Kinesiophobia is associated with pain intensity and disability in chronic shoulder pain : a cross-sectional study

Abstract

Objectives: Kinesiophobia is a clinically relevant factor in the management of chronic musculoskeletal pain. The aim of this study was to explore the cross-sectional association between kinesiophobia with both pain intensity and disability among individuals with chronic shoulder pain.

Methods: A total of 65 participants with chronic unilateral subacromial shoulder pain were recruited from three primary care centres. The Shoulder Pain and Disability Index assessed pain intensity and disability. The Tampa Scale for Kinesiophobia short form assessed the presence of kinesiophobia. A linear multivariable regression analysis evaluated the potential association between kinesiophobia and range of movement free of pain with pain intensity and disability. The analysis was adjusted for gender and age.

Results: In the linear multivariable regression analysis, only greater kinesiophobia (standardized $\beta = 0.35$ $p<.01$) and gender (standardized $\beta = -0.29$ $p<.01$) contributed to explain 19% of the variance in shoulder pain and disability scores.

Conclusions: This cross-sectional study provides preliminary evidence about the association between kinesiophobia with pain intensity and disability among individuals with chronic shoulder pain. However, our findings only contributed to explain 19% of the variance in shoulder pain and disability scores.

Keywords: shoulder pain; chronic pain; kinesiophobia; fear; disability

Introduction

Shoulder pain (SP) is the third most common musculoskeletal pain condition (1,2), with up to 3% of adults with SP probably consult health care annually (3–6). The global prevalence of SP differs highly across populations and reaches up to 67% for lifetime prevalence (7). The annual socioeconomic costs occasioned by shoulder disorders are enormous, being estimated to be around $7 billion in the United States (8). A large number of surgical and conservative interventions have been proposed in order to improve the outcome of SP (9–13). Unfortunately, relapse and persistence of symptoms are frequently seen (13.6%) three years after first onset (4).

The course of chronic SP is often unpredictable. The complexity and the nature of shoulder demands make it susceptible to a range of articular and peri-articular shoulder pathologies such as shoulder impingement syndrome, adhesive capsulitis, and glenohumeral arthritis, among others (14). However, the extent of tissue damage observed on clinical imaging are not completely associated with the intensity of chronic SP (15). Certainly, evidence support that chronic SP may be not only associated with structural damage, but also induced by referred pain from other body areas (7), as well as altered central pain modulation (16), which may difficult SP diagnosis and clinical decision making.

A large number of biopsychosocial factors has been associated with the transition and maintenance of chronic SP (17–19). Biological factors such as high pain intensity and pain severity; high disability at baseline; a gradual onset of complaints; long duration of complaints; being male; middle age [45-54]; poor general health; and a large amount of sick leave contributed to a poor prognosis of SP (17,18). Occupational and social factors such as perception of high job demands; low social support; and number of visits to a

health care professional were also associated with a poor prognosis of SP (17,18). Psychological factors such as psychological distress; depressive symptoms; anxiety; preoperative concerns; fear-avoidance; somatisation; and pain catastrophising also favored the maintenance of chronic SP (19). Inside of biopsychosocial factors, psychological factors are probably the most influential factors in the perception, processing, interpretation, and coping with chronic pain (20,21). Fear is one of the most investigated psychological factors during the last two decades in the context of musculoskeletal pain (20,22,23).

Kinesiophobia, an extreme form of fear of movement, is defined as an excessive, irrational, and debilitating fear to execute a determined movement or activity due to a feeling of vulnerability to a painful injury or re-injury (24). Kinesiophobia is often associated with escape behaviours such as hypervigilance or avoidance (25). For example, evidence has shown how kinesiophobia is related to altered motor behaviours (26) which may mask the real functional capacity of certain individuals when they face a stressful movement or event (27). Indeed, kinesiophobia is associated with less range of movement (ROM) in people with chronic musculoskeletal pain (28), and ROM has been also related to greater levels of shoulder pain and disability (29). Particularly in chronic musculoskeletal pain, a large number of studies (30) underlined that kinesiophobia is cross-sectionally associated with and longitudinally predicts greater pain intensity, disability and poor quality of life over time (30).

In a clinical setting, kinesiophobia is a barrier for physical activity (31) as well as a moderator of treatment response after physiotherapy (32,33), surgery (33), and biopsychosocial education (34). Consequently, kinesiophobia becomes a targeted outcome in clinical practice (35–38). The role that kinesiophobia plays in chronic SP intensity and disability has been explored (39–41). However, a scarce number of cross-

sectional studies reporting an huge heterogeneity in terms of pain duration and shoulder pain diagnosis has been conducted (39–41). These studies also showed evident inconsistency regarding the association between kinesiophobia and SP outcomes. For example, Lentz et al. (41) reported that kinesiophobia was associated with greater shoulder disability whereas Clausen et al. (39) showed a lack of relationship between both variables. Given these considerations, our cross-sectional study may help to reduce the inconsistency observed in previous studies as well as improve the current knowledge about the association between kinesiophobia and SP intensity and disability in individuals with chronic SP.

Therefore, the aim of the present cross-sectional study was to explore the association between kinesiophobia and SP intensity and disability among individuals with chronic SP. The null hypothesis (H_0) was: [i] there are not a significant association between kinesiophobia and SP intensity and disability. The alternative hypothesis (H_a) was: [ii] there is a significant association between kinesiophobia and SP intensity and disability.

Methods

Study design

A cross-sectional study was conducted according to the Declaration of Helsinki and the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for observational studies (42). Ethical approval was obtained from the Ethics Committee where the primary care centres were located (PI9/012014).

Participants and setting

A consecutive sample of 65 individuals with chronic unilateral subacromial shoulder pain in their dominant arm were recruited from November 2016 to December 2017 in

three primary care centres localized in the province of Malaga, Spain. General practitioners (GPs) performed the recruitment. In this sense, every individual with shoulder pain who attended GPs consultation was derived to the physiotherapy service. Thereafter, the research team, who was composed by two physiotherapists with experience in the management of shoulder pain disorders, trained physiotherapists in primary care centres over a one-hour session. Subsequently, physiotherapists in primary care assessed participants for eligibility. Participants who satisfied the inclusion criteria were invited to participate and provided a written informed consent.

The inclusion criteria were:

(i) At least 18 years old.

(ii) Chronic SP (pain duration more than three months) based on the multidimensional diagnostic criteria for chronic pain (43).

(iii) Unilateral pain located in the anterior and/or lateral shoulder region (44).

(iv) Presence of two out of three positive pain provocation test: Hawkins-Kennedy; Jobe; Neer (45).

The exclusion criteria were:

(i) History of significant shoulder trauma, such as fracture or ultrasonography-clinically suspected full thickness cuff tear.

(ii) Recent shoulder dislocation in the last two years.

(iii) Diagnosis of adhesive capsulitis characterized by a gradual and painful loss of both active and passive ROM in all shoulder planes, primarily external rotation (46).

(iv) SP originated from the cervical spine by using Spurling's neck compression test.

(v) SP due to the following disorders: arthritis (e.g. rheumatoid arthritis), neurological (e.g. stroke), neoplastic (e.g. breast cancer) and/or referred spinal pain (e.g. visceral referred pain).

(vi) Corticoid injections during six months prior to the study.

(vii) SP originated after shoulder surgery.

Sample Size Calculation

Sample size was determined a priori based on the assumption that the association between one variable (kinesiophobia (41)) and SP intensity and disability provides a coefficient of association of 0.35, with a power of 80% and an alpha of .05 as well as a probability of drop-out of 5%. Calculations indicated that a total of 65 individuals with chronic SP were required.

Outcomes Measures

Shoulder Pain and Function

The Spanish version of Shoulder Pain and Disability Index (SPADI) assessed SP intensity and function (47). This tool is an 11-point scale composed of 13 items divided into two subdomains, namely pain intensity and function. Each item is scored from 0 (no pain or difficulty) to 10 (worst pain and difficulty). The SPADI total score ranges from 0 to 130 where greater scores indicate greater SP intensity and disability. The Spanish version of SPADI has good psychometric properties (the intraclass correlation coefficient = .992; Cronbach's alpha value = .965) to assess pain intensity and function among individuals with shoulder pain (47).

Kinesiophobia

The Spanish short-form version of the Tampa Scale for Kinesiophobia (TSK-11) was used to assess the presence of kinesiophobia (48). The original TSK is composed by 17-items (49). However, the TSK-11 removed six items from the original TSK-17 due to the presence of poor psychometric properties (50). Every item is scored through a 4-point scale from 1 (strongly disagree) to 4 (strongly agree). The TSK-11 scores ranges from 11 to 44, where higher scores reflect greater kinesiophobia (50). For TSK-11, no cutoff value differentiating between high and low kinesiophobia in chronic pain exists. However, the minimal detectable change (MDC) for TSK-11 has been calculated (MCD = 5.6) (51). An MCD = 5.6 means that when stable patients are assessed on two occasions, 90% of them will display random fluctuations of <5.6 points in their score (51). The Spanish version of TSK-11 has good psychometric properties (the intraclass correlation coefficient = .81; Cronbach's alpha value = .79) to assess kinesiophobia among individuals with chronic pain (49,51).

Shoulder range of movement free of pain

A gravity referenced inclinometer assessed the active pain-free shoulder ROM during shoulder elevation in the scapular plane (52). Participants were instructed to elevate their affected shoulder in a standing, upright position. Afterwards, participants were also asked to communicate to the research team when the pain started in order to stop the movement. Three measurement were collected at one-minute intervals and the mean value was calculated (**Figure 1**).

Demographic data

Age and gender were gathered through a self-reported questionnaire. Physiotherapists also collected the anonymized age and gender for eligible participants who declined to take part in this study in order to evaluate the external validity of the recruited sample.

Data Analysis

Descriptive and exploratory statistics and the Kolmogorov-Smirnov test were conducted to analyze the distribution and normality of the variables. Pearson's correlation analyses were performed to determine potential associations between kinesiophobia, SP intensity and disability, ROM free of pain, and demographic data. A linear multivariable regression model was built to observe the potential association between the outcome measure (SPADI total score), with kinesiophobia and ROM free of pain (independent variables). The model was adjusted for gender and age. Changes in adjusted R^2 were estimated, as well as collinearity, autocorrelation, homoscedasticity and linearity through correlation matrix, Durbin-Watson's coefficient, tolerance, variance inflation factor (VIF), and analysis of residuals. A p-value less than .05 was used to determine significance. All the analyses were carried out with SPSS 25 statistical package (IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp.).

Results

Sample characteristics

More than half of participants were females (63.1%). The mean age of the whole sample was 46.37 (SD=10.60) (**Table 1**).

Relation between ROM free of pain, kinesiophobia, demographic variables, and SP intensity and disability

Correlations between SP intensity and disability, ROM free of pain, kinesiophobia, and sociodemographic data are reported in **Table 2**.

The association between kinesiophobia and both chronic SP intensity and disability (adjusted for ROM free of pain, gender and age).

Greater levels of kinesiophobia were associated with greater levels of SPADI total score (Standardized $\beta = 0.35$ $p<.01$) in the multivariable regression analysis. This association remained significant after the adjustment for gender and age. Previous evidence has reported gender and age differences in chronic pain (53–56). In this sense, age was maintained as covariate in the linear multivariable regression model even though age was not correlated with SP intensity and disability in the correlation analysis. We also decided to include ROM-free of pain in the linear multivariable regression analysis as there is some evidence in the literature supporting the existing association between this variable and shoulder pain and function (29). The predictive value of the regression model for SPADI total score was small (R^2=0.19). The adjustment was good for SPADI total score (Durbin-Watson's coefficient= 1.85; VIF<1.15 and tolerance over=0.9) (**Table 3**).

Discussion

The purpose of this study was to explore the cross-sectional association between kinesiophobia with both SP intensity and disability among individuals with chronic SP. This study revealed that greater kinesiophobia was associated with both greater SP intensity and disability. This association remained significant after the adjustment for

potential covariates. However, our findings only contributed to explain 19% of the variance in SP and disability scores.

In the context of chronic musculoskeletal pain, a large number of studies supports our findings. Luque-Suarez et al. (30) concluded that kinesiophobia was cross-sectionally associated with and longitudinally predicted more chronic musculoskeletal pain and disability over time after the analysis of 63 observational studies. Specifically in chronic SP, Lentz et al. (41) explored the cross-sectional association between kinesiophobia and shoulder function. They concluded that greater levels of kinesiophobia contributed to explain a 33% increase in the total variance in shoulder disability.

The fear-avoidance model of pain hypothesizes that individuals with musculoskeletal pain who show certain levels of kinesiophobia have more probability to develop chronic musculoskeletal pain and disability (20,22). Kinesiophobia favours hypervigilance and avoidance behaviours and consequently, fearful SP individuals often immobilize their shoulder in order to avoid certain movements (22). Exercise therapy produces huge benefits in individuals with chronic musculoskeletal pain and is often the preferred choice of therapy (57,58). Nevertheless, these maladaptive behaviours mean a barrier to practice exercise, which hampers recovery (31,59). Based on the present findings of our study, we can neither confirm nor disagree with this model due to the cross-sectional nature of our analysis, and the sample was comprised of subjects with chronic pain. Further studies which explore the predictive role of kinesiophobia in individuals with acute and subacute SP are definitely required.

On the other hand, Clausen et al. recently investigated whether kinesiophobia is associated with shoulder function in a heterogeneous subacromial shoulder impingement sample with acute, subacute, and chronic SP. This study found that

kinesiophobia was associated with shoulder function, but its influence was small (2.6–4.5%, $p < .05$) and disappeared after adjusting for pain, sociodemographic, and impairment variables (39). In our study, the association between kinesiophobia and SP intensity and disability remained significant (standardized $\beta = 0.35$ $p < .01$) after the adjustment for potential covariates. However, our findings only contributed to explain 19% of the variance in SP and disability scores. A broad list of biopsychosocial factors (mentioned in the introduction) are associated with the transition and perpetuation of chronic SP (17–19). These factors may contribute to explain the 81% of the variance in shoulder pain and disability scores which cannot be explained by our analysis. In this sense, further studies which include a broad set of biopsychosocial factors in order to evaluate their association with chronic SP and disability are required. This information will allow researchers and clinicians to have a big picture on all the aspects which may facilitate the perpetuation of chronic SP and disability.

Despite our findings only contributed to explain 19% of the variance in SP and disability scores., kinesiophobia is considered a moderator of treatment response among individuals with musculoskeletal pain (32–34). Therefore, clinicians should be encouraged to pay attention to this factor in their clinical practice. They can reduce kinesiophobia using different conservative interventions such as multidisciplinary interventions (60,61), and exercise therapy (62,63) which have shown promising results in decreasing kinesiophobia among individuals with chronic low back pain.

There are certain limitations in the current cross-sectional study that must be mentioned. All factors were simultaneously assessed which cause that the prognostic role that kinesiophobia plays in the maintenance of chronic SP and disability, cannot be determined. A large number of psychological factors (fear-avoidance beliefs, and self-efficacy, among others) which have shown their association chronic SP outcomes (19)

were not assessed. They are considered mediators of the relationship between musculoskeletal pain and disability (64). Future investigations in this field addressing these limitations are required.

Conclusions

This cross-sectional study provided preliminary evidence about the association between kinesiophobia and chronic SP intensity and disability. Greater levels of kinesiophobia were associated with greater levels of chronic SP intensity and disability. This association remained moderately significant after the adjustment for potential covariates. However, our findings only contributed to explain 19% of the variance in SP and disability scores.

Ethical Approval: The organization providing ethical approval and ethics protocol reference number where appropriate.

Declaration of Interest Statement: The authors report no conflicts of interest. All authors have made a substantial scientific contribution to the study and they are thoroughly familiar with the primary data. All authors have read the complete manuscript and take responsibility for the content and completeness of the manuscript.

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Figure 1. The gravity inclinometer and the test position.

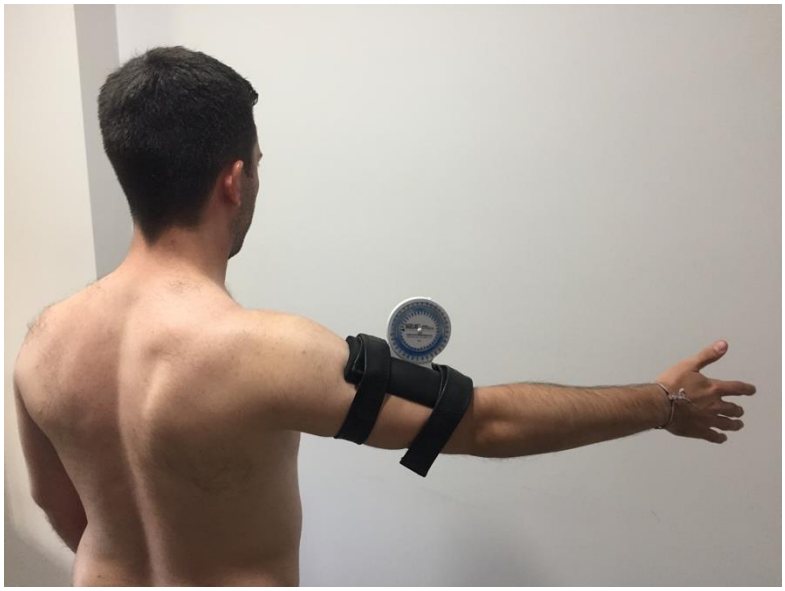

Table 1. Sample characteristics expressed by mean and standard deviation (n=65)

	Mean and Standard deviation (SD)
Age	46.37 (10.60)
Mean ROM free of pain (0-180º)	87.93 (29.01)
TSK-11 total score (11-44)	29.66 (8.68)
% SPADI total (0-100)	60.39 (18.97)

Abbreviations: ROM= range of movement; TSK-11= tampa scale for kinesiophobia short-form; SPADI= shoulder and disability index.

Table 2. Relationship between ROM free pain, SP intensity and disability, kinesiophobia, age and gender (n=65)

	SPADI total score	Mean ROM free pain	Age	Gender	TSK-11 total score
TSK-11 total score	0.30*	-0.12	-0.05	0.12	-
Mean ROM free pain	-0.21	-	-0.22*	0.06	-0.12
SPADI total score	-	-0.21	0.21*	-0.18	0.30*

Age	0.21*	-0.22*	-	0.23*	-0.05
Gender	-0.18	0.06	0.23*	-	0.12

Abbreviations: ROM= range of movement; TSK-11= tampa scale for kinesiophobia short-form; SPADI= shoulder and disability index. Differences statistically significant: *p< .05; **p< .001.

Table 3. Multivariable linear regression analysis with SPADI total score as the outcome.

	Unstandardized B	Standardized β	p	95% confidence interval for Standardized β	
				Lower limit	Upper limit
SPADI total score					
TSK-11 total score	0.76	0.35	<.01*	0.26	1.26
Mean ROM free of pain	-0.05	-0.08	.47	-0.20	0.09
Gender	-11.50	-0.29	.01*	-20.70	-2.29
Age	0.51	0.28	.02*	0.08	0.94

Differences statistically significant: *p< .05; R^2=0.19; Durbin-Watson's coefficient= 1.85; VIF<1.15; and tolerance over=0.9. Abbreviations: ROM= range of movement; TSK-11= tampa scale for kinesiophobia short-form; SPADI= shoulder and disability index.