Contribution of Kinesophobia and Catastrophic Thinking to Upper-Extremity-Specific Disability

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Background: Upper-extremity-specific disability correlates with mood and coping strategies. The aim of this study was to determine if two psychological factors, kinesiophobia (fear of movement) and perceived partner support, contribute significantly to variation in upper-extremity-specific disability in a model that included factors known to contribute to variation such as depression, pain anxiety, and catastrophic thinking.

Methods: We performed an observational cross-sectional study of 319 patients who each had one of the following conditions: trigger finger (n = 94), carpal tunnel syndrome (n = 29), trapeziometacarpal arthrosis (n = 33), Dupuytren contracture (n = 31), de Quervain syndrome (n = 28), wrist ganglion cyst (n = 32), lateral epicondylosis (n = 41), and a fracture of the distal part of the radius treated nonoperatively six weeks previously (n = 31). Each patient completed the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire and questionnaires measuring symptoms of depression, pain anxiety, catastrophic thinking, kinesiophobia, and perceived level of support from a partner or significant other. Stepwise multiple linear regression was used to determine significant independent predictors of the DASH score.

Results: Men had significantly lower (better) DASH scores than women (21 versus 31; $p < 0.01$). DASH scores also differed significantly by diagnosis ($p < 0.01$), marital status ($p = 0.047$), and employment status ($p < 0.01$). The DASH score correlated significantly with depressive symptoms ($p < 0.01$), catastrophic thinking ($p < 0.01$), kinesiophobia ($p < 0.01$), and pain anxiety ($p < 0.01$) but not with perceived partner support. The best multivariable model of factors associated with greater arm-specific disability (according to the DASH score) included sex, diagnosis, employment status, catastrophic thinking, and kinesiophobia and accounted for 55% of the variation.

Conclusions: In this sample, kinesiophobia and catastrophic thinking were the most important predictors of upper-extremity-specific disability in a model that accounted for symptoms of depression, anxiety, and pathophysiology (diagnosis) and explained more than half of the variation in disability. Perceived partner support was not a significant factor. The consistent and predominant role of several modifiable psychological factors in disability suggests that patients may benefit from a multidisciplinary approach that optimizes mindset and coping strategies.

Psychological factors explain a large part of the variability in disability associated with similar levels of impairment[1,2]. Catastrophic thinking, symptoms of depression, pain anxiety, and heightened illness concern are important modifiable predictors of disability and pain intensity for a variety of hand and arm pain conditions, ranging from nonspecific pain to fractures[3,4]. These variables have not explained all of the variance in hand and arm disability, suggesting the need for additional research.

Research on chronic back pain suggests that two additional psychological factors, kinesiophobia (the irrational and excessive fear of movement or injury)[5-7] and patients' perception of their partner's responses (solicitous, negative, or distracting), are associated with greater disability[8]. Additionally, research suggests that there may be considerable interrelation among measures of psychological dysfunction, such as kinesiophobia and catastrophic thinking[5,6,9,10]. It is not clear that kinesiophobia is a risk factor for greater disability independent of catastrophic thinking, symptoms of depression, and other factors.

The primary aim of this study was to determine whether kinesiophobia and partner support are retained as part of the

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TABLE I Correlations Between DASH Scores and Self-Reported Measures of Mood and Coping Styles*

Measure	R	P
Depression	0.39	<0.01
Catastrophic thinking	0.57	<0.01
Kinesiophobia	0.47	<0.01
Pain anxiety	0.30	<0.01
Partner response: punishing	0.12	0.05
Partner response: solicitous	0.07	0.30
Partner response: distraction	0.11	0.07

*R = Pearson correlation coefficient. P = p value.

best explanatory model of upper-extremity disability when symptoms of depression, anxiety, and catastrophic thinking as well as pathophysiology (diagnosis) are accounted for.

Materials and Methods

Study Design and Patients

A prospective, observational, cross-sectional study design was employed. New patients seeking treatment from a hand and upper-extremity specialist for one of several common conditions (trigger finger, carpal tunnel syndrome, trapeziometacarpal arthrosis, Dupuytren contracture, de Quervain syndrome, wrist ganglion cyst, lateral epicondylosis, or a distal radial fracture treated nonoperatively six weeks previously) were invited to enroll. These conditions were selected because they are common enough to study the influence of diagnosis with sufficient power. Patients who had more than one of these conditions in the same upper extremity, in whom the diagnosis was questionable, or who did not speak and/or read English were excluded from the study. There were no medical or psychiatric exclusion criteria. In addition, subjects who answered fewer than twenty-seven questions on the Disabilities of the Arm, Shoulder and Hand (DASH) questionnaire were excluded. Our institutional review board approved the study protocol, and informed consent was obtained from each patient.

Patients

Between November 2006 and July 2011, we enrolled 319 eligible patients, including ninety-four with trigger finger, forty-one with lateral epicondylosis, thirty-three with trapeziometacarpal arthrosis, thirty-two with wrist ganglion cyst, thirty-one with Dupuytren contracture, twenty-nine with carpal tunnel syndrome, thirty-one with a recent distal radial fracture, and twenty-eight with de Quervain syndrome. The long time period reflects the time it took to enroll a sufficient number of patients with the least common condition (de Quervain syndrome) as well as competition for subjects with other ongoing studies. The demographic characteristics of the entire sample are shown in the Appendix. The mean age was fifty-six years (standard deviation [SD], 15) and there were 137 males (43%) and 182 females (57%). Of the 319 patients, 284 (89%) were white and the rest were Hispanic, black, and Asian, with a fairly equal distribution of these racial groups.

Measures

The DASH questionnaire was used to measure upper-extremity-specific disability. This is a self-administered thirty-item questionnaire that was jointly developed by the American Academy of Orthopaedic Surgeons (AAOS), Council of Musculoskeletal Specialty Societies, and the Institute for Work & Health[11]. Scores range from 0 to 100, with a lower score indicating better function. The average DASH score in the North American population has been estimated to be 10 (SD, 15)[12].

Depressive symptoms were measured with use of the Center for Epidemiologic Studies Depression (CES-D) scale[13]. This is a validated measure of depressive symptoms. The scores range from 0 to 60, with an average score of 9.1 (SD, 8.6) for the general population[14]. Lower scores are better.

The Pain Catastrophizing Scale (PCS) is a thirteen-item validated measure that was developed to determine the extent to which patients respond to pain with catastrophic thinking[15]. In the original instrument, the response scale for each item ranged from 0 to 4; however, in our questionnaire, we inadvertently used a scale from 1 to 4. Lower scores are better.

Kinesiophobia—pain-related fear of movement—was assessed with use of the Tampa Scale for Kinesiophobia (TSK), a validated scale that has been used to assess quality of life and disability in other musculoskeletal conditions[5,16]. We utilized the seventeen-item questionnaire, in which TSK scores range from 17 to 68. Lower scores are better.

Pain-related anxiety was assessed with use of the short version of the Pain Anxiety Symptoms Scale (PASS-20)[17], which is a validated, shorter version of the original Pain Anxiety Symptoms Scale (PASS) that was proposed by McCracken et al. in 1992[18]. The PASS-20 is a twenty-item scale that has four subscales: pain-escaping behavior, fear of pain, cognitive anxiety, and physiological symptoms when in pain. The total PASS-20 score ranges from 0 to 100 and is used to evaluate generalized pain anxiety, while the score for each five-item subscale ranges from 0 to 25. Lower scores are better.

Perceived support by a partner or significant other was assessed with use of the West Haven-Yale Multidimensional Pain Inventory (WHYMPI), Part II (partner subscale)[19]. This subscale comprises fourteen items, and the score ranges from 0 to 84, with lower scores being better. It has three subscales: punishing responses (four items), solicitous responses (six items), and distracting responses (four items).

Statistical Analysis

The distributions of continuous variables and assumptions concerning normality were assessed to determine the appropriateness of the statistical tests. The relationships between DASH scores and CES-D, PASS-20, TSK, WHYMPI, and PCS scores were determined with use of Pearson correlation coefficients. The relationships between DASH scores and demographic characteristics (age, sex, highest education, marital status, and employment status) were determined with use of Pearson correlations for continuous variables and one-way

TABLE II Comparison of DASH Scores Between Diagnostic Groups*

Carpal Tunnel Syndrome (N = 29)	de Quervain Syndrome (N = 28)	Lateral Epicondylosis (N = 41)	Trigger Finger (N = 94)	Trapeziometacarpal Arthrosis (N = 33)	Distal Radial Fracture (N = 31)	Wrist Ganglion Cyst (N = 32)	Dupuytren Contracture (N = 31)
36 (23)[abc]	30 (14)[de]	35 (16)[fgh]	22 (18)[bgij]	27 (16)[kl]	44 (19)[jlmn]	16 (15)[cehn]	9 (8)[adfikm]

*Overall ANOVA results: F = 15.09, p < 0.01. The values are given as the mean with the standard deviation in parentheses. Diagnostic groups with the same superscript letters differed significantly with regard to the DASH scores in pairwise comparisons (p < 0.05).

TABLE III Significant Correlations Between DASH Scores and Self-Reported Measures of Mood and Coping Styles by Diagnosis*

	Carpal Tunnel Syndrome		de Quervain Syndrome		Lateral Epicondylosis		Trigger Finger	
Measure	R	P	R	P	R	P	R	P
Depression	0.50	<0.01	0.19	NS	0.32	0.04	0.40	<0.01
Catastrophic thinking	0.71	<0.01	0.50	<0.01	0.32	0.04	0.69	<0.01
Kinesiophobia	0.43	0.02	0.22	NS	0.17	NS	0.58	<0.01
Pain anxiety	0.25	NS	0.07	NS	0.18	NS	0.49	<0.01
Partner response: punishing	0.45	0.03	0.08	NS	0.09	NS	0.14	NS
Partner response: solicitous	0.11	NS	0.29	NS	0.08	NS	0.11	NS
Partner response: distraction	0.14	NS	0.03	NS	0.17	NS	0.12	NS

*R = Pearson correlation coefficient. P = p value. NS = not significant.

analysis of variance (ANOVA) for categorical variables; race was omitted because the majority of patients (89%) were white. In addition, DASH scores were compared among diagnostic groups with use of ANOVA. Pairwise tests were then performed to determine significant differences between diagnostic groups. Finally, bivariate correlations between DASH scores and psychological variables were examined for the diagnostic categories that differed significantly in terms of DASH scores. A Bonferroni correction was applied to pairwise comparisons within multicategorical variables.

Significant bivariate predictors of the DASH score were selected as candidates for a multiple linear regression model. Categorical variables were dummy-coded, with the subgroup having the largest sample size being considered the reference group. A forward stepwise selection method was utilized, with marginal significance levels for entry and removal set at 5% and 10%, respectively. This approach to model building was selected to minimize the collinearity (redundancy) that is reported between measures of psychological dysfunction, particularly kinesiophobia, catastrophic thinking, and pain anxiety[16].

Previous analyses[4] showed that a minimum of twenty-five patients in each of the eight diagnostic groups was necessary to achieve a power of 80% to detect a Pearson correlation of 0.40.

Source of Funding

No external funding was received for this study.

Results

The mean DASH score was 26 (SD, 19) (see Appendix). When all of the diagnoses were considered together, DASH scores correlated significantly with the depression score ($r = 0.39$, $p < 0.01$), catastrophic-thinking score ($r = 0.57$, $p < 0.01$), kinesiophobia score ($r = 0.47$, $p < 0.01$), and pain anxiety score ($r = 0.30$, $p < 0.01$) but not with perceived partner support or any of its subcategories (Table I).

Analysis of the DASH scores according to sociodemographic factors showed that the scores differed significantly according to sex ($t = -4.81$, $p < 0.01$), employment status ($F = 3.93$, $p < 0.01$), and marital status ($F = 2.28$, $p = 0.047$). The mean DASH score was 21 (SD, 18) for males and 31 (SD, 19) for females ($p < 0.01$). Patients who had a full-time job had significantly lower DASH scores compared with those who were unemployed (24 versus 39, $p < 0.01$). A large difference in the mean DASH score was seen between widowed individuals and those living with a partner (37 versus 20) and between widowed individuals and those who were married (37 versus 25), but the Bonferroni-corrected pairwise tests failed to show significance ($p > 0.05$ for both comparisons). Age and highest education attained were not significantly associated with the DASH score.

The ANOVA indicated that DASH scores differed significantly by diagnosis ($F = 15.09$, $p < 0.01$). The results of pairwise comparisons of DASH scores between the diagnostic groups are summarized in Table II. The lowest DASH score was observed in the Dupuytren contracture group (mean and SD, 9 ± 8) and the highest, in patients with a recent distal radial fracture (44 ± 19). The DASH scores in the Dupuytren contracture group were significantly lower than those in the patients with trapeziometacarpal arthrosis ($p < 0.01$), trigger finger ($p < 0.01$), carpal tunnel syndrome ($p < 0.01$), de Quervain syndrome ($p < 0.01$), lateral epicondylosis ($p < 0.01$), or a recent distal radial fracture ($p < 0.01$). Patients with a recent distal radial fracture had significantly higher DASH scores than those with a wrist ganglion cyst ($p < 0.01$), trigger finger ($p < 0.01$), or trapeziometacarpal arthrosis ($p < 0.01$). Other significant differences in DASH scores were observed between carpal tunnel syndrome and trigger finger ($p < 0.01$), carpal tunnel syndrome and ganglion cyst ($p < 0.01$), ganglion cyst and de Quervain syndrome ($p < 0.05$), ganglion cyst and lateral epicondylosis ($p < 0.01$), and lateral epicondylosis and trigger finger ($p < 0.01$). The correlations between DASH scores and measures of psychological dysfunction within individual diagnostic groups are shown in Table III.

The stepwise regression analysis (Table IV) indicated that sex, diagnosis, employment status, kinesiophobia score, and catastrophic-thinking score accounted for 55% of the variability in the DASH scores. Compared with trigger finger, the following conditions were associated with significantly higher DASH scores after adjustment for sex, employment status, kinesiophobia score, and catastrophic-thinking score: trapeziometacarpal arthrosis ($p = 0.02$), de Quervain syndrome ($p = 0.02$), carpal tunnel syndrome ($p = 0.02$), lateral epicondylosis ($p < 0.01$), and recent distal radial fracture ($p < 0.01$). The partial R^2 values indicated that catastrophic-thinking scores (partial

TABLE III (*continued*)

Trapeziometacarpal Arthrosis		Wrist Ganglion Cyst		Dupuytren Contracture		Distal Radial Fracture	
R	P	R	P	R	P	R	P
0.32	NS	0.31	NS	0.39	0.03	0.20	NS
0.58	<0.01	0.63	<0.01	0.04	NS	0.31	NS
0.36	0.04	0.35	0.05	0.28	NS	0.30	NS
0.41	0.02	−0.02	NS	0.12	NS	0.31	NS
0.03	NS	−0.03	NS	0.13	NS	0.22	NS
−0.01	NS	−0.12	NS	−0.30	NS	0.04	NS
0.23	NS	−0.06	NS	−0.04	NS	0.38	NS

TABLE IV Independent Predictors of DASH Score Obtained from Stepwise Regression*

Predictor	Regression Coefficient	95% Confidence Interval	Variance Inflation Factor	T Value	P Value	Partial R^2
Sex	5.97	2.70-9.24	1.22	3.59	<0.01	4.1%
Catastrophic thinking	0.92	0.70-1.15	1.58	8.07	<0.01	17.7%
Kinesiophobia	0.53	0.30-0.77	1.40	4.51	<0.01	6.3%
Diagnosis (reference: trigger finger)						
Trapeziometacarpal arthrosis	6.56	1.14-11.98	1.27	2.38	0.02	1.8%
Dupuytren contracture	−5.21	−10.82-0.40	1.29	−1.83	0.07	1.1%
Carpal tunnel syndrome	6.73	1.00-12.47	1.27	2.31	0.02	1.7%
de Quervain syndrome	7.06	1.17-12.94	1.29	2.36	0.02	1.8%
Wrist ganglion cyst	−4.69	−10.28-0.90	1.32	−1.65	0.10	0.9%
Lateral epicondylosis	7.22	1.86-12.59	1.50	2.65	<0.01	2.3%
Distal radial fracture	20.33	14.67-25.99	1.31	7.07	<0.01	14.2%
Employment status (reference: full-time)						
Part-time	4.29	−0.35-8.94	1.18	1.82	0.07	1.1%
Homemaker	6.82	−1.24-14.90	1.10	1.67	0.10	0.9%
Retired	3.76	−0.36-7.87	1.33	1.80	0.07	1.1%
Unemployed	3.03	−3.09-9.14	1.17	0.97	0.33	0.3%
Student/other	−7.86	−16.59-0.86	1.08	−1.77	0.08	1.0%

*Overall model fit: $R^2 = 0.55$. Adjusted $R^2 = 0.53$. $F = 24.79$ ($p < 0.01$).

R^2 = 17.7%) and kinesiophobia scores (partial R^2 = 6.3%) are the most important independent predictors of arm-specific disability. The variance inflation factors were ≤1.58, suggesting that collinearity had little influence on the model.

Discussion

Catastrophic-thinking scores accounted for the greatest proportion of the variation in disability. Kinesiophobia scores also accounted for disability in our statistical model. Both accounted for more variance than did the diagnosis. Partner support was not a significant factor. Symptoms of depression and pain anxiety scores were significant factors in the bivariate analysis but were not retained in the best multivariable model. This builds on prior work[3,4,7] that has established that the magnitude of upper-extremity disability results largely from modifiable psychological factors—chiefly misinterpretation of nociception (catastrophic thinking and kinesiophobia). Our findings suggest that asking patients questions about their thoughts regarding pain and avoidance of activities that are causing pain is more important than asking questions about mood and support from partners.

It is important not to dichotomize kinesiophobia into something some of us have and some of us do not. It is normal to feel protective in response to pain. Caution about painful movement is a normal aspect of human illness behavior that occurs on a spectrum. The term *kinesiophobia* may inadvertently place emphasis on the maladaptive extreme of that spectrum. What our data show is that patients experience less intense symptoms and less disability in proportion to how confident and at ease they are with body movement even when they are in pain. Psychologists have demonstrated that we can train ourselves to be more adaptive to painful body movement (to limit kinesiophobia), which should help limit symptoms and disability[20-24].

Recent research suggests that kinesiophobia consists of two lower-order factors: a somatic focus (the notion of a serious underlying medical condition) and an activity-avoidance focus (the belief that movement can result in further injury)[5,25,26]. Vincent et al. reported that fear of movement increased disability in patients with chronic low-back pain independent of pain scores, particularly in obese individuals[5]. Other studies corroborate this association between disability and pain-related fear in individuals with chronic low-back pain[6,27] and neck-shoulder pain[28,29]. Crombez et al. showed that the kinesiophobia score was a better predictor of disability than the pain anxiety score, even after adjusting for sociodemographic factors[7].

The Australian epidemic of "repetitive strain injury"[30,31] teaches us that erroneous illness beliefs can cause patients to experience greater symptoms and disability and physicians to overdiagnose and overtreat them. Indeed, extensive research documents a consistent and prominent role of catastrophic thinking (misinterpretation of nociception) in upper-extremity-specific disability[3,32-35]. Consequently, there may be a benefit in training health-care providers to choose the most positive, reassuring, and optimistic language to coach a patient through an illness to avoid reinforcing potentially disabling misconceptions with overcautious activity restrictions and speculative etiological theories. This hypothesis merits further study.

This study should be interpreted in light of the fact that 45% variance in disability remains unexplained. The unaccounted-for variability relates to some combination of unmeasured pathophysiology, psychological factors, and "noise" in the data (e.g., patients misunderstanding the questionnaires or not being honest in their responses for personal gain or other reasons, difficulties with being precise, or a waxing and waning level of attentiveness). Also, the use of an automated model-building process, which is good for addressing collinearity, may overemphasize the importance of certain factors. These data may not apply directly to other practices. Finally, although one of the authors is a psychologist, our study did not include evaluations by a psychologist. We were interested in current symptoms and strategies rather than prior or current diagnoses, some of which might partially or fully resolve with treatment.

Greater symptoms and disability than expected for a given disease should alert caregivers to the opportunity for training patients in improved strategies for managing nociception. Ineffective coping strategies are likely a key component in prolonging symptoms and disability[6-9,16]. We recommend that, in addition to treating the pathophysiology, orthopaedic surgeons and other health-care providers attend to the patient's coping strategies—for example, by referring patients with greater symptoms and disability than expected for cognitive behavioral therapy, or even by learning themselves how to teach these patients to manage nociception better. Cognitive behavioral therapy and its variants have proved highly effective for improving coping strategies with resulting decreases in symptoms and disability, and they warrant greater attention[20-24].

Appendix

eA A table showing patient characteristics is available with the online version of this article as a data supplement at jbjs.org. ■

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