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Effectiveness of spencer muscle energy technique on periarthritis shoulder

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Abstract
Background: Periarthritis shoulder is characterized by a painful, gradual loss of active and passive gleno-humeral movement. The Spencer Muscle Energy Technique is unique in its implementation as the client makes the initial effort while being facilitated by the practitioner. The main uses of this technique are to normalize joint range, rather than increase flexibility.
Objective: To evaluate the effectiveness of the Spencer muscle energy technique on Pain, Shoulder ROM and Functional disability in patients with Periarthritis Shoulder.
Materials and Methods: In this study, 30 participants were chosen using a random sampling method based on selection criteria and informed consent was obtained from each participant. Subjects were assigned randomly into two groups. Group A (N=15) was treated with the Spencer muscle energy technique, ultrasound therapy and Codman's pendulum exercise. Group B (N=15) was treated with ultrasound therapy and Codman's pendulum exercise. The initial evaluation of the pain intensity by the numerical pain rating scale (NPRS), the shoulder ROM by the universal goniometer, and the functional disability was scored using the hand behind back (HBB).
Results: Significant improvements observed in patients of Group A and Group B. When comparing the group A and B, NPRS (Z=3.53, P=0.001), shoulder abduction (Z=3.45, P=0.001), shoulder internal rotation (Z=3.45, P=0.001), shoulder external rotation (Z=3.44, P=0.001) and hand behind back (Z=3.53, P=0.001) are significantly increased in group A.
Conclusion: The study result concludes that in patients with periarthritis shoulder, the Spencer muscle energy technique group is effective in decreasing pain, improving ROM, and functional disability.

Keywords: spencer muscle energy technique, periarthritis shoulder, ultrasound therapy, functional disability

1. Introduction

The shoulder is considered to be the most mobile joint in the human body. It is better to call the shoulder complex because it takes a series of articulations to position the humerus in space. The main joints are glenohumeral joint, sternoclavicular joint, acromioclavicular joint and scapulothoracic articulations [1]. The shoulder complex functions in a coordinated way to provide the upper limb with smoothest and widest range of motion. The motion available to the glenohumeral joint alone cannot account for complete elevation (abduction and flexion) available to the humerus. The scapula on the thorax contributes to the rest of the range through its sternoclavicular and acromioclavicular connections [2, 3]

Periarthritis shoulder is a common problem in the shoulder between 40 and 60 years. It is reported to affect 2-5 present of the overall population, increasing to 10-38 % of diabetes and thyroid disease patients. Women are more affected than the men, with the dominant side more involved [4, 5].

It is a condition of unclear etiology characterized by a gradual loss of active and passive movement that happens when there is no other known intrinsic shoulder disorder [6]. This condition is defined by the thickening of the synovial capsule, the contraction of soft tissue and biceps tendon adhesion and/or axillary fold obliteration secondary to adhesion resulting in an insidious and gradual loss of active and passive mobility in the glenohumeral joint owing to joint contracture [7].

Multiple procedures have been defined in the treatment of periarthritis shoulder such as cryotherapy, modalities (SWD, TENS, UST), moist heat, joint mobilization, stretching and strengthening exercises are given to restore function by decreasing inflammation and pain and thus enabling normal shoulder mechanics to be restored.

The Spencer muscle energy technique is a standardized sequence of shoulder treatments with extensive diagnosis, treatment, and prognosis execution. It was developed in 1916 by Spencer, D.O. This technique evolved from 1916 to the present in an attempt to identify factors in the development of manipulative methods [8]. This strategy is a well-known manipulative osteopathic technique focusing on mobilizing of the scapulothoracic and glenohumeral joints. It enables the limited joints, enhances their function, and affects other emotional, social and cognitive regions positively [9].

Spencer muscle energy technique is an articulatory technique used in seven different processes to treat shoulder limitation caused by periarthritis shoulder. In this technique, smooth, passive, rhythmic motion is designed for the stretching of contracted muscles, capsules and ligaments. Most of the force is applied to the movement end range. This technique improves pain-free movement by stretching the soft tissues, improving lymphatic flow and stimulating enhanced joint circulation [10]. So the study intends to evaluate the effect of the Spencer Muscle Energy Technique on periarthritis Shoulder.

2. Materials and methods

The present study was an intervention study conducted at the outpatient Department of Physical Medicine and Rehabilitation, RMMCH, Annamalai University, Tamil Nadu, India, during September, October and November 2018. The study was endorsed by the Departmental Research Committee (PMR/DRC-7/2018). During the specified time period, the sample size was selected using a convenient sampling method. Thirty-seven patients with plantar fasciitis were selected, seven of them were excluded and the study sample was 30 patients. The inclusion criteria for the study were (1) Patients with a primary periarthritis shoulder (2) Duration of the condition from 3 to 14 months (3) One-sided involvement (4) Both male and female (5) Age group from 40 to 60 years (6) Those willing to take five consecutive days of treatment. The main exclusion criteria were (1) Intra articular injection in the affected shoulder for the last 3 months (2) Any prior surgery on the affected shoulder.

2.1 Study Procedure

Based on the selection criteria, the subjects were chosen. The purpose of the study was explained to the subjects and an informed consent was given in their known language. Demographic data were collected. Subjects were randomly allocated to two groups. Group A (N=15) received ultrasound therapy, Spencer muscle energy technique and Codman's pendulum exercise, whereas Group B (N=15) received ultrasound therapy and Codman's pendulum exercise. Shoulder pain, shoulder ROM and shoulder functional disability measured using NPRS, universal goniometer and HBB score for both the groups. The above evaluation was carried out on the patient first visit before the beginning of treatment and again on the final day of treatment at the end of the 5th day. Pre and post treatment evaluation was compared and statistically analyzed.

2.2 Outcome measures

2.2.1 Numerical Pain Rating Scale (NPRS)

The NPRS was used to measure pain intensity of the subject. The subject sat on a chair and was requested to mark the severity of resting pain from 0 as "no pain" to 10 as "severe pain" on a 10 cm line [11].

2.2.2 Goniometer measurement for Shoulder ROM

2.2.2.1 Shoulder abduction

The patient is in the supine lying position. The axis are taken one inch below the acromion process of the scapula. The movable arm is placed over the midline of the anterior side of the arm and is held in the right hand of the therapist. It is placed on the clavicle horizontally and is held by the therapist left hand. The therapist's right hand performs the shoulder abduction movement with the goniometer and measures the angle to see the passive ROM and the active ROM is measured by the patient himself performing the movement [12].

2.2.2.2 Shoulder internal rotation and external rotation

Patient in supine lying with shoulder and elbow 90º position. The olecranon process of the ulna is taken as the axis. The movable arm is placed over the midline of the posterior aspect of the forearm and is held in the therapist's left hand. The stable arm is placed straight line of the moving arm, kept in the air without the patient's body contact and is held in the therapist's right hand. The therapist's left hand is performing the medial and lateral rotation movement of the shoulder joint with the Goniometer and measuring the angle to see the passive ROM and the active ROM is measured by the patient himself performing the movement [12].

2.2.3 Hand behind Back

HBB was determined by asking subjects to reach the middle of their spine with their thumb as a feasible measure. The distance between the T1 spinous process and the radial styloid process will be measured by the tape measure [13].

2.3 Treatment procedure

The treatment procedure was administered five days a week. The frequency was one session a day, three sets of 10 repetitions with one-minute rest between sets. Before mobilization, all participants were received ultrasound treatment (8 minutes) and were advised to perform the Codman's pendulum exercise as a home program.

2.3.1 Spencer Muscle Energy Technique

Treatment position:

The patient in lateral lying in the shoulder to be handled away from the table. The therapist standing at the side of the table facing the patient at the level of the patient's chest [14].

Techniques

Step 1. Shoulder extension with elbow flexion: The elbow of patients was kept in a flexed position and the arm was extended to the limited barrier (Figure 1).

Step 2. Shoulder flexion with elbow extension: Patients with flexed elbows were extended and moved anteriorly into shoulder flexion until the restricted barrier was reached (Figure 2).

Step 3. Circumduction with compression and elbow flexed: In 90° abduction, grasping the patient's elbow and shoulder, moved the elbow in small clockwise and counter clockwise circles with compressive force (Figure 3).

Step 4. Circumduction with traction and elbow extended: Therapist maintained the traction of the patients with the shoulder joint at 90° of abduction and holding either elbow or wrist induced small clockwise and counter clockwise circles (Figure 4)

Step 5. Shoulder abduction and internal rotation with elbow flexion: The patient was asked to place his hand on the therapists forearm for support and then the therapist carried out the abduction and internal rotation of the patients arm internal rotation (90°) (Figure 5)

Step 6. Internal rotation with arm abducted, hand behind back: The therapist's hands on patient's shoulder to stabilize the clavicle and scapula and move the patient's hand to lumbosacral area. Pull elbow anteriorly to internally rotate the shoulder into the restrictive barrier (Figure 6).

Step 7. Distraction, stretching tissues and enhancing fluid drainage with arm extended: The therapist clamps his fingertips over the deltoid muscle, the patient's hand is placed over the therapist's shoulder, and the therapist slowly shifts his arm away from the shoulder and releases it, repeating it 5–10 times if necessary (Figure 7).

3. Results

The outcome measures used were NPRS, shoulder ROM such as abduction, internal rotation and external rotation and

HBB. As the NPRS was a discrete variable, a non-parametric test such as the Wilcoxon signed rank test (Before and after treatment) and the Mann Whitney'U' test (Between group comparison) was selected. The other outcome variables are studied by parametric tests such as Paired sample't' test (Before and After treatment) and Independent sample 't' test (Between group comparison). The entire statistical procedure is carried out by statistical package of social sciences (SPSS -21).

There was a significant difference in NPRS after treatment in both groups. The degree of improvement in group A was significantly higher than in group B (2.70±1.06), Therefore group A was significantly better than group B in reducing pain of the PA shoulder (Table 1).

Significant improvements in shoulder abduction, internal rotation, and external rotation of the ROM were observed following treatment in both groups. The improvement in comparison group A was significantly higher than in group B. The mean difference was 25.17±13.09. The mean difference in the improvement of the internal rotation of the shoulder was 16.33±6.69 and the external rotation was 17.33±7.96 (Table 2).

After treatment, the HBB measurement was significantly reduced in both groups. The magnitude of reduction in measurement was higher in group A (Mean =3.07±0.59) than in group B (Mean=1.33±0.62). Between group comparison, it shows that the decrease of the HBB measures was significantly different (Z=4.49, P=0.001). Consequently, in group A, improvement in the HBB was significantly higher than in group B (Table 3).

There was a significant difference in the magnitude of improvement between the two groups in all of the outcome measures. The mean difference in NPRS was 2.70±1.06. The mean difference in abduction ROM was 25.17±13.09, the mean difference in internal rotation was 16.33±6.69, and the mean difference in external rotation was 17.33±7.96. The mean difference in HBB was 2.20±1.06. The improvement was significantly higher in group A (Table 4).

4. Discussion

Spencer's technique is designed to reduce pain by changing the circulatory pain biomarkers and improves the pain free range of motion by stretching the shoulder capsule and tight soft tissues, thus restoring specific joint movement. The result of this study is that, in accordance with the previous study by Contractor ES *et al*. [15], the Spencer technique reduces pain, the possible mechanism includes neurological and tissue variables such as stimulation of low-threshold mechanoreceptors on central pain inhibitory systems and neuronal populations with possible gating effects in the dorsal horn. Low threshold mechanoreceptors from the joints and muscles project in the mid brain region to the periaqueductal gray. During isometric contraction, muscle and joint mechanoreceptors are activated. This results in sympathetic excitation evoked by the somatic efferent and localized activation of periaqueductal gray (PAG), which plays a part in the descending modulation of pain. Nociceptive inhibition take place in the dorsal horn of the spinal cord, as nociceptive impulses in the dorsal horn are caused by the stimulation of the mechanoreceptor [16].

As a result, the reduction in HBB (Improvement) is significantly higher in group A. In Spencer muscle energy technique, passive rhythmic movement restores arthrokinematic gliding and rolls, restoring mobility of the shoulder. Biomechanically, the coracohumeral ligament is believed to limit external rotation of the ROM. Other potential factors limiting external rotation being the rotator interval and the superior glenohumeral ligament, which is more resistant to external rotation ROM. Shoulder abduction, is restricted by inferior capsule. The pattern of loss of internal rotation is consistent with the capsular tension in the posterior band of the inferior glenohumeral ligament complex, which restricts the internal rotation ROM.

The chronic periarthritis shoulder is characterized by an adherent axillary recess, coracohumeral thickness, adhesion in the rotator intervals and contracted soft tissues which may lead to kinematic alteration of the scapulohumeral and scapulothoracic joints, resulting in restricted in capsular pattern, i.e. more restricted external rotation and abduction, and less limited internal rotation and flexion and increased lateral rotation of the scapula. The effects of joint mobilization include alleviation of capsular constraints and rupture of adhesions, distraction of affected tissue and normal articular cartilage motion and lubrication. The results of this study are consistent with the previous study of Grieve GP [17].

Khyathi P, *et al* [18], says Spencer's technique of stretching the shoulder capsule and tight soft tissues improves pain-free ROM, restoring specific joint movement. When used, this technique improves the lymphatic flow from the treatment area. The joint recovers its normal ROM and with this technique resets neural reflex. This technique assists the limited joints, and favorably affect other emotional, social and cognitive regions. Passive repetitive movement, traction or gliding of the translator improves the nutrition, circulation and lubrication of the joints. It reverses negative changes in the joint, and normalizes arthrokinematic gliding and rolling movements. Increased gliding will normalize the osteokinematic rotation and allow the mobility of the shoulder to be restored.

4.1 Limitations and Recommendations

- Sample size is limited. In order to further validate these innovative therapeutic techniques for PA shoulder, an increase in the number of participants may be required.
- Short duration study (1 week) may increase duration of the study.
- It is suggested that the patient should be followed up periodically in the future to find out if the improvement is being maintained or changed for good or bad.

Table 1: Shows Group Comparison of NPRS

NPRS	Group A				Group B			
	Mean	S. D	2 Related Sample		Mean	S. D	2 Related Sample	
			Z	P			Z	P
Pre	7.66	1.12	3.53	0.001	7.13	1.06	3.63	0.001
Post	4.00	0.92			5.33	0.82		

Table 2: Shows Group Comparison of ROM

Shoulder Movement (ROM)		Group A				Group B			
		Mean	S. D	2 Related Sample		Mean	S. D	2 Related Sample	
				Z	P			Z	P
Abduction	Pre	77.67	28.21	3.45	0.001	88.33	6.98	3.46	0.001
	Post	114.33	23.51			102.6.76	6.76		
Internal Rotation	Pre	37.67	8.42	3.45	0.001	50.67	10.15	3.63	0.001
	Post	59.33	8.63			61.67	9.94		
External Rotation	Pre	34.00	7.37	3.44	0.001	42.00	14.12	3.26	0.001
	Post	57.67	8.21			51.67	13.68		

Table 3: Shows Group Comparison of HBB

HBB	Group A				Group B			
	Mean	S. D	2 Related Sample		Mean	S. D	2 Related Sample	
			Z	P			Z	P
Pre	21.67	2.53	3.53	0.001	21.73	2.05	3.58	0.001
Post	18.60	2.16			20.47	2.19		
Mean Difference	Mean=3.07		S. D=0.59		Mean=1.33		S. D=0.62	

Table 4: Pre and Post Difference between Group Comparisons

Variables	Mean Difference	S. D	Independent Sample	
			Z	P
NPRS	2.70	1.06	4.71	0.001
Abduction	25.17	13.09	4.74	0.001
Internal Rotation	16.33	6.69	4.68	0.001
External Rotation	17.33	7.96	4.66	0.001
HBB	2.20	1.06	4.49	0.001

Fig 1: Shoulder extension

Fig 2: Shoulder flexion with elbow extension

Fig 3: Circumduction with compression

Fig 4: Circumduction with traction

Fig 5: Shoulder abduction and internal rotation

Fig 6: Internal rotation

Fig 7: Distraction, Toint Pump

6. Conclusion

The study result concludes that in patients with periarthritis shoulder, the Spencer muscle energy technique group is effective in decreasing pain, improving ROM, and functional disability. However, the patients who received the Spencer muscle energy technique showed better improvement than the control group.

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8. Conflicts of Interest: There are no conflicts of interest.

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