https://doi.org/10.37939/jrmc.v27i3.1959

Effectiveness Of Kaltenborn Mobilization Versus Muscle Energy Technique On Shoulder Range Of Motion In Adhesive Capsulitis

Muhammad Umar[1], Aqsa Anwar[2], Nida Khan[3], Misbah Marryam[4], Hiba Rashid[5]

Abstract

Objective: To compare the effectiveness of muscle energy techniques (post isometrics relaxation) and Kaltenborn mobilizations on shoulder range of motion (ROM) in adhesive capsulitis.
Methodology: A randomized Control Trial (CRT) was conducted on patients with adhesive capsulitis for 6 months September 2021 to February 2022. Data was collected through a convenient sampling technique. 30 patients were taken from the physiotherapy department of the holy family hospital, Rawalpindi. The sample size was calculated using the Open Epi Tool. Data was collected by using Universal Goniometer at baseline, after 2 weeks and after 4 weeks of treatment. Patients who met the inclusion criteria and gave consent were included in the study. Patients were randomly allocated into two groups: Group A & Group B. Group A received muscle energy technique and Group B received grade II & III Kaltenborn mobilizations.
Results: Data was analysed using SPSS software version 22. Both groups showed improvements in shoulder range of motion but Group A showed a statistically significant difference ($p<0.05$) in flexion and abduction ROM from Group B.
Conclusion: The muscle energy technique is much more effective in improving flexion and abduction ROM except rotation than Kaltenborn mobilizations in adhesive capsulitis.
Keywords: Adhesive Capsulitis, Kaltenborn mobilizations, Muscle energy techniques, Post isometric relaxation, Universal Goniometer.

[1] Head of Physiotherapy Department, Holy Family Hospital, Rawalpindi; [2,3,5] Lecturer, Rawalpindi Medical University, Rawalpindi; [4] Physiotherapist, Benazir Bhutto Hospital, Rawalpindi.
Correspondence: Dr. Aqsa Anwar, Lecturer, Rawalpindi Medical University, Rawalpindi. **Email:** knida816@gmail.com.
Cite this Article: Umar, M., Anwar, A., Khan, N., Marryam, M., & Rashid, H. (2023). Effectiveness Of Kaltenborn Mobilization Versus Muscle Energy Technique On Shoulder Range Of Motion In Adhesive Capsulitis. *Journal of Rawalpindi Medical College*, *27*(3). https://doi.org/10.37939/jrmc.v27i3.1959.
Received January 19, 2023; accepted September 11, 2023; published online September 26, 2023

1. Introduction

Adhesive capsulitis is a severe painful condition that causes stiffness and disability. It is usually a clinically diagnosed disorder based on history and physical assessment. It is a musculoskeletal condition caused by damage to the soft tissues and joint capsule of the shoulder joint and characterized by inflammation and adhesions [(1)].
Many etiological and referral factors cause pain in the shoulder such as local pathologies, and abdominal pathologies affecting the viscera, the diaphragm and the liver. Disorders specific to the shoulder vary, as adhesive capsulitis is the leading cause of shoulder pain [(2)]. It is more common in women who mainly suffer from diabetes between the ages of 40 and 60 and 2 to 5% of the population suffer from adhesive capsulitis [(3)].
The shoulder joint offers a wide range of motion and its extraordinary flexibility is due to the glenohumeral, acromioclavicular, scapulothoracic, and sternoclavicular joints. The muscle and tendon support system supports the capsule inside and outside of the structure. This complex structure is more prone to injury, strain and distortion due to many idiopathic and secondary to other etiologies [(4)]. Clinical features of adhesive capsulitis are acute which can disable an individual's ability to carry out daily activities at domestic and workplace. It causes a very significant economic loss with a lot of poor work performance. The shoulder joint is essential to withstand heavy physical activity due to its ball and socket joint which provide a wide range of motion [(5)]. Pain, stiffness, or pain and stiffness are both main sources of physical impairment of the shoulder joint resulting in sleep deprivation and other ADL loss [(6)]. Typically, 4 stages are seen as the frozen shoulder progresses, defined as “painful, freezing, frozen and thawing”. These phases persist for about two years, with preliminary onset over days or weeks. In the first phase, there is sleep disturbance and pain occurs at the end of the range of motion [(7)]. The preliminary stage (freezing) is characterized by severe pain and lasts for about 3 months. [(8)] The frozen (adhesive) stage lasts for three to nine months, with marked stiffness and pain on the extremes of movement. The thawing (resolution) stage lasts for eighteen months,

and is comparatively painless, with stiffness improving gradually throughout this stage. Several authors have defined frozen shoulder as a self-limiting disorder that resolves in 12-36 months [9]. On inspection, the patient frequently presents severe pain while keeping the arm in adduction and internal rotation [10]. Sometimes, atrophy of the shoulder muscle groups may be found. On palpation, there may be diffuse tenderness alongside the shoulder joint. There is a global limitation of movements of the shoulder, and pain during the early and middle phases of the disease. Of specific significance is an about total loss of external rotation, which is nearly pathognomonic [11]. This is confirmed by measuring the active and, more significantly, the passive ranges of movement. Adhesive capsulitis is normally a medical diagnosis and usually does not require extensive investigations. Plain radiographs of the shoulder to exclude osteoarthritis of the joint or different pathologies are generally sufficient. Blood tests such as infection markers are within the normal range in true frozen shoulder [12].

Treatment of adhesive capsulitis is either conservative or surgical. Conservative management includes oral medications, intra-articular injections, and physiotherapy. Studies have shown that rehabilitation is very effective in improving range of motion (ROM), reducing pain, enhancing function, and subsequently increasing physical level of activity. Various physiotherapy treatments commonly used with adhesive capsules include ice packs, heat packs, therapeutic ultrasound, low-level laser therapy, interferential currents, transcutaneous electrical nerve stimulation, pulsed electromagnetic field therapy, active and passive range of motion exercises, joint mobilization techniques, proprioceptive neuromuscular facilitation (PNF), supervised home exercise programs, and kinesio taping [13, 14].

The muscle energy technique is unique in its application as the client makes the first effort while the practitioner facilitates the process. One of the main uses of this method is to normalize the range of joints rather than increase flexibility. This technique can be used on any joint with a limited range of motion. The main effects of muscle energy technique can be explained by two different physiological processes: post-isometric relaxation (PIR) and Reciprocal Inhibition (RI) [15]. Kaltenborn mobilization assesses joint surface movements and applies them to treatment according to the MacConaill classification. This indicates that most articular surfaces have a convex interior and a concave exterior. Kaltenborn mobilizations involve the use of passive and sustained stretching techniques to improve joint mobility without compressing the surface of the joint. The forces applied to increase joint mobility are classified as I-III [16].

Several physical therapy treatment options are proposed for the treatment of adhesive capsulitis. Joint mobilizations are highly recommended to restore the mobility of the shoulder joint. Muscle energy techniques also improve the range of motion, however, comparison regarding the effectiveness of muscle energy techniques and Kaltenborn mobilizations is less and is based on limited methodological design. The objective of this study is to compare the effectiveness of muscle energy techniques (post isometrics relaxation) and Kaltenborn mobilizations on shoulder range of motion (ROM) in adhesive capsulitis.

2. Materials & Methods

A randomized control trial (CRT) was conducted at the outpatient physiotherapy department of the holy family hospital, Rawalpindi. The study was approved by the ethical review committee of Rawalpindi Medical University, Pakistan (142/IREF/RMU/2021). The sample size was calculated by the Open Epi tool [17]. The total sample size was 24 patients with 12 patients in each group, however, as it was a long-term follow-up study so additional 25 % of patients were added and a total of 30 patients were included in the study with 15 patients in each group. Convenient sampling was done to include the patients in this study and the allocation of subjects into different groups was done through the sealed envelope method. Patients who met the inclusion criteria and gave consent were included in the study. Those patients who fulfilled the criteria were included in this study and others were exempted. The duration of the study was six months from September 2021 to February 2022.Patients with idiopathic adhesive capsulitis, male & female patients between the age group 20-60 years having complained of shoulder pain for more than 3 months and restriction in more than 2 shoulder ranges were included. Patients with a language barrier, shoulder dislocations or fractures, labral tears, motor control deficit associated with a neurological disorder, and bony

deformities acquired or congenital in the glenohumeral joint were excluded from the study. Prior consent was taken from all the participants before inclusion in the study. 36 patients were screened out of which 30 patients met the inclusion criteria and were recruited into the study.

Group A received post-isometric relaxation of muscle energy technique with 3 repetitions (3 muscle contractions with 5-7 seconds each contraction) per set, 1 session per day, thrice a week for 4 weeks & Group B received 12 sessions of Kaltenborn mobilizations with 3 sessions per week for 4 weeks. Both groups received conventional therapy in the form of 10 min short wave diathermy, codman and ladder exercises. The shoulder range of motion was measured by a Universal Goniometer. The data was collected before the treatment and then after 2 and 4 weeks of treatment. Statistical Package for Social Sciences (SPSS) version 22 was used for the statistical analysis of data and results were presented in the form of tables and graphs. Shapiro-Wilk test was used to assess the normality of the data. The data was normally distributed so an independent sample t-test was used for between-group analysis and a paired t-test was used for within-group analysis. P-values of <0.05 were considered significant.

3. Results

Out of a total of 30 patients, 10 participants were male, and 20 were female. The comparison of the mean value of age in Group A is 49 yrs and in Group B is 52 yrs. Between groups analysis by independent sample t-test yielded p Value <0.05 showing that improvement in flexion and abduction range was more in the shoulder muscle energy technique group than Kaltenborn mobilization group. However,p- Value is >0.05 for external and internal rotation showing that both techniques are equally effective in improving these ranges. Between-group mean differences and within-group mean change scores are reported along with their 95% confidence intervals at baseline, after 2 weeks 4 weeks and 6 weeks. The null hypothesis for equality of change scores across groups was statistically tested.

Table 1 The comparison of the Muscle Energy Technique and Kaltenborn Mobilization is made on the measures of Shoulder ROM.

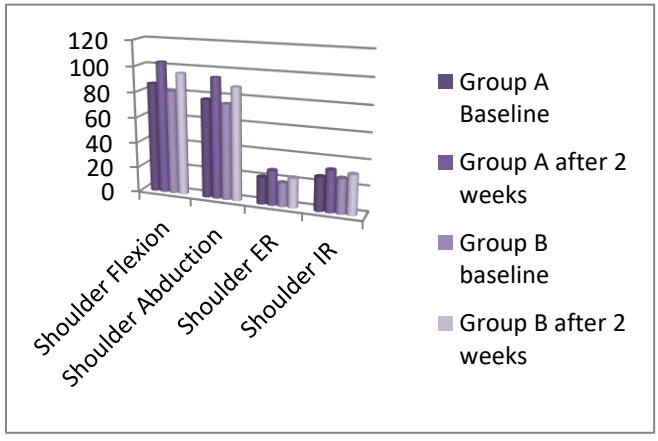
Variables	Time duration	Group A	Group B	p-value
		Mean ± SD	Mean ±SD	
Shoulder Flexion	At baseline	86.33 ±17.369	81.33 ±22.238	0.498
	After 2 weeks	103.33 ±16.868	95.67 ±21.865	0.291
	After 4 weeks	120.00 ±13.887	106.40 ±20.430	0.042
Shoulder Abduction	At baseline	77.33 ±21.784	75.00 ±20.354	0.764
	After 2 weeks	94.33 ±21.033	88.33 ±18.772	0.417
	After 4 weeks	111.33 ±15.864	98.87±16.754	0.046
Shoulder ER	At baseline	21.27 ±4.605	18.67 ±4.483	0.128
	After 2 weeks	27.27 ±5.203	23.33 ±4.880	0.042
	After 4 weeks	31.60 ±5.369	27.67 ±5.473	0.057
Shoulder IR	At baseline	26.73 ±8.040	27.33 ±7.566	0.835
	After 2 weeks	32.80 ±8.495	31.27 ±6.964	0.593
	After 4 weeks	37.07 ±8.852	35.13 ±6.865	0.5

Table 2 Repeated measure ANOVA showing changes in Means over the period

Variables	Groups	Mean ± SD	Mean ± SD	Mean ±SD	p Value
		Baseline	After 2 weeks	After 4 weeks	
Shoulder Flexion	Group A	86.33± 17.369	103.33± 16.868	120.00 ±13.887	<0.0001
	Group B	81.33 ± 22.238	95.67 ± 21.865	106.40± 20.430	<0.0001
Shoulder Abduction	Group A	77.33± 21.784	94.33± 21.033	111.33±15.864	<0.0001
	Group B	75.00± 20.354	88.33± 18.772	98.87± 16.754	<0.0001
Shoulder ER	Group A	21.27 ±(4.605	27.27± 5.203	31.60± 5.369	<0.0001
	Group B	18.67± 4.483	23.33 ± 4.880	27.67±5.473	<0.0001
Shoulder IR	Group A	26.73± 8.040	32.80± 8.495	37.07±8.852	<0.0001
	Group B	27.33± 7.566	31.27 ± 6.964	35.13±6.865	<0.0001

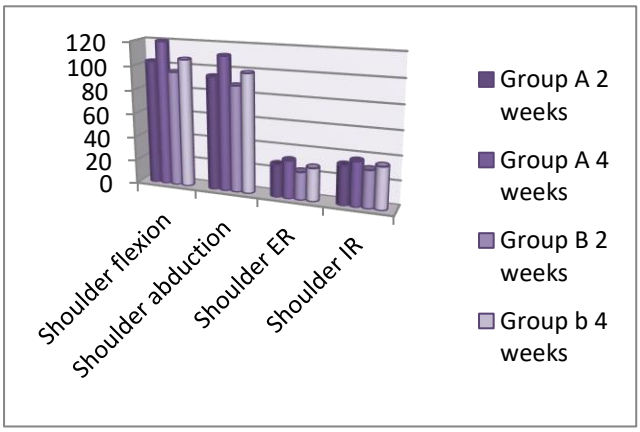
5. Discussion

The purpose of this study was to see the effectiveness of muscle energy technique and Kaltenborn mobilizations on shoulder range of motion in adhesive capsulitis. Group A showed significant changes in shoulder flexion and abduction range, which may be due to the application of the muscle energy technique that relaxes and improves biomechanics and thus results in improved mobility. Group B also showed changes in these scores. The results of this study can be compared with Edrish Saifee and colleges.



Graph-2 Comparison of Muscle Energy Technique and Kaltenborn Mobilization is made on the measures of Shoulder ROM after 2 and 4 weeks of treatment.

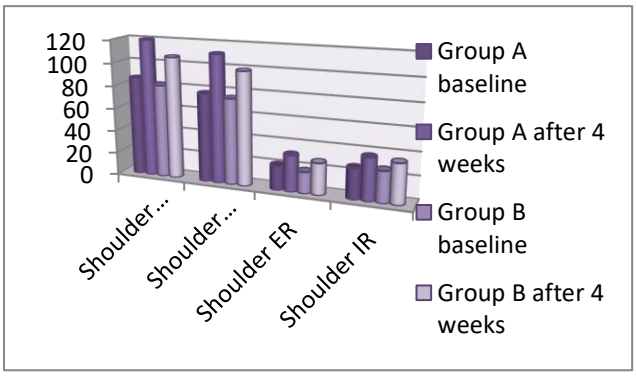
Edrish Saifee and colleagues conducted a study on the frozen shoulder in which they compared the effectiveness of the muscle energy technique with conventional therapy on abduction and external rotation ROM and concluded that the muscle energy technique is more effective in increasing both these ranges of Motion [18]. In this study, the effectiveness of the muscle energy technique on shoulder Flexion and internal rotation is also shown.



Graph-3 Comparison of Muscle Energy Technique and Kaltenborn Mobilization is made on the measures of Shoulder ROM after 4 weeks of treatment.

A study on comparison of Maitland and Kaltenborn Mobilizations (KM) techniques for improving shoulder pain and ROM in adhesive capsulitis patients showed that both groups exhibited significant decreases in pain post-intervention. A total of 20 subjects participated in their study The ROM of internal and external rotation increased significantly post-intervention in both groups. However, there was no significant difference between the groups concerning pain improvement or ROM [19]. The results of this study can also be compared with

Suri and colleges. Suri and colleagues conducted a study on frozen shoulder in which they compared the muscle energy technique with Maitland techniques and they concluded that the muscle energy technique is more effective for control of pain while Maitland mobilizations are effective in improving joint ROM[20]. Sumit Ragav and colleagues conducted a study on the effectiveness of Mulligan MWM and KM techniques on the end range of motion in adhesive capsulitis and concluded that the effect of the Mulligan MWM technique and Kaltenborn mobilization technique was significant in reducing pain and improving the end range of motion on comparison Mulligan 'MWM' was more effective than Kaltenborn mobilization technique [21]. However, another study on the effectiveness of Kaltnborn mobilizations by Alisha Fernandes showed that the Group that received KM was more effective in improving shoulder ROM, reducing pain & disability than Mulligan's MWM after 2 weeks of intervention [22].



Graph-4 The p-value for Flexion and abduction For Group A is <0.05 while for External and Internal rotation is >0.05.

Shakil and colleagues conducted a study on adhesive capsulitis to compare the effects of Kaltenborn techniques and general scapular mobilization and they concluded that Kaltenborn mobilization is more effective when compared with general scapular mobilization [23].In this study, a comparison was made between the muscle energy technique and Kaltenborn mobilizations. Syed Muhammad Hammad and colleagues conducted a randomized control trial on patients of adhesive capsulitis regarding the effectiveness of Kaltenborn mobilizations along with thermotherapy and thermotherapy alone and concluded that Kaltenborn mobilizations along with thermotherapy have more beneficial effects than thermotherapy alone [24].

5. Conclusion

The muscle energy technique is more effective in improving flexion and abduction ROM than Kaltenborn mobilizations in adhesive capsulitis. However, for External & internal Rotation, both are equally effective.

CONFLICTS OF INTEREST- None

Financial support: None to report.
Potential competing interests: None to report
Contributions:
M.U, A.A, N.K, M.M, H.R - Conception of study
M.U, A.A, N.K, M.M, H.R - Experimentation/Study Conduction
M.U, A.A, M.M, - Analysis/Interpretation/Discussion
A.A, N.K, M.M, - Manuscript Writing
M.U - Critical Review
M.U, A.A, N.K, M.M, H.R - Facilitation and Material analysis

References

[1] Arsh A, Ullah I. Shoulder Pain and Disability Among Post Mastectomy Patients. Physikalische Medizin, Rehabilitationsmedizin, Kurortmedizin. 2019;29(03):151-5.
[2] Ebrahimzadeh MH, Moradi A, Bidgoli HF, Zarei B. The relationship between depression or anxiety symptoms and objective and subjective symptoms of patients with frozen shoulder. International journal of preventive medicine. 2019;10.
[3] Bagheri F, Ebrahimzadeh MH, Moradi A, Bidgoli HF. Factors associated with pain, disability and quality of life in patients suffering from frozen shoulder. Archives of Bone and Joint Surgery. 2016;4(3):243.
[4] Guyver P, Bruce D, Rees J. Frozen shoulder–A stiff problem that requires a flexible approach. Maturitas. 2014;78(1):11-6.
[5] Brenner H. A Case Report: Adhesive Capsulitis and Physical Therapy Intervention. 2019.
[6] Uppal HS, Evans JP, Smith C. Frozen shoulder: a systematic review of therapeutic options. World journal of orthopaedics. 2015;6(2):263.
[7] Papalexis N, Parmeggiani A, Facchini G, Miceli M, Carbone G, Cavallo M, et al. Current concepts in the diagnosis and treatment of adhesive capsulitis: Role of diagnostic imaging and ultrasound-guided interventional procedures. La radiologia medica. 2022;127(12):1390-9.
[8] Paul A, Rajkumar JS, Peter S, Lambert L. Effectiveness of sustained stretching of the inferior capsule in the management of a frozen shoulder. Clinical Orthopaedics and Related Research®. 2014;472(7):2262-8.
[9] Ryan V, Brown H, Minns Lowe CJ, Lewis JS. The pathophysiology associated with primary (idiopathic) frozen

shoulder: A systematic review. BMC musculoskeletal disorders. 2016;17(1):1-21.
[10] Tang H-y, Wei W, Yu T, Zhao Y. Physical therapy for the treatment of frozen shoulder: A protocol for a systematic review of a randomized controlled trial. Medicine. 2019;98(32).
[11] Rai S, Kashid M, Chakrabarty B, Upreti V, Shaki O. Is it necessary to screen patient with adhesive capsulitis of shoulder for diabetes mellitus? Journal of family medicine and primary care. 2019;8(9):2927.
[12] Jason JI, Ganesh Sundaram S, Vengata Subramani M. Physiotherapy interventions for adhesive capsulitis of shoulder: A systematic review. Int j physiother Res. 2015;3(6):1318-25.
[13] Tedla JS, Sangadala DR. Proprioceptive neuromuscular facilitation techniques in adhesive capsulitis: a systematic review and meta-analysis. Journal of musculoskeletal & neuronal interactions. 2019;19(4):482.
[14] Page MJ, Green S, Kramer S, Johnston RV, McBain B, Buchbinder R. Electrotherapy modalities for adhesive capsulitis (frozen shoulder). Cochrane Database of Systematic Reviews. 2014(10).
[15] Gibbon J. Introduction to muscle energy technique. International Therapist. 2011;97:26-8.
[16] Sunderamuthy K, Govind S, Wah YC, Singh K. Maitland Vs Kaltenborn Approach in Improving Pain and External Rotation in Adhesive Capsulitis. AGE. 2019;50(55):56-60.
[17] Sharma SP, Bærheim A, Moe-Nilssen R, Kvåle A. Adhesive capsulitis of the shoulder, treatment with corticosteroid, corticosteroid with distension or treatment-as-usual; a randomised controlled trial in primary care. BMC musculoskeletal disorders. 2016;17(1):1-10.
[18] Contractor ES, Agnihotri DS, Patel RM. Effect of spencer muscle energy technique on pain and functional disability in cases of adhesive capsulitis of shoulder joint. IAIM. 2016;3(8):126-31.
[19] Do Moon G, Lim JY, Da YK, Kim TH. Comparison of Maitland and Kaltenborn mobilization techniques for improving shoulder pain and range of motion in frozen shoulders. Journal of physical therapy science. 2015;27(5):1391-5.
[20] Suri SA, Anand M. Comparative study on the effectiveness of Maitland mobilization technique versus muscle energy technique in treatment of shoulder adhesive capsulitis. Indian Journal of Physiotherapy & Occupational Therapy-An International Journal. 2013;7(4):1-6.
[21] Ragav S, Singh A. Comparison of effectiveness of mulligan 'MWM'technique versus kaltenborn mobilization technique on pain and end range of motion in patients with adhesive capsulitis of shoulder joint: A randomized controlled trial. Journal of Exercise Science & Physiotherapy Vol. 2019;15(1).
[22] Fernandes A, Shah L, Mohan A. Effectiveness of Kaltenborn Mobilization Technique Versus Mulligan's MWM in Patients with Adhesive Capsulitis of Shoulder. Indian Journal of Physiotherapy & Occupational Therapy. 2020;14(3).
[23] Shakil-ur-Rehman S. Comparison between Kaltenborn and general scapular mobilization in Adhesive capsulitis Patients. Journal of Rawalpindi Medical College. 2012;16(2):121-2.
[24] Hammad SM, Arsh A, Iqbal M, Khan W, Shah A. Comparing the effectiveness of kaltenborn mobilization with thermotherapy versus kaltenborn mobilization alone in patients with frozen shoulder [adhesive capsulitis]: A randomized control trial. J Pak Med Assoc. 2019;69:1421-4.