Depression and Anxiety Are Associated With Worse Subjective and Functional Baseline Scores in Patients With Frozen Shoulder Contracture Syndrome: A Systematic Review

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Purpose: To investigate whether psychological factors, such as avoidance behavior, fear, pain catastrophization, kinesiophobia, anxiety, depression, optimism, and expectation are associated with different subjective and functional baseline scores in patients with frozen shoulder contracture syndrome (FSCS).

Methods: Searches were conducted in MEDLINE, Cochrane Library (CENTRAL Database), PEDro, Pubpsych, and PsychNET.APA without restrictions applied to language, date, or status of publication. Two authors reviewed study titles, abstract, and full text based on the following inclusion criteria: adult population (≥ 30 < 70 years old) with FSCS. Results: Seven hundred and seventy-six records were included by the search strategies. After title final screening, 6 studies were included for the qualitative synthesis. Psychological features investigated were anxiety, depression, pain-related fear, pain catastrophizing, and pain self-efficacy; reported outcomes included pain, function, disability, quality of life, and range of motion. Data suggest that anxiety and depression impact self-assessed function, pain, and quality of life. There is no consensus on the correlation between psychological variables and range of motion. Associations were suggested between pain-related fear, pain-related beliefs, and pain-related behavior and perceived arm function; pain-related conditions showed no significant correlation with range of motion and with perceived stiffness at baseline. Conclusion: Scores traditionally thought to assess physical dimensions like shoulder pain, disability, and function seem to be influenced by psychological variables. In FSCS patients, depression and anxiety were associated with increased pain perception and decreased function and quality of life at baseline. Moreover, pain-related fear and catastrophizing seem to be associated with perceived arm function.

Introduction

Frozen shoulder contracture syndrome (FSCS) is a musculoskeletal pathology characterized by insidious onset, shoulder pain, intense night pain, limitation in range of motion, pain during movements, disturbing sleep, and disability. Despite the lack of a clear etiology, FSCS has a prevalence of 2-5% in the general population, and it occurs more frequently in people...
who suffer from diabetes, thyroid disease, autoimmune disease, and Dupuytren’s contracture. Moreover, it seems that the occurrence of FSCS is higher in patients with sedentary jobs with physically low activity, that women seem to be slightly more predisposed to develop FSCS than men, that the prevalence is higher in the age range between 50 and 59, and the incidence increases with age.

Recovery from FSCS remains controversial in the literature. FSCS is sometimes reported as self-limiting pathology, or that need of care and the time for symptoms resolution ranged from few months to two years. Moreover, although some patients report complete symptom resolution, others report residual range of motion impairments and pain. Despite reports of a three-phased evolution of the disease (freezing, frozen, and thawing), there exists no strong evidence supporting this kind of subclassification in terms of prognostic or diagnostic value.

In shoulder pathologies different from FSCS, the impact of psychological factors and baseline self-assessment evaluation in pain, disability, and function is well documented. However, little is known about the association between psychological factors and the main patient-reported outcome measures (PROMs) in FSCS patients.

The association between psychological factors and patients self-assessment demands further investigation, as psychological factors play an important role in mediating objective pathophysiology and patients’ subjective experience of pain and disability, greater self-perceived pain, and self-perceived function in patients with musculoskeletal pathologies.

The purpose of this systematic review is to investigate whether psychological factors, such as avoidance behavior, fear, pain catastrophization, kinesiophobia, anxiety, depression, optimism, and expectation are associated with different subjective and functional baseline scores in patients with FSCS. We hypothesized that higher levels of psychological features will be associated with clinically different baseline scores assessing pain disability, function, and quality of life in patients with FSCS.

Materials and Methods

Data Sources and Searches

This systematic review was conducted according to the Manual of Evidence and synthesis of JBI 2020, and the protocol was registered in PROSPERO (CRD42021290212). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement was used for the reporting. The research was conducted in the following databases: MEDLINE, Cochrane Library (CENTRAL database), Pubpsych, PsychN ET.APA, and PEDro. In efforts to extract additional relevant articles, a reference list of identified articles was also reviewed with other noncommercially operated databases (gray literature sources as Google Scholar, conference proceedings, as theses).

Searches were conducted for all studies published until to 31st of July 2021 without restriction of language, data, or status of publication were applied. Additionally, the authors did not apply restrictions to study design in efforts to maximize the inclusion of reviewed literature that examines psychological factors in multiple capacities, which may provide prevalent information to the review (e.g., cross-sectional studies; surveys; cohort studies; and observational, epidemiological, and descriptive studies).

Furthermore, a manual cross-referencing was performed on the reference lists of included articles, and experts in the field were asked for further manuscripts of interest for both search strategies. A combination of medical subject heading terms and text words were used to create search strategies for each database to include all potentially eligible studies (Appendix Table 1). Population, Exposition, Outcomes (PEO) strategy is described in Appendix Table 2.

Study selection criteria

Population

Studies were included if participants met the following criteria: adult population (≥30 <70 years old) with FSCS. Studies were excluded if they encompassed patients with secondary frozen shoulder, patient with shoulder fractures during the last year, patients with rotator cuff repair during the last year, patients with shoulder surgery procedure during the last year, patients with shoulder dislocation during the last year, patients with serious specific shoulder disorders (i.e., tumor, infection), or patients with psychiatric diagnosed disorders.

Condition

Two authors evaluated all retrieved studies that analyzed the association between psychological factors and baseline scores in patients with FSCS. Psychological factors variables, including fear, avoidance behavior, catastrophization, anxiety, hypervigilance, depression and depressive disorder, expectation motivation, kinesiophobia, and optimism, were included.

Context

The association between psychological factors and baseline subjective and functional scores in groups of patients with FSCS was compared.

Setting

The setting was primary and secondary care.

Types of Publications and Study Design

The authors did not apply restrictions to study design in efforts to maximize the inclusion of reviewed
literature that examines psychological factors in multiple capacities, which may provide prevalent information to the review (e.g., cross-sectional studies; surveys; cohort studies; and observational, epidemiological, descriptive studies).23

Data Extraction
A single search strategy was used to conduct the systematic review (Appendix Table 1). Search results from consulted databases were exported to EndNote v.X9 (Clarivate Analytics, Philadelphia, PA). Duplicates were removed and Rayyan QCRI online software were used for the study selection process. Two authors independently screened the extracted literature by title, abstract, and full-text review, according to the inclusion/exclusion criteria. Disagreements at any stage of the study selection process were resolved by a third author consultation. When data of interest were not reported in the full text, original investigators were contacted to retrieve missing data. To ensure relevant literature had not been missed, a list of the identified articles was shared with the third author to examine the reference lists of the eligible studies and to perform a manual citation search. Moreover, four experts in the field were contacted to suggest articles of interest that could have been missed from the prior search strategies. The following data were extracted from the included literature: general study information (first author, study design, and publication year); patient’s characteristics and selection criteria, psychological factors considered, characteristics of intervention and control groups, follow-up periods, outcome measures, and main results (Table 1). The extraction form was filled in by two authors alternately with mutual check on each entry. Disagreements were resolved by either consensus or consultation with a third review author. The results of the studies were analyzed by the first author and were summarized in a qualitative synthesis. A second researcher was involved in case of doubt.

Quality Assessment of Studies Included
Two authors independently assessed the quality in included studies (C.G. and F.B.) using a modified version of the Downs and Black score26 by two independent authors (C.G. and E.S.) (Table 2). A clear description of the aims (item 1), the main outcome to be measured (item 2), the patients characteristics (item 3), the principal founders (item 4), and the main findings (item 5) were provided in all included studies; moreover, the main outcome measures used were accurate (item 13). In the majority of the studies, the authors were unable to determine whether groups of different intervention came from the same population (item 14).

Results

Study Selection
Overall, the search strategies retrieved 776 articles. No additional records were identified through other sources and expert on field inquiry and 14 duplicates were found. Two blinded authors (C.G. and E.S.) independently screened all articles retrieved for title and abstract. A total of 751 articles were excluded. The remaining 11 articles were independently screened by the same researchers for full text, and 5 additional articles were further excluded (Appendix Table 3).27-31 A total of 6 articles were included in the final review.32-37 A PRISMA flowchart of the selection process can be viewed in Fig 1.

Data Extraction
Two authors checked each other’s choices of extracted studies, as previously specified in Methods section (Table 1). Disagreements were resolved by consulting a third author. Missing data from one included study were reached by contacting the corresponding authors of the article.

Quality Assessment
Studies were assessed using a modified version of the Downs and Black score26 by two independent authors (C.G. and E.S.) (Table 2). A clear description of the aims (item 1), the main outcome to be measured (item 2), the patients characteristics (item 3), the principal founders (item 4), and the main findings (item 5) were provided in all included studies; moreover, the main outcome measures used were accurate (item 13). In the majority of the studies, the authors were unable to determine whether groups of different intervention came from the same population (item 14).

All but one study reported estimates of the random variability for the main outcome (item 6). In all but two studies, actual probability statistical values were not reported for the main outcomes (item 7), and appropriate statistical tests to assess the main outcomes were not used (item 12).

For a majority of the included studies, the reviewers were unable to determine whether the included
| Author, Year | Study Design | Participants ($n$), Inclusion/exclusion criteria | Psychological Factors Investigated | Group of Intervention (GI) | Group of Control (GC) | Outcome Measures, Units, Time of Follow-Up |
|--------------|--------------|-----------------------------------------------|---------------------------------|--------------------------|----------------------|-------------------------------------------|
| **Bagheri et al., 2016** | Cross-sectional study | $n = 120$ (mean age 52 y; 37 men, 83 woman) | Anxiety; depression | | | DASH score, VAS score, SF-36 (PCS component), SF-36 (MCS component), HAQ, HDQ, at baseline |
| **De Baets et al., 2020** | Cross-sectional study | $n = 85$ (mean age 55.2 y; 26 men, 59 woman) | Pain-related fear, pain catastrophizing, pain self-efficacy | | | DASH questionnaire, TSK, PCS*, PSEQ, NPRS at baseline |
| **Ding et al., 2014** | Cross-sectional study | $n = 254$ (mean age: 52.16 ± 6.16 y; 46 men, 78 woman) | Anxiety; depression | **GI**: $n = 124$ FSCS | **GC**: $n = 130$ healthy people | VAS, sleep disturbances, SST, SPADI, ROM, HAQ, HADS-D, HADS-A at baseline |
| **Ebrahimzadeh et al., 2019** | Cross-sectional study | $n = 120$ (mean age 52 SD 17 y; 37 men, 83 women) | Anxiety; depression | | | VAS, DASH, HADS-D, HADS-A at baseline |

(continued)
Table 1. Continued

| Author, Year, Study Design | Participants (n), Inclusion/exclusion criteria | Psychological Factors Investigated | Group of Intervention (GI) | Group of Control (GC) | Outcome Measures, Units, Time of Follow-Up |
|----------------------------|-----------------------------------------------|----------------------------------|---------------------------|----------------------|------------------------------------------|
| Toprak et al., 2018 Cross-sectional study | Level of evidence: IV | Inclusion criteria: Age range 25—65 y, insidious onset of pain and stiffness with a clinical reduction in ROM, principally ER reduction >50%, no radiological abnormalities, presence of pain | Anxiety; depression | GI: n = 76 FSCS patients (mean age 59.32 ± SD 13.91 y; 21 men, 55 women) | VAS, BDI, BAI, WHO-QoL bref, PSQI | |
| | | Exclusion criteria: History of shoulder surgery or trauma, other shoulder pathology, history of psychiatric disorders, local corticosteroid injection or any physiotherapy intervention to the affected shoulder within the last 6 months, cerebrovascular accident affecting the shoulder, concomitant disorders unwillingness to participate in the study | | GC: n=72 healthy patients (mean age 58.50 ± SD 8.74 y; 18 men, 54 women) | |
| De Baets et al., 2020 Prognostic study | Level of evidence: IV | Inclusion criteria: Adults with unilateral, FSCS passive ROM restriction ≥25% in minimum 2 directions, unaffected shoulder, ER restriction of at least 50%, pain and restricted ROM last ≥2 months, A gradual onset of the perceived pain and stiffness, Be able to fill in questionnaires in Dutch | Pain-related fear, pain catastrophizing | patients were treated with Ultrasound-guided intra-articular corticosteroid injections (80 mg Depomedrol and 6 cc Lidocaine HCl 1%) via posterior at baseline, 6 and 12 weeks; patient education (manual), joint mobilizations, mobility and stretching exercises, home-management training, and neuromuscular training | Outcome measures: DASH, GH ABD and ER ROM (goniometry), NRS-stiffness, NRS-pain, TSK, PCS*, CHL thickness, IGR perimeter | Follow-up: baseline and 4 months |

ABD, abduction; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; CHL, coraco-humeral ligament; DASH, Disability of the Arm, Shoulder and Hand; ER, external rotation; FS, frozen shoulder; FSCS, Frozen Shoulder Contracture Syndrome; GH, glenohumeral; HADS-A, Hamilton Anxiety and depression Scale-Anxiety; HADS-D, Hamilton Anxiety and depression Scale-Depression; HAQ, Hamilton Anxiety Questionnaire; HDQ, Hamilton Depression Questionnaire; IGR, inferior glenohumeral recess perimeter; IR, internal rotation; MCS, Mental Component Summary; NPRS, Numeric Pain Rating Scale; NRS, Numeric Rating Scale; PCS, Physical Component Summary; PCS*, Pain Catastrophizing Scale; PSEQ, Pain Self-Efficacy Questionnaire; PSQI, Pittsburgh Sleep Quality Index; ROM, range of movement; SF-36, Health Survey Short Form, 36 question; SPADI, Shoulder Pain and Disability Index; SST, Simple Shoulder Test; TSK, Tampa Scale of Kinesiophobia; VAS, visual analog scale; WHO-QoL bref, World Health Organization Quality of Life Scale short form; Y, years.
subjects were representative of the entire population from which they were recruited (item 14).

Description of Included Studies

Overall, 545 patients with FSCS were included. Psychological features most investigated were anxiety and depression; however, included studies also assessed pain-related fear, pain catastrophizing, and pain self-efficacy. No other psychological factors were investigated.

Depression

Four studies investigated the correlation between depression and patient baseline scores in FSCS patients. In multivariable analysis, DASH score (partial $R^2 = 0.089$, Beta = .107; SE .034, 95% CI: 0.039 to 0.17; $P = .002$), education (partial $R^2 = 0.12$, Beta = −1.46; SE .39, 95% CI: −2.22 to −0.69; $P < .001$), and internal rotation (partial $R^2 = 0.042$, Beta = .99; SE 0.47, 95% CI: −1.93 to −0.052; $P = .039$) correlated with severity of depression symptoms. In Toprak et al.’s cross-sectional study, there was no statistically significant difference between FSCS patients and healthy control groups in terms of the Beck Depression Inventory (BDI) at baseline (14.63 SD 9.60 vs 11.53 SD 10.85, respectively; $P = .06$). Further detailed results of these correlations were shown in Table 3.

Anxiety

Four studies investigated the correlation between anxiety and baseline scores in patients with FSCS. In multivariable analysis, anxiety was strongly correlated (partial $R^2 = 0.11$, Beta = .98; SE .28, 95% CI: 0.43-1.5) with change in function assessed with DASH score. Ding et al. reported that FSCS patients showed significantly higher Hamilton Anxiety and depression Scale-Anxiety (HADS-A) scores than healthy control (mean: 6.16, SD 3.62 and mean: 4.90, SD 3.05, respectively; $P = .003$) and significant high risk for anxiety (HADS-A >9) than healthy control (24.2% and 13.8%, respectively; $P = .035$).

Fig 1. PRISMA flowchart.
score was correlated with severity of anxiety (partial $R^2 = 0.15$, Beta $= .12$, SE .029, 95% CI: 0.065 to 0.18; $P < .001$) symptoms. In the cross-sectional study of Toprak et al., FSCS patients showed a significantly stronger correlation with the Beck Anxiety Inventory (BAI) than healthy control subjects at baseline (18.45, SD 13.51 vs 11.97, SD 10.22, respectively; $P = .001$) . Further detailed results of these correlations are shown in Table 3.

### Pain-Related Beliefs

Two studies by De Baets et al. investigated the correlation between pain-related beliefs and subjective and functional baseline scores in FSCS patients. (Table 4). The authors found that pain-related beliefs in patients with FSCS explained some of the variance in perceived arm function, including Tampa Scale of Kinesiophobia (TSK) (standardized Beta $= .23$; $P = .01$) and Pain Self-Efficacy Questionnaire (PSEQ) (standardized Beta $= -.5$; $P < .0001$), as well as pain intensity (standardized Beta $= .29$; $P < .0005$).

### Discussion

The results of this systematic review suggest that depression and anxiety are associated with increased pain perception and decreased function and quality of life at baseline. Moreover, pain beliefs, such as pain-related fear and catastrophizing, seem to be associated with worse perceived arm function, but not with pain intensity and range of motion (ROM) at baseline.

There were numerous strengths of this systematic review: a prespecified protocol was previously registered on PROSPERO to guaranteed clarity and transparency of the research and the article was structured with rigorous methodology following appropriate guidelines. Moreover, the current guidelines for reporting a systematic review (PRISMA checklist 2020) and specific review tools to assess the risk of bias were used. Additionally, no language, date of publication, or study design restrictions were applied in this research aiming to reach a broad body of literature for exploring the topics of interest. However, the included risk of bias of studies illustrated that samples size was not calculated a priori and that outcome measurements were not blinded. Additionally, the reviewers were unable to determine whether the included literature’s patient population in different intervention groups were recruited from similar populations of interest.

While association between shoulder pathologies and psychological factors represents a topic widely discussed, there is a paucity of literature that thoroughly examines the relationship between subjective and functional baseline scores and psychological distress in FSCS. To the authors’ knowledge, this is the first systematic review that investigated this topic.

On the basis of the findings from this review, scores traditionally thought to assess physical dimensions like...
|                  | HDQ | HAQ | HADS-D | HADS-D > 9 | HADS-A | HADS-A > 9 | HADS-D | HADS-D > 8 | HADS-A | HADS-A > 8 | BDI | BAI |
|------------------|-----|-----|--------|------------|--------|------------|--------|------------|--------|------------|-----|-----|
| VAS              | R = 0.21, P = .024 | R = 0.482, P < .005 | R = 0.382, P < .05 | R = 0.000, P < .05 | R = 0.011, P < .05 | R = 0.21, P = .02 |
| DASH             | R = 0.38, P < .001 | R = 0.32, P < .01 | R > .001, P < .001 | R = 0.37, P < .006 |
| MCS              | R = 0.60, P < .001 | R = −0.51, P < .01 | R > .001, P < .001 |
| SST              | R = −0.491, P < .005 | R = −0.366, P < .05 | R = 0.001, P < .05 |
| SPADI            | R = 0.475, P < .005 | R = 0.400, P < .05 | R = 0.013, P < .05 |
| HAQ              | R = 0.505, P < .005 | R = −0.396, P < .001 |
| HADS-A           | R = 0.741, P < .005 | R = 0.741, P < .05 |
| HADS-D           | R = 0.741, P < .005 | R = 0.741, P < .05 |
| Sleep Disturbance | R = 0.319, P = 0.012 | R = 0.322, P = 0.026 |
| ER ROM           | P > .005, P < .05 | P > .005, P < .05 | P > .001, P < .05 | R = −0.37, P < .001 | R = −0.29, P < .001 |
| IR ROM           | P > .005, P < .05 | P > .005, P < .05 | P > .001, P < .05 | R = −0.35, P < .001 | R = −0.36, P < .001 |
| EL ROM           | R = −0.3, P < .001 | R = −0.3, P < .001 | R = 0.3, P < .001 | R = 0.29, P < .001 |
| ABD ROM          | R = 0.3, P = 0.013 | R = −0.3, P < .001 |
| Education        | P = 0.013, P < .001 | P = 0.013, P < .001 |
| WHO-QoL          | R = −0.267, P < 0.05 | R = −0.266, P < 0.05 |
| FSCS Stages      | P > 0.05, P < 0.05 | P > 0.05, P < 0.05 |
| BDI              | R = 0.296, P < 0.01 |

Bagheri et al., 2016  Ding et al., 2014  Ebrahimzadeh et al., 2019  Toprak et al., 2019

ABD, abduction; ABD ROM, range of motion in abduction; BAI, Beck Anxiety Inventory; BDI, Beck Depression Inventory; CHL, coraco-humeral ligament; DASH, Disability of the Arm, Shoulder and Hand; ER, external rotation; EL ROM, range of motion in elevation; ER ROM, range of motion in external rotation; FS, frozen shoulder; FSCS, Frozen Shoulder Contracture Syndrome; GH, glenohumeral; HADS-A, Hamilton Anxiety and depression Scale-Anxiety; HADS-D, Hamilton Anxiety and depression Scale-Depression; HAQ, Hamilton Anxiety Questionnaire; HDQ, Hamilton Depression Questionnaire; IGR, Inferior Gleno-Humeral Recess perimeter; IR, internal rotation; IR ROM, range of motion in internal rotation; MCS, Mental Component Summary; NPRS, Numeric Pain Rating Scale; NRS, Numeric Rating Scale; PCS, Physical Component Summary; PCS*, Pain Catastrophizing Scale; PSEQ, Pain Self-Efficacy Questionnaire; PSQI, Pittsburgh Sleep Quality Index; ROM, range of movement; SF-36, Health Survey Short Form, 36 question; SPADI, Shoulder Pain and Disability Index; SST, Simple Shoulder Test; TSK, Tampa Scale of Kinesiophobia; VAS, visual analog scale; WHO-QoL bref, World Health Organization Quality of Life Scale short form; Y, years.
shoulder pain, disability, and function seem to be influenced by psychological variables. This is in agreement with previous studies that showed how commonly used shoulder patient-reported outcome measures (PROMs) depend heavily on psychological variables.17,18,44 Moreover, this systematic review suggests an important and perhaps underappreciated negative association between psychological factors and baseline scores on multiple PROMs that rely exclusively on patient self-assessment of pain and function (i.e., VAS for pain and DASH). Contrarily, other PROMs such as the Constant-Murley score, which bases 65% of its score on physical examination findings, did not correlate significantly with measures of psychological dimension.16,17

In clinical practice, the principal assessment for FSCS is range of motion (ROM) measurement;45 however, in addition, PROMs have become increasingly important for patients’ comprehensive assessments,46 as clinician-based outcome instruments do not reflect patients’ psychological distress.47 Therefore, as illustrated from the current review, efforts should be made to select and to better interpret shoulder patient-based outcome instruments properly.

Knowledge about psychological distress on shoulder pathology should emphasize the importance of rehabilitation that should be catered not only toward physical management but also on psychological care to optimize patients outcomes: in this case, rehabilitation of FSCS patients could be directed not only to peripheral structures for gaining ROM and decreasing pain, but also to psychological aspects through a bio-psycho-social approach.48-51

In light of the findings from this review, clinicians should also consider the clinical assessment of FSCS patients. In addition to the biological aspects of pathology (i.e., the intensity of pain and the amount of the ROM restriction), a deeper assessment of psychological factors, such as anxiety, depression, and pain could be appropriate for early recognition management of these aspects that impact patients’ conditions (i.e., seems that some symptoms such as pain, discomfort, and mental components of quality of life are more impacted by depression, while anxiety and pain beliefs have a greater impact on upper limb disability).55 In fact, patients with depression and anxiety may see themselves as being more disabled than might be expected on the basis of objective findings and, thus, might not be capable of adapting to and managing painful upper extremity problem;17 moreover, depression and anxiety could also impair adherence to prescribed therapy and response to treatment.52

A myriad of available treatment options for patients with FSCS were reported in the current review; however, findings suggest that the best rehabilitation choices encompassed corticosteroid injection, manual therapy techniques, stretching, and exercises.53-55 However, not all FSCS patients had a complete recovery; some still experienced pain, functional disability, ROM deficiency, or both.12,56 Presently, it has been shown that rehabilitation does not change the presence of pain-related fear and catastrophization in FSCS patients,34 even if a decrease of score values is observed at 4 months. This is likely because current rehabilitation approaches are not fully directed to the psychological aspects of the pathology and, considering the results of

| Table 4. Synopses of Correlations Between Pain Related Beliefs and Patient-Reported Outcome Measures |
|---------------------------------------------------------------|
| Perceived arm function | Pain Self-Efficacy | PCS | PSEQ | TSK | PCS | TSK |
| DASH | R= 0.51 | R = −.69 | R = 0.45 | P = .66 | P = .88 |
| P < .0001 | P < .0001 | P < .0001 |
| TSK | R = 0.55 | R = −0.46 | R = 0.2732 | P = .24 |
| P < .001 | P < .001 |
| PSEQ | R = −.58 | R = −0.46 | P > .001 |
| PCS | R = −0.58 | R = 0.55 |
| ER ROM | P = .90 | P = .77 |
| ABD ROM | P = .91 | P = .17 |
| PAIN at rest | R = 0.2615 | R = 0.0265 |
| P = .26 | P = .91 |
| PAIN at night | R = 0.3104 | R = 0.0324 |
| P = .18 | P = .89 |
| PAIN during activities | R = 0.2243 | R = −0.3256 |
| P = .34 | P = .16 |

De Baets et al., 2020 De Bates et al., 2020

ABD ROM, range of motion in abduction; DASH, Disability of the Arm, Shoulder and Hand; ER ROM, Range of Motion in External Rotation; PCS, pain catastrophizing scale; PSEQ, Pain Self-Efficacy Questionnaire; TSK, Tampa Scale of Kinesiophobia.
this systematic review, an implemented and comprehensive physical therapy treatment approach could be advocated.

Overall, the current review suggests that FSCS patients that reported anxiety and depression were more prone to show higher pain perception, lower function, and quality of life than healthy patients; however, it cannot be confirmed if these psychological aspects were present before the onset of the FSCS, or following FSCS diagnosis. In other words, this systematic review cannot answer the question of whether individuals who are depressed and anxious are more prone to develop FSCS.

The existence of personality traits that facilitate the onset of FSCS was a theme discussed in the included literature,28-31 but the results were variable; accordingly, the hypothesis of a specific “frozen shoulder personality” was not substantiated. Moreover, authors in this article believe that the intrinsic characters of the FSCS (i.e., subdolous and criptogenetic onset, and high pain, high disability in middle-aged working subjects) could be factors that increase the probability to develop psychological complaints as a consequence of pathology. Notably, the long period of recovery in a group of people who were usually active, the inability to use the arm normally due to pain and stiffness that affect even very fundamental activities of daily living, as well as sport and hobbies, could be psychologically disruptive.57

Moreover, the presence of anxiety and depression seem to be a trigger point for sleep disorders,35 that could, in a vicious circle, increase physical and psychological fatigue. Sleep disturbances seem to be present at two different times for different causes: quality of sleep seems to be impaired due to pain in the first phase (generally characterized by intense pain and mild restriction of movement), while from the third month onward, sleep disturbance seems to be more strictly correlated with anxiety and depression, and mainly affect patients who habitually suffer from shoulder pain for 3 months or longer, negatively affecting the quality of life.37,58,59 Sleep deprivation wore participants psychologically down, even though they self-declare as “resilient”. The nature of the pain was such that they worried about what could be the cause,57 enhancing catastrophization and pain-related beliefs that decrease the perceived arm function and increase disability in FSCS patients.33,34 Notably, pain-related beliefs were in negative correlation with self-efficacy, that, in turn was directly correlated with better physical functioning, lower level of pain, and disability55,60 in people with chronic musculoskeletal pain.

Jones et al.57 estimated that patients experienced delay in receiving a definitive diagnosis of FSCS: for example, an average of 2 months elapsed from the onset of symptoms to the first medical consultation and that an average of 4.1 months elapsed from the first consultation to the definitive clinical diagnosis. The delay in diagnosis, especially in the early period when the ROM restrictions were not evident, with the increasing of pain-related disability and decreasing quality of life, as soon as the uncertainty about the recovery, could contribute to the development of anxiety and depression, as well as the length of recovery, described as up to 30 months.36

Anxiety and depression, the struggle of living, and dealing with FSCS was compounded, in some cases, by a lack of awareness on the part of clinicians and, foremost, a failure to properly and timely diagnose the condition. In fact, diagnosis presented a challenge among nonspecialist (i.e., not upgraded about shoulder disorders management) clinicians, and sometimes, lack of diagnosis or misdiagnosis led to diverse consequences among patients; for example, anxiety, depression, unanswered questions, uncertainty and/or contradictory advice to the treatment options and the potential risks and benefits of different treatments approach.57 Some clinicians opted for a wait-and-see approach, and most prescribed analgesics without a precise diagnosis. The ineffectiveness of this approach could generate distrust in the patients, and the gaps of awareness of the particular characteristics of the pathology could bring the patients in a situation of psychological fragility.57

Notably, patient education is a milestone for clinicians that manage musculoskeletal diseases61,62 and pain neuroscience education was shown to be effective for the reduction of pain and the improvement in knowledge about pain, for improving function and lowering disability, and reducing psychosocial factors in adults with musculoskeletal pain.51 Moreover, studies showed that this approach can enhance pain reconceptualization, which seems to be an important process to facilitate patients’ ability to cope with their condition.61 The results of this study highlights the importance of clinicians managing FSCS through patient education, as neuroscience education in these kinds of patients could reduce the impact of pain-related beliefs on self-efficacy and function.63

Clinicians involved in FSCS patients’ rehabilitation should investigate the presence of psychological features. Moreover, the prognostic value of psychological features must be investigated: improving knowledge about this aspects could direct clinicians to include other therapeutic strategies and to gain further expertise in psychological management, because these factors can be positively managed by physiotherapeutic approaches.64 Moreover, FSCS patients could be oriented to a multiprofessional pattern of care, implementing current care administration strategies.

Other psychological factors (i.e., expectation, fear, or optimism) should be investigated in future studies that aim to understand their own prognostic value.
Research into understanding the potential causative role of psychological distress in the FSCS development should be structured with the aim to identify people at risk, and the additional value of a psychosocial oriented therapeutic approach should be evaluated.

Limitations
Some limitations did exist in the current review. This review explored psychological factors in a specific pathological population: this limits the generalizability of our results, but at the same time increases the value of these results in a specific FSCS patient population. An additional limitation of the studies that was reflected by our review is that not all psychological factors were equally explored and that the level of evidence of the analyzed studies was low. Search strategies, even if comprehensive and based on the Population, Intervention, Comparison, Outcomes (PICO) approach, may have missed some studies of interest, and some psychological factors (e.g., helplessness, pessimism, and acceptance of illness) were not investigated.

Conclusion
Scores traditionally thought to assess physical dimensions like shoulder pain, disability, and function seem to be influenced by psychological variables. In FSCS patients, depression and anxiety were associated with increased pain perception and decreased function and quality of life at baseline. Moreover, pain-related fear and catastrophizing seem to be associated with perceived arm function.

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Appendix Table 1. Search Strategies for Databases

| Source                        | Search Terms                                                                 |
|-------------------------------|-----------------------------------------------------------------------------|
| MEDLINE (589 results)         | (((((((((frozen shoulder) OR (Adhesive Capsulitis of the Shoulder)) OR (Bursitis[MeSH Terms])) OR (Capsulitis*)) OR (Shoulder Adhesive Capsulitis)) OR (Stiff shoulder)) OR (adhesive capsulitis)) OR (Frozen shoulder contracture syndrome)) OR (Frozen Shoulder[MeSH Terms]) AND ((((((((psychosocial) OR (psychosocial factors)) OR (psychological)) OR (psychology[MeSH Terms])) OR (fear[MeSH Terms])) OR (avoid*)) OR (avoidance behaviour)) OR (avoidance learning[MeSH Terms])) OR (Avoidance Behavior)) OR (Avoidance Behaviors)) OR (catastrophization[MeSH Terms])) OR (catastroph*) OR (Catastrophizing) OR (Pain Catastrophizing) OR (Pain Catastrophizing) OR (Catastrophizing) OR (Anxiety OR hypervigilance) OR (depression[MeSH Terms])) OR (depressive disorder[MeSH Terms])) OR (expectation[MeSH Terms])) OR (motivation[MeSH Terms])) OR (Expectations)) OR (Kinesiophobia) OR (optimism) |
| Cochrane Library (CENTRAL database) (92 results) | (“Frozen shoulder” OR “Adhesive Capsulitis of the shoulder” OR “stiff shoulder” OR “frozen shoulder contracture syndrome” OR bursitis OR capsulitis OR shoulder adhesive capsulitis OR “adhesive capsulitis”) AND (psychosocial OR “psychosocial factors” OR psychological OR psychology OR fear OR avoiding OR avoid OR avoided OR “avoidance behaviour” OR “Avoidance Behavior” OR catastrophization OR Catastrophizing OR “Pain Catastrophizing” OR Anxiety OR hypervigilance OR “depressive disorder” OR expectation OR motivation OR Expectations OR Kinesiophobia OR optimism) |
| PEDro Database (90 results)   | Title and abstract: “Frozen Shoulder*” |
| PubPSYCH (4 results)          | Title and abstract: “Frozen Shoulder*” |
| PsychNET.APA (1 result)       | Title and abstract: “Frozen Shoulder*” |
| Appendix Table 2. Population, Exposition, Outcomes (PEO) |
|----------------------------------------------------------|
| **Strategy**                                             |
| **MEDLINE**                                              |
| **POPULATION**                                           |
| Frozen Shoulder [MeSH Terms]                             |
| Frozen shoulder contracture syndrome                     |
| Adhesive capsulitis                                      |
| Stiff shoulder                                           |
| Shoulder Adhesive Capsulitis                             |
| Capsulit*                                                |
| Bursitis [MeSH Terms]                                    |
| Adhesive Capsulitis of the Shoulder                      |
| **EXPOSITION**                                           |
| psychosocial                                            |
| psychosocial factors                                     |
| psychological                                            |
| psychology [MeSH Terms]                                 |
| fear [MeSH Terms]                                        |
| avoid*                                                  |
| avoidance behaviour                                      |
| avoidance learning [MeSH Terms]                          |
| Avoidance Behavior                                       |
| Avoidance Behaviors catastrophization [MeSH Terms]       |
| catastroph*                                             |
| Catastrophizing                                          |
| Pain Catastrophizing anxiety [MeSH Terms]                |
| hypervigilance                                           |
| depression [MeSH Terms]                                 |
| depressive disorder [MeSH Terms]                        |
| expectation [MeSH Terms]                                |
| motivation [MeSH Terms]                                 |
| Expectations                                            |
| Kinesiophobia optimism                                   |
| **OUTCOME**                                              |
| Disability                                               |
| Pain                                                     |
| Health-related quality of life                           |
| Return to work                                           |
| Return to recovery                                       |
| Authors (Year)          | Title                                                   | Study Design       | Reason for Exclusion                                                                 |
|------------------------|---------------------------------------------------------|--------------------|--------------------------------------------------------------------------------------|
| 1. Lorenz et al. (1952)| Life stress, emotions and painful stiff shoulder        | Cross-sectional    | Wrong population sample                                                                |
| 2. Chiaramonte et al. (2019)| A significant relationship between personality traits and adhesive capsulitis | Prospective study  | Did not investigate association between psychological factors and PROMs               |
| 3. Debeer et al. (2014)| Frozen shoulder and the Big Five personality traits    | Cross-sectional    | Did not investigate association between psychological factors and PROMs               |
| 4. Fleming et al. (1976)| Personality in frozen shoulder                          | Cross sectional    | Did not investigate association between psychological factors and PROMs               |
| 5. Wright et al. (1976)| Periarthritis of the shoulder. I. Aetiological considerations with particular reference to personality factors | Cross sectional    | Did not investigate association between psychological factors and PROMs               |

PROMS, patient-reported outcome measures.