Original Study

Effectiveness of Kaltenborn Mobilization Technique Versus Mulligan's MWM in Patients with Adhesive Capsulitis of Shoulder

Alisha Fernandes[1], LakshitaShah[2], AarthiMohan

[1]MPT (Musculoskeletal and Sports), In-charge Physiotherapist, SDM Institute of Ayurveda and Hospital, Bangalore, [2]Post graduate student in paediatrics (MPT), SDM College of Physiotherapy, [3]MPT (Musculoskeletal and Sports), Physiotherapist, Australia.

Abstract

Background and Objectives: Adhesive capsulitis(AC) is a condition commonly affecting the shoulder with 2% prevalence, causing insidious pain and restriction of active as well as passive gleno-humeral movement. This study compares the effectiveness of Kaltenborn mobilization versus Mulligan's MWM technique for AC of the shoulder.

Method: 56 participants were randomly allocated in Group M and Group K for the shoulder. SPADI and shoulder ROM were used as outcome measures. These were recorded at baseline and at the end of 2 weeks post treatment.

Results: Statistically significant ($p<0.05$) improvements were found in Group K with respect to SPADI scores, while the same was observed in ROM although not statistically significant.

Conclusion: Pain and disability along with ROM improved in both groups.

***Keywords**: Adhesive capsulitis, Mulligan, MWM, Kaltenborn, SPADI.*

Introduction

Adhesive Capsulitis (AC) is a condition characterized by significant restriction of active and passive shoulder motion that occurs in the absence of a known intrinsic shoulder disorder[1]. The Kaltenborn method places an emphasis on translatory linear joint , the convex-concave rule, 3-dimensional pre-positioning for the joint movement, protecting adjacent joints during procedures, self treatment and ergonomic principles applied to protect the therapist[2].Mulligan's MWM is used in the management of musculoskeletal pain and passively involves the application of a sustained glide to a joint while a concurrent movement is actively performed by the patient.[3] This study compares the efficacy of Kaltenborn method with movement (MWM) techniques in the management of AC of the shoulder.

Corresponding author
Alisha Fernandes MPT (Musculoskeletal and Sports), In-charge Physiotherapist, SDM Institute of Ayurveda and Hospital, Bangalore.
E-mail: alishafdes@gmail.com

Objective of the Study

Effectiveness of Kaltenborn mobilization versus Mulligan's MWM in AC of shoulder for 2 weeks on pain, ROM & functional impairment.

Material and Method

Ethical clearance was obtained from S.D.M. College of Medical Science and Hospital, Dharwad. Subject's affected shoulder was evaluated & allocated into Group K or M.

Treatment given for 3 sessions/ week for 2 weeks. The outcome were: shoulder ROM Pain,Disability Index (SPADI) at baseline & post 2 weeks of intervention.

Inclusion criteria:

Subjects diagnosed & referred by an Orthopedician with primary AC of shoulder, having shoulder ROM limitation of 25% or more compared to the non-involved shoulder, 40 - 70 years of either.

Exclusion criteria:

Musculoskeletal pathology in upper limb other than AC, recent rotator cuff injuries, Neurological conditions affecting the shoulder, Physiotherapy treatment/on corticosteroid injections for the affected shoulder.

Study design, duration A Prospective Randomized Study, 1 year.

Sample size: 28 subjects were allocated randomly in each group.

Procedure:

All the subjects with AC were screened for inclusion & exclusion criteria after which written consent was taken. Demographic data & baseline data was recorded.

Intervention

GROUP K:

<u>Shoulder Traction Technique (restricted flexion)</u>:

Grade II/III traction was sustained for 30 seconds; repeated 20 times with a gap of 10 seconds.

<u>Shoulder Caudal Glide (restricted Abduction)</u>:

Grade II/III distraction with caudal glide was given & sustained for 30 seconds; repeated 20 times with gap of 10 seconds.

<u>Shoulder Ventral Glide (for restricted external rotation)</u>:

Grade II/III ventral glide was performed with shoulder in end ROM in extension & external rotation sustained for 30 seconds; repeated 20 times with gap of 10 seconds.

(1)

Kaltenborn Mobilization (1) Ventral glide

Shoulder Dorsal Glide (for restricted internal rotation):

Grade II/III dorsal gliding movement to the joint was given & sustained for 30 seconds; repeated 20 times with a gap of 10 seconds[2].

GROUP M:

To improve shoulder abduction, flexion & rotations were performed on the involved shoulder as described by Mulligan[3]. 3 sets of painless glides of 10 repetitions were given, with 1 minute rest between sets.

Subjects were asked not to perform home exercises to exclude the influence of adherence to the exercise protocol.[4]

(2)

Mulligan Mobilization :(2) Shoulder abduction

Result

Table 1: Depicts distribution of study subjects by gender, age, duration.

DATA	GROUP M	GROUP K
Gender	Male=19(67.86%)	Male=14(50.00%)
Age(mean±SD)	Female=9(32.14%)	Female=14(50.00%)
Duration	3.29±2.22	3.73±2.07
Affected side shoulder	Left= 17(60.71%)	Left=20(71.43%)
	Right=11(39.29%)	Right=08(28.57%)

Table 2: Depicts pre and post scores of Group M

DATA	GROUP M		
	pre test ;mean ± SD	post test; mean ± SD	mean change; mean± SD
% of pain score	59.00± 8.17	36.93± 5.88	22.07± 4.66
% of disability scores	48.39± 12.18	27.95± 9.50	29.86± 2.27
% of SPADI scores	53.9± 3.49	32.07± 0.90	21.84± 8.26
Flexion ROM scores	104.8 ±22.05	126.61± 14.97	21.79 ±12.26
Abduction scores	86.6± 15.52	1.43± 8.35	24.82± 4.94
Internal rotation scores	37.14 ±20.34	5.6 ±14.91	4.46± 11.41
External rotation scores	30.61± 14.87	50.54± 2.62	14.42 ±9.14

Table 3: Depicts pre and post scores of Group K

DATA	GROUP K		
	pre test; mean SD	post test; mean SD	mean change; mean SD
% of pain score	66.50± 12.93	34.94± 11.38	31.56 ±12.56
% of disability scores	55.97± 13.69	26.11 ± 9.27	29.86 ± 2.27
% of SPADI scores	58.70 ±11.04	30.42 ± 0.11	28.29 ±11.06
Flexion ROM scores	93.36±26.05	25.00± 2.52	28.68 ± 7.23
Abduction scores	8.96± 20.70	107.14± 18.53	25.18 ±18.08
Internal rotation scores	32.32± 14.69	49.46 ± 4.42	17.14 ±8.44
External rotation scores	37.68 ± 22.01	50.54 21.62±	12.86± 11.74

Table 4: Intergroup Comparison using Independent t-test

DATA	PRE-TEST		POST-TEST	
	Group M	Group K	Group M	Group K
% of pain score	59.00± 8.17	66.50±12.93	36.93± 15.88	34.94± 11.38
% of disability scores	48.39± 12.18	55.97±13.69	27.95± 9.50	26.11 ± 9.27
% of SPADI scores	53.91± 13.49	58.70±11.04	32.07± 10.90	30.42 ± 10.11
Flexion ROM scores	104.8 ±22.05	93.36±26.05	126.61± 14.97	125.00±21.52
Abduction scores	86.61± 15.52	81.96±20.70	111.43 ±18.35	107.14±18.53
Internal rotation scores	37.14 ±20.34	32.32±14.69	51.61 ± 14.91	49.46 ± 14.42
External rotation scores	30.61± 14.87	37.68±22.01	44.82 ± 14.43	50.54 ± 21.62
Mean	60.06286	60.91857	61.63	60.51571
SD	24.70953	20.38827	37.23256	36.4445

There was no significant difference between Group M & Group K (t=0.05, p=47) post intervention, despite Group M (61.63±37.2) attaining higher scores than Group K (60.5±36.4).

Discussion

The results indicate that Kaltenborn mobilization when administered for 6 sessions over a period of 2 weeks was effective in improving ROM deficits which are commonly found in patients with AC. Although the higher number of male subjects with AC compared to female subjects is in contrast to general notion that there exists a higher prevalence of AC in female population, our study result is consistent with findings of Balci N et al.[5]

Study suggests AC is common in people aged 51 years &above in agreement with previous studies which have found AC to be uncommon before 40 years of age while its incidence increases until 60 years, peaks at 56 & then plateaus.[6,7] In the present study, age distribution showed no statistical difference in groups, depicting homogeneity of subjects.

A majority of the subjects who reported pain and movement restriction were in 1st or 2ndphase of AC. Homogeneity of duration of symptoms was observed, with similar findings byRauoof MA et al.[8]

Comparing the 2 groups, a greater number of subjects affected with AC have left shoulder affected more than right. A study noted that non-dominant shoulder is more frequently affected.[6]

On analysis, both groups showed significant reduction of pain(<0.05), while comparison of painscores between groups following 2 weeks of intervention, showed Group K with significantly higher improvement(10.05%). The effect size of the post treatment scores (between both groups) for pain in present study was found to be 0.0718 & for SPADI was found to be 1.62. For Cohen's *d*, effect size of 0.2 - 0.3 might be smaller, around 0.5 medium effect and 0.8 to infinity, a large effect.[9]

Joint motion maintains extensibility & tensile strength of joint & surrounding structures which reduces pain. Joint mobilization restores joint mobility &facilitate proper biomechanics of involved tissues. There are two rationales proposed for joint mobilization - neurophysiologic & biomechanical. The former is based on stimulation of peripheral mechanoreceptors & inhibition of nociceptors. Evidence suggests that stimulation of peripheral mechanoreceptors blocks transmission of pain to central nervous system.[10]Traction often relieves pain [11] & this has been part of the mobilization techniques used in Group K, presumably leading to higher improvement seen in this group. Stimulation of mechanoreceptors by distraction & small-amplitude oscillatory movements may also inhibit transmission of painful stimuli at spinal cord or brain stem levels.[12,13]

Disability scores also improved significantly ($p< 0.05$) in both groups individually & comparison between groups showed Group K with significantly higher improvement in scores with $p<0.05$, leading us to assume that it may have been brought about by reduction in pain & improvement in ROM, facilitating subjects to perform their ADL with better ease in agreement with Shaffer et al.[14]

Small-amplitude distraction or gliding movements of joint are utilized to cause synovial fluid motion, responsible for nutrition to avascular portions of the articular cartilage & intra-articular fibrocartilage which helps sustain nutrient exchange & consequently prevent painful and degenerating effects of stasis when a joint is painful & cannot move through ROM.[15]

The same was also reflected in the Total SPADI scores , showing significant change in the pain & disability (Total) scores ($p < 0.05$) between both groups, but Group K showed 7.67 % better results than Group M.

Improved flexion scores in both groups were seen on comparing pre & post-treatment values. Group K showed higher improvement than Group M. Grade III traction mobilization at the point of restriction increases joint mobility mainly in the pre-positioned direction.[11]This maneuver was used in treating the restriction in flexion for subjects in Group K of our study.

Backing up this theory is, a cadaver study done to analyze humeral head displacement while performing an axial distraction mobilization of GH joint, which stated that end range distraction may be more effective in gaining mobility of GH joint.[16]Manske R C et al [17]observed that lengthening of the posterior shoulder structures by posterior shoulder joint mobilization techniques permits humeral head to glide in appropriate direction, thus allowing normal GH arthro-kinematics. A study by Ludewig P M & Cook T M [18] also found that forward translation of humeral head limits shoulder movement along withcausing pain. The MWM technique applied in our study in Group M utilized a posterior directed glide, which hence leads us to speculate whether this led to increasing the flexion ROM in the said Group.

In present study, shoulder abduction ROM also improved, where higher improvement was seen in Group K. Our abduction procedure in Group K involved using a caudal glide applied at the end of available range for treating restricted shoulder abduction.

Hsu et al[16] showed that a caudal glide was more efficient in improving abduction ROM & applying glide at resting position of the GH joint is not effective in improving abduction range, hence suggesting otherwise. Hypomobility of a joint of reversible nature can be treated with progressively vigorous joint-play stretching techniques to extend hypomobile capsular &ligamentous connective tissue. Sustained or oscillatory stretch forces are used to mechanically lengthen shortened tissue.[19]

Group M also showed improvement in abduction from baseline to 2 weeks of intervention. Application of MWM has been indicated for treatment of AC wherein painful movement is repeated by patient while the therapist continues to sustain appropriate accessory glide. Additional gains are believed to occur with repetition of same during treatment session mainly involving 3 sets of 10 repetition.[20]

Group K showed 14.10% higher improvement in internal rotation scores compared to Group M &same trend was observed in terms of external rotation scores with an improvement of 12.3 % in Group K.

Asymmetrical tightening of shoulder capsule during humeral rotation results in translation of humeral head in direction opposite to capsular tightening. Hence, when the arm is rotated internally, posterior capsule becomes tight & pushes humeral head anteriorly, resulting in anterior translation according to capsular constraint mechanism, which may be responsible for causing positional fault in GH joint. Hence longer posterior capsule will lead to a greater ROM in internal rotation.[21] Thus application of dorsal glide might have stretched the posterior capsule & increased internal rotation in Group K which is reflected in the pre -intervention to post-intervention values, substantiated by the study done by Ticker et al who reported the presence of thickened posterior capsules in those patients diagnosed with limited internal rotation.[22] Results of this study are consistent with previous studies demonstrating that end-range mobilization technique appear to generate positive outcomes in improving abduction & rotational joint range.[23,24]

According to Kaltenborn, stretching of shortened connective tissues increases & maintains mobility, delays progressive stiffness & loss of ROM in chronic musculoskeletal disorders including AC.[19] A fibrous contracture of rotator interval &coraco-humeral ligament is said to cause frozen shoulder[25] which might have led to the higher improvements seen in Group K, indicating that correction of positional fault alone may not be effective in treating shoulder AC. Treatment goals may include restoration of normal capsular tissue length by mobilizing in the direction of anterior-inferior GH ligaments.[26]

All the shoulder ROMs documented in our study showed a large effect size of>0.8, which concludes that Kaltenborn mobilization technique showed greater clinical benefit in improving ROM than MWM technique.

We may conclude that although correction of positional fault showed improvements in pain, disability and ROM of the shoulder, application of traction and capsular stretching demonstrated a greater clinical effectiveness in relieving pain & disability & in improving ROM in individuals with AC of shoulder.

Conclusion

Experimental trial provided evidence to support use of physiotherapy intervention in the form of Kaltenborn mobilization technique &Mulligan's MWM in reducing pain & improving disability & ROM over a period of 2 weeks. Group K was more effective in improving shoulder ROM, reducing pain & disability.

Thus, Kaltenborn mobilization technique could be used effectively in the treatment by way of reducing pain, disability & improving ROM.

Conflict of Interest: None

Source of Funding: Self

Limitations of the study:

1. Lack of subject blinding process due to experimental conditions for each subject & primary outcome being subjective measurement.

2. Small sample size

3. Gender wise analysis was not performed

Further scope of study:

1. Studies with larger sample size

2. Longer duration of follow up, can be extended by comparing these treatment interventions with true control group.

Bibliography

1. Zuckerman JD, Cuomo F. Frozen shoulder. Am AcadOrthopSurg Rosemont. 1993
2. Freddy M. Kaltenborn. Manual Mobilization of the Joints TheKaltenborn Method of Joint Examination and Treatment Volume I The Extremities. 6th Editio. Norli Oslo, Norway; 2006.
3. Mulligan BR. Manual Therapy:" nags"," snags"," mwms" Etc. edn 6th. Plane View Services Wellington; 2010.
4. Vermeulen HM, Obermann WR, Burger BJ, Kok GJ, Rozing PM, van den Ende CHM. End-range mobilization techniques in AC of the shoulder joint: a multiple-subject case report. PhysTher. American Physical Therapy Association; 2000;80(12):1204–13.
5. Balci N, Balci MK, Tüzüner S. Shoulder AC and Shoulder Range of Motion in Type II Diabetes Mellitus. J Diabetes Complications. 1999;13(99):135–40.
6. Dias R, Cutts S, Massoud S. Clinical review Frozen

shoulder. BMJ. 2005;331(December):1453–6.

7. White D, Choi H, Peloquin C, Zhu Y, Zhang Y. Secular trend of AC. Arthritis Care Res (Hoboken) [Internet]. 2011 Nov [cited 2014 Nov 21];63(11):1571–5. Available from: http://www.ncbi.nlm.nih.gov/pubmed/22034118
8. Rauoof MA, Lone NA, Bhat BA, Habib S. Etiological factors and clinical profile of AC in patients seen at the Rheumatology clinic of a tertiary care hospital. 2003;91(June):359–62.
9. Cohen J. Statistical power analysis for the behavioral sciences [Internet]. Statistical Power Analysis for the Behavioral Sciences. 1988. p. 567. Available from: http://books.google.com/books?id=Tl0N2lRAO9oC&pgis=1
10. Donatelli. Physical therapy management of the shoulder. PhysTher. Elsevier Health Sciences; 1986;66:1912–9.
11. Kaltenborn F M. Manual Mobilization of the Joints: The Kaltenborn Method of Joint Examination and Treatment Volume II - The Spine. 2011.
12. Paris S V. Mobilization of the spine. PhysTher. 1979;59(8):988–95.
13. Warwick R, Williams PL. Arthrology. Gray's anatomy, 35th Br edn Philadelphia WB Saunders. 1973;388–412.
14. Shaffer B, Tibone JE, Kerlan RK. Frozen shoulder. A long-term follow-up. J Bone JtSurg [Internet]. 1992;74(5):738–46. Available from: http://www.ncbi.nlm.nih.gov/pubmed/1624489
15. Kisner C, Colby LA. Therapeutic Exercise: Foundations and Techniques. edn 5. Davis Plus. USA: Margaret Biblis; 2007.
16. Hsu A, Chiu J, Chang JH. Biomechanical analysis of axial distraction mobilization of the glenohumeral joint--a cadaver study. [Internet]. Manual therapy. Elsevier Ltd; 2009 p. 381–6. Available from: http://dx.doi.org/10.1016/j.math.2008.06.003
17. Manske RC, Meschke M, Porter A, Smith B, Reiman M. A Randomized Controlled Single-Blinded Comparison of Stretching Versus Stretching and Joint Mobilization for Posterior Shoulder Tightness Measured by Internal Rotation Motion Loss. Sport Heal A Multidiscip Approach. 2010;2(2):94–100.
18. Ludewig P M, Cook T M. Alterations in Shoulder Kinematics and Associated Muscle Activity in People With Symptoms of Shoulder Impingement. PhysTher APTA. 2000;80(3):276–91.
19. Freddy M. Kaltenborn. Manual Mobilization of the Joints TheKaltenborn Method of Joint Examination and Treatment Volume I The Extremities. 6th Editio. Norli Oslo, Norway; 2006.
20. Kumar D, Mulligan BR. Manual of Mulligan Concept:"Step by Step Guide to deliver manual therapy based on Mulligan concept." Capri Institute of Manual Therapy. New Delhi; 2014.
21. Ar-Tyan Hsu, Tom Hedman, JiaHao Chang, Chuong Vo, Larry Ho, Sally Ho G-LC. Changes in Abduction and Rotation Range of Motion in Response to Simulated Dorsal and Ventral Translational Mobilization of the Glenohumeral Joint. PhysTher. 2002;82(6):544–56.
22. Warner JJ, Ticker JB, Beim GM. Recognition and treatment of refractory capsular contracture of the shoulder. Arthroscopy. 2000;16(1):673–4.
23. Wadsworth CT. Frozen shoulder. PhysTher. 1986;66(12):1878–83.
24. Edmond SL. Manipulation and mobilization: extremity and spinal techniques. Mosby; 1993.
25. Bunker TD. Frozen shoulder : unravelling the enigma. 1997;210–3.
26. Hjelm R, Draper C, Spencer S. Anterior-inferior capsular length insufficiency in the painful shoulder. J Orthop Sports PhysTher. 1996;23(3):216–22.