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ORIGINAL RESEARCH

Reductions in Perceived Injustice are Associated with Reductions in Pain Catastrophizing in Individuals with Low Back Pain

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Purpose: This study examined whether reductions in pain catastrophizing were associated with reductions in perceived injustice in individuals with occupational low back pain receiving physical therapy combined with a brief psychological intervention (Empowered Relief) to improve pain self-management skills.

Methods: A secondary analysis of a quasi-experimental study was conducted with 63 participants with subacute and chronic low back pain. Perceived injustice and pain catastrophizing were measured at baseline (T1) and four weeks post-intervention (T2). Correlation and regression analyses were performed to identify predictors of changes in perceived injustice. Ethical approval was obtained from the Université de Sherbrooke Research Ethics Board (#2022-3392).

Results: Changes in pain catastrophizing were strongly associated with changes in perceived injustice ($r = 0.723$, $p < 0.001$). Regression analyses revealed that pain stage and reductions in pain catastrophizing were significantly associated with decreases in perceived injustice. Regression analyses also revealed that reductions in the "rumination" subscale of pain catastrophizing significantly predicted changes in both subscales of perceived injustice.

Conclusion: The results demonstrate that reductions in pain catastrophizing are associated with reductions in perceived injustice during the subacute phase. The findings also shed light on shared mechanisms between pain catastrophizing and perceived injustice, emphasizing the role of rumination. The findings from this study underscore the importance of early psychological intervention for occupational low back pain, particularly in the subacute phase to improve recovery.

Keywords: perceived injustice, pain catastrophizing, rumination, low back pain, subacute and chronic pain

Introduction

Perceived injustice is defined as a cognitive appraisal reflecting the severity and irreparability of pain or injury-related loss, as well as the perception of externalized blame and unfairness related to that pain or injury.[1] It is suggested that perceptions of injustice can result in negative consequences on recovery after injury or pain condition.[2,3] A systematic review has provided strong evidence linking perceived injustice to pain intensity, pain-related disability, mental health outcomes such as depression and anxiety, and quality of life in adults with musculoskeletal pain conditions.[4] These conditions include whiplash injury, lower back pain, rheumatoid arthritis, osteoarthritis, and fibromyalgia.[4]

Despite its significant impact on pain and disability, there are currently no interventions specifically designed to target pain-related perceptions of injustice.[1,5] Research indicates that perceived injustice tends to be more persistent over time than other psychosocial factors.[1] For example, a study assessing changes in psychosocial risk factors following a four-week multidisciplinary rehabilitation program for individuals with subacute musculoskeletal injuries resulting from either an occupational injury or a motor vehicle accident found that perceived injustice exhibited the least improvement.[1] There

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was only a 5% reduction in perceived injustice compared to 12–15% reductions in pain catastrophizing, fear of reinjury, and depression.[1]

Studies have demonstrated a strong association between perceived injustice and pain catastrophizing.[1,5] Pain catastrophizing is a psychological factor characterized by an exaggerated negative orientation towards actual or anticipated pain experiences. It is comprised of rumination, magnification and helplessness.[6] A systematic review and meta-analysis of psychological interventions for reducing chronic pain suggests that cognitive behavioral therapy is among the effective treatments available. The magnitude of the correlation between perceived injustice and pain catastrophizing suggests that perceived injustice might influence pain outcomes, at least partially, through mechanisms similar to those of catastrophizing.[5] Indeed, it has been suggested that the dimension of "severity/irreparability of loss" in perceived injustice likely overlaps with the dimension of "rumination" in pain catastrophizing.[5] It is possible that interventions aimed at reducing pain catastrophizing may, by similar mechanisms of action, then also be associated with reductions in perceptions of injustice.

The objective of this study is to examine whether the changes in ppain catastrophizing are associated with the changes in perceived injustice in a sample of adults with occupational low back pain in physical therapy following a short psychological intervention that reduces pain catastrophizing. From a clinical point of view, the results could help identify ways to intervene on perceived injustice using existing evidence-based psychological interventions that are brief and accessible to individuals who live with pain. This study will also allow for a deeper understanding of the shared mechanisms between perceived injustice and pain catastrophizing.

Methods

Design and Participants

This study conducted secondary analyses of data from a quasi-experimental study. The primary project from which the data was used aimed to evaluate the acceptability, feasibility, and effectiveness of a psychological intervention (Empowered Relief) in the context of primary care physical therapy. The primary project was approved by the *Comité d'éthique de la recherche – Éducation et sciences sociales* of the Université de Sherbrooke (#2022-3392).

The study sample consisted of 63 adults with occupational low back pain in primary care physical therapy. In total, 42 participants reported pain in the subacute stage (lasting between 1 to 3 months) and 21 participants reported pain in the chronic stage (lasting between 3 and 12 months). Inclusion criteria included: (1) Non-specific low back pain from a workplace injury, (2) Date of injury between 3 to 12 weeks prior to the date of treatment, (3) Enrolled in a physical therapy program, (4) Currently absent from regular job, (5) French fluency, (6) Ability to attend a web-based class and complete web-based surveys. Exclusion criteria included: (1) Clinical evidence of severe spinal pathology or any medical condition contraindicating participation in the study, (2) Previous participation in the Empowered Relief class. Medication use was not controlled for in this study.

The statistical software G* Power was used to calculate the number of participants required for the larger study. Using the F-test family and a MANOVA with overall effects, the minimal sample size required to achieve 95% power, at a significance criterion of $\alpha = 0.05$, for an average effect size with 8 independent variables was 52.

Procedure

Participants were recruited from a network of physical therapy clinics across the province of Quebec. Physical therapists at these clinics provided their patients with a brochure summarizing the study procedures and asked for their permission to be contacted by the research team. After eligibility screening, participants gave their consent by telephone and signed the electronic consent form. One week prior to the intervention (time one; T1), participants completed the first questionnaire which contained sociodemographic and psychological measures. Participants then participated in the intervention (described below) individually or group format via *Zoom* or *TEAMS*. Four weeks after the intervention (time two; T2), participants completed a follow-up questionnaire comprised of the same questionnaires as the initial questionnaire. This study used data from the T1 and T2 questionnaires.

Intervention

Empowered Relief © (2014) is a two-hour, single-session pain course incorporating pain neuroscience education, mindfulness principles, and cognitive-behavioral strategies, such as identifying distressing thoughts and emotions, cognitive reframing, relaxation exercises, and developing a self-soothing action plan.[7] The intervention was delivered online to increase accessibility and eliminate logistical obstacles, especially for those with mobility or geographic limitations. This approach is supported by research demonstrating the effectiveness of virtual delivery of Empowered Relief.[1] The content focuses on mind-body science and the body's response to stress, pain, and relaxation. Participants learn to identify distressing thoughts and practice cognitive restructuring. At the end of the course, participants receive a 20-minute guided relaxation audio file featuring binaural tones. In this study, the intervention was delivered by a licensed physical therapist and certified instructor of Empowered Relief using an electronic slide deck to patients in a single session lasting 120 minutes. This study utilized the French-Canadian version of Empowered Relief © Stanford University.

Measures

Sociodemographic Characteristics

This questionnaire assessed participants' age, sex, gender, and history of musculoskeletal injuries. It included questions about the date of injury, attempts at return to work, company size, seniority in current position, type of work (labour, administrative/clerical, health services, transport, and education), schedule (full- or part-time) and union status (unionized or non-unionized). Participants also indicated whether there was any dispute over their compensation.

Pain Catastrophizing

The Pain Catastrophizing Scale (PCS)[8] was used to assess pain catastrophizing thoughts. The PCS consists of 13 items describing the emotions individuals may experience when thinking about their pain.[8] Participants rated these statements on a 5-point scale, ranging from 0 (not at all) to 4 (all the time).[8] The PCS has three subscales: rumination ("I can't seem to keep it out of my mind"), magnification ("I keep thinking of other painful events"), and helplessness ("It's terrible and I think it's never going to get any better").[8] Several studies involving participants with chronic pain have shown that the PCS exhibits high internal consistency, with a Cronbach's alpha of 0.87.[8,9] In this study, the Cronbach's alpha was 0.591. While these values are lower than those reported in previous research, they still suggest moderate internal consistency. The lower reliability could be attributed to sample size, differences in pain chronicity, or variability in participants' responses. PCS scores range from 0 to 52, and the clinical threshold for pain catastrophizing severity is of 30.[8]

Perceived Injustice

Perceived injustice was assessed using the Injustice Experience Questionnaire (IEQ).[1] The IEQ consists of 12 items rated on a 5-point scale ranging from 0 (not at all) to 4 (extremely).[1] The IEQ includes two subscales "severity/irreparability of loss" and "blame/injustice", but it can also be interpreted using a total score.[1] The "severity/irreparability of loss" scale consists of items such as "My life will never be the same", while the "blame/injustice" one has items like "I am suffering because of someone else's negligence".[1] The IEQ has demonstrated strong test-retest reliability and a Cronbach's alpha coefficient of 0.92 in a sample of work-disabled individuals with chronic pain.[1] In this study, the Cronbach's alpha was 0.571 for the IEQ, which may reflect differences in sample characteristics or the inclusion of individuals in the subacute phase of pain recovery. IEQ scores range from 0 to 48, and the clinical threshold for a risk of high levels of perceived injustice is of 19.[10]

PROMIS measures

The National Institutes of Health Patient-Reported Outcomes Measurement Information System (PROMIS) short-form measures have been applied in pain research, and specific domains were identified by the Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials as core outcomes.[11–14] In the current study, measures of anxiety, depression, and pain intensity were selected. Participants were asked to refer to the previous 7 days when rating items related to pain intensity (version 1a), depression (version 8a), and anxiety (version 8a). Higher scores on PROMIS measures reflect greater symptom severity. The T scores were calculated using the web-based PROMIS Assessment

Center software, which employs Item Response Theory scoring algorithms based on the Bayesian expected A posteriori method.[15,16]

The PROMIS Pain Intensity questionnaire assessed participants' average pain intensity using a numerical rating scale ranging from "0" for no pain to "10" for the worst pain imaginable. The validity of this questionnaire has been demonstrated.[17] In addition, this questionnaire has also been shown to be reliable.[18] The Cronbach's alpha of this questionnaire is 0.91, demonstrating high internal consistency.[18] The PROMIS Emotional Distress Anxiety and Depression questionnaires assessed symptoms of depression and anxiety. Participants rated statements on a scale of 1 to 5, where 1 was "never" and 5 was "all the time". Symptoms of depression and anxiety, and pain intensity were included as cofounders in the regression analyses as they are associated with pain catastrophizing.[19,20] These questionnaires show good validity and reliability.

Statistical Analyses

Descriptive statistics consisted of means (standard deviations (SDs)), counts (proportions) and total scores for each measure pre- and post-treatment (T1 and T2). To evaluate the significance of changes in measures for each study variable, paired-samples *t*-tests were performed. The change in score for each variable was quantified for each participant as a percentage change from pretreatment to post-treatment values. Cohen's d was calculated to assess effect sizes.

The Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials (IMMPACT) recommendations were used to categorize the clinical importance of the changes in perceived injustice, pain catastrophizing, and pain intensity scores: a 15% change was considered clinically unimportant, while a 15–30% change was classified minimally clinically important, a 30–50% change was moderately clinically important, and a change of 50% or more as substantially clinically important.[21] For PROMIS measures, the threshold for minimal important change typically falls within the range of 2 to 6 T-score points.[22] The minimally important difference for PROMIS anxiety ranges from 2.3 to 3.4 and for depression ranges from 2.0 to 3.1.[23,24]

A univariate correlation analysis was performed to examine the relationship between changes in pain catastrophizing and changes in perceived injustice. Correlation analyses and independent samples t-tests were performed performed to examine associations between the study variables and changes in perceived injustice. A stepwise regression analysis was conducted to identify predictors of change in perceived injustice from pretreatment to post-treatment. Variables that demonstrated a significant univariate association with the percent change in perceived injustice were incorporated in the regression analysis.[25] Furthermore, regression analyses were conducted to analyze the contributions of the subscales of the PCS to those of the IEQ. All analyses were performed using IBM SPSS Statistics software (version 29.0).

Results

Baseline Sample Characteristics

Demographic information and baseline measures appear in Table 1. Participants' age ranged from 20 to 75 years old. Overall, the sample had a few more females (58.7%) than males (41.3%), with no significant sex differences observed on any of the measures (>.05). Furthermore, the vast majority of the sample consisted of Caucasian participants (81%) with a few ones being Black (19%). Most of the participants (66%) were in the subacute stage of pain while only a few (33.4%) were in the chronic stage. The sample was fairly educated, with 79.3% having completed a degree or training beyond high school, and 53.9% were married while the rest were either single, widowed or separated. More than half the sample (65.1%) reported being unionized and not involved in a legal dispute process. Half the sample (47.6%) had attempted to return to work at least once. About a quarter of the sample a history of at least one musculoskeletal disorder, and about the same number reported having had at least 2. Most participants worked in a full-time (90.5%) or a permanent position (95.2%), and half of the sample were labourers. Scores and effect sizes (Cohen's d) for each study variable at baseline and follow-up appear in Table 2.

Table 1 Sample Characteristics at Baseline (n = 63)

Age, mean (SD)	45.68 (10.61)
Sex, n (%)	
Male	26 (41.3)
Female	37 (58.7)
Race, n (%)	
White (caucasian)	51 (81)
Black (African-American)	12 (19)
Pain stage, n (%)	
Subacute	42 (66.7)
Chronic	21 (33.3)
Marital status, n (%)	
Single	19 (30.2)
Married	34 (53.9)
Widowed	1 (1.6)
Separated	9 (14.3)
Education level, n (%)	
Highschool not completed	4 (6.3)
Highschool completed	9 (14.3)
Professional degree	13 (20.6)
College	16 (25.4)
University	21 (33.3)
Unionized, n (%)	
Yes	41 (65.1)
No	22 (34.9)
Dispute process, n (%)	
Yes	11 (8.8)
No	115 (91.2)
Attempt to return to work, n (%)	
Yes	30 (47.6)
No	33 (52.4)
Previous musculoskeletal disorder episodes, n (%)	
0	16 (25.4)
1	13 (20.6)
2	12 (19)
3	9 (14.3)
4	4 (6.3)
5	2 (3.3)
6-10	4 (6.3)
More than 10	3 (4.8)
Work schedule, n (%)	
Full-time	57 (90.5)
Part-time	6 (9.5)
Work type, n (%)	
Labour	31 (49.2)
Administrative/Clerical	10 (15.9)
Health services	13 (20.6)
Transport	5 (7.9)
Education	4 (6.3)

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Table 2 Scores at Baseline and Post-Treatment for Each Study Variable

Variable	T1 (M (SD))	T2 (M (SD))	p-value	Cohen's *d*
Perceived injustice	27.66 (7.36)	14.22 (12.13)	< 0.001***	1.179
Pain catastrophizing	43.53 (8.87)	15.54 (12.75)	< 0.001***	2.313
Pain intensity	5.22 (2.11)	4.07 (2.36)	0.002**	0.420
Anxiety symptoms	55.92 (9.43)	52.66 (9.40)	0.004**	0.395
Depressive symptoms	55.04 (9.99)	51.53 (9.86)	< 0.001***	0.547

Notes: ** = p <0.01, *** = p <0.001. Perceived injustice, Injustice Experience Questionnaire; Pain catastrophizing, Pain Catastrophizing Scale, Pain intensity, PROMIS Pain Intensity Questionnaire; Anxiety and depressive symptoms; PROMIS anxiety and depressive symptoms Questionnaires.

Changes in Pain Catastrophizing

Pain catastrophizing scores demonstrated a significant reduction from baseline to follow-up ($t(58) = 17.77$, $p < 0.001$) and a large effect size (Cohen's d = 2.313). On average, scores on the PCS decreased by 27.99 point (64.3%), which is considered a substantially clinically important change based on the IMPAACT recommendations.[21] At baseline, participants reported high levels of pain catastrophizing, with most average scores exceeding the clinical threshold of 30. By the follow-up, scores had fallen below this threshold. Paired-samples t-tests were performed to assess whether there were significant changes in each subscale of the PCS. Results revealed a significant decrease in the three subscales: "rumination" ($t(58) = 10.12$, $p < 0.001$), "magnification" ($t(58) = 15.53$, $p < 0.001$) and "helplessness" ($t(58) = 17.89$, $p < 0.001$).

Changes in Perceived Injustice

Perceived injustice scores demonstrated a significant reduction from baseline to follow-up ($t(58) = 9.06$, $p < 0.001$) and a large effect size (Cohen's d = 1.179). As seen in Figure 1, the mean decrease in perceived injustice scores was 13.44 points, representing a 48.6% reduction. This magnitude of change exceeds the threshold for substantially clinically importance according to the IMPAACT recommendations.[21] Notably, all baseline perceived injustice scores were above the clinical cutoff of 19, indicating high levels of perceived injustice. By the follow-up, all perceived injustice scores were below this cutoff, signifying a meaningful shift to a clinically non-significant range. Paired-samples t-tests were performed to assess whether there were significant changes in each subscale of the IEQ. Results revealed a significant decrease in the "externalized blame/unfairness" subscale ($t(58) = 10.31$, $p < 0.001$) and in the "severity/irreparability" subscale ($t(58) = 6.46$, $p < 0.001$).

Associations with Changes in Perceived Injustice

A correlational analysis was performed to examine the relationship between percent changes in pain catastrophizing and percent changes in perceived injustice from baseline to follow-up. The analyses revealed a strong association between changes in pain catastrophizing and changes in perceived injustice ($r = 0.723$, $p < 0.001$).

Independent samples T-tests examined the association between study variables and changes in perceived injustice. Pain stage (subacute or chronic) was associated with percent change in perceived injustice ($t(57) = -2.08$, $p = 0.043$). That is, participants with subacute pain reported a greater reduction in perceived injustice (62%) than participants with chronic pain (19.8%). Union status at work (whether the participant was part of a union (yes/no)) was also significantly associated with percent change in perceived injustice ($t(57) = -3.50$, $p = 0.002$). Unionized participants experienced a larger reduction in perceived injustice (58.1%) compared to non-unionized participants (36.1%). Lastly, ethnicity was also significantly associated with percent change in perceived injustice ($t(57) = -2.47$, $p = 0.028$). White participants experienced a higher reduction in perceived injustice levels (55.5%) compared to Black participants (22%). These three variables were retained in the multiple regression model.

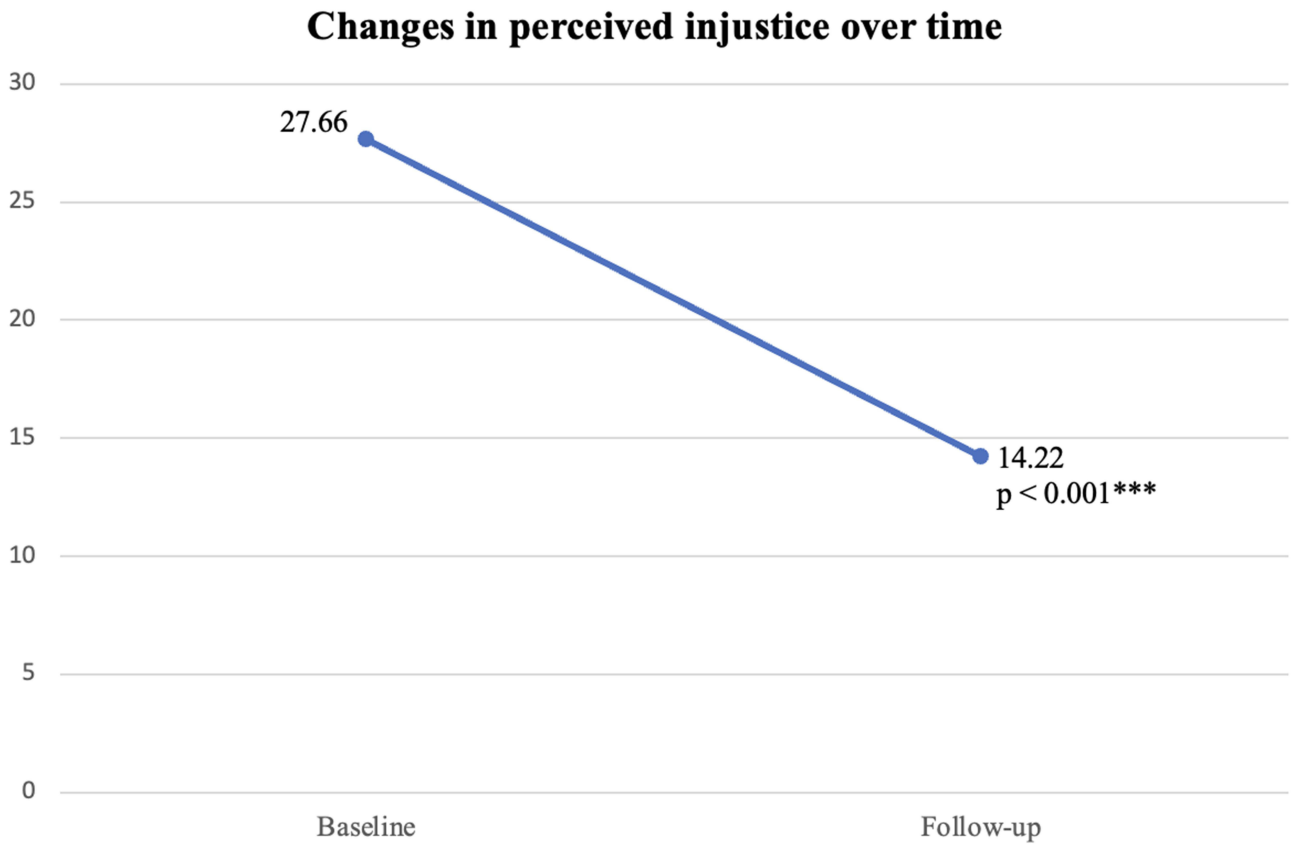

Figure 1 Changes in perceived injustice mean scores over time.

Predictors of Change in Perceived Injustice

Next, a multiple linear regression was performed to identify predictors of change in perceived injustice. Pain stage, union status at work, and ethnicity were entered in the first step, followed by percent change in pain catastrophizing, anxiety symptoms, depression symptoms, and pain intensity in the second step. In the final model, pain stage ($\beta = 0.227$, $p = 0.025$) and percent change in pain catastrophizing ($\beta = 0.607$, $p < 0.001$) were the only significant contributors to the model as seen in Table 3. The final model explained 60.9% of the variance in the percent change in perceived injustice (Adjusted $R^2 = 0.55$). This indicates that participants in the subacute and chronic pain ages experienced different changes in perceptions of injustice over time. In addition, participants who reported greater reductions in catastrophizing scores at follow-up were more likely to report greater reductions in perceptions of injustice.

Two multiple linear regressions were performed to examine the contribution of the three subscales of pain catastrophizing, "rumination", "magnification" and "helplessness", to each of the subscales of perceived injustice, "externalized blame/unfairness" and "severity/irreparability". First, for the "severity/irreparability" subscale of perceived injustice, pain stage, union status at work, and ethnicity were entered in the first step and percent change in anxiety symptoms, percent change in depression symptoms and percent change in pain intensity were entered in the second step. Lastly, percent change in the "rumination", "magnification", and "helplessness" subscales of pain catastrophizing were entered in the third step. In the final model, percent change in the "rumination" subscale ($\beta = 0.520$, $p < 0.001$) and pain stage ($\beta = 0.196$, $p= 0.044$) both significantly contributed to the model. The final model explained 65.3% of the variance in the "severity/irreparability" subscale of perceived injustice (Adjusted $R^2 = 0.59$). For the "externalized blame/unfairness" subscale, the same steps were followed and percent change in the "rumination" subscale ($\beta = 0.381$, $p = 0.027$) and "pain stage" ($\beta = 0.241$, $p= 0.040$) significantly contributed to the model. The final model explained 49.7% of the variance in the subscale of pain catastrophizing "externalized blame/unfairness" in perceived injustice (Adjusted $R^2 = 0.40$).

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Table 3 Multiple Linear Regression Assessing the Contributions of Study Variables to Changes in Perceived Injustice

Step	Variable	B (Unstandardized Coefficient)	Standard Error	Beta (Standardized Coefficient)	t-value	p-value
1	(Constant)	−165.258	22.588		−7.316	<0.001***
	Pain stage	37.097	9.753	0.422	3.804	<0.001***
	Union status	18.663	9.282	0.227	2.011	0.049
	Ethnicity	36.302	11.684	0.343	3.107	0.003**
2	(Constant)	−40.013	31.295		−1.279	0.207
	Pain stage	19.926	8.653	0.227	2.303	0.025*
	Union status	11.716	7.863	0.142	1.490	0.143
	Ethnicity	8.384	11.536	0.079	0.727	0.471
	Percent change in pain intensity	−0.063	0.052	−0.143	−1.201	0.236
	Percent change in anxiety	0.327	0.371	0.109	0.880	0.383
	Percent change in depression	−0.136	0.365	−0.057	−0.372	0.711
	Percent change in PCS	0.926	0.186	0.607	4.987	<0.001***

Notes: *p <0.05, **p <0.01, ***p <0.001.

Discussion

The present study investigated whether reductions in pain catastrophizing were associated with reductions in perceptions of injustice in individuals with occupational low back pain receiving physical therapy combined with a brief psychological intervention for pain. Results indicated that at 4 weeks post-treatment, pain catastrophizing scores were significantly reduced, however, significant reductions in perceived injustice were only observed among participants with subacute pain. Findings from multivariate analyses showed that pain stage and reductions in pain catastrophizing were significantly associated with decreases in perceived injustice, highlighting the potential benefit of early interventions that target pain catastrophizing in individuals with low back pain.

The results of this study demonstrated that pain stage and changes in pain catastrophizing predicted changes in perceived injustice at follow-up, while controlling for union status at work, ethnicity, anxiety and depressive symptoms, and pain intensity. This suggests that during the subacute phase, reductions in pain catastrophizing were strongly linked to improvements in how unjust the pain experience was perceived. It is important to consider that the observed reductions in pain catastrophizing and perceived injustice among participants in the subacute phase may reflect natural recovery processes or the effects of physical therapy.[26–28] However, it has been suggested that current rehabilitation approaches may have a limited impact on perceived injustice. For example, Sullivan et al reported a 5% decrease in perceived injustice in a sample of 70 work-disabled participants with subacute and chronic pain musculoskeletal pain who were enrolled in a rehabilitation program that consisted primarily of physical and occupational therapy interventions aimed at maximizing tolerance for work-related activities.[1]

Scores on the Pain Catastrophizing Scale were significantly reduced at follow-up among participants in both pain stages. However, in individuals with chronic pain, scores on the Injustice Experience Questionnaire reduced by 16.8% but remained above the clinical cut-off of 19,[10] indicating that perceived injustice persisted at clinically significant levels despite some improvement. It is possible that when individuals experience prolonged occupational pain, they are more likely to encounter multiple sources of injustice that fuel perceptions of injustice. In fact, disability reflects a complex interaction of numerous factors involving personal factors as well as workplace, healthcare, and legislative factors.[29,30]

Scott et al reported that potential sources of injustice following painful injury include employers and/or colleagues, insurers, healthcare professionals, as well as personal factors such as family and friends.[31] This underscores the importance of providing early interventions before workers encounter additional sources of injustice that can hinder their rehabilitation process.

The current study revealed a strong association (r = 0.723) between pain catastrophizing and perceived injustice in participants subacute and chronic low back pain. This finding aligns with prior correlational research, for example, Sullivan et al reported a similar correlation between pain catastrophizing and perceived injustice in a sample of 70 individuals with subacute and chronic pain following an occupational injury or a rear-end motor vehicle accident (r = 0.65 to 0.75).[1] Rodero et al also reported a similar association between pain catastrophizing and perceived injustice in a sample of 250 participants with fibromyalgia (r = 0.65).[32] Due to the correlational nature of these studies, it remains unclear whether pain catastrophizing influences perceived injustice, or how both are shaped by other factors such as coping strategies, social support, or external influences.

Previous studies have discussed the conceptual overlap between pain catastrophizing and perceived injustice. Specifically, it has been suggested that the "rumination" dimension of pain catastrophizing may overlap with the "severity/irreparability of loss" dimension of perceived injustice.[1,5] This study demonstrates that changes in the "rumination" subscale in pain catastrophizing contributed to changes in both dimensions of perceived injustice: "severity/irreparability of loss" and "externalized blame/unfairness". This finding highlights the central role of rumination as a core mechanism through which individuals may become "stuck" after musculoskeletal injury. Indeed, it has been suggested that attentional difficulties may represent a common mechanism of action linking pain catastrophizing and perceived injustice.[5] It is possible that people who ruminate tend to have difficulty disengaging from their pain-related thoughts, which can impact perceptions of injustice. Just as catastrophizing reflects an exaggerated focus on pain, perceived injustice may reflect an exaggerated and persistent focus on loss—both of which are fueled by the inability to shift attention away from distressing pain-related thoughts.[5]

The findings of this study have multiple implications. Clinically, these findings suggest that early psychological intervention targeting pain catastrophizing—particularly its rumination component—may be important for reducing perceptions of injustice in individuals with occupational low back pain. The findings also highlight that timing matters: since reductions in perceived injustice were observed primarily in those with subacute pain, implementing brief psychological interventions in combination with physical therapy during this stage may prevent the development of maladaptive pain-related thoughts that can hinder recovery. From a theoretical perspective, the results support discussions linking pain catastrophizing to perceived injustice through shared mechanisms such as rumination. Future research may expand on these findings to develop a conceptual model to better understand the development, maintenance and worsening of perceptions of injustice following injury.

This study had several limitations that should be taken into account when interpreting the findings. First, the absence of a control group prevented us from attributing changes in perceived injustice solely to the interventions (pain management skills course and physical therapy). Second, the recruitment was limited to participants with occupational low back pain, minimizing generalizability of the findings to the broader population or to individuals with other types of pain. Additionally, the small proportion of participants (33%) in the chronic pain stage might have limited the study's ability to draw robust conclusions about this group. Furthermore, the sample lacked diversity, as 81% of the participants identified as white. Further research should aim to replicate these findings with a more diversified and balanced representation of participants across pain phases to developed more effective and tailored interventions.

Conclusion

This study highlights the value of early psychological intervention in the treatment of occupational low back pain, showing that changes in pain catastrophizing are associated with changes in perceived injustice during the subacute phase. The findings also offer insights into the shared mechanisms between pain catastrophizing and perceived injustice, highlighting the important role of rumination and potential difficulties with attentional disengagement following injury. The results support the development of stage-specific interventions that address pain-related psychological risk factors following low back pain.

Abbreviations

IEQ, Injustice Experience Questionnaire; PCS, Pain Catastrophizing Scale; T1, time one; T2, time two; PROMIS, Patient-Reported Outcomes Measurement Information System; SD, standard deviation; IMMPACT, The Initiative on Methods, Measurement, and Pain Assessment in Clinical Trials.

Data Sharing Statement

The datasets used or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethics Approval

The primary project was approved by the *Comité d'éthique de la recherche – Éducation et sciences sociales* of the Université de Sherbrooke (#2022-3392). This study complies with the Declaration of Helsinki.

Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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