RESEARCH PAPER

To Study the Combined Effect of Spencer Technique and Kinesio Taping in Patients with Acute Frozen Shoulder

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ABSTRACT

Background: Frozen Shoulder, commonly referred to as adhesive capsulitis is a debilitating musculoskeletal condition. It is typically associated with excruciating shoulder pain, discomfort, increasing stiffness, and noticeable limitations in both active as well as passive shoulder range of motion. The acute phase is very difficult because of the extreme pain along with marked limitation in shoulder mobility, which negatively impacts everyday living activities and general quality of life. Many studies have shown beneficial effect of **spencer technique** and **kinesio taping** for pain relief, restoration of shoulder joint mobility and enhancing functional ability, but their combine effect in patients with acute frozen shoulder remains unclear.

Materials: Consent form, Data Collection Sheet, Plint, Chair / Stool, Resistance bands, Wand, Kinesio tape, Finger ladder, Ultrasound, Aquasonic gel, Cotton, NPRS scale, Constant score scale, SPAID scale.

Methods: A **randomized clinical trial** was conducted with **76 subjects diagnosed with acute Frozen Shoulder** aged **40-65 years** who meet the inclusion criteria were selected for the study. The Constant Murley Score, Shoulder Pain and Disability Index, and Numerical Rating Scale were used for the pre and post assessments. The data collection includes age, gender, chief complain (patients complain with shoulder pain from/between 0 – 3 months) and past medical history. Subjects were divided into two groups: Group A (Controlled group) includes 38 subjects and Group B (experimental group) includes 38 subjects. In **Group A** (Controlled group): Conventional physiotherapy protocol (Ultrasound, Hot moist pack, Codman's pendulum exercises, Capsular and Pectoral Stretching, Isometric exercises, Pulley, Wand, Finger Ladder exercises, Active and Active Assisted exercises, Scapular stabilization exercises) was given and in **Group B** (experimental group): combine Spencer Technique and Kinesio Taping along with Ultrasound, Passive- Active Assisted – Active shoulder range of motion exercises, Shoulder Pendulum exercises, Wand exercises, Maitland Mobilization, Myofascial Release Technique, Capsular Stretching, Shoulder Isometric exercises, Self-stretching exercises, Self-Mobilization, Self-Myofascial Release Technique was given. The intervention was performed for **3 weeks**. Before and after the intervention, the individuals were evaluated using the Constant Murley Score (CMS), Shoulder Pain and Disability Index (SPAID), and Numeric Rating Scale (NRS). To assess changes within and between the groups, **statistical analysis** (paired and unpaired t-test) was carried out.

Results: Group B pre and post evaluations on the Numeric Rating Scale (NRS), Shoulder Pain and Disability Index (SPAID), and Constant Murley Score (CMS) showed a statistically significant difference (p value < 0.001*) compared to group A.

Conclusion: The study shows that patients with acute frozen shoulder experienced **statistically significant improvement** in reduction of pain and shoulder disability, and improvement in functional ability with **both conventional physiotherapy and the combined intervention of Spencer technique and kinesio taping** ($p < 0.001$). However, the group that received **Spencer technique and kinesio taping in addition to conventional physiotherapy showed greater improvement** in shoulder function and reduction in pain intensity and shoulder disability scores compared to conventional physiotherapy alone. Therefore, combine application of Spencer technique and kinesio taping appears to be a more effective treatment approach for improving clinical outcomes in patients with acute frozen shoulder.

KEYWORDS:

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INTRODUCTION

Frozen Shoulder is among the most prevalent pathological ailment affecting the shoulder and glenohumeral joints, commonly referred to as adhesive capsulitis or periarthritis (1)(2). Capsular thickening, capsular constriction, and extensive adhesion development are the hallmarks of Frozen Shoulder. Patients with frozen shoulder have stiff shoulders, excruciating pain that usually gets worse at night, and limited shoulder movements, especially abduction, medial and external rotation (1)(2)(3)(4). When the glenohumeral joint is elevated, individuals with frozen shoulder eventually exhibit distinctive "shrug sign," in which the scapula migrates upward before 60 degrees of abduction. Patients diagnosed with frozen shoulder demonstrate altered shoulder kinematics and movement pattern, such as excessive scapular elevation and enhanced upward rotational movement. Restricted shoulder mobility accompanied by pain is a common clinical feature of frozen shoulder are probably caused by fascial limits, muscle tightness, and myofascial trigger points in addition to capsular and ligamentous tightness (5). When executing overhead flexion and abduction, the scapular motion is overused, which reduces the contribution of the glenohumeral joint and changes the scapulohumeral rhythm (4). According to several research, frozen shoulder (11–35%) is reported more frequently among individuals suffering from diabetes mellitus. The occurrence of diabetes mellitus among frozen shoulder patients is 11% in India and 30% worldwide. Seventy-one percent of individuals with diabetes mellitus have frozen shoulders (6). And mostly affect those between the ages of 40 and 65, with a female preponderance (7). With a prevalence of approximately 43.1% among reported shoulder cases, frozen shoulder is considered most common causes of shoulder pain and functional impairment (8).

Primary and secondary frozen shoulders are the two categories into which frozen shoulders fall. The idiopathic primary frozen shoulder is frequently linked to other illnesses and ailments, include diabetes mellitus, and could be the first sign of diabetic patient. Patients who suffer from systemic illnesses like thyroid disease and Parkinson's disease are particularly vulnerable. Following shoulder injuries or immobilization (such as rotator cuff tendon tears, biceps tenosynovitis, subacromial impingement and calcific tendonitis), secondary frozen shoulder may develop. These patients experience shoulder pathology-related pain, which limits mobility of the affected shoulder and eventually results in frozen shoulder (3).

Frozen shoulder occurs in four stages. The first stage, known as the preadhesive stage, has a normal underlying capsule and hypervascular synovitis. End-range restrictions and discomfort are either minimal or non-existent when patients first arrive. This phase could last for 0 to 3 month period. The second stage, also known as the acute adhesive or freezing stage, is distinguished by a reduction in hypervascular synovitis and early adhesion development, which causes capsular thickening and contraction. Patients have increased pain, restricted passive and active movements, and significant levels of discomfort near the end range motion. The stage could go on for three to nine months. Stage 3, often known as the frozen or fibrotic stage, has more established adhesion in the axillary fold and capsule but less synovitis. This phase lasts for nine to fifteen months. Additionally, stage 4, referred to as the thawing phase, has substantial capsular constriction but no visible synovitis. The stage could continue anywhere from 15 to 24 months (7).

A comprehensive history and physical examination provide the foundation for the diagnosis of frozen shoulder; no formal criteria are used. Prior research has shown that the most common criteria for diagnosing frozen shoulder include: painful end range motion; significant limitations of active and passive shoulder motion in multiple planes to less than 100◦ and 50% or greater than 30◦ loss of passive external rotation (at the side); insidious or minimal event leading to onset; significant shoulder pain interfering with successful activities of daily living; and significant night pain. Radiological appearance is normal, there are no secondary causes, and there is notable internal rotator weakness or discomfort in all movements (7).

The use of NSAIDs and intra-articular corticosteroid injections were part of the medical treatment for frozen shoulder. Electroacupuncture, interferential treatment, ultrasound, and laser were the electrotherapy interventions that were employed. Therapeutic exercises, shoulder girdle joint mobilizations, mobilization with movement, Cyriax's continuous passive motion manipulation, heat, splinting, and physical therapy were among the interventions. Corticosteroid injections were contrasted with these methods. For non- surgical management of frozen shoulder, a range of exercise therapies were employed, many of which included range-of-motion exercises with mobilization, massage

and stretching. A comparison was made between the effects of glenohumeral and scapulothoracic exercises when combined. A home exercise regimen was administered in addition to the occupation-based treatment. The impact of splinting in frozen shoulder was evaluated using shoulder dynasplints either independently or together with physiotherapy treatment (7).

Three studies evaluated the impact of Maitland mobilization technique in frozen shoulder patients among those that employed shoulder girdle mobilization. A comparison was made between the effects of anterior and posterior mobilization. The effects of exercise alone versus mobilization plus exercise, as well as the outcomes associated with high grade versus low grade mobilization, were studied in earlier research. Mobilization performed at the terminal range of movement was combined, and its impact on patients with frozen shoulders was examined. To assess the impact of a particular mobilization approach, comparisons were done between mid-range mobilization, terminal-range mobilization, and movement-based mobilization. Going one step further, the benefits of combining scapular mobilization treatment with end-range mobilization were investigated. A comparison was made between physical treatment and Cyriax's manipulation. Research evaluated the effects of acupuncture vs acupuncture and physical therapy together, and a control group included a home workout regimen in their intervention plan. In contrast to perform only stretching or individual home exercise, the effects of electroacupuncture, interferential treatment, deep and superficial heat, ultrasound, and continuous passive motion were evaluated when combined with stretching and home exercises. Scam laser therapy was contrasted with low level laser treatment. The trials also compared the effects of physical therapy and local corticosteroid injections. These studies either contrasted physical therapy and corticosteroid injections, or corticosteroid injections and physical therapy, with either physical therapy alone or corticosteroid injections alone (7).

METHODOLOGY

A Prospective Comparative, an Interventional study conducted at D.Y. Patil Hospital and Research Centre, Kolhapur using [Computer generated] Simple Random Sampling method on patient diagnosed with acute frozen shoulder, Probability Sampling for a duration of – 6 months. The **sample size was 38** in each group. Individuals fulfilling the inclusion and exclusion criteria were enrolled in the study.

Inclusion criteria: Age group 40 – 65 years (7), Gender – Male and Female Participants (9), Patients diagnosed with acute frozen shoulder, Patients who are ready to take part in the study and are able to comprehend command (10).

Exclusion Criteria: Patients who have recently undergone surgery on particular shoulder (10), Patients having a history of shoulder complex fractures, Individuals with incomplete medical Records, Patients with Brachial Plexus Injury, Infection and neurology condition.

Materials:

Consent form, Data Collection Sheet, Plint, Chair / Stool, Resistance bands, Wand, Kinesio tape, Finger ladder, Ultrasound, Aquasonic gel, Cotton, NPRS scale, Constant score scale, SPAID scale.

PROCEDURE

The study protocol will be submitted for approval to the D. Y. Patil University Kolhapur Protocol Committee and the institutional ethical committee. Research will be started after approval from Institutional Ethical Committee. The consulting subjects with acute Frozen Shoulder will be screened as per inclusion criteria and exclusion criteria and they will be informed about the study and intervention. The procedure for intervention will be explained to the subject. Before proceeding to intervention, a written consent will be taken from the subjects who are willing to participate. Subjects' details will be taken as per the data collection sheet and will be assessed using outcome measures. The Constant Murley Score, Shoulder Pain and Disability Index, and Numerical Rating Scale will be used to evaluate the individuals. The participants included in the study will be randomly divided into two groups using simple random sampling method. The two groups, Group A and Group B each group consisting of 38 individuals. Group A includes conventional physiotherapy protocol for patients with acute frozen shoulder. Group B includes combine application of Spencer technique and Kinesio taping for patients with acute frozen shoulder. The three weeks protocol will be supervised in hospital's outward patient department. The total time needed to complete study will be 6 months. Statistical analysis will be recorded and the result will be obtained and conclusion will be drawn.

GROUP A (Conventional Physiotherapy Protocol)

1st week	**2nd week**	**3rd week**
Ultrasound	Ultrasound	Ultrasound
Hot moist pack	Hot moist pack	Hot moist pack
Codman's pendulum exercises	Codman's pendulum exercises	Codman's pendulum exercises

Capsular and Pectoral Stretching	Capsular and Pectoral Stretching	Capsular and Pectoral Stretching
Isometric exercises	Isometric exercises	Isometric exercises
Pulley, Wand, Finger Ladder exercises	Pulley, Wand, Finger Ladder exercises	Pulley, Wand, Finger Ladder exercises
Active and Active Assisted exercises	Active and Active Assisted exercises	Active and Active Assisted exercises
Scapular stabilization exercises	Scapular stabilization exercises	Scapular stabilization exercises

ULTRASOUND - Patient Position – The afflicted arm should be facing the therapist while seated.

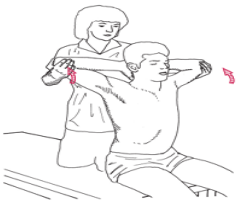
Procedure – Using ultrasound gel, continuous ultrasound at a frequency of 3MHz and an intensity of 1w/cm was applied to the afflicted shoulder at the discomfort region for five minutes (19).

HOT MOIST PACK - Patient Position – The position for the patient is supine. Procedure - The hot packs were put in a heating unit with water that was kept at a constant temperature of 79.4^{0}C (175^{0}F). The packs were covered with terrycloth and had equal layers. For each participant, a regular six-layer towel was used. Due to severe heat build-up, additional layering was only added during treatment if the participants desired it. Every hot pack was administered to the afflicted shoulder area for 20 minutes (20).

CODMAN'S PENDULUM EXERCISES - Patients Position – Patients were instructed to bend over at the waist about 90^0 degrees (or as near to 90^0 degrees as possible) while using their unaffected arm to grab onto a stable surface. Procedure – Patients were told to keep their back, shoulder, and arm muscles relaxed and to keep the afflicted arm hanging down. Patients were instructed to move their arms in circumduction, side to side (abduction, adduction) and forward and backward (flexion and extension). Ten repetitions of each exercise were performed (21).

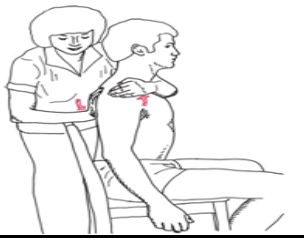
PECTORAL STRETCH

Pectoralis Major Muscle - Patient position – With patient's hands behind the head while seated on a treatment table or mat. Procedure – The patient is seated with their hands behind their head on a therapy table or mat. Grasp the patient's elbows while kneeling behind them. As the patient extends their elbows to the side (horizontal abduction and scapular adduction), they inhale. As the patient exhales, hold their elbows at this point. Since the proximal connection of the pectoralis major muscles on both sides is extending due to the rib cage, there is no need for a vigorous stretch against the elbows. Move the elbows up and out to the limit of the range as the patient inhales again, then hold the position while the patient exhales. To prevent hyperventilation, only repeat three times in a row (2).



Pectoralis major muscle active stretching. When the patient inhales, the elbows are gently pulled posteriorly by the therapist
; when the patient exhales, the therapist holds the elbows at the end (2).

Pectoral Minor Muscle - Patient position – Patient sitting on chair. Procedure – One hand is placed anteriorly on the shoulder, slightly above the coracoid process, by the therapist, and other hand posteriorly on the scapula. Press down against the inferior angle of the scapula and up and back against the coracoid process to tip the scapula posteriorly while the patient inhales. Hold the scapula in this position until the patient exhales. Repeat, stabilizing as the patient exhales and repositioning the end with each inhale (2).



The pectoralis minor is actively stretched. As the patient exhales, at the terminal point the scapular and coracoid processes is hold by the therapist (2).

CAPSULAR STRETCHING

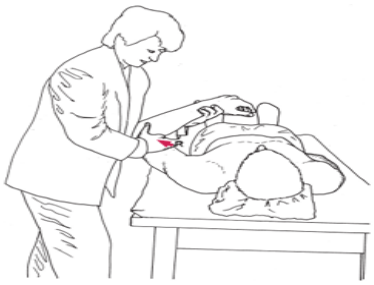
Anterior Capsule - Patients Position – Sitting. Procedure – The therapist used stretch force for 20 to 30 seconds while the patient's shoulders and arms were pulled back (22).

Anterior – inferior capsule - Patients Position – Sitting. Procedure – Arm elevation is stretched to its maximum extent and maintained for 20 to 30 seconds (22).

Posterior Capsule - Patients Position – Sitting. Procedure – Cross abduction, or arm crossing the body, is used to apply the stretch, which is held for 20 to 30 seconds (22).

ISOMETRIC EXERCISES

Scapular plane elevation- Patients Position **–** Supine, sitting, or standing. Procedure – Place patient halfway between flexion and abduction and apply resistance at different points in the range, such as 30° and 60° in the scapular plane (2).

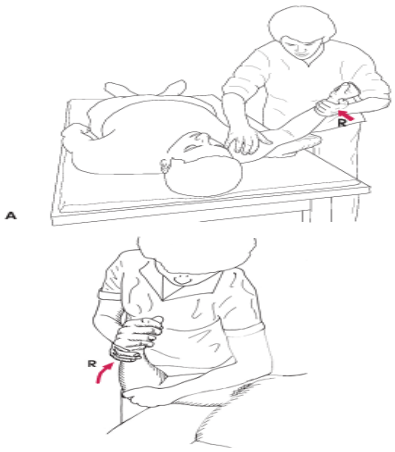


Scapular plane elevation isometric resistance. The shoulder is elevated between 30 and 60 degrees, and the humerus is subjected to regulated manual resistance (2).

Isometrics of Shoulder Abduction - Patients Position – Supine, sitting, or standing. Procedure – At 0°, 30°, 45°, and 60°, resist abduction and keep the humerus neutral to rotation. Prior to raising the humerus and preventing abduction that is greater than 90°, place it in external rotation if motion above 90° is not contraindicated (2).

Isometrics of Shoulder Internal (Medial) Rotation and External (Lateral) Rotation

Patients Position – Supine, sitting, or standing. Hand Placement and Procedure – Place the elbow 90 degrees flexed and the patient's humerus slightly flexed at the side, minor abduction, or slight elevation of the scapular plane. To prevent external rotation, apply resistance to the forearm's dorsal surface (Fig. A), and to prevent internal rotation, apply resistance to the volar surface (Fig. B) (2).



Isometric resistance to shoulder rotation. The shoulder is rotated externally in the scapular plane. (B) Internal rotation while the shoulder is 90^0 abducted (2).

PULLEY EXERCISES

Up and down – facing the shoulder rope pulley - Patients Position – Patient sitting on chair.

Procedure – The affected arm is gently stretched forward and upward by the non-affected arm while the patient's chair is facing the shoulder rope pully. The final position is held for ten seconds before the arm is lowered (23).

Shoulder Abduction - Patients Position – Sitting on chair. Procedure – In order to get the affected arm closest to the door. In relation to the shoulder rope pulley, the chair was turned sideways. Holding the pulley handles, the affected arm was dragged as high as possible to the side, alternating with the unaffected side. Position should be maintained for ten seconds. Relax and do these five to ten times (23).

Up and Down Back to the shoulder rope pulley - Patients Position – Sitting on chair.

Procedure – The chair is facing the pulley of the rope. Holding the pulley handles, the damaged arm was dragged as high as possible to the side, alternating with the unaffected side. Maintain it for ten seconds. Relax and do these five to ten times (23).

Internal Rotation - Patients Position – Sitting on chair. Procedure – The patient is positioned against the shoulder rope pully in a chair. The woman used both hands to grip the pulley handles. Used an unaffected arm to pull down on the pulley. This raised the afflicted arm as high over the patient's head as possible. For ten seconds, hold. Unwind and repeat five to ten times (23).

WAND EXERCISES

Wand exercise for flexion - Patients Position – Stand in upright position. Procedure – The patient holds a stick in both palm-down hands while standing up straight. In order to stretch their arms, patients were told to raise them above their heads, hold them straight

for five seconds, and then return to their original position. Perform this ten times (24).

Wand exercise for abduction - Patients Position – Stand in upright position. Procedure – Patients grasp a stick with both hands, palm facing away from the body, while standing erect. Using the unaffected side, push the affected side as high and out to the side as you can. Straighten your arm. Hold it for five seconds. Relax and go back to starting position. Do this ten times (24).

Wand exercise for External Rotation - Patients Position – Supine. Procedure – Patients were told to lie on their backs with the stick in both hands, palms facing up, their upper arm lying on the floor, their elbow by their sides, and their elbows bent to a 90-degree angle. Patients were instructed to push their afflicted arm away from their bodies using their undamaged arm. For five seconds, hold the stretch. Perform ten repetitions (24).

FINGER LADDER EXERCISES

Finger ladder exercise for flexion - Patients Position – Take a standing position facing the wall.

Procedure – Patients are instructed to stand with their elbows straight and facing the wall. Patients are instructed to get closer to the wall, walk their finger as high as they can up the ladder, hold it for a few seconds, and then walk it back down. The identical exercise should be performed ten times by patients (21).

Finger ladder exercise for Abduction - Patients Position – The patient is instructed to face the side of the afflicted shoulder while standing. Procedure – The patient was instructed to move closer to the wall, slowly walk finger up the ladder as high as he could, hold it for a short while, and then walk it down. The patient was instructed to perform the identical exercise ten times (21).

ACTIVE RANGE OF MOTION

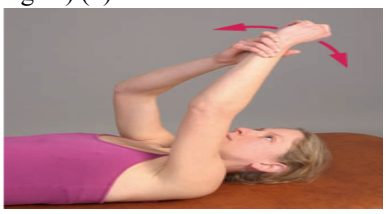
Shoulder flexion/extension - With palms toward your body and arms at sides, take a tall stance. Raise your arms as high and back as you can, then lower them as far as you can. Go back to the beginning position (25).

Shoulder abduction - Raise your arms laterally until they are overhead, then lower them back to the beginning position. With your arms at sides, elbows straight, and palms facing forward, take a tall stance. Throughout the exercise, keep your elbows straight and your hands facing forward (25).

Shoulder internal/external rotation - With your shoulders and elbows at a 90-degree angle and your palms facing down, stand tall and rotate your arms as far up and back as you can. Then, rotate your arms as far down and back as you can. Go back to the beginning (25).

ASSISTED RANGE OF MOTION

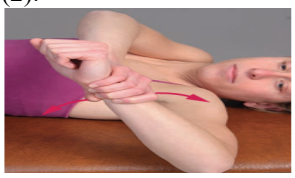
Shoulder Flexion and Extension - Patients Position – Supine. Procedure – The patient raises the involved limb above their head and puts it back to the side. Fig. A) (2).



Self-assisted range of motion for shoulder flexion and extension is provided by the patient. Adduction and horizontal abduction can be used with the same hand position (2).

Shoulder Horizontal Abduction and Adduction - Patients Position – Supine. Procedure – Starting with the arm abducted at a 90-degree angle, the patient drags the extremity across the chest and returns it to the side (2).

Shoulder Rotation - Patients Position – Supine. Procedure **–** The patient turns the forearm with the unaffected extremity, beginning with the elbow flexed 90 degrees and the arm at their side in a minor abduction (Fig. B). It's crucial to focus on rotating the humerus rather to just flexing and stretching the elbow (2).



The patient's arm position to provide self-assisted range of motion for shoulder internal and external rotation (2).

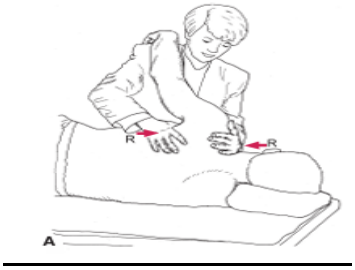
SCAPULAR STABILIZATION EXERCISES

Patients Position – Lying sideways, with the afflicted limb raised.

Procedure - **Scapular elevation/depression:** To apply manual resistance, place your upper hand superiorly and your lower hand around the scapula inferiorly (fig A).

Scapular protraction/depression: To apply resistance, place one hand around the coracoid process and the other along the medial border (fig B).

Scapular upward and downward rotation: To generate resistance, wrap one hand around the inferior angle and the other around the acromion and coracoid process (2).



(A) Elevation/depression resistance. **(B)** Retraction and protraction resistance. As the therapist pushes against the acromion and coracoid process, instruct the patient to reach over the therapist's shoulder to extend the scapula. To resist retraction, the therapist places their other hand behind the scapula (2)

GROUP B (Combine application of Spencer technique and Kinesio taping)

1st week	2nd week	3rd week
Ultrasound	Ultrasound	Ultrasound
Kinesio Taping	Kinesio Taping	Kinesio Taping
Passive shoulder range of motion exercises	Active Assisted range of motion exercises	Active range of motion exercises
Spencer Technique	Spencer Technique	Spencer Technique
Shoulder Pendulum exercises	Capsular Stretching	Self stretching exercises
Wand exercises	Shoulder Isometric exercises	Shoulder Strengthening exercises
Maitland Mobilization	Maitland Mobilization	Self Mobilization
Myofascial Release Technique	Myofascial Release Technique	Self-Myofascial Release Technique

ULTRASOUND - Patient Position – With the afflicted arm facing the therapist while seated.
Procedure – The affected shoulder was subjected to five minutes of continuous ultrasound at a frequency of 3MHz and an intensity of 1w/cm using ultrasound gel (19).

KINESIO TAPING

KINESIOTAPING TECHNIQUE -

Patient position- Seated with a back support in a chair. To successfully adhere Kinesio tape, the afflicted region must be thoroughly cleaned and dried.
Before starting the procedure, allergy test should be performed.

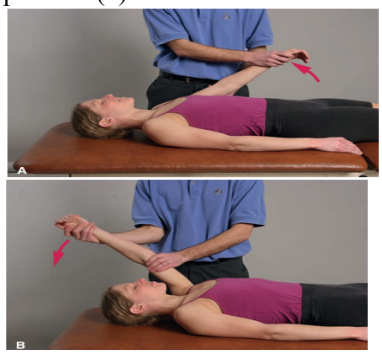
For supraspinatus muscle: The patient's neck was kept laterally bent to the other side as they sat in the chair. The afflicted arm underwent internal rotation and adduction. From behind the larger tuberosity of the humerus, a two-inch Kinesio Y strip was attached without tension. The K tape Y strip was subjected to a mild tension or paper of tension. On the superior medial margin of the scapula, the superior tail terminates at the supraspinous fossa. It was placed superior to the scapular spinous process between the top end and middle trapezius muscles. The inferior tail was placed without tension along the distal 1-2 inches of the scapula's spinous process (31).

For deltoid: A Y-shaped strip of Kinesio tape was employed from insertion to origin.

The patient was seated, and the Kinesio tape Y strip's base was on deltoid tuberosity two inches below the humerus without any stress. One strip was applied to the anterior deltoid while patient's arm was in horizontal abduction, external rotation, and horizontal extension.
Another strip was put to the posterior deltoid while the patient's arm was in internal rotation, adduction, and horizontal flexion (31).

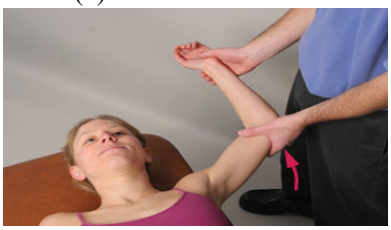
PASSIVE SHOULDER RANGE OF MOTION EXEERCISES

Shoulder Flexion and Extension - Patient Position – The patient can be positioned sideways, prone, or sitting, or they can lie supine with their shoulder at the edge of the bed. Hand Placement and Procedure – Use your lower hand to grasp patient's arm beneath the elbow. Cross over and take hold of the patient's palm and wrist with the top hand. Extend and flex the arm within the range that is provided, then return to starting position (2).



Positioning the hands for (A) starting and (B) finishing shoulder flexion (2).

Shoulder Abduction - Patient Position- The patient is supine, with their shoulder resting on the bed's edge. Hand Placement and Procedure – Use your lower hand to grasp the patient's arm beneath the elbow. Cross over, take hold of the patient's wrist and palm with the top hand, and extend the arm to the side. To make completing the arc of motion easier, the elbow may be flexed (2).



Shoulder abduction with the elbow flexion (2).

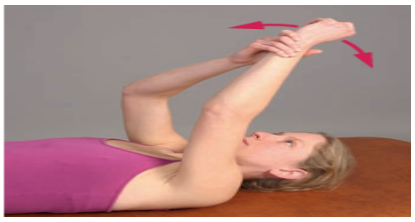
Shoulder internal and external rotation - Patient Position – The patient is supine, with their shoulder at the bed's edge. Hand Placement and Procedure – The elbow should be flexed to 90^0, the arm should be abducted to 90^0, and the forearm should remain neutral. Although complete internal rotation is not feasible in this posture, rotation can also be carried out with the arm of the patient positioned beside the thorax. Between the thumb and index finger of the patient, place your index finger on their hand and wrist. To stabilize the patient's wrist, place your thumb and the remaining fingers on either side of it. Stabilize elbow with the opposite hand. Move the humerus forward like a spoke on a wheel to rotate it (2).

The 90/90 position for starting the shoulder's (A) internal and (B) external rotation (2).

Repeat the movements five to ten times in a smooth and rhythmic manner. The program's goals, the patient's health, and how well they respond to treatment all influence how many repetitions are necessary (2).

ACTIVE ASSISTED RANGE OF MOTION EXERCISES

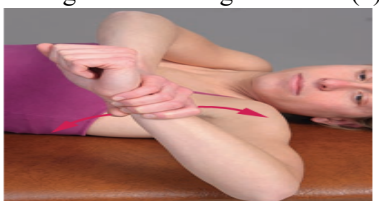
Shoulder Flexion and Extension- Patients Position – Supine. Procedure – The involved extremity is raised over the head by the patient and then lowered to the side (Fig. A) (2).



The patient is performing self-assisted shoulder flexion and extension range of motion. The same hand positioning can be used for both horizontal abduction and adduction (2).

Shoulder Horizontal Abduction and Adduction - Patients Position – Supine. Procedure – Starting with the arm abducted at a 90-degree angle, the patient draws the extremity across their chest before putting it back to the side (2).

Shoulder Rotation - Patients Position – Supine. Procedure **–** Starting with the arm at their side in minor abduction 90˚ and elbow flexed 90˚, the patient rotates the forearm with the unaffected extremity (Fig. B). It is crucial to focus on rotating the humerus rather to just flexing and extending the elbow (2).



The patient's arm position for self-assisted shoulder rotation both internally and externally (2).

ACTIVE RANGE OF MOTION

Shoulder flexion/extension – Stand upright with your arms resting beside your body and palms directed towards you. Raise your arms as high and back as you can, then lower them as far as you can. Go back to where you started (25).

Shoulder abduction - With your arms at your sides, elbows extended and palms facing forward, take a tall stance. Raise your arms laterally until they are overhead, then lower them back to the beginning position. Throughout the movement, keep your elbows and palms straight (25).

Shoulder internal/external rotation - With your hands facing down and your shoulders and elbows at a 90-degree angle, take a tall stance. Rotate your arms as far up and back as you can, then as far down and back. Go back to your initial position (25).

SPENCER TECHNIQUE

Patient Position – Side lying

Procedure – While the patient lay on their side with the shoulder to be treated uppermost, the therapist stood in front of them, supporting the superior aspect of the shoulder girdle. The arm was used as a long lever, and the fixed shoulder girdle offered a resistant structure against which to stretch the soft tissues surrounding the glenohumeral articulation. The

patient's wrist and forearm are then supported by the therapist, who moves the arm passively, smoothly, and rhythmically while being carried to the greatest extent as the patient's constricted muscles, ligaments, and shoulder capsule allow.

Step 1 – Shoulder extension with elbow flexion: The patient's elbow remained flexed
while their arm was extended to the restricted barrier.

Step 2 – Shoulder flexion with elbow extension: The patient's elbow flexion was extended, and the shoulder flexion was moved anteriorly until the barrier was constrained.

Step 3 – Circumduction with compression: Using compressive force, move the patient's elbow in small circular and counterclockwise circles while holding his shoulder in a 90° abduction position.

Step 4 – Circumduction with distraction: The therapist held the patient's elbow or wrist in small circular and counterclockwise circles while maintaining the traction of the shoulder joint in a 90° abduction.

Step 5 – Shoulder abduction and internal rotation with elbow flexion: After asking the patient to lay his hand on the therapist's forearm for support, the therapist abducted the patient's arm and rotated it internally. Internal rotation (90°): The therapist moved the patient's elbow anteriorly while placing the dorsum of the patient's palm behind the hip.

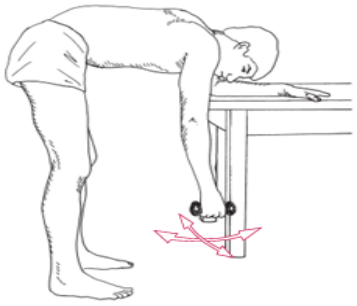
Step 6 – Shoulder adduction and external rotation with elbow flexion: The therapist moved the patient's arm into adduction and external rotation after instructing the patient ton rest the hand on the therapist's forearm for assistance.

Step 7 – Stretching tissue and pumping fluids with the arm extended: The therapist interlaced his fingertips over the deltoid muscle and placed the patient's hand over his shoulder. The therapist then carefully pulled the arm away from the shoulder and released it, repeating the process five to ten times if necessary (24).

SHOULDER PENDULUM EXERCISES

Patient position – Standing with the hip flexion at a 90-degree angle.

Procedure -The afflicted arm is positioned between 60° and 90° elevation, hanging loosely down. The patient gently rocks the trunk in a steady rhythm to start a swinging or pendulum motion of the arm. Depending on which way the trunk shakes, flexion, extension, horizontal abduction, adduction, and circumduction can be performed. The arc of motion should be increased as acceptable. There shouldn't be any pain from this method. Have the patient lie prone on a table or cling to a sturdy object if they are unable to keep their balance while bending over. Use the prone position if bending over causes the patient to have back pain. (2). Ten repetitions of each exercise were performed (21).



Pendulum exercises (2).

WAND EXERCISES

Wand exercise for flexion - Patients Position – Standing in erect posture. Procedure – The patient holds a stick in both hands, palm down, while standing straight. In order to stretch their arms, patients were told to raise them above their heads, hold them straight for five seconds, and then return to their initial position. Do this ten times (21).

Wand exercise for abduction - Patients Position – Standing up straight. Procedure – Patients should stand upright, grasp a stick with both palms facing away from their bodies, and push the afflicted side as high and out to the side as they can with the unaffected side. Hold your arm straight. Five seconds of holding. Unwind and go back to your initial position. Perform ten repetitions (21).

Wand exercise for External Rotation - Patients Position – Supine. Procedure – Patients were told to lie on their backs with the stick in both hands, palms facing up, their upper arm lying on the floor, their elbow by their sides, and their elbows bent to a 90-degree angle. Patients were instructed to push their afflicted arm away from their bodies using their unaffected arm. For five seconds, hold the stretch. Exercise should be repeated for ten times (21).

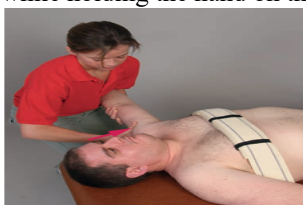
MAITLAND MOBILIZATION

Glenohumeral caudal Glide in Resting Position - Indication – Used to improve shoulder abduction.

Patient Position- Lying supine with arm at rest. Therapist Position and Hand Placement – Support the patient's forearm between your trunk and elbow while standing lateral to the arm being treated. To give a grade I distraction, insert one hand inside the patient's axilla. The acromion process is located just distal to your other hand's web space. Mobilizing Force – Move the humerus inferiorly with the hand positioned superiorly (2).

Caudal glide for GH joint in the resting position (2).

Glenohumeral Caudal Glide Progression - Indication – For increasing abduction of the shoulder. Patient Position – In sitting or supine lying, the arm should be in abduction as far as it is possible. As the arm gets closer to and beyond 90 degrees, the end range position should include external rotation of the humerus. Therapist Position and Hand Placement – Stand facing the patient's feet while they are supine, and use the hand that is farthest from the patient to steady their arm against your trunk. By using a long axis traction, a slight sideways movement of the trunk produces grade I distraction. When the patient is seated, step behind them and use the hand that is farthest away from them to cradle the distal humerus. This hand uses long axis traction to generate a grade I distraction. Mobilizing Force – Inferiorly move the humerus in relation to the scapula's glenoid fossa while holding the hand on the proximal humerus (2).

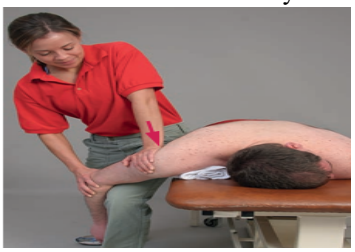


Caudal glide for glenohumeral joint with the shoulder near 90˚ (2).

Glenohumeral Posterior Glide in Resting Position - Indications – Performed to improve flexion and internal rotation. Patient Position – The patient lies supine with the arm maintained in relaxed resting posture. Therapist Position and Hand Placement – Place yourself between the patient's trunk and arm with your back to them. Support the arm against your trunk while holding the distal humerus with lateral hand . The joint receives grade I distraction in this position. With your fingers pointed superiorly, position the lateral border of upper hand just distal to the joint's anterior boundary. The mobilizing force comes from this hand. Mobilizing Force – Bend your knees and move your entire arm to glide the humeral head posteriorly (2).

Posterior glide of glenohumeral joint in the resting position (2).

Glenohumeral Anterior Glide in Resting Position - Indication – To improve shoulder extension and external rotation. Patient Position – Lying Prone, resting on your thigh with your arm lying over the side of the treatment table. Use padding to keep the acromion stable. The supine position is another option. Therapist Position and Hand Placement – Place your leg closer to the table and face the top of the table while taking a forward step. Using your outside hand, hold arm of patient against the thigh to create a grade I diversion. The mobilizing force is applied by placing the ulnar border of your other hand immediately position the hand just below the back aspect of the acromion process, keeping the fingers directed upward. Mobilizing Force – The humeral head should be moved anteriorly and somewhat medially. Make the entire arm move anterior by bending both knees (2).



Anterior glide of glenohumeral joint in the resting position (2).

MYOFASCIAL RELEASE TECHNIQUE

Pectoralis major – Participants' pectoralis major muscle was palpated to find limitations and trigger sites, while they were in the supine position. The therapist glided over the muscle and slid their treating arm passively into flexion. For three to five minutes, the pectoralis major muscle was subjected to the myofascial release method (MFR), which involved moving the afflicted arm in different directions.

Pectoralis minor – The treatment arm was positioned in the supine position at 90 degrees of elbow flexion and 90 degrees of GH abduction. The therapist passively adducted and abducted the shoulder while applying sustained pressure on the trigger points of the pectoralis minor muscle, despite the difficulty of palpating it beneath the pectoralis major. MFR was applied to the pectoralis minor muscle for three to five minutes.

Subscapularis – The elbow was flexed to 90 degrees while the participants' humerus was abducted to 45 degrees. Up to its maximum range of motion, the humerus was externally rotated. To find limitations, taut bands, and trigger points, the therapist palpated the subscapularis in the axilla. Myofascial release prolonged manual method pressure was applied to the subscapularis trigger sites in order to treat the

indicated limits. The subscapularis received MFR for about three to five minutes.

Levator scapulae – The supine laying position was used for the participants. The therapist flexed and passively rotated the neck to the opposite side. Restrictions, tense bands, and trigger points were felt in the levator scapulae muscle. The levator scapulae trigger points were subjected to prolonged manual pressure as part of myofascial release techniques (MFR) to address the indicated limitations. MFR was administered to the levator scapulae for three to five minutes (32).

CAPSULAR STRETCHING

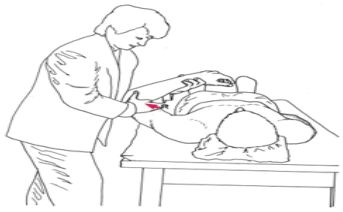
Anterior Capsule - Patients Position – Sitting. Procedure – For 20 to 30 seconds, the stretch force is applied by therapist while bringing the arms and shoulders back (22).

Anterior – inferior capsule - Patients Position – Sitting. Procedure – Elevation of the arms is stretched to the maximal range; hold it for 20-30 seconds (22).

Posterior Capsule - Patients Position – Sitting. Procedure – For 20 to 30 seconds, the stretch is applied by crossing the body with the arm (cross abduction) (22).

SHOULDER ISOMETRIC EXERCISES

Scapular plane elevation - Patients Position **–** Supine, sitting, or standing. Procedure – Place yourself halfway between flexion and abduction and apply resistance at different points in the range, such as 30° and 60° in the scapular plane (2).

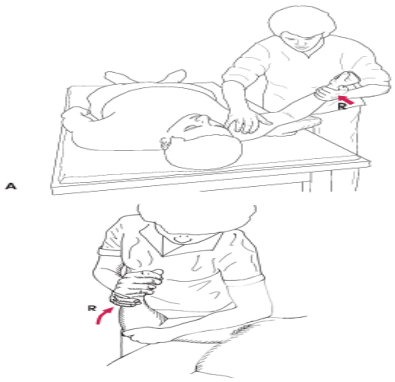


Elevation of the scapular plane with isometric resistance. The humerus is subjected to regulated manual resistance while the shoulder is elevated between 30° and 60° (2).

Isometrics of Shoulder Abduction - Patients Position – Supine, sitting, or standing. Procedure – At 0°, 30°, 45°, and 60°, resist abduction and keep the humerus neutral to rotation. Prior to elevating the humerus and applying resistance above 90° of abduction, place it in external rotation if motion above 90° is not contraindicated (2).

Isometrics of Shoulder Internal (Medial) Rotation and External (Lateral) Rotation

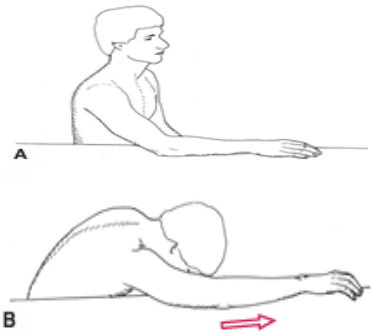
Patients Position – Supine, sitting, or standing. Hand Placement and Procedure – With the elbow flexed to 90^0, position the humerus beside the patients body in slight flexion, mild abduction or slight elevation within the scapular plane. Resistance should be applied to the forearm's volar surface to prevent internal rotation (Fig. B) and its dorsal surface to prevent external rotation (Fig. A) (2).



Isometric resistance to shoulder rotation. (A) External rotation while keeping the shoulder in the scapular plane. (B) Internal rotation at 90° abduction with the shoulder (2).

SELF STRETCHING EXERCISES

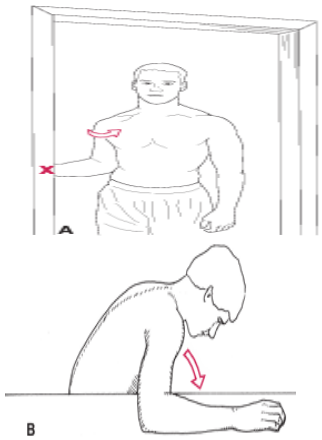
To Increase Flexion and Elevation of the Arm – The patient should sit beside a table with the affected side positioned close to it. Procedure - Sitting with the affected side close to the table, elbow slightly bent, and forearm lying along the edge of the table (A). Ask the patient to bend from the waist and slide their forearm forward along the table. The head and shoulder should eventually be level (B) (2).



(A) Initial position and **(B)** end positions for self-stretching to elevate and increase shoulder flexion (2).

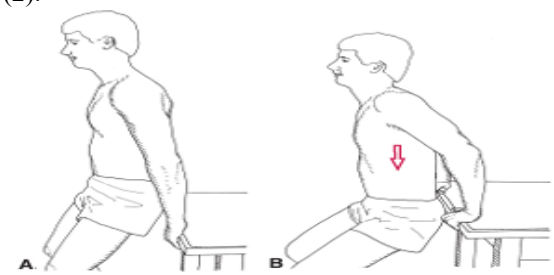
To Increase External (Lateral) Rotation – Patient stands upright. Procedure – Stand in front of a doorway with the elbow bent 90 degrees and the palm of the hand pressed against the frame's edge. Turn the patient away from the fixed hand (A) while maintaining the arm against the side or slightly abducted.

Patient Position – Sitting. Procedure – Flexing the elbow to a 90-degree angle and place the forearm on the table surface while sitting near the table. Bring the patient's head and shoulders level with the table by bending them from the waist (B) (2).



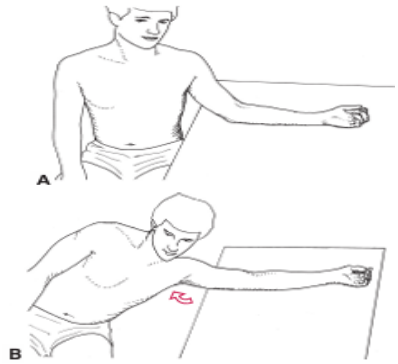
Self-stretching to enhance shoulder external rotation **(A)** utilizing a doorframe with the arm at the side and **(B)** using a table to stabilize the forearm with the arm in the scapular plane (2).

To increase Extension of arm – Patient in Standing position . Procedure – With both hands gripping the edge of the table and their fingers pointing forward, the person stands with their back to the table (A). Ask the patient to start squatting with their elbows flexed (B) (2).



(A) Starting positing and **(B)** end positions to improve shoulder extension with self-stretching (2).

To Increase Abduction and Elevation of the Arm - Patient position – Sitting. Procedure – Sitting with one side facing a table, pointing to the other side of the table while placing the forearm with palm supinated on the table (A). While lowering the head toward the arm and moving the chest away from the table, ask the patient to slide their arm over the surface (B) (2).



(A) Starting position and **(B)** end positions to improve shoulder abduction with elevation through self-stretching (2).

To Increase Internal Rotation - Patient Position – Standing. Procedure – Place the dorsum of hand against the doorframe and the elbow bent to a 90-degree angle while facing the frame. Ask the patient to rotate their trunk in the direction of the fixed hand. Patient position – Side-lying

Procedure – Patient lying on the afflicted side, with internal rotation of arm to the "sleeper" position and the shoulder and 90 degrees elbow flexed each. Next, ask the patient to use the other hand to push their forearm in the direction of the table (2).

Using a table to stabilize the humerus while self-stretching in the "sleeper position" to enhance shoulder internal rotation (2).

SHOULDER STRENGTHENING EXERCISES

Shoulder Flexion

Position of Patient – With your thumb pointing forward and your elbow extended, you can be sitting, standing, or lying down. Procedure – With your thumb pointing forward and your elbow extended, you can be sitting, standing, or lying down. Ask the patient to flex their shoulder forward. When using a free weight while lying down, the most resistance is felt at the start of the range; when standing, the most resistance is felt when the shoulder is flexed to a 90° angle. If a solid object is placed on the floor or under the patient's foot, elastic resistance can also be utilized (2).

Shoulder Extension

Patient Position – Flex your arm when sitting or standing. Procedure – Flexing the arm when standing or sitting. Overhead, elastic resistance or a pulley is fastened. Ask the patient to extend by pulling down against the resistance (2).

Shoulder Adduction

Patient Positioned with the arm Abducted in sitting or standing position. Procedure – Instruct the patient to abduct their arm whether they are standing or seated. Ask the patient to pull down against an overhead pulley force or elastic resistance. When the resistive force is perpendicular to the patient's arm, resistance is at its highest (2).

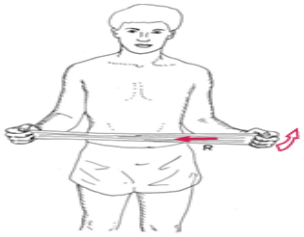
Internal Rotation of Shoulder

Patient Position – Standing or Sitting. Procedure – Utilizing a pulley system or elastic resistance while

sitting or standing, with the force applied at elbow level and out to the side. Ask the patient to rotate internally by pulling across the front of their trunk (2).

Shoulder External Rotation

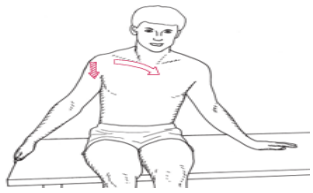
Patient Position – Sitting or standing. Procedure – Using a wall pulley or elastic resistance near the elbow, in front of the body height when seated or standing. Ask the patient to grab the pulley handle or the elastic material and turn their arm outward (2).



Resisted external rotation using elastic resistance (2).

SELF-MOBILIZATION TECHNIQUES.

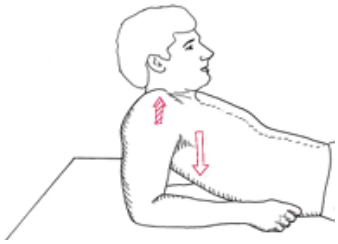
Caudal Glide - Patient Position – Sitting. Procedure – Holding the fingers beneath the edge while seated on a solid surface. After stabilizing the arm, the patient leans their trunk away from it (2).



Self-mobilization. Leaning away from the stationary arm causes the humerus to glide caudally (2).

Anterior Glide - Patient Position – Sitting

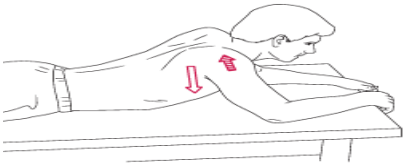
Procedure – Either lying supine and supported on a stable surface or sitting with both arms behind the body. Ask the patient leans their weight between their arms (2).



Self-mobilization. Leaning between the fixed arms causes the humerus to glide anteriorly (2).

Posterior Glide

Patient Position – Prone. Procedure – On both elbows, lying prone. The body weight moves between the arms downward (2).



Self-mobilization. Between the fixed arms, the individual shifts his weight lower, causing the humerus to glide posteriorly (2).

SELF-MYOFACIAL RELEASE TECHNIQUE

Pectoralis Major - Patient Position – Standing with face close to the wall. Procedure – The participant was instructed to roll a 12-cm-diameter foam ball between the start of the axillary fold and sternum's upper end, applying pressure when discomfort started. To optimize possible ROM increases, the rolling frequency was set at 2 seconds per direction. Throughout the intervention, the individual was instructed to maintain a constant rolling intensity, or till the point of discomfort (26).

Deltoid - Patient Position – The patient should stand facing towards the wall. Procedure – A lacrosse ball must be positioned between the patient's muscle and the wall, and the patient must continually move it back and forth while applying light pressure for six to thirty seconds (27).

Upper Trapezius - Patient Position – Supine. Procedure – Starting in a supine lying posture with the hips unsupported and flexed, the roller is positioned beneath the upper section of trapezius muscle (28). The body was pushed back and forth across the roller while the head was kept in a neutral position with the shoulders and ears in line. Every participant completed 20 repeats two or three times at intervals of one minute (29).

Supraspinatus - Procedure – The patient should insert their fingers between the tip of the trapezius and the scapula's spine, then move in a transverse or circular motion for a short while (27).

Posterior rotator cuff - Patient Position – Supine. Procedure – The foam roller was placed behind the armpit region as the patient descended slightly toward the feet. The individual vigorously rotated his or her humerus both internally and externally while keeping the elbow steady on the floor for two minutes while rolling over the foam roll until an area of limitation was detected (30).

Latissimus Dorsi - Patient Position – Supine. Procedure – The client rolled back a little such that the foam roll was over the latissimus dorsi muscles and under the armpit area. The subject will actively stretch their humerus overhead while rolling over the foam roll until they feel a region of limitation. They will then remain in that posture on the foam roll for two minutes (30).

RESULTS

Statistical methods used include:

Mean and Standard Deviation (S. D.) Calculation.

Paired t – test (for within – group comparisons before and after training).

Unpaired t-test (for comparisons between Group A and Group B).

Descriptive Statistics:

The following table shows the mean and standard deviation for age in both groups:

Variable	Mean	Std. Deviation
Age	54.00	7.49

Table No. 1 mean age with standard deviation

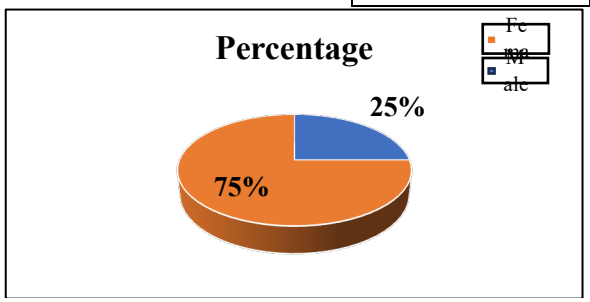
A total 76 subjects diagnosed with acute frozen shoulder who meet the inclusion criteria were selected for the study. There were two groups, each with 38 individuals, such as Group A and Group B. Patients age were from 40 – 65 years with mean of age in both groups is 54.00 (±7.49).

Table No. 2 Female and Male participants

The study included 76 participants diagnosed with acute frozen shoulder who meet the inclusion criteria, consisting of 57 females (75%) and 19 males (25%).

Gender	Frequency	Percentage
Female	57	75%
Male	19	25%
Total	**76**	**100%**

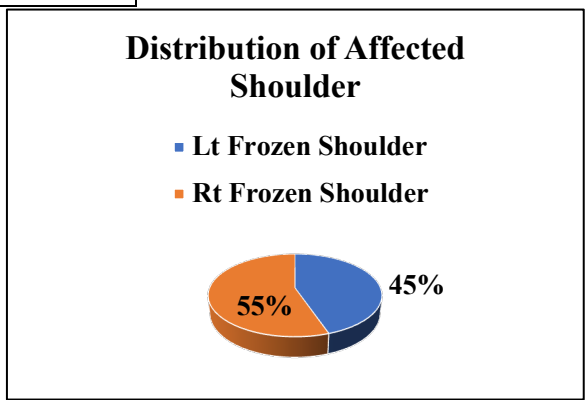
Diagnosis	Frequency	Percentage
Lt Frozen Shoulder	34	45%
Rt Frozen Shoulder	42	55%
Total	**76**	**100%**



Graph No. 1 Distribution of Gender

Table No. 3 Affected Shoulder (Right/ Left)

A total 76 patients diagnosed with acute frozen shoulder were included in the study, the affected shoulder was observed to be distributed as follows: 34 patients had frozen shoulder on left side and 42 patients had frozen shoulder on right side. According to the distribution, 55% of the affected instances were in the right shoulder, whereas 45% were in the left shoulder.



Graph No. 2 Distribution of Affected

Shoulder (Rt/ Lt)

Group A Analysis (Paired t-test)

This Scale evaluates the before and after changes in the parameters for Group A

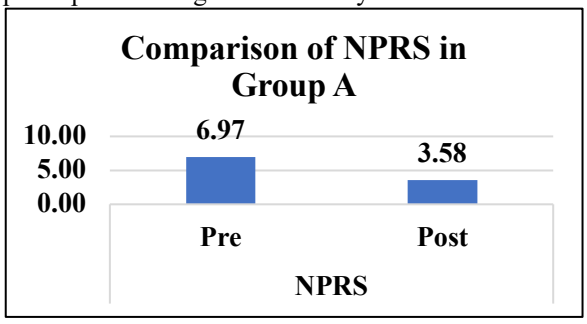
Table No. 4 Parameters for group A

Parameters	Assessment Period	Mean	Std. Deviation	p-value
NPRS	Pre	6.97	0.82	<0.001*
	Post	3.58	0.92	
SPAID	Pre	0.75	0.05	<0.001*
	Post	0.49	0.05	
CMS	Pre	33.37	3.74	<0.001*
	Post	54.39	5.49	

The mean NPRS score dropped from 6.97 ± 0.82 at baseline pre-treatment to 3.58 ± 0.92 post-treatment. A statistically significant decrease in pain was seen ($p < 0.001$).

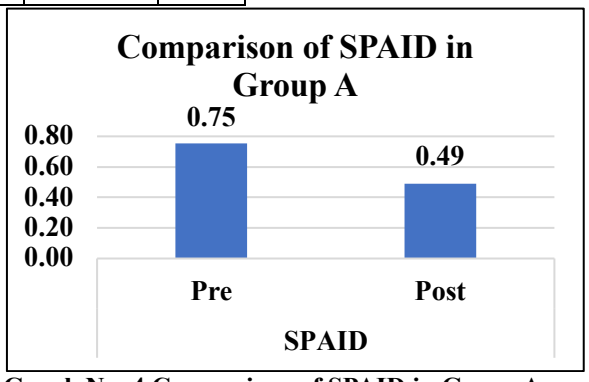
The mean SPAID score decreased from 0.75 ± 0.05 pre- treatment to 0.49 ± 0.05 post- treatment, indicating that after the intervention, participants had less shoulder pain and difficulties with everyday tasks. Statistically, this improvement was highly significant ($p < 0.001$).

The mean CMS score showed a significant improvement in shoulder function, increasing from 33.37 ± 3.74 pre- treatment to 54.39 ± 5.49 post- treatment. This improvement was statistically significant ($p < 0.001$), suggesting that participant's strength and mobility was increased.



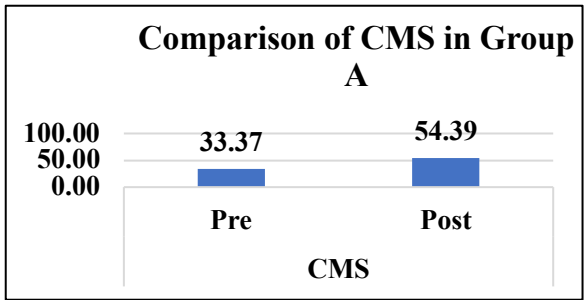
Graph No. 3 Comparison of NPRS in Group A

The Numeric Pain Rating Scale (NPRS), which measures pain severity, demonstrated a discernible decrease from 6.97 (pre- intervention) to 3.58 (post-intervention). The intervention was successful in reducing shoulder pain since participant's initial reports of moderate to severe pain significantly decreased after the treatment.



Graph No. 4 Comparison of SPAID in Group A

Using the SPAID shoulder pain and disability was assessed, showed reduction from 0.75 (pre-intervention) to 0.49 (post-intervention). This decrease indicates a notable amelioration of shoulder discomfort and functional impairment, suggesting improved capacity of shoulder to carry out shoulder-related daily tasks following the intervention.



Graph No. 5 Comparison of CMS in Group A

Functional ability of the shoulder, measured by CMS, showed a substantial improvement from 33.37 (pre- intervention) to 54.39 (post-intervention). A higher CMS score indicates reduced pain, improved shoulder mobility, strength, and activities of daily living of the afflicted arm.

Group B Analysis (Paired t-test)

This Scale evaluates the before and after changes in the parameters for Group A

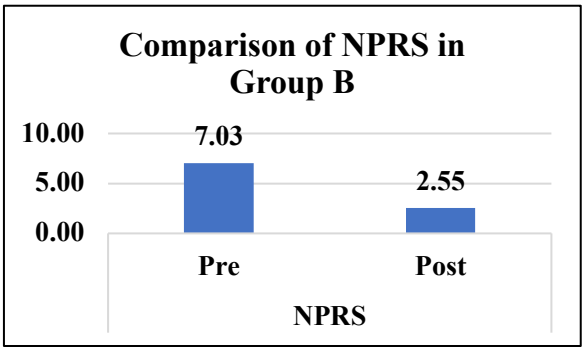
Table No. 5 Parameters for group B

Parameters	Assessment Period	Mean	Std. Deviation	p-value
NPRS	Pre	7.03	0.72	<0.001*
	Post	2.55	0.50	
SPAID	Pre	0.76	0.05	<0.001*
	Post	0.39	0.04	
CMS	Pre	35.08	3.66	<0.001*
	Post	71.58	5.96	

The mean NPRS score dropped from 7.03 ± 0.72 pre- treatment to 2.55 ± 0.50 post- treatment. A statistically significant substantial reduction in pain was seen ($p < 0.001$).

The mean SPAID score decreased from 0.76 ± 0.05 pre- treatment to 0.39 ± 0.04 post- treatment, indicating that individuals felt more at ease and less discomfort when carrying out daily tasks ($p < 0.001$).

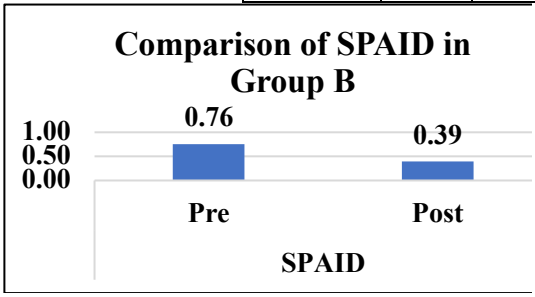
The mean CMS score showed a significant improvement in shoulder function, increasing from 35.08 ± 3.66 pre- treatment to 71.58 ± 5.96 post- treatment. This improvement was statistically significant ($p < 0.001$), suggesting that participant's strength and mobility was increased.



Graph No. 6 Comparison of NPRS in Group B

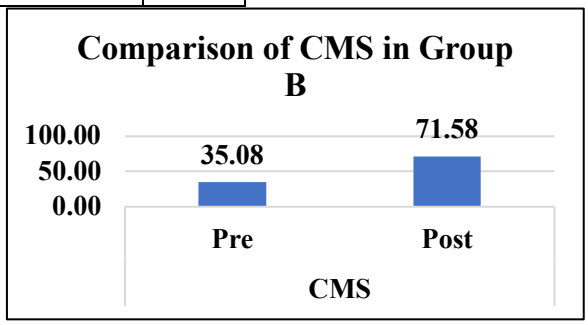
The Numeric Pain Rating Scale scores for Group B pre and post intervention are compared in the graph above. Participants reported high levels of pain at baseline, as shown by the mean pre-intervention NPRS score of 7.03. The mean NPRS score decreased to 2.55 post intervention, indicating a significant reduction in the severity of the pain. This significant decrease implies that Group B's discomfort was successfully reduced by the intervention. As pain levels changed from severe to mild on the NPRS scale, the difference between pre- and post-treatment scores shows a clinically significant improvement.

Parameters	Group	Mean	Std. Deviation	p-value
NPRS	A	3.58	0.92	<0.001*
	B	2.55	0.50	
SPAID	A	0.49	0.05	<0.001*
	B	0.39	0.04	
CMS	A	54.39	5.49	<0.001*
	B	71.58	5.96	



Graph No. 7 Comparison of SPAID in Group B

The SPADI scores for Group B pre and post intervention are shown in the above graph. There was more shoulder discomfort and functional disability at baseline, as indicated by the mean pre-intervention SPADI score of 0.76. The mean SPADI score dropped to 0.39 post intervention. The results show that Group B's treatment protocol greatly increased functional capacity and decreased shoulder pain, both of which improved the participants' quality of life.



Graph No. 8 Comparison of CMS in Group B

The Constant-Murley Score (CMS) values in Group B are shown in the above graph both before and after the intervention. Reduced shoulder function and overall performance at baseline were indicated by the mean pre-intervention CMS score of 35.08. The mean CMS score significantly rise to 71.58 post intervention. The results show that the intervention given to Group B significantly enhanced shoulder function and restored functional capacity. The significant improvement in CMS scores demonstrates the treatment protocol's beneficial therapeutic effects.

Group A v/s Group B (Unpaired t- test)

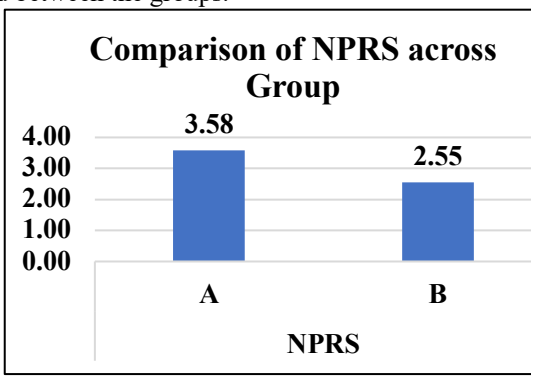
The post-intervention comparison of NPRS, SPADI, and CMS scores between Group A and Group B is shown in the table.

Table No. 6 Comparison of group A v/s group B

Group A had a mean score of 3.58 ± 0.92 on the Numeric Pain Rating Scale (NPRS), while Group B had a reduced mean score of 2.55 ± 0.50. The findings imply that Group B experienced more pain reduction than Group A since lower NPRS scores indicate less pain. A statistically significant variation was observed between the groups ($p < 0.001$).

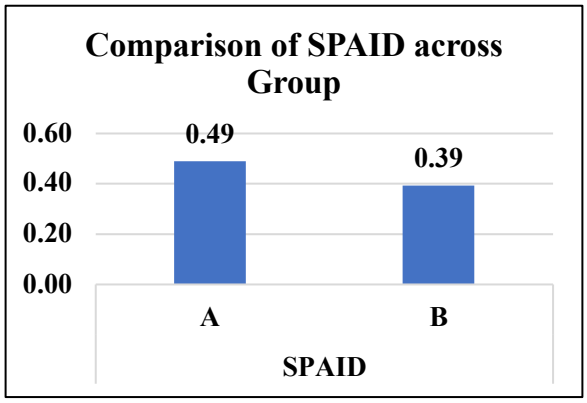
Group B had a lower mean score of 0.39 ± 0.04 on the SPADI, whereas Group A had a mean score of 0.49 ± 0.05. Group B showed higher functional improvement than Group A because lower SPADI ratings indicate less pain and impairment. Additionally, this difference was statistically significant ($p < 0.001$).

Mean score of group B was significantly higher 71.58 ± 5.96 than Group A 54.39 ± 5.49 on the Constant–Murley Score (CMS), where higher scores indicate superior shoulder function. This suggests that Group B experienced better functional recovery. A significant statistically difference ($p < 0.001$) was identified between the groups.



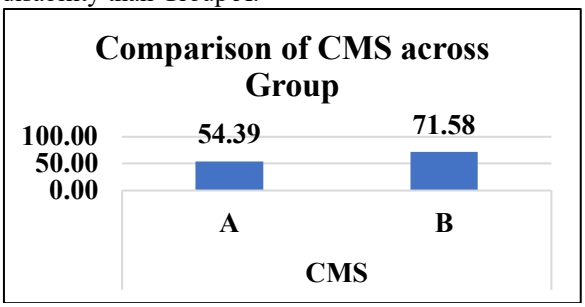
Graph No. 9 Comparison of NPRS across Group A and Group B

NPRS scores for Group A and Group B are compared in the graph. The NPRS is frequently used to measure pain intensity, with higher scores denoting higher degrees of discomfort. The graph indicates that Group B had a lower mean NPRS score of 2.55, whereas Group A reported a mean score of 3.58. This indicates that participants in Group B experienced less pain compared to those in Group A. The difference between the two groups raises the possibility that Group B's treatment was more successful in lowering pain levels. Since a decrease of one point or more on the NPRS scale is sometimes seen as significant in clinical settings, the observed difference (about 1.03 points) might be a pertinent improvement. Overall, the results indicate that the potential efficacy of the intervention performed in Group B by showing that Group B experienced better pain outcomes than Group A.



Graph No. 10 Comparison of SPAID across Group A and Group B

A comparison of Group A and Group B's SPADI scores is shown in the above graph. It is commonly utilized to measure pain intensity and functional disability associated with shoulder conditions; more pain and impairment are indicated by higher ratings. The graph indicates that Group A had a mean SPADI score of 0.49, but Group B had a lower mean score of 0.39. This suggests that individuals in Group B had comparatively less shoulder pain and functional impairment than those in Group A. The intervention given to Group B may have been more successful in lowering shoulder-related pain and impairment, according to the differences between the groups. Even slight decreases in SPADI scores can indicate significant gains in day-to-day activities and functional performance. Overall, the results indicate that the potential efficacy of the intervention performed in Group B, by showing that Group B experienced better reduction in pain and functional disability than Group A.



Graph No. 10 Comparison of CMS across Group A and Group B

The graph shows a comparison of the mean CMS scores for Group A and Group B. The CMS is commonly used to evaluate pain, ADLs , range of motion and muscle strength. Higher CMS scores indicate better function and improvement. According to the graph, mean CMS score for Group B was higher at 71.58 than Group A, which was 54.39. This implies that individuals in Group B exhibited superior functional outcomes in contrast to those in Group A.

The results demonstrate the possible efficacy of the intervention given to Group B, as seen by their higher CMS scores. According to these findings, the total functional recovery of Group B was superior than Group A.

DISCUSSION

Frozen Shoulder also called as Adhesive capsulitis, is a painful and disabling musculoskeletal disorder marked by increasing glenohumeral joint mobility limitation. The condition is characterized by severe shoulder pain, discomfort, growing stiffness, and restrictions in both active and passive range of motion. The severe pain and limited shoulder range make the acute phase extremely challenging, which has a detrimental effect on daily activities and overall quality of life. The prospective comparative study was conducted to evaluate the combine effect of spencer technique and kinesio taping in patients with acute frozen shoulder.

The mean age of the individuals in this study was 54 ± 7.49 years, which is consistent with commonly reported age range of 40–65 years that is typically associated with frozen shoulder. The condition is recognized to primarily affect middle-aged people because of metabolic and degenerative alterations in connective tissue. In the present study, males constituted 25% and female constituted 75% of the sample. As the literature usually finds higher prevalence among females. In terms of side engagement, the right shoulder was slightly more involved (55%) than the left (45%), maybe as a result of overuse associated to dominance.

A total of 76 subjects diagnosed with acute frozen shoulder were included based on inclusion criteria and excluded based on exclusion criteria, and randomly allocated into 2 groups. Group A (Controlled group) with 38 participants received conventional physiotherapy protocol (Ultrasound, Hot moist pack, Codman's pendulum exercises, Capsular and Pectoral Stretching, Isometric exercises, Pulley, Wand, Finger Ladder exercises, Active and Active Assisted exercises, Scapular stabilization exercises), whereas Group B (Experimental group) with 38 participants received combined Spencer Technique and Kinesio Taping along with Ultrasound, Passive- Active Assisted – Active shoulder range of motion exercises, Shoulder Pendulum exercises, Wand exercises, Maitland Mobilization, Myofascial Release Technique, Capsular Stretching, Shoulder Isometric exercises, Self-stretching exercises, Self-Mobilization, Self-Myofascial Release Technique. NPRS, SPADI, and CMS were the outcome measures used for evaluation of pre and post intervention. After three weeks of treatment, significant improvements were observed in all the outcome measures in both groups ($p < 0.001$). However, compared to Group A (conventional physiotherapy), Group B (combine Spencer Technique and Kinesio taping) showed greater improvement.

Pain (NPRS)

NPRS was used to evaluate the intensity of pain. The mean NPRS score in Group A decreased significantly with conventional physiotherapy, from 6.97 ± 0.82 pre to 3.58 ± 0.92 post-treatment ($p < 0.001$). The mean NPRS score in Group B decreased from 7.03 ± 0.72 pre to 2.55 ± 0.50 post-treatment ($p < 0.001$).

Group B showed substantial lower pain scores (2.55) than Group A (3.58) when post-treatment values were compared between groups ($p < 0.001$). This implies that combine effect of Spencer Technique and kinesio taping was more effective in reducing pain than using conventional physiotherapy alone.

Functional Disability (SPAID)

SPADI was used to measure functional disability. The mean SPADI score in Group A decreased from 0.75 ± 0.05 pre- treatment to 0.49 ± 0.05 post-treatment ($p < 0.001$). Group B's score decreased from 0.76 ± 0.05 pre- treatment to 0.39 ± 0.04 post-treatment ($p < 0.001$).

Group B significantly outperformed Group A in terms of functional improvement, according to a between-group comparison ($p < 0.001$). The higher improvement in Group B can be directly linked to better pain reduction and increased mobility attained with the combined intervention because SPADI measures both pain and disability components.

Shoulder Function (CMS)

CMS was used to evaluate shoulder function. Following conventional physiotherapy, CMS values of Group A improved from 33.37 pre- treatment ± 3.74 pre- treatment to 54.39 ± 5.49 post-treatment ($p < 0.001$), showing considerable functional benefits. CMS significantly improved in Group B, rising from 35.08 ± 3.66 pre- treatment to 71.58 ± 5.96 post-treatment ($p < 0.001$).

Group B had considerably higher CMS scores (71.58) than Group A (54.39) after the intervention ($p < 0.001$). This large difference suggests that the combined use of Kinesio tape and the Spencer Technique greatly enhanced shoulder function, strength, and ROM in addition to reducing pain.

Following the use of the Kinesio taping technique, there is a notable decrease in both pre and post pain scores on the NPRS. Support for this result was provided by Smita Bhimrao Kanase (2012) that the Kinesio taping technique considerably reduced pain scores in individuals with frozen shoulder. The expanding and contracting characteristics of kinesio tape allow it to gently stimulate different kinds of skin sensory receptors while you move. By stimulating touch receptors, this triggers the spinal inhibitory system, which in turn triggers the descending

inhibitory system to reduce pain through the Gate control theory.

The application of Kinesio taping technique there is significant increase in pre and post shoulder range of motion. These finding are consistent with the study conducted by Jung Hyun Choi et al (2017), the Kinesio taping technique helped patients with adhesive capsulitis to improve range of motion in their joints. The application of kinesio tape around the shoulder joint stimulated the brainstem's reticular development, cerebellum, and muscles. Consequently, the joint range of motion would be regulated by the balance between muscle tension and bodily adjustment. Kinesio taping supports weaker muscles and helps to restore proper muscle function.

Haveela.B, Dowle Praveen et al (2018), Spencer technique aims to reduce pain by modifying circulatory pain indicators. Spencer technique improves joint mobility by stretching the shoulder capsule and surrounding tight soft tissues, increases pain-free range of motion. When this method is used, the lymphatic flow from the treated area is increased. This method restores the joint's normal range of motion and resets neural reflexes. Nutrition, circulation, and joint lubrication are all enhanced by the passive repetitive translation movements, traction, or gliding. It normalizes arthrokinematics rolling and gliding motion and reverses the detrimental alterations in the joint. Increased gliding will allow shoulder mobility to be restored and return the osteokinematic rotation to normal.

The study findings indicate that both conventional physiotherapy protocol (Group A) and combined intervention of spencer technique and kinesio taping in addition to conventional physiotherapy protocol (Group B) reduced pain, functional disability and improved shoulder function, with statistically significant greater improvement in combined intervention of spencer technique and kinesio taping in addition to conventional physiotherapy protocol (Group B).

CONCLUSION

The research included individuals diagnosed with acute frozen shoulder, assigning conventional physiotherapy protocol to control group (Group A) and combine spencer technique and kinesio taping in addition to conventional physiotherapy protocol to experimental group (group B). Pain, functional disability and shoulder function were evaluated using NPRS, SPAID and CMS respectively. The study shows that both conventional physiotherapy and the combined intervention of Spencer technique and kinesio taping significantly improved functional ability and reduced pain and shoulder disability in patients with acute frozen shoulder ($p < 0.001$). However, the group that received Spencer technique and kinesio taping in addition to conventional physiotherapy demonstrated a larger improvement in shoulder function as well as a decrease in disability and pain scores compared to conventional physiotherapy alone. Therefore, combine application of Spencer technique and kinesio taping seems to be a more successful therapeutic strategy for enhancing clinical outcomes in individuals with acute frozen shoulder.

CONFLICT OF INTEREST

The authors affirm that they have no potential conflicts of interest exist regarding the research, writing, and publication of this article.

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