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Prevalence of Shoulder Pain in Overhead Occupation Workers Associated with Impingement Syndrome

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Abstract

Background and Objectives: Shoulder impingement syndrome is a frequent cause of shoulder pain, typically characterized by a dull, aching sensation that worsens with overhead movements. Jobs requiring repetitive overhead tasks, such as those in construction and painting, are at higher risk for shoulder discomfort due to factors like workload, ergonomic challenges, and personal health conditions. This research focuses on examining the prevalence of shoulder pain linked to impingement syndrome among overhead workers in Bangalore. **Method:** A sample of 150 overhead workers was selected based on specific inclusion and exclusion criteria. Shoulder pain and disability were assessed using the Visual Analog Scale (VAS) and Shoulder Pain and Disability Index (SPADI). Neer's impingement, Drop arm, and Empty can tests were performed to diagnose impingement. The data analysis aimed to determine the occurrence of shoulder pain, its relationship with specific occupations, and to identify which group-construction workers, painters, carpenters, or electricians-experienced the highest prevalence. **Results:** The study of 150 overhead workers (carpenters, construction workers, electricians, painters) found no significant link between occupation and shoulder pain prevalence. However, 24.7% reported very severe pain (SPADI score 61-80), with average VAS and SPADI scores of 5.0 (SD 3.2) and 48.9 (SD 29.3). A strong positive correlation was observed between VAS and SPADI (r=0.961, p<0.001r = 0.961, p<0.001r=0.961, p<0.001). Age (r=0.800r= 0.800r=0.800) and years of experience (r= 0.857r = 0.857r= 0.857) significantly correlated with higher pain and disability (p<0.001p < 0.001p<0.001), while BMI showed no significant correlation. **Conclusion**: The study shows a direct correlation with age, years of experience, and the intensity of disability and pain. These findings highlight the need for preventive and rehabilitative measures to improve ergonomics in overhead occupational settings.

Major Findings: The study suggested a strong positive correlation between VAS and SPADI. Age and years of experience were significantly correlated with higher pain and disability, while BMI showed no significant correlation.

Keywords: Overhead Work, Occupational Health, Shoulder Pain, Shoulder Impingement Syndrome, Shoulder Disability, Work Related Musculoskeletal Disorders

1. Introduction

The remarkable flexibility of the shoulder joint is made possible by four key articulations: The glenohumeral, acromioclavicular, sternoclavicular, and scapulothoracic joints. This mobility, however, comes at the cost of stability, which depends on a coordinated system of muscular and tendinous support, including the rotator cuff and surrounding structures. Due to its intricate design, the shoulder is highly susceptible to injuries, especially when subjected to excessive or repetitive loading[1].

Shoulder pain is the third commonest condition and has a prevalence of 70%[2]. Shoulder impingement is the second most common cause for shoulder pain and can

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have a major socioeconomic impact on the work capacity. Shoulder Impingement Syndrome (SIS) is a common condition that causes discomfort and pain in the shoulder joint[3]. It occurs when the tendons and bursa in the shoulder joint become compressed or irritated as they pass through a narrow space, leading to inflammation, pain, and restricted movement, which further reduces shoulder mobility[4].

Impingement syndrome of shoulder can be categorized as external or internal based on location and primary or secondary depending on the cause. Secondary impingement or external impingement, occurs when there is compression of the subacromial tissues in the subacromial space. Impingement of rotator cuff tendons, usually supraspinatus and infraspinatus, between the humeral head and glenoid grim can cause internal impingement[5]. Primary impingement is caused by reduction in subacromial space, such as abnormal acromion anatomy or swelling of soft tissues. Secondary impingement involves normal anatomy but occurs during movement, often due to rotator cuff weakness or poor scapular control, limiting external rotation and further narrowing the space. Pain is caused by compressive forces from the humeral head on the rotator cuff or subacromial bursa during movements like abduction or forward flexion. Repeated tendon compression and degeneration contribute to the narrowing, though it's unclear whether tendon damage or narrowing occurs first[6].

Repeated stress on the shoulder joint and performing tasks that involve raising the hands above the height of the acromion can result in mechanical pressure on structures like the supraspinatus tendon, rotator cuff, subacromial bursa, and biceps tendon[7]. This mechanical stress is considered a key factor contributing to the development of tendon-related pain. At the shoulder, repetitive loading leads to rotator cuff tendon thickening. This increase in tendon size might serve as an early sign of shoulder pain, as individuals with tendinopathy often exhibit thicker supraspinatus tendons. A thicker supraspinatus tendon occupies a larger portion of the subacromial space, raising the likelihood of tendon compression and the onset of pain. However, structural changes in tendons have also been observed in individuals without symptoms, highlighting the complex relationship between repetitive loading, tendon morphology, and the development of shoulder pain[5].

Overhead workers are individuals whose jobs entail regular or extended engagement in tasks conducted above shoulder height. These occupations typically involve actions like reaching, lifting, carrying, or maneuvering objects or tools overhead. Examples of overhead workers include those in construction, electrical work; painting, and carpentry. Moreover, individuals engaged in overhead occupations frequently encounter ergonomic difficulties, including uncomfortable postures, incorrect lifting methods, and insufficient workstation arrangements. These challenges can intensify the pressure on the shoulder joint, raising the likelihood of developing SIS[5].

Patients with shoulder impingement syndrome typically experience pain localized to the anterolateral shoulder, which worsens with overhead activities like painting, cleaning, or lifting. The pain often radiates to the deltoid area and may become particularly bothersome at night, especially when lying on the affected side. Additionally, patients may report restricted shoulder range of motion, especially during abduction beyond 60 degrees or internal rotation, as these movements narrow the subacromial space and exacerbate symptoms. Weakness, particularly in the supraspinatus muscle, is common and can make lifting or maintaining the arm in certain positions challenging. Some patients may also experience a catching or clicking sensation during shoulder movement, particularly in abduction or elevation, along with tenderness upon palpation of the subacromial space or rotator cuff tendons[8].

The diagnosis of shoulder impingement can be supported through specific tests that offer reliable results and consistency over time. These tests enable comparisons across different examinations, providing a dependable measure to track the progression of the condition.

Neer's Impingement is the most commonly used special test to diagnose shoulder impingement. This test identifies pain during passive arm abduction while stabilizing the scapula. The examiner lifts the arm in the scapular plane with internal rotation.

The test first described in 1977, did not originally specify a 'painful arc,' though this is often associated with the test[9].

Hawkins-Kennedy test is widely used to detect subacromial impingement syndrome. In this test the examiner positions the patient's arm at 90° of shoulder flexion with the elbow bent at 90°, followed by internal rotation of the arm. A positive result is indicated if the patient experiences pain during internal rotation, confirming the likelihood of impingement[10].

The two tests differ with the position of the humeral head below the acromion. A study conducted by Pappas *et al*., used magnetic resonance imaging to study how the supraspinatus tendon behaves during these tests. They found that the Hawkins-Kennedy test caused a higher occurrence of contact and a greater reduction in the distance between the supraspinatus tendon and the acromion compared to Neer's sign[11].

The Empty Can test (Jobe test) and Drop Arm test (Codman's Sign) are commonly used to detect rotator cuff injuries. The Empty Can test evaluates muscle weakness or pain caused by tendonitis or cuff rupture. The patient, seated or standing, positions their shoulder in 90° of abduction, 30° of forward flexion, and full internal rotation while resisting downward pressure applied by the examiner. A positive result indicates limited function, such as the inability to resist the applied force. The Drop Arm test identifies muscle weakness, pain, or a cuff tear by asking the patient to slowly lower their arm from maximal passive abduction. If the arm drops due to weakness or pain, the test is positive. These tests, particularly when paired with subacromial injection, provide valuable insights into the functional integrity of the rotator cuff and are widely used in clinical assessments[12].

Shoulder impingement is highly prevalent among individuals involved in overhead occupations such as construction workers, carpenters, painters, and electricians, as well as among the athletes who engage in overhead activities like throwing or swimming. The repetitive nature of their duties and the prolonged strain exerted on the shoulder joint and adjacent tissues can elevate the likelihood of experiencing shoulder injuries and conditions like impingement syndrome and rotator cuff tears[13].

The prevalence of Shoulder Impingement Syndrome (SIS) among overhead workers represents a critical issue due to its impact on their productivity, quality of life, and occupational sustainability. Overhead workers, such as construction laborers, carpenters, painters, and electricians, are particularly prone to repetitive stress injuries that lead to pain and functional impairments[5].

This study provides valuable insights into the association of shoulder pain with occupational demands, age, and years of experience. Identifying the prevalence of SIS helps highlight the importance of preventive measures, ergonomic education, and tailored rehabilitation programs to improve occupational health and reduce the socioeconomic burden associated with shoulder dysfunction.

Thus, this research study aimed to evaluate the prevalence of shoulder pain related to overhead occupation in Bangalore.

2. Materials and Methods

This observational research study was carried out at Dayananda Sagar University, Bangalore, India. The inclusion criteria for the study were:

1. Male individuals aged between 25 and 45 years.
2. Minimum of 5 years of work experience.
3. Engaged in overhead occupations such as construction, carpentry, painting, and electrical work.

Data collection took place between March and May 2024. The exclusion criteria were:

1. Workers who had experienced physical trauma, such as road traffic accidents or recent arm injuries.
2. Those with physical disabilities.
3. Individuals diagnosed with inflammatory joint diseases such as rheumatoid arthritis, peri-arthritic shoulder, or frozen shoulder.

Non-probability convenient sampling was used due to its practicality, allowing for the inclusion of overhead workers who were readily available and willing to participate during the study period. The method facilitated efficient data collection within the constraints of time and resources. An informed written consent was obtained from the participants before participation in the study.

The study utilized two assessment tools to evaluate shoulder pain and disability caused by Subacromial Impingement Syndrome (SIS): Visual Analogue Scale (VAS) and Shoulder Pain and Disability Index (SPADI). The VAS assesses the severity and perception of shoulder pain on a continuum from 0 (indicating no or nil pain) to 10 (representing the worst pain imaginable). The test-retest reliability has been shown to be good for VAS scale ($r= 0.94$, $P= 0.001$) [14].

SPADI includes 13 self-reported items, with 5 items measuring pain and 8 other items evaluating disability and function. The total SPADI score is calculated by averaging the scores of all 13 items. Scores range from 0 to 100, with higher scores indicating increased severity of shoulder pain and disability. SPADI has test-retest

reliability of 95% and has 100% validity for pain subscale and 75% for disability subscale[15].

Special tests, including the Neer Impingement test, Drop Arm test, and Empty Can test, were employed for the diagnosis of impingement. Neer Impingement test has sensitivity of 0-93 % and specificity of 31%-100%[16], and Drop Arm test has sensitivity of 73% and specificity is 77%[17].

The Empty Can test demonstrates a specificity of 55% for detecting pain, 68% for identifying muscle weakness, and 50% for either pain, muscle weakness, or both. Additionally, its sensitivity is recorded at 63% for pain, 77% for muscle weakness, and 89% for the presence of pain, muscle weakness, or a combination of the two[18,19].

3. Results

Among 150 overhead workers the prevalence of shoulder pain and disability categorized into 5 levels: Mild (0-20) at 23.3%, Moderate (21-40) at 17.3%, Severe (41-60) at 19.3%, Very Severe (61-80) at 24.7%, and Extremely Severe (81-100) at 15.3%. The likelihood ratio tests found no remarkable relationship ($p<0.05$) between occupation and pain prevalence, but age and years of experience showed a substantial positive correlation ($p<0.001$) with both VAS and SPADI results. Significant positive correlation ($p<0.001$) with both VAS and SPADI scores. Conversely, BMI did not show a significant correlation with either measure. VAS and SPADI scores showed a strong positive correlation ($p<0.05$) of 0.961, indicating a mutual increase.

Table 1 shows the selected criteria age ranges from 25-45, were BMI ranges from 21-25 and year of experience 5 - 20 years.

The table outlines the prevalence of shoulder pain and disability categorized into 5 levels: Mild (0-20) at 23.3%, Moderate (21-40) at 17.3%, Severe (41-60) at 19.3%, Very severe (61-80) At 24.7%, and extremely severe (81-100) at 15.3%.

Table 3 presents the association between occupation and the prevalence of shoulder pain and disability. The likelihood ratio test found no significant association ($p<0.05$) between occupation and the prevalence of shoulder pain and disability.

Table 4 compares age, BMI, years of experience, VAS, and SPADI index score based on the prevalence of shoulder pain and disability. No notable differences

Table 1. Descriptive statistics for age, BMI and years of experience

(n=150)	Range	Mean	S. D
Age (Years)	25 - 45	35.8	5.7
BMI (Kg/M^2)	21 - 25	22.9	1.3
Years of experience	5 - 20	12.0	5.3

Table 2. Shoulder pain and disability prevalence

Prevalence of Shoulder Pain and Disability	Frequency	%
Mild (0-20)	35	23.3
Moderate (21-40)	26	17.3
Severe (41-60)	29	19.3
Very severe (61-80)	37	24.7
Extremely severe (81-100)	23	15.3

($p < 0.05$) were found in age, years of experience, VAS, and SPADI score across the different levels of shoulder pain and disability.

Table 5 displays the multiple comparisons of age, years of experience, VAS, and SPADI score based on the prevalence of shoulder pain and disability. Significant differences ($p < 0.05$) were found in age, years of experience, VAS, and SPADI score across various levels of shoulder pain and disability.

Table 6 indicates the relationship between the Visual Analogue Scale and the Shoulder Pain and Disability Index score using the Pearson correlation coefficient ("r"). A strong positive correlation ($p<0.05$) of 0.961was found between the Visual Analogue Scale and the Shoulder Pain and Disability Index score, indicating that as one measure increases, the other tends to increase as well.

Table 7 presents the relationship between age, BMI, years of experience, and the VAS and SPADI score using the Pearson correlation coefficient ("r"). Age and years of experience showed a significant positive correlation ($p<0.05$) with both the VAS and SPADI score. However, BMI did not show a significant correlation with either measure.

4. Discussion

Among the 150 overhead workers, shoulder pain and disability were prevalent across different levels, with the highest percentage experiencing "Very severe" disability

Table 3. Association between occupation and the prevalence of shoulder pain and disability

Occupation	Prevalence of shoulder pain and disability										Likelihood Ratio	p value
	Mild (0-20)		Moderate (21-40)		Severe (41-60)		Verysevere (61-80)		Extremely severe (81-100)			
	n	%	n	%	n	%	n	%	n	%		
Carpenter	6	17.1	3	11.5	4	13.8	7	18.9	4	17.4	16.16	0.184
Construction worker	20	57.1	10	38.5	9	31.0	20	54.1	12	52.2		
Electrician	4	11.4	10	38.5	10	34.5	3	8.1	4	17.4		
Painter	5	14.3	3	11.5	6	20.7	7	18.9	3	13.0		

Table 4. Multiple comparisons of age, years of experience, visual analogue scale, shoulder pain and disability index score according to the prevalence of shoulder pain and disability

Multiple Comparisons			Mean Difference	p value
Age (Years)	Mild (0-20)	Moderate (21-40)	-5.95	<0.001*
		Severe (41-60)	-6.86	<0.001*
		Very severe (61-80)	-9.73	<0.001*
		Extremely severe (81-100)	-13.25	<0.001*
	Moderate (21-40)	Severe (41-60)	-0.91	0.896
		Very severe (61-80)	-3.78	0.001*
		Extremely severe (81-100)	-7.29	<0.001*
	Severe (41-60)	Very severe (61-80)	-2.88	0.018*
		Extremely severe (81-100)	-6.39	<0.001*
	Very severe (61-80)	Extremely severe (81-100)	-3.52	0.004*
Year of experience	Mild (0-20)	Moderate (21-40)	-4.93	<0.001*
		Severe (41-60)	-5.69	<0.001*
		Very severe (61-80)	-9.88	<0.001*
		Extremely severe (81-100)	-12.27	<0.001*
	Moderate (21-40)	Severe (41-60)	-0.76	0.903
		Very severe (61-80)	-4.95	<0.001*
		Extremely severe (81-100)	-7.34	<0.001*
	Severe (41-60)	Very severe (61-80)	-4.19	<0.001*
		Extremely severe (81-100)	-6.58	<0.001*
	Very severe (61-80)	Extremely severe (81-100)	-2.39	0.044*
Visual analogue scale	Mild (0-20)	Moderate (21-40)	-3.76	<0.001*
		Severe (41-60)	-5.14	<0.001*
		Very severe (61-80)	-7.01	<0.001*
		Extremely severe (81-100)	-8.79	<0.001*
	Moderate (21-40)	Severe (41-60)	-1.38	<0.001*
		Very severe (61-80)	-3.26	<0.001*
		Extremely severe (81-100)	-5.04	<0.001*

	Severe (41-60)	Very severe (61-80)	-1.87	<0.001*
		Extremely severe (81-100)	-3.66	<0.001*
	Very severe (61-80)	Extremely severe (81-100)	-1.78	<0.001*
Shoulder pain and disability index score	Mild (0-20)	Moderate (21-40)	-28.37	<0.001*
		Severe (41-60)	-45.71	<0.001*
		Very severe (61-80)	-66.31	<0.001*
		Extremely severe (81-100)	-81.54	<0.001*
	Moderate (21-40)	Severe (41-60)	-17.35	<0.001*
		Very severe (61-80)	-37.94	<0.001*
		Extremely severe (81-100)	-53.17	<0.001*
	Severe (41-60)	Very severe (61-80)	-20.60	<0.001*
		Extremely severe (81-100)	-35.83	<0.001*
	Very severe (61-80)	Extremely severe (81-100)	-15.23	<0.001*

(*Significant)

Table 5. Association between various special tests used to diagnose type of shoulder impingement and the prevalence of shoulder pain and disability

		Prevalence of shoulder pain and disability										Chi square	P value
		Mild (0-20)		Moderate (21-40)		Severe (41-60)		Very severe (61-80)		Extremely severe (81-100)			
	n	%	N	%	n	%	n	%	n	%			
NEER impingement test	Positive	0	0	16	61.5	20	69.0	31	83.8	7	30.4	60.96	<0.001*
	Negative	35	100	10	38.5	9	31.0	6	16.2	16	69.6		
Drop arm test	Positive	1	2.9	11	42.3	16	55.2	22	59.5	8	34.8	29.29	<0.001*
	Negative	34	97.1	15	57.7	13	44.8	15	40.5	15	65.2		
Empty can test	Positive	1	2.9	5	19.2	11	37.9	23	62.2	11	47.8	32.89	<0.001*
	Negative	34	97.1	21	80.8	18	62.1	14	37.8	12	52.2		

(*Significant)

Table 6. Relation between visual analogue scale, shoulder pain and disability index score

	Shoulder Pain and Disability Index Score	
	"r"	p value
Visual analogue scale	0.961	<0.001*

(24.7%), followed by "Mild" (23.3%) and "Severe" (19.3%). This finding emphasizes the significant burden of shoulder pain among this group of workers. The absence of a significant relationship between specific occupations (carpenters, electricians, construction workers, and painters) and shoulder pain prevalence suggests that any type of overhead work, regardless of the specific job, could pose a risk for developing shoulder issues.

Table 7. Relation between age, BMI years of experience and the visual analogue scale, shoulder pain and disability index score

		Visual Analogue Scale	Shoulder Pain and Disability Index Score
Age (Years)	r	0.800	0.780
	p value	<0.001*	<0.001*
BMI (Kg/M^2)	r	-0.097	-0.076
	p value	0.237	0.355
Year of experience	r	0.857	0.821
	p value	<0.001*	<0.001*

("r"= Pearson correlation coefficient; *Significant)

The study highlights that both age and years of experience are strongly correlated with the severity of shoulder pain and disability. As workers age or gain more years of experience in overhead tasks, their likelihood of experiencing shoulder impingement and related pain increases significantly. This result aligns with the literature, where repetitive overhead activities over prolonged periods are known to cause cumulative wear and tear on the shoulder joint, leading to conditions like impingement syndrome.

Interestingly, BMI did not show a positive correlation with shoulder disability or pain in this study. This is an unexpected finding as obesity is often considered a risk factor for musculoskeletal disorders. However, the range of BMI among the workers was relatively narrow (21-25 kg/m²), which may explain the lack of a significant relationship. A broader BMI range might have yielded different results.

A marked positive correlation ($r = 0.961$, $p < 0.001$) between VAS and SPADI scores indicates that as subjective pain intensity increases, so does the level of functional disability. This reinforces the notion that severe pain impairs a worker's capacity to carry out overhead tasks, resulting in an elevated disability index.

The special tests used in this study, such as Neer's impingement, and Drop Arm test. These tests were highly effective in diagnosing shoulder impingement syndrome. The positive outcomes of these tests correlated significantly with more severe pain and disability. These tests offer a reliable means to assess shoulder dysfunction among workers, particularly those in occupations requiring overhead work.

Jun-Hee, Chung-Hwi Yi *et al.*, conducted a comparative study on shoulder function in workers with and without subacromial pain syndrome. The analysis showed that SPADI, DASH, and VAS scores were higher in workers with SPS compared to those without, which aligns with our current study[20].

A cross-sectional study that was conducted by Po-Ching Chu, Tyng-Guey Wang *et al.*, on occupational and personal factors contributing to shoulder disorders among electrical workers found that the prevalence of shoulder symptoms was 30.5%, with 19% of those cases being diagnosed with SIS. Multivariable analyses revealed that older age, repetitive motions, and posture were linked to shoulder symptoms. These findings are consistent with our current study, which also demonstrated a positive correlation between years of experience and shoulder pain[21].

A comparative study by Jun-Hee Kim, Oh-Yun Kwon *et al.*, on shoulder pain between workers with and without SIS revealed that workers with SIS experienced significantly more pain than workers without SIS[22].

However, our study did not find positive correlation with BMI and shoulder pain, which contrasts with some literature that suggests a possible link. For instance, while Jun-Hee *et al.* and Po-Ching Chu *et al.*, indicated that body composition might influence shoulder function, this was not evident in our population, possibly due to the relatively homogenous BMI range of our sample (21–25 kg/m²). Additionally, while the occupation was not significantly associated with shoulder pain in our study, both Jun-Hee Kim *et al.*, and Chu *et al.*, found that certain occupational risks were more prevalent in specific job types, suggesting that the nature of the work may play a larger role in specific subgroups.

Overall, the study revealed that a significant portion of overhead occupational workers experience shoulder pain, with varying degrees of severity associated with age and years of experience. Therefore, preventive measures should be applied at the primary level to decrease the prevalence of shoulder pain in overhead workers. These measures include reducing workload, providing ergonomic education to workers, encouraging frequent breaks to rest the shoulder and prevent overuse injuries, and using supportive devices or ergonomic tools to reduce strain on the shoulder during overhead work.

5. Conclusion

This study highlights the significant prevalence of shoulder pain among overhead occupational workers, with age and years of experience as key contributing factors. Although BMI was not associated with shoulder pain in this population, targeted ergonomic interventions, training programs, and policy measures are essential to address the broader risk factors. These initiatives can help improve working conditions, promote optimal shoulder mechanics, and reduce the burden of shoulder pain in overhead workers, aligning with the study's findings and emphasizing the importance of preventive strategies in occupational health.

6. References

1. Tien JDY, Tan AHC. Shoulder impingement syndrome, a common affliction of the shoulder: A comprehensive review. Proc Singap Healthc. 2014; 23(4):297-305. https://doi.org/10.1177/201010581402300406
2. Jambure VM, Malawade M. Prevalence of impingement syndrome due to overhead activity in construction site workers. Afr J Biomed Res. 2024; 27(3):1136-1139. https://doi.org/10.53555/ajbr.v27i3.3121
3. Koester MC, George MS, Kuhn JE. Shoulder impingement syndrome. Am J Med. Elsevier. 2005; 118(5):452-455.
4. Chang WK. Shoulder impingement syndrome. Phys Med Rehabil Clin N Am. 2004; 15(2):493-510.
5. Pozzi F, Sousa CO, Plummer HA, Andrade B, Awokuse D, Kono N, *et al*. Development of shoulder pain with job-related repetitive load: Mechanisms of tendon pathology and anxiety. J Shoulder Elbow Surg. 2022; 31(2):225-234. https://doi.org/10.1016/j.jse.2021.09.007
6. Creech JA, Silver S. Shoulder impingement syndrome. StatPearls Publishing.
7. Tate A, Turner GN, Knab SE, Jorgensen C, Strittmatter A, Michener LA. Risk factors associated with shoulder pain and disability across the lifespan of competitive swimmers. J Athl Train. 2012; 47(2):149-158. https://doi.org/10.4085/1062-6050- 47.2.149
8. Koukoulithras I, Kolokotsios S, Plexousakis M. Shoulder impingement syndrome: From pathology to treatment. SSRN Electronic J. 2020. https://doi.org/10.2139/ssrn.3676373
9. Phillips N. Tests for diagnosing subacromial impingement syndrome and rotator cuff disease. Shoulder elbow. 2014; 6(3):215-221. https://doi.org/10.1177/1758573214535368
10. Yaver J. Users guide to the musculoskeletal examination: Fundamentals for the evidence-based clinician. PT. 2008; 88(12): 1605-1606. https://doi.org/10.2522/ptj.2008.88.12.1605
11. Pappas GP, Blemker SS, Beaulieu CF, McAdams TR, Whalen ST, Gold GE. *In vivo* anatomy of the Neer and Hawkins sign positions for shoulder impingement. J Shoulder Elbow Surg. 2006; 15(1):40-49. https://doi.org/10.1016/j.jse.2005.04.007
12. Penning LIF, De BIe RA, Leffers P, Weijers RE, Walenkamp GH. Empty can and drop arm tests for cuff rupture: Improved specificity after subacromial injection. Acta Orthop Belg. 2016; 82(2):166-173. PMID: 27682276
13. Shaheen H, Ahmad A, Gillani SA, Raza M, Waqas M. Frequency of shoulder pain among overhead throwing athletes. RMJ. 2020; 45(1):227-229.
14. Ferraz MB, Quaresma MR, Aquino LR, Atra E, Tugwell P, Goldsmith C. Reliability of pain scales in the assessment of literate and illiterate patients with rheumatoid arthritis. J Rheumatol. 1990; 17(8):1022-1024. PMID: 2213777
15. Venturin D, Giannotta G, Pellicciari L, Rossi A, Pennella D, Goffredo M, *et al*. Reliability and validity of the shoulder pain and disability index in a sample of patients with frozen shoulder. BMC Musculoskelet Disord. 2023; 24(1):212. https://doi.org/10.1186/s12891-023-06268-2
16. Dutton M. Orthopaedic examination, evaluation, and intervention. 2nd ed. McGraw- Hill; 2008.
17. Miller CA, Forrester GA, Lewis JS. The validity of the lag signs in diagnosing full- thickness tears of the rotator cuff: A preliminary investigation. Arch Phys Med Rehabil. 2008; 89(6):1162-1168. PMID: 18503815. https://doi.org/10.1016/j.apmr.2007.10.046
18. Magee DJ, Manske RC. Orthopedic physical assessment. 7th ed. Elsevier; 2022.
19. Michener LA, Walsworth MK, Doukas WC, Murphy KP. Reliability and diagnostic accuracy of 5 physical examination tests and combination of tests for subacromial impingement. Arch Phys Med Rehabil. 2009; 90(11):1898-1903. https://doi.org/10.1016/j.apmr.2009.05.015
20. Kim JH, Kwon OY, *et al*. Comparison of shoulder functions between assembly workers with and without subacromial pain syndrome. 2023;1091-101.
21. Karasuyama M, Oike T, Okamatsu S, Kawakami J. Shoulder pain in wheelchair basketball athletes: A scoping review. J Spinal Cord Med. 2023; 46(5):753-759. https://doi.org/10.1080/10790268.2022.2038050
22. Chu PC, Wang TG, Guo YL. Work-related and personal factors in shoulder disorders among electronics workers: Findings from an electronics enterprise in Taiwan. BMC Public Health. 2021; 21(1):1-5. https://doi.org/10.1186/s12889-021-11572-4

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