

## Comparison of Spencer muscle energy technique and Passive stretching in adhesive capsulitis: A single blind randomized control trial

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### Abstract

**Objective:** To compare the effects of Spencer muscle energy technique and passive stretching in adhesive capsulitis.

**Method:** The single-blind randomised control trial was conducted at the District Headquarter Hospital and Fatima Hospital, Sargodha, Pakistan, from February to May 2018, and comprised patients of either gender aged 30-55 years with idiopathic frozen shoulder stage 1 and 2 or stiff painful shoulder joint for at least 3 months. They were randomised into two equal groups using the sealed envelope method. Group 1 was exposed to muscle energy technique, while group 2 was exposed to passive stretching. Pain, shoulder range of motion and function were assessed by numeric pain rating scale, goniometer, shoulder pain and disability index and the quick version of the disabilities of the arm, shoulder and hand questionnaire. Measurements were taken at baseline, 2nd and 4th week. Data was analysed using SPSS 20.

**Results:** Of the 60 patients, there were 30(50%) in each of the two groups. There were 39(65%) females and 21(35%) males with an overall mean age of 45.84±5.88 years. All parameters significantly improved in group 1 compared to group 2 t post-intervention (p<0.001).

**Conclusion:** Spencer technique was found to be more effective than passive stretching in treating patients with adhesive capsulitis.

**Keywords:** Adhesive capsulitis, Frozen shoulder, Osteopathic manipulative treatment, Spencer technique, Passive stretching, Muscle energy technique. (JPMA 70: 2113; 2020)

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### Introduction

Adhesive capsulitis (AC) was first described as Periartthritis scapulohumerale in 1872 and subsequently as Frozen shoulder in 1934.<sup>1,2</sup> It is a common musculoskeletal disorder characterised by progressive and painful shoulder joint restriction in capsular pattern.<sup>3</sup> In the general population, the incidence of AC is 2-5%, more in females, those aged 40-65 years and those suffering from diabetes mellitus (DM).<sup>4</sup> In Pakistan, its precise prevalence is unknown, but, in general, it ranges 2-5%.<sup>5</sup> It is categorized into primary or idiopathic and secondary due to intrinsic or extrinsic causes.<sup>6,7</sup> AC is further classified into 4 stages: pre-adhesive stage 1 with deltoid insertion and night pain; acute adhesive stage 2 with persistent night pain and stiffness; maturation stage 3; and chronic stage 4 with minimal pain and improved joint range.<sup>8-13</sup>

Multiple physiotherapeutic interventions have been used to manage pain, restricted mobility and to improve patient functionality in AC in both long and short terms.<sup>14-16</sup> These comprise various physical therapy (PT) modalities and

therapeutic exercises.<sup>17-19</sup> Literature cites AC as best managed by PT techniques, such as joint mobilisation, glides, and active and passive stretching (PS) exercises.<sup>20</sup> PS exercises are intermittent, or cyclic, short duration exercises performed by physical therapists. In this technique, stretch force is gently and repeatedly applied, maintained, released and then re-applied. These are performed in each direction of the joint, i.e. flexion, scapular plane abduction, internal and external rotations.<sup>21</sup> Like other physiotherapeutic manoeuvres, it produces mechanical effects by realigning collagen, improves joint pain by stimulating mechanoreceptors, and improves patient functions.<sup>22</sup> Studies have reported addition of PS exercises as an effective modality.<sup>21,23</sup>

Spencer technique, also known as the seven stages of the Spencer, is an osteopathic manipulative treatment (OMT) developed in 1915.<sup>24,25</sup> It is a standardised series of treatments with broad application to diagnose, treat and establish prognosis for shoulder pain due to restricted mobility.<sup>24,26</sup> It is a well-known multistep technique that combines Spencer's positioning, sequencing, slow stretching of the shoulder complex within pain-free limits done by physical therapist while incorporating muscular energy with post-isometric contraction and relaxation.<sup>27-30</sup> It serves to enhance mobility of glenohumeral and scapulothoracic joints by soft tissue stretching and fluid

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mobilisation.<sup>31</sup> It is sequenced to improve shoulder complex mobility by first treating most pain-free followed by most restricted motions. Spenser muscle energy technique (SMET) attempts to re-establish functional relationship between soft and articular tissues of the shoulder region, minimises inflammatory and later developing fibrotic process,<sup>32</sup> and restores arterial, venous and lymphatic flow.<sup>13</sup> Like other OMT procedures, it not only restores joint functions, but enhances positive well-being and full expression of a patient's life.<sup>28</sup>

Numerous PT techniques have been found to be beneficial but there is no consensus on the best treatment approach for speeding up rehabilitation process and rejuvenating functional capacity in patients. The effects of OMT on AC has generally not been explored in literature. The current study was planned to compare the effects of SMET and PS on pain, range of motion (ROM) and disability in AC.

## Patients and Methods

The single-blind randomised control trial was conducted at the District Headquarter (DHQ) Hospital and Fatima Hospital, Sargodha, Pakistan, from February to May 2018. After approval from the ethics review committee of Riphah College of Rehabilitation Sciences, Riphah International University, Islamabad, the sample size was calculated using OpenEpi version 3 with 95% confidence interval (CI) and power 80% in line with literature.<sup>33,34</sup> Informed written consent was taken from the patients for being part of study. The sample was raised using non-probability purposive sampling from among patients of either gender aged 30-55 years with idiopathic frozen shoulder stages 1 and 2 or stiff painful shoulder joint for at least 3 months. Those excluded were patients with rotator cuff tears, rheumatoid and gouty arthritis, tumours of the shoulder region, reflex sympathetic dystrophy of the shoulder, thoracic outlet syndrome, peripheral nerve injuries, shoulder girdle fractures, dislocations and those who were not taking any pain medication.

The subjects were randomly allocated into two equal groups using the sealed envelope method. Group 1 was exposed to SMET, and group 2 was exposed to PS. Shoulder pain was assessed with numeric pain rating scale (NPRS) which consists of 11 items ranges from 0 (no pain) to 10 (worst pain).<sup>35</sup> Shoulder ROM (SROM) was measured using a standardised manual goniometer, which is a reliable instrument for the testing of shoulder joint movements in degrees.<sup>36,37</sup>

The quick version of the disabilities of the arm, shoulder and hand (DASH) questionnaire (Quick-DASH) was used for functional assessment of upper extremity conditions. It is a modified version of DASH and is a reliable (Cronbach  $\alpha=0.92-0.95$ ) and valid self-assessment tool.<sup>38</sup> It calculates

the percentage of shoulder disability, from 0% (best) to 100% (worst), with the help of 11 questions that are ranked on a Likert scale of 0-5. Different studies have reported various cut-off scores to interpret symptoms severity.<sup>39,40</sup>

The shoulder pain and disability index (SPADI) is also a reliable and valid clinimetric (Cronbach- $\alpha>0.90$ ), self-administered questionnaire used by orthopaedics and physical therapists for proper assessment of shoulder-related pain and disabilities in terms of functional outcomes in patients suffering from different types of the shoulder-related pathologies. It consists of 13 items with two domains; a subscale (5-item) that measures pain, and another subscale (8-item) that assesses disability. Each subscale is added and transformed into a score that ranges from 0 (less shoulder disability) to 100 (more shoulder dysfunction).<sup>41,42</sup>

Group 1 patients were initially given a control treatment of heating pack for 7-10 minutes and later the glenohumeral joint was mobilised using SMET. The patient was positioned lying on the side with the affected shoulder above. The therapist stabilised the shoulder girdle with the proximal hand and the distal hand provided force into the restrictive barrier of shoulder in 7 different movements. These were shoulder extension (SE), circumduction with compression, shoulder flexion (SF), circumduction with distraction, abduction, adduction with internal rotation and glenohumeral pump. During all the movements, patients were asked to use their muscle energy against the slight resistance offered by the therapist for 3-5 second. The exercise was repeated 3-5 times with rest intervals over 3 sessions per week on alternate days for 4 weeks.<sup>14,28</sup>

Group 2 patients were also treated with hot pack for 7-10min before being exposed to specific PS exercises. The shoulder was stretched in flexion, Internal and external rotations and scapular plane abduction for 20 sec with 10sec rest, and repeated 10 times over 3 sessions per week on alternate days to avoid post-exercise tissue soreness.<sup>22</sup> The assessment was done at the baseline, after 2 weeks and post-treatment i.e. 4th week. The study was done according to the Consolidated Standards for Reporting of Trials (CONSORT) statement.<sup>43</sup> (Figure)

Data was analysed using SPSS 20. After checking normality of data variables using Shapiro Wilk test ( $p<0.05$ ), non-parametric Mann-Whitney U test was applied for inter-group analysis, while Friedman test was used for intra-group comparison.  $P<0.05$  was considered statistically significant at 95% confidence interval (CI).

## Results

Of the 97 patients screened, 60 were included; 30(50%) in

**Table-1:** Inter-group analysis of shoulder pain and disability.

Variables	Time Periods	Groups	Mean Rank	Med (IQ)	P value
NPRS	Pre-test	GSp	28.53	5(2)	0.36
		GPS	32.47	5(2)	
	2nd week	GSp	23.83	2(1)	0.002**
		GPS	37.17	3(2)	
	Post-test	GSp	19.90	0(1)	0.000***
		GPS	41.10	2(1)	
QuickDASH	Pre-test	GSp	30.03	47(32)	0.836
		GPS	30.97	54(25)	
	2nd week	GSp	23.60	32(30)	0.002**
		GPS	37.40	47(24)	
	Post-test	GSp	19.87	20(17)	0.000***
		GPS	41.13	40(22)	
SPADI	Pre-test	GSp	32.77	50(16)	0.314
		GPS	23.27	62(33)	
	2nd week	GSp	37.73	32(14)	0.001**
		GPS	20.97	51(31)	
	Post-test	GSp	40.03	20(7)	0.000***
		GPS	28.53	43(33.25)	

GSp: Spenser Technique, GPS: Passive Stretching,  $p < .05 = *$ ,  $p < .01 = **$ ,  $p < .001 = ***$

NPRS: Numeric pain rating scale, SPADI: Shoulder pain and disability index; DASH: Disabilities of the arm, shoulder and hand.

**Table-2:** Inter-group analysis of shoulder range of movements.

Variables	Time Periods	Groups	Mean Rank	Med (IQ)	P value
Extension	Pre-test	GSp	31.33	40(17)	0.71
		GPS	26.67	40(9)	
	2nd week	GSp	35.37	52(10)	0.02*
		GPS	25.23	47(10)	
	Post-test	GSp	39.90	60(4)	0.000***
		GPS	21.10	53(5)	
Flexion	Pre-test	GSp	27.83	110(35)	0.236
		GPS	33.17	108(29)	
	2nd week	GSp	37.53	139(25)	0.002**
		GPS	23.47	127(22)	
	Post-test	GSp	44.80	171(13)	0.000***
		GPS	16.20	137(13)	
Abduction	Pre-test	GSp	26.30	100(29)	0.062*
		GPS	34.70	116(16)	
	2nd week	GSp	35.90	139(22)	0.016
		GPS	25.10	131(19)	
	Post-test	GSp	43.20	170(10)	0.000***
		GPS	17.80	148(8)	
Internal Rotation	Pre-test	GSp	32.47	25(17)	0.381
		GPS	28.53	26(14)	
	2nd week	GSp	35.90	42(24)	0.016*
		GPS	25.10	32(16)	
	Post-test	GSp	41.83	64(11)	0.000***
		GPS	19.17	44(9)	
External Rotation	Pre-test	GSp	31.00	20(18)	0.823
		GPS	30.00	23(10)	
	2nd week	GSp	38.47	45(14)	0.000***
		GPS	22.53	33(11)	
	Post-test	GSp	44.57	78(5)	0.000***
		GPS	16.43	47(9.75)	

GSp: Spenser Technique, GPS: Passive Stretching,  $p < .05 = *$ ,  $p < .01 = **$ ,  $p < .001 = ***$

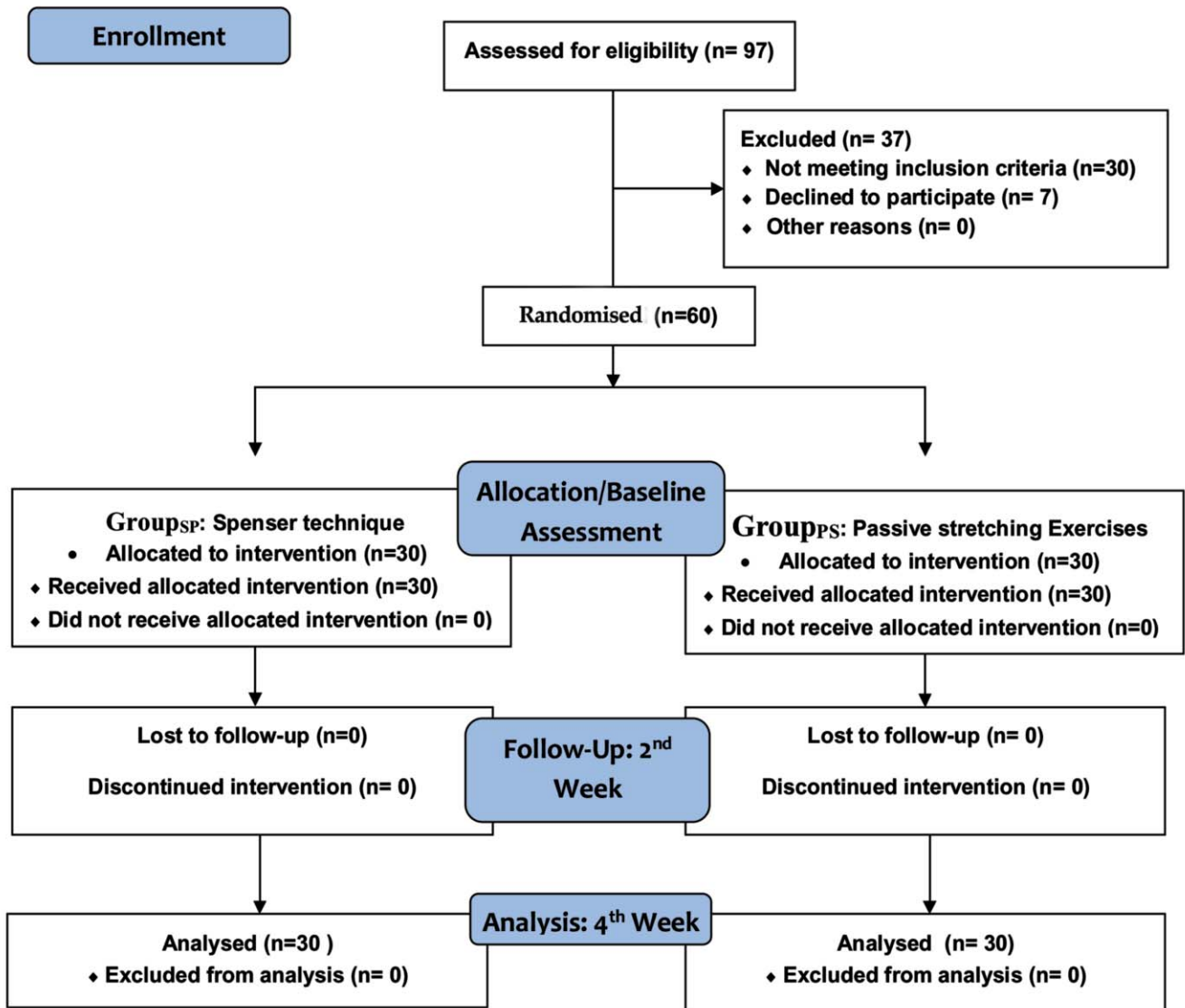


Figure: Consolidated Standards for Reporting of Trials (CONSORT) Diagram.

each of the two groups. There were 39(65%) females and 21(35%) males with an overall mean age of 45.84±5.88 years. The mean age in group 1 was 45.06±6.46 years and it was 46.63±5.22 years in group 2. The difference between the groups in terms of pain and disability markers was non-significant (p>0.05) at baseline, but there was significant difference at midway and post-intervention assessments (p<0.05) (Table-1), and the same was the case with SROM (Table-2).

**Discussion**

Understanding the mechanism of AC, which is a self-limiting yet disabling musculoskeletal disorder, improves chances of benefitting from PT interventions without any

complications.<sup>6,44</sup> It is essential to guide physical therapists about the most effective conservative management technique options amongst many. The current study compared SMET and shoulder PS.

Findings suggest SMET is more effective than PS for decreasing shoulder pain, disability and for improving SROM. Literature supports the observation that SMET improves pain (p<0.001) by altering circulatory biomarkers of pain, and also restores pain-free joint motion by stretching the shoulder capsule and soft tissues.<sup>28</sup> Incorporation of isometric muscle contraction along with mobilisation of shoulder complex stimulates muscle and joint mechanoreceptors that closes pain gate

at the level of dorsal horn of the spinal cord, and stimulates descending modulation of pain by periaqueductal gray (PAG) of midbrain.<sup>45,46</sup> The results of the current study are similar to a study which reported decrease in NPRS score ( $p < 0.001$ ) in SMET group compared to the conventional deep heating and PS exercises.<sup>31</sup> Another study reported no significant effect ( $p > .05$ ) of PS exercises in comparison with joint mobilisation technique in AC shoulder pain.<sup>22</sup>

Constellation of various signs and symptoms in AC include progressive and painful restriction of glenohumeral joint ROM in its capsular pattern i.e. abduction, external rotation, flexion and internal rotation. Decrease in ROM is the key impairment which minimises active participation of AC patients.<sup>44</sup> SROM improved significantly in the current study both at midway and post-intervention assessments, indicating more improvement in the SMET group. These findings are congruent with earlier evidence.<sup>28</sup> This can be linked back to stimulation of Golgi tendon organs while isometrically contracting shoulder muscle with equal counterforce, and further inducing post-isometric relaxation and improved joint ROM.<sup>31</sup>

Function is considered one of the essential outcome measures for any treatment approach. The current study found significant difference in QuickDASH and SPADI scores between the groups. Similar results were reported earlier.<sup>31</sup> Previous studies on SMET effectiveness did not measure the upper limb performance by using QuickDASH. As such, the current study's findings for this outcome measure was not comparable in literature. Several studies have been conducted in which SPADI was assessed for measuring the level of disability.<sup>47-49</sup>

### Limitation

The current RCT was not registered with the relevant registry due to the unavailability of trial registry in the country and the institution at the time.

The study is one of its kind to compare two manual therapeutic techniques using long axis movement and stimulating joint mechanoreceptors. The greater reported effects of SMET can be linked to utilisation of active muscle energy. This fact needs further exploration in future studies. Also, the current study had a short duration, and long-term RCTs using large sample sizes at multiple centres with equal distribution along gender lines and by including age-based sub-group and longer-follow-ups are recommended. Severity and stages of AC also need to be equally considered in future studies to compare the effects of these techniques in chronic AC as well.

### Conclusion

Spencer's joint mobility and muscle energy technique was found to be more effective than passive stretching exercises to reduce pain, and to improve joint ROM and functionality in AC.

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**Conflict of Interest:** None.

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