

An Inside Look at Swimmers Shoulder Antero-Superior Internal Impingement (ASII) A Cause of Swimmer's Shoulder

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ABSTRACT

Background: Shoulder impingement syndrome is the most common disorder of the shoulder in swimmers, resulting in functional loss and disability.

OBJECTIVES

The purpose of this study was to compare between the effects of scapular muscle training versus rhythmic stabilization exercises in treatment of swimmers with Shoulder impingement syndrome.

Study Design/ Settings

A prospective randomized study

Methods

Thirty swimmers with shoulder impingement syndrome participated in this study. They were assigned randomly into two experimental groups. The 1st experimental group (group A) (n= 15) received a graduated rhythmic stabilization exercises and stretching of the posterior capsule. The 2nd experimental group (group B) (n= 15) received a scapular muscle training exercise in addition to stretching of the posterior capsule. Treatment was given 3 times per week, every other day, for 4 consecutive weeks. Patients were evaluated pretreatment and posttreatment for shoulder pain severity, shoulder functional disability, scapular protraction and upward rotation, upper trapezius/ serratus anterior ratio and external / internal rotation ratio.

Results

A statistically non-significant difference was found between both groups in all measured variables neither pretreatment nor post treatment.

Conclusion

Both rhythmic stabilization and scapular muscle training exercises are effective interventions to treat swimmers shoulder

Key words

Shoulder Impingement Syndrome, Scapular Exercises, Rhythmic Stabilization Exercises, Posterior Capsule Stretch.

INTRODUCTION

Swimming is a popular recreational and competitive sport that requires a combination of muscular strength, endurance, flexibility, coordination, and efficient movement mechanics. It involves repetitive upper-limb movements, coordinated trunk rotation, and sustained shoulder activity to generate propulsion through the water. The shoulder joint plays a particularly important role in swimming because it allows a wide range of motion and facilitates the repeated overhead movements required during different swimming strokes. Competitive swimmers may perform thousands of shoulder rotations during training and competition, placing considerable repetitive demands on the muscles, tendons, ligaments, and other structures surrounding the shoulder. Although swimming is generally considered a low-impact sport, the repetitive nature of its movements can contribute to shoulder pain and overuse injuries. Among the most common swimming-related musculoskeletal complaints is swimmer's shoulder, a condition associated with shoulder pain, reduced functional capacity, and difficulty maintaining training intensity.

Swimmer's shoulder is a broad clinical term used to describe shoulder pain and dysfunction experienced by swimmers, particularly those involved in repetitive overhead activity. It is not a single pathological diagnosis but may involve several interacting factors, including rotator cuff tendinopathy, long head of the biceps tendon irritation, altered scapular movement, reduced shoulder strength, glenohumeral instability, and internal impingement. Symptoms may develop gradually as a result of repeated loading, inadequate recovery, sudden increases in training volume, or changes in swimming technique. Swimmers commonly report pain during the pulling phase of the stroke, during overhead recovery, or after prolonged training sessions. Persistent symptoms may interfere with stroke efficiency, reduce swimming performance, and limit participation in regular training. Therefore, understanding the anatomical and biomechanical mechanisms contributing to swimmer's shoulder is important for accurate assessment, prevention, and rehabilitation.

The shoulder complex consists of the glenohumeral, acromioclavicular, and sternoclavicular joints, together with the functional articulation between the scapula and thoracic wall. These structures work together to provide the mobility and stability necessary for overhead activities. The glenohumeral joint permits extensive movement but depends substantially on the surrounding muscles, tendons, joint capsule, and ligaments for dynamic and passive stability. The rotator cuff muscles, comprising the supraspinatus, infraspinatus, teres minor, and subscapularis, contribute to the control of the humeral head during shoulder movement. The scapular stabilizing muscles, including the serratus anterior and trapezius, facilitate appropriate scapular positioning and movement during arm elevation. Efficient coordination between the scapula, humerus, and trunk is essential for distributing mechanical loads and maintaining shoulder function during repetitive swimming movements.

Swimming places distinctive biomechanical demands on the shoulder because propulsion depends heavily on coordinated arm movement and the generation of force against water resistance. During freestyle and butterfly swimming, the shoulder repeatedly moves through elevation, rotation, and horizontal movement, while the rotator cuff and scapular muscles help control the humeral head and maintain functional alignment. During the recovery phase, the arm moves above the water, while the underwater pulling phase requires the upper limb to generate substantial propulsive force. Repetitive loading, particularly when combined with fatigue, inadequate muscular endurance, or altered movement mechanics, may increase stress on the shoulder structures. Reduced flexibility, impaired scapular control, excessive shoulder rotation, and weakness of the rotator cuff may further contribute to symptoms in susceptible swimmers. However, shoulder pain is multifactorial, and no single biomechanical abnormality explains every case of swimmer's shoulder.

Internal impingement refers to the contact or compression of structures within the glenohumeral joint, particularly involving the rotator cuff tendons and the glenoid region, during certain shoulder positions. It is commonly discussed in relation to overhead athletes and is influenced by the position of the humeral head, shoulder rotation, scapular mechanics, and the loading demands of the activity. Internal impingement is distinct from the more familiar concept of external or subacromial impingement, in which structures beneath the acromion may become symptomatic. In overhead athletes, internal impingement may be associated with changes in shoulder mobility, repetitive loading, rotator cuff pathology, and alterations in glenohumeral mechanics. The presence of internal contact alone does not necessarily indicate a pathological condition; clinical symptoms and the overall examination findings are required to establish its relevance.

Antero-superior internal impingement (ASII) describes a proposed pattern of internal impingement involving the anterosuperior region of the glenohumeral joint. This concept requires careful anatomical and clinical interpretation because internal impingement is not a single uniform disorder, and terminology may vary across clinical literature. The precise structures involved and the mechanisms responsible for symptoms depend on the shoulder position, movement pattern, and underlying pathology. In swimmers, repetitive shoulder loading may contribute to anterior shoulder symptoms through several possible mechanisms, including altered humeral head control, rotator cuff dysfunction, capsular adaptations, and impaired scapulohumeral coordination. Consequently, ASII should be evaluated within the broader clinical context of swimmer's shoulder rather than assumed to be the cause of every case of swimming-related shoulder pain.

The pathomechanics of internal impingement may involve an interaction between repetitive overhead movement, altered glenohumeral kinematics, and the capacity of the surrounding musculature to control joint motion. Repeated shoulder rotation and elevation can place considerable demands on the rotator cuff, particularly when muscular endurance is insufficient to maintain control throughout prolonged training. Fatigue may influence the timing and effectiveness of muscle activation, potentially altering humeral head positioning and increasing stress on sensitive structures. Similarly, altered scapular movement may affect the orientation of the glenoid and the coordination of shoulder elevation. These factors may interact with training volume, stroke technique, recovery periods, and individual anatomical characteristics to contribute to shoulder symptoms.

The clinical presentation of swimmer's shoulder may include anterior, superior, or posterior shoulder pain, discomfort during overhead movement, reduced shoulder strength, and difficulty performing repetitive swimming strokes. Some swimmers may report pain during the catch, pull-through, or recovery phase, while others experience symptoms after training or during activities such as reaching overhead. Restricted shoulder internal rotation, excessive external rotation, scapular dyskinesis, and rotator cuff weakness may be identified in some individuals, although these findings are not universal and should not be interpreted independently of symptoms. A comprehensive assessment should consider the swimmer's training history, stroke specialization, weekly training volume, recent changes in workload, previous injuries, shoulder range of motion, strength, scapular control, and functional limitations.

Physiotherapy plays an important role in the assessment and management of swimmer's shoulder. Conservative rehabilitation may include modification of training load, patient education, rotator cuff strengthening, scapular stabilization exercises, mobility interventions when indicated, trunk conditioning, and gradual return to swimming. Exercise programmes aim to improve the strength and endurance of the shoulder musculature, optimize movement coordination, and increase tolerance to repetitive overhead loading. Technical assessment may also help identify modifiable factors related to stroke mechanics. Treatment should be individualized according to the swimmer's symptoms, examination findings, training demands, and functional goals. When internal impingement is suspected, clinical assessment is essential to distinguish it from other causes of shoulder pain, including rotator cuff tendinopathy, biceps tendon disorders, instability, and labral pathology.

Investigating antero-superior internal impingement in swimmers is clinically relevant because a more detailed understanding of the possible mechanisms underlying shoulder pain may support more appropriate assessment and rehabilitation. However, the association between ASII and swimmer's shoulder should be examined carefully because swimming-related shoulder pain is multifactorial and may arise from several overlapping conditions. A focused investigation of shoulder symptoms, movement patterns, muscle function, and relevant clinical findings may help clarify whether features consistent with internal impingement are present in the selected population. Where appropriate, imaging and specialist evaluation may provide additional information, although imaging findings must be interpreted alongside clinical symptoms and examination results.

Despite increasing awareness of shoulder overuse injuries in swimming, further clinical investigation may be useful to understand the role of specific internal impingement mechanisms in swimmers with shoulder pain. Evaluating anterosuperior internal impingement within the broader framework of swimmer's shoulder may contribute to a better understanding of shoulder biomechanics, clinical presentation, and potential contributing factors. Such investigation may also help physiotherapists distinguish between different sources of shoulder pain and develop more targeted, evidence-informed rehabilitation strategies.

Therefore, the present study, entitled “**An Inside Look at Swimmer’s Shoulder: Antero-Superior Internal Impingement (ASII) as a Cause of Swimmer’s Shoulder,**” aims to explore the possible relationship between antero-superior internal impingement and shoulder pain among swimmers. The study may focus on the clinical presentation, shoulder range of motion, rotator cuff function, scapular mechanics, and other relevant assessment findings, depending on the selected research design. By examining these factors, the study seeks to contribute to a better understanding of the potential role of ASII in swimming-related shoulder dysfunction. The findings may support improved clinical assessment, identification of relevant contributing factors, and the development of individualized physiotherapy approaches to help swimmers manage shoulder symptoms and maintain functional performance.

METHODOLOGY

This study was conducted in the outpatient clinic of faculty of physical therapy, Deep hospital, Jaipur from June 2019 to January 2020.

Patients:

Thirty male and female swimmers with SIS, with their age between 20 to 25 years participated in this study. They were randomly distributed into two equal experimental groups. Group (A) received a combined program of graduated rhythmic stabilization exercises in addition to stretching of posterior capsule, while group (B) received a combined program of specific scapular muscles exercises and stretching of posterior capsule. Treatment was given 3 times per week, every other day, for 4 consecutive weeks. Patients were evaluated pre-treatment and post treatment for shoulder pain severity, shoulder functional disability, scapular protraction, scapular upward rotation, UT/SA ratio and ER/IR ratio. Patient who had current symptoms related to cervical spine disorders (such as cervical spondylosis, disc prolapse) or who had a history of acromio-clavicular pain were excluded.

Assessment Procedures:

Each patient was assessed pretreatment and posttreatment after (12) sessions.

Shoulder Pain Severity and Functional Disability:

were assessed by using (SPADI).

Scapular protraction was assessed by measuring the distance between the posterior border of the acromion and the table using an electronic digital caliper.

Assessment of Scapular Upward Rotation:

One inclinometer was velcro taped perpendicular to the humeral shaft. Another inclinometer was placed on the superior border of the spine of the scapula. Patient was instructed to perform shoulder abduction to 180°. The overall intra-rater reliability is very good (ICC=0.88), and ranges from 0.81 to 0.94[29].

Isometric strength of UT, SA, ER, and IR was measured by HHD and then the UT/SA and ER/IR ratios were calculated.

Treatment procedures:

Patients of both groups received three sessions weekly for four weeks with a total of 12 sessions. Patients of the two groups received stretching of the posterior capsule.

Patients in group (A), received graduated rhythmic stabilization exercises either in open or closed kinetic chain. In all exercises, the patients were instructed to hold the position for 10 seconds, and they took a rest for 3 seconds. Ten repetitions considered one set, and the patients conducted three sets. A break of 3 minutes was given between sets.

In the first four sessions: patients performed open kinetic chain rhythmic stabilization, and scapular stabilization exercises.

sessions: patients performed closed kinetic chain rhythmic stabilization exercises on stable surface with bilateral upper extremity support, then unilateral first from standing against the wall then from quadruped position.

In the last four sessions: patients performed closed kinetic chain rhythmic stabilization exercises on unstable surface with bilateral upper extremity support, then unilateral first from standing facing the Swiss ball against the wall then from quadruped position on the Swiss ball against the ground.

Patients of group (B) received the following four resisted scapular muscles exercises.

1. Side-lying external rotation.
2. Side-lying forward flexion.
3. Horizontal abduction with external rotation.
4. Prone extension.

OUT COME MEASUREMENTS

The subjects were required to fill out a questionnaire to obtain their demographic data, medical and surgical history. They were evaluated by physical examination viz., observation, palpation, joint range of motion measurements, muscle power, special tests, imaging technique. □

Treatment protocol will be assessed by VAS scale for pain, MMT for muscle strength. The patient has to rate their levels of pain and disability from 0-10, and consists of 2 sub scales. There is the pain sub scale (0=No pain, 10=worst imaginable) and this functional subscale (0=No difficulty, 10=unable to do).

RESULTS

“Mann Whitney test was used to compare between pain, disability and UT/SA values in the two groups. A statistically significant improvement was achieved in both groups except for the UT/SA in group B. A statistically non-significant difference was found between group A and group B both pretreatment and posttreatment. (Table 1; Fig.1, 2,3).

“Unpaired t test was used to compare between the mean values of scapular protraction, scapular upward rotation and ratio of ER /IR in the two groups.

A statistically significant improvement was achieved in both groups except for the scapular upward rotation in group B. A statistically non-significant difference was found between group A and group B both pretreatment and posttreatment (Table 2, Fig.4, 5, 6).

Table 1: A comparison between mean values of pain, disability and ratio of UT/SA pre- and post- treatment in both groups.

variables	Items	Group A	Group B	Z-value	P-value
		Mean $\pm$ SD	Mean $\pm$ SD		
Pain	Pre-treatment	0.29 $\pm$ 0.21	0.42 $\pm$ 0.22	-1.827	0.068
	Post-treatment	0.13 $\pm$ 0.14	0.17 $\pm$ 0.17	-0.935	0.350
	Difference %	55.17	59.52		
	Z-value	-2.726	-3.295		
	P-value	0.006**	0.001**		
Disability	Pre-treatment	0.20 $\pm$ 0.12	0.29 $\pm$ 0.17	-1.454	0.146
	Post-treatment	0.11 $\pm$ 0.08	0.13 $\pm$ 0.11	-0.664	0.506
	Difference %	45	55.17		
	Z-value	-3.068	-3.297		
	P-value	0.002**	0.001**		
UT/SA	Pre-treatment	1.69 $\pm$ 0.91	1.45 $\pm$ 0.69	-0.892	0.372
	Post-treatment	1.14 $\pm$ 0.32	1.14 $\pm$ 0.39	-0.145	0.885
	Difference %	32.54	21.38		
	Z-value	-2.755	-1.538		
	P-value	0.006**	0.124		

SD: standard deviation %: percentage P-value: probability value Significant ($P \leq 0.05$) ** $p < 0.01$ = highly significant.

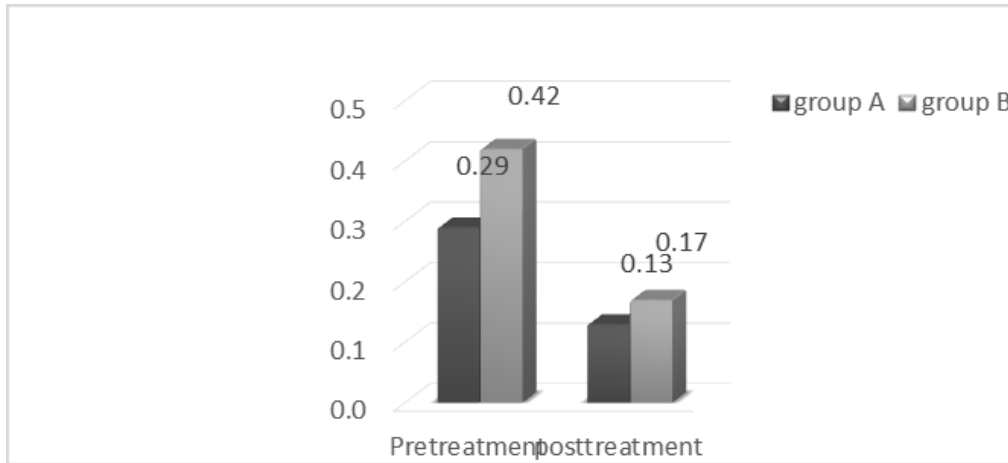


Fig. 1: Comparison between mean values of pain.

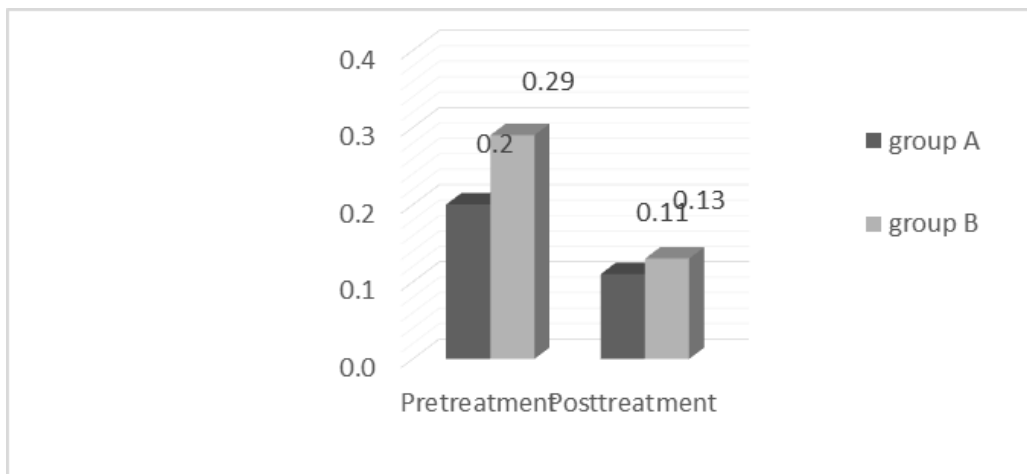


Fig. 2: Comparison between mean values of disability

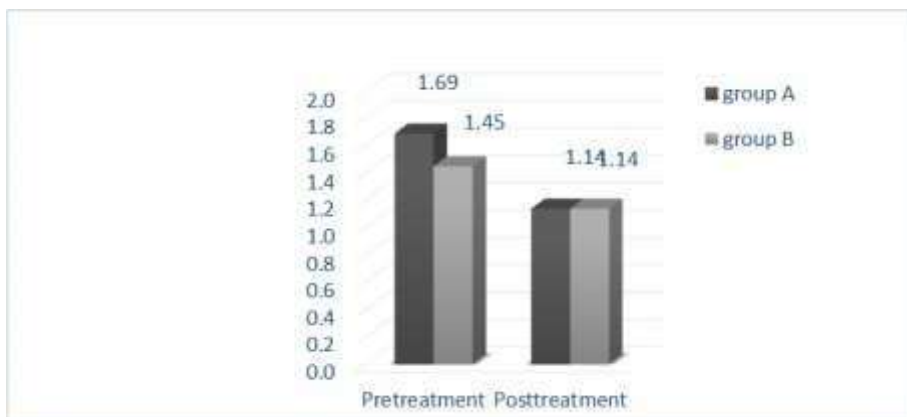


Fig. 3: Comparison between mean values of ratio of UT/SA

Table 2: A comparison between mean values of scapular protraction, scapular up ward rotation and ratio of ER /IR pre-andpost-treatment in both groups

variables	Items	Group A	Group B	t-value	P-value
		Mean $\pm$ SD	Mean $\pm$ SD		
Scapular protraction	Pre- treatment	57.06 $\pm$ 18.18	50.56 $\pm$ 8.89	1.243	0.224
	Post- treatment	40.92 $\pm$ 11.64	36.06 $\pm$ 6.93	1.388	0.176
	Difference %	28.29	28.68		
	t-value	4.343	7.002		
	P-value	0.001**	0.001**		
Scapular upward rotation	Pre- treatment	51.00 $\pm$ 6.87	53.47 $\pm$ 10.40	-0.767	0.450
	Post- treatment	57.67 $\pm$ 4.58	58.53 $\pm$ 4.24	-0.538	0.595
	Difference %	13.08	9.46		
	t-value	-4.000	-1.688		
	P-value	0.001**	0.114		
ER /IR	Pre- treatment	0.87 $\pm$ 0.15	0.82 $\pm$ 0.17	0.880	0.386
	Post- treatment	0.99 $\pm$ 0.11	0.97 $\pm$ 0.17	0.388	0.701
	Difference %	13.79	18.29		
	t-value	-2.376	-3.086		
	P-value	0.032*	0.008**		

SD: standard deviation %: percentage P-value: probability value Significant ($P \leq 0.05$) * $p < 0.05$, ** $p < 0.01$ = highly significant.

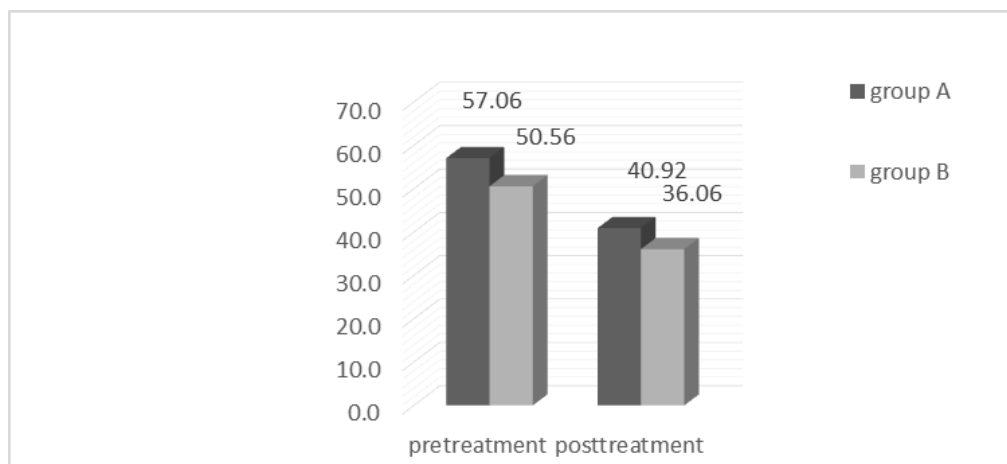


Fig. 4: Comparison between mean values of scapular protraction

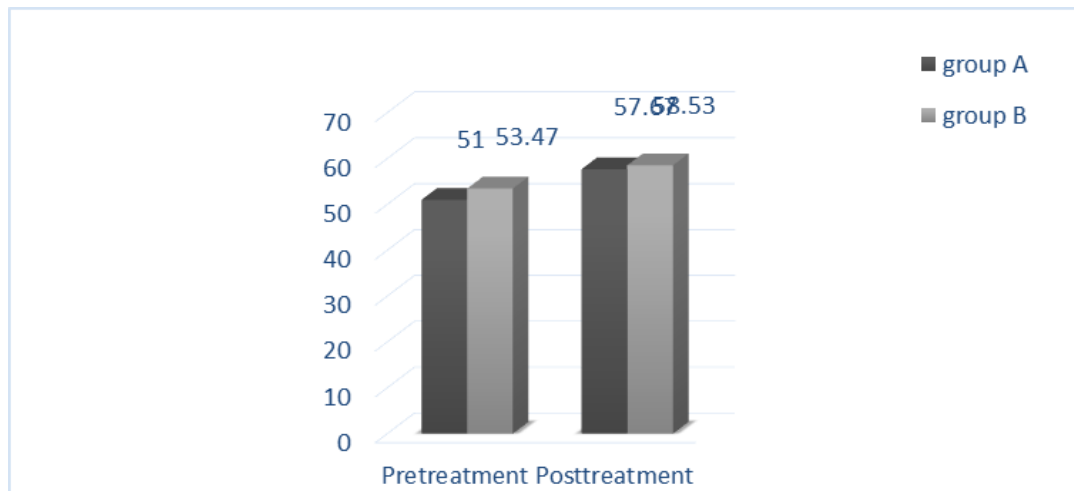


Fig. 5: Comparison between mean values of scapular up ward rotation.

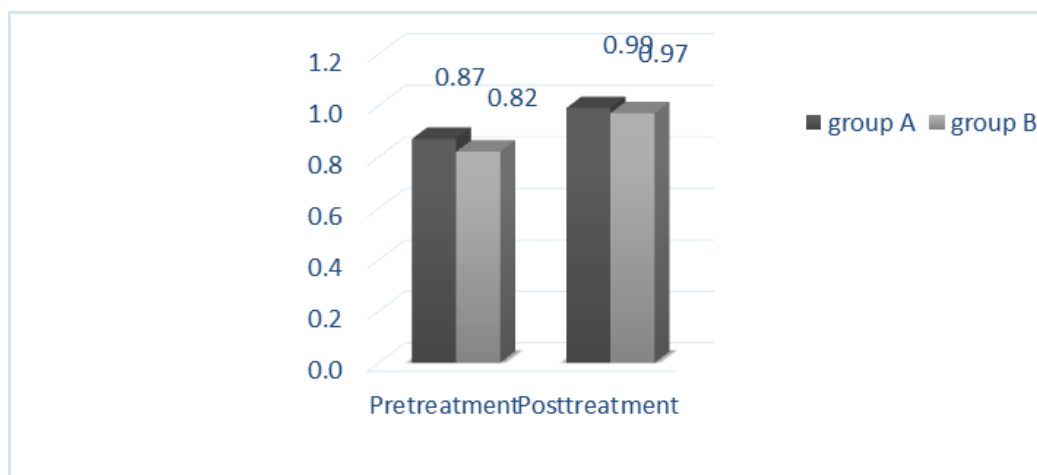


Fig. 6: Comparison between mean values of ratio of external /internal.

DISCUSSION

The purpose of this study was to investigate the effect of scapular muscle training versus rhythmic stabilization exercises on shoulder pain severity, functional disability, scapular protraction, scapular upward rotation, UT/SA ratio and ER/IR ratio in treatment of SIS. These results were agreed with the results of [30] who examined the effect of shoulder stabilization exercises immediately after surgery in patients diagnosed as SIS.

The results of the current study also agreed with the results of [31] who conducted a study to compare between the effects of scapular stabilization based exercise and physiotherapy intervention on pain, posture, flexibility and shoulder mobility. They reported that there was an equal effectiveness of physiotherapy and exercise therapy in decreasing pain. Also a decrease in scapular protraction in the exercise therapy group who received a 6 weeks of scapular stabilization based exercise in addition to stretching of posterior capsule and pectoralis minor and theraband exercises for rotator cuff muscles compared with its value in the physiotherapy group who received a program of ultra sound, Infrared and transcutaneous electrical nerve stimulation. The results of the current study agreed with the results of the study conducted by [32] who determine the most effective exercise to specifically activate the scapular posterior tilting muscles. The results of the current study showed a statistical significant decrease in UT/SA ratio in group (A), which is consistent with the results of the study conducted by [33] whose results were higher when assessing wall push up on stable and un stable surfaces. The improvement after scapular muscle training in group (B) was described by [34]. They stated that these specific exercises effectively enhance intermuscular as well as intramuscular timing of stabilizing portions of trapezius muscle by the activation of the middle and lower trapezius portion prior to the glenohumeral prime mover

(posterior deltoid) as well the upper trapezius. In the current study, both groups showed increase in the ER/IR ratio which come in agreement with [35] who also reported significant gains in strength of the rotator cuff, specifically targeting external rotation strengthening to normalize external/internal rotation strength balance in a group of female overhead athletes.

CONCLUSION

The results of the current study showed that both rhythmic stabilization and scapular muscle training exercises are effective interventions to improve: shoulder pain, functional disability, scapular protraction, and external / internal rotation ratio. But only rhythmic stabilization exercises are effective interventions to improve the upper trapezius/serratus anterior ratio and the scapular upward rotation.

REFERENCES:

1. Bak K. The practical management of swimmer's painful shoulder: etiology, diagnosis, and treatment. *Clinical journal of sport medicine: Official Journal of the Canadian Academy of Sport Medicine*. 2010;20(5):386-90.
2. Bak K, Fauno P. Clinical findings in competitive swimmers with shoulder pain. *Am J Sports Med* 1997;25(2):254-60.
3. Bak K, Magnusson SP. Shoulder strength and range of motion in symptomatic and pain-free elite swimmers. *Am J Sports Med* 1997;25(4):454-9.
4. Batalha N, Marmeleira J, Garrido N, Silva AJ. Does a water-training macrocycle really create imbalances in swimmers' shoulder rotator muscles? *Eur J Sport Science* 2015;15(2):167-72.
5. Beach ML, Whitney SL, Dickoff-Hoffman S. Relationship of shoulder flexibility, strength, and endurance to shoulder pain in competitive swimmers. *J Orthop Sports Phys Ther* 1992;16(6):262-8.
6. Belling Sorensen AK, Jorgensen U. Secondary impingement in the shoulder. An improved terminology in impingement. *Scandinavian Journal of Medicine & Science in Sports*. 2000;10(5):266-78.
7. Blanch P. Conservative management of shoulder pain in swimming. *Physical Therapy in Sport* 2004;5(3):109-24.
8. Blevins FT, Djurasovic M, Flatow EL, Vogel KG. Biology of the rotator cuff tendon. *The Orthopedic Clinics of North America* 1997;28(1):1-16.
9. Boettcher C. Rotating Our Approach - Hand Held Dynamometry and Swimmers Shoulder. *Sports Physio* 2013(2).
10. Borsa PA, Scibek JS, Jacobson JA, Meister K. Sonographic stress measurement of glenohumeral joint laxity in collegiate swimmers and age-matched controls. *Am J Sports Med* 2005;33(7):1077-84.
11. Bourne D, Choo A, Regan W, MacIntyre D, Oxland T. Accuracy of digitization of bony landmarks for measuring change in scapular attitude. *Proc Inst Mech Eng. Part H, Journal of Engineering in Medicine* 2009;223(3):349-61.
12. Brushoj C, Bak K, Johannsen HV, Fauno P. Swimmers' painful shoulder arthroscopic findings and return rate to sports. *Scandinavian Journal of Medicine & Science in Sports*. 2007;17(4):373-7.
13. Burkhart SS, Morgan CD, Kibler WB. The disabled throwing shoulder: spectrum of pathology Part I: pathoanatomy and biomechanics. *Arthroscopy: The Journal of Arthroscopic & Related Surgery* 2003;19(4):404-20.
14. Ciullo JV. Swimmer's shoulder. *Clin Sports Med* 1986;5(1):115-37.
15. Clark JM, Harryman DT, 2nd. Tendons, ligaments, and capsule of the rotator cuff. Gross and microscopic anatomy. *The Journal of Bone and Joint Surgery. American* 1992;74(5):713-25.
16. Cook JL, Purdam C. Is compressive load a factor in the development of tendinopathy? *Br J Sports Med* 2012;46(3):163-8.



17. Cook JL, Purdam CR. Is tendon pathology a continuum? A pathology model to explain the clinical presentation of load-induced tendinopathy. *Br J Sports Med* 2009;43(6):409-16.
18. Couanis G, Breidahl W, Burnham S. The relationship between subacromial bursa thickness on ultrasound and shoulder pain in open water endurance swimmers over time. *J Sci Med Sport* 2015;18(4):373-7.
19. Fallon J. Functional morphology of the supraspinatus tendon. *Journal of Orthopaedic Research* 2002;20(5):920-6.
20. Fukuda H. Partial-thickness rotator cuff tears: A modern view on Codman's classic. *Journal of Shoulder and Elbow Surgery* 2000;9(2):163-8.