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ORIGINAL ARTICLE

The Evaluation of Sleep Hygiene in Subacromial Impingement Syndrome: A Case Control Study

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Abstract

Introduction: The aim of our study is to evaluate the pain, function, and sleep quality of patients with Subacromial Impingement Syndrome (SIS) and to reveal the relationship of this situation with the presence of depression in patients with sleep disorders.

Methods: Patients aged between 30-60 years with nocturnal shoulder pain who were diagnosed with SIS (SIS group) and healthy individuals (control group) whose age and gender were matched were included. The presence of SIS was confirmed with clinical evaluation and Subacromial Injection Test (SIT). Visual Analogue Scale (VAS) at rest, during activity, and at night were recorded. Pain and disability of the shoulder were assessed by the Shoulder Disability Questionnaire and American Shoulder and Elbow Surgeons (ASES) Standardized Shoulder Assessment Form. Pittsburgh Sleep Quality Index (PSQI) and Sleep Hygiene Index (SHI) were used to evaluate sleep quality. The diagnosis of depression was made according to the Beck Depression Inventory (BDI).

Results: Sleep quality assessed by PSQI total score and SHI were significantly decreased in the SIS group (p=0.010, p=0.017, respectively). The SIS group had significantly higher PSQI sleep latency and sleep disturbances scores (p=0.045, p=0.019, respectively). The SIS group had mild depression according to BDI (p=0.001). In the SIS group, PSQI subscores (sleep latency, sleep disturbances) and SHI score were moderately significantly correlated with BDI score (p<0.05).

Discussion and Conclusion: Sleep quality may deteriorate in SIS patients compared to the healthy control group. In these patients, there may be a relationship between some of the subscores showing the deterioration in sleep quality and depression.

Keywords: Shoulder Pain; Sleep Hygiene; Subacromial Impingement Syndrome.

Subacromial Impingement Syndrome (SIS) occurs due to mechanical compression of rotator cuff tendons as they pass through the subacromial space, which can result in shoulder pain and functional restriction, especially in overhead activities[1]. Night pain is a frequently encountered problem in SIS[2]. Although there are some proposed factors, the pathogenesis of nighttime shoulder pain is unclear. Sleeping postures and the chronicity and severity of the pathology are among some factors that may lead to night pain[3-6].

Patients who have intense pain state a variety of sleep disturbances like delayed sleep onset, increased number of awakenings, and short duration of sleep[6-12]. Pain and sleep disturbance can mutually affect each other with complex mechanisms that ultimately influence biological and behavioral well-being. Painful pathologies frequently disturb sleep and thus negatively affect daytime activities. Moreover, appropriate diagnosis and treatment of the sleep complaint may decrease pain symptoms in several diseases

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and help break the vicious cycle[9,13,14]. Surprisingly, in spite of a strong relationship between sleep and pain, there are few studies investigating this association with established psychometric properties[15,16].

Numerous patients with shoulder pathologies can have sleep problems; patients with frozen shoulder are especially vulnerable to sleep disturbance,[17] and a strong association of pain, anxiety, and poor sleep quality was found in a study[18]. Shorter sleep periods, frequent waking ups, and decreased daily performance were found in patients with rotator cuff tears[19]. Significant differences in Pittsburgh Sleep Quality Index (PSQI) global scores and subdivisions were discovered between SIS patients and healthy individuals. The subjective sleep quality, sleep latency, sleep length, habitual sleep efficiency, and sleep disruption scores were all positively linked with the Shoulder Disability Questionnaire (SDQ) pain ratings[12].

Although there are some studies reporting the association between shoulder disease and sleep disturbance, we present the first study using the Sleep Hygiene Index in patients with SIS. Our own personal experience and observations of patients tell us that the majority of patients with SIS suffer from night pain. In this respect, we conducted this study to more clearly interpret the relation between nocturnal shoulder pain and sleep quality in patients with SIS, and also to define the relation amongst sleep-related issues and the presence of depression in these patients.

Materials and Methods

Study Design

This cross-sectional case-control study was carried out at a Physical Medicine and Rehabilitation clinic. After approval by the Ethics Committee, all participants signed a written informed consent form. The research was conducted in accordance with the Helsinki Declaration.

Participants

Patients aged 30-60 years diagnosed with SIS and age and sex-matched healthy subjects were included in the research. Demographic information (age, sex, body mass index (BMI), education) was recorded. Diagnosis of SIS was confirmed according to the history, clinical examinations, radiological investigations, and subacromial injection tests. Injection of 5 ml of 2% lidocaine beneath the anterior acromion in a sitting position was performed as a subacromial impingement test[20,21]. A positive test result is interpreted as a decrease in pain by 50 percent and an increase in shoulder movement nearly to the normal range. Patients with the following exclusion criteria were not accepted into the study:

- Primary shoulder disorders other than SIS or acromioclavicular pathology
- Cervicogenic pain
- Rheumatologic diseases
- Neoplastic diseases
- Central and peripheral nervous system disorders
- Recent shoulder operation
- Recent shoulder trauma, fracture, or dislocation
- Having had physical therapy, medical therapy, or an injection in the past 3 months.

Evaluations

All patients were evaluated with the Shoulder Disability Questionnaire (SDQ), American Shoulder and Elbow Surgeons (ASES) Shoulder Assessment Form, Pittsburgh Sleep Quality Index (PSQI), Sleep Hygiene Index (SHI), and Beck Depression Inventory (BDI). Visual Analogue Scale (VAS) at rest, during activity, and at night were recorded. The duration of the disease was recorded. These evaluations were performed at the initial visit.

Shoulder Disability Questionnaire

The SDQ is a 16-item questionnaire that assesses the functional status of patients with shoulder disorders during the last 24 hours[22]. The Turkish validity and reliability studies were performed by Ozsahin et al.[23] Answer options are divided into "yes," "no," or "not applicable." The SDQ score ranges from 0 to 100, with a higher score indicating a greater level of disability[24,25].

American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form

The American Shoulder and Elbow Surgeons (ASES) shoulder evaluation form includes objective and subjective elements. The ASES is divided into two parts: a patient self-evaluation component and a physician-led assessment. In the patient self-evaluation section, there are 11 elements that are used to calculate a score, grouped into two categories: pain (1 item) and function (10 items). The pain question is graded on a scale of 0 to 10 on a visual analogue scale. Patients are asked whether they can execute ten daily activities in the function questions. The results of the pain and function subsections are converted to percentages, each representing 50% of the total score. The ASES scores range from 0 to 100, with higher scores indicating better outcomes. In the Turkish population, the

ASES has shown excellent psychometric performance for individuals with various shoulder diseases[26].

Pittsburgh Sleep Quality Index

The Pittsburgh Sleep Quality Index (PSQI) is a 24-item questionnaire that evaluates sleep quality over the previous month. Of these, 18 items are used in the scoring, divided into seven categories: sleep quality, sleep latency, sleep length, habitual sleep efficiency, sleep disruptions, use of sleeping medication, and daytime dysfunction. The total PSQI score is calculated by adding the points from these components, with each component scored on a scale of 0-3. The total PSQI score ranges from 0 to 21, where a PSQI total score of 5 or more indicates poor sleep quality[27].

Sleep Hygiene Index

The Sleep Hygiene Index (SHI) is a 13-item self-administered questionnaire designed to measure environmental and behavioral factors that may contribute to insufficient sleep[28]. Participants were asked how often they engaged in certain behaviors[29]. When all of the categories are added together, a global assessment score for sleep hygiene is calculated, ranging from 13 to 65. Higher scores are associated with more maladaptive sleep hygiene habits. Ozdemir and colleagues conducted the Turkish validity and reliability investigations in 2015[30].

Beck Depression Inventory

The Beck Depression Inventory (BDI) was developed by Beck in 1961 to assess the risk of depression in adults and to evaluate the levels and changes in the severity of depressive symptoms[31,32]. The cut-off point for the scale was set at 17. It is a Likert-type self-report scale. Each item is linked to a behavioral trait observed in people who are depressed. The items are graded on a scale of 0 to 3 points, depending on the severity of the depression. The total score ranges from 0 to 63.

Statistical Analysis

The Statistical Package for the Social Sciences, version 20.0 (SPSS, Chicago, IL), was used for all statistical analyses. Descriptive statistics were expressed as mean and standard deviation (SD). Categorical variables were represented by number (n) and percentage (%). The Shapiro-Wilk or Kolmogorov-Smirnov tests were used to assess the normality of the data. Independent samples t-tests were used for comparing variables with normal distribution between groups, while Mann-Whitney U tests were used for variables lacking normal distribution. The correlations of within-group variables were evaluated with Pearson correlation tests (for normally distributed data) and Spearman correlation tests (for non-normally distributed data). Nominal data were compared using the Chi-square test. A p-value of <0.05 was considered statistically significant in all analyses.

Power analysis was performed using G*Power version 3.1.9.7 software (Heinrich-Heine-Universität Düsseldorf, Düsseldorf, Germany). The sample size was calculated with respect to the PSIQ total score. To evaluate the difference between the means of two independent groups, a t-test was used. A sample size of 48 patients per group was required to achieve a significance level of 5%, an effect size of 75%, and a power of 95%, while a maximum loss rate of 20% was accounted for.

Results

A total of 169 patients with shoulder pain were evaluated. 50 were excluded from the study because their age did not match, 17 had other illnesses, and 47 had other causes of shoulder pain. The study was completed with 55 patients in the SIS group and 49 patients in the healthy control group, and statistical analyses were performed (Fig. 1).

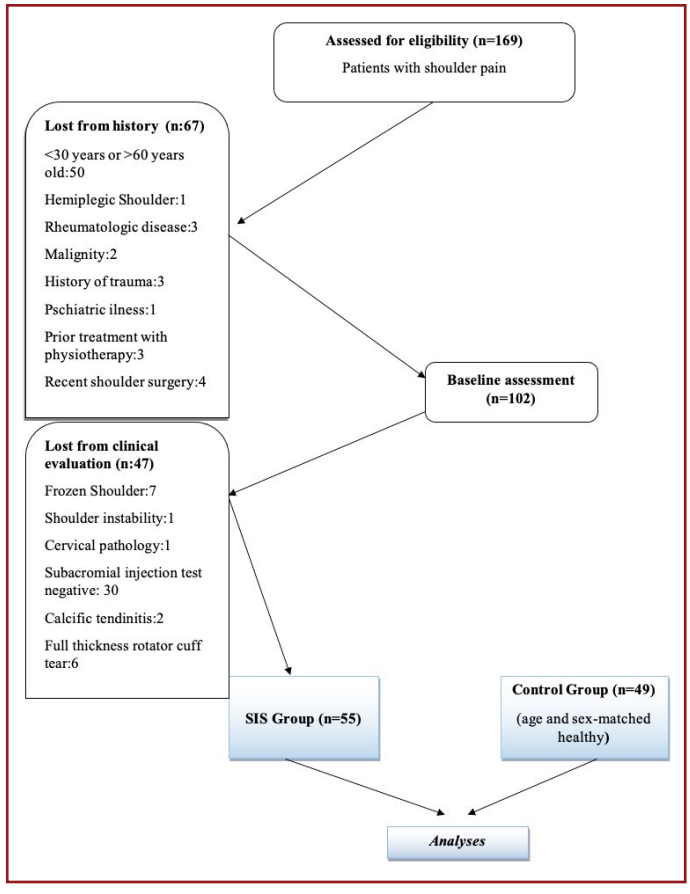

Figure 1. Study Flow Chart.

The average age of the participants, who were mostly women, was 47. In terms of demographic variables, there was no significant difference between the groups (p>0.05) (Table 1).

All patients in the SIS group had night pain. The mean night, activated, and resting VAS scores of the patients in this group were 7.5, 7.1, and 4.1, respectively. The SIS group had significantly higher PSQI total scores and SHI scores, both of which reflect sleep quality (p=0.010, p=0.017, respectively) (Table 2). These findings support the deterioration of sleep quality in SIS patients.

Furthermore, the mean BDI score in the SIS group (15.6) indicated mild depression, which was substantially

Table 1. Demographic Characteristics

Parameters	SIS Group (n=55)	Control Group (n=49)	p
Age (years), mean (SD)	47.7 (7.5)	47.2 (8.4)	0.720**
Sex, n (%)			0.304^{+}
Male	14 (25.4)	17 (34.7)	
Female	41 (74.5)	32 (65.3)	
BMI (kg/m^2), mean (SD)	26.4 (2.3)	26.2 (2.5)	0.665**
Education, n (%)			0.395^{+}
Primary school	27 (49.1)	25 (51)	
Middle school	9 (16.3)	7 (14.3)	
High school	16 (29.1)	10 (20.4)	
University	3 (5.5)	7 (14.3)	

SIS: Subacromial Impingement Syndrome; SD: standard deviation; **Independent samples t-test; $^{+}$Chi-square test.

Table 2. Results and Comparison of Pain, Sleep Quality, and Function Scores in SIS and Control Groups

Parameters	SIS Group (n=55)	Control Group (n=49)	p
Time of Disease (months)	5.7 (3.0)	0 (0)	0.000*
VAS			0.000*
Resting	4.1 (3.0)	0 (0)	
Activity	7.1 (2.5)	0 (0)	
Night	7.5 (2.7)	0 (0)	
ASES			0.000*
Pain	20.0 (11.8)	44.3 (11.4)	
Function	24.0 (10.2)	42.7 (9.0)	
Total	44.0 (17.7)	84.9 (20.4)	
SDQ	80.7 (16.9)	13.9 (25.2)	0.000*
PSQI			0.010**
Subjective Sleep Quality	1.6 (0.9)	1.3 (0.9)	0.082*
Sleep Latency	1.7 (1.0)	1.3 (1.0)	0.045*
Sleep Duration	1.1 (0.9)	1.0 (0.9)	0.622*
Habitual Sleep Efficiency	0.6 (1.1)	0.4 (0.9)	0.480*
Sleep Disturbances	1.8 (0.7)	1.5 (0.7)	0.019*
Medication Use for Sleep	0.2 (0.8)	0.1 (0.4)	0.077*
Daytime Dysfunction	1.2 (1.0)	0.9 (0.8)	0.057*
Total	8.4 (3.6)	6.6 (3.4)	
SHI	14.0 (6.0)	11.3 (8.0)	0.017*
BDI	15.6 (8.6)	9.7 (8.4)	0.001**

SIS: Subacromial Impingement Syndrome; VAS: Visual Analogue Scale; ASES: American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form; SDQ: Shoulder Disability Questionnaire; PSQI: Pittsburgh Sleep Quality Index; SHI: Sleep Hygiene Index; BDI: Beck Depression Inventory; SD: standard deviation; *Mann-Whitney U test; **Independent samples t-test.

Table 3. Intragroup correlations of variables in the SIS group

SIS group (n=55)	Duration of disease	VAS			ASES			SDQ	PSQI								SHI	BDI
		Resting	Activity	Night	Pain	Function	Total		Subjective sleep quality	Sleep latency	Sleep duration	Habitual sleep efficiency	Sleep disturbances	Medication use for sleep	Daytime dysfunction	Total		
Duration of disease								r: -0.336 p: 0.012										
VAS																		
Resting				r: 0.036 p: 0.023	r: -0.298 p: 0.027		r: -0.320 p: 0.017							r: 0.316 p: 0.019			r: -0.295 p: 0.029	
Activity				r: 0.302 p: 0.025	r: -0.281 p: 0.038													
Night		r: 0.306 p: 0.023	r: 0.302 p: 0.025					r: 0.337 p: 0.012			r: 0.392 p: 0.003	r: 0.304 p: 0.024						
ASES																		
Pain		r: -0.298 p: 0.027	r: -0.281 p: 0.038			r: 0.346 p: 0.010	r: 0.826 p: 0.000	r: -0.330 p: 0.014										
Function					r: 0.346 p: 0.010		r: 0.796 p: 0.000	r: -0.357 p: 0.008										
Total		r: -0.320 p: 0.017			r: 0.826 p: 0.000	r: 0.796 p: 0.000		r: -0.410 p: 0.002										
SDQ	r: -0.336 p: 0.012			r: 0.337 p: 0.012	r: -0.330 p: 0.014	r: -0.357 p: 0.008	r: -0.410 p: 0.002					r: 0.351 p: 0.009				r: 0.357 p: 0.007		
PSQI																		
Subjective sleep quality											r: 0.403 p: 0.002	r: 0.382 p: 0.004	r: 0.427 p: 0.001	r: 0.297 p: 0.028	r: 0.364 p: 0.006	r: 0.754 p: 0.000		
Sleep latency													r: 0.420 p: 0.001			r: 0.442 p:0.001		r: 0.334 p: 0.013
Sleep duration				r: 0.392 p: 0.003					r: 0.403 p: 0.002			r: 0.707 p: 0.000	r: 0.268 p: 0.048			r: 0.687 p: 0.000		
Habitual sleep efficiency				r: 0.304 p: 0.024				r: 0.351 p: 0.009	r: 0.382 p: 0.004		r: 0.707 p: 0.000					r: 0.686 p: 0.000		
Sleep disturbances									r: 0.427 p: 0.001	r: 0.420 p: 0.001	r: 0.268 p: 0.048					r: 0.510 p:0.000	r: 0.480 p: 0.002	r: 0.447 p: 0.001
Medication use for sleep		r: 0.316 p: 0.019							r: 0.297 p: 0.028							r: 0.306 p: 0.023		
Daytime dysfunction									r: 0.364 p: 0.006							r: 0.482 p: 0.000		
Total								r: 0.357 p: 0.007	r: 0.754 p: 0.000	r: 0.442 p:0.001	r: 0.687 p: 0.000	r: 0.686 p: 0.000	r: 0.510 p:0.000	r: 0.306 p: 0.023	r: 0.482 p: 0.000			
SHI		r: -0.295 p: 0.029											r: 0.480 p: 0.002					r: 0.462 p: 0.000
BDI										r: 0.334 p: 0.013			r: 0.447 p: 0.001				r: 0.462 p: 0.000	

SIS: Subacromial Impingement Syndrome; VAS: Visual Analogue Scale; ASES: American Shoulder and Elbow Surgeons Standardized Shoulder Assessment Form; SDQ: Shoulder Disability Questionnaire; PSQI: Pittsburgh Sleep Quality Index; SHI: Sleep Hygiene Index; BDI: Beck Depression Inventory; r: correlation coefficient; p: statistical value.

different from the control group (p=0.001) (Table 2).

The SDQ and ASES Shoulder Assessment Form are practical, easy to comprehend, and valid and reliable self-assessment questionnaires that do not require specific tools for administration[26]. ASES and SDQ scores in our study showed statistically significant differences in the SIS group (Table 2).

In the intragroup correlations of the variables in the SIS group, VAS, ASES, and SDQ scores were found to be correlated with each other. Additionally, PSQI sleep scores were correlated with each other, and PSQI subscores (sleep latency, sleep disturbances) and SHI scores were moderately significantly correlated with BDI scores (p<0.05) (Table 3).

Discussion

The current study's findings revealed significant sleep difficulties in a group of SIS patients. In this group of patients, deterioration in some scores of sleep quality was also partially related to depression.

Night pain is a frequently encountered problem in shoulder pathologies like SIS and adversely affects the quality of life[2,20,33,34]. In a study conducted on patients with rotator cuff tears, they reported difficulty in falling asleep and waking up frequently during the night, difficulty in finding a proper and painless sleeping position, and that sleep problems adversely affect the quality of life, thus inducing them to consult a doctor[2]. Although not among the inclusion criteria, all the patients included in this study had night pain.

Some sleep postures may increase subacromial pressure, potentially affecting blood flow and hence tendon-to-bone healing. In addition to its negative effect on tendon healing, there are some studies proving that it also exacerbates nighttime pain. Some research has suggested that lying on the affected shoulder or sleeping with the affected arm overhead are hazardous positions[35]. For this reason, proper sleep posture, which keeps subacromial pressure to a minimum, is an important part of SIS management[3].

Although there are few explanatory findings about the etiology of night pain in individuals with shoulder disorders, past studies have proposed the duration and severity of the pathology, as well as the intensity of the pain, as contributing factors[4]. When compared to a healthy group, patients with shoulder pain lasting more than three months had a greater risk of sleep disturbance. It is said that shoulder discomfort lasting three months or more is a major predictor of sleep disturbance, most likely due to concurrent night pain in shoulder diseases[5]. On the other hand, in this study, there was no relation between the duration of the disease and sleep quality.

Although it has been established that there is a link between pain severity and sleep quality, the underlying pathophysiology has yet to be fully understood. It's aforementioned that this could be due to biochemical alterations in the central nervous system[12]. Therewithal, patients with chronic painful SIS are thought to have central sensitization[36]. Sleep deprivation also leads to generalized hyperalgesia[37]. Sleep disturbance is a regular occurrence among chronic pain patients and can exacerbate pain symptoms. After a while, lack of sleep due to shoulder pain leads to hyperalgesia, thus starting a vicious cycle. There are many studies supporting hyperalgesia in SIS patients. For example, lower pain pressure thresholds were detected in local and distal parts of the involved arm in patients diagnosed with SIS, which is compatible with primary and secondary hyperalgesia.

In our study, sleep quality assessed by PSQI and SHI was significantly decreased in the SIS group. Sleep latency and sleep disturbance components were statistically significantly lower in the SIS group. It's known that depression is among the frequently encountered etiologies of sleep disturbance. There was a correlation between subscores of sleep quality (sleep latency, sleep disturbance, SHI) and depression in the SIS group.

Despite the fact that poor sleep quality has been identified in patients with both acute and chronic pain, the characteristics of the sleep problem, its etiology, and management have not been thoroughly examined. A higher frequency of awakenings and shorter sleep duration, as well as a reduction in slow wave and REM sleep, are associated with acute discomfort after surgeries. Actually, improvement in REM sleep may be the beginning of the recovery process. The nature of the sleep problem and its clinical significance in chronic pain is less established. The problem stems, in part, from the complexity and variability of chronic pain conditions, as well as their comorbidities with psychiatric disorders, most commonly depression and anxiety. The association between sleep and pain has been proven to be bidirectional in experimental settings. Sleep has an antinociceptive impact in healthy, pain-free individuals, while sleep deprivation has a hyperalgesic effect. The sleep stage specificity of this interaction has yet to be convincingly proven. Several medication classes have been explored in the management of acute and chronic pain, but no consensus has emerged on how to treat disturbed sleep in acute or chronic pain, much less

differentiated etiology-based treatment options[17,38].

One of the strengths of this study is that we were able to include a specific disease group as a result of the meticulous application of exclusion criteria and clarification of SIS with an SET-confirmed diagnosis. Additionally, this is the first study in which the SHI was used in painful pathologies of the shoulder. The fact that sleep disorder was also evaluated together with the depression scale constitutes the strength of the study. However, if a psychiatrist had conducted an evaluation of the presence of depression and associated factors, the study would have been more robust. The fact that sleep disturbance was not evaluated with polysomnographic measurements is a limitation of the study. Other limitations include the lack of a follow-up period and a relatively small sample size.

As a conclusion, sleep quality may deteriorate in SIS patients compared to healthy control group patients. In these patients, there may be a relationship between some of the subscores showing the deterioration in sleep quality and depression. Further studies focusing on the effect of treating sleep disturbance on the quality of life in SIS patients may be beneficial.

Ethics Committee Approval: Approval from the hospital Ethics Committee (University of Health Sciences Ethic Committee of Scientific Studies; Approval number: HNHEAH-KAEK 2019/176) and patient consent were completed.

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