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ORIGINAL ARTICLE

Fear of Movement and Associated Factors Among Adults With Symptomatic Knee Osteoarthritis

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Objective. **To examine the frequency of and factors associated with fear of movement (FOM) among patients with symptomatic knee osteoarthritis (KOA), using the new Brief Fear of Movement (BFOM) measure.**

Methods. **Participants (n = 350) enrolled in a clinical trial completed the BFOM scale prior to randomization. The relationships of BFOM with the following characteristics were examined: age, sex, race, education, pain and activities of daily living (ADL) subscales of the Knee Injury and Osteoarthritis Outcome Score (KOOS), knee symptom duration, depressive symptoms (8-item Patient Health Questionnaire [PHQ-8]), history of falls and knee injury, family history of knee problems, self-efficacy for exercise (SEE), and unilateral balance test. A proportional odds logistic regression model examined multivariable associations of participant characteristics with a 3-level BFOM variable (agreement with 0, 1–2, or ≥3 items).**

Results. **The majority of participants (77%) agreed with at least 1 item on the BFOM scale, and 36% endorsed 3+ items, suggesting a high degree of FOM. In the multivariable model, the following remained significant after backward selection: age (odds ratio [OR] 0.79 per 10-point increase, 95% confidence interval [95% CI] 0.66–0.95), KOOS ADL (OR 0.86 per 10-point increase, 95% CI 0.76–0.97), PHQ-8 (OR 1.15, 95% CI 1.08–1.22), and SEE (OR 0.87 per 10-point increase, 95% CI 0.78–0.96).**

Conclusion. **FOM was common among patients with symptomatic KOA, and this could negatively impact physical activity. Psychological variables were significantly associated with FOM, suggesting behavioral and psychological interventions may decrease FOM and improve outcomes among individuals with symptomatic KOA.**

INTRODUCTION

Osteoarthritis (OA) is a leading cause of pain and functional limitations among adults worldwide (1). Knee OA (KOA) is particularly common with a lifetime risk of 45% (2). OA is associated not only with poor physical outcomes but also with a number of negative psychological outcomes such as depressive symptoms and anxiety (3). Another important psychological construct that has been less studied in OA is fear of movement (FOM), or kinesiophobia. This is defined as a fear of physical movement or activity, stemming from a belief that this will cause pain, injury, or re-injury (4). Studies to date indicate FOM is associated with increased pain, poorer physical function, and higher physical and psychological disability, which are all key outcomes for individuals with musculoskeletal conditions (5–7). In addition, FOM has been associated with physical inactivity, which is of

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Significance & Innovations

- Psychological variables (depressive symptoms, self-efficacy for exercise) were significantly associated with fear of movement (FOM) in this study, suggesting that behavioral or psychological interventions have strong potential for decreasing FOM among individuals with symptomatic knee osteoarthritis (KOA). Directly addressing psychological variables could help to improve physical activity levels and clinical outcomes.
- FOM was common in this sample of individuals with symptomatic KOA. This has important implications, since FOM can lead to decreased physical activity. Since physical activity is an essential component to KOA management, individuals with FOM may experience poorer outcomes.

particular relevance for individuals with OA since activity is an essential component of OA management (8). However, despite the apparent clinical importance of FOM in general, very few studies have examined FOM specifically among patients with OA, and we have limited understanding of its role in this patient group (6,7,9,10). Further, prior studies have focused primarily on relationships of FOM with other OA-related outcomes, but little is known about patient characteristics associated with increased risk for FOM.

Another limitation in the study of FOM among patients with OA relates to measurement. Most scales measuring kinesiophobia are relatively long, making them impractical to administer in large-scale studies and clinical environments. In addition, they were not developed to specifically address movement-related concerns most relevant to individuals with OA. Shelby et al recently developed the Brief Fear of Movement Scale (BFOM) for use among individuals with OA (9). This scale is derived from the Tampa Scale for Kinesiophobia (TSK), which is the most widely used measure of disease-related FOM (4,11). The BFOM was developed to be directly applicable to individuals with OA and is more concise than the TSK, so that it can be feasibly administered in large studies and clinical settings. In particular, the BFOM includes 6 items from the TSK that focus on activity avoidance, which is of particular relevance to OA (9). However, to our knowledge there have not been any published data on this scale among individuals with OA since the initial work describing its development. Therefore, there is still a need to examine the utility of the BFOM among people with symptomatic OA.

To address these gaps, this study characterizes FOM, based on the BFOM, among a sample of individuals with symptomatic KOA. It also examines associations of an array of demographic, physical, and psychosocial variables with BFOM in this sample. This is important because identifying characteristics associated with FOM in OA may help clinicians to target those most at risk for pain, disability, and physical inactivity. These patients may benefit from interventions that specifically address FOM within the context of other treatments or interventions such as exercise programs. Although this was an exploratory study with no formal a priori hypotheses, based on previous literature (primarily among individuals with other musculoskeletal conditions), we expected that higher pain and disability ratings, more depressive symptoms, younger age, and female sex would be associated with greater FOM among individuals with symptomatic KOA (12–15).

PATIENTS AND METHODS

Participants. This study included participants from the study Physical Therapy Versus Internet-Based Exercise Training for Patients with Knee Osteoarthritis (PATH-IN). Details about the study methods are provided elsewhere (16). Briefly, this is a clinical trial with participants randomly assigned to 1 of 3 groups: standard physical therapy for KOA, an internet-based exercise program for KOA, and wait-list control. The data reported here were collected at the baseline assessment of the study, prior to randomization or taking part in an intervention. Participants (n = 350) were recruited from the University of North Carolina at Chapel Hill health care system, surrounding communities, and the Johnston County Osteoarthritis Project cohort (17). Participants with KOA were identified from electronic medical record documentation or previous radiographs from the Johnston County Osteoarthritis Project. Participants also self-reported current knee symptoms on most days of the week. This research complies with the Helsinki Declaration and was approved by the institutional review boards of the University of North Carolina at Chapel Hill and Duke University Medical Center.

Measures. *Fear of movement.* The BFOM is a 6-item measure, with each item measured on a 4-point scale with responses of strongly agree, agree, disagree, and strongly disagree; the scale range is 6–24, with higher scores indicating greater fear. Initial analysis of the scale showed sound psychometric properties, including convergent validity with measures of pain, physical functioning, and psychological functioning, as well as consistent performance across sex, race, education, and OA severity (9). Because the continuous BFOM scale has a relatively limited range, for our primary analyses we treated this as a categorical variable, using groupings that were meaningful and based upon observed responses in our sample (shown below). Specifically, BFOM responses were categorized in 2 ways, as a dichotomous variable and as a 3-level ordinal variable. For the dichotomous form, participants were grouped as those who did not agree or strongly agree with any of the items versus those who agreed or strongly agreed with at least 1 item (e.g., no FOM versus any FOM). For the 3-level BFOM variable, participants were grouped as those who agreed or strongly agreed with 0, 1–2, and 3–6 items, respectively. This categorization was chosen because it resulted in approximately equal proportions of participants

in the 2 groupings who indicated any FOM (1–2 items, and 3–6 items). We also created 2 alternative groupings for the purpose of sensitivity analysis: 1) agreement with 0, 1–3, and 4–6 items, and 2) tertiles of BFOM scores. There were no substantial differences between these alternative groupings and the ordinal variable described above. Therefore, we only report results of the initial 3-level variable. In addition, we performed parallel analyses with the BFOM treated as a continuous variable (data not shown), and results were also consistent.

Pain and physical function. The Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales for pain and function in activities of daily living (ADLs) were used to assess participants' opinions about their knees and associated problems. Items are rated on a Likert scale of 0 (no symptoms) to 4 (extreme symptoms). Each subscale is calculated as the sum of the included items, and scores are converted to a 0–100 scale, with zero representing extreme knee problems and 100 representing no knee problems (18). The KOOS has been validated in different populations with varying disease and durations, as well as varying ages and activity levels (19).

Self-Efficacy For Exercise (SEE). The SEE scale was used to assess participants' self-reported ability to continue exercise in the face of barriers to exercise (20). The SEE scale consists of 9 situations that may affect participation in exercise. For each situation, the participant uses the scale from 0 (not confident) to 10 (very confident) to describe their current confidence that they could exercise 3 times a week for 20 minutes each time. The SEE scale has been validated in different populations and shows expected associations with actual exercise, as well as physical and mental health (20,21).

Depressive symptoms. The 8-item version of the Patient Health Questionnaire depression scale (PHQ-8) was used to assess the depressive symptoms of the participants (22). The PHQ-8 asks participants to indicate the number of days that they have experienced a particular depressive symptom in the previous 2 weeks. Each of the 8 questions is scored from 0 (not at all) to 3 (nearly every day), and total scores range from 0 to 24.

Test of unilateral balance. Each participant was asked to stand on either their right or left leg. A digital stopwatch was used to track the time from the beginning of the test to when the participant either placed the lifted foot on the floor or placed a hand on a chair or wall. The maximum score was 10 seconds. Participants who could not complete the test or who were not able to stand for 10 seconds in semi-tandem and tandem positions were given a score of 0.

Participant characteristics. We obtained demographic and clinical information via self-report, including age, sex, race (white versus nonwhite), education (any education up to a bachelor's degree versus a bachelor's degree or postgraduate work), history of falls (self-report of whether or not the participant fell in the past 12 months), knee injuries (self-report of whether or not the participant had a significant knee injury that limited walking for at least 2 days), and family history of knee problems (self-report of siblings, parents, grandparents, or children with knee arthritis or other problem). For the family history of knee problem variable, we compared those with a positive response for 1 or more family members versus those with no positive responses, combined with those with responses of "don't know."

Statistical analysis. We computed descriptive statistics for participant characteristics and for the overall BFOM responses, as well as responses for individual items. For bivariate analyses, chi-square tests and general linear models were used to compare categorical and continuous participant characteristics, respectively, across the dichotomous and ordinal BFOM response variables. For the ordinal BFOM response variable, corresponding tests of trend (Mantel-Haenszel tests or linear contrasts, as appropriate) across the BFOM categories were also conducted. We used logistic regression models to examine multivariable associations of participant characteristics with the categorical BFOM response variables; for the dichotomous and ordinal BFOM response variables, we fitted dichotomous logistic regression models and proportional odds logistic regression models, respectively. In the latter case, a test of the proportional odds assumption was conducted. Our "full" multivariable model included all terms as explanatory variables; a backward selection procedure was used to reduce this model to include only variables meeting a significance level of 0.20, producing a more parsimonious model. We chose this significance level because it was not highly restrictive, allowing us to capture any variables showing potential associations with BFOM. Analyses were conducted using SAS, version 9.4.

RESULTS

Characteristics of participants. The mean ± SD age of participants was 65.3 ± 11.1 years, and 71.7% were female. More than half of participants (59.4%) had a bachelor's degree or completed some postgraduate education. Additional participant characteristics are shown in Table 1.

Frequency of FOM. The majority of participants (77%) agreed or strongly agreed with at least 1 item on the BFOM scale, indicating some level of FOM. Further, 41% agreed with 1 or 2 items, and 36% endorsed 3 or more items, indicating a high FOM. Table 2 shows the responses to the individual BFOM scale items. The most commonly endorsed item was "Simply being careful that I do not make unnecessary movements is the safest thing I can do to prevent pain from worsening," with more than half (58.3%) of participants either agreeing or strongly agreeing. The least commonly endorsed item was "It's really not safe for a person with a condition like mine to be physically active." Only 7.2% of participants agreed or strongly agreed with this item.

Associations of participant characteristics with FOM. In bivariate analyses, the following variables were significantly associated ($P < 0.05$) with the dichotomous BFOM variable: age, KOOS pain, KOOS ADL, depressive symptoms (PHQ-8), and SEE scale (Table 3). In the multivariable logistic regression model, the following

Table 1. Participant characteristics (n = 350)*

Characteristic	Value
Age, years	65.3 ± 11.1
Female, %	71.7
Nonwhite, %	26.3
Bachelor's degree or postgraduate work, %	59.4
KOOS pain subscale	62.0 ± 18.0
KOOS ADL subscale	66.8 ± 19.1
Years with arthritis symptom	13.1 ± 11.7
Depressive symptoms (PHQ-8)	3.8 ± 4.1
≥1 fall in the previous 12 months, %	34.1
History of knee injury, %	50.0
Family history of knee problems, %	65.1
Self-Efficacy for Exercise scale	56.3 ± 20.3
Unilateral stand time	7.3 ± 3.5

* Values are the mean ± SD unless indicated otherwise. Race information was missing for 12 participants, history of falls was missing for 1 participant, and family history of knee problems was missing for 3 participants. KOOS = Knee Injury and Osteoarthritis Outcome Score; ADL = activities of daily living; PHQ-8 = 8-item Patient Health Questionnaire.

were associated with agreement with 1 or more BFOM items: age (odds ratio [OR] 0.61 per decade increase [95% confidence interval (95% CI) 0.44–0.85]), KOOS ADL (OR 0.67 per 10-point increase [95% CI 0.49–0.91]), and PHQ-8 (OR1.15 per 1-unit increase [95% CI 1.03–1.28]).

In bivariate analyses, the following variables were significantly associated ($P < 0.05$) with the ordinal BFOM variable: age, KOOS pain, KOOS ADL, depressive symptoms, and SEE scale (Table 3). Similar results were observed for the linear trend tests, except that education was also significantly associated ($P = 0.04$) with the ordinal BFOM variable. The test of the proportional odds assumption supported use of a single OR in the multivariable models for the ordinal BFOM response variable ($P > 0.79$). The following variables were associated with greater FOM in the parsimonious (backward selection) model (Table 4): age (OR 0.79 per decade [95% CI 0.66–0.95]), KOOS ADL (OR 0.86 per 10-point increase [95% CI 0.76–0.97]), depressive symptoms (OR 1.15 per 1-unit increase [95% CI 1.08–1.22]), and self-efficacy for exercise (OR 0.87 per 10-unit increase [95% CI 0.78–0.96]). In other words, for each 1-decade increase in age there was a 21% decrease in the odds of having a higher degree of FOM (i.e., 3–6 versus 0–2 items, as well as 1–6 versus 0 items), for each 10-unit increase in KOOS ADL there was a 14% reduction in the odds of having a higher degree of FOM, for each 1-unit increase in depressive symptoms there was a 15% increase in the odds of having a higher degree of FOM, and for each 10-unit increase in self-efficacy there was a 13% reduction in the odds of having a higher degree of FOM. Table 4 also shows results of the full multivariable model including all variables. Family history of knee problems, race, unilateral stand test, history of a fall in the previous 12 months, duration of symptoms, and sex were not significant in any of the models.

DISCUSSION

This study assessed FOM, based on the new BFOM scale, among a sample of individuals with symptomatic KOA. There were 3 main findings of the study. First, results supported the utility and appropriateness of the BFOM among patients with OA, confirming the results of the initial development study (9). Second, results showed a relatively high frequency of FOM among these individuals with OA. Third, several participant characteristics, including modifiable ones, were significantly associated with BFOM.

With respect to the utility and appropriateness of the BFOM among individuals with OA, we found that participants' responses to the scale items were well distributed and showed neither a floor nor ceiling effect. These results support the use of the BFOM for measuring FOM among individuals with OA. Because the BFOM includes only 6 items, it can be feasibly administered in large-scale epidemiologic and outcomes studies, as well as large pragmatic trials and clinical settings.

Table 2. Distribution of responses to the items of the Brief Fear of Movement Questionnaire (n = 350)*

Item	Strongly agree, %	Agree, %	Disagree, %	Strongly disagree, %
I am afraid that I may injure myself if I exercise	5.4	19.1	49.1	26.3
If I were to try to overcome it, my pain would increase†	6.9	36.3	43.4	12.9
I am afraid that I might injure myself accidently	7.4	34.6	42.9	15.1
Simply being careful that I do not make unnecessary movements is the safest thing I can do to prevent pain from worsening‡	13.1	45.1	30.0	11.4
It's really not safe for a person with a condition like mine to be physically active	0.9	6.3	50.6	42.3
I can't do all the things normal people do because it's too easy to get injured	3.1	23.7	47.1	26.0

* For the participants with missing values, the number of "agree" and "strongly agree" responses still allowed us to accurately categorize them into the appropriate level for the dichotomous and 3-level Brief Fear of Movement variables.
† Two participants missing response.
‡ One participant missing response.

Table 3. Descriptive statistics and bivariate associations of participant characteristics with Brief Fear of Movement (BFOM) scale as a dichotomous and ordinal variable*

	Dichotomous variable			Ordinal variable				
	Agree with 0 BFOM items (n = 81)	Agree with ≥1 BFOM items (n = 269)	*P*	Agree with 0 BFOM items (n = 81)	Agree with 1–2 BFOM items (n = 142)	Agree with 3–6 BFOM items (n = 127)	*P*	*P*, for trend across ordinal levels
Age, years	68.7 ± 8.0	64.2 ± 11.7	< 0.01	68.7 ± 8.0	65.1 ± 11.6	63.3 ± 11.8	< 0.01	< 0.01
Female	72.8	71.4	0.80	72.8	69.0	74.0	0.64	0.75
Nonwhite	21.5	27.8	0.27	21.5	23.7	32.5	0.15	0.07
Bachelor's degree or postgraduate work	66.7	57.2	0.13	66.7	61.3	52.8	0.12	0.04
KOOS pain	67.2 ± 16.9	60.4 ± 18.1	< 0.01	67.2 ± 16.9	64.1 ± 16.6	56.2 ± 18.7	< 0.01	< 0.01
KOOS ADL	73.7 ± 18.1	64.7 ± 19.0	< 0.01	73.7 ± 8.1	68.7 ± 17.3	60.3 ± 19.9	< 0.01	< 0.01
Years with arthritis symptom	13.4 ± 10.9	13.0 ± 11.9	0.82	13.4 ± 10.9	13.8 ± 12.4	12.1 ± 11.3	0.49	0.47
PHQ-8	2.1 ± 2.2	4.3 ± 4.5	< 0.01	2.1 ± 2.2	3.1 ± 3.4	5.6 ± 5.1	< 0.01	< 0.01
≥1 fall in the previous 12 months	33.3	34.3	0.87	33.3	32.4	36.5	0.77	0.59
History of knee injury	45.7	51.3	0.38	45.7	50.0	52.8	0.61	0.33
Family history of knee problems	65.8	64.9	0.88	65.8	64.5	65.3	0.98	0.97
Self-Efficacy for Exercise scale	61.9 ± 18.3	54.6 ± 20.6	< 0.01	61.9 ± 8.3	58.1 ± 18.7	50.8 ± 22.0	< 0.01	< 0.01
Unilateral stand time, seconds	7.5 ± 3.4	7.2 ± 3.6	0.53	7.5 ± 3.4	7.3 ± 3.6	7.1 ± 3.6	0.78	0.48

* Values are the mean ± SD or percentage, unless indicated otherwise. Missing data: race information was missing in 12 participants, history of falls was missing for 1 participant, history of knee injury in family was missing for 3 participants, and measured unilateral stand time was missing for 2 participants. KOOS = Knee Injury and Osteoarthritis Outcome Score; ADL = activities of daily living; PHQ-8 = 8-item Patient Health Questionnaire.

Table 4. Multivariable associations of patient characteristics with the ordinal Brief Fear of Movement variable*

	Full model		Parsimonious model (backward selection)	
	OR	**95% CI**	**OR**	**95% CI**
Older age (per decade)	0.78	0.62–0.98	0.79	0.66–0.95
Female sex	0.88	0.54–1.43	–	–
Nonwhite race	0.88	0.51–1.50	–	–
Bachelor's degree or postgraduate work	1.11	0.66–1.85	–	–
KOOS pain score (per 10 units)	1.01	0.81–1.27	–	–
KOOS ADL score (per 10 units)	0.76	0.61–0.95	0.86	0.76–0.97
Years with arthritis symptoms	0.99	0.97–1.01	–	–
PHQ-8 score (per 1 unit)	1.14	1.07–1.22	1.15	1.08–1.22
≥1 fall in the previous 12 months	0.81	0.52–1.27	–	–
History of knee injury	1.17	0.75–1.83	–	–
Family member with knee problems	0.66	0.42–1.06	–	–
SEE scale (per 10 units)	0.87	0.78–0.97	0.87	0.78–0.96
Unilateral stand time	1.01	0.94–1.08	–	–

* Missing data: race information was missing for 12 participants, history of falls was missing for 1 participant, history of knee injury in family was missing for 3 participants, and measured unilateral stand time was missing for 2 participants. OR = odds ratio; 95% CI = 95% confidence interval; KOOS = Knee Injury and Osteoarthritis Outcome Score; ADL = activities of daily living; PHQ-8 = 8-item Patient Health Questionnaire; SEE = Self-Efficacy for Exercise.

The second important finding from these analyses was the relatively high frequency of FOM among adults with symptomatic KOA. For example, 36% of participants endorsed at least 3 items on the BFOM scale, suggesting FOM was likely a concern. This is important because research in other chronic conditions, such as low back pain, indicates FOM is associated with pain disability and poorer responses to treatment (6,23). It is also problematic given that physical activity plays a critical role in managing the pain and burden related to OA (24,25).

Although it is challenging to directly compare our results to previous studies since the BFOM measure is new, these findings are consistent with prior research showing that FOM is common among individuals with a variety of chronic pain conditions. Branstrom and Fahlstrom reported that 56% of participants with chronic musculoskeletal pain had a high degree of FOM, defined as a score >37 on the Swedish Version of the TSK (12). Although a cut point for high FOM has not been defined for the BFOM, we found that 36% endorsed 3 of the 6 items on the scale, which may indicate a high level of fear. Another study reported that 24.5% of the general population has some FOM, based on the TSK (26). The frequency was substantially higher (76%) among our sample of participants with symptomatic KOA.

We also found interesting patterns regarding aspects of FOM that seem to be particularly salient for individuals with symptomatic KOA. The majority (58.3%) endorsed that "Simply being careful that I do not make unnecessary movements is the safest thing I can do to prevent pain from worsening." Although avoidance of potentially injurious movements is important in OA, and joint protection strategies should be encouraged as part of overall disease management, some individuals may avoid movement in general to minimize risk of pain exacerbation. Somers et al concluded that individuals who experience pain-related fear are likely to engage in avoidance behaviors, specifically avoidance of movement and physical activity (7). It is encouraging that only 7% of participants in this study endorsed the statement "It's really not safe for a person with a condition like mine to be physically active." However, a higher proportion (24.2%) endorsed that they were afraid they might injure themselves if they exercise. Therefore, while most participants considered activity to be safe for them in a global sense, a substantial proportion feared injury as a consequence of physical activity.

The third main contribution of this study was the identification of multiple participant characteristics that were associated with FOM. Increasing age was associated with a lower likelihood of FOM (0.79 times the odds of having greater FOM [i.e., either 3–6 versus 0–2 items, or 1–6 items versus 0 items] per decade), and this is consistent with a prior study among individuals with chronic low back pain (13). It is possible that older individuals have gained more experience with engagement in activity despite having a chronic pain condition, lessening their FOM. Alternatively, younger individuals may have considered higher intensity activity when responding to the BFOM items, with responses reflecting fear of more strenuous or potentially injurious movement. We expected, based on prior studies, that women would have greater FOM than men, but this was not the case. It is possible that sex differences in FOM are not as pronounced among individuals with OA as in back pain or other musculoskeletal conditions, but additional research is needed to examine whether this pattern is consistent in other cohorts of patients. As expected, participants with better function had less FOM (0.86 times the odds of having greater FOM per 10-unit increase in KOOS ADL score). This relationship is consistent with previous

research on FOM in people with OA (5,7). Unexpectedly, although more severe pain was associated with greater FOM in bivariate analyses, this association was not significant in multivariable models. Therefore, the association of pain with FOM appeared to be attenuated when controlling for other variables in the model. This is an important finding, illustrating that pain reduction alone may not reduce FOM among individuals with OA. In alignment with prior studies, individuals reporting more depressive symptoms had greater FOM (1.15 times the odds of having greater FOM per unit increase on the PHQ-8) (5–7). In addition, participants with greater self-efficacy for exercise had less FOM (0.87 times the odds of having greater FOM per 10-unit increase in SEE score). Since physical activity and behavioral interventions can improve both self-efficacy and depressive symptoms (27), our results suggest these types of programs have promise for addressing FOM and improving clinical outcomes in individuals with KOA.

These results offer potential for future intervention approaches, based on prior studies of FOM in other chronic pain conditions. Specifically, interventions directly targeting FOM can help to improve pain-related outcomes (14,28). Vlaeyen et al has shown that individuals with pain can successfully experience and habituate to movements or activities that they might normally avoid (28). Koho et al reported that an intervention that resulted in lower FOM was also associated with an increase in physical activity among individuals with chronic musculoskeletal pain (14).

We note some limitations to this study. First, these data are cross-sectional, so we are not claiming causality in these relationships. Second, we did not obtain de novo radiographs on participants, though all had a previous physician diagnosis and/or prior radiographic verification of KOA. Finally, participants were part of 1 clinical trial, and it is unclear how results may generalize to the general population.

In summary, this study showed that among a group of participants with symptomatic KOA, FOM was common, and individuals with more depressive symptoms and lower self-efficacy for exercise had greater levels of FOM. The relatively high frequency of FOM and the association with psychological variables suggest that behavioral and psychological interventions may be important strategies for decreasing FOM in order to improve physical activity participation and outcomes in individuals with KOA. Additional research is needed to identify effective strategies for delivering targeted interventions to people with OA who have a high level of FOM.

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AUTHOR CONTRIBUTIONS

All authors were involved in drafting the article or revising it critically for important intellectual content, and all authors approved the final version to be submitted for publication. Dr. Allen had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

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Acquisition of data. Gunn, Hill, Iverson, Pathak, Allen.

Analysis and interpretation of data. Gunn, Schwartz, Abreeva, Callahan, Golightly, Goode, Iverson, Taylor, Allen.

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