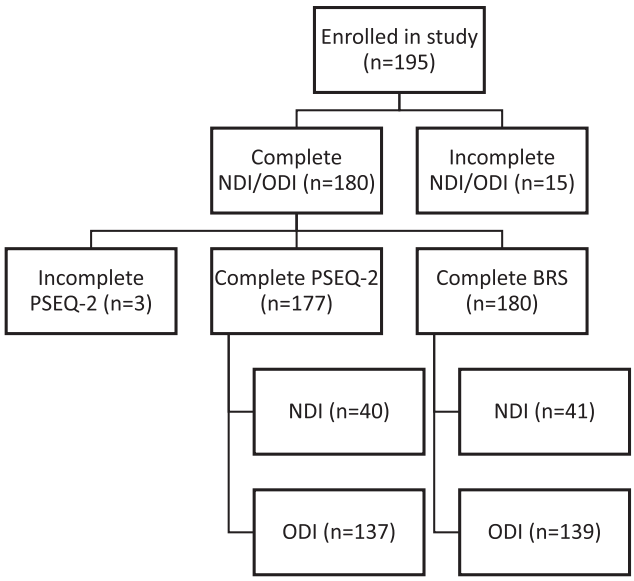

Fig. 3. Flow diagram for subject enrollment and analysis.

with ODI ($r = -0.34$, $p < .0001$) for patients with neck and low back pain, respectively (Table 2).

PSEQ-2 was strongly negatively correlated with NDI ($r = -0.69$, $p < .0001$) and strongly negatively correlated with ODI ($r = -0.62$, $p < .0001$) for patients with neck and low back pain, respectively.

BRS was moderately positively correlated with PSEQ-2 ($r = 0.36$, $p < .0001$) for the neck and low back pain combined cohort.

BRS was not significantly correlated with age ($r = 0.13$, $p = .09$) or BMI ($r = 0.12$, $p = .10$) for the neck and low back pain combined cohort.

PSEQ-2 was not significantly correlated with age ($r = 0.04$, $p = .62$) or BMI ($r = 0.20$, $p = .01$) for the neck and low back pain combined cohort.

For the low back pain cohort, the correlation between PSEQ-2 and ODI was significantly greater than the correlation between BRS and ODI ($p = .0003$); this difference was not noted in the neck pain cohort ($p = .34$; Table 3).

Discussion

This prospective study sought to assess the relationship among resilience, pain self-efficacy, and disability in neck and low back pain patients presenting to a tertiary orthopedic spine clinic. As was hypothesized, low resilience and low pain self-efficacy are each independently associated with greater functional disability in neck and back pain patients. Neither resilience nor pain self-efficacy were found to be associated with age or BMI, suggesting that the relationship of the BRS and PSEQ-2 with disability was independent of these baseline characteristics. Additionally, in low back pain patients, the correlation between PSEQ-2 and ODI was significantly greater than the correlation between BRS and ODI, suggesting that the simple two-question PSEQ-2 is more strongly associated with disability than the BRS in this population. Overall, these findings confirm that resilience and pain self-efficacy are significantly associated with disability in patients with spinal pain, and suggest that the BRS and PSEQ-2, both short self-reported tools, may be useful in predicting disability in patients. Moreover, this study serves as a pilot for future prospective studies examining resilience and pain self-efficacy as predictors of outcomes after spine surgery.

The findings of this study suggest that resilience and pain self-efficacy are important components of the biopsychosocial model of spinal pain. Collectively, low back, neck pain, and disability have been associated with depression, anxiety, somatization, work dissatisfaction, perceived disability, poor expectations for recovery of function, pain catastrophizing, fear avoidance beliefs, poor coping strategies, and poor social support [1–9]. Additionally, cognitive behavioral therapy and mindfulness-based stress reduction are examples of psychological treatment interventions that have demonstrated moderate benefit for select patients with spinal pain [24,25]. Resilience and pain self-efficacy are similarly important behavioral predictors of spinal disability, and improvement in resilience or pain self-efficacy may lead to improvement in spinal pain or function.

The present study demonstrated that low resilience is associated with greater disability in neck and low back pain patients. Resilience has been shown to relate to measures of quality of life, suicide risk in active-duty military personnel, and recovery in cancer patients [11]. Greater resilience has also been associated with lower overall health care utilization and improved self-rated health [26]. Ramirez-Maestre et al. demonstrated that higher resilience is associated with higher pain acceptance and active coping strategies in patients with chronic spinal pain [12]. Jegan et al. found a negative association between resilience and disability in primary care patients with chronic low back pain, at baseline and at follow-up after 1 year [27]. The findings presented here demonstrate a similar cross-sectional relationship between resilience and disability in a population of patients presenting to spine surgeons. However, in a multivariable regression model of disability, Jegan et al. found that resilience did not predict disability. The authors also reported that resilience was not associated with the transition of chronic localized low back pain to chronic widespread pain [28]. Taken together, these studies suggest that perhaps resilience has differing effects on pain and disability in the short- and long term, and this interplay may vary depending on the specific patient population.

Additionally, Tokish et al. report conducting the first assessment of the relationship between the BRS and outcomes after surgery [11]. In their study of patients undergoing primary total shoulder arthroplasty, they found that the BRS was significantly positively correlated with traditional total shoulder arthroplasty postoperative outcome scores.

This suggests that greater resilience is predictive of better surgical outcomes, which may also be true for spinal surgery patients.

Additionally, previous studies of resilience and spinal pain assessed resilience using the Resilience Scale (25 items) [12] or its short form (11 items) [27,28]. The present study demonstrates a similar relationship between resilience and disability in spinal pain patients using the simpler six-item BRS, a notably shorter test that spine surgeons may find easier to implement in their assessment of patients.

The present study demonstrated that low pain self-efficacy is associated with greater disability in neck and low back pain patients. In a study of primary care patients with low back pain, pain self-efficacy was shown to be inversely associated with disability at baseline and an important predictor of disability at 6-month follow-up [14]. Additionally, Maughan et al. studied the responsiveness (ie, ability to detect real or important change over time when it has occurred) of several assessment tools for patients with chronic low back pain. In the setting of a back class treatment intervention, their analysis suggested that the PSEQ was more responsive to change than the ODI, Roland Morris Disability Questionnaire, and Numerical Rating Scale [29], highlighting the strength of this less popular tool. The findings of the present study confirm the association of pain self-efficacy and disability, but also suggest that a short two-question version of the PSEQ may be an important and easily implementable tool for spine surgeons to use in their assessment of patients.

There are several potential limitations to this study. Whereas 195 patients were initially enrolled, 15 patients had missing data and thus had to be excluded from the analysis. It is possible that the data from these missing patients may have affected the study results. Additionally, the data analysis examines correlations between the various outcome measures independently; however, these correlations do not imply causal relationships. In previous studies, for example, pain self-efficacy appears to have been studied as an independent predictor of outcomes, but also as a dependent outcome variable itself, and the correlation analysis here does not suggest one or the other. Also, multiple short forms of the PSEQ have been developed utilizing different two-question or for-question combinations of the original 10-item PSEQ. The specific PSEQ-2 used for this study was the one developed in an upper extremity orthopedic population by Bot et al. [17] and validated by Briet et al. [18]. These authors selected questions 8 and 9 of the original PSEQ for the short form after conducting interitem correlation analysis for the entire PSEQ. They demonstrated this PSEQ-2 to have good internal consistency (Cronbach $\alpha = 0.90$; original 10-item PSEQ has Cronbach $\alpha = 0.94$) and strong correlation with the original PSEQ ($r = 0.76$). Therefore, it was felt that this PSEQ-2 was an appropriate choice for this study, though it should be noted that other versions exist [30].

Future studies should aim to follow neck and low back pain patients longitudinally to determine the impact resilience and pain self-efficacy have on patients over time. It will be important to assess the relationships between resilience, pain self-efficacy, and disability before and after spine surgery, potentially focusing on the utility of the BRS and PSEQ-2 in predicting outcomes after surgery.

Conclusions

In summary, resilience and pain self-efficacy are each independently inversely associated with disability in patients with spinal pain. Spine surgeons may find it useful to incorporate the BRS and PSEQ-2 into preoperative assessment and management. Future studies may wish to examine the utility of these tests in predicting response to treatments, including surgical intervention.

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