Egyptian Journal of Physical Therapy (EJPT)

Egy. J. Phys. Ther. 2024; 20:33-37

Original article

https://ejpt.journals.ekb.eg

Relationship between Pain, Disability, Proprioception, and Functional Performance in Subjects with Subacromial Impingement Syndrome

Omnia Mamdouh Youssef[1*], Enas F. Youssef[2], Mohamed Abdelmegeed[3], Eman A. Kamel[4].

[1,2,3,4] Department of physical Therapy for musculoskeletal disorders and its surgery, Faculty of Physical Therapy, Cairo University, Egypt.

***Correspondence to:**
Omnia M. Youssef, Physical Therapist at Borg El-Arab hospital, Alexandria, Egypt.

Email:
omniamum899@gmail.com

Telephone:
+201140072213

Published online:
Dec 2024

Abstract:

Purpose: The aim of this cross-sectional and correlation study was to investigate the relationship between pain, disability, proprioception and functional performance in patients with subacromial impingement syndrome.

Methods: Twenty- four subjects were included in this study. Their mean age was 26.83± 4.39 and they were referred from orthopedic surgeons with diagnosis of SIS. All subjects were assessed for pain intensity and function using The Arabic Shoulder pain and disability index (SPADI), shoulder proprioception using an inclinometer to calculate the active repositioning error, and functional performance using three functional performance tests (push up, modified pull up, Davies' Closed Kinetic Chain Upper Extremity Stability). A correlation analysis was conducted between the outcome measures using Pearson's correlation coefficient.

Results: No significant relationships were found between pain, proprioception, and functional performance ($p > 0.05$). On the other hand, pain, and disability of SPADI showed significant correlation ($p \leq 0.05$). In addition, internal rotation repositioning error showed a significant correlation with push up test, push up significantly correlated with pull up test. Moreover, there was direct significant correlation between push up and CKC tests ($p \leq 0.05$).

Conclusion: Functional performance of patients with SIS is correlated with the degree of pain and disability and should be considered in the assessment while should joint proprioception does not seem to be correlated with the measured outcome variables.

Key words: Subacromial impingement syndrome; proprioception; functional performance, Shoulder pain and disability index.

1.Introduction:

Shoulder disorders are one of the most frequent musculoskeletal problems among workers (1). In the United Kingdom, the estimated percentage of patients seeking treatment for shoulder disorders in general practice is between 20% and 50% during the course of their lives (2). One in every four of these individuals sought medical assistance for Subacromial impingement syndrome (SIS) (3).

Shoulder impingement is caused by inflammation and degradation of anatomical components in the subacromial space (4). Several hypotheses have been proposed to explain the pathophysiology of the SIS; however, an accurate explanation has yet to be identified. (5). According to some theories, the lack of vascularity at the supraspinatus tendon insertion could possess an integral part in the etiology of degenerative rotator cuff tears. (5).

Pleas cite this article as follows: Omnia Mamdouh Youssef, Enas F. Youssef, Mohamed Abdelmegeed, Eman A. Kamel. Relationship between Pain, Disability, Proprioception, and Functional Performance in Subjects with Subacromial Impingement Syndrome. EJPT. EJPT. 2024; 20:33-37.

Although impingement symptoms may develop after a trauma, the pain usually appears gradually over a period of weeks to months. The pain is usually centered on the anterolateral acromion and spreads to the lateral mid-humerus (6).

As a result, the impact of pain affects both efferent (motor output) and afferent (proprioception) pathways. Motor cortex inhibition occurs rapidly in reaction to pain, but it decreases once levels of perceived pain stabilize for a period of time and the patient expects no additional increase in pain perception. The altered motor behavior is often assumed to provide short-term protection of the injured/painful tissue (7).

Besides, tonic muscular nociception, which is accompanied by severe loss of position awareness and stimulus perception, also influences afferent pathways. There is evidence that patients with chronic rotator cuff pain and patients with nonspecific shoulder pain have worse active joint reposition perception as compared to healthy controls (7).

In general, the musculoskeletal physical exam focuses on measuring range of motion and muscular strength of the affected limb, which may not provide adequate information on the overall functional level of activity of the affected limb. Therefore, shoulder examination could be more effective by integrating techniques that measure functional movements and biomechanical impairments that occur in occupational or daily life activities. Functional testing could be regarded as a beneficial additional low-cost clinical technique for providing quantitative data about a body segment's functional ability and performance. Some tests can also be used to track the progress of a rehabilitation protocol by evaluating, for example, a patient's performance and ability during a physical task (8).

Despite the great advances in various therapeutic applications, there is lack of research information about considering the relationship between pain, disability, proprioception, functional performance. Consequently, the purpose of this study was to investigate the relationship between pain, disability, proprioception, and functional performance in patients with SIS.

2.Patients and Methods:

2.1. Study design:

Measurements of pain, disability, proprioception, and functional performance were collected from twenty-four patients diagnosed with SIS. This study was designed as cross-sectional and observational analysis. This study was carried out in the Borg El-Arab hospital's outpatient clinic between October 2022 and June 2023, with ethical committee permission from the Institutional Review Board (IRB) of the Faculty of Physical Therapy, Cairo University (approved number: PT.REC/012/004032). The trial was registered on Clinicaltrials.gov with the registration number (NCT05955820).

2.2. Participants:

Twenty-four male and female patients with a mean age of 26.83± 4.39. There were 10 females (41.6%) and 14 males (58.3%) referred from orthopedic surgeon with diagnosis of SIS. Patients were included if they had complaining of SIS (more than three months), their body mass between 18-25 and showed positive results in at least two of the following tests: Neer's impingement test, Hawkins-Kennedy test, supraspinatus (empty can) test, apprehension and relocation test (9).

2.3. Assessment procedure:

The goal of the study was described to the qualified participants for the study, and the principal investigator (PI) fully clarified all of the elements on the informed consent form and answered any questions or concerns. After that, the subjects were requested to sign an informed consent form. Patients' demographics were collected after assignment, and pain, disability, proprioception, and functional performance were evaluated.

Pain and Disability Assessment:

The shoulder pain and disability index (SPADI) subscale were used to assess pain and disability associated with shoulder pathology in the subjects. The SPADI has high internal consistency, test-retest reliability, as well as criteria and concept validity. It was also believed to be effective at detecting changes in patients' conditions over time. (10).

Proprioception Assessment:

The inclinometer was used to assess proprioception through four glenohumeral joint motions (flexion, extension, external rotation, and internal rotation). Using the active repositioning test, the subjects were instructed to actively reproduce the target angle of the four ranges of motion. The reliability analysis of this device obtained an ICC value was 0.99 (11).

Functional Performance Assessment:

Three activities requiring upper body strength and power were performed by all subjects to assess the functional performance, including the Push-Up test (reliability of ICC = 0.96), the Modified Pull-Up test (reliability of ICC = 0.99) and Davies Closed Kinetic Chain Upper Extremity Stability test (reliability of ICC = 0.92) (12).

3.Data Analysis:

The statistical package for social sciences (SPSS) computer program version 27 software for Windows (IBM SPSS Inc., Chicago, IL, USA) was utilized to analyze the data. For continuous variables, descriptive statistics were given as mean standard deviation and frequency distribution (%) for categorical variables.

The Shapiro-Wilk statistical test was used to determine the data's normality. Pearson's correlation coefficient was used to calculate a correlation between the variables under consideration. Pearson's correlation coefficients were estimated to be 0-0.19 extremely weak, 0.2-0.39 weak, 0.4-0.69 moderate, 0.7-0.89 strong, and 0.9-1.00 very strong. The alpha value was set at $p = 0.05$. The level of significance was established at $p < 0.05$ for all statistical tests.

4. Results:

A total of 24 participants with impingement syndrome completed the study. Their mean age was 26.83± 4.39. There were 10 females (41.6%) and 14 males (58.3%) in total. The Shapiro-Wilk test revealed a mixture of normal and non-normally distributed variables, but after visual examination of the histograms and QQ plots, parametric tests were more appropriate to conduct.

Pearson correlation coefficient showed no significant differences were found between pain, proprioception, and functional performance ($p>0.05$). On the other hand, pain, and disability of SPADI showed significant correlation ($p \leq 0.05$). In addition, internal rotation repositioning error showed a significant correlation with push up test, push up significantly correlated with pull up test. Moreover, there was direct significant correlation between push up and CKC tests ($p \leq 0.05$) (**Table 1).**

Table (1): Correlation between the tested variables.

	Pain SPADI	Disability SPADI	Total SPADI	Flex. Rep.	Ext. Rep.	ER. Rep.	IR. Rep.	Push Up	Pull Up	CKC
Pain SPADI	-	0.668**	.896**	-.098	.098	-.284	-.174	.357	.068	.008
Disability SPADI	.668**	-	.904**	.119	-.169	.015	-.224	.320	.169	.093
Total SPADI	.896**	0.904**	-	.029	-.027	-.112	-.194	.335	.110	-.011
Flex. Rep.	-0.098	0.119	0.029	-	0.01	-.145	.091	-.251	.003	-.117
Ext. Rep.	0.098	-0.169	-0.027	0.01	-	-.133	.013	-.114	-.159	.117
ER. Rep.	-0.284	0.015	-0.112	-.145	-.133	-	.340	-.073	.011	-.251
IR. Rep	-0.174	-0.224	-0.194	.091	.013	.340	-	-.317	-.417*	-.33
Push Up	0.357	0.32	0.335	-.251	-.114	-.073	-.317	-	.455*	.430*
Pull Up	0.068	0.169	0.11	.003	-.159	-.011	-.417*	.455*	-	.036
CKC	0.008	0.093	-0.011	-.117	.117	-.251	-.330	.43*	.036	-

***Correlation is significant at p-value ≤ 0.05 (2-tailed)**
****Correlation is significant at p-value ≤ 0.01 (2-tailed)**
Abbreviations: SPADI: Shoulder Pain and Disability Index, ER: external rotation, IR: internal rotation, Rep: repositioning, CKC: Davies Closed Kinetic Chain Upper Extremity Stability.

5. Discussion:

This study analyzed the relationship between pain, disability, proprioception and functional performance in subjects with SIS. The result showed a correlation between pain and disability in SPADI. It appears likely that shoulder pain and shoulder disability are highly associated. Our findings were in line with another study that the correlation between the pain and disability subscales was 0.87 ($p < 0.01$) (10). One way to classify numerical pain ratings is based on pain impact on functioning (13). Clinically, higher pain level is a direct influence of disability. Thus, pain may lead to changes in disability, even though progression in disability decreases episodes of pain in the chronic stage probably due to the adaptability of the soft tissue (14).

In addition, proprioception tests did not correlate with any of the variables except internal rotation

repositioning error which showed a significant correlation with push up test ($p \leq 0.05$). This conclusion is contradicted by further studies that indicated strong positive relationships between joint position error at different degrees of flexion and rotation and pain severity and disability (15). On the other hand, the outcomes of this study are consistent with prior study on the correlation between shoulder proprioception and pain intensity in people with subacromial impingement syndrome (SIS) (16).

There was a lack in correlation between shoulder internal rotation proprioception and the push up test performance. This result is incompatible with previous study compared the effects of open and closed kinetic chain exercise on shoulder joint reposition sense. In that study, the shoulders were more sensitive to external rotation than to internal rotation (17). This was theorized by Blasier et al. (18) who found this discrepancy is caused by a relative tightening of the capsular ligaments and rotator cuff tendons as the shoulder externally rotates from abducted externally rotated arm. In contrast, internal rotation from the externally rotated position toward the neutral position relaxes the capsule and rotator cuff.

The lack of correlation may be due to the small sample size investigated in this study. Considering the inclinometer application, there was limitation to this instrument. Since the inclinometer uses a fixed vertical reference point realized by gravity, it is stable as long as the zero point is precisely calibrated and set. Therefore, understanding the instrument's positioning is critical when making various measurements to avoid the screen rotating at 45° (19). Also, the inclinometer was taped to the participant's limb using straps. Consequently, these straps have to fasten and fit precisely around the limb to keep the inclinometer in place and prevent it moving from place. Additionally, we used one type of inclinometer in this study, repeating target angle measurements three times for each motion to avoid this problem .

Our study showed that the push up significantly correlated with pull up test ($p \leq 0.05$). Also, there was direct significant correlation between push up and CKC tests ($p \leq 0.05$). In contrast, there was a deficit of significant difference between the pull up and CKC. This contradicts another study which indicated that all the upper extremity tests for functional performance demonstrate significant relationships with one another (12). This could be explained by that the sample size in our study was small to show enough correlation between variables .

Another possible explanation is that pull up testing appeared to be more difficult than the remnant tests, this could result in lower performance in pull up test from the participants than the other tests. Thus, the result may show unrealistic numbers and may be influenced by participants' interests. Additionally, pull up test depends on group of muscles on the upper limb such as brachioradialis, biceps brachii, middle deltoid, upper pectoralis major, lower trapezius, latissimus dorsi and infraspinatus (20).

Therefore, participants with weak upper limb muscles may experience difficulty in performing this test in spite of the impairment. However, the sample size was insufficient to demonstrate correlation. We recommend that future research may be conducted to investigate the correlation between the same variables with large group samples.

6. Study limitations:

The small sample size could hinder the generalizability of this study's findings. It is likely that if we had used a bigger sample size, our results would have been different. Second, since we only kept in touch with the participants at the time of assessment only, we were unable to assess the long-term results. Third, the method used for assessment of proprioception using an inclinometer may have been subjected to examiner's bias.

6. Conclusion:

Functional performance of patients with SIS is correlated with the degree of pain and disability and should be considered in the assessment while should joint proprioception does not seem to be correlated with the measured outcome variables.

Funding:

The study was not funded by any organization or entity.

Conflict of Interests:

The authors declare that they have no potential conflicts of interest.

Acknowledgement:

We are grateful to all the individuals who participated in this work, we appreciate their help.

Reference:

1) Roquelaure Y, Ha C, Leclerc A, Touranchet A, Sauteron M, Melchior M, et al. Epidemiologic surveillance of upper-extremity musculoskeletal disorders in the working population. Arthritis & Rheumatism. 2006;55(5):765–78.
2) Linsell L, Dawson J, Zondervan K, Rose P, Randall T, Fitzpatrick R, et al. Prevalence and incidence of adults consulting for shoulder conditions in UK primary care; patterns of diagnosis and referral. Rheumatology. 2005 Nov 1;45(2):215–21.

3) Bodin J, Ha C, Petit Le Manac'h A, Sérazin C, Descatha A, Leclerc A, et al. Risk factors for incidence of rotator cuff syndrome in a large working population. Scandinavian Journal of Work, Environment & Health. 2012 Feb 27;38(5):436–46.
4) Michener LA, Walsworth MK, Doukas WC, Murphy KP. Reliability and Diagnostic Accuracy of 5 Physical Examination Tests and Combination of Tests for Subacromial Impingement. Archives of Physical Medicine and Rehabilitation. 2009 Nov;90(11):1898–903.
5) Consigliere P, Haddo O, Levy O, Sforza G. Subacromial impingement syndrome: management challenges. Orthopedic Research and Reviews. 2018 Oct;Volume 10:83–91.
6) Umer M, Qadir I, Azam M. Subacromial impingement syndrome. Orthopedic Reviews. 2012 May 31;4(2):18.
7) Struyf F, Lluch E, Falla D, Meeus M, Noten S, Nijs J. Influence of shoulder pain on muscle function: implications for the assessment and therapy of shoulder disorders. European Journal of Applied Physiology. 2014 Nov 28;115(2):225–34.
8) Tucci HT, Martins J, Sposito G de C, Camarini PMF, de Oliveira AS. Closed Kinetic Chain Upper Extremity Stability test (CKCUES test): a reliability study in persons with and without shoulder impingement syndrome. BMC Musculoskeletal Disorders. 2014 Jan 3;15.(١)
9) Cotter EJ, Hannon CP, Christian D, Frank RM, Bach BR. Comprehensive Examination of the Athlete's Shoulder. Sports Health: A Multidisciplinary Approach. 2018 Feb 14;10(4):366–75.
10) Roach KE, Budiman-Mak E, Songsiridej N, Lertratanakul Y. Development of shoulder pain and disability index. Arthritis Care and Research: The Official Journal of the Arthritis Health Professions Association [Internet]. 1991;4(4):143–9.
11) Dover GC, Kaminski TW, Meister K, Powers ME, Horodyski M. Assessment of Shoulder Proprioception in the Female Softball Athlete. The American Journal of Sports Medicine. 2003 Mar;31(3):431–7.
12) Negrete RJ, Hanney WJ, Kolber MJ, Davies GJ, Riemann B. Can upper extremity functional tests predict the softball throw for distance: a predictive validity investigation. International journal of sports physical therapy [Internet]. 2011;6(2):104–1
13) Turner JA, Franklin G, Heagerty PJ, Wu R, Egan K, Fulton-Kehoe D, et al. The association between pain and disability. Pain. 2004 Dec;112(3):307–14.
14) MacDermid JC, Solomon P, Prkachin K. The Shoulder Pain and Disability Index demonstrates factor, construct and longitudinal validity. BMC Musculoskeletal Disorders. 2006 Feb 10;7.(١)
15) Ager AL, Borms D, Deschepper L, Dhooghe R, Dijkhuis J, Roy JS, et al. Proprioception: How is it affected by shoulder pain? A systematic review. Journal of Hand Therapy. 2019 Aug; 33.4:507-516.
16) Alfaya FF, Ravi Shankar Reddy, Batool Abdulelah Alkhamis, Praveen Kumar Kandakurti, Mukherjee D. Shoulder Proprioception and Its Correlation with Pain Intensity and Functional Disability in Individuals with Subacromial Impingement Syndrome—A Cross-Sectional Study. 2023 Jun 17;13(12):2099–9.
17) Rogol IM, Ernst G, Perrin DH. Open and closed kinetic chain exercises improve shoulder joint reposition sense equally in healthy subjects. Journal of athletic training [Internet]. 1998 [cited 2023 Jul 21];33(4):315–8 .
18) Blasier RB, Carpenter JE, Huston LJ. Shoulder proprioception. Effect of joint laxity, joint position, and direction of motion. Orthopaedic Review [Internet]. 1994 Jan 1 [cited 2023 Jul 21];23(1):45–50.
19) Kolber MJ, Pizzini M, Robinson A, Yanez D, Hanney WJ. The reliability and concurrent validity of measurements used to quantify lumbar spine mobility: an analysis of an iphone® application and gravity based inclinometry. International journal of sports physical therapy [Internet]. 2013;8(2):129–37 .
20) Dickie JA, Faulkner JA, Barnes MJ, Lark SD. Electromyographic analysis of muscle activation during pull-up variations. Journal of Electromyography and Kinesiology. 2017 Feb; 32:30–6.

Pleas cite this article as follows: Omnia Mamdouh Youssef, Enas F. Youssef, Mohamed Abdelmegeed, Eman A. Kamel. Relationship between Pain, Disability, Proprioception, and Functional Performance in Subjects with Subacromial Impingement Syndrome. EJPT. EJPT. 2024; 20:24-28.