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Original Article

Effectiveness of Functional Electrical Stimulation Versus Spencer Technique in Patients with Adhesive Capsulitis

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ABSTRACT

Objective*: To determine effectiveness of functional electrical stimulation versus spencer approach for relieving pain, stiffness and enhance range of motion and functional capacity among adhesive capsulitis subjects.*

Methods*: Study design was randomized control trial. Ali Fatima hospital Lahore was study setting. Sample size was 32. Study ran from Sep 2023 to May 2024. Both genders from 40 to 60 years having diabetic frozen shoulder and stiff shoulder for at least 3 months were included. Having dislocated shoulder, fracture within past 12 weeks excluded. Ethical considerations were followed throughout study. 2 intervention groups were made: group B undergone spencer technique or group A received functional electrical stimulation. Data was gathered using Goniometer, VAS and shoulder pain and disability index. SPSS version 25 utilized for statistical analysis.*

Results*: Group B (spencer technique group) showed more improvement post-intervention VAS scores and mean difference was 1.222 with p-value .002. SPADI pain scores were with mean difference 6.055 having p-value .006 and ROM were also improved with p value <.001 indicating a significant difference post-intervention but adduction showed no improvement pre and post value.*

Conclusion: *Both spencer technique and functional electrical stimulation hold promise as effective interventions for improving pain ,ROM and shoulder disability but spencer technique showed more significant results as compare to functional electrical stimulation.*

Keywords*: Adhesive capsulitis, Functional Electrical Stimulation ,Frozen shoulder , Spencer Technique*

1. INTRODUCTION

Adhesive capsulitis occasionally referred as "frozen shoulder" is a predominant inflammatory ailment prevalent in the general population. Codman first wrote about frozen shoulder in 1934.Navisear introduced the name adhesive capsulitis later in 1945 and demonstrated the synovial alterations in the glenohumeral joint. It affects 2 to 5% of the overall community.(1)(2)Reports have indicated that the estimated global incidence varies between 0.5% and 10%. Both genders affected .(3, 4) It is estimated people with diabetes mellitus having frequency of adhesive capsulitis is 11% to 30% higher than in non-diabetic individuals (2% to 10%) among Indian. Adhesive capsulitis is 38% common overall in Pakistan affecting 28.07% of men and 45.70% of women. Between 2% and 5% of Americans suffer with adhesive capsulitis. It is predicted that 20% to 30% of those with adhesive capsulitis in one shoulder will also develop it in the other shoulder.(5)Frozen shoulder is also more common in those with diabetes, thyroid conditions, autoimmune diseases , strokes, heart attacks or extended immobilization.

Women are affected more frequently than men and the majority of patients are between the ages of 40 and 65. However younger individuals who do not have any of the aforementioned risk factors may occasionally get frozen shoulder.(6, 7) Impaired range of motion with abduction, internal rotation , forward flexion or external rotation are the main clinical observation of adhesive capsulitis. When a patient has an advanced illness their gait show missed normal arm swing that comes with walking.(8)(9)A high specificity for adhesive capsulitis can be obtained from non contrast magnetic resonance imaging when coracohumeral ligament thickening is detected.(10)(11, 12)In cases with ACS physical therapy historically is primary management often utilized in combination with other alternatives including cryotherapy, analgesic , hot pack or TENS.(13)Despite the fact that there are still variations in physical therapy regimen between clinical settings and published works . During the frozen phase resistive activities, posterior capsular stretching and isometric shoulder external rotation can be implemented.(14)To improve range of motion during the thawing phase exercises that include stretching and strengthening can be done more often in combination with Maitland Grade 3 or 4th mobilization.(15)

By using electrical impulses to stimulate paralyzed or weak muscle a technique known as functional electrical stimulation or FES can be used to stimulate sensory nerves and lessen adhesive capsulitis pain and discomfort. The muscles surrounding the shoulder joint can be strengthened and activated using FES which can enhance joint mobility and stability. FES can aid in improving the shoulder joint's range of motion which is frequently restricted in cases of adhesive capsulitis by activating the muscles.(16)Stretching and exercises are examples of other rehabilitation strategies that can be utilized in conjunction with FES to increase the efficacy of the overall treatment plan. While there is a lack of prior research on the use of functional electrical stimulation (FES) to treat adhesive capsulitis this study will address the issue and provide idea that FES may have a mild anti-inflammatory effect.(17)Spencer technique a 1915 invention of osteopathic manipulative therapy (OMT) is a standardised broadly applicable collection of therapies for the diagnosis management and prognosis of shoulder discomfort brought on by limited mobility.

It's a popular multistep method that combines physical therapy's sequencing and gradual stretching of the shoulder complex within pain-free range with the integration of muscle energy

through post-isometric contraction and relaxation.For the purpose of increasing glenohumeral and scapulothoracic joint mobility soft tissue stretching utilized. In order to increase shoulder complex mobility the least painful movements are treated first then the most limited motions.(18)By reducing inflammation and the ensuing fibrotic process spenser muscle energy method intentions to reestablish the efficient association between the soft and articular tissues of the shoulder area and to reestablish venous, arterial or lymphatic stream. It improves a patient's well-being and ability to express themselves like other therapies do to restoring joint functionality. There is disagreement over the optimal course of action for expediting the rehabilitation process and restoring patients' functional ability despite the fact that several PT treatments have been proven to be helpful.(19)

2. METHODOLOGY

Non Probability convenient sampling technique was utilized .Both genders of 40 to 60 years having diabetic frozen shoulder or stiff shoulder for at least 3 months were included .Having dislocated shoulder, bone fracture within past 12 weeks or had shoulder arthroplasty excluded . Data was gathered through Goniometer ,Shoulder Pain and Disability Index and Visual Analogue Scale.2 intervention groups were made.

Group A received functional electrical stimulation or group B undergone spencer technique for 20 min 5 sessions/week lasting for a total duration of six weeks both groups SPSS version 25 used for statistical analysis .Paired Sample T test used for difference between pre-treatment post-treatment readings for computing pre- and post-treatment within group readings the Independent Sample T Test was used.Ethical consideration were followed throughout study.

3. RESULTS

In table 1 the study compared demographic and physical characteristics between Group A and Group B, each consisting of 18 participants. In terms of gender distribution, Group A had a higher proportion of females (83.3%) compared to Group B (61.1%), while Group B had more males (38.9%) than Group A (16.7%). Regarding the affected side, Group A predominantly had the right side affected (66.7%), whereas Group B had a higher proportion of left side involvement (61.1%). The mean age of participants in both groups was similar. Group B participants mean height of 65.05 inches (±4.372) compared to Group A's mean height of 63.88 inches (±2.246). In terms of weight, Group B had a higher mean weight (71.94 kg, ±11.562) than Group A (68.22 kg, ±11.22). Correspondingly, the BMI was slightly higher in Group B (26.75, ±4.62) compared to Group A (25.98, ±4.55).

Table 1: Demographic

Variables	**Group A**	**Group B**	**P Value**
	N=18	**N=18**	
	Mean ±SD	**Mean ±SD**	
Gender			.13
Male	3(16.7%)	7(38.9%)	
Female	15(83.3%)	11(61.1%)	
Affected side			.09
Right	12 (66.7%)	7(38.9%)	
Left	6(33.3%)	11(61.1%)	
Age (years)	50.27±6.87	49.44±6.98	.68
Height (Inches)	63.88±2.24	65.05±4.37	.66
Weight (kg)	68.22±11.22	71.94±11.56	.19
BMI	25.98±4.55	26.75±4.62	.56

Table 2 showed Pre-intervention VAS scores were 5.444 (±1.542) for Group A and 6.166 (±1.723) for Group B, showing no significant difference (p = .194). Post-intervention VAS scores significantly decreased in both

groups, with Group A reporting 3.666 (±1.283) and Group B reporting 2.444 (±0.921). The mean difference was 1.222, and the p-value was.002, signifying a significant post-intervention difference between the groups.Pre-intervention SPADI pain scores showed no significant difference between Group A (36.611 ± 6.869) and Group B (36.944 ± 4.976) (p = .869). Post-intervention SPADI pain scores significantly decreased in both groups, with Group A reporting 23.944 (±7.141) and Group B reporting 17.888 (±4.921). The mean difference was 6.055, and the p-value was .006, indicating a significant difference post-intervention.

Table 2: Independent Sample T Test between group comparison of VAS and SPADIPre and post intervention

		Treatment Groups		Independent Sample T-test
		Group A	Group B	
Outcome Measure	**Assessment**	**Mean ±SD N=18**	**Mean ±SD N=18**	**P value**
VAS	Pre Intervention	5.444±1.542	6.166±1.723	.19
	Post Intervention	3.666±1.283	2.444±.921	.002
SPADI Pain	Pre Intervention	36.611±6.869	36.944±4.976	.86
	Post Intervention	23.944±7.141	17.888±4.921	.006
SPADI Disability	Pre Intervention	57.500±11.014	55.388±10.522	.56
	Post Intervention	39.444±12.339	31.611±8.437	.03
SPADI Total	Pre Intervention	94.888±17.699	92.500±14.900	.66
	Post Intervention	63.388±18.327	49.500±9.076	.007

Pre-intervention SPADI disability scores showed no significant difference between Group A (57.500 ± 11.014) and Group B (55.388 ± 10.522) (p = .560). Post-intervention SPADI disability scores significantly decreased in both groups, with Group A reporting 39.444 (±12.339) and Group B reporting 31.611 (±8.437). The mean difference was 7.833, and the p-value was .034, indicating a significant difference post-intervention.

Pre-intervention SPADI total scores showed no significant difference between Group A (94.888 ± 17.699) and Group B (92.500 ± 14.900) (p = .664). Post-intervention SPADI total scores significantly decreased in both groups, with Group A reporting 63.388 (±18.327) and Group B reporting 49.500 (±9.076). The mean difference was 13.889, and the p-value was .007, indicating a significant difference post-intervention.

Table 3 : Paired Sample T test used within group difference of Visual Analogue Scale and SPADI pre and post interventions

		Assessment		Paired Sample T test	
		Pre	Post		
Outcome Measure	**Treatment Group**	**Mean ±SD N=18**	**Mean ±SD N=18**	**Paired difference**	**P value**
VAS	Group A	5.444±1.542	3.666±1.283	1.777±.808	<.001
	Group B	6.166±1.723	2.444±.921	3.722±1.487	<.001
SPADI Pain	Group A	36.611±6.869	23.944±7.141	12.666±4.043	<.001
	Group B	36.944±4.976	17.888±4.921	19.055±4.620	<.001
SPADI Disability	Group A	57.500±11.014	39.444±12.339	18.055±6.448	<.001
	Group B	55.388±10.522	31.611±8.437	23.777±8.149	<.001
SPADI Total	Group A	94.888±17.699	63.388±18.327	31.500±10.939	<.001
	Group B	92.500±14.900	49.500±9.076	43.000±9.652	<.001

The table 3 illustrates that the paired sample t-tests compared pre- and post-intervention outcomes within each treatment group. The outcomes measured were Visual Analog Scale (VAS) scores, Shoulder Pain and Disability Index

(SPADI) pain scores, SPADI disability scores, and SPADI total scores.

Overall, within each treatment group, there were significant improvements in VAS scores, SPADI pain scores, SPADI disability scores, and SPADI total scores from pre- to post-intervention assessments. These findings suggest that the interventions had a positive effect on reducing pain and improving shoulder function in both Group A and Group B participants.

Table 4: Independent Sample T Test between group comparison of Shoulder ROM Pre and post intervention

		Treatment Groups		Independent Sample T-test	
		Group A	Group B		
Outcome Measure	**Assessment**	**Mean ±SD N=18**	**Mean ±SD N=18**	**Mean Difference**	**P value**
Shoulder Flexion	Pre Intervention	88.444 ±8.438	85.222 ±6.983	3.22222	.22
	Post Intervention	97.944 ±7.657	130.666±11.891	-32.72222	.00
Shoulder Extension	Pre Intervention	37.000 ±10.341	33.722 ±8.539	3.27778	.30
	Post Intervention	57.388 ±3.483	59.500 ±1.465	-2.11111	.02
Shoulder Abduction	Pre Intervention	56.666 ±10.341	58.055 ±8.170	-1.38889	.65
	Post Intervention	88.277 ±8.655	126.888±8.281	-38.61111	.00
Shoulder Adduction	Pre Intervention	37.777 ±5.536	36.500 ±5.680	1.27778	.49
	Post Intervention	49.888 ±3.562	49.666 ±1.188	.22222	.80
Shoulder Internal Rotation	Pre Intervention	50.944 ±5.460	49.833 ±5.382	1.11111	.54
	Post Intervention	76.111 ±6.479	82.277 ±4.267	-6.16667	.00
Shoulder External Rotation	Pre Intervention	46.666 ±4.432	45.833 ±6.099	.83333	.64
	Post Intervention	75.777 ±3.919	83.000 ±4.172	-7.22222	.00

In table 4 the study compared shoulder range of motion (ROM) outcomes between Group A and Group B using independent sample t-tests, both pre- and post-intervention. The outcomes measured included shoulder flexion, extension, abduction, adduction, internal rotation, and external rotation.

These findings suggest that the intervention had a greater impact on improving shoulder flexion, extension, abduction, internal rotation, and external rotation in Group B compared to Group A. However, no significant differences were observed for shoulder adduction, between the groups post-intervention.

4. DISCUSSION

A randomized controlled trial was conducted on 36 participant on the base of inclusion and exclusion criteria to compare the effectiveness of functional electrical stimulation and spencer technique in patients of adhesive capsuilitis..Group A received functional electrical stimulation group B received spencer technique. Current study findings demonstrated post-intervention VAS scores significantly decreased in both groups, with Group A reporting 3.66 (±1.28) and Group B reporting 2.44 (±0.92). The mean difference was 1.22, and the p-value was .002, indicating a noteworthy difference between the groups post-intervention.

These results were accordance to Mushyyaida Iqbal et al randomized controlled trial to evaluate the effects of Spencer MET and passive stretching in patients of frozen shoulder. Results illustrated that there was greater improvement with Spencer technique as compared to passive stretching in patients with frozen shoulder pain this study just focused on pain but current study with pain also focused on disability index and ROM.(18)

Present study findings revealed post-intervention SPADI pain scores

significantly decreased in both groups, spencer technique and functional electrical stimulation with Group A(Functional electrical stimulation) reporting 23.94 (±7.14) and Group B(Spencer technique) reporting 17.88 (±4.92). The mean difference was 6.05, and the p-value was .006, indicating a noteworthy difference post-intervention was 6.05, and the p-value was .006, indicating a noteworthy difference post-intervention. Post-intervention VAS scores significantly decreased in both groups, with Group A reporting 3.66 (±1.28) and Group B reporting 2.44 (±0.92) p-value was .002, indicating a noteworthy difference among the groups post-intervention these results were contrast to RCT conducted by Q et al. to evaluate the benefits of spencer Muscle Energy Technique versus traditional therapy methods for frozen shoulder. Utilizing shoulder disability index and visual analogue scale post-intervention assessment was carried out. When it came to reducing shoulder pain, traditional therapy was more successful than spencer treatment. Post-intervention VAS scores significantly decreased in both groups, with Group A reporting 3.66 (±1.28).(19)

Current study revealed spencer technique group showed more improvement post-intervention VAS scores p-value of less than .001 also improved ROM with p <.001 and SPADI with p <.001 showed significant improvement after intervention these results were inlined to Phansopkar et al. case study on male shopkeeper having frozen shoulder. For 6 month the patient received conventional physiotherapy rehabilitation with spencer's approach findings revealed sixth months following therapy pain, range of motion and disability index (SPADI) improved after intervention current study took 6 week to show same results (20)

Deepika, B et al. conducted study on proprioceptive neuromuscular facilitation vs spencer muscle energy technique's capacity to lessen pain and impairment in patients with adhesive capsulitis.According to the study's findings, proprioceptive neuromuscular facilitation in adhesive capsulitis is less successful than Spencer Muscle Energy Technique in terms of lowering pain and impairment in its patients these results were match able to current study group B was spencer technique group showed more improvement post-intervention VAS scores significantly decreased in both groups, with Group A reporting 3.666 (±1.283) and Group B reporting 2.444 (±0.921). The mean difference was 1.222, and the p-value was .002, indicating a significant difference between the groups post-intervention. Post-intervention SPADI pain scores significantly decreased in both groups, with Group A reporting 23.944 (±7.141) and Group B reporting 17.888 (±4.921). The mean difference was 6.055, and the p-value was .006, indicating a significant difference post-interventionwas 6.055, and the p-value was .006, indicating a significant difference post-intervention.(21)

Current findings suggested functional electrical stimulation group A having the mean VAS score considerably decreased from 5.44 (±1.54) pre-intervention to 3.66 (±1.28) post-intervention, with a mean paired difference of 1.77 (±0.80) and a p-value of less than .001.In Group A, the mean SPADI pain score significantly decreased from 36.61 (±6.86) pre-intervention to 23.94 (±7.14) post-intervention, with a mean paired difference of 12.66 (±4.04) and a p-value of less than .001 these results suggested functional electrical stimulation having improvement on shoulder pan disability index these results compatible to Koyuncu, Engin et al Examine how functional electrical stimulation (39) treats hemiplegic patients' shoulder sublaxation and discomfort. Study findings indicate that while treating subluxation in hemiplegic patients, FES therapy applied to the supraspinatus and posterior deltoid

muscles is superior to conventional treatment administered alone but current study not just focused on pain but also focused on disability index and also explored the FES effects on ROM (22)

5. CONCLUSION

In conclusion, Study revealed both spencer technique and functional electrical stimulation are effective interventions for improving pain, ROM and Shoulder disability among shoulder adhesive individual but spencer technique showed more significant results as compare to functional electrical stimulation.

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