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Original Article

Pain Catastrophizing, Pain Self-Efficacy, and Kinesiophobia Effects on Outcomes After Upper Extremity Fracture

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ABSTRACT

Objective: The aim of our study was to investigate the effects of pain-related psychosocial factors such as pain catastrophizing, pain self-efficacy, and kinesiophobia on pain, disability, and quality of life after upper extremity fracture.

Methods: This single-center cross-sectional study included 90 individuals with upper extremity fracture between March and August 2021, with a mean age of 45.00 ± 12.63 years. Data were collected with the Demographic Information Form, Quick Disabilities of the Arm, Shoulder, and Hand Questionnaire (QuickDASH), Tampa Kinesiophobia Scale (TKS), Short Form McGill Pain Questionnaire (SF-MPQ), Short Form-12 (SF-12) Quality of Life Questionnaire, Pain Self-Efficacy Questionnaire (PESQ), and Pain Catastrophizing Scale (PCS). Multivariate regression analysis was used to examine the effects of psychosocial factors on outcomes.

Results: Pain catastrophizing, of pain and quality of life; pain self-efficacy, of disability and quality of life; and kinesiophobia, of all outcomes were found to be significant predictors ($P < .001$). Higher pain catastrophizing scores predicted increased pain and decreased quality of life (SF-MPQ, $R^2 = 0.446$; SF-12, $R^2 = -0.616$) higher pain self-efficacy scores predicted increased disability and quality of life (QuickDASH, $R^2 = -0.662$ SF-12, $R^2 = 0.376$), and higher kinesiophobia scores predicted increased pain, extent of disability, and quality of life (SF-MPQ, $R^2 = 0.276$; QuickDASH, $R^2 = -0.391$; SF-12, $R^2 = -0.229$).

Conclusion: The findings of the study support an approach with a biopsychosocial perspective that explains the possible contributions of ineffective coping strategies such as kinesiophobia and pain catastrophizing on pain intensity and extent of disability after upper extremity fractures.

Keywords: Disability, musculoskeletal pain, pain catastrophizing, psychosocial factors

Introduction

Orthopedic traumas in the upper extremities are associated with higher levels of disability and reduced health-related quality of life (QoL) compared to other body parts.[1] There is difficulty in meeting self-efficacy needs such as nutrition, cleaning, and dressing, which are important disabilities that affect QoL, especially when trauma affects the dominant extremity.[2,3]

Studies about musculoskeletal injuries, including fractures, showed that there is no relationship between pain intensity and injury severity, and this difference was explained by the measurement results for psychosocial aspects of the disease rather than pathophysiology.[4] Common psychological effects are seen after extremity fractures, including catastrophic thoughts, changes in appetite, disturbed sleep patterns, re-injury, limitation of participation in physical activities due to kinesiophobia and falling, awareness of esthetic appearance of the affected limb, acute and chronic post-traumatic stress disorder, depression, and anxiety.[3,5] These factors are significantly related to pain intensity and disability, and catastrophic thinking especially is a response to pain that may be a risk factor for long-term disability and pain.[6] Recent evidence supports the adoption of a biopsychosocial model rather than a biomedical model for many health conditions.[7]

Studies involving the evaluation of depression, anxiety, and coping strategies in individuals with specific injuries such as fracture history and investigating their effects on functional status are limited.[1] There is evidence that early addressing of psychosocial factors can reduce disability,

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improve the outcomes of surgical intervention and medical procedures, and reduce healthcare costs and resource use.[6] Psychological interventions were beneficial in reducing pain and psychological distress, especially in chronic pain conditions.[8-10], but the evidence for acute post-injury is limited.[11] It was reported that acute pain turns into chronic pain in up to 86% of extremity trauma patients, and anxiety and depression are important determinants of post-traumatic chronic pain. Addressing psychosocial factors as well as medical factors in the early period of the pain experience may prevent the transition to chronic pain syndromes.[6,12] The aim of our study was to investigate the effects of pain-related psychosocial factors such as pain catastrophizing, pain self-efficacy, and kinesiophobia on pain, disability, and QoL after upper extremity fracture. We hypothesized that the pain-related psychosocial factors, of pain catastrophizing, pain self-efficacy, and kinesiophobia, are predictive of pain, disability, and QoL outcomes in the acute phase after upper extremity fractures.

Methods

Study Design and Participants

In this cross-sectional, single-site, observational study, the effect of pain-related psychosocial factors on pain intensity, disability level, and QoL was investigated in individuals with upper extremity fractures. The study was approved by Istanbul Medipol University Institute of Health Sciences Non-Interventional Clinical Studies Ethics Committee with number E-10840098-772.02-9044 dated 2021/03-02.

Based on the correlation analysis performed using the Pain Catastrophizing Scale (PCS) and pain at rest scores' results from the reference study,[6] $d = 0.67$ effect size was calculated by using the G-Power program, and 100% power value was reached for $n = 90$ samples with an error margin of 0.05. To create the sample for the study, 95 volunteers over the age of 18 who were diagnosed with fractures by an orthopedist between March 2021 and August 2021 and were included in the physiotherapy program at Medipol Mega University Hospital were assessed. Due to deficiencies in the process of filling out the questionnaires, 5 participants were excluded from the study and the study was completed with 90 participants. Before participating in the study, individuals were informed about the content and procedure of the study and signed informed consent forms.

Inclusion criteria were being over 18 years of age, patients with single upper extremity fracture, and injury resulting in fracture in the last 1-4 weeks. Exclusion criteria were patients with any cognitive incapacity that prevents understanding and completing the informed consent and questionnaires, multiple or open upper extremity fractures, refracture during recovery from a previous injury, and a psychiatric disease diagnosis resulting in psychosis.

Data Collection Tools

All assessment tools were administered during face-to-face interviews.

Demographic Information Form: Age, gender, marital status, employment status, drug use status, fracture location, and surgical procedure were questioned, and demographic information was recorded.

Short Form McGill Pain Questionnaire: Participants' pain was evaluated with the Short Form McGill Pain Questionnaire (SF-MPQ). It includes 2 subscales, sensory pain (11 items) and affective pain (4 items), and a total of 15 items that examine different aspects of pain. Each item is evaluated by scoring between 0 and 3 (0: none, 3: severe) on a 4-point Likert-type scale, and the sum of the item scores gives the pain score. The total pain score ranges from 0 to 45 (0: no pain, 45: severe pain). The Turkish validity and reliability study for the SF-MAQ was conducted, and it is widely used in studies about chronic pain and is reported to have strong psychometric properties.[13]

Quick Disabilities of the Arm, Shoulder, and Hand Questionnaire: Participants' disability levels were assessed with Quick Disabilities of the Arm, Shoulder, and Hand (QuickDASH) questionnaire, an abbreviated version of the DASH questionnaire. QuickDASH is an assessment scale that measures activity and participation limitations in all upper extremity disorders. With 11 questions on the scale, the difficulties experienced by patients during activities of daily living are questioned. This scale, which had Turkish validity and reliability confirmed, is rated with a Likert scale, and each answer is scored from 1 to 5 from good to bad.[14]

Short Form 12 Quality of Life Questionnaire: The QoL of participants was assessed with Short Form-12 (SF-12), which was created by taking 12 different items from 8 sub-headings of the SF-36. Compared to SF-36, the use of SF-12 was reported to be more advantageous due to its ease of application and shorter completion time. SF-12 has 2 subscales: physical components and mental components. The subscales of this scale, which had Turkish validity and reliability studied, assesses health between 0 and 100, with 0 indicating poor health and 100 indicating good health.[15]

Pain Self-Efficacy Questionnaire: Individual pain self-efficacy was assessed with a 10-item self-assessment questionnaire designed to measure the degree of confidence in performing a range of activities despite ongoing pain. Among the scales assessing pain self-efficacy, PSEQ was proven to be highly valid and reliable, is practical because of its shortness, and measures multiple domains of self-efficacy related to social and physical functions. Each item is evaluated on a 7-point Likert-type scale (0: I do not trust myself at all, 6: I am completely confident in myself). The total score on this scale, which had Turkish validity and reliability confirmed, ranges from 0 to 60, and high scores indicate greater self-efficacy for functionality despite pain.[16]

Pain Catastrophizing Scale: The Pain Catastrophizing Scale (PCS) was used to assess the feelings and thoughts of individuals when they feel pain. PCS is divided into 3 subscales: magnification, rumination, and helplessness. It is a 5-point scale; 0: never, 4: always. This scale, which had Turkish validity and reliability studied, was developed as a self-report tool that provides a valid measure of catastrophizing index in clinical and non-clinical populations. Higher scores indicate higher levels of pain catastrophizing; scores over 30 are considered clinically positive.[17]

Tampa Kinesiophobia Scale: The fear of movement of individuals participating in the study was assessed with Tampa Kinesiophobia Scale (TKS). It is used in a wide variety of diseases associated with acute and chronic low back pain, fibromyalgia and musculoskeletal injuries, and whiplash. This 17-item scale, developed to measure kinesiophobia and re-injury, includes the parameters of injury/re-injury and fear/avoidance in work-related activities. A 4-point Likert scoring (1 = I strongly disagree, 4 = I totally agree) is used for the scale. After reversing items 4, 8, 12, and 16, the total score is calculated. Individuals receive a total score between 17 and 68. It is recommended to use the total score in studies. A high score in the TKS, which had Turkish validity and reliability studies completed, indicates that kinesiophobia is also high.[18]

Statistical Analysis

The R-Project (R Core Team, 2021) program was used to calculate the descriptive statistics (frequency, mean, and standard deviations) for the data. The statistical significance value was accepted as $P < .05$, and the normal distribution of the data was analyzed using the Shapiro–Wilk

test. Multivariate regression analysis was applied to examine the effects of psychosocial factors on outcomes. Since 3 different dependent variables related to physical functionality were handled, a multivariate modeling approach was chosen instead of modeling separately, thus avoiding the negative effects of type-1 errors. In the regression analysis, beta coefficients (B), standard errors of the coefficients (SE(B)), test statistics, and significance values (*P*) are given together. These analyses were completed with the codes written in the McGLM package of the R-Project (R Core Team, 2021) software.[19]

Results

Totally 90 individuals aged between 18 and 70 years, with a mean age of 45.00 ± 12.63 (23-70) years and a history of upper extremity fracture, were included in the study. The age, gender, marital status, employment status, drug use status, fracture location, and surgical intervention information for the participants are given in Table 1 and the distribution of participant questionnaire scores is given in Table 2.

According to the results of multivariate regression analysis, TSK and PCS factors were found to be significant predictors of the SF-MPQ factor ($P < .001$), TSK and PSEQ factors were found to be significant predictors of the QuickDASH factor ($P < .001$), and TSK, PSEQ, and PCS factors were found to be significant predictors of the SF-12 factor ($P < .001$) (Table 3).

Discussion

In our study, in which we investigated the effects of pain-related psychosocial factors on the level of pain, disability, and QoL in individuals with a history of upper extremity fractures, the psychosocial status of individuals was determined using pain catastrophizing, pain self-efficacy, and kinesiophobia levels. According to our findings, it was predicted that the increase in pain catastrophizing may lead to an increase in pain and it negatively affects the QoL; the increase in pain self-efficacy may lead to an improvement in disability and QoL; and the increase in kinesiophobia may adversely affect all outcomes.

It was reported that holistic factors, including psychological, social, and biological factors, are associated with pain in patients with upper extremity injuries, and the interaction of pain and depression increases the level of disability.[1,20] It is possible to reduce the level of disability with approaches aiming to teach coping skills to improve mood and pain perceptions of individuals after upper extremity trauma.[21,22] Positive psychosocial factors such as coping with the effects of the disease, accepting the disease, appreciating incoming support, and trusting physical skills after the illness produce good health outcomes.[23] Pain interventions to increase the ability to successfully use coping mechanisms and help patients stay active and achieve their goal despite pain is the predominant determinant of pain intensity and extent of disability in patients with upper extremity disorders and seem to be an integral part of improving the musculoskeletal system.[24,25]

Psychological interventions aim to increase the individual's confidence in their ability to perform a certain behavior by acting on self-efficacy (e.g., engaging in rehabilitation, exercising, using their arms, etc.).[11] Increases in self-efficacy are associated with improved pain, disability, and functional outcomes in terms of the musculoskeletal system.[26] There is potential for interventions targeting psychological factors such as self-efficacy to support routine orthopedic care and improve outcomes. The findings of our study predict that an increase in the level of pain self-efficacy may lead to an improvement in disability and QoL and that an increase in the level of kinesiophobia may result in an increase in the level of disability. Supporting the literature, our

Table 1. Patient Demographics (n = 90)

Variables		
Age (mean ± SD, year)	45.00 ± 12.63	
	n	**%**
Gender		
Female	44	48.9
Male	46	51.1
Marital status		
Single	15	16.6
Married	63	70
Divorced/separated/widowed	12	13.3
Work status		
Employed full time	44	48.8
Unemployed	21	23.3
Homemaker	11	12.2
Student	4	4.4
Retired	10	11.1
Location of the fracture, n (%)		
Distal radius	18	20
Elbow	33	36.6
Humerus	39	43.3
Surgery, n (%)	27	30
Dominant side injured, n (%)	53	58.8
Opioid medications by self-report, n (%)	57	63.3

SD, standard deviation.

Table 2. Distribution of Patients' Questionnaire Scores

Questionnaires	**n**	**Median**	**Min-Max**	**Q1-Q3**
SF-MPQ	90	22	8-45	15-35
QuickDASH	90	65	30-100	50-72,5
SF-12	90	50	30-90	40-70
PSEQ	90	38	30-90	30-50
PCS	90	28	0-52	17-39
TKS	90	34	17-62	20-40

Min, minimum; Max, maximum; QuickDASH, Quick Disabilities of the Arm, Shoulder, and Hand; TKS, Tampa Kinesiophobia Scale; SF-MPQ, Short Form McGill Pain Questionnaire; SF-12, Short Form 12; PSEQ, Pain Self-Efficacy Scale; PCS, Pain Catastrophizing Scale.

Table 3. Factors from Multivariate Linear Regression Models Predicting SF-MPQ, QuickDASH, and SF-12 Scores at 1-4 Weeks Following Upper Extremity Fractures (n = 90)

		Unstandardized Coefficients			
Variables	**Predictors**	**B**	**Standard Error (B)**	***t***	***P***
SF-MPQ	Constant	−5.485	4.117	−1.332	.186
	TKS	0.276	0.063	4.397	<.001*
	PSEQ	0.025	0.063	0.398	.692
	PCS	0.446	0.074	6.056	<.001*
QuickDASH	Constant	52.146	7.191	7.252	<.001*
	TKS	−0.391	0.109	−3.571	<.001*
	PSEQ	0.662	0.109	6.056	<.001*
	PCS	−0.118	0.128	−0.919	.361
SF-12	Constant	77.334	6.470	11.953	<.001**
	TKS	−0.229	0.099	−2.329	.022*
	PSEQ	0.376	0.098	3.826	<.001*
	PCS	−0.616	0.116	−5.325	<.001*

QuickDASH, Quick Disabilities of the Arm, Shoulder, and Hand; TKS, Tampa Kinesiophobia Scale; SF-MPQ, Short Form McGill Pain Questionnaire; SF-12, Short Form 12; PSEQ, Pain Self-Efficacy Scale; PCS, Pain Catastrophizing Scale.
*$P < .05$.

results showed that psychosocial approaches to improve self-efficacy and reduce fear of movement can improve pain, disability, and QoL in patients with a history of fracture.

It was reported that psychological comorbidities such as depression and pain catastrophizing in orthopedic patients negatively affect patients' perceptions of pain and function[27] and are associated with increased pain levels and decreased function.[28] In patients with carpal tunnel syndrome and other atraumatic hand problems, high levels of depression and pain catastrophizing were shown to increase the intensity of pain at the beginning of treatment.[29] Aitken et al[30] reported that restoring psychological balance after injury is an important goal for patients because it affects their ability to return to work, gain independence, and fulfill their family duties. In the results of our study, it is predicted that the increase in the pain catastrophizing levels of the participants may lead to an increase in pain intensity and a decrease in QoL. These results may be related to the negative psychological state caused by post-traumatic depression that leads to anxious thoughts about situations such as inability to be self-sufficient and not being able to continue with daily life, and this negatively affects the healing process.

Fear of falling after upper extremity fractures causes depression and anxiety, limits participation in physical activities, and increases the level of disability.[3,31,32] Kinesiophobia also negatively affects the ability of individuals to cope with post-fracture symptoms, thoughts about pain, and the level of post-traumatic stress.[33,34] As most proximal humerus and wrist fractures are associated with falling, balance and gait disturbances are expected to accompany anxiety and kinesiophobia in the majority of those with upper extremity fractures.[33,34] The results of our study predict that an increase in kinesiophobia may lead to worsening pain, disability, and QoL. These findings, in addition to fear and avoidance behavior, may be associated with an increase in the person's negative thoughts about pain and depressive symptoms and a more challenging functional recovery process.

Psychological interventions produced mixed results in the literature.[4] Intervention studies performed only in patients with high depression and pain anxiety achieved more successful results for recovery[21,22], while studies that did not determine inclusion criteria based on psychological scores did not result in improvement.[11] These results suggest that psychological intervention may be more effective when it targets patients with relatively low self-efficacy or high levels of stress or distress. To facilitate functional gains, to combat psychosocial barriers to recovery, and to identify ways to benefit from early recovery in the recovery process, evidence is insufficient, and more studies are needed.

There is a lack of a single psychological scoring system that can be used to screen patients who respond negatively to injury and that can be reproducibly associated with functional measurement results.[11] Similarly, in our study, we used different scales, determined as a result of literature research, while evaluating the level of psychosocial effects related to pain, due to the lack of a single clear scoring system. Future research should explore how best to identify and intervene for these patients by identifying the subset of patients with adverse psychological response to injury who may benefit from psychological intervention.[35]

Study Limitations

One of the limitations of our study is that we did not correlate the fracture location with the psychosocial impact levels. Psychological response to injury may differ between patient groups with different fracture locations and injury severity; therefore, the benefit of a psychological intervention may also differ in these patient groups. Another limitation of our study is that the anxiety and depression levels of the patients were not assessed. It is thought that inclusion of assessments for post-fracture anxiety and depression states in future studies will contribute to the literature.

This study supports an approach with a biopsychosocial perspective that explains the possible contributions of ineffective coping strategies such as kinesiophobia and pain catastrophizing to pain intensity and extent of disability after upper extremity fractures. Patients with greater-than-expected pain or disability after upper extremity fractures may benefit from psychosocial approaches to improve coping strategies and psychological health during recovery.

Ethics Committee Approval: The study was approved by Istanbul Medipol University Institute of Health Sciences Non-Interventional Clinical Studies Ethics Committee (Date: March 2, 2021, number E-108 40098 -772. 02-90 44). 2021/03-02.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

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Author Contributions: Concept – D.Ş., P.K.C.; Design – D.Ş., P.K.C.; Supervision – P.K.C.; Materials – D.Ş.; Data Collection and/or Processing – D.Ş., P.K.C.; Analysis and/or Interpretation – D.Ş., P.K.C.; Literature Review – D.Ş., P.K.C.; Writing – D.Ş., P.K.C.; Critical Review – P.K.C.

Declaration of Interests: The authors declare that they have no competing interest.

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