Original Article

Effectiveness Of Muscle Energy Technique And Kaltenborn Mobilization On Functional Disability And Pain In Adhesive Capsulitis

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Abstract

Objective: To determine the effectiveness of kaltenborn mobilization and muscle energy technique on functional disability and pain in adhesive capsulitis.

Study design: It was a Randomized Controlled Trial study.

Place and duration of study: The study was conducted at the outpatient physiotherapy department of Holy Family Hospital in Rawalpindi from September 2021 to February 2022.

Material and Methods: This study was carried out on patients diagnosed with adhesive capsulitis.By convenient sampling technique, 30 participants were recruited from the Physiotherapy Department. Open Epi Tool was used to calculate the sample size. The Shoulder Pain and Disability Index (SPADI) was used to collect data at three time points: baseline, two weeks, and four weeks post-treatment. After obtaining informed consent, participants according to the inclusion criteria were randomly assigned into two groups: Group A, who received Post Isometric Relaxation (PIR) of Muscle Energy Technique, and Group B, who received Grade II and III Kaltenborn Mobilizations.

Results: The data was statistically analyzed with the help of SPSS version 22. Both groups were shown to have significant improvements in pain and functional disability scores. However, the improvement in Group A was greater than in Group B (P-value <0.05).

Conclusion: Muscle Energy Technique has superior treatment efficacy than Kaltenborn Mobilizations in decreasing pain and functional disability in adhesive capsulitis.

Keywords: Shoulder Pain and Disability Index (SPADI), Kaltenborn mobilizations, Post Isometric Relaxation, Muscle Energy Technique, Adhesive Capsulitis

1. Introduction

Adhesive Capsulitis, a condition marked by shoulder pain and stiffness, leading to a gradual and significant loss of mobility in the shoulder joint, affecting both active and passive ranges of motion.[(1)] The glenohumeral joint displays a characteristic pattern of restricted movement, known as a capsular pattern, which is marked by severely limited external rotation followed by restricted abduction in the scapular plane and finally, limited flexion.[(2)]Although there are many factors that cause Adhesive Capsulitis(AC), the etiology remains unclear.[(3)] Adhesive Capsulitis (AC) is classified into two broad categories: primary AC and secondary AC. Primary AC is the one with no known cause also referred to as idiopathic adhesive capsulitis and is characterized by widespread inflammation and fibrosis (scarring) in the shoulder joint capsule. In contrast, various underlying conditions can contribute to the development of secondary adhesive capsulitis, including acromion-clavicular arthritis, glenohumeral arthritis, tears of rotator cuff, prior shoulder trauma or operative procedures and calcific tendinopathies. Accurate diagnosis of the underlying cause is crucial as treatment for secondary AC aims to address it before addressing the resulting stiffness.[(4)]

Adhesive Capsulitis, affects approximately 2-3% of the general population.

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It is uncommon in children, but its incidence increases significantly between the ages of 40 and 70 years. Additionally, females are more likely to be affected by frozen shoulder than males, although there is no known genetic or racial predisposition.[5]There are several risk factors associated with adhesive capsulitis, some of which include previous trauma, aging, female gender, dyslipidemia, hypertension, thyroid dysfunction, and diabetes. Diabetes is the most common disease associated with adhesive capsulitis and people with diabetes have a 10% to 20% lifetime risk of developing the disease.[6] Restrictions in range and pain affect activities of daily living, such as grooming and dressing.[7]

Adhesive capsulitis is a condition that can resolve spontaneously, but the approximate duration is unpredictable. While some individuals may achieve complete recovery, others may experience residual dysfunction. The traditional understanding of frozen shoulder as a self-limiting condition that progresses through a painful stage to a recovery stage, followed by complete resolution within a year or two, is being challenged by recent research. According to which, untreated cases can result in persistent functional limitations, contradicting the long-held belief of complete resolution.[8] The treatment of adhesive capsulitis can involve both surgical and non-surgical (conservative) approaches. Non surgical or conservative treatment includes intra-articular injections, oral pharmacological treatment, and physiotherapy. Research has demonstrated that rehabilitation plays a crucial role in producing improvements in joint range of motion (ROM), relieving pain, enhancing functional ability, and enhancing the rate at which physical activities are performed.[9] Physiotherapists employ a range of treatments to manage adhesive capsulitis, including heat and ice packs, interferential currents, transcutaneous electrical nerve stimulation (TENS), therapeutic ultrasound, passive and active range of motion (ROM) exercises, proprioceptive neuromuscular facilitation (PNF), joint mobilization techniques, kinesio taping and supervised home exercise programs.[10]

Kaltenborn mobilization is used to evaluate and treat joint mobility based on the MacConaill classification, categorizing the joint surfaces as convex on the interior and concave on the exterior. This approach employs passive and sustained stretching methods to enhance joint mobility without compressing the joint surfaces. Joint mobilization forces applied to enhance joint range of motion (ROM) are graded into three grades from grade I to grade III.[11] Muscle Energy Technique empowers clients to take an active role in their treatment, as they produce contraction against the resistance provided by the practitioner in a controlled direction Unlike other techniques that focus on increasing flexibility, muscle energy technique primarily aims to restore the normal range of motion in joints.[12] The effectiveness of muscle energy technique can be attributed to two mechanisms: one is, reciprocal inhibition (RI): This mechanism involves the contraction of a muscle, which inhibits the opposing muscle, resulting in a more balanced and efficient movement pattern and second, post-isometric relaxation (PIR): This process occurs when a muscle is contracted and then relaxed, leading to a decrease in muscle tone and an increase in joint range of motion.[13] Post-isometric contraction reduces muscle tone following a brief period of submaximal isometric contraction. While joint mobilizations are highly effective in restoring shoulder joint function and mobility, post-isometric relaxation exercises may not be as effective. Despite the popularity of Kaltenborn mobilizations and post-isometric relaxation of muscle energy technique, there is limited research comparing their efficacy. The aim of the study was to investigate and compare efficacy of post isometric relaxation (muscle energy technique) and kaltenborn mobilizations in reducing pain and improving functional outcomes in patients with adhesive capsulitis.

2. Materials & Methods

A comparative study was conducted at the outpatient physiotherapy department. The sample size was calculated using the Open Epi tool.[14] The total sample size was 24 patients with 12 patients in each group but as it was a long-term follow-up study so additional 25 % of patients were added, so a total of 30 patients were included in the study with 15 patients in each group. This study employed convenient sampling to recruit patients with adhesive capsulitis and a lottery method was used to randomly allocate participants into different groups. The screening process was conducted according to inclusion criteria, which include patients of idiopathic adhesive capsulitis, with age range of 20-60 years, having shoulder pain persisting for more than 3 months and restriction in at least 2 shoulder ranges. Conversely, patients excluded from study were those having language barrier, shoulder dislocations or fractures, labral tears, motor control deficits due to neurological disorders, bony deformities (acquired or congenital) in the glenohumeral joint. Informed consent was obtained from all participants before their inclusion in the study. Out of 36 screened patients, 30 met the inclusion criteria and were recruited for the six-month study, which took place from September 2021 to February 2022.

This study employed a randomized controlled trial design where Group A was treated with muscle energy technique using post isometric relaxation and Group B received grade II & III kaltenborn mobilization. Group A received 3 repetitions of post isometric relaxation (3 muscle contractions, each 5-7 seconds) per set, 1 session per day, 3 times a week, for 4 weeks. Group B was treated with 12 sessions of kaltenborn mobilizations, 3 times a week, for 4 weeks. Both groups also treated with conventional therapy consisting of Short Wave Diathermy (10 min), Ladder and Codman exercises.The outcome measures were degree of pain and functional disability, assessed using the shoulder pain and disability index (SPADI). Data were collected at baseline, and at 2 and 4 weeks post-treatment. Statistical analysis was done using SPSS version 22. The normality of data was assessed using the Shapiro-Wilk test, and parametric tests (independent sample t-test and paired t-test) were used for between-group and within-group comparisons, respectively. Results were presented in form of figures and tables while statistical significance was set at $p < 0.05$.

3. Results

This study included a total of 30 patients, comprising 10 male and 20 female participants. The mean age of participants in Group A (Muscle Energy Technique) was 49 ± 7.428 years, while in Group B (Kaltenborn Mobilization) it was 52 ± 6.538 years. An independent sample t-test revealed a statistically significant difference ($p < 0.0001$) in the percentage of shoulder pain and disability index scores between the two groups, favoring the muscle energy technique group. The study results are presented with 95% confidence intervals at four points in time i.e pre-treatment, and post-treatment at 2nd, 4th and 6th weeks. The null hypothesis, which assumed similar differences in outcome values among groups, was tested statistically and rejected, indicating significant differences in treatment outcomes between the two groups.

TABLE 1: The comparison of Kaltenborn Mobilization and Muscle Energy Technique was made on SPADI scores.

VARIABLES	TIME	GROUP A	GROUP B	p-value
Pain Score	At baseline	66.67±18.200	74.27 ±11.436	**0.182**
	After 2 weeks	47.87 ±15.090	68.47 ±11.482	**<0.001**
	After 4 weeks	34.93 ±16.731	62.80 ± 11.583	**<0.001**
SPADI score	At baseline	63.73 ±18.105	65.80 ± 10.738	**0.707**
	After 2 weeks	46.60 ±15.968	60.93±10.152	**0.007**
	After 4 weeks	35.33±15.792	55.73±9.982	**<0.001**

Pain score of Group A at baseline was 66.67±18.200 that was reduced to 47.87 ±15.090 after 2 weeks of intervention and after 4 weeks of intervention, it was reduced to 34.93 ±16.731. However in Group B, baseline pain score was 74.27 ±11.436 that was reduced

to 68.47 ±11.482 after 2 weeks of intervention and after 4 weeks of intervention, it was reduced to 62.80 ± 11.583 and yielding p value of <0.001.This showed significant difference of intervention between 2 group with greater reduction in pain score in Group A treated with Muscle Energy Technique.

Disability score of Group A at baseline was 63.73 ±18.105that was reduced to 46.60 ±15.968 after 2 weeks of intervention and after 4 weeks of intervention, it was reduced to 35.33±15.792. However in Group B, baseline disability score was 65.80 ± 10.738 that was reduced to 60.93±10.152 after 2 weeks of intervention and after 4 weeks of intervention, it was reduced to 55.73±9.982 and yielding p value of <0.001.This showed significant difference between the 2 groups with greater reduction of disability in Group A treated with muscle energy technique.

FIGURE 1: Comparison of Kaltenborn Mobilization and Muscle Energy Technique was made on shoulder pain and disability index after 2 weeks.

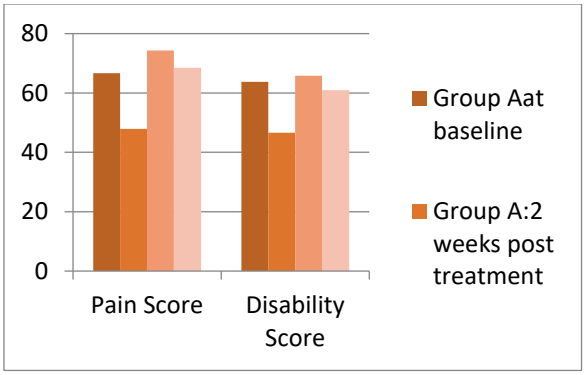

FIGURE 2: Comparison of Kaltenborn Mobilization and Muscle Energy Technique was made on shoulder pain and disability index after 2 and 4 weeks of treatment.

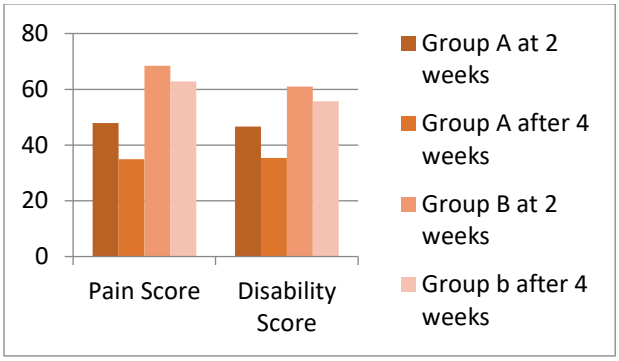

FIGURE 3: Comparison of Kaltenborn Mobilization and Muscle Energy Technique and is made on SPADI after 4 weeks of treatment.

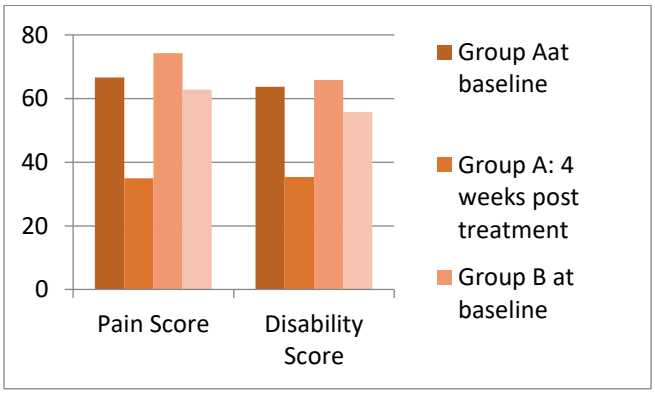

TABLE 2: Changes in Means over the period of time was shown by using Repeated measure ANOVA

Measured Variables	Groups	Baseline	After 2 weeks	After 4 weeks	p Value
		Mean ± SD	Mean ± SD	Mean ±SD	
Pain score	Group A	66.67± 18.200	47.87 ± 15.090	34.93± 16.731	**<0.001**
	Group B	74.27±11.436	68.47 ± 11.482	62.80 ± 11.583	**<0.001**
SPADI score	Group A	63.73± 18.105	46.60 ± 15.968	35.33 ±15.792	**<0.001**
	Group B	65.80± 10.738	60.93± 10.152	55.73± 9.982	**<0.001**

Within group analysis was done over different time duration i.e weeks, by using repeated measures ANOVA that shows changes in means of groups over the period of time yielded P- Value <0.0001 for both the groups suggesting that both the groups improved significantly after intervention.

4. Discussion

Our study investigated the efficacy of the kaltenborn mobilizations and muscle energy technique in decreasing pain and functional disability due to adhesive capsulitis. The results showed that Group A exhibited a significant decrease in pain and functional disability due to the relaxation and improved biomechanics. Group B also demonstrated improvements in these outcomes. This study's results are in line with those of Suri et al., who compared muscle energy technique with maitland techniques in the management of frozen shoulder and find out that pain was better managed by muscle energy technique as compared to maitland mobilizations. The present study's results contribute to the existing literature, further supporting the use of muscle energy technique as a valuable intervention for adhesive capsulitis.[15] A comparative study examined efficacy of maitland and kaltenborn mobilizations to alleviate pain and increase ROM at the shoulder joint in adhesive capsulitis and concluded that both treatment groups reported noticeable decrease in level of pain after treatment. Additionally, both groups demonstrated significant improvements in internal and external rotation ROM post-intervention. There was insignificant differences between two groups regarding ROM gains or improvements in level of pain suggesting that both maitland and kaltenborn mobilizations are equally effective in managing shoulder pain and improving mobility in adhesive capsulitis patients.[16] Farjad Afzal et al. examined the effectiveness of the muscle energy technique in adhesive capsulitis. They administered muscle energy technique for two weeks and found that it significantly reduced pain and disability in comparison to the control group, suggesting that it is a effective intervention to improve outcomes in pain management and functional ability. This study suggests that muscle energy technique holds a superior position as an approach for managing symptoms in adhesive capsulitis.[17] Findings of Farjad Afzal et al. are further corroborated by the study of Edrish Saifee Contractor et al., which compared the outcomes of conventional therapy alone (control group) with the combination of muscle energy technique and conventional therapy (interventional group) in patients with adhesive capsulitis. The results showed that the interventional group, which was treated with muscle energy technique in addition to conventional therapy, exhibited a statistically significant improvement in outcomes compared to the control group.[18] A quasi-experimental study investigated the efficacy of Grade III kaltenborn mobilization in patients of frozen shoulder presented during frozen stage.The conclusion drawn from the study was that kaltenborn mobilization techniques (Grade III) were more effective than routine physiotherapy techniques in improving range of motion. The results suggest that the use of Grade III Kaltenborn mobilization techniques leads to greater gains in mobility and flexibility.[19]

Conclusion:

Both techniques are effective but the muscle energy technique have superior treatment efficacy than Kaltenborn Mobilizations in decreasing pain and functional disability in adhesive capsulitis.

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