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Comparison of the Effectiveness of SPENCER MET and PNF Technique in Adhesive Capsulitis: A Randomized Clinical Trial

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ABSTRACT

Adhesive capsulitis is a very common condition which can be observed in the clinical settings, it is commonly known as frozen shoulder and tends to affect the glenohumeral joint of the shoulder. Spencer Muscle Energy Technique (SMET) has been applied in recent times for pain reduction and increased articular ROM. Proprioceptive neuromuscular facilitation is a technique used in the physiotherapy to enhance the range of motion and activation of muscles via stress relaxation, and gate clinical theory. This study compares the efficacy of Spencer-MET and PNF Techniques for idiopathic unilateral adhesive capsulitis by comparing the decrease in disability using NPRS, goniometry and SPADI scores. To compare the Effectiveness of Spencer-MET and PNF Technique on Pain, Range of Motion (ROM) and Disability in Adhesive Capsulitis. It was a clinical trial in which 84 patients were enrolled at the start of the study. The score for Numeric Pain Rating Scale (NPRS) in the clinical group (PNF Technique) as 2.47 ± 0.79918 and the experimental group (Spencer-MET) as 2.85 ± 0.87 .⁵ The time period of this whole study was 6 months. The data was analyzed using SPSS 26 and the major improvements were noted by comparing before and after test results. Spencer-MET group after post treatment had a greater reduction of NPRS scores with a mean of 3.02 and 4.71 for PNF group. Spencer-MET is better suited to treat adhesive capsulitis than Proprioceptive Neuromuscular Facilitation (PNF). It proved more efficacious in reduction of pain and stiffness, enhancing the joint mobility and even the functionality of patients.

Keywords: Adhesive Capsulitis, Spencer Muscle Energy Technique (SMET), Proprioceptive Neuromuscular Facilitation (PNF), Range of Motion (ROM).

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INTRODUCTION

Adhesive capsulitis is a very common condition which can be observed in the clinical settings, it is commonly known as frozen shoulder and tends to affect the glenohumeral joint of the shoulder. Its common hallmarks are the pain in the shoulder, and a decline in the range of motion (ROM) and in later stages it tends to result in exertion during higher extremity activities, severe impairment, and functional

limitations (Nakandala 2020). This disease has been documented to affect about 2-5% of people among the normal population, but has been affecting nearly 20% of all diabetics and normally occurs when people have crossed their 40 years of age (Mishra et al., 2019, Asif et al., 2022, Lin et al., 2022). Proprioceptive neuromuscular facilitation is a technique used in the physiotherapy to enhance the range of motion and activation of muscles by four means: first is the autogenic

inhibition, second is reciprocal inhibition, third is stress relaxation, and the fourth is the gate control theory (Alaca et al., 2015). The newest osteopathic manual treatment approach commonly employed for this is Spencer Muscle Energy Technique (SMET) introduced in western therapeutic procedures for treating numerous shoulder disorders. It has been applied in recent times for pain reduction and increased articular ROM by unlocking the adhesions inside the joint, relaxation of muscle groups and its tone, and by performing the stretching of tightened muscles and fascia (Curcio et al., 2017, Asif et al., 2022). It is a popular manual therapeutic technique for pain relief. It also enhances the strength of the muscle as it makes use of voluntary actions against the applied force or resistance of the therapist (Syed 2021). The efficacy of MET as a therapeutic treatment of adhesive capsulitis results from the impact on alleviation of pain, making sure of ROM increments, and functional activities are developed, which are a result of the muscular movements in a specific direction and in a supervised manner against resistance to help improve joint range by increasing flexible movements in joint. This technique can be applied to all such joints which do not have normal ROM (Butt & Tanveer 2022). Studies do prove the effectiveness of Spencer-MET and PNF for reducing pain, enhancement of ROM and functionality in patients with frozen shoulders individually. Comparative analysis of the aforementioned two techniques elaborates that both of them have been found useful in the decreasing pain, the increment in the range of motion (ROM) and improving the prognosis. Other findings tend to show that MET may be more advantageous when it comes to the internal and external rotation improvement which breaks adhesions and activates restricted muscles (Ghaffar et al., 2023, Iqbal et al., 2020, Gasibat et al., 2023). Another randomized clinical trial showed that the patients who received Spencer-MET improved more significantly demonstrated that patients treated with Spencer-MET showed significantly greater gains in SPADI and NPRS scores compared to those receiving PNF alone (Ghaffar et al., 2023). But, the effectiveness of these techniques compared to each other is still unclear. Therefore, my study tends to find the efficacy of Spencer-MET and PNF Techniques as both are effective rehabilitation techniques for idiopathic unilateral adhesive capsulitis. Thus, this study will compare the reduction of pain, enhancement of Range of motion and decrease in disability using NPRS, goniometry and SPADI scores of both Spencer-MET and PNF in patients with idiopathic unilateral adhesive capsulitis.

The Muscle Energy Technique has been a well-documented and established standard procedure for the treatment for adhesive capsulitis, the primary reason for that is it is

designed for the shoulder joint. In this technique, the patient performs muscular contractions against the applied resistance of the therapist. There are seven major movements which are the key framework for this technique, the extension, flexion, circumduction with compression, circumduction with traction, abduction, internal rotation, and lymphatic pump. These movements tend to mobilize the shoulder joint, remove the formed adhesion of the capsule and the tightened state of the soft tissue (Veer et al., 2020 & Iqbal et al., 2020).

The usage of this technique is quite widespread and its positive impact on the adhesive capsulitis is well known, another finding by Gasibat et al. showed that Spencer-MET had improved the range of motion (ROM), minimized pain, alongwith the stiffness in patients with frozen shoulder (Gasibat et al., 2022)

Similarly, Jivani and Hingarajia found out in their study that there was significant enhancement in the patient scores of SPADI and NPRS who had been treated with Spencer-MET, they had performed a lot better than those patients who had been treated with Maitland mobilization (Jivani & Hingarajia 2021). These patients had also seen significant improvements in their rotatory motion. The other major finding in regard to this technique is that it is successful because it stretches the fibrotic tissue and is involved in the improvement of the synovial fluid in shoulder joint because of its patterns of repetitive movements (Veera et al., 2020 & Curcio et al., 2017).

One other study conducted at CRP by Rimal and Savar also act in favor of Spencer-MET in treating adhesive capsulitis (Rimal 2020). Furthermore, another study conducted by Moore et al. showed that Spencer-MET has been very beneficial for patients by decreasing their tightness of the posterior shoulder and hence should be a part of the normal rehabilitation procedures to improve prognosis (Moore et al., 2011). Another major technique which has also been documented by a vast body of researchers and clinicians is that of the Proprioceptive Neuromuscular Facilitation (PNF). This technique uses a series of exercises which tend to target the agonist and antagonist muscular regions in order to enhance the flexibility and range of motion of the joint by reducing adhesion. Normally the practitioners use this in the form of “hold-relax” and “contract-relax” which aim to improve the mobility of the shoulder (Tedla and Sangadala 2019). It has been elaborated in their review that there are quite the number of studies which have supported the use of PNF and its positive outcomes for the patients suffering from adhesive capsulitis (Tedla and Sangadala 2019). Another major initial pilot randomized clinical trial elaborated that the exercises and movement patterns of the

PNF technique tend to improve the shoulder mobility and overall control of the scapular movement and also provides better disability scores as compared to general therapy administered alone (Lin et al., 2022).

MATERIALS AND METHODS

Study Design and Setting

This clinical trial was carried out in the Department of physiotherapy, Mayo Clinic Hospital, Lahore. The approval for this study was granted by the institutional review board and all of the participants were given forms which they had filled for informed consent.

Participants

A grand total of 84 patients were enrolled in this study and hence were initially grouped in to two, each comprising of 42 patients. The inclusion criteria for the trial are as follows: the patients were of 40-65 years of age; they had been diagnosed with unilateral adhesive capsulitis in stage II or III by clinician and had pain score ≥ 4 on the Numeric Pain Rating Scale (NPRS). Besides this they also had a limited range of motion (ROM). The exclusion criteria are also as follows: the patients would have bilateral adhesive capsulitis, if they had a recent history of fractures or even surgery of the affected shoulder, if they had any sort of neurological impairment specific to upper limb function. If they had any form of inflammatory arthritis, or if had received prior physiotherapy for this disease in prior three months for this condition.

Randomization and Allocation

After the initial baseline assessment, the patients were randomly placed in two groups of 42 patients each by using the sealed envelope method which tends to ensure secrecy. The group A had received Spencer-MET and Group B received PNF.

Intervention Protocols

Spencer-MET group: Intervention methods comprised of seven methods which are used in mobilizing positions, these were used sequentially to target restriction of capsule, and mobility of joint. The movements were gentle and oscillatory in nature, in axis which were pain free. Passive stretching was followed after isometric holding for 5-7 seconds.

PNF group: For this group, the contraction-relaxation method was opted and emphasized the antagonist muscles of the shoulder. The participants had to perform their contractions against applied resistance of the therapist for 5-10 seconds. After this, passive stretching was followed for the next few seconds in new range.

The treatment sessions of both groups comprised of 30-minutes, thrice per week, with a total of four weeks duration. The physiotherapist was same in all the sessions

and was a proper licensed individual. Furthermore, participants were informed to avoid any other additional physiotherapy besides from the one they received at Mayo clinic hospital to maintain the validity of the treatment.

Outcome Measures

The main assessment was conducted through the measurements of NPRS, where 0 represents no pain and 10 represents the greatest level of pain. In terms of functionality the Shoulder Pain and Disability Index (SPADI) was used and it had two sub categories: pain (five items) and disability (eight items). The score came out in the form of percentage and higher scores implied greater level of disability.

Shoulder ROM (abduction and external rotation) was also assessed by the use of goniometer and participant was in a normalized position. All of these results were analyzed as pre-intervention and after four weeks (post-intervention).

Data Collection Procedure

The major demographic and clinical data was acquired before the randomization process and this data was analyzed by a person who was blinded to the whole randomization process of group formation. All the participants took part in their sessions and none of them skipped any session as their attendance was marked in the logs.

Statistical Analysis

Data was analyzed using SPSS 26, the descriptive statistics of the data was conducted in the form of mean \pm standard deviation. The continuous variables along with their frequencies were also used in these descriptive analysis and normality of the data was confirmed by performing the Shapiro-Wilk test. The differences amongst the groups and those within the groups were found out by using the standards of independent t-tests and paired t-tests. The level of significance was set at the $p < 0.05$ for all conducted tests.

RESULTS

This study comprised of a total of 84 patients who had been randomized into two study groups (42 per group). Out of the total 84 patients, there were only 76 patients who had completed the study and out of these, 60 were female while the 16 were male. The remaining 8 patients lost follow-up and hence not a final part of the study. The demographics and other clinical conditions and data was comparable for all the patients and even within the groups.

Pain intensity (NPRS)

It has been observed that both the groups had witnessed a significant reduction in their pain and hence their improvement in terms of NPRS scores was good. However, there was a greater level of improvement of NPRS scores in the patients of

Spencer-MET group as compared to the PNF group, with the Spencer-MET group showing decrease of NPRS mean score of 7.00 ± 0.74 to 3.02 ± 0.91 , whereas the latter PNF group showed an improvement of 6.89 ± 0.83 to 4.71 ± 1.18 . As the differences between the groups was statistically valid ($p < 0.001$), the results favored Spencer MET.

Disability (SPADI)

In terms of functionality, the patients of both groups had

witnessed a significant improvement in restoration of function. The Spencer-MET group had shown the reduction of SPADI scores from 73.98 ± 5.57 to 22.98 ± 7.88 , and the PNF group had shown the reduction from 72.51 ± 3.53 to 44.89 ± 6.37 . the analysis of the groups data showed statistical significance and a greater improvement with Spencer-MET group ($p < 0.001$).

Table 1: Comparison of NPRS Scores.

Group	Baseline (Mean \pm SD)	Post-treatment (Mean \pm SD)	p-value (within group)	Between-group p-value
Spencer MET	7.00 ± 0.74	3.02 ± 0.91	<0.001	
PNF	6.89 ± 0.83	4.71 ± 1.18	<0.001	0.019

Table 2: Comparison of SPADI Scores.

Group	Baseline (Mean \pm SD)	Post-treatment (Mean \pm SD)	p-value (within group)	Between-group p-value
Spencer MET	73.98 ± 5.57	22.98 ± 7.88	<0.001	
PNF	72.51 ± 3.53	44.89 ± 6.37	<0.001	<0.001

Range of Motion (ROM)

Abduction: There was also an improvement of the abduction in both groups with Spencer-MET group showing improvement from $90.24^\circ \pm 5.76$ to $129.17^\circ \pm 8.34$. On the other hand, the PNF group showed improvement from $89.20^\circ \pm 5.16$ to $108.80^\circ \pm 7.31$. External rotation: In terms of this motion, the Spencer-

MET group showed improvement from $23.80^\circ \pm 3.09$ to $43.34^\circ \pm 4.41$, and in comparison, the PNF group improved from $24.40^\circ \pm 3.14$ to $33.80^\circ \pm 4.39$. When independent t-tests were performed for both groups, the results showed the valuable significant differences for the Spencer-MET group for abduction and external rotation ($p < 0.001$).

Table 3: Comparison of ROM Outcomes.

ROM (Degrees)	Group	Baseline (Mean \pm SD)	Post-treatment (Mean \pm SD)	p-value (within group)	Between-group p-value
Abduction	Spencer MET	90.24 ± 5.76	129.17 ± 8.34	<0.001	
	PNF	89.20 ± 5.16	108.80 ± 7.31	<0.001	<0.001
External rot.	Spencer MET	23.80 ± 3.09	43.34 ± 4.41	<0.001	
	PNF	24.40 ± 3.14	33.80 ± 4.39	<0.001	<0.001

Overall findings

Both treatment techniques were effective and both yielded good outcomes, yet the findings in the aspects of pain reduction, disability and enhancement of mobility and functionality the patients treated with Spencer-MET illustrated better demonstrated significantly greater improvements across all measured outcomes compared to those receiving PNF.

DISCUSSION

The current study has managed to compare the Spencer Muscle Energy Technique (MET) with Proprioceptive Neuromuscular Facilitation (PNF) in the form of a randomized clinical trial for managing the disease of

adhesive capsulitis. The findings have conformed to those which have been reported in literature regarding both techniques being effective for the treatment of this condition and show a significant level of improvement in reducing pain, functional disability, and increasing range of motion (ROM). But when it comes to the point that which one is more effective, then the answer is that Spencer-MET illustrated better results and across all parameters. It only indicates that it has greater efficacy in being the manual therapy for this condition.

The findings of this study are consistent with those of others cited in literature. These studies have also shown that Spencer-MET is effective for the improvement of joint mobility, the reduction of hypotonicity of muscles and pain.

The reason behind these facts is that the technique uses active muscle contractions against clinical resistance (Asif et al., 2021, Saeed et al., 2022). It is the logical mechanism which is behind the improvements witnessed in the current study as well. The other major fact is that the technique involves the use of sequential mobilization methods which addresses the capsular tightness and improves functionality in the form of ROM (Butt & Tanveer 2022).

On the contrary, the stretching which is performed by the PNF method tends to decrease pain and also it improves the functionality yet the degree by which it is able to do so is lesser in comparison (Rimal 2020). In the current scenario the findings did conform to those which are reported in literature and the improvements were significant within the groups. Yet it was not as much in comparison with the Spencer-MET method. Another study has also mentioned that the findings to be quite similar to those of this study, it was reported by Sharma et al., that greater positive changes were observed in the conditions of patients who had been treated with MET as compared to other stretching interventions in adhesive capsulitis (Jivani et al., 2021).

Another point to be taken into account is that there is a greater level of improvement in the NPRS scores of MET group patients, i.e. 7.00 to 3.02). This elaborates the fact that a mechanism is behind this technique and it is perhaps the stimulation of the mechanoreceptors and the Golgi tendon organs, which in turn improves muscle relaxation and pain (Alaca et al., 2015). These improvements were also illustrated in the scores of SPADI during this trial and this decline in pain is one of the major signs of restoration of function (Redler & Dennis 2019).

Besides these there was also a very significant improvement in MET group patients in the abduction and rotational movement of the joint which is in fact the most difficult and hindered movement in this disease. Similar findings have been reported in the study of Cagnie et al., who had mentioned that MET had a greater impact in restoration of rotational movement and reduction of stiffness as compared to conventional therapy techniques (Viswanathan et al., 2015). All of these findings are clinically relevant as well as the restoration of functionality is one of the keys aspects of treatment and the step back towards a healthy everyday living. This condition is quite challenging for individuals in that age range and even recovery tends to be a slow process, taking about 12–24 months (Malpani et al., 2022). The technique used for therapies for this condition tend to reduce the time frame of recovery and hence they are valuable in the field of physiotherapy. The positive impacts found in terms of outcomes in this trial are a reason due which it is proposed that it should be made a standard manual therapy

for treatment of frozen shoulder patients (Zahoor et al., 2021).

LIMITATIONS

The major limitation to this study was the smaller sample size, although it was significant yet still not large enough to form generalization as it was performed in a single clinical setting. Blinding the patients as to which type of intervention they were going to receive was not possible. The study also evaluated short term outcomes and could not look at long term outcomes in terms of sustainability of the improvements.

FUTURE DIRECTIONS

Such studies in the future should be more inclusive as to conduct such trials with larger sample sizes and at different centers. Long-term follow up should also be a part of the study to assess the sustainability of improvements in patients. Furthermore, other such trials for Spence-MET and PNF along with Maitland Mobilizations should also be carried out so that a thorough understanding of these interventions and their improvements in comparison to each other could be made. This would allow the selection of a more catered intervention for the treatment of such problems.

CONCLUSION

Both Spencer Muscle Energy Technique (MET) and Proprioceptive Neuromuscular Facilitation (PNF) were effective in improving pain, functional ability, and shoulder mobility in patients with adhesive capsulitis. Yet, it has been found that the outcomes of using Spencer-MET were significantly better than PNF technique across all parametric standards and hence it is recommended that Spencer-MET be used as the optimal manual therapy technique for the treatment for the management of the adhesive capsulitis. By incorporating the technique into the normal physiotherapy methods is a pivotal factor which may improve the recovery rate and sustainability of functions in patients.

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