



## King's Research Portal

DOI:

[10.1097/AJP.0000000000000551](https://doi.org/10.1097/AJP.0000000000000551)

*Document Version*

Peer reviewed version

[Link to publication record in King's Research Portal](#)

*Citation for published version (APA):*

Yakobov, E., Scott, W., Stanish, W. D., Tanzer, M., Dunbar, M., Richardson, G., & Sullivan, M. J. L. (2018). Reductions in Perceived Injustice are Associated with Reductions in Disability and Depressive Symptoms after Total Knee Arthroplasty. *Clinical Journal of Pain*, 34(5), 415-420. <https://doi.org/10.1097/AJP.0000000000000551>

### **Citing this paper**

Please note that where the full-text provided on King's Research Portal is the Author Accepted Manuscript or Post-Print version this may differ from the final Published version. If citing, it is advised that you check and use the publisher's definitive version for pagination, volume/issue, and date of publication details. And where the final published version is provided on the Research Portal, if citing you are again advised to check the publisher's website for any subsequent corrections.

### **General rights**

Copyright and moral rights for the publications made accessible in the Research Portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognize and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the Research Portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the Research Portal

### **Take down policy**

If you believe that this document breaches copyright please contact [librarypure@kcl.ac.uk](mailto:librarypure@kcl.ac.uk) providing details, and we will remove access to the work immediately and investigate your claim.

NOTE: This is the final accepted version of the manuscript before copyediting. This article may not exactly replicate the final version published in the Clinical Journal of Pain, which holds the copyright for this article. It is not the copy of the record. The published article can be accessed at <https://doi.org/10.1097/AJP.0000000000000551>

RUNNING TITLE: Perceived injustice, disability and depressive symptoms

**Reductions in perceived injustice are associated with reductions in disability and depressive symptoms after total knee arthroplasty**

Esther Yakobov, PhD Candidate  
Department of Psychology  
McGill University

Whitney Scott, PhD  
Institute of Psychiatry, Psychology, and Neuroscience  
King's College London  
London, UK

William Stanish, MD  
Department of Surgery  
Dalhousie University

Michael Tanzer, MD  
Department of Surgery  
McGill University

Michael Dunbar, MD  
Department of Surgery  
Dalhousie University

Glen Richardson, MD  
Department of Surgery  
Dalhousie University

Michael Sullivan, PhD  
Department of Psychology  
McGill University

The authors have no financial interests associated with the findings of this research. This research was supported by funds from the Canadian Institutes for Health Research.

Address for Correspondence:

Dr. Michael Sullivan  
Department of Psychology, McGill University

1205 Doctor Penfield Avenue  
Montreal, QC H3A 1B1  
Phone: 514-398-5677  
[michael.sullivan@mcgill.ca](mailto:michael.sullivan@mcgill.ca)

**Introduction:** Perceptions of injustice have been associated with problematic recovery outcomes in individuals suffering from a wide range of debilitating pain conditions. It has been suggested that perceptions of injustice are likely to arise in response to experiences characterized by suffering and loss. If suffering and loss are important contributors to perceived injustice, it follows that interventions that yield reductions in suffering and loss should also contribute to reductions in perceptions of injustice. The present study examined the relative contributions of post-surgical reduction in pain severity, depressive symptoms and disability to the prediction of reductions in perceptions of injustice. **Methods:** The study sample consisted of 110 individuals (69 women and 41 men) with severe osteoarthritis of the knee scheduled for total knee arthroplasty. Patients completed measures of perceived injustice, depressive symptoms, pain and disability approximately one week before surgery, and at one year follow-up. Reductions in symptom severity were used as a proxy for reductions in suffering. Reductions in disability were used as a proxy for reductions in losses. **Results:** The results revealed that reductions in depressive symptoms and disability, but not pain severity, were correlated with reductions in perceived injustice. Regression analyses revealed that reductions in disability and reductions in depressive symptoms contributed significant unique variance to the prediction of reductions in perceived injustice. **Discussion:** The present findings are consistent with conceptual frameworks that propose a central role for suffering and loss in the emergence of perceptions of injustice. From a clinical perspective, the results suggest that supplementing surgical and rehabilitation treatment with psychosocial interventions that target depressive symptoms and perceived injustice might improve total knee arthroplasty outcomes.

Key words: Perceived injustice, disability, pain, depressive symptoms

Several studies have highlighted the deleterious health and mental health consequences of justice-related appraisals. Perceptions of injustice have been prospectively associated with poor recovery outcomes in patients with musculoskeletal injuries [1, 2]. Pre-surgical scores on measures of perceived injustice have been shown to be prospectively associated with persistent pain one year following knee replacement surgery [3]. Additionally, in several studies with individuals with whiplash, perceived injustice predicted the persistence of posttraumatic and depressive symptoms [4, 5].

Although research has been consistent in showing a relation between perceived injustice and problematic recovery outcomes, little is currently known about the factors that contribute to the development and persistence of perceptions of injustice. The lack of information about the factors that contribute to the emergence of perceptions of injustice will necessarily impede efforts to develop effective interventions aimed at reducing perceptions of injustice.

It has been suggested that perceptions of injustice are likely to arise in response to experiences characterized by suffering and loss [6-9]. The experience of debilitating health conditions can be construed in terms of suffering and loss [9, 10]. The suffering associated with pain-related conditions might include symptoms of pain and emotional distress [11, 12]. The losses associated with pain-related disability might include loss of independence, employment, financial security, and the loss of identity [13, 14].

Osteoarthritis is a debilitating health condition that affects up to 40% of the population by the age of 65 years [15]. In advanced stages of the disease, joint deterioration can lead to significant pain and limitations of function [16, 17]. Progressive increase in pain and impairment in function often lead to loss in one's ability to participate in many activities of daily life [18].

Total knee arthroplasty (TKA) is a surgical procedure that involves the replacement of diseased tissue and bone with a prosthetic joint. TKA has been shown to be highly successful in reducing pain and disability in majority of cases. [19]. If suffering and loss are important contributors to perceived injustice, it follows that interventions that yield reductions in suffering and losses should also contribute to reductions in perceptions of injustice. No research to date has investigated the relative contributions of reductions in symptom severity and disability to reductions in perceived injustice following a surgical intervention.

The primary objective of the present study was to examine whether reductions in symptom severity (i.e., pain and depressive symptoms) and disability following TKA were associated with reductions in perceptions of injustice. Participants completed measures of perceived injustice, depressive symptomatology, pain severity, and disability one week before the surgery and at one year follow-up. Reductions in symptom severity were used as a proxy for reductions in physical and emotional suffering. Reductions in disability were used as proxy for reductions in OA-related losses. It was hypothesized that perceived injustice would decrease as a function of post-TKA reductions in suffering (i.e., pain severity and depressive symptoms) and loss (i.e., disability).

## **Methods**

### ***Participants***

The study sample consisted of 110 individuals (69 women and 41 men) with severe OA of the knee scheduled for TKA. The age range of the study sample was from 50 to 85 years (mean = 66.9; SD = 8.3). The pre-surgical body mass index (BMI) ranged from 20.52 to 45.2 (mean = 31.00; SD = 5.0). Sixty-one individuals had TKA of the right knee and 49 had TKA of

the left knee. More than 80% of the participants were married and completed at least 12 years of education.

## **Measures**

### ***Perceived injustice***

Perceived injustice was assessed with the Injustice Experiences Questionnaire adapted for use in patients with chronic health conditions (IEQ-*chr*). The item-content of the original IEQ addresses injustice appraisals related to an injury that has been sustained. The item-content of the IEQ-*chr* addresses injustice appraisals related to the experience of a chronic health condition [2]. The IEQ-*chr* contains 12 items that assess respondents' appraisals of their illness in terms of unfairness ("It all seems so unfair"), the severity and irreparability of losses ("My life will never be the same"), and attributions of blame ("I am suffering because of someone else's negligence"). Respondents are asked to rate the frequency with which they experience the thoughts described in the item-content of the IEQ-*chr* on a 5-point Likert-type scale with the endpoints (0) = *never* and (4) = *all the time*. Previous research has supported the reliability and validity of the IEQ-*chr* as a measure of health-related perceived injustice [20].

### ***Pain severity and disability***

Pain severity and disability were assessed with The Western Ontario and McMaster University Osteoarthritis Index (WOMAC) [21]. The WOMAC is a 24-item measure that yields a total score and subscale scores for 1) Pain, 2) Stiffness, and 3) Physical Function. For the purposes of the present study, only the subscale scores for pain and physical function are reported. For each item of the WOMAC, respondents are asked to rate the severity of their OA-related symptoms and limitations on a 5-point Likert scale with the endpoints (0) = *none* to (4) = *extreme*. The scores range from 0 to 20 for pain subscale and 0 to 68 for physical function

subscale. The reliability and validity of the WOMAC have been demonstrated in patients in several studies [21-23].

### ***Depressive symptomatology***

Depressive symptoms were assessed with the Patient Health Questionnaire-9 (PHQ-9) [24]. Respondents were asked to rate the frequency with which they experienced nine symptoms that are considered in the diagnostic criteria for major depressive disorder. For each item of the PHQ-9, respondents made their ratings on a 4-point frequency scale with the endpoints (0) = *not at all* to (3) = *nearly every day*. The PHQ-9 has been shown to be reliable and valid measure of depressive symptom severity in individuals with various health conditions [25-27].

### **Procedure**

Participants in the current study were recruited from 3 hospitals located in Eastern Canada. Criteria for inclusion in the present study included a diagnosis of primary OA of the knee, age between 50 and 85 years and scheduled for TKA at one of the three collaborating sites. Exclusion criteria included; a) diagnosis of rheumatoid arthritis, b) previous arthroplasty of the knee, c) previous patellectomy, d) major bone loss requiring structural bone graft, e) requiring bilateral TKA within 1 year of the index procedure.

Participants were informed that the study was concerned with the physical and psychological determinants of recovery after surgery. Patients interested in study participation provided written informed consent and received \$25 as compensation for completing the questionnaires. The research was approved by the Research Ethics Boards of the McGill University Health Centre, the Hôpital Maisonneuve-Rosemont, and the Capital Health Authority of Nova Scotia. Participants were asked to complete the questionnaires at the time of their pre-

surgical evaluation and at their 1-year postsurgical follow-up. Outcomes of all surgical procedures in the present sample were considered as clinically successful. Findings from cross-sectional and prospective analyses on a portion of these data have been reported in two previous papers [20, 28]

## **Data Analysis**

All data analyses were conducted with SPSS version 20 [29]. Independent sample t tests were used to assess sex differences on all study measures. Paired sample t tests were computed to assess the differences between pre and postsurgical reports of pain severity, disability, depressive symptoms and perceptions of injustice. Raw change scores were computed for pain severity, disability, depressive symptoms, and perceived injustice. Zero order Pearson correlations were used to compute the associations between changes in pain, disability, depressive symptoms and perceived injustice. A hierarchical regression equation was conducted to examine the unique contribution of changes in symptom severity and disability to changes in scores of perceptions of injustice while controlling for demographic variables.

## **Results**

### ***Sample characteristics***

Men and women did not differ significantly on any demographic or study variable except for post TKA depressive symptoms where women reported higher scores ( $M = 4.3$ ;  $SD = 6.1$ ) than men ( $M = 2.2$ ;  $SD = 2.9$ )  $t(108) = 2.5, p < .05$ . There was a significant decrease in pain severity  $t(109) = 19.13, p < .001, d = 1.82$ , disability  $t(109) = 18.80, p < .001, d = 1.79$ , depressive symptoms  $t(109) = 5.69, p = .001, d = 0.54$  and perceived injustice  $t(109) = 4.16, p < .001, d = 0.40$  from the pre to postsurgical evaluation (Table 1).

### ***Correlations among study variables***

Zero-order correlations revealed that, before surgery, perceived injustice was associated with depressive symptoms ( $r = .52, p < .001$ ), pain severity ( $r = .50, p < .001$ ), and disability ( $r = .53, p < .001$ ). Pain intensity was associated with age ( $r = -.26, p < .05$ ) and BMI ( $r = .24, p < .05$ ). (Table 2).

Pearson correlations were computed between raw change scores of pain, disability, depressive symptoms, perceived injustice (Table 2). Zero-order correlations revealed that post-surgical reductions in depressive symptom severity were associated with reductions in perceived injustice ( $r = .24, p < .05$ ). Post-surgical reductions in pain severity were not significantly correlated with reductions in perceived injustice ( $r = .10, p = .29$ ). Post-surgical reductions in disability were associated with reduction in perceived injustice ( $r = .29, p < .05$ ). Post-surgical reductions in disability were also associated with reductions in depressive symptom severity ( $r = .20, p < .05$ ). Reductions in pain severity were also associated with reductions in disability ( $r = .71, p < .001$ ). BMI was associated with reductions in pain ( $r = .26, p < .05$ ) and disability ( $r = .25, p < .05$ ).

### ***Determinants of changes in perceived injustice***

A hierarchical regression was computed to assess the contribution of changes in depressive symptoms, and disability to changes in perception of injustice from pre to post-surgery. Because reduction in pain severity was not correlated with reductions in perceived injustice, changes in pain severity were not included in regression analyses. The overall model was significant,  $F(5, 104) = 3.38, p < .05$  and accounted for 14% of the variance (10% adjusted)(Table 4). Demographic variables were entered in the first step of the analysis but did not make a significant contribution to the prediction of reductions in perceived injustice. Changes in depressive symptom severity were entered in the third step of the analysis and

accounted for 6% of the variance in changes in perceived injustice. Changes in disability were entered in the last step and accounted for additional 7% of the variance in changes in perceived injustice. Examination of the standardized beta weights from the final regression equation indicated that only reduction in depressive symptom severity ( $\beta=0.19, p <.05$ ), and reductions in disability ( $\beta=0.28, p <.05$ ) contributed significant unique variance to the prediction of reductions in perceptions of injustice. A hierarchical regression analysis using residualized change scores was also conducted yielding a comparable pattern of findings.

## **Discussion**

The goal of the present study was to examine whether the reductions in OA-related suffering and loss following TKA would be associated with reductions in perceptions of injustice. The results of the present investigation were consistent with previous research showing significant cross-sectional relations between perceptions of injustice, pain severity, depressive symptom severity, and disability. The findings of the present study extend previous research in showing that reductions in depressive symptom severity and reductions in disability contributed uniquely to reduction in perceptions of injustice.

Numerous research investigations have reported significant associations between perceptions of injustice, symptom severity and disability. Sullivan and colleagues reported that, in a sample of individuals with musculoskeletal injuries, perceived injustice was associated with pain severity, disability and depressive symptoms [2]. Similar findings were reported across several patient samples including whiplash, spinal cord injury, fibromyalgia, rheumatoid arthritis, and osteoarthritis of the knee [1, 20, 30-33].

The relations between suffering, loss and perceptions of injustice have been addressed by several authors. It has been suggested that life events, including illness or injury, that lead to

suffering, deprivation of resources, and losses might give rise to perceived injustice [6, 9, 10, 34]. Contributions of loss and suffering to perceived injustice can be conceptualized within the theories of distributive justice and equity norms [9, 35]. At the core of the principles of distributive justice and equity norms is the assumption that all individuals are ‘entitled’ to the same benefits or resources as others. The losses or suffering associated with debilitating illness or injury can be appraised as a violation of equity norms. To date, there has been limited empirical research on the determinants of injustice in the context of debilitating pain conditions and conceptual models of the antecedents and consequences of health-related perceptions of injustice have yet to be put forward.

Consistent with previous research, the results of the present study revealed that the relation between perceptions of injustice and disability was stronger than the relation between perceived injustice and pain severity [2, 32, 36]. In the present study reductions in disability, but not reductions in pain were associated with reductions in perceived injustice. At present there is no conceptual framework that addresses why disability-related losses would be a stronger determinant of perceived injustice than pain severity. One possibility is that pain in later years might be appraised as normative and as such, might not be appraised, as a violation of justice principles [9]. However, for many individuals, the retirement years are intended for the realization of many life dreams. The loss of the ability to realize the dreams of retirement as a result of limitations associated with OA might be more likely to be appraised as a violation of justice principles. Surgical intervention aimed at reducing or minimizing disability might recover some of these losses restoring breaches in justice violation and reducing perceived injustice.

In the present study, reductions in depressive symptoms were associated with reductions in perceived injustice even when controlling for reductions in disability. These findings indicate

that emotional suffering impacts on perceived injustice through mechanisms that are at least partly independent of the experience of disability-related losses. Several empirical investigations have highlighted strong associations between perceived injustice and depressive symptoms [2, 5, 31]. Clinical psychology literature suggests that part of the phenomenology of depression entails a sense of being unfairly punished [37]. The relation between perceived injustice and depressive symptoms is reflected in the item-content of measures of depressive symptoms (i.e., “I feel I am being punished” (BDI-II, item 6)” [38]. Additionally, punitive and invalidating responses of others to one’s suffering have been discussed as important contributors to psychological distress [39-42], and have been identified as important contributors to perceived injustice in individuals with chronic pain [43]. Future research is needed to explore the processes by which reductions in depressive symptomatology lead to reductions in perceived injustice.

The results of hierarchical regression analyses revealed that reductions in depressive symptoms and disability accounted for approximately 10% of the variance in the prediction of reductions in perceived injustice, leaving 90% of the variance not accounted for. A recent study by Scott and colleagues points to additional factors that might be associated with perceived injustice in individuals with debilitating pain conditions. The investigators interviewed individuals with whiplash injuries about sources of injustice. Participants pointed to the actions of employers, insurers, family members, health care providers, and other individuals from their social circle as sources of injustice. Some reasons for identifying the sources included inadequate assessment and treatment by health professionals, invalidation, and lack of social support [43]. It is possible that similar factors might contribute to perceived injustice in patients with severe OA of the knee.

There are important clinical implications to current findings. The findings suggest that interventions designed to reduce disability might have a greater impact on reducing perceptions of injustice than interventions designed to reduce pain severity. The findings also suggest that interventions designed to reduce depressive symptoms might also be important in reducing perceptions of injustice. Even though depression has been identified as a prognostic indicator for poor recovery outcomes following TKA, there have been few reports addressing the management of depressive symptoms in this population. Future studies need to investigate whether the outcomes of TKA might be enhanced by the provision of interventions designed to target depressive symptoms and perceptions of injustice.

The findings of the present study must be interpreted in light of several limitations. The sample size was modest, and replication is needed to support the present findings. Assumptions were made about how symptom severity and disability can be construed as proxies for suffering and loss. Assumptions were also made about the specific principles of justice that were violated by the experience of symptom severity and disability associated with OA. The tenability of assumptions will have implications for the confidence that can be placed in the conclusions drawn. Additionally, participants in this study received medical services under publicly funded health care system. Publically funded health care systems are known to have longer wait times for knee replacement surgery than privately funded health care systems. Longer wait time may have played a role in a pattern of findings relevant to perceptions of injustice.

Despite the limitations, this was the first study that to demonstrate that emotional suffering and disability-related losses are important determinants of perceived injustice in individuals with OA of the knee. Post- surgical reductions in disability-related losses and emotional suffering, but not pain severity, were associated with reductions in perceived injustice.

The present findings argue for importance of supplementing surgical and rehabilitative treatment with psychosocial interventions designed to target depressive symptoms and perceived injustice. Future research is needed to determine whether supplementing TKA with psychosocial interventions that target depressive symptoms and perceptions of injustice may translate in more positive recovery outcomes after TKA.

1. Scott W, Trost Z, Milioto M, and Sullivan MJL. Further Validation of a Measure of Injury-Related Injustice Perceptions to Identify Risk for Occupational Disability: A Prospective Study of Individuals with Whiplash Injury. *J Occup Rehabil* 2013;23:557-65.
2. Sullivan, Adams H, Horan S, Maher D, Boland D and Gross R. The role of perceived injustice in the experience of chronic pain and disability: scale development and validation. *J Occup Rehabil* 2008;18:249-61.
3. Yakobov E, Scott W, Stanish W, Dunbar M, Richardson G and Sullivan MJL. The role of perceived injustice in the prediction of pain and function after total knee arthroplasty. *Pain* 2014;155:2040-2046.
4. Sullivan MJL, Thibault P, Simmonds MJ, Milioto M, Cantin AP and Velly AM. Pain, perceived injustice and the persistence of post-traumatic stress symptoms during the course of rehabilitation for whiplash injuries. *Pain* 2009;145:325-31.
5. Scott W, Trost Z, Milioto M and Sullivan MJ. Barriers to change in depressive symptoms after multidisciplinary rehabilitation for whiplash: the role of perceived injustice. *Clin J Pain* 2015;31:145-51.
6. Darley JM and Pittman TS. The psychology of compensatory and retributive justice. *Pers Soc Psychol Rev* 2003;7:324-36.
7. Lind EA and Tyler TR. *The Social Psychology of Procedural Justice*. New York.: Plenum., 1988.
8. Montada L. Injustice in harm and loss. *Soc Just Res* 1994;7:5-28.
9. Montada L Coping with Life Stress Injustice and the Question "Who Is Responsible?". In: Steensma H and Vermunt R eds. *Social Justice in Human Relations: Societal and Psychological Consequences of Justice and Injustice*. Boston, MA: Springer US, 1991:9-30.
10. McParland and Eccleston C. "It's Not Fair" Social Justice Appraisals in the Context of Chronic Pain. *Curr Dir Psychol Sci* 2013;22:484-489.
11. Berglund A, Bodin L, Jensen I, Wiklund A and Alfredsson L. The influence of prognostic factors on neck pain intensity, disability, anxiety and depression over a 2-year period in subjects with acute whiplash injury. *Pain* 2006;125:244-56.
12. Nederhand MJ, Hermens HJ, Ijzerman MJ, Turk DC and Zilvold G. Chronic pain disability due to an acute whiplash injury. *Pain* 2003;102:63 - 71.
13. Lyons R and Sullivan MJL Curbing loss in illness and disability. In: Harvey J ed. *Perspectives on Personal and Interpersonal Loss*. New York: Taylor & Francis, 1998:579-605.
14. Walker J, Sofaer B and Holloway I. The experience of chronic back pain: Accounts of loss in those seeking help from pain clinics. *Eur J Pain* 2006;10:199-207.
15. Salaffi F, Carotti M and Grassi W. Health-related quality of life in patients with hip or knee osteoarthritis: comparison of generic and disease-specific instruments. *Clin Rheumatol* 2005;24:29-37.
16. Felson DT. An update on the pathogenesis and epidemiology of osteoarthritis. *Radiol Clin North Am* 2004;42:1-9, v.

17. Martel-Pelletier J, Boileau C, Pelletier JP and Roughley PJ. Cartilage in normal and osteoarthritis conditions. *Best Pract Res Clin Rheumatol* 2008;22:351-84.
18. Farr li J, Miller LE and Block JE. Quality of Life in Patients with Knee Osteoarthritis: A Commentary on Nonsurgical and Surgical Treatments. *Open Orthop J* 2013;7:619-623.
19. Robertsson O, Dunbar M, Pehrsson T, Knutson K and Lidgren L. Patient satisfaction after knee arthroplasty: a report on 27,372 knees operated on between 1981 and 1995 in Sweden. *Acta Orthop Scand* 2000;71:262-7.
20. Yakobov E, Scott W, Stanish W, Tanzer M, Dunbar M, Richardson G and Sullivan M. Validation of Injustice Experiences Questionnaire adapted for Use with Patients with Severe Osteoarthritis of the Knee. *J Arthritis* 2014;3:130-136.
21. Bellamy N, Buchanan W, Goldsmith G, Campbell J and Stitt L. Validation study of WOMAC: a health status instrument for measuring clinically important patient relevant outcomes to antirheumatic drug therapy in patients with osteoarthritis of hip or knee. *J Rheumatol* 1988;15:1833 - 1840.
22. Bellamy N. Pain assessment in osteoarthritis: experience with the WOMAC osteoarthritis index. *Semin Arthritis Rheu* 1989;18:14-7.
23. Bellamy N, Kean WF, Buchanan WW, Gercz-Simon E and Campbell J. Double blind randomized controlled trial of sodium meclofenamate (Meclomen) and diclofenac sodium (Voltaren): post validation reapplication of the WOMAC Osteoarthritis Index. *J Rheumatol* 1992;19:153-9.
24. Spitzer RL, Williams JBW, Kroenke K and al. e. *Patient Health Questionnaire - 9. Prime MD Today*. New York: Pfizer Inc., 1999.
25. Gilbody S, Richards D, Brealey S and Hewitt C. Screening for depression in medical settings with the Patient Health Questionnaire (PHQ): a diagnostic meta-analysis. *J Gen Intern Med* 2007;22:1596-602.
26. Huang FY, Chung H, Kroenke K, Delucchi KL and Spitzer RL. Using the Patient Health Questionnaire-9 to measure depression among racially and ethnically diverse primary care patients. *J Gen Intern Med* 2006;21:547-52.
27. Li C, Friedman B, Conwell Y and Fiscella K. Validity of the Patient Health Questionnaire 2 (PHQ-2) in identifying major depression in older people. *J Am Geriatr Soc* 2007;55:596-602.
28. Yakobov E, Scott W, Stanish W, Dunbar M, Adams H and Sullivan MJL The role of perceived injustice in the prediction of pain and function following total knee arthroplasty. *Pain* 2014;155:2040-2046..
29. Statistical Package for the Social Sciences (SPSS, Version 20 for Windows). Rel. 09.14. 2011. Armonk, NY: IBM.
30. Ferrari R and Russell AS. Perceived injustice in fibromyalgia and rheumatoid arthritis. *Clin Rheumatol* 2014;33:1501-7.
31. Rodero B, Luciano JV, Montero-Marin J, Casanueva B, Palacin JC, Gili M, Lopez Del Hoyo Y, Serrano-Blanco A and Garcia-Campayo J. Perceived injustice in fibromyalgia: Psychometric characteristics of the Injustice Experience Questionnaire and relationship with pain catastrophising and pain acceptance. *J Psychosom Res* 2012;73:86-91.
32. Sullivan MJL, Davidson N, Garfinkel B, Siriapaipant N and Scott W. Perceived injustice is associated with heightened pain behavior and disability in individuals with whiplash injuries. *Psychol Inj Law* 2009;2:238 - 247.

33. Trost Z, Agtarap S, Scott W, Driver S, Guck A, Roden-Foreman K, Reynolds M, Foreman ML and Warren AM. Perceived injustice after traumatic injury: Associations with pain, psychological distress, and quality of life outcomes 12 months after injury. *Rehabil Psychol* 2015;60:213-21.
34. McParland, Eccleston C, Osborn M and Hezseltine L. It's not fair: an Interpretative Phenomenological Analysis of discourses of justice and fairness in chronic pain. *Health* 2011;15:459-74.
35. Adams JS Inequity in social exchange. In: Berkowitz L ed. *Advances in Experimental social psychology*. New York: Academic Press, 1965.
36. Yakobov E, Scott W, Thibault P and Sullivan MJ. Treatment-Related Reductions in Disability Are Associated with Reductions in Perceived Injustice Following Treatment of Whiplash Injury. *Psychol Inj Law* 2016;9:41-47.
37. Freud S, Strachey J, Freud A, Strachey A and Tyson A Mourning and Melancholia. *The standard edition of the complete psychological works of Sigmund Freud On the history of the psycho-analytic movement, Papers on metapsychology and Other works*. London: The Hogarth Press, 1917:237-258.
38. Beck AT, Steer RA and Brown GK. *Manual for the Beck Depression Inventory - II*. San Antonio TX: Psychological Corporation, 1996.
39. Dickerson SS, Gruenewald TL and Kemeny ME. When the social self is threatened: shame, physiology, and health. *J Pers* 2004;72:1191-216.
40. Ghavidel-Parsa B, Amir Maafi A, Aarabi Y, Haghdoost A, Khojamli M, Montazeri A, Sanaei O and Bidari A. Correlation of invalidation with symptom severity and health status in fibromyalgia. *Rheumatol* 2015;54:482-6.
41. Gilbert P. The relationship of shame, social anxiety and depression: the role of the evaluation of social rank. *Clin Psychol Psychother* 2000;7:174-189.
42. Sullivan, Yakobov E, Scott W and Tait R. Perceived Injustice and Adverse Recovery Outcomes. *Psychol Inj Law* 2014;7:325-334.
43. Scott W, McEvoy A, Garland R, Bernier E, Milioto M, Trost Z and Sullivan M. Sources of injustice among individuals with persistent pain following musculoskeletal injury. *Psychol Inj Law* 2016;9:6-15.



Table 1: Means and Standard Deviations of Pre and Post treatment variables

Variables	Pre-treatment	Post-treatment	<i>P</i>	Cohen's d
Pain intensity	10.6 (3.3)	3.4 (3.4)	.000	1.82
Disability	37.8 (11.8)	14.4 (11.5)	.000	1.79
Depressive symptoms	6.8 (7.0)	3.5 (5.2)	.000	0.54
IEQ-chr	8.9 (8.4)	6.3 (8.4)	.000	0.40

Note: *N*= 110. IEQ-chr = Injustice Experiences Questionnaire

Table 2. Correlations among variables before surgery

	1	2	3	4	5	6
1. Age						
2. BMI	-.38*					
3. Sex	-.06	-.03				
4. IEQ-chr	-.08	-.02	-.05			
5. Depressive symptoms	-.09	-.04	-.01	.52**		
6. Pain intensity	-.26*	.24*	-.07	.50**	.31*	
7. Disability	-.18	.17	.01	.53**	.39**	.71**

Note:  $N = 110$ ; IEQ-chr =Injustice Experiences Questionnaire

\* $p < .05$ , \*\* $p < .001$

Table 3. Correlations among change scores pre and post treatment

	1	2	3	4	5	6
1. Age						
2. BMI	-.33*					
3. Sex	-.04	-.04				
4. Δ IEQ-chr	-.13	-.01	-.03			
5. Δ Depressive symptoms	-.15	-.02	.15	.24*		
6. Δ Pain intensity	-.14	.26*	-.02	.10	.07	
7. Δ Disability	-.15	.25*	.08	.29*	.20*	.70**

*Note:*  $N = 110$ ; Δ IEQ-chr = Changes in Injustice Experiences Questionnaire; Δ Depressive symptoms = Changes in Depressive Symptoms; Δ Pain intensity = Changes in Pain intensity; Δ Disability = Changes in disability.

\* $p < .05$ , \*\* $p < .001$

Table 4. Regression analyses predicting post-treatment changes in perceived injustice

	Beta	R <sup>2</sup> change	F change
Dependent = Change in scores of IEQ			
Step 1			
Age	-.08		
BMI	-.09		
Sex	-.09	.02	.68 (3, 106)
Step 3			
Δ Depressive symptoms	.19*	.06	6.18 (1, 105)*
Step 4			
Δ Disability	.27*	.07	8.00 (1,104)*

*Note:*  $N = 110$ ; BMI = Body Mass Index; Δ Depressive symptoms = Changes in Depressive Symptoms; Δ Pain intensity = Changes in Pain intensity; Δ Disability = Changes in disability. Standardized Betas are reported for the final step.

\* $p < .05$