Original Article

Effects of Sleeper stretch and Mobilization with movement in patients with adhesive capsulitis: A randomized control trial

Kiran Azam khan [1], Maria Khalid[2]

Abstract

Objective: To determine the effects of Mobilization with movement and Sleeper stretch on Shoulder pain, Disability, Shoulder range of motion and Scapulohumeral rhythm.
Study design: It is a randomized control trial study.
Place and duration of study: A Six-month study was carried out in The Physiotherapy Clinic, Saidpur Road, Rawalpindi.
Material and Methods: 44 patients who had stage 1 and 2 Adhesive capsulitis with idiopathic onset of symptoms were randomly allocated through sealed enveloped method in Group A (Sleeper stretch) and B (mobilization with movement) i.e. 22 patients in each group. The frequency of treatment was 3 sessions per week for a total of 4 weeks. Tools used in the study were Numeric pain rating scale (NPRS), Shoulder pain and disability index (SPADI), Goniometer and Inclinometer.
Results: Between group Analysis showed significant difference in effects of MWM and Sleeper stretch in decreasing pain, improving shoulder disability, shoulder ranges of motion i.e. (adduction, abduction, extension and external rotation) with p value <0.001. Within group Analysis showed that shoulder pain, shoulder disability and some shoulder ranges were significantly improved by MWM, whereas shoulder flexion and internal rotation were improved more in sleeper stretch group. Scapulohumeral rhythm showed no significant improvement with p value > 0.05 in both groups.
Conclusion: The results conclude that Mobilization with movement is productive in improving pain, disability and shoulder ranges except shoulder flexion and internal rotation which improved more in Sleeper stretch. Whereas both interventions had no significant effects on Scapulohumeral rhythm

Keywords: Adhesive capsulitis, NPRS, SPADI, Scapulohumeral rhythm, Sleeper stretch, mobilization with movement.

1. Introduction

Adhesive capsulitis, also recognized as arthrofibrosis, is a dysfunctional disorder in which a person's own body create excessive scar tissue and adhesions around the shoulder joint, causing excessive pain, stiffness, as well as functional limitations.[1] The majority of the time, shoulder pain is initially noticed on night or when the shoulder moved approximately to the limits of range of motion (ROM). Certain synchronized shoulder movements, such as external rotation and abduction (for example, when combing one's hair) or internal rotation and extension (e.g., scratching ones back) can cause shoulder pain.[2] Contracture being the other key characteristic causes progressive decline of active range of motion i.e. AROM and passive range of motion i.e. PROM in a capsular pattern at glenohumeral joint.[3]

It is a type of condition that resolves on its own without any treatment within 12 to 36 months but symptoms may persist for up to 10 years in 20-50% of the population.[4] According to estimates, between 2 and 5% of the general population suffers from adhesive capsulitis, with females being more frequently affected than males.[5]

Population ranging between 40-60 years is most likely to get diagnosed with a frozen shoulder.[6] The chief symptom of adhesive capsulitis is shoulder joint discomfort that is supplemented by a noticeably reduced ROM. A dull, poorly localized uneasiness that may radiate into the biceps is the pattern of pain amongst people. Reaching over head or behind the back may cause discomfort and stiffness.[7]

The Physiotherapy Clinic, RWP,[1] Assistant professor, Riphah International university, Rawalpindi.[2]
Correspondence: Kiran Azam khan, The Physiotherapy Clinic, RWP. **Email:** Drkirankhanpt@gmail.com

Numerous therapies, including oral medicines, corticosteroid injections, distension, manipulation, and surgery, and Manual therapy have been studied as ways to treat pain and capsular contractions. Different studies demonstrate the efficacy of manual therapy techniques for the treatment of adhesive capsulitis, including high and low-grade glenohumeral mobilizations,[22] proprioceptive neuromuscular facilitation,[23] muscle energy techniques,[24] scapular mobilization,[25] manual muscle release, mobilization with movement,[26] and sleeper stretch.[8]

The objective of this study was to determine the effects of Sleeper stretch and Mobilization with movement on Pain, Shoulder range of motions, Functional disability and Scapulohumeral rhythm in patients with Adhesive capsulitis.

Various studies[10] have been conducted to check the effects of mobilization with movement and sleeper stretch for improving shoulder pain and ROM in patients with Adhesive capsulitis individually however there is lack of evidence to allow conclusions to be drawn about the effectiveness of MWM when compared with Sleeper stretch for Adhesive capsulitis. This study will add to the growing body of knowledge that if these two techniques yield comparable outcomes, which should be the alternate choice of therapy. Many researches claims that Scapulohumeral rhythm gets disturbed in Adhesive capsulitis. This study also aims to check whether these techniques are effective in improving Scapulohumeral rhythm and which one is better between both techniques.

2. Materials & Methods

A Randomized controlled trial (RCT) was conducted at the Physiotherapy clinic, satellite town Rawalpindi. After the approval from Riphah international university ethics review committee, BASR and permission from The Physiotherapy Clinic. Ethical values during study were considered on priority. The sample size was calculated using the G power with post treatment values of SPADI. Sample size came out to be 44. (9) Non probability purposive sampling was used and patients were randomly allocated using sealed envelope method in group A and B, 22 participants in each group .

Only those patients were included in the study who had stage 1 and 2 Adhesive capsulitis[10], age ranging between 40-65 years,[11] idiopathic onset of disease,[12] patients having unilateral symptomatic shoulder without any traumatic history,[13] marked decrease in active and passive ranges specifically shoulder Abduction, Internal rotation, external rotations[14] and patients having 1.5cm asymmetry on affected side through bilateral comparison during lateral scapular slide test.[15] Both male and female patients were included in the study. Patients having any neurological abnormalities,[16] rotator cuff injuries,[17] recent traumatic history,[18] bone disorders, cervical radiculopathy, cardiovascular impairments,[19] malignancy and those who received any intra articular injections in the shoulder joint during last three months were excluded from the study.[20]

All patients were provided with complete information about the study and intervention and written informed consent was signed before the treatment program in English/Urdu according to the need. The patients were reassured that there was no potential harm of the intervention and they have the right to withdraw from the study anytime they want. Patients were randomly allocated in Group A receiving Sleeper stretch and Group B receiving Mobilization with movement. Conventional therapy which included Hot pack for 15 minutes, Interferential therapy for 15 minutes, Active Range of motion exercises such as wall ladder exercise, towel stretch ex, Codman exercise, Wand exercise, Rope and pulley exercise, shoulder wheel exercise[22] were given to both groups Demographic data was collected using self-structured questionnaire. Patients were assessed on baseline, end of 2nd week and end of 4th week. Questionnaire comprised of demographics, Numeric Pain Rating scale with ICC= 0.74 for shoulder pain, and Shoulder pain and disability index questionnaire with ICC for pain scale 0.989, and ICC for disability 0.990 in Adhesive capsulitis, Shoulder range of motion using goniometer with ICC variying from 0.91 to 0.99, and Scapulohumeral rhythm measurement using inclinometer, with ICC > 0.892.

Data was analyzed with SPSS version 25. Normality of data was checked through Shapiro-wilk and p value of most of variables were < 0.05 as shown in table Demographics and descriptive data was presented in form of percentages, frequencies and mean + SD. Mixed way ANOVA was used for between group analysis whereas within group analysis was carried out through Repeated measure Anova.

3. Results

Out of 22 participants in each group there were 13(29.5%) males and 9(20.5%) females in Group A and

7(15.9%) males and 15(34.1%) females in Group B. Mean age of Group A and Group B was 54.13 + 6.33 and 49.22 + 6.67 years respectively. The occupation details of the participants in Group A were as follow 9(40.9%) house wife, 5(22.7%) computer operators, 1(4.5%) construction workers, 2(9.1%) business men, 4(18.2%) drivers, 1(4.5%) labors, and in Group B 10(45.5%) house wife, 9(40.9%) computer operators, 0 construction workers,1 (4.5%) business men, 2(9.1%) drivers, 0 labors.

A two way mixed ANOVA was carried out in order to investigate the impact of intervention and time on NPRS. There was not a significant main effect of intervention F-value = .002 and p-value = .962. However, there was a significant main effect of time F =658.621 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 3.68± 1.211 and 2.86± 1.125 respectively, as compared to baseline mean ± SD 6.771± 1.343 and 7.73± .985 respectively. Additionally, there was a significant interaction between intervention and time F= 33.03 and p-value = ≤ 0.001.

On shoulder pain and disability index a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was not a significant main effect of intervention F-value = .255 and p-value = .616. However, there was a significant main effect of time F = 593.75 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 31.77± 9.61 and 20.18± 4.61 respectively, as compared to baseline mean ± SD 67.51± 11.78 and 81.89± 8.88 respectively. Additionally, there was a significant interaction between intervention and time F= 42.24 and p-value = ≤ 0.001.

a two-way mixed ANOVA was conducted to investigate the impact of intervention and time on Shoulder Flexion ROM. There was a significant main effect of intervention F-value =27.638 and p-value= <.001.Additionally, there was a significant main effect of time F = 610.57 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 146.81±12.96 and 134.77± 9.44 respectively, as compared to baseline mean ± SD 90.45± 17.72 and 72.5± 9.09. However, there was not a significant interaction between intervention and time F= .106 and p-value = .013.

On Shoulder Extension ROM, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was a significant main effect of intervention F-value= 21.51 and p-value = <.001. There was a significant main effect of time F = 245.67 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 50.22± 4.49 and 49.31± 4.44 respectively, as compared to baseline mean ± SD 40.68± 6.60 and 30.90± 3.66. Additionally, there was a significant interaction between intervention and time F= 26.02 and p-value = <.001

On Shoulder Abduction ROM, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was a significant main effect of intervention F-value = 11.23 and p-value = .002. There was a significant main effect of time F =598.005 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 133.63± 8.61 and 134.09± 11.30 respectively, as compared to baseline mean ± SD 80.90± 18.49 and 67.50± 6.31. Additionally, there was a significant interaction between intervention and time F= .269 and p-value = <.001.

On Shoulder Adduction ROM, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was a significant main effect of intervention F-value = 23.14 and p-value = <.001.There was a significant main effect of time F = 257.79 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 47.27± 3.69 and 41.13± 4.34 respectively, as compared to baseline mean ± SD 40.22± 4.49 and 28.86± 5.75. Additionally, there was a significant interaction between intervention and time F= 19.25 and p-value = <.001.

On Shoulder Internal Rotation ROM, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was a significant main effect of intervention F-value =59.74 and p-value = <.001. There was a significant main effect of time F = 494.92 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 63.86± 8.98 and 46.36±5.81 respectively, as compared to baseline mean ± SD 24.31± 10.26 and 12.95± 3.33. Additionally, there was not a significant interaction between intervention and time F= .080 and p-value = .040.

On Shoulder External Rotation ROM, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was a significant main effect of intervention F-value = 29.02 and p-value = <.001. There was a significant main effect of time F = 356.89 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD 46.13± 7.05 and 45.00± 6.725 respectively, as compared to baseline mean ± SD 27.50± 7.02 and 14.54± 4.33. Additionally, there was a

significant interaction between intervention and time F=23.08 and p-value = <.001.

On Scapulohumeral rhythm 0-45 degree, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was not a significant main effect of intervention F-value = .035 and p-value = <.001. However, there was a significant main effect of time F = 499.13 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD .708± .299 and .711± .307 respectively, as compared to baseline mean ± SD -.450± .041 and -.445± .046. Additionally, there was not a significant interaction between intervention and time F= .011 and p-value = .951.

On Scapulohumeral rhythm 0-90 degree, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was not a significant main effect of intervention F-value = .163 and p-value = .689. However, there was a significant main effect of time F = 100.54 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD .087± .038 and .080± .0377 respectively, as compared to baseline mean ± SD -.305± .1105 and -.304± .119. Additionally, there was not a significant interaction between intervention and time F= .270 and p-value = .699

On Scapulohumeral rhythm 0-120 degree, a two way mixed ANOVA was conducted to investigate the impact of intervention and time. There was not a significant main effect of intervention F-value = .022 and p-value = .884. However, there was a significant main effect of time F = 199.72 and p-value = <.001 with Group A and Group B (4th week) end line mean ± SD .1371± .0807 and .1304± .0787 respectively, as compared to baseline mean ± SD -.278± .1294 and -.2780± .1374. Additionally, there was not a significant interaction between intervention and time F= .092 and p-value = .851

Figure 1: Comparison of NPRS values in Group A and B with time

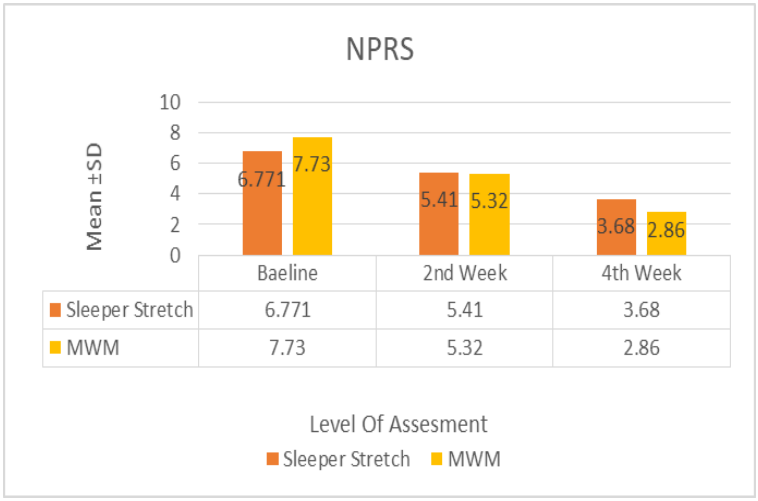
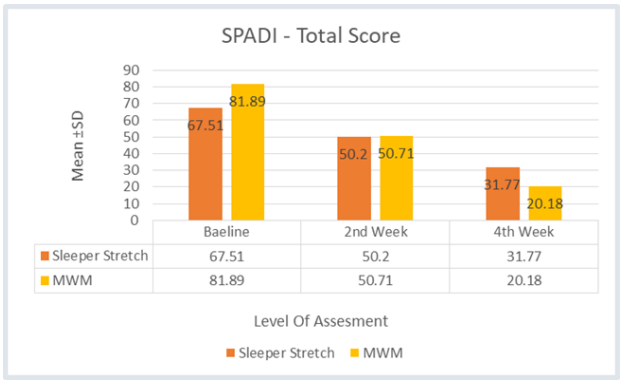


Figure 2: Comparison of SPADI value in Group A and B with time



4. Discussion

Within group Analysis of Numeric pain rating scale for shoulder pain showed that both techniques i.e. sleeper stretch and mobilization with movement are effective in reducing shoulder pain for patients having adhesive capsulitis with P value ≤ 0.001 but MWM is more effective in reducing pain as compared to sleeper stretch. For SPADI both techniques i.e. sleeper stretch and mobilization with movement are effective in reducing shoulder disability for patients having adhesive capsulitis with P value ≤ 0.001 but MWM is more efficient in reducing pain as compared to sleeper stretch. For shoulder ranges i.e. Flexion, Extension, Abduction, Adduction, Internal Rotation, and External Rotation both techniques i.e. sleeper stretch and mobilization with movement is effective in improving shoulder ranges for patients having adhesive capsulitis with P value ≤ 0.001. MWM is more efficient in improving shoulder ranges (Extension, abduction, Adduction and External rotation)

Flexion was improved more in the group receiving sleeper stretch. For Scapulohumeral rhythm at 45 degree, 90 degree and 120 degree both techniques i.e. sleeper stretch and mobilization with movement are effective in improving Scapulohumeral rhythm for patients having adhesive capsulitis with P value ≤ 0.001.

Conclusion:

This research article concludes that there is a significant difference in effects of Sleeper stretch and mobilization with movement, MWM being more beneficial than the other technique in decreasing pain, reducing shoulder disability and improving shoulder range of motions except flexion and internal rotation range of motion. Nevertheless in case of Scapulohumeral rhythm it was observed that there was no advent difference in effects of both techniques i.e. sleeper stretch and mobilization with movement. The limitation faced during this study is that it was difficult to measure Scapulohumeral rhythm at 45, 90 and 120 degree with bubble inclinometer for future researches it is recommended to use digital inclinometer. Other limitations faced during the study is that the gender was not equally distributed between both groups and retention of intervention was not measured in long term follow up plan. For future scope control group can be added in the study as well to make it more efficient.

References:

1. Le HV, Lee SJ, Nazarian A, Rodriguez EKJS, elbow. Adhesive capsulitis of the shoulder: review of pathophysiology and current clinical treatments. 2017;9(2):75-84.
2. Staples MP, Forbes A, Green S, Buchbinder RJJoce. Shoulder-specific disability measures showed acceptable construct validity and responsiveness. 2010;63(2):163-70.
3. Deshmukh N, Kahile M, Chaudhary N, Panchbhudhe S, Gawande VJIJoCR, Review. Adjunct effect of kinesiotaping on adhesive capsulities of shoulder joint. 2021;13(08):48-53.
4. Fields BK, Skalski MR, Patel DB, White EA, Tomasian A, Gross JS, et al. Adhesive capsulitis: review of imaging findings, pathophysiology, clinical presentation, and treatment options. 2019;48:1171-84.
5. Sunderamuthy K, Govind S, Wah YC, Singh KJA. Maitland Vs Kaltenborn Approach in Improving Pain and External Rotation in Adhesive Capsulitis. 2019;50(55):56-60.
6. Ramirez JJAfp. Adhesive capsulitis: diagnosis and management. 2019;99(5):297-300.
7. Cho C-H, Bae K-C, Kim D-HJCios. Treatment strategy for frozen shoulder. 2019;11(3):249-57.
8. Ishaq H, Zuber M, Kandakurti PK, Arulsingh WJCRiP, Medicine R. Do Manual Therapy Techniques Help in Patients with Frozen Shoulder?: A Systematic Literature Review. 2022;34(2).
9. Kotagiri S, Mathur N, Balakavi G, Songa AK. The Effectiveness of Muscle Energy Technique and Mobilization to Improve the Shoulder Range of Motion in Frozen Shoulder. 2019.
10. Chidambaram R, Muruganandam P, Bhandure KSJIJoP, Print-OT, Electronic–. The Efficacy of Sleeper's Stretch and Movement with mobilization on Pain, Range of Motion & Functional Capacity in Patients with Adhesive Capsulitis. 2020;14(4):149-55.
11. Mishra N, Mishra A, Goti KJIJRSR. Effect of capsular stretch versus sleeper stretch on pain, rom and shoulder functions in patients with adhesive capsulities-a comparative study. 2018;9(4):25634-7.
12. Nithya N, Prabu SS, Arun B, Abraham MMJIJoPHR, Development. Effect of Mulligan's Mobilization with Movement and Post Isometric Relaxation Technique on Pain, Range of Motion and Functional Outcome in Subjects with Adhesive Capsulitis. 2021;12(3):185-91.
13. Kundu S, Sherke A, Ughade JM, Kanwar Y, Jatwar R, Tiwari S, et al. Scapulohumeral RYTHM: Anatomical Highlights and Clinical Implications.
14. Tedla JS, Sangadala DRJJom, interactions n. Proprioceptive neuromuscular facilitation techniques in adhesive capsulitis: a systematic review and meta-analysis. 2019;19(4):482.
15. Pitchai P, Krishnan V, Mangle KJJoC, Medicine I. Functional status in adhesive capsulitis–yoga vs. physiotherapy: a quasi experimental study. 2020;18(2):363-9.
16. WADIDA HE, EL SAWABEY MFS, DALIA MM, ASHRAF NMJTMJoCU. Effect of Mobilization with Movement versus Diclofenac Phonophoresis on Shoulder Adhesive Capsulitis. 2020;88(March):45-50.
17. Ragav S, Singh AJJoES, Vol P. 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. 2019;15(1).
18. WADIDA HE, EL SAWABEY MFS, DALIA MM, ASHRAF NMJTMJoCU. Effect of Mobilization with Movement versus Diclofenac Phonophoresis on Shoulder Adhesive Capsulitis. 2020;88(March):45-50.

19. Sunderamuthy K, Govind S, Wah YC, Singh KJA. Maitland Vs Kaltenborn Approach in Improving Pain and External Rotation in Adhesive Capsulitis. 2019;50(55):56-60.

20. Sivasubramanian H, Chua CXK, Lim SY, Manohara R, Ng ZWD, Kumar P, et al. Arthroscopic capsular release to treat idiopathic frozen shoulder: How much release is needed? 2021;107(1):102766.

21. Nawaz S, Anwar S, Humayun K, Nawaz S, Kazmi SK, Ilyas U, et al. Comparative Study on the Effects of Mulligan Mobilization Technique and Muscle Energy Technique on Pain and Range of Motion in Adhesive Capsulitis.1(11):82.18-0.68.

22. Silva R, Pimentel A, Gutierres M. A literature review of the treatment options for Idiopathic Adhesive Capsulitis of the Shoulde. Orthopedics and Sports Medicine Open Access Journal. 2021; 9:460-468.

23. Maund E, Craig D, Suekarran S, Neilson A, Wright K, et al. (2012) Management of frozen shoulder: a systematic review and cost-effectiveness analysis. Health Techno Assess 16(11): 1-264.

24. Shanker Tedla J, Sangadala D. Proprioceptive neuromuscular facilitation techniques in adhesive capsulitis: a systematic review and meta-analysis. Journal of Musculoskeletal and Neuronal Interactions. 2019; 19(4):482-491.

25. Kumar A. A comparative study on the efficacy of Maitland's mobilization and muscle energy technique on frozen shoulder. Indian J Physiotherapy Occupation Therapy. 2015; 9: 39–43. doi:10.5958/0973-5674.2015.00143.4

26. Kiran Satpute, Sue Reid, Thomas Mitchell, Grant Mackay & Toby Hall (2022) Efficacy of mobilization with movement (MWM) for shoulder conditions: a systematic review and meta-analysis, Journal of Manual & Manipulative Therapy, 30:1, 13-32, DOI: 10.1080/10669817.2021.195518

Table 1: Mixed way ANOVA time, treatment group and interaction effect of NPRS and SPADI

Sr. No	Variables		Group A	Group B	Time			Treatment Group			Interaction effect		
			Mean ± SD	Mean ± SD	F-value	η2	p-value	F-value	η2	p-value	F-value	η2	p-value
1.	NPRS	Baseline	**6.771± 1.343**	**7.73± .985**	**658.621(1.748)**	**.940**	**≤ 0.001.**	**.002(1)**	**.000**	**.962**	**33.03 (1.748)**	**.440**	**≤ 0.001.**
		2nd Week	**5.41± 1.008**	**5.32± 1.129**									
		4th Week	**3.68± 1.211**	**2.86± 1.125**									
2.	SPADI	Baseline	**67.51± 11.78**	**81.89± 8.88**	**593.75(1.400)**	**.934**	**≤ 0.001.**	**.255(1)**	**.006**	**.616**	**42.24 (1.400)**	**.501**	**≤ 0.001.**
		2nd Week	**50.20± 10.43**	**50.71± 6.98**									
		4th Week	**31.77± 9.61**	**20.18± 4.61**									

Table 2: Mixed way ANOVA time, treatment group and Interaction effect of Shoulder ranges and Scapulohumeral rhythm

Sr. No	Variables		Group A	Group B	Time			Treatment Group			Interaction effect		
			Mean ± SD	Mean ± SD	F-value	η2	p-value	F-value	η2	p-value	F-value	η2	p-value
3.	Shoulder Flexion ROM	Baseline	**90.45± 17.72**	**72.5± 9.09**	**610.571(1.730)**	**.936**	**≤ 0.001**	**27.638(1)**	**.397**	**<.001**	**4.968(1.730)**	**.106**	**.013**
		2nd Week	**122.27 ± 14.85**	**99.54± 10.79**									
		4th Week	**146.81 ±12.96**	**134.77 ± 9.44**									
4.	Shoulder Extension ROM	Baseline	**40.68± 6.60**	**30.90± 3.66**	**246.67(1.917)**	**.855**	**≤ 0.001**	**21.51 (1)**	**.336**	**<.001**	**26.02(2)**	**.383**	**≤ 0.001**
		2nd Week	**46.36± 4.41**	**39.31± 5.18**									
		4th Week	**50.22± 4.49**	**49.31± 4.44**									
5.	Shoulder Abduction ROM	Baseline	**80.90± 18.49**	**67.50± 6.31**	**598.005(1.593)**	**.934**	**≤ 0.001**	**11.23 (1)**	**.211**	**.002**	**15.44(1.593)**	**.269**	**≤ 0.001**
		2ND Week	**112.50 ± 12.32**	**94.54± 12.23**									
		4TH Week	**133.63 ± 8.61**	**134.09 ± 11.30**									
6.	Shoulder Adduction ROM	Baseline	**40.22± 4.49**	**28.86± 5.75**	**257.79(2.00)**	**.860**	**≤ 0.001**	**43.14 (1)**	**.507**	**<.001**	**19.25(2)**	**.314**	**≤ 0.001**
		2nd Week	**45.00± 4.08**	**35.45± 6.15**									
		4th Week	**47.27± 3.69**	**41.13± 4.34**									
7.	Shoulder IR ROM	Baseline	**24.31± 10.26**	**12.95± 3.33**	**494.92(1.625)**	**.992**	**≤ 0.001**	**59.74 (1)**	**.587**	**<.001**	**3.654(1.625)**	**.080**	**.040**
		2nd Week	**41.36± 11.03**	**25.68± 3.19**									
		4th Week	**63.86± 8.98**	**46.36± 5.81**									
8.	Shoulder ER ROM	Baseline	**27.50± 7.02**	**14.54± 4.33**	**356.89(1.341)**	**.895**	**≤ 0.001**	**29.02 (1)**	**.409**	**<.001**	**23.08(1.341)**	**.355**	**≤ 0.001**
		2nd Week	**36.59± 6.79**	**25.90± 4.53**									
		4th Week	**46.13± 7.05**	**45.00± 6.725**									
9.	Scapulohumeral rhythm at 45 degree angle	Baseline	**-.450± .041**	**-.445± .046**	**499.13(1.24)**	**.922**	**≤ 0.001**	**.035(1)**	**.001**	**.852**	**.011(1.24)**	**.000**	**.951**
		2ND Week	**-.048±.146**	**-.034±.148**									
		4TH Week	**.708± .299**	**.711± .307**									