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ORIGINAL ARTICLE

Additional effects of Thoracic manipulation on pain, shoulder disability and range of motion in patients with Adhesive Capsulitis

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ABSTRACT

Aim: To determine the additional effects of thoracic manipulation on shoulder pain, shoulder range of motion (ROM) and disability in combination with conventional physical therapy exercises for individuals with adhesive capsulitis.

Materials: A parallel, randomized controlled clinical trial was conducted. 32 patients (16 in each group), aged between 40-60 years from both genders having shoulder pain, clinically diagnosed with adhesive capsulitis (Stage II and III), along with thoracic spine hypo mobility were included. Patients were randomized into conventional physiotherapy group (A) and thoracic manipulation group (B). Clinical trial was continued for two weeks with three sessions per week and a follow up was done at the end of 3rd week. Visual analogue scale (VAS), shoulder range of motion (ROM) and Disabilities of Arm Shoulder and Hand (DASH) score were used for outcomes measurement.

Results: Intragroup comparison for shoulder ROM, DASH and VAS scores shows a significant (p value=≤0.001) for both groups. Intergroup comparison for shoulder ROM was improved significantly on post-intervention (p value=≤0.001). While intergroup comparison of baseline to end value for VAS showed insignificant result (p value=0.373).

Conclusion: Additional effects of thoracic manipulation to conventional physical therapy underwent a greater improvement regarding shoulder range of motions and disability. Conventional physical therapy exercises and a combination of thoracic manipulation to conventional physical therapy exercises are equally effective for decreasing shoulder pain.

Keywords: Adhesive Capsulitis, Pain, Frozen shoulder, Physical Therapy, Rehabilitation

INTRODUCTION

Adhesive capsulitis or frozen shoulder is a widespread musculoskeletal disorder that causes significant disability. Gradual onset of pain, inflexibility and restricted ranges are common symptoms[1]. The pathophysiology of the frozen shoulder is not yet exactly known. However, it is generally supposed that a combination of contracture of capsule, rotator cuff tendon fibrosis often leads to comprehensive movement restriction at the glenohumeral joint[2]. It is more common in women than a man between the ages of 40 and 60. Bilateral frozen shoulder occurs in 14% of the population and up to 20% of the population will develop some degree of related symptoms in the other shoulder. Adhesive capsulitis often evolves through three stages, freezing stage which is a painful stage, which lasts for 2-9 months with diffuse severe pain while frozen stage lasts for 12 months, in which pain gradually reduces with time along with loss of flexion, abduction, external and internal rotation[3], the third stage is thawing stage or recovery stage in which patient experience gradual return of ranges of motion at the shoulder joint[4].

The management of Adhesive capsulitis usually focus on pain relief and prevent disability by using conservative management including intra-articular steroid injection, NSAIDS, heat therapy, electrotherapy while functional restoration of the shoulder joint is achieved by various manual therapy soft tissues techniques including mobilization technique, manipulation techniques and therapeutic exercises. It has been observed that stretching exercises have beneficial effects on Adhesive capsulitis. The stretching exercises can increase flexibility, range of motion, and mobility by decreasing pain and discomfort[5-8].

Thoracic spinal manipulation can be effective for treating patients with shoulder dysfunctions or pain. Treatment protocols focusing on the thoracic spine must be added to the intervention of rehabilitation of patients with shoulder pain[9]. In common clinical practice, a series of thoracic hypo-mobility has been noticed at the T1-T3 or the T3-T5 segments in patients with glenohumeral pathologies[10]. Study revealed that thoracic and rib manipulation are effective in relieving pain and increasing the range of motions along with reducing disability in different shoulder pathologies[2]. In literature thoracic spine manipulation has been shown to produce improvement in upper extremity blood flow. Literature related to thoracic spine management is signifying an association between thoracic spine manipulation regarding shoulder functional capabilities[11]. The objective of the study was to determine the additional effects of thoracic manipulation on shoulder pain, shoulder ROM and disability in combination with conventional physical therapy exercises for individuals with adhesive capsulitis.

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MATERIALS AND METHODS

Study Design and Participants: A randomized, clinical trial was conducted at the Rehabilitation department of HHIRS, Mansehra. Participants were recruited between March 2020 to August 2020.Participants aged between 40-60 years including both genders having unilateral or bilateral shoulder pain, clinically diagnosed with adhesive capsulitis (Stage II and III)[12], along with thoracic spine hypomobility were included in this study[13,14]. The subjects had a recent history of shoulder complex trauma/ fracture, were diagnosed with thoracic outlet syndrome, myelopathy and cervical radiculopathy[7,15] were excluded.

Randomization: The subjects were randomly divided into control group-A (n= 16) and Experimental Group-B (n=16) by using the non-probability purposive sampling technique. Three sessions per week were given and measurement was performed at baseline, 2nd assessment on 6th visit and 3rd assessment on follow-up at 3rd week by using a semi-structured questionnaire (Figure 1).

Intervention:

Control Group A, received conventional physical therapy exercises including hot pack for 5-8 mins[16], TENS for 10 mins , and stretches of the posterior capsule, serratus anterior, pectoralis major and pectoralis minor muscles. The duration of each stretch was 15 seconds and 5 repetitions were done. Pectoralis stretch was done in supine while serratus anterior and posterior capsular stretching was done in side-lying[17,18]. Furthermore, subscapularis and infraspinatus facilitation was also done in a supine position, during subscapularis facilitation passive internal rotation was done,

while during infraspinatus facilitation passive external rotation was performed[19].

In interventional Group-B, subjects received conventional physical therapy exercises (hot pack, TENS, stretches of the posterior capsule, serratus anterior, pectoralis major and pectoralis minor muscles along with subscapularis and infraspinatus facilitation). They also received five attempts of thoracic manipulation in each session.

Outcomes measurements: Visual analogue scale (VAS) for pain, Bubble Inclinometer for shoulder range of motion (ROM) and DASH scale (Disabilities of the Arm, Shoulder and Hand) for the upper limb disability were used. Self-reported, unidirectional, visual analogue scale (VAS) is a reliable and valid scale that is used to measure an attitude or characteristic of pain.[20] The universal Bubble inclinometer has a known validity and reliability to measure spinal and joint movements[21]. Self-reported DASH scale having 30-items, to evaluate the functional disability of shoulder joint[22].

Statistical analysis: IBM SPSS 22 was used for analysis. Normality test (Shapiro-Wilk) was used to measure data distribution and appropriate parametric and non-parametric tests to measure changes within and between interventional groups.

RESULTS

Disability: A repeated measures ANOVA with a Greenhouse-Geisser correction determined the statistically significant difference for DASH scores (F=110.9, p value=≤0.001) for group A and (F=188.4, p value=≤0.001) for group B. Post hoc test for pairwise analysis of Dash score for group (A) showed a significant difference between baseline and second week (p value=≤0.001).Experimental group also showed a marked difference between baseline and second week (p value=≤0.001) while there was an insignificant difference in 3rd week (Table 1).

Pain intensity and Shoulder Range of motion: Friedman test showed within group analysis of different non-parametric variables. The overall changes in variables of VAS and ROM for Group A and B showed significant difference with (p-value =≤0.001) (Table 2). Pairwise comparison of VAS, internal rotation, external rotation, flexion and abduction determined by Wilcoxon Rank pair test. External rotation between 2nd- third week was non-significant (p-value ≥0.05). Internal rotation between 2nd- third week was non-significant (p-value ≥0.05). For group A & group B the flexion between 2nd- third week was non-significant (p-value ≥0.05). Abduction between 2nd- third week was non-significant at (p-value ≥0.05). For group B the VAS score between 2nd- third week was (p-value 0.083). The rest of the variables for Group A and B show significant difference at baseline to third week (p-value ≥0.05) (Table 3).

Thoracic manipulation and conventional physical therapy exercises control disability, pain intensity and range of motion: Independent T-test was used for DASH scores to evaluate intergroup comparison between baseline to end value. There was an insignificant difference on post-intervention (p value=0.985) for both groups. Intragroup analysis was done by Wilcoxon signed-rank test was applied for baseline assessment to 3 weeks follow-up assessment for VAS and shoulder ROMs. Statistically non-significant (p value=0.373) was observed for VAS scores. While all shoulder ROMs were significantly improved at post-intervention (p value= ≤0.001) (Table 4).

Table 1: Repeated Measures ANOVA (Parametric Test-within group analysis) for DASH score and Post hoc test for pairwise analysis

Variables		Mean±SD	Mean difference	P-value	F- value	Post-hoc (p-value)
DASH Group A	**Baseline**					
	At 1st week	54.88± 9.06	26.12	≤0.001***	110.9	<0.001[a]
	At 2nd week	28.75± 3.66				<0.001[b]
	At 3rd week	26.25±4.40	28.63			0.015[c]
DASH Group B	**Baseline**					
	At 1st week	51.63±9.45	28.63	≤0.001***	188.4	<0.001[d]
	At 2nd week	23.0±3.14				<0.001[e]
	At 3rd week	23.06±2.89	28.56			1.00[f]

DASH, Disabilities of the Arm, Shoulder and Hand,***P≤0.001, significant difference.

Table 1: Friedman Test (Non-Parametric-within group analysis) for Group A and B

Variables	Group	Baseline	2nd week	3rd week	P-value
		Median (IQR)			
VAS	A	6 (1)	4.5 (3)	3 (0)	≤0.001***
	B	8 (4)	3 (3)	3 (2.25)	≤0.001***
External rotation ROM	A	39.5 (5)	67.5 (9)	67.5 (9)	≤0.001***
	B	39.5 (7)	83.0 (5)	83.0 (5)	≤0.001***
Internal rotation ROM	A	37.5 (15)	54 (4)	54 (4)	≤0.001***
	B	28 (4)	61.5 (3)	61.5 (3)	≤0.001***
Flexion ROM	A	111.5(19.5)	160(5.75)	160(5.75)	≤0.001***
	B	110 (10.5)	169.50 (4)	169.50 (4)	≤0.001***
Abduction ROM	A	92.0 (10)	154 (19.5)	154 (19.5)	≤0.001***
	B	97 (6.5)	169 (5)	169 (5)	≤0.001***

VAS, Visual Analog Scale,

Table 2: Wilcoxon Signed Rank test for pairwise comparison of Group A and B
VAS, Visual Analog Scale, ***P≤0.001, significant difference

Variables		Median (IQR)	P-value	Median (IQR)	P-value
		Group A		Group B	
VAS	Baseline-	6 (1)	0.002***	6 (1)	0.001***
	At 2nd week	4.5 (3)		4.5 (3)	
	At 2nd week-	4.5 (3)	0.014	4.5 (3)	0.083
	At 3rd week	3 (0)		3 (0)	
	Baseline –	6 (1)	≤0.001***	6 (1)	0.001***
	3rd week	3 (0)		3 (0)	
External Rotation ROM	Baseline at 1st week-	39.5 (5)	≤0.001***	39.5 (5)	≤0.001***
	At 2nd week	67.5 (9)		67.5 (9)	
	At 2nd week –	67.5 (9)	1	67.5 (9)	1
	At 3rd week	67.5 (9)		67.5 (9)	
	Baseline At 1st week-	39.5 (5)	≤0.001***	39.5 (5)	≤0.001***

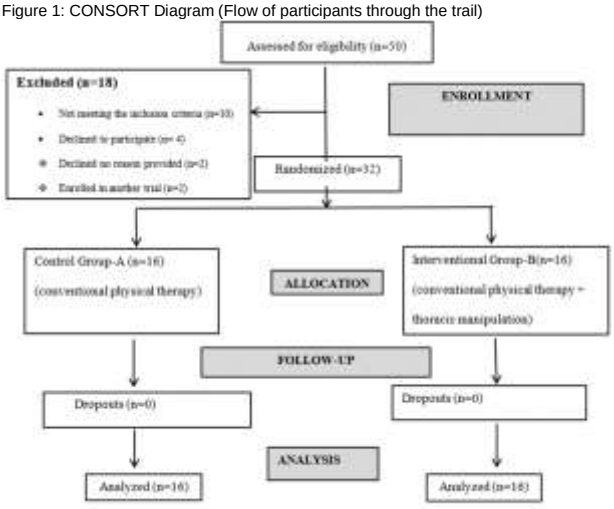
	At 3rd week	67.5 (9)		67.5 (9)	
Internal Rotation ROM	Baseline At 1st week At 2nd week	37.5 (15) 54 (4)	≤0.001***	37.5 (15) 54 (4)	≤0.001***
	At 2nd week – At 3rd week	54 (4) 54 (4)	1	54 (4) 54 (4)	0.317
	At baseline- At 3rd week	37.5 (15) 54 (4)	≤0.001***	37.5 (15) 54 (4)	≤0.001***
Flexion ROM	Baseline At 1st week- At 2nd week	111.5(19.5) 160(5.75)	≤0.001***	111.5(19.5) 160(5.75)	≤0.001***
	At 2nd week- At 3rd week	160(5.75) 160(5.75)	1	160(5.75) 160(5.75)	1
	Baseline At 1st week- At 3rd week	111.5(19.5) 160(5.75)	≤0.001***	111.5(19.5) 160(5.75)	≤0.001***
Abduction ROM	Baseline At 1st week- At 2nd week	92.0 (10) 154 (19.5)	≤0.001***	160(5.75) 154 (19.5)	≤0.001***
	At 2nd week – At 3rd week	154 (19.5) 154 (19.5)	1	154 (19.5) 154 (19.5)	1
	At baseline- At 3rd week	92.0 (10) 154 (19.5)	≤0.001***	160(5.75) 154 (19.5)	≤0.001***

Table 3 : Intergroup comparison of baseline to end value for DASH scores, VAS scores and shoulder ROMs.

Variable	GROUPS#	Mean±SD	Mean difference	p-value
DASH	Group A	28.63±10.48	0.0625	0.985
	Group B	28.56±8.34		
		Mean Rank	Median (IQR)	p-value
VAS	Group A	15.50	3 (0)	0.373
	Group B	17.50		
External Rotation ROM	Group A	9.31	75(18.5)	≤0.001***
	Group B	23.69		
Flexion ROM	Group A	9.50	166.0(10.50)	≤0.001***
	Group B	23.50		
Abduction ROM	Group A	9.56	164.5(17.25)	≤0.001***
	Group B	23.44		
Internal rotation ROM	Group A	8.97	58.5(8.25)	≤0.001***
	Group B	24.03		

VAS, Visual Analog Scale; DASH, Disabilities of the Arm, Shoulder and Hand, ***P≤0.001, significant difference

Figure 1: CONSORT Diagram (Flow of participants through the trail)



DISCUSSION

A study held by Alyssa Conte da Silva et al (2018) on thoracic spinal manipulation intended to improve shoulder range of motion and shoulder pain[10]. Outcomes of this study correlated with the findings of our study in which increased shoulder ROM was observed in both groups.

Andrew Hua et al determined the effect of thoracic spine manipulation on adhesive capsulitis. The outcome variable used to assess upper limb musculoskeletal upper limb disorder was the DASH score. The finding of the study demonstrated the improvement in shoulder range of motion by improving patient functional reaching capabilities[23]. This study also reinforces the results of a recent study in terms of improvement in shoulder mobility.

Furthermore, a study conducted by Rida Shabir et al; on adhesive capsulitis to estimate the effectiveness of the combination of different soft tissue techniques along with conventional physical therapy. Additional soft tissue techniques along with conventional physical therapy addressed the improvement in pain scores and functional capabilities of shoulder joint rather than conventional physical therapy alone[24]. While in our study findings revealed the marked improvement in shoulder functional capabilities are also observed in conventional physical therapy exercises group.

Joshua R McCormack in 2012 presented a case report that acknowledged substantial enhancement in shoulder ranges of patients with adhesive capsulitis with the application of thoracic manipulation, similarly our study also showed a significant effect of thoracic manipulation on shoulder range of motions grossly. The case report aided in the emerging evidence that thoracic manipulation can be effective in reducing shoulder pain but it wasn't enough to develop a cause-effect relationship due to documentation of a single case report but the finding of the case report relates to our study[25]. In a systematic review by Minkalis AL et al in which thrust manipulation was categorized as a treatment of choice for nonsurgical shoulder conditions, as Studies consistently reported pain reduction[26]. Similar in our recent clinical trial in which statistical as well as clinically significant change was observed between the groups, so that the pain reduction could be considered as a real improvement. It is recommended that the manipulative therapy should also be compared with other schools of manual therapy for the effective management of adhesive capsulitis.

CONCLUSION

Addition of thoracic manipulation to conventional physical therapy exercises underwent a greater improvement regarding shoulder range of motions and disability. Conventional physical therapy exercises and a combination of thoracic manipulation to conventional physical therapy exercises are equally effective for decreasing shoulder pain.

Conflict of Interest: The authors declared no conflicts of interest.

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