
Impact of Scapular Stabilization Exercises on Pain and Performance in University Level Volleyball Player with Scapular Dyskinesia – A Case Report

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Abstract

Introduction: Scapular dyskinesia is a prevalent condition among overhead athletes, particularly volleyball players, often leading to shoulder pain, impaired biomechanics, and decreased performance. Effective rehabilitation strategies, such as scapular stabilization exercises, are crucial for improving shoulder function. This case study aims to evaluate the impact of an eight-week scapular stabilization exercise program on pain and performance in university level volleyball player with scapular dyskinesia.

Objective: To assess the effectiveness of scapular stabilization exercises in reducing shoulder pain and enhancing athletic performance in university level volleyball player diagnosed with scapular dyskinesia.

Method: A 22-year-old female university level volleyball player with 6 months of dominant shoulder pain and scapular dyskinesia was selected for this study. She underwent an eight-week intervention consisting of scapular retraction, push-ups plus, scapular depression, and suspension exercises. Pre and Post-intervention assessments included Numeric Pain Rating Scale and AAHPERD volleyball service test.

Results: Post-intervention result showed a significant reduction in shoulder pain (from 5 to 3 on the Numeric Pain Rating Scale) and enhanced volleyball performance, as reflected in increased service test score (From 24 to 29). These findings indicated that the given training program reduced shoulder pain and improved specific performance in a player with scapular dyskinesia.

Conclusion: Scapular stabilization exercises effectively reduce pain and improve performance in university level volleyball player with scapular dyskinesia. Integrating these exercises into training programs can optimize shoulder function and prevent injuries. Further research with larger sample sizes is recommended.

Keywords: scapulae, abnormal movement, shoulder pain, exercise training, athletic performance.

INTRODUCTION

Scapular dyskinesia, characterized by alterations in normal scapular motion and positioning, is a prevalent clinical entity, particularly among overhead athletes. This condition significantly impairs shoulder function, leading to pain, decreased range of motion, and compromised athletic performance. The scapula's role in providing a stable base for glenohumeral joint movement is paramount, and any disruption can have cascading effects on the entire kinetic chain (Voight & Thomson, 2000). In volleyball, a

sport demanding repetitive and forceful overhead movements, the scapula's stability and dynamic control are crucial for optimal performance and injury prevention (Myers et al., 2005). The kinematics of the scapula are intricately linked to the health and function of the shoulder complex.

Studies have demonstrated a strong correlation between scapular dyskinesia and various shoulder pathologies, including subacromial impingement syndrome and rotator cuff tendinopathies (Timmons et al., 2012; Kibler et al., 2013). (Keshavarz et al. 2017) highlighted the critical role of scapular kinematics in numerous shoulder musculoskeletal disorders, underscoring the necessity for targeted interventions. Furthermore, age-related changes and specific conditions like frozen shoulder can further restrict scapular motion, emphasizing the importance of maintaining scapular mobility and stability (Endo et al., 2016). Volleyball players, in particular, are at an elevated risk of developing scapular dyskinesia due to the repetitive nature of serving, spiking, and blocking. The forceful and rapid overhead movements place substantial stress on the shoulder complex, necessitating precise scapular control to maintain joint stability and prevent injury (Palao et al., 2004; Lima et al., 2019). The repetitive overhead throwing motion has been shown to alter scapular kinematics and muscle strength (Birkelo et al., 2003; Downar et al., 2002). Kibler (1991) further elaborated on the scapula's critical role in the throwing motion. Scapular stabilization exercises have emerged as a cornerstone of rehabilitation for individuals with scapular dyskinesia.

These exercises aim to restore normal scapular kinematics by strengthening the muscles responsible for scapular control, such as the serratus anterior, rhomboids, and lower trapezius. Gorji et al. (2022) demonstrated the efficacy of a six-week stability exercise program in improving glenohumeral joint function in female tennis players with scapular dyskinesia, providing evidence for the effectiveness of targeted exercise interventions. Javadaneh et al. (2020) showed the effect of corrective exercises on pain and disability in scapular dyskinesia. Nodehi-Moghadam et al. (2011) examined shoulder girdle muscle endurance in impingement syndrome. Furthermore, Tang et al. (2021) proposed a randomized controlled trial comparing scapular stabilization exercises based on the type of scapular dyskinesia versus traditional rehabilitation training, indicating the ongoing research and refinement of treatment protocols. Kim et al. (2019) presented a case report showcasing the benefits of an eight-week scapular stabilization exercise program in an elite archer with scapular dyskinesia, highlighting the potential for personalized rehabilitation approaches. In addition to exercise-based interventions, other treatment modalities, such as intra-articular corticosteroid injections, have been explored for managing shoulder pain and dysfunction (Ryans et al., 2005).

However, a comprehensive approach integrating targeted exercises is often preferred for long-term functional improvement. Hajihosseini et al. (2015) compared the effects of strengthening, stretching, and comprehensive programs on upper crossed syndrome, emphasizing the importance of a multifaceted rehabilitation strategy. Pain assessment is crucial in evaluating the effectiveness of interventions. The Numeric Pain Rating Scale (NPRS) and Visual Analog Scale (VAS) are commonly used tools for

quantifying pain intensity (Bijur et al., 2001; Downie et al., 1978). These tools provide a reliable and valid measure of pain, allowing for objective assessment of treatment outcomes. Libman et al. (2000) also addressed the minimum clinically important change in pain scores. Performance assessment in volleyball is equally important.

Gabbett and Georgieff (2006) developed a standardized skill assessment for junior volleyball players, highlighting the need for objective measures of athletic performance. Velentzas et al. (2011) examined the effects of routine integration strategies on volleyball serve performance, emphasizing the importance of mental representation and motor control. The AAHPERD volleyball service test, used in this case report, provides a practical and reliable measure of service performance. This case report aims to evaluate the impact of an eight-week scapular stabilization exercise program on pain and performance in a university-level volleyball player with scapular dyskinesia. By documenting the clinical course and outcomes of this individual, This study intends to strengthen the evidence base supporting the application of tailored exercise therapies for scapular dyskinesia among overhead athletes.

CASE DESCRIPTION

A 22-year-old, right-hand dominant female university volleyball player, actively participating in competitive volleyball for five years with a pronounced focus on overhead movements like serving and spiking, presented to the sports physiotherapy clinic with a primary complaint of persistent right shoulder pain. The patient reported an insidious onset of right shoulder pain approximately six months prior to presentation. This pain was characterized as a dull, aching sensation, specifically localized to the posterior and lateral aspects of the shoulder, with occasional radiation extending to the upper arm.

The pain was notably exacerbated by overhead activities, particularly those performed during volleyball training sessions and competitive matches, and experienced partial relief with rest. Critically, she denied any history of acute trauma or direct injury to the shoulder. As a key member of her university volleyball team, she participated in regular training sessions, occurring four times per week, each lasting approximately two hours, and in competitive matches. Her primary role on the team necessitated frequent performance of overhead movements, including serving, spiking, and blocking. She reported a gradual, progressive increase in her training volume and intensity over the past year, which coincided with the onset of her shoulder pain. Her past medical history was unremarkable, with no significant prior medical conditions, including any previous shoulder injuries or surgeries. She also denied any history of systemic diseases or other musculoskeletal conditions.

Clinical examination commenced with static observation, revealing subtle asymmetry in scapular positioning, specifically a slightly more prominent medial border of the right scapula compared to the left. Dynamic observation during active arm elevation demonstrated visible winging of the right scapula, particularly pronounced during the lowering phase of the movement. Furthermore, the patient's scapulohumeral rhythm was disrupted, marked by a noticeable lack of smooth, coordinated movement. Palpation of the

right scapular muscles revealed tenderness upon palpation of the upper trapezius, rhomboids, and serratus anterior muscles.

Notably, no bony abnormalities were detected upon palpation of the scapular spine, acromion, and medial border. Range of motion (ROM) assessment revealed that active ROM of the right shoulder demonstrated mild restriction in flexion and abduction, with the patient reporting pain at the end-range of these movements. In contrast, passive ROM was assessed to be within normal limits, suggesting that the limitations observed during active ROM were likely attributable to pain and muscle dysfunction rather than structural limitations. Strength testing, specifically manual muscle testing (MMT), revealed demonstrable weakness in the right serratus anterior and middle trapezius muscles.

Assessment Procedures:

1. Numeric Pain Rating Scale (NPRS): Pain intensity was assessed using the NPRS, an 10 point scale ranging from 0 (no pain) to 10 (worst imaginable pain). The participant rated her current pain level at rest and during activity.

2. AAHPERD Volleyball Service Test: Volleyball performance was evaluated using the AAHPERD volleyball service test. This test measures the accuracy and consistency of volleyball serves, providing an objective measure of service performance. The test was conducted under standardized conditions, and the participant's score was recorded as the player should pass the ball 10 times over to the opposite side of the net, scores are given as mentioned in the image pre and post intervention if the player throws the ball out-side the court or hit net the points where not given.

3. Clinical Observation of Scapular Dyskinesia: Visual observation of the scapula during active shoulder movements was performed to assess the presence and severity of dyskinesia. Observations included winging, abnormal scapulohumeral rhythm, and altered scapular positioning, (scapular retraction test).

Pre-Intervention Assessment

Before the intervention, the participant completed baseline assessments, which included the NPRS and the AAHPERD volleyball service test. The NPRS is used to evaluate the participant's level of shoulder pain and the pain score was 5. The AAHPERD volleyball service test was used to assess the participant's volleyball performance, focusing on her ability to perform consistent and accurate serves. The score from this test was 24(fig-1). And scapular retraction test was done it was positive.

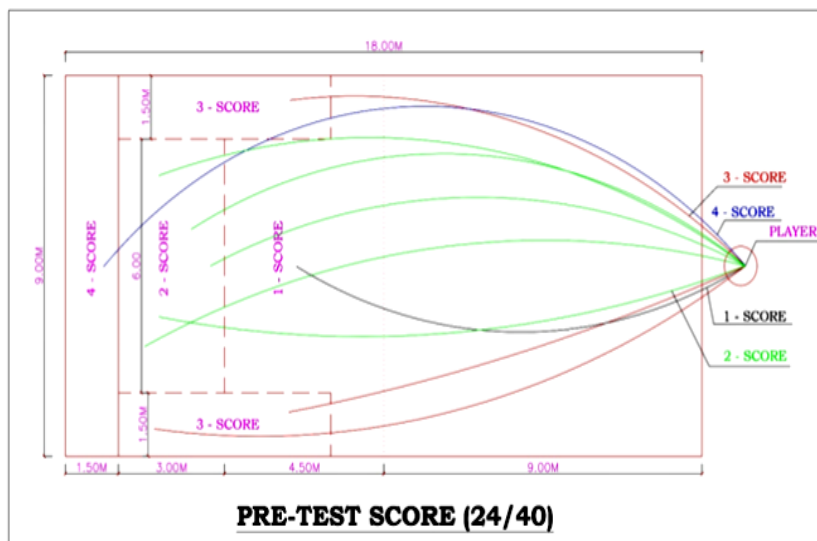


Fig-1: AAHPERD VOLLEYBALL SERVICE TEST(PRE).

INTERVENTION

The participant underwent an eight-week scapular stabilization exercise program, consisting of three sessions per week. Each session lasted approximately 45 minutes and included the following exercises:

1. Scapular Retraction: The participant performed scapular retraction exercises in a prone position, focusing on squeezing the shoulder blades together. This exercise aimed to strengthen the rhomboids and middle trapezius.

2. Push-Ups Plus: The participant performed push-ups with an added protraction phase at the end, emphasizing serratus anterior activation. This exercise aimed to improve scapular stability and control.

3. Scapular Depression: The participant performed scapular depression exercises, focusing on lowering the shoulder blades while maintaining a neutral spine. This exercise aimed to strengthen the lower trapezius.

4. Resistance band Exercises: The participant performed resistance band exercises, targeting various scapular muscles. These exercises aimed to enhance dynamic scapular stability and neuromuscular control. The exercise program was progressed gradually based on the participant's tolerance and performance. Proper form and technique were emphasized throughout the intervention.

Each exercise was performed for three sets of 12–15 repetitions, with progressive increases in intensity as tolerated. The exercises were performed three times per week, under the supervision of a certified rehabilitation specialist. Additionally, the participant was instructed to incorporate proper posture and scapular positioning during volleyball practice to reinforce the benefits of the rehabilitation program.

Post-Intervention Assessment

After completing the eight-week exercise program, the participant underwent a post-intervention assessment using the same measures as the pre-intervention phase. The NPRS score was 3. The AAHPERD volleyball service test score was 29 (fig-2). And scapular retraction test was negative. The results were compared to the baseline data to assess the effectiveness of the scapular stabilization exercise program.

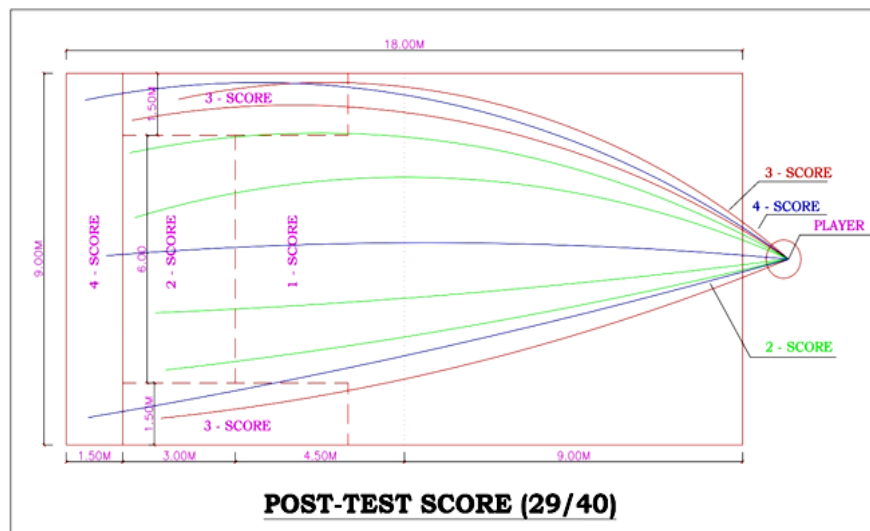


Fig-2: AAHPERD VOLLEYBALL SERVICE TEST (POST).

RESULT

The results of the case study indicated significant improvements in both pain reduction and volleyball performance following the eight-week scapular stabilization exercise program. The participant reported a noticeable reduction in shoulder pain after completing the exercise program. On the Numeric Pain Rating Scale (NPRS), her pain intensity during activity decreased from a baseline score of 5 to a post-intervention score of 3. This reduction in pain was consistent with the participant's self-reported experience, as she noted a significant improvement in her ability to perform overhead movements without discomfort. Additionally, pain during rest decreased from a baseline score of 2 to a post-intervention score of 1, indicating an overall improvement in shoulder function.

The AAHPERD volleyball service test score, which was initially 24 points, increased to 29 points after the intervention, reflecting a marked improvement in the participant's serving accuracy and consistency. The improvement in performance was attributed to enhanced scapular stability and shoulder function, allowing the participant to generate more efficient force during her serves. The increased score indicated that the participant's ability to perform a key volleyball skill had improved as a result of the scapular stabilization exercises.

In summary, the post-intervention results have shown a significant reduction in shoulder pain and an improvement in volleyball performance, and scapular retraction test

was negative, supporting the effectiveness of scapular stabilization exercises for addressing scapular dyskinesia in a university-level volleyball player.

DISCUSSION

The findings of this case study align with existing literature, reinforcing the significance of scapular stabilization exercises in managing scapular dyskinesia and improving performance in overhead athletes. This case report demonstrated that an eight-week scapular stabilization program effectively reduced shoulder pain and enhanced volleyball-specific skills in a university-level volleyball player. The observed improvements in pain reduction and increased performance scores emphasize the importance of targeted rehabilitation strategies to address the biomechanical deficiencies associated with scapular dyskinesia.

Scapular dyskinesia is known to contribute to shoulder pain, particularly in overhead athletes like volleyball players, due to altered kinematics and muscle imbalances (Kibler et al., 2013). The preintervention Numeric Pain Rating Scale (NPRS) score of 5 suggests moderate pain, which could impair functional performance. Following the intervention, the pain level decreased to 3, indicating a clinically meaningful improvement. This result aligns with previous studies demonstrating that scapular stabilization exercises alleviate shoulder discomfort by improving scapular positioning and muscle activation (Javdaneh et al., 2020; Gorji et al., 2022).

Previous studies have established that corrective exercises targeting scapular stabilization lead to reduced pain and dysfunction in individuals with scapular dyskinesia. A systematic review by Keshavarz et al. (2017) confirmed that scapular kinematics play a crucial role in various shoulder musculoskeletal disorders. Similarly, Nodehi-Moghadam et al. (2011) reported that individuals with shoulder impingement syndrome, a condition commonly associated with scapular dyskinesia, exhibit reduced endurance in scapular stabilizing muscles, leading to pain and dysfunction.

Moreover, the pain reduction observed in this case can be attributed to improved muscle activation patterns. Voight and Thomson (2000) highlighted that dysfunction of the serratus anterior and lower trapezius contributes to altered scapular mechanics, increasing stress on the glenohumeral joint. The intervention program in this case study, which included scapular retraction, push-ups plus, scapular depression, and suspension exercises, likely facilitated optimal scapular positioning, thereby reducing stress on the shoulder joint and alleviating pain.

Apart from pain reduction, this case study highlights the functional benefits of scapular stabilization exercises, as reflected in the improvement in volleyball-specific performance. The increase in the AAHPERD volleyball service test score from 24 to 29 post-intervention indicates enhanced performance, which is consistent with findings from previous research on overhead athletes. Studies have shown that altered scapular biomechanics can compromise force generation, coordination, and endurance, ultimately affecting sports performance (Tang et al., 2021; Myers et al., 2005).

In volleyball players, optimal scapular control is crucial for executing powerful and accurate serves, spikes, and overhead motions (Palao et al., 2004; Lima et al., 2019). The improvements observed in the current study suggest that the scapular stabilization exercises enhanced motor control, strength, and endurance of the scapular muscles, leading to better kinetic chain function and overall

performance. This aligns with research by Kim et al. (2019), who reported similar performance improvements in an elite archer following an eight-week scapular stabilization program.

Additionally, the present findings support the argument that prolonged overhead activity, without proper scapular control, leads to altered kinematics and reduced performance. Studies by Birkelo et al. (2003) and Downar et al. (2002) have highlighted how chronic adaptations in overhead athletes negatively affect shoulder mobility and strength, underscoring the need for corrective exercises to counteract these changes. By addressing scapular dyskinesia, the current intervention likely contributed to improved shoulder mechanics and efficiency in executing volleyball-specific skills.

The clinical implications of this case study highlight the importance of integrating scapular stabilization exercises into training and rehabilitation programs for volleyball players. The significant reduction in pain and enhancement in performance suggest that such exercises should be a fundamental component of strength and conditioning protocols for overhead athletes.

From a rehabilitation perspective, these findings provide further evidence supporting the use of scapular stabilization as a non-invasive intervention for shoulder pain management. Given that volleyball players are highly susceptible to shoulder injuries due to repetitive overhead motions, proactive implementation of stabilization exercises could serve as a preventive strategy, reducing the risk of chronic shoulder dysfunction.

Furthermore, these findings align with the 2013 consensus statement from the Scapular Summit, which emphasized the clinical importance of scapular stabilization in preventing and rehabilitating shoulder injuries (Kibler et al., 2013). The improvements seen in the present study support the necessity of early identification and targeted intervention for scapular dyskinesia to optimize athletic performance and prevent long-term complications.

Limitations and Future Directions:

Firstly, this study was conducted on a single participant, limiting its generalizability. Future studies should include larger sample sizes to establish stronger evidence regarding the efficacy of scapular stabilization exercises in volleyball players with scapular dyskinesia. Additionally, objective measures such as electromyography (EMG) could provide deeper insights into muscle activation patterns and neuromuscular adaptations following intervention.

Moreover, incorporating additional performance metrics, such as spike velocity and shoulder range of motion, could provide a more comprehensive evaluation of scapular stabilization impact on volleyball performance.

CONCLUSION

This case report provides evidence that scapular stabilization exercises can be an effective intervention for reducing shoulder pain and improving performance in university-level volleyball players with scapular dyskinesia. The eight-week exercise program led to significant improvements in both pain levels and performance, as assessed by the Numeric Pain Rating Scale and the AAHPERD volleyball service test. These findings suggest that scapular stabilization exercises can be integrated into rehabilitation programs to optimize shoulder function and prevent injuries in volleyball players.

Given the positive outcomes observed in this case study, it is recommended that scapular stabilization exercises be incorporated into training and rehabilitation programs for athletes with scapular dyskinesia. Further research is needed to expand on these findings and establish more comprehensive guidelines for the use of scapular stabilization exercises in sports rehabilitation.

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