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The Relationship of Poor Posture While Using Electronic Devices and Periscapular Shoulder Pain

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Background: Periscapular pain involves the muscles surrounding the shoulder blade, which can result from trauma, overuse or repetitive use, and poor posture. This study aimed to evaluate the prevalence of periscapular pain and the association between it and seating posture while using electronic devices, utilizing the American Shoulder and Elbow Score (ASES).

Material/Methods: This was a cross-sectional study conducted using an online questionnaire. The calculated sample size required 372 participants. The questionnaire was divided into 3 sections; sociodemographic information, risk factors for periscapular and shoulder pain, and ASES used for periscapular pain and disability assessment.

Results: We included 379 patients. The lifetime prevalence of periscapular pain was 82.1%, and 48.5% reported current periscapular pain. Females were more likely to experience it (*P* value <.001). Most respondents who experienced periscapular pain worked in jobs that combined office and fieldwork (away from the office). Periscapular pain was significantly associated with forward tilt of the neck while using electronic devices (*P*=0.017). The mean ASES was 62.18. As age advances, worse ASESs were reported.

Conclusions: Periscapular shoulder pain is a very common and under-acknowledged problem among the general population, and poor posture while using an electronic device is significantly associated with periscapular pain.

Keywords: Pain • Shoulder

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Introduction

Shoulder pain is a common health problem and the third most common musculoskeletal concern in orthopedics [1,2]. Shoulder pain significantly affects individuals' lives and work, decreasing their ability to perform daily activities and productivity [3]. Pain in the shoulder region can arise from structures within the shoulder itself, remote structures such as the neck and back, or even referred pain from internal visceral pathologies [1,4].

The mean point prevalence of shoulder pain globally is 20.9-26% [5,6]. The prevalence and risk factors associated with shoulder pain have been studied extensively. However, studies on pain at precise shoulder sites are lacking.

Working in inappropriate postures and repeating similar movements for prolonged periods, such as typing on electronic device, have been found to be associated with neck-shoulder pain [3,7-10] and can increase the risk of developing chronic shoulder pain by 80-150% [11]. Unsurprisingly, posture impacts the neck, posterior shoulder region, and upper back. Calik et al observed participants who sat in an inappropriate posture and found that upper back pain was the most frequently reported musculoskeletal concern, with a prevalence of 69.6% [12]. Among university students, the prevalence of neck and shoulder pain was 59.1%, and a higher percentage was found in participants using mobile devices while sitting with a prominent neck tilt [13].

The periscapular region is bordered by the upper trapezium and C7 spine superiorly down to the inferior angle of the scapula and T7 inferiorly; the medial border is formed by the spinous processes of the thoracic vertebrae, while the lateral margin is formed by the glenohumeral joint [14]. Any pain in this area is called periscapular pain. Pain in the periscapular or upper back region is one of the most frequently reported sites, resulting from continuous and repetitive movements causing microtrauma [15,16]. The scapular muscles (upper trapezius, serratus anterior, and anterior deltoids) elevate the scapula and are involved in over-head activities [17], which can then cause periscapular pain.

The American Shoulder and Elbow Score was developed in 1994. It is a self-evaluation score containing pain visual analog scales and an activity of daily living questionnaire. This score ranges from zero to 100, in which higher scores indicate better shoulder function [18].

As epidemiological studies on periscapular pain are extremely limited, this study aimed to evaluate periscapular pain, its prevalence, and associated risk factors in the general population in Saudi Arabia using the ASES, ultimately aiming to increase public awareness and prevent these risk factors.

Material and Methods

Study Design and Sample Size

This observational cross-sectional study was conducted on the general population of Saudi Arabia. The sample size was calculated using the standard formula for cross-sectional studies, with 95% level of confidence and 5% precision. Furthermore, we used a population prevalence estimate of 59.1%, as indicated in a prior study [12]. This prevalence estimate was crucial in determining the necessary sample size to achieve reliable results. Based on these parameters, the required sample size was calculated to be 372 participants.

Questionnaire and Data Collection

The online questionnaire (**Table 1**) was distributed on various social media platforms to general population of Saudi Arabia in September 2023. The questionnaire was divided into 3 parts: the first part assessed sociodemographic information, including age, sex, and marital status. The hypothesized risk factors were explored in the second part, in which participants were asked about their occupation, as certain types of jobs can involve prolonged sitting or repetitive over-head activities, or awkward posture that could increase risk of musculoskeletal discomfort. Moreover, we gathered information about the participants' usual posture while reading as well as their daily habits related to electronic devices use. Participants were asked how many hours they typically spent on reading, using electronic devices, and sitting behind a desk. These questions were designed to explore relationship between lifestyle and habits with periscapular pain. The third part was to assess periscapular pain and disability in participants who had experienced periscapular pain at least once in their lives, using the ASES [18]. This score ranges from zero to 100, in which higher scores indicate better shoulder condition. This score was used to provide an objective and reliable measurement to assess the impact of periscapular pain on daily activities.

Participant Selection

Participants were eligible for inclusion if they provided informed consent and were residents of Saudi Arabia, and had had to be age 16-80 years, capturing a broad range of individuals to ensure diverse representation of the general population. Individuals who did not complete the questionnaire or declined to provide consent were excluded from the study.

Ethics Statement

All participants signed an informed consent form before enrolment, and approval was obtained from the Institutional Review Board at King Saud University in June 2023, with approval number E-23-7760.

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Table 1. The 3-Section Questionnaire.

Section 1:
Q1: Gender
A. Male
B. Female
Q2: Age
Q3: Social status
A. Single
B. Married
Q4: Job status
A. Student
B. Employee
C. Retired
D. Housewife
E. I do not work
Q5: Job nature
A. Office job
B. Field job
C. Combined field and office job
D. I do not work
Q6: Does your work require carrying heavy objects or lifting the arm/upper limb above head level?
A. Yes
B. No
Section 2:
Q7: How many hours per day do you spend on office work?
Q8: What is your preferred position for reading or performing paper/office tasks?
A. Sitting on a chair at a desk
B. Sitting on a couch or bed
C. Lying on a bed or couch
Q9: How many hours do you spend using electronic devices?
Q10: What is your usual sitting posture when reading or using electronic devices (desktop/laptop) among the postures shown below? (Figure 1)
A. Posture No. 1
B. Posture No. 2
C. Posture No. 3
D. Posture No. 4
Q11: Which of the postures shown below best represents your usual back position when using mobile phones or tablets? (**Figure 2**)
A. Posture No. 1
B. Posture No. 2
Q12: Currently or previously had pain in the posterior shoulder region or around the shoulder blade?
A. Yes, I currently have it
B. Yes, I have had it in the past
C. No (end of survey)
Q13: What do you usually do to relieve posterior shoulder pain?
Q13.1: Use of topical or oral pain relievers
A. Yes
B. No
Q13.2: Use of muscle relaxant medications or ointments
A. Yes
B. No
Q13.3: Massage of the painful area
A. Yes
B. No
Q13.4: Use of warm compresses
A. Yes
B. No
Q13.5: Stretching exercises or physical therapy
A. Yes
B. No
Q13.6: Endure the pain and do nothing
A. Yes
B. No
Section 3:
Q14: What is the intensity of posterior shoulder pain at rest, if you currently have or previously had it?
Scale 0-10 (0=no pain, 10=worst pain)
Q15: What is the intensity of pain during daily activities (eg, bathing, eating, dressing)?
Scale 0-10 (0=no pain, 10=worst pain)
Q16: What is the intensity of pain during exercise or lifting heavy objects?
Scale 0-10 (0=no pain, 10=worst pain)
Q17: How satisfied are you with your ability to move or use your shoulder joint in daily tasks?
Scale 0-10 (0=not satisfied, 10=completely satisfied)

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Table 1 continued. The 3-Section Questionnaire.

Q18: Activity of daily living				
	Not difficult	Somewhat difficult	Very difficult to do	Unable to do
Is it difficult to put on a coat?				
Is it difficult to sleep on the affected side?				
Is it difficult to wash your back/do up your bra?				
Is it difficult to manage toileting?				
Is it difficult to comb your hair?				
Is it difficult for you to reach a high shelf?				
Is it difficult to lift 4.5 kg above your shoulder?				
Is it difficult to throw a ball overhand?				
Is it difficult for you to do your usual work?				
Is it difficult to do your usual sport/leisure activities?				

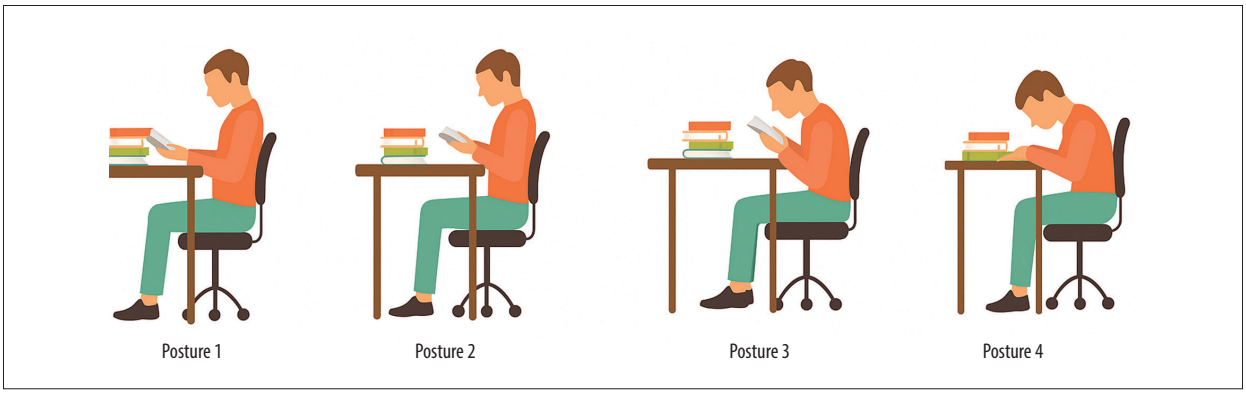

Figure 1. Different postures while using electronic devices or reading and sitting behind a desk.

Statistical Analysis

All the statistical analyses were performed using SPSS version 26.0 (IBM, Armonk, NY). Categorical variables were measured using frequencies and percentages, while continuous variables were described using mean and standard deviation analysis. The chi-squared test was used to compare responders with periscapular pain and responders without periscapular pain with respect to sociodemographic characteristics. A binary logistic regression model was evaluated for overall fit using the Hosmer-Lemeshow goodness-of-fit test. The Nagelkerke R^2 was used to estimate the proportion of variance explained by the model. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for each predictor to determine the strength and direction of associations. Assessment of the statistical significance of the ASES scores across the qualitative independent variables was performed using an independent *t* test and one-way ANOVA, while Pearson's correlation was used to assess the statistical significance of ASES scores across quantitative variables. The significance level was set at 0.05.

Results

Demographic Data

A total of 379 participants completed the questionnaires; 60.4% were female (229), and the mean age was 39.28 years. Most participants were employed (200, 52.8%), 36.4% performed a combination of office and fieldwork, and 59.9% were not required to perform over-head tasks. The mean time respondents spent on office work and reading was 5.1 h per day, and 6.62 h were spent using electronic devices. Of the participants, 56.7% preferred sitting on a chair behind a desk, 27.2% preferred sitting on a bed or sofa, and 16.1% preferred lying on a bed or sofa. Participants were asked which posture was their usual while sitting behind a desk, referring to **Figure 1**; 28.8% and 28% of the participants preferred postures 1 and 2, respectively. The least favored posture was Posture 4 (19.8%). Most participants (69.9%) reported Posture 2 as their usual position while using electronic devices while standing or walking (**Figure 2**), all of which are summarized in **Table 2**.

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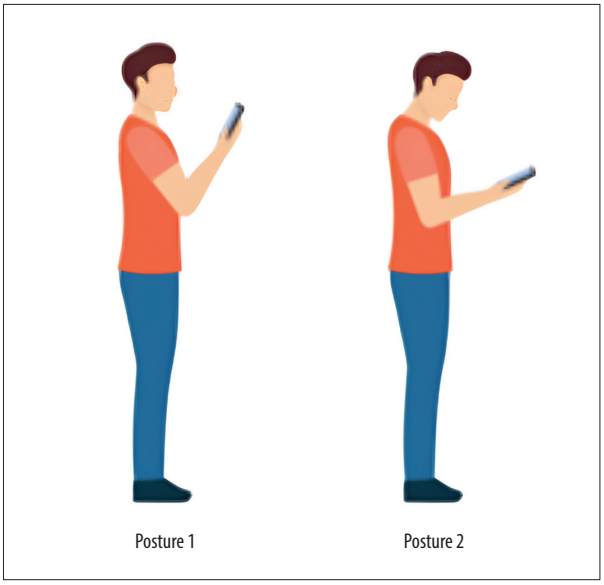

Figure 2. Different postures while using electronic devices while standing or walking.

Periscapular Pain Prevalence

Approximately 48.5% reported that they currently had periscapular pain, 33.5% had previously had it, and 82.1% had experienced periscapular pain at least once in their lives. Females were significantly more likely to experience periscapular pain than males (**Table 3**).

The prevalence of periscapular pain was the highest among those in the 33-42 years age group (89.6%), followed by 85% in the 43-52 years age group, while the lowest was in the 23-32 years age group (76.1%).

Factors Associated with Periscapular Pain

The favorite sitting positions while reading or finishing paperwork did not show a statistically significant difference between participants who reported periscapular pain and those who did not. Furthermore, the different postures in **Figure 1** while sitting behind a desk were not significantly different between the

Table 2. Participants' general characteristics.

		Frequency (%)	
Gender	Male	150	(39.6%)
	Female	229	(60.4%)
Age (years)	<23	29	(7.7%)
	23-32	113	(29.8%)
	33-42	77	(20.3%)
	43-52	80	(21.1%)
	53-62	71	(18.7%)
	>62	9	(2.4%)
Marital status	Single	139	(36.7%)
	Married	240	(63.3%)
Occupation	Student	52	(13.7%)
	Employee	200	(52.8%)
	Retired	60	(15.8%)
	Housewife	53	(14%)
	Not working	14	(3.7%)
Job nature	Office work	93	(24.5%)
	Field work	43	(11.3%)
	Office and field work	138	(36.4%)
	Not working	105	(27.7%)
Work requiring over-head activities	Yes	94	(24.8%)
	no	227	(59.9%)
	Not working	58	(15%)

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Table 2 continued. Participants' general characteristics.

		Frequency (%)
Reading/office work time (hours)	<3	97 (25.6%)
	3-4	61 (16.1%)
	5-6	78 (20.6%)
	7-8	107 (28.2%)
	9-10	29 (7.7%)
	>10	7 (1.9%)
Using electronic devices time (hours)	<3	34 (9%)
	3-4	87 (23%)
	5-6	109 (28.8%)
	7-8	51 (13.5%)
	9-10	53 (14%)
	11-12	21 (5.5%)
	>12	24 (6.3%)
Work requiring over-head activities. In which position you prefer reading or finishing paperwork?	I prefer sitting on chair at desk	215 (56.7%)
	I prefer sitting on sofa or bed	103 (27.2%)
	I prefer lying on sofa or bed	61 (16.1%)
Which one is your usual posture while reading or using electronic devices? (**Figure 1**)	Posture 1	109 (28.8%)
	Posture 2	89 (23.5%)
	Posture 3	106 (28%)
	Posture 4	75 (19.8%)
Which one is your usual posture when using phone while walking/standing? (**Figure 2**)	Posture 1	114 (30.1%)
	Posture 2	265 (69.9%)

2 groups. However, standing or walking while using electronic devices with the neck tilted forward was significantly associated with periscapular pain (*P*=.013) (**Figure 2**). Binary logistic regression was performed to identify predictors of periscapular pain, and a significant predictor was Posture 2 (**Figure 2**) while using electronics, which had significantly higher odds of pain (OR=2.15, 95% CI 1.15-4.04, *P*=0.017). The mean intensity of periscapular pain was 5.63 out of 10. Night-after-night pain was reported by 47% of all responders who experienced periscapular pain. Massage (63.6%) and topical or oral muscle relaxants (54.9%) were the most common ways used to manage periscapular pain.

The American Shoulder and Elbow Score

The mean ASES was 62.18 out of 100. Males had a statistically significant higher ASES (mean=68.5, SD=15.68) than females (mean=58.4, SD= 15.62), with a *P* value <0.001. Age was negatively correlated with ASES (*P*<.001), and married participants reported a significantly lower ASES (mean=59.7, SD=16.97) than single participants (mean=66.7, SD=14.1; *P*<.001. Retired respondents and housewives reported lower ASES, at 55.7 and 55.1, respectively.

With respect to the type of work, office workers reported the highest mean ASES (68.22), whereas field workers reported the lowest score (59.17). Respondents with jobs requiring overhead activities had significantly lower mean ASES scores than those who did not (*P*=.021). The effect of hours spent on office work (*P*=0.18) and the use of electronic devices (*P*=0.16) on ASES was not statistically significant. Those who preferred to read lying on a bed or sofa reported a mean ASES of 59.1, lower than those who preferred sitting on a chair at a desk or sitting on a bed or a sofa, at 63.88 and 60.46, respectively. **Figure 3** shows the mean ASES scores across different postures while sitting behind a desk, with no significant difference between the groups (**Figure 3**). Moreover, posture while standing and walking was not significantly associated with the ASES score (*P*=0.24). Significantly lower ASES scores were

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Table 3. Risk factors for periscapular pain.

		Have you ever suffered from periscapular pain?			*P* value
		Yes, currently	Yes, previously	No	
Gender	Male	48 (12.7%)	68 (17.9%)	34 (9%)	<.001
	Female	136 (35.9%)	59 (15.6%)	34 (9%)	
Marital status	Single	62 (16.4%)	46 (12.1%)	31 (8.2%)	0.219
	Married	122 (32.2%)	81 (21.4%)	37 (9.8%)	
Occupation	Student	23 (6.1%)	15 (4%)	14 (3.7%)	0.367
	Employee	92 (24.3%)	74 (19.5%)	34 (9%)	
	Retired	28 (7.4%)	22 (5.8%)	10 (2.6%)	
	Housewife	32 (8.4%)	13 (3.4%)	8 (2.6%)	
	Not working	9 (2.4%)	3 (0.8%)	2 (0.5%)	
Job nature	Office work	44 (11.6%)	30 (7.9%)	19 (5%)	.237
	Field work	23 (6.1%)	11 (2.9%)	9 (2.4%)	
	Office and field work	63 (16.6%)	57 (15%)	18 (4.7%)	
	Not working	54 (14.2%)	29 (7.7%)	22 (5.8%)	
Work requiring overhead activities	Yes	49 (12.9%)	34 (9%)	11 (2.9%)	.261
	No	108 (28.5%)	77 (20.3%)	42 (11.1%)	
	Not working	27 (7.1%)	16 (4.2%)	15 (4%)	
In which position do you prefer reading or finishing paperwork?	I prefer sitting on chair at desk	97 (25.6%)	79 (20.8%)	39 (10.3%)	.463
	I prefer sitting on sofa or bed	55 (14.5%)	28 (7.4%)	20 (5.3%)	
	I prefer lying on sofa or bed	32 (8.4%)	20 (5.3%)	9 (2.4%)	
Which one is your usual posture while reading or using electronic devices? **Figure 1**	Posture 1	56 (14.8%)	32 (8.4%)	21 (5.5%)	.072
	Posture 2	38 (10%)	32 (8.4%)	19 (5%)	
	Posture 3	43 (11.3%)	43 (11.3%)	20 (5.3%)	
	Posture 4	47 (12.4%)	20 (5.3%)	8 (12.1%)	
Which one is your usual posture when using phone while walking/ standing? **Figure 2**	Posture 1	44 (11.6%)	41 (10.8%)	29 (7.7%)	.013
	Posture 2	140 (36.9%)	86 (22.7%)	39 (10.3%)	

observed in participants who reported night pain than in those who did not (*P*<.001) (**Table 4**).

Discussion

This study may be the first of its kind, focusing on a specific site of shoulder pain, the periscapula, and its associated factors. To our knowledge, no epidemiological studies have specifically described the prevalence of periscapular pain. Periscapular pain has been referred to in the literature using different terms, such as upper back pain [19], upper trapezius pain [20], and posterior shoulder pain [1]. Moreover, it has been described as the presenting symptom of multiple conditions such as snapping scapula syndrome [21], scapulothoracic bursitis [22,23], dorsal scapular nerve neuropathy [24], and trapezius myofascial trigger points [20].

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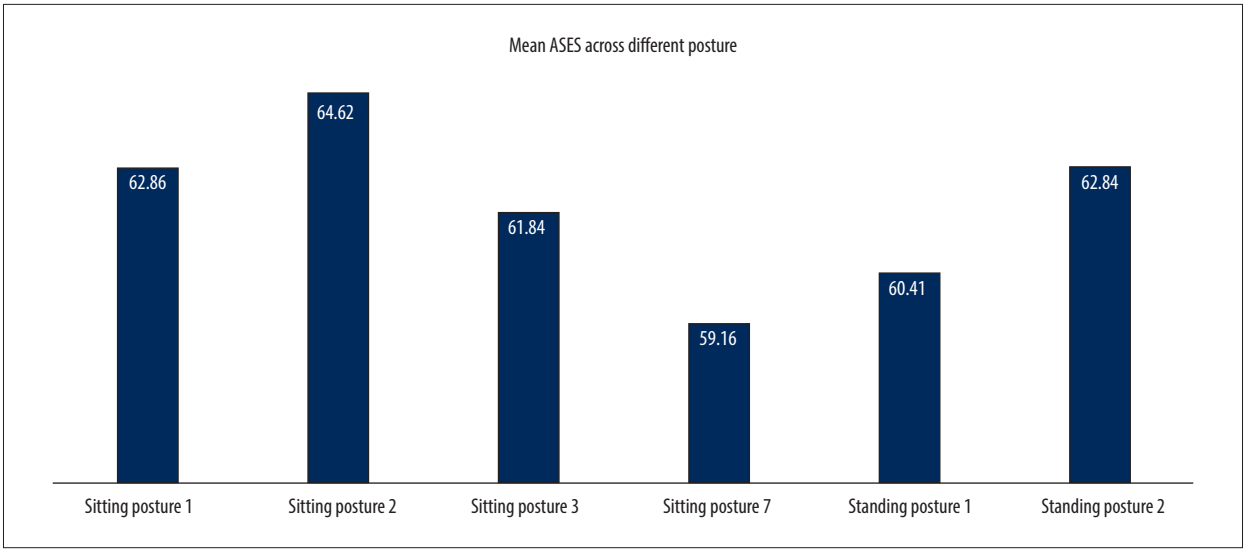

Figure 3. Bar chart representing the mean American Shoulder and Elbow Score (ASES) among different sitting and standing postures.

The prevalence varies widely in the literature. Many studies have described the musculoskeletal symptoms and concerns among workers in different occupations. For instance, in China, upper back pain was reported by 14.89% of manufacturing workers [15] and 72.8% of sonographers [25]. In a systematic review of 30 studies, Lietz et al reported the prevalence of upper back pain was 41.1% in dental professionals [26], and another study showed that 80% of Pakistani tailors reported upper back pain [27]. In our study, the lifetime prevalence of periscapular pain was 82.1%, and that of point pain was 48.5%.

Similar to our findings, Abaraogu et al found a significant association between sex and periscapular pain, with females being more likely to develop it [28]. Regarding age, in a Nigerian study, 85.4% of upper back pain was found in the 40-49 age group, and age was significantly associated with upper back pain [28]. Similarly, Mekonnen et al stated that people aged >30 had a 2.61 times greater risk of developing upper back pain [29]. In our study, we found the highest prevalence of periscapular pain among participants aged 33-42 years, with no significant association between age and periscapular pain. This could be attributed to an interesting finding by Lahti et al, who reported that older adults more frequently experience painless shoulder stiffness than shoulder pain [30].

Workers who rarely or never sit during their jobs experience significantly less upper back pain than sitting workers [15]. However, most respondents who experienced periscapular pain worked in jobs that combined office and fieldwork (38.6%), followed by office workers (23.8%). However, in this cross-sectional study, there were no significant differences in the development of periscapular pain between the groups. Computer users who had poor posture were more than 4 times more likely to develop shoulder pain compared to those who maintained proper posture during computer use [7]. Furthermore, neck-shoulder pain was significantly related to poor posture and prolonged use of electronic devices among Chinese college students [10]. Poor posture involves a forward head and forward shoulder position, which was associated with upper back and periscapular pain [12,16,25,31,32], corresponding to our findings in standing/walking while the head was flexed, as in posture 2 (**Figure 2**), with a *P* value of 0.013.

We used the ASES [18] to accurately assess and quantify periscapular pain and disability in participants who had experienced it at least once in their lives. This score ranges from zero to 100, with 100 indicating the best shoulder condition. This score has 2 main parts, each with 50 points possible. Part 1 is for pain severity uses a visual analog scale (VAS) from 0 to 10. Part 2 assessed upper limb function and disability during daily living activity. The mean ASES and VAS scores in the participants with periscapular pain were 62.18 and 5.63, respectively. In patients with snapping scapula syndrome, the average ASES and VAS scores were worse, at 36.3 and 8.3, respectively [33]. Moreover, the mean ASES score was 56.2 among patients with dorsal scapular nerve neuropathy [34].

Sallay and Reed found no significant correlation between ASES and sex, and there was a notable but statistically insignificant decline in activities of daily living scores with age [35]. We found that females had significantly lower ASES scores than males, and ASES scores were inversely correlated with age.

Interestingly, ASES was associated with marital status; we found lower scores among married participants than among single participants, at 59.7 and 66.7, respectively. Sallay et al also found a correlation of ASES with marital status, but stated that divorced individuals had lower ASES scores [36]. We

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Table 4. Mean American Shoulder and Elbow Score (ASES) score.

		Mean ASES score (SD)	P value
Gender	Male	68.5 (15.68)	<.001
	Female	58.42 (15.62)	
Marital status	Single	66.7 (14.1)	<.001
	Married	59.7 (16.97)	
Occupation	Student	65.86 (11.3)	<.001
	Employee	64.82 (16.5)	
	Retired	55.74 (16.2)	
	Housewife	55.15 (15.9)	
	Not working	67.16 (16.4)	
Job nature	Office work	68.22 (14)	=.003
	Field work	59.17 (20.8)	
	Office and field work	61.2 (16.4)	
	Not working	59.4 (14.96)	
Work requiring over-head activities	Yes	58.59 (17.17)	=.021
	No	63.69 (16.44)	
In which position do you prefer reading or finishing paperwork?	I prefer sitting on chair at a desk	63.88 (15.9)	=0.1
	I prefer sitting on sofa or bed	60.46 (15.04)	
	I prefer lying on sofa or bed	59.15 (19.31)	
Usual posture while sitting behind a desk, **Figure 1**	Posture 1	62.86 (16.26)	=.259
	Posture 2	64.62 (15.35)	
	Posture 3	61.84 (15.69)	
	Posture 4	59.16 (18.16)	
Usual posture when using phone while walking/standing, **Figure 2**	Posture 1	60.41 (15.78)	=.243
	Posture 2	62.84 (16.57)	
Pain at night	Yes	56.6 (14.79)	<.001
	No	69.65 (15.41)	

found that occupation and job nature were associated with ASES, with *P* values of <.001 and.003, respectively. Over-head activity was significantly associated with lower ASES scores, which is consistent with the literature, as both dysfunction and scapular superomedial angle pain worsen with over-head activity [37,38]. Against expectations, daily electronic device usage time and time spent on office work were not associated with worse ASES (*P* 0.16 and 0.18, respectively). This finding suggests that periscapular pain is more likely to be associated with poor postural habits while using electronic devices rather than the duration of use itself.

We found that use of analgesics, muscle relaxants, massaging, and warm compresses were all statistically associated with ASES scores (*P*.001, <.001, =.005, and <.001, respectively). Although the presence of night pain was not included in the ASES scoring, 47% of our participants had night pain, which showed a statistically significant negative correlation with ASES.

Our study has certain limitations. We used convenience sampling techniques, which could limit generalizability, and the assessment of self-reported periscapular pain and disability was subjective. However, most periscapular pain and disability are subjective

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concerns and are not always associated with objective clinical or radiologic findings. We used validated assessment tools and visual illustrations to minimize the impact of such limitations.

Conclusions

Our study demonstrated a high prevalence of periscapular pain (48.5%), which is under-acknowledged in the literature. Female gender and walking with the neck tilted forward while using an electronic device were associated with the development of periscapular pain. This highlights the need for posture awareness and poor posture correction, especially with increased electronic devices use. Lower ASES scores were observed in individuals with jobs involving over-head activities.

Department and Institution Where Work Was Done

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Patient Consents

Written informed consent was provided by all participants.

Declaration of Figures' Authenticity

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