

## Comparing the effectiveness of kaltenborn mobilization with thermotherapy versus kaltenborn mobilization alone in patients with frozen shoulder [adhesive capsulitis]: A randomized control trial

Syed Muhammad Hammad,<sup>1</sup> Aatik Arsh,<sup>2</sup> Muhammad Iqbal,<sup>3</sup> Waleed Khan,<sup>4</sup> Bilal,<sup>5</sup> Arif Shah<sup>6</sup>

### Abstract

**Objective:** To compare the effectiveness of Kaltenborn mobilisation combined with thermotherapy versus Kaltenborn mobilisation alone in patients with adhesive capsulitis.

**Methods:** The randomised controlled trial was conducted at the Hayatabad Medical Complex and Habib Physiotherapy Complex, Peshawar, Pakistan, from January to June 2017, and comprised patients with adhesive capsulitis. The subjects were randomised into two groups. Group A received Kaltenborn mobilisation with thermotherapy, while group B received Kaltenborn mobilisation alone. Shoulder pain and disability index was used to assess the effectiveness of the intervention. SPSS 20 was used for data analysis.

**Results:** Of the 30 patients, 15(50%) were in each of the two groups. Baseline characteristics were not significantly different between the groups ( $p>0.05$ ). Pre- and post-treatment Shoulder pain and disability index score of group A was  $75.27\pm 5.738$  and  $12.33\pm 1.988$  respectively ( $p<0.05$ ). Corresponding scores in group B were  $73.67\pm 6.137$  and  $64.13\pm 5$  ( $p<0.05$ ). Group A showed greater reduction in disability compared to group B ( $p<0.05$ ).

**Conclusion:** Kaltenborn mobilisation combined with thermotherapy was found to be more effective than Kaltenborn mobilisation alone in patients with adhesive capsulitis.

**Keywords:** Adhesive capsulitis, Mobilisation, Pain, Physiotherapy, Range of Motion. (JPMA 69: 1421; 2019)

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### Introduction

Adhesive capsulitis (AC), commonly known as frozen shoulder, is a condition of uncertain aetiology characterised by pain and a progressive loss of both active and passive range of motions (ROMs).<sup>1,2</sup> Globally, the overall AC prevalence ranges 23-30%.<sup>3</sup> AC is an economic burden on the healthcare services due to high prevalence, chronic characteristics and range of therapeutic interventions.<sup>4</sup> The annual financial burden of shoulder pain management in the United States has been estimated to be \$3 billion.<sup>2</sup>

Due to reports of high AC prevalence in general population, in recent years, physical therapy (PT) treatment of AC has received much attention.<sup>5</sup> There are different physical therapy modalities available for treating AC patients, but high-quality randomised controlled trials (RCTs) and systematic reviews supported the effectiveness of joint mobilisation in AC patients and thus reducing pain and improving

shoulder joint mobility.<sup>5</sup> Various grades of mobilisations, such as mid-range and end-range mobilisations, are suggested by Kaltenborn to improve joint mobility and to reduce pain.<sup>6</sup> Jing-lan Yang et al. reported that Kaltenborn mobilisation (KM) and Mulligan mobilisation with movement (MWM) appeared to be more effective than Maitland mobilisation (MM) in AC patients.<sup>6</sup> Vermeulen HM et al. reported that KM (end-range) was more effective in increasing lenohumeral mobility in AC patients.<sup>7</sup> Several researchers have suggested that steroid therapy, thermotherapy and manual mobilisation techniques are effective in AC management.<sup>1</sup> Bal et al. reported that thermotherapy applied before and after shoulder exercises was more effective in increasing glenohumeral mobility in AC patients.<sup>8</sup>

Several treatment options are in use in AC management, but any one optimal treatment intervention has not been suggested. There are studies reporting effectiveness of KM and thermotherapy in AC treatment. However there are limited studies in the literature which compare the effectiveness of KM alone versus KM with thermotherapy.<sup>5-7,9-11</sup>

The current study was planned to compare the effectiveness of KM alone versus KM and thermotherapy for pain, mobility and functional ability of AC patients.

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<sup>1</sup>School of Health Sciences, Peshawar, <sup>2,3</sup>Department of Physiotherapist, Paraplegic Centre Peshawar, <sup>4</sup>Sarhad University of Sciences and Information Sciences, Peshawar, <sup>5</sup>North West General Hospital & Research Centre, Peshawar, <sup>6</sup>Hafeez Institute of Medical Sciences, Peshawar.

Correspondence: Aatik Arsh. Email: aatikarshkmu@yahoo.com

## Patients and Methods

The RCT was conducted at the Physiotherapy Department of Hayatabad Medical Complex (HMC) and Habib Physiotherapy Complex (HPC), Peshawar, Pakistan, from January to June 2017.

After obtaining ethical approval from the review committee of Mahboob School of Physiotherapy, Peshawar, the sample was raised by enrolling patients regardless of age and gender with idiopathic AC having capsular pattern for at least 4 months. Those excluded were patients using oral steroids for more than 3 months or using intra-articular injection of steroids, having secondary AC due to recent fracture or surgery in and around the shoulder joint, any musculoskeletal pathology in the upper limb other than AC and malignancy.

A trained physical therapist with Masters in Orthopaedic manual therapy or musculoskeletal physical therapy diagnosed the patients on the basis of through examination. Patients with painful and limited active and passive glenohumeral ROM  $\geq 25\%$  in capsular pattern (external rotation then abduction and then flexion) for at least 4 months or more were included. Physical tests such as Hawkins-Kennedy test, empty can tests etc., and radiographs were used to exclude other shoulder conditions.

Shoulder pain and disability index (SPADI) was used at baseline and post-treatment to evaluate pain and disability of AC patients. SPADI questionnaire, which is the easiest and the quickest to administer, detects responsiveness to change. It is a disease-specific instrument and self-administered questionnaire which measures pain and disability due to shoulder pain. Cronbach's alpha value of SPADI is 0.94 while internal consistency is 0.92.<sup>12</sup>

SPADI questions were asked in the local language as majority of the subjects preferred to interact in Pashto language.

In the current single-blind RCT, patients were blinded to the method being applied. Envelopes containing information sheets and data collection tools were equally numbered with half labelled as group A, the experimental group, and the other half as group B, which was the control group. These labelled papers, folded in such a manner that the labelling was not visible, were placed in a container. Patients who fulfilled the eligibility criteria and were furnished written consent to participate were requested to pick an envelope for getting them assigned to either of the groups.

Data was collected through the standard SPADI questionnaire. Evaluation of pain as well as disability was done pre-treatment and post-treatment using SPADI. Data obtained was coded to ensure confidentiality.

The sample size was calculated according to Gehan's method, considering 30% improvement.<sup>13-15</sup>

In group A, thermotherapy (TT), like (hot pack/ microwave/ shortwave diathermy) was applied for 15 minutes at continuous mode in supine position before the treatment 3 times/week on alternative days for a period of 3 weeks.

A trained physical therapist applied KM after TT; 3 sets (10 glides per set), 3 times/week on alternative days for a period of 3 weeks. To increase ROM at the shoulder joint, posterior glide was applied in supine lying position for internal rotation; inferior glide for abduction, and anterior glide in prone lying position for external rotation.

In group B, KM was applied without TT; 3 sets (10 glides per set), 3 times/week on alternative days for a period of 3 weeks.

Data was analysed using SPSS 23. Descriptive statistics were expressed as frequencies and percentages for variables. Normality of the data was checked using Shapiro-Wilk test. For the comparison of variables, independent t-test and paired t-test were used.

## Results

Of the 30 patients, there were 15(50%) in each of the two groups. There was no significant difference between the groups with respect to age, gender distribution and baseline SPADI scores ( $p > 0.05$  each) (Table-1).

Table-1: Baseline characteristics of both groups in terms of age and gender.

Variable	Group A (n=15)	Group B (n=15)	P-value
Age (Mean $\pm$ S.D)	48.60 $\pm$ 9.701	43.13 $\pm$ 8.634	0.114
Gender			
Male	7 (46.7%)	8 (53.3%)	0.715
Female	8 (53.3%)	7 (46.7%)	

SD: Standard deviation.

Table-2: Paired t-test for pre and post SPADI of both groups.

	Pre-treatment (SPADI score)	Post-treatment (SPADI score)	P-Value
Group A (Mean $\pm$ S.D) (n= 15)	75.27 $\pm$ 5.738	12.33 $\pm$ 1.988	0.000
Group B (Mean $\pm$ S.D) (n= 15)	73.67 $\pm$ 6.137	64.13 $\pm$ 5.866	0.000

SPADI: Shoulder pain and disability index

SD: Standard deviation.

Pre- and post-treatment SPADI score of group A were  $75.27 \pm 5.738$  and  $12.33 \pm 1.988$  respectively ( $p < 0.001$ ), while corresponding scores in group B were  $73.67 \pm 6.137$  and  $64.13 \pm 5$  ( $p < 0.001$ ) (Table-2). Group A showed greater reduction in disability compared to group B ( $p < 0.005$ ).

## Discussion

The findings indicated that KM with TT and KM without TT were both effective in reducing pain and disability in AC patients.

An earlier study with similar subject characteristics showed no significant difference in age and gender distribution when comparing patients affected in the right shoulder versus those affected in the left shoulder ( $p > 0.05$ ), but the combination of PT, exercise and manual techniques was effective in treating AC.<sup>16</sup>

One study reported that the application of posterior glide improved external rotation based on the "capsular constraint mechanism," while another study argued that posterior gliding was more efficient than anterior gliding for improving external ROM among AC patients.<sup>17</sup>

A study compared the effects of high-grade mobilisation techniques (HGMT) and low-grade mobilisation techniques (LGMT) in AC patients. The study showed that HGMT appeared to be more effective for shoulder ROM improvement and malfunction reduction than LGMT in AC subjects.<sup>11</sup> The study also showed the effectiveness of KM which was also the objective of the current study.

In another study, post-interventional analysis showed significant improvements in all outcome measures ( $p < 0.001$ ). Intra-group analysis showed no significant difference between two groups ( $p > 0.05$ ). Mean visual analogue score (VAS) and SPADI difference was 2.23 and 22 in general exercise and manual therapy group and 2.33 and 23 in general exercise group respectively. The study concluded that both exercises with manual therapy and exercises alone were equally effective in the management of AC of the shoulder joint.<sup>9</sup>

A study on comparison of Maitland and KM techniques for improving shoulder pain and ROM in AC patients showed that both groups exhibited significant decrease in pain post-intervention. The ROM of internal and external rotation increased significantly post-intervention in both the groups. However, there was no significant difference between the groups with respect to pain improvement or ROM.<sup>10</sup>

One study on comparison of the early response to two methods of rehabilitation in AC patients revealed that

mean age [ $56.0 \pm 8.6$  (43-82) years], duration of symptoms, ratio of sex and stages according to Reeves were similar in the two treatment groups. Comparison of the initial pain scores and passive ROM values between the two groups revealed no statistical significance ( $p > 0.05$ ) but the Cyriax method of rehabilitation provided a faster and better response than the conventional PT methods in the early phase of treatment.<sup>18</sup>

A study to determine whether the addition of deep or superficial heating to stretching produced better clinical outcomes than stretching alone in the management of AC patients showed that with the addition of deep heating to stretching exercises produced greater improvement in pain relief, and resulted in better performance in the activities of daily living and in ROM than did superficial heating.<sup>19</sup>

A systematic review to determine the effectiveness of corticosteroid injections compared with TT interventions suggested that corticosteroid injections had greater effect in the short term compared to TT interventions.<sup>20</sup>

## Conclusion

Both treatment strategies were found to be effective in alleviating pain and disability, but KM with TT was better than KM alone in the treatment of AC patients.

## Limitations

The trial was not registered in a trial registration centre due to non-availability of a regulatory authority for trials related to Physical Therapy. Therefore no trial number was obtained. The certificate of the institution's IRB has taken the responsibility of the accuracy of the trial.

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**Conflict of Interest:** None.

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## References

1. Favejee M, Huisstede B, Koes B. Frozen shoulder: the effectiveness of conservative and surgical interventions-systematic review. *Br J Sports Med.* 2011;45:49-56.
2. Rangan A, Goodchild L, Gibson J, Brownson P, Thomas M, Rees J, et al. Frozen shoulder. *Shoulder Elbow.* 2015; 7:299-307.
3. Ahmad S, Rafi MS, Siddiqui IA, Hamidi K, Faruq NM. The Frequency of Adhesive Capsulitis in Diabetes Mellitus Patients. *Pak J Rehab.* 2012;1.
4. Robinson C, Seah KM, Chee Y, Hindle P, Murray I. Frozen shoulder. *J Bone Joint Surg Br.* 2012;94:1-9.
5. Celik D. Comparison of the outcomes of two different exercise programs on frozen shoulder. *Acta OrthopTraumatolTurc.* 2010;44:285-92.
6. Yang JL, Chang CW, Chen SY, Wang SF, Lin JJ. Mobilization techniques in subjects with frozen shoulder syndrome: randomized multiple-treatment trial. *Phys Ther.* 2007;87:1307-15.

7. Vermeulen HM, Rozing PM, Obermann WR, le Cessie S, Vliet Vlieland TP. End-range mobilization techniques in adhesive capsulitis of the shoulder joint: a multiple-subject case report. *Phys Ther.* 2006; 86:355-68.
  8. Bal A, Eksioğlu E, Gulec B, Aydog E, Gurcay E, Cakci A. Effectiveness of corticosteroid injection in adhesive capsulitis. *Clin Rehabil.* 2008;22:503-12.
  9. Ali SA, Khan M. Comparison for efficacy of general exercises with and without mobilization therapy for the management of adhesive capsulitis of shoulder-An interventional study. *Pak J Med Sci.* 2015;31:1372.
  10. Do Moon G, Lim JY, Da Yeon Kim THK. Comparison of Maitland and Kaltenborn mobilization techniques for improving shoulder pain and range of motion in frozen shoulders. *J Phys Ther Sci.* 2015;27:1391.
  11. Vermeulen HM, Rozing PM, Obermann WR, le Cessie S, Vlieland TPV. Comparison of High-Grade and Low-Grade Mobilization Techniques in the Management of Adhesive Capsulitis of the Shoulder: Randomized Controlled Trial. *Phys Ther.* 2006; 86:355-68.
  - 12. Luque-Suarez A, Rondon-Ramos A, Fernandez-Sanchez M, Roach KE, Morales-Asencio JM. Spanish version of SPADI (shoulder pain and disability index) in musculoskeletal shoulder pain: a new 10-items version after confirmatory factor analysis. *Health Qual Life Outcomes.* 2016;14:32.
  13. Gehan EA. The determination of the number of patients required in a preliminary and a follow-up trial of a new chemotherapeutic agent. *J Chronic Dis.* 1961;13:346-53.
  14. StatTools : Sample Size for Phase II Study (Gehan's Procedure) Explained and Tables. [Online][Cited 2016 Dec 21]. Available from: URL: [http://www.obg.cuhk.edu.hk/ResearchSupport/StatTools/SSizGehan\\_Exp.php](http://www.obg.cuhk.edu.hk/ResearchSupport/StatTools/SSizGehan_Exp.php)
  15. StatsToDo : Phase II Study Explained.[Online] [Cited 2016 Dec 21]. Available from: URL: [https://www.statstodo.com/PhaseII\\_Exp.php](https://www.statstodo.com/PhaseII_Exp.php)
  16. Alptekin HK, Aydın T, İfrazoğlu ES, Alkan M. Evaluating the effectiveness of frozen shoulder treatment on the right and left sides. *J Phys Ther Sci.* 2016;28:207.
  17. Roubal PJ, Dobritt D, Placzek JD. Glenohumeral gliding manipulation following interscalene brachial plexus block in patients with adhesive capsulitis. *J Orthop Sports Phys Ther.* 1996;24:66-77.
  18. Guler-Uysal F, Kozanoglu E. Comparison of the early response to two methods of rehabilitation in adhesive capsulitis. *Swiss Med Wkly.* 2004;134:353-8.
  19. Leung MS, Cheing GL. Effects of deep and superficial heating in the management of frozen shoulder. *J Rehabil Med.* 2008; 40:145-50.
  20. Blanchard V, Barr S, Cerisola FL. The effectiveness of corticosteroid injections compared with physiotherapeutic interventions for adhesive capsulitis: a systematic review. *Physiotherapy.* 2010; 96:95-107.
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