TO FIND THE EFFECT OF SHOULDER REHABILITATION FOR IMBALANCED FORCE COUPLE MUSCLE IN INSTABILITY INDUCED SHOULDER IMPINGEMENT SYNDROME

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ABSTRACT
Aim: The study is to find the effect of shoulder rehabilitation for imbalanced force couple muscle in instability induced shoulder impingement syndrome. Method: The study is done on 72 subjects with shoulder impingement syndrome. This group would perform exercises like Scapula Stabilizers Strengthening exercises and Rotator Cuff Strengthening exercise for 4 weeks. Subjects were chosen using a reasonable sample approach, and the study was clearly explained to them, with signed informed consent obtained from those who fit the criteria. Subjects were separated into 2 groups Group A (n=30) and Group B (n=30) where Group A was given Scapula Stabilizers Strengthening exercises and Group B were given Rotator Cuff Strengthening exercises Result: The pre and post value were examined by the Numerical Pain Rating Scale and Constant Murley Score in Group A. The mean difference is 6.0 and 31.6 respectively. The Standard Deviation is 1.22 and 0.76 respectively. The paired’t’ values for the Numerical Pain Rating Scale and Constant Murley Score are 19.04 and 41.53. For a 5 percent significance, the paired’t’ value is greater than table value 2.15. The pre and post value were examined by the Numerical Pain Rating Scale and Constant Murley Score in Group B. The mean difference is 4.3 and 24.2 respectively. The Standard Deviation is 1.35 and 0.56 respectively. The paired’t’ values for the Numerical Pain Rating Scale and Constant Murley Score are 12.32 and 43.04. For a 5 percent significance, the paired’t’ value is higher than the tabulated value of 2.15. The calculated value by Unpaired’t’ test assessed by Numerical Pain Rating Scale and Constant Murley Score were 10.09 and 10.62. For a 5% significant level at 38 percent variation, the calculated value was greater than the table value of 2.05. Conclusion: In this study, the use of Scapula Stabilizers Rehabilitation Protocol was effective in treating the muscular imbalance which leads to force couple instability causing Shoulder Impingement Syndrome.

Keywords: Scapula Stabilizers Rehabilitation Protocol, Rotator cuff Rehabilitation Protocol, Imbalanced force couple muscles, Subacromial space.

INTRODUCTION
The shoulder joint has a greater range of motion than any joint in the body. It possesses a shallow articular fovea, which could instability between the acromion and the humeral head. Shoulder pain is the second more frequent form of compliant pain as a result of this instability (1). Adults had a 2.4 percent yearly problem and a 1.5 percent annual incidence rate of shoulder difficulties, respectively (2). Shoulder Impingement Syndrome has the greatest occurrence rate of 36 % among individuals who complain of shoulder pain. (3). In normal practice, shoulder impingement syndrome (SIS) (4) is the more frequent shoulder condition, Impingement of the rotator cuff tendons, notably the supraspinatus and long head of the biceps tendon, as well as the adjacent bursa in the subacromial region, induces it (5). According to Neer, impingement syndrome is a clinical syndrome in which the superhumeral tissues are squeezed against the acromion and/or the coracoacromial ligament (6, 7, 8, 9). Internal impingement between the humerus, glenoid rim, and labrum can also develop (10).

The superhumeral space, also known as the supraspinatus outlet, is formed by the superior surface of the humeral head underneath and the inferior surface of the acromion, the acromioclavicular joint, and the coracoacromial ligament above. Within the superhumeral space are the subacromial bursa and rotator cuff tendons (supraspinatus, infraspinatus, teres minor), The
Shoulder impingement syndrome has always been thought to be the more prevalent mechanism of shoulder pain since it was first documented in 1852, contributing to 44 percent to 65 percent of all shoulder complaints (14). People who engage in sports activities and occupations that involve repetitive overhead actions are more likely to develop shoulder impingement syndrome (15). Impairments linked with postural alterations, muscle imbalance, and rotator cuff motor control issues are further extrinsic risk factors that lead to impingement syndromes. Changes in the rotator cuff's vascularity, degeneration, and anatomic or bony deformities are examples of intrinsic causes that directly affect the subacromial region (16-25).

Subacromial bony proliferation, degenerative alterations in the greater tuberosity of the humerus, and degenerative joint disease in the acromioclavicular joint were the most common radiographic abnormalities, accounting for 68 percent, 66 percent, and 66 percent, respectively. In 37% of the cases, there was evidence of calcium deposition in the rotator cuff, 32% had inferiorly orientated acromioclavicular osteophytes, and 29% had degenerative alterations in the lesser humeral tuberosity. Only 21% of the acromiohumeral space was narrowed (26).

External impingement syndrome is also known as "outlet-based" impingement syndrome is hypothesized to be influenced by the acromion's form.
- Class I - Flat acromion
- Class II - Curved acromion
- Class III – Hooked acromion.

The 3 most prevalent morphologies of the acromion were characterized by Bigliani and Morrison (27).
- Stage I, Impingement is caused by edema, bleeding, or both, and is commonly associated with overuse mechanisms.
- Greater fibrosis and permanent tendon alterations characterize Stage II.
- In Stage III, chronic, long-term fibrosis can cause a tendon rupture or tear.

A succession of muscular force couples is in charge of controlling the scapula and humerus. A force couple is a combination of two forces of equal magnitude (30) but opposite directions that cause a body to rotate (31). The upper fibers of the trapezius muscle, the levator scapulae muscle, and the serratus anterior muscle make up the scapula force couple. The lower trapezius muscle fibers and lower serratus anterior muscle fibers make up the lowest portion of the force couple (32). Coordination of these muscles generates a smooth, rhythmic motion that rotates and protracts (abducts) the scapula along the posterior thorax during arm elevation. The scapula's function is to provide a secure foundation for the revolving humerus so that it can continue its regular route or spin along the glenoid (33).

Serratus anterior and trapezius muscle weakness might prevent the scapula from rotating upward (outward) or outcome in an imbalanced humeral base of support. The rotator cuff muscles may be unable to manage the humeral head adequately along the glenoid fossa during overhead elevation as a result of the unstable scapula. Furthermore, the acromion may well not raise adequately to allow appropriate clearance of the greater tuberosity of the humerus. Scapular retractors that are weak can cause the scapula to protract, limiting the space beneath the acromion and allowing suprahumeral tissues to impinge.

Scapular dyskinesis was named by Kibler, after observing consistent and aberrant scapular posture alterations and changed scapular biomechanics in overhead athletes with shoulder impingement (34). Stability refers to the ability to keep the humeral head centered in the glenoid cavity (48).

In individuals with certain shoulder disorders, such as impingement, Sahrmann categorized scapular positioning deficits. She documented scapular positional alterations of downward rotation and anterior tilting in individuals with initial impairment according to her years of clinical observations. Patients with a persistently downwardly rotated scapular upward rotation during the overhead elevation of the arm, induce subacromial discomfort and impingement, according to Sahrmann (35).

Patients among a series of muscle imbalances linked to prolonged forward head and rounded shoulder posture had impaired shoulder elevation, according to Kendall and McCreaey, which included shortness of the pectoralis major and minor, as well as the subscapularis muscles, as well as elongation of the middle trapezius and rhomboid muscles (36).

Clinical and motion analysis studies support the importance of scapular postural and movement alterations as main impairments in shoulder discomfort and impingement symptoms in general. Given these observations and scientific studies on the significance of the shoulder blade in shoulder impingements, contemporary shoulder impingement therapies highlight the relevance of scapular muscle training as a critical component of shoulder rehabilitation (37, 38, 39).

Budoff et al. defined impingement as the result of an initial instability and subsequent impingement. Glenohumeral muscle imbalance is the term for the series of events that lead to that instability. The supraspinatus is a tiny, weak muscle at a critical place that is prone to damage due to overuse. When the rotator cuff muscles are subjected to repetitive eccentric loading, the musculotendinous components become weak, resulting in tendon injury. The weak, fatigued, or damaged medial and lateral rotator muscles seem unable to resist the upper pull of the deltoid muscle (40).
The humeral head is possessed within the shallow glenoid by the inferiorly and horizontally orientated rotator cuff muscle force vectors, preventing the deltid from being sheared upward during active arm elevation (41). The subsequent contractions of the rotator cuff muscles and the deltid form the glenohumeral joint force coupling. When the rotator cuff force couple is lost, the humeral head migrates forward, causing the larger tuberosity and rotator cuff to interact with the acromion's lower surface and the coracoacromial ligament (41, 42). The humeral head's repeated contact with the acromion results in reactive and degenerative osseous alterations. Osteophytic spurring develops on the acromion's underside. Additional traction spurs may grow near the acromion's anterior medial tip. A type III acromion, which is an aberrant acromial hook, is often misidentified for a traction spur. As a result, superior humeral migration might cause recurrent impingement of the subacromial soft tissue (40).

The pathomechanics of posterior-superior labrum impingement were outlined by Jobe (43). Overhead-throwing sportsmen are vulnerable to stresses that can cause the head of the humerus to impinge on the posterior-superior labrum. The shoulder joint is in 60 percent to 90 percent abduction, maximal lateral rotation, and horizontal extension during throwing. About the glenoid, the humeral head's angulation is in a posterior-superior orientation. Furthermore, due to lateral rotation of the humeral head, the greater tuberosity advances posteriorly.

The inferior glenohumeral ligament and the subscapularis limit the humeral head's angulation on the glenoid. Impingement is produced by a lack of resistance from a fatigued and inadequately engaged subscapularis muscle, which causes hyperangulation of the humeral head to the glenoid. The subscapularis is unable to constrain the humeral head's exaggerated lateral rotation and extension angulation. Angulation, rather than displacement, causes the capsule to extend unevenly. Partial dislocations are caused by hyperextending and instability of the anterior capsule, which leads to capsule failure. Between the humeral head and the posterior-superior labrum, the supraspinatus' deep surface is impinged (44).

On the anterior-superior glenoid rim, Gerber and Sebesta (45) observed impingement of the deep surface of the subscapularis tendon and the coracohumeral ligaments. The lesser tuberosity and biceps tendon are closely bound to the anterior superior glenoid margin as internal rotation increases. The subscapularis, biceps tendon, and superior and middle glenohumeral ligaments impinge on the anterior superior glenoid labrum and rim between 100 and 90 degrees of shoulder flexion and full medial rotation. Patients who engage in overhead throwing sports are more likely to get anterior-superior glenoid rim impingement. In overhead-throwing athletes, eccentric overload of the glenohumeral external rotation is prevalent. A weak and exhausted infraspinatus and teres minor muscle induce excessive medial rotation of the humerus. During the last phase of throwing, the shoulder is in flexion and medial rotation. Excessive medial rotation of the humerus in a flexed posture between 100 and 90 degrees may impinge on the anterior-superior glenoid rim, causing impingement of the soft tissue structures mentioned above.

There is a 'critical region' at the supraspinatus tendon, according to Moseley, Rothman, and Parke, where the structure's vasculature can be altered during movement. Chronic irritation of this thin vasculature area might cause an inflammatory reaction, leading to tendinitis. Inflammation causes the rotator cuff to thicken and grow, making it difficult for the supraspinatus tendon to pass through the Subacromial area (46, 47).

Shoulder impingement syndrome causes pain and swelling in the shoulder joints, as well as limits in anterior flexion, medial rotation, and abduction. Patients have pain in the shoulder joints while lifting their hands outward or forward in the early stages of the condition, and most have trouble sleeping owing to the agony. When elevating the arm between 70 and 120 degrees, there is pain on enforced movement over the head (the "painful arc"). As the symptoms worsen, the shoulder joint becomes unstable and uncomfortable, and joint stiffness develops (48).

MATERIALS
Participation
A total of 72 subjects and 60 subjects were comprised in this study. With an age range of 18 to 40 years old, and no history of shoulder surgery, radicular discomfort, or any neurological indications indicating nerve damage. The following were the inclusion criteria: Neer's impingement test, Hawkins – Kennedy test, the uncomfortable arc of motion, Empty can test, X-ray, and MRI were used to diagnose patients.

Study Design
The study was set up as a Quasi-experiment. The participants were categorized into two groups: Group A (n=30) received scapular stabilizer strengthening exercises, while Group B (n=30) received rotator cuff strengthening exercises. The study's goal was described to the participants, and their permission to take part in the study was obtained before the start of the trial.

OUTCOME MEASURES
Shoulder Pain And Disability Index (Spadi)
The Shoulder Pain and Disability Index is a self-administered set of questions that measures pain and functional activities in two domains. Five questions concerning the severity of a person's suffering make up the pain dimension. Eight
questions designed to assess functional activities are used to assess the degree of discomfort a person has with different activities of daily living that involve upper extremity use. The SPADI is the only precise and valid region-specific evaluation for the shoulder, and it takes a participant 5 to 10 minutes to accomplish.

Instructions for scoring: Patients respond to each question by placing a mark on a 10cm visual analog scale. 'No pain at all' and 'worst agony imaginable' are the verbal anchors for the pain dimension, while 'no difficulty' and 'so difficult it needs help' are the verbal anchors for the functional tasks. The overall score is calculated by averaging the results from both dimensions (59).

**Lateral Scapular Slide Test (LSST)**

The first physical test was described by Kibler (49) as a trial measurement of scapular muscle strength. The sportsmen must execute an isometric shoulder blade contraction and hold it for 15 to 20 seconds. In less than 15 seconds, a probable scapular muscular weakening causes a “burning agony.” 10 On the other hand, this first test can be utilized to corroborate or adequately objectify muscular Weakness in Scapulars as a particular assessment of the scapula's optimal activity. Measure the length between the inferior angle of the scapula and the nearest vertebral spinous process in three positions: neutral, 40-45 degrees of coronal plane abduction with hands resting on hips, and shoulder at 90 degrees abduction with arms in full internal rotation using a tape measure or goniometer.

Kibler (50) claims that the injured or deficient side has a larger scapular distance than the uninjured or normal side and that a bilateral difference of 1.5 cm (15 mm) should be used to determine if scapular asymmetry exists. Curtis et al (51) have indicated that LSST might be utilized to track the scapular stabilizer muscles during any shoulder training program. This can be utilized as a field test because

- It is simple to use for coaches;
- Replicates the appropriate scapular movements and the targeted metrics.
- Appears to be, in terms of reproducibility, a trustworthy test
- Evaluates the scapula's stabilizing muscle

Measurements are taken at three places between the inferior angle of the scapula and the spinous process during this test. The operator starts by marking a specific reference point or a frame of reference on the spinous process of the appropriate lower corner of the scapula regionally.

- The distance between the scapula's bottom corner and the thorny counterpart is measured. The width between both the base of the scapula and the thorny parallel is in on a landmark.
- The patient's hands were placed on the iliac crest in the second position of Kibler's proposed test, fingers straight forward and thumb on the back. It places the humerus at a 45-degree abduction angle and evaluates it from the bottom and thorny socket, which acts as a starting point.
- The third position, which is advised as an advancement, is a mobility examination in a far more operational position. In this position, the upper limb is abducted 90 degrees and glenohumeral medial rotation is accomplished. The measurement has been the same with a marking on the thorny and inferior angle of the scapula.

**Neer’s Impingement Test**

To indicate discomfort after passive abduction of the arm with the scapula fixed, the examiner raises the arm in the scapular plane with the arm medially rotated. It had been first presented in 1977, and it did not depict an ‘arc’ of pain. However, the eponym is frequently associated with a painful arc through abduction. Neer's test is a supplementary portion of this maneuver that measures the effect of a local anesthetic injection into the subacromial region on pain. A positive test is regarded as a significant reduction or elimination of pain (60).

**Hawkins-Kennedy Test**

This is a passive test in which the observer places the patient's arm at 90 degrees in the scapular plane, the elbow is flexed to 90 degrees and passively rotated the arm into medial rotation. It was first documented in 1980. The induction of pain during this movement demonstrated a positive test (61).

**Empty Can Test**

The empty can test is a diagnostic way to determine the integrity of the supraspinatus tendon. In this examination, the subject is elevated 90 degrees in the scapular plane and rotated fully medially (empty can). The examiner exerts downward force to the elbow of the patient, which the patient opposes. If there is weakening, pain, or both during opposition, the test is demonstrated positive. A positive test could indicate injury or rips to the supraspinatus tendon or muscle, as well as other pathological neuropathies. Jobe and Moyne’s first described it as a way to analyze the viability of the supraspinatus tendon (52, 53).
The Numeric Pain Rating Scale (NPRS)
The Numeric Pain Rating Scale is the most basic and widely used quantitative range, where the child evaluates pain on a scale of 0 (no pain) to 10 (extreme pain) (worst pain). Its validity has been demonstrated by strong correlations between NRS and FPS-R scores in children aged 7 to 17, as well as NRS and VAS scores in children aged 9 to 17. In children, the NRS corresponds well with the requirement for analgesic, painful alleviation, and patient satisfaction. It's critical to double-check the numerator that the child is utilizing while using numeric scales. A pain score of 9 on a 0 to 100 range, for example, indicates mild discomfort which might not respond to treatment, while a score of 9 on a 0 to 10 scale indicates extreme pain that necessitates intensive treatment (62).

Constant Murley Score (CMS)
The CMS is a multi-item operational index that evaluates pain, daily activities, range of motion, and strength of the afflicted shoulder. It is graded on a scale of 0 to 100 points, with subjective (35 points) and objective (100 points) components (65). The intensity of the pain (15 points) and daily living activities (20 points) were subjective components, whereas the range of motion (flexion, abduction, lateral rotation, and axial rotation; a total of 40 points) and muscular power were objective components (25 points). The greater each item's or total score, the better. In the original description, the pain experienced while daily activities was scored as follows: no pain=15 points, mild=10, moderate=5, and severe=0 points.

Originally, grading was determined on how many pounds of force a participant could oppose using an unrestrained cable tensiometer or spring balance in up to 90 degrees of abduction. According to current recommendations, it was done at 90 degrees abduction with the hand pointed downward, using a dynamometer or a defined spring balance method. A total of three successive sessions should be used. When the subject is unable to complete the intended abduction, he or she obtains a score of 0 points. Considering the significance of age and gender in shoulder functional ability, and alternative CMS scoring system that accounts for these two variables was developed (63).

Intervention
These 72 subjects underwent Scapular Stabilizers Strengthening Exercise and Rotator Cuff Strengthening Exercise program following 4 weeks for 45 minutes per session where 15 subjects were treated with Scapula Stabilizers Rehabilitation Protocol and the other 15 students were treated with Rotator Cuff Muscle Rehabilitation Protocol to help in regaining the muscle strength of imbalanced muscles. Based on the principles of DAPRE subjects received progression in their protocols.

Training Program
The subjects were chosen using a practical sampling strategy. A suitable sampling approach was used to pick 60 patients who met the inclusion and exclusion criteria, with 30 being assigned to Group A and 30 to Group B. Subjects were given a thorough explanation of the study, and those who met the requirements signed a written informed consent form. Pre-test and post-test evaluations were conducted on both Group A and B subjects. Group A and Group B completed the Scapula Stabilizer Rehabilitation Protocol as well as the Rotator Cuff Rehabilitation Protocol.

Rest, rotator cuff and scapular strengthening, and physical technique have all been documented as effective treatment options for impingement syndrome in the literature. The treatment program's main goal is to lessen physical irritation of the rotator cuff and scapula stabilizers.

Phases of rehabilitation;
- Phase I: Acute phase
- Phase II: Intermediate phase
- Phase III: Advanced strengthening phase

The rehabilitation program's objective is to maintain the strengthening program while also improving flexibility. Reduced symptoms of inflammation and no palpable warmth are both required for progression to phase II. In this phase, strengthening exercises are progressed to more intense isotonic exercises to restore balanced muscular force while also completing isolation exercises of selected muscles.

Group A – Scapula Stabilizers Rehabilitation Protocol
The Scapula Stabilizers are Trapezius, Serratus anterior, Levator scapulae, Rhomboids, Pectoralis major and minor.

Serratus Anterior Muscle:
- Isometric exercise
  - Begin with a standing position against the wall and place the hand in it. The shoulder should be flexed 90 degrees and the elbow extended. Protract the shoulder and hold for 10 seconds before slowly returning to the beginning position.
- Horizontal abduction with External rotation
Position to begin shoulder blades going to come down and back, elbows straight except this time we start with the thumb pointing out and now it’s a straight horizontal lift keeping the thumb up towards the ceiling, do not shrug the shoulder up towards your neck.

- Scaption with External rotation
  
  Patient position – standing, the angle of the movement is really important because your hand is going to come up an angle about 30 degrees off from your body so it’s going to come up not to the front, not to the side but kind of right in the middle and the thumb should be facing the ceiling. Lift the arm to the shoulder level and hold the position for 10 seconds. Slowly lower your shoulders back to the starting position.

- Dynamic hug with resistance exercise
  
  Start by wrapping the band across your upper back and holding both ends in your palms. Bend your elbows around 45 degrees and abduct your shoulders about 60 degrees. Push your arms forward and inward while keeping your shoulder lifted; when your hands contact, keep and gently reverse. If you can, prevent shrugging your shoulders.

**Trapezius Muscle:**

- Shoulder shrugs
  
  Begin with a standing position, posture should be straight and slightly bend your knees. Arms should remain long by your sides, with a slight bend in your elbows. Evenly distribute the weight. Pretend your shoulder, hip and engage your core. Keep your arms outstretched and steadily raise your shoulder straight up towards your ears while keeping a neutral head and neck position. At the apex of the movement, pause for a second. Slowly return your shoulders to their initial posture. the top of the movement.

- Prone horizontal abduction in a neutral position
  
  Begin by lying on the couch in a prone position with one arm dangling over the edge and the head turns slightly towards the side you will be exercising, the movement is initiated with slight retraction of the shoulder blade followed by slow and controlled lifting of the arm up and out to the side to the level of horizontal or slightly above throughout the exercise the palm should be facing the ground.

- Prone horizontal abduction in External rotation
  
  Position to begin shoulder blades going to come down and back, elbows straight except this time we start with the thumb pointing out and now it’s a straight horizontal lift keeping the thumb up towards the ceiling, do not shrug the shoulder up towards your neck.

- Shoulder abduction in a scapular plane above 120 degrees
  
  Patient position – standing, the angle of the movement is really important because your hand is going to come up an angle about 30 degrees off from your body so it’s going to come up not to the front, not to the side but kind of right in the middle and the thumb should be facing the ceiling. Move the arm above 120 degrees in the scapular plane, hold the position for 10 seconds. Slowly lower your shoulders back to the starting position.

**Pectoralis Muscle:**

- Isometric
  
  Begin with a standing position, both arms should be extended in front of you at a 90-degree angle. Squeeze your hands together as tightly as you can. Relax after 15-30 seconds of holding the contraction.

- Doorway pull-apart
  
  Standing in a doorway, place your hands at about chest level against either side of the door frame. Exert outward pressure as if you are trying to push the sides of the door frame farther apart. Use the pressure to pull your chest slightly outward into the doorway. Hold for 15 seconds then gently release.

- Stretch
  
  Extend your arm parallel to the ground and place your palm on a firm surface such as a wall and rotate your torso in the opposite direction.

**Rhomboids Muscle:**

- Prone horizontal abduction in a neutral position
  
  Begin by lying on the couch in a prone position with one arm dangling over the edge and the head turns slightly towards the side you will be exercising, the movement is initiated with slight retraction of the shoulder blade followed by slow and controlled lifting of the arm up and out to the side to the level of horizontal or slightly above throughout the exercise the palm should be facing the floor.

- Prone lateral raise
  
  On a mattress or couch, lie down on your belly. Make an impression on the mattress with your forehead. Retain a shoulder-width gap between your feet. Hold a 90-degree abduction of your shoulder, outstretched arms, and wrist pronation. Wave your
arms to your sides until they are parallel to the floor and elbows are at shoulder height. Breathe out and keep your arms fully extended and perpendicular to your torso throughout the exercise. Compress your shoulder blades together and hold for one count once you've achieved shoulder height. Only your arms should be lifting you. Inhale, then slowly return the arm to its original position.

- Front raise thumbs up
  - Lie on the floor on your belly on a mattress or couch, your forehead rests on the mattress or couch. Maintain a shoulder-width gap between your feet. Shoulder flexion 180 degrees, elbow extension, and thump facing the ceiling are the starting positions. Breathe out before straightening the arms. Keep proper extension of your arms without raising the head off the mat. Raise as far as you can without changing posture while compressing the muscle between shoulder blades. For one count, stay in this position. Inhale and slowly lower yourself back to your starting posture, arms fully extended.

- Scapular retraction
  - Sit up straight in your chair, shoulders back and down. Place your hands on your hips and round your upper back by bringing your shoulders forward. Pull your elbows back and squeeze your shoulder blades together as you bring your shoulders back and down. Throughout this exercise, make sure to keep your shoulders down.

**Levator scapulae:**

- Shoulder shrugs
  - Begin with a standing position, posture should be straight and slightly bend your knees. Arms should remain long by your sides, with a slight bend in your elbows. Evenly distribute the weight. Pretend your shoulder, hip and engage your core. Keep your arms outstretched and steadily raise your shoulder straight up towards your ears while keeping a neutral head and neck position. At the apex of the movement, pause for a second. Slowly return your shoulders to their original posture.

- Shoulder Extension in Prone position
  - Lie on your stomach with one arm dangling from a table or bench. Elbow should be in the extended position, wrist supination, and thumb away from you. Raise your arm towards your hip. Keep your elbow locked and your thumb facing away from you. Avoid shrugging your shoulder by moving your shoulder blade down and back while raising your arm.

**Group B – Rotator Cuff Rehabilitation Protocol**

The Rotator cuff comprises four muscles: Supraspinatus, Infraspinatus, Subscapularis, and Teres minor.

**Supraspinatus Muscle:**

- Prone horizontal abduction
  - Begin by lying on the couch in a prone position with one arm dangling over the side and the head turns slightly towards the side you will be exercising; the movement is initiated with slight retraction of the shoulder blade followed by slow and controlled lifting of the arm up and out to the side to the level of horizontal or slightly above throughout the exercise the palm should be facing the floor.

- Isometric exercise
  - With your elbow bent at 90 degrees, stand with the side of your arm against the wall. Hold the contraction for 5 seconds by pushing the side of your arm onto the door/wall.

- Scaption in internal rotation
  - Patient position – standing, the angle of the movement is really important because your hand is going to come up an angle about 30 degrees off from your body so it’s going to come up not to the front, not to the side but kind of right in the middle and the thumb should be facing the floor.

- Full can exercise
  - It is done by in-directly producing the necessary shoulder external rotation by raising the arm in the scapular plane through the thumb directed up. Before being dropped, the arm is raised to 90 degrees.

- Empty can exercise
  - Stand holding you’re pectoral out, the elbow should be in the extended position, and thumb should face the ground, lift the extended arms out to the sides of your body till the shoulder level keep your palm facing down and do not arch your back nor shrug their shoulders reverse the motion to go back to the start positioning.

**Infraspinatus Muscle:**

- Prone horizontal abduction in external rotation
  - Starting position shoulder blades going to come down and back, elbows straight except this time we start with the thumb pointing out and now it’s a straight horizontal lift keeping the thumb up towards the ceiling, do not shrug the shoulder up towards your neck.

- Isometric exercise
Standing with elbow bent at 90 degrees and the outside of forearm against the wall. Hold the contraction for 5 seconds by pressing the side of your forearm against the door/wall and rotating out.

- **External rotation in the side-lying position**
  
  Flex your elbow to a 90-degree angle and maintain the performed arm tightly towards your side with your hand laying on your belly while lying on the non-operated side. Elevate your hand, toward the ceiling, through a comfortable range of motion by rotating your shoulder. Hold the position for 1 to 2 seconds until releasing the hand slowly.

- **External rotation while standing**
  
  Enclose the Thera Band to a doorknob or a post at waist level. Seize one edge of the band and drag it all the way through until it becomes tight while standing diagonally to the door and looking directly ahead. The knees are slightly bent and the feet are shoulder-width apart. The elbow should be adjacent to the side, and the hand should be as near to the chest as feasible. 'Set' the shoulder blade with the rope in your hand and slide the hand away from the body as far as it gets comfortable. Revert to your original starting position.

- **External rotation Thera Band tubing**
  
  Secure the tubing's midpoint to a door or other substantial object. Under the arm, place a rolled-up towel. Bring your forearm in front of your body and bend your elbow to the side. Pull outward on the handle, maintaining your elbow by your side and your forearm parallel to the ground. Hold for a moment and then gently return. Maintain a straight wrist.

**Subscapularis:**

- **Isometric exercise**
  
  With your elbow bent at 90 degrees, stand with the inside of your forearm against with wall. Hold the contraction for 5 seconds by pressing the inside of your forearm on the door/wall, creating a rotating motion.

- **Resisted medial rotation**
  
  Mount the Thera band to a doorknob or post at waist height. Seize one edge of the handle and pull the string all the way through until it is tight while standing diagonally to the door and staring straight. The knees are slightly bent and the feet are shoulder-width apart. The elbow is flexed at 90 degrees and positioned close to the side. 'Set' the shoulder blade and move the hand toward the belly as far as it gets comfortable, or as far as the endpoint of pain limits you, with the string in your hand. Return to your original starting position.

- **Internal rotation with a 90degree**
  
  Attach the band to a high anchor point and stand erect, facing away from it. hold the band straight out to our side the elbow bent to 90 degrees and palm facing forward, rotate your elbow away from the anchor point and return to the starting position.

**Teres minor:**

- **Isometric exercise**
  
  With your elbow flex at 90 degrees, stand with the outside of your forearm against the wall. Hold the contraction for 5 seconds by pressing the side of your forearm against the door/wall and rotating out.

- **External rotation while standing**
  
  Enclose the Thera Band to a doorknob or a post at waist level. Seize one edge of the band and drag it all the way through until it becomes tight while standing diagonally to the door and looking directly ahead. The knees are slightly bent and the feet are shoulder-width apart. The elbow should be adjacent to the side, and the hand should be as near to the chest as feasible. 'Set' the shoulder blade with the rope in your hand and the hand should be moved as far as possible it gets comfortable. Revert to your original starting position.

- **Prone horizontal abduction in external rotation**
  
  Position begins with shoulder blades going to come down and back, elbows straight except this time we start with the thumb pointing out and now it’s a straight horizontal lift keeping the thumb up towards the ceiling, do not shrug the shoulder up towards your neck.

**Statistical Analysis**

The data were evaluated by using paired t-test. The statistical significance of pre and post t-test values of the Numerical Pain Rating Scale and Constant Murley Score for Group A and Group B was determined using the paired t-test. The mean difference in the Numerical Pain Rating Scale and the Constant Murley Score was utilized to compare the two groups using an unpaired t-test. For all of the quality indicators in both groups, the arithmetic mean was calculated at pre and post-training, and the standard deviation was used to see the variance from means. To see how the groups differed, the mean difference was determined.

**Table 1: Data Analysis and Presentation for Group A and Group B**

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<table>
<thead>
<tr>
<th>Data values</th>
<th>Group – A (Scapula Stabilizers Rehabilitation Protocol)</th>
<th>Group – B (Rotator Cuff Muscles Rehabilitation Protocol)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NPRS</td>
<td>CMS</td>
</tr>
<tr>
<td>Mean difference</td>
<td>6.06</td>
<td>31.6</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>1.22</td>
<td>0.76</td>
</tr>
<tr>
<td>t-test</td>
<td>19.04</td>
<td>41.53</td>
</tr>
<tr>
<td>Table value</td>
<td>2.15</td>
<td>2.15</td>
</tr>
</tbody>
</table>

TABLE: 2 Unpaired ‘t’ test Analysis and Presentation between Group A and B

<table>
<thead>
<tr>
<th>Data value</th>
<th>Unpaired ‘t’ value</th>
<th>Table value</th>
<th>Significant</th>
</tr>
</thead>
<tbody>
<tr>
<td>NPRS</td>
<td>10.09</td>
<td>2.05</td>
<td>Significance</td>
</tr>
<tr>
<td>CMS</td>
<td>10.62</td>
<td>2.05</td>
<td>Significance</td>
</tr>
</tbody>
</table>

Figure 6: Mean difference and Standard deviation between outcome measures for Group A & Group B

NPRS – Numerical Pain Rating Scale, CMS – Constant Murley Scale

Figure 1.

Figure 2.

Figure 3.

Figure 4.
RESULT

In Group A, the Numerical Pain Rating Scale and Constant Murley Score were used to evaluate pre and post-values. The average difference between the two groups is 6.0 and 31.6, respectively. 1.22 and 0.76, respectively, are the standard deviations. Numerical Pain Rating Scale and Constant Murley Score have paired 't' values of 19.04 and 41.53, respectively. For a 5% significance level, the paired 't' value is greater than table value 2.15.

In Group B, the Numerical Pain Rating Scale and Constant Murley Score were used to evaluate the before and post values. The average difference between the two groups is 4.3 and 24.2. The Standard Deviation is 1.35 in one case and 0.56 in the other. Numerical Pain Rating Scale and Constant Murley Score have paired't' values of 12.32 and 43.04, respectively. For a 5 percent significance, the paired't' value is greater than table value 2.15.

The calculated 't' value by unpaired't' test assessed by Numerical Pain Rating Scale and Constant Murley Score were 10.09 and 10.62. The calculated't' value was more than the table value 2.05 for a 5% level of significance at 38% freedom.

DISCUSSION

While thinking about how to improve functioning abilities after suffering from Shoulder Impingement Syndrome. I observed that there was a significant and positive improvement in Shoulder Impingement Syndrome.

According to Magee et al, stability is described as the shoulder joints having the highest range of motion, and stabilization was defined as an individual's ability to consciously and unconsciously correct major and minute motions of the joints. Because these are unsteady, the participation of muscles in dynamic stability is vital, and regular movement patterns of the shoulder joints are associated with scapula stabilization rhythms, according to this study (54).

According to Mottram SL et al explained Scapular stabilization exercise is generally utilized to promote stability to the whole scapula which is used to treat incorrect scapular placement and functional movement disorder. Balanced development of the shoulder joint complex is crucial for shoulder joint stability, although the scapulothoracic joints, rather than the glenohumeral joints, should be stabilized first. The scapulothoracic joint is a fictitious joint that encompasses the shoulder joint area and is made up of soft tissue mobilization planes. The scapulothoracic joint's function is critical for upper-extremity motion and stability (55).

According to Rasmussen – Barr E et al, the scapular plane stabilization exercise can be securely conducted on persons with shoulder joint problems shortly after surgery because it does not exert undue stress on the joint (56).
Stability of the scapula should be achieved initially in normal movement disorders of the scapula, according to Jang JH et al., and then lateral rotation, abduction, adduction, extension, and medial rotation exercises should be performed (57).

According to Jung et al., who evaluated how stabilizing exercises affected a range of motion and pain. The scapular stability exercise, according to their findings, avoids improper muscle contractions, regulates movements, and promotes good posture (58).

CONCLUSION
The final stage of my thesis works fondly that Scapula Stabilizers Rehabilitation Protocol was effective in treating the muscular imbalance which leads to force couple instability causing Shoulder Impingement Syndrome.

This study has proved that Scapula Stabilizers Rehabilitation Protocol was effective than Rotator Cuff Rehabilitation Protocol in treating the muscular imbalance which leads to force couple instability causing Shoulder Impingement Syndrome.

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