Comparison of Caudal and Antero-Posterior Glide Mobilisation for the Improvement of Abduction Range of Motion

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Abstract

The study was conducted on twenty patients of age between 40-65 year of adhesive capsulitis to compare caudal and antero-posterior glide mobilisation technique for the improvement of abduction range of motion, pain relief, and improvement in ADL'S. Significant improvement in abduction active ROM & passive ROM as well as alleviation in pain and disability was observed, when end range mobilisation was administered for three weeks. It was further observed that caudal glide was more effective than the antero-posterior glide.

Key Words: Caudal Glide, Antero-posterior Glide, End Range Mobilisation

Introduction

Adhesive Capsulitis is one of the most common and disabling Orthopaedic disorder characterized by painful restriction of shoulder motion for which patients seeks treatment *(Codman, 1934)* Adhesive Capsulitis is characterized by an insidious and progressive loss of active and passive mobility in glenohumeral joint presumably due to capsular contracture. Despite research in the last century its etiology and pathology remains enigmatic *(Howel et al., 1988)*.

This painful, debilitating disorder reportedly affects 2-5% of the general adult population *(Neer et al., 1989)* and 10-20% of people with diabetes *(Kevin et al., 1997).* Incidence is slightly higher in women than in men and is somewhat more common in the non dominant arm *(Dan et al., 1987).* This condition most frequently affects persons aged 40-60 years *(Uitvlugt et al., 1993).*

Primary frozen shoulder is classically described as having three stages, "Freezing", "Frozen" and "Thawing" *(Richard et al., 1986).* Pain particularly in the 1st phase often keeps patients from performing activities of daily living (ADL). In the second phase pain appears to be less pronounced but the restriction in active motion appears to limit the patient in personal care, ADL, and occupational activities. In the third stage there is increase in mobility, which leads to full or almost full recovery *(Richard et al., 1986).*

Inspite of various approaches there remains a lack of evidence that treatment speeds up recovery Joint mobilisation has become a widely employed physical therapy procedure for treating patients with joint hypomobility *(Maitland, 1983).* It is accomplished by performing gliding movements in the direction of limited joint glide *(Henricus & Obesmann, 2000).* Antero-posterior Glide and Caudal Glide mobilisations are frequently employed by physical therapists to mobilise the shoulder joint to decrease pain, improve mobility and

regain normal joint function *(Goldstein, 2004).*

This study is conducted to investigate if Antero-posterior Glide mobilisation is effective in increasing abduction range of motion when given at the end of available range of motion. It is also to compare Antero-posterior Glide with Caudal Glide so as to analyse which of the two is more effective. These glides are given along with lateral distraction, capsular stretching, hot fomentation and exercises. This study done on patients of Adhesive Capsulitis is also to know about the effect of treatment on pain and functional recovery by evaluating through Shoulder Pain and Disability Index.

Materials and Methods

Subjects: Patients of Adhesive Capsulitis (n=20) in between the age of 40-65 years were included in the study. They were taken from out patient department of Prayas Physiotherapy Center, Dehradun and SBSPGI, Balawala. The sample studied includes 11 males and 9 female subjects with a mean age of 57.2. Thirteen subjects had left arm involvement and 7 had right arm involvement. They were instructed not to do any other exercises.

Inclusion Criteria

1. Case of pure Adhesive Capsulitis
2. Painful restriction of more then 50% of active & passive range of motion of the shoulder.
3. Capsular pattern of motion restriction.
4. An absence of radiological evidence of glenohumeral joint arthritis.
5. Symptoms present for at least 3 months.

Exclusion Criteria

- Local corticosteroid injection to the affected shoulder within the last 3 months or current corticosteroid therapy.
- Neuromuscular diseases.
- Shoulder symptoms due to other causes
- Pregnancy
- History of metastatic cancer or diagnosis of cancer within 12 months.
- Unstable angina
- Insulin dependent diabetes
- Prior shoulder surgery
- Arthritis of shoulder

Variables of the Study

Independent Variable

1. Joint Mobilisation (Caudal glide, Antero-posterior glide & Lateral distraction)
2. Hot pack
3. Capsular stretching (Posterior & Anterior)
4. Codman's exercise

Dependent Variable

1. Abduction range of Motion (Active and Passive)
2. Pain and functional ability through Shoulder Pain and Disability index *(Warren et al., 1984).*

Study Protocol

Group A (n=10) (Caudal Glide + Lateral Distraction + Conventional treatment)

Lateral distraction was given with Shoulder in neutral position followed by caudal glide, given at the shoulder joint line after the end of available abduction range was achieved. Grade 3 and 4 of Maitland Mobilisation was given for 10-15 repetitions for 5-6 times. Total duration lasted for 20 minutes. This was followed by conventional treatment.

Group B (n=10) (Antero-Posterior Glide + Lateral Distraction + Conventional Treatment)

Lateral distraction was given with shoulder in neutral position followed by Antero-posterior glide given at the shoulder joint line after the end of available abduction range was achieved. Grade 3 & 4 of Maitland mobilisation was given for 10-15 repetitions for 5-6 times for 20 minutes. This was followed by conventional treatment.

Procedure

With the initiations of each treatment session the subjects' abduction range of motion was measured actively and passively using standard goniometer according to the method as described by *Lippman (1943) and Norkin and White (1995)*. The level of pain and disability was measured with the help of Shoulder Pain and Disability Index. Once measurements were recorded the patients were then treated according to the assigned groups. Intervention started with hot fomentation for 10 minutes followed by few minutes of warm up consisting of rhythmic mid range mobilisation. This was done with patient in supine position; the joint was taken through full range of available range of motion 3 times. After the patient were given capsular stretching for the posterior and anterior part of the capsule with 20 seconds hold in order to maintain the stretched position. This was repeated for 4 times. Thereafter the joint mobilisation was given according to the group the patients were assigned to. For all the glides 10-15 repetitions were made of grade 3 and 4 for Maitland Mobilisation technique, which were performed at the end of available range. Intermittently the shoulder was moved once or twice through full range of available ROM to obtain muscle relaxation. Total duration of end range mobilisation technique lasted for 30 minutes.

Codman's Exercise was first started with 10-15 repetitions without any weights. All other exercises were also performed for 10-15 repetitions in a particular session. All these exercises were first demonstrated to the patient and then were asked to repeat the same. They were instructed that while performing these exercises at home, they should avoid causing pain of greater than 5 out of 10 on pain scale (10 being the worst).

After the completion of intervention the measurement of abduction range of motion and values for pain and disability through SPADI was again taken. This protocol was given for total 9 sessions, which was completed in duration of 3 weeks.

Data Analysis

Unrelated and Paired t test was used to compare AROM, PROM, pain and disability. The significance (probability – P) has been selected as 0.05.

Results

Ten subjects were taken in each group with the mean age of 56.1 ± 4.95 and 58.3± 4.37 respectively (table 1)

Table 1. Subject Information

Serial No.	Group	N	Age Mean ± S.D.
1	A	10	56.1 ± 4.95
2	B	10	58.3 ± 4.37

Student t test was used for the comparison of mean of AROM between group A & B. At zero session calculated t value was 1.36 which is less than the tabulated value at significance level 0.05. This indicates that there was no much disparity amongst the subject of the two

groups, before starting the intervention. The mean value of AROM was 43.7±10.44, 52.6±15.77 and that of PROM was 53.4±0.16, 62±17.08 respectively of the groups. (Tables 2 & 3).

Table 2. Comparison of mean of AROM between Group A &Group B

Sessions	Group A $\overline{X}$ ± S.D.	Group B $\overline{X}$ ± S.D.	t	S/Ns
0	43.7 ± 10.44	52.6±15.77	1.36	NS
3	67.3 ±11.31	66.7 ± 19.8	0.1	NS
6	99.7 ±7.16	88 ± 17.37	1.89	NS
9	126.5 ± 10.9	104.3 ±17.63	3.58	S

P < 0.05

Table 3. Comparison of mean of PROM between Group A & Group B

Sessions	Group A $\overline{X}$ ± S.D.	Group B $\overline{X}$ ± S.D.	t	S/Ns
0	53.4 ± 0.16	62 ± 17.08	1.61	NS
3	77.5 ± 9.4	77.2 ± 20.5	0.04	NS
6	110.8± 7.08	98.1± 17.47	2.27	S
9	137.7± 9.28	115.6±15.99	4.02	S

P<0.05

Student t test was done to compare the means of AROM group A & B at 0, 3rd, 6th and 9th sessions. The result of 0, 3rd and 6th session were found to be insignificant whereas that of 9th session were significant with the means of AROM being 126.5±10.9, 104.3 ±17.63 respectively of the groups (Table 2).

While comparing the means of PROM between groups A & B at 0, 3rd, 6th & 9thsessions the results of 3rd session were insignificant .The 6th and 9th sessions showed significant improvement with the t values of 2.27 and 4.02 respectively of the sessions (table 3).

Paired t test was used to compare AROM within the group A between 0 and 9th sessions. The mean difference of the session was 82.8 and the t value was 43.13 thus showing a significant improvement. Similarly of the group B the mean difference was 51.7 and the t value was 36.35 which was also significant (table 4).

Table 4. Comparison of Improvement in Mean of ROM within Group A&B between 0-9 sessions.

G	SESSION 0	SESSION 9	Mean Difference	t	S/NS
A	43.7±10.44	126.5±10.90	82.8	43.12	S
B	52.6 ±15.77	104.3±17.63	51.7	36.35	S

G stands for Group

When comparison of PROM was done within group A between 0 and 9th sessions the mean difference was found to be 84.3 and the t value was 67.6 which was significant .Similarly of group B the mean difference was 53.6 and the t value was 37.06 which was significant (Table 5).

Table 5. Comparison of Improvement in Mean of PROM within Group A & B between 0-9 sessions.

G	SESSION0	SESSION 9	Mean Difference	t	S/NS
A	53.4±10.16	137.7±9.28	84.3	67.6	S
B	62.0±17.08	115.6±15.99	53.6	37.06	S

G stands for Group, P<0.05

Evaluation of pain and disability was carried out through SPADI and student t test was used to compare the means of 0, 3rd, 6th and 9th sessions. At 0 session, the t value was significant whereas at 3rd, 6th and 9th sessions it was found to be insignificant (Table 6).

Table 6: Comparison of mean SPADI between groups A & B

Sessions	Group A $\overline{X}$ ± S.D.	Group B $\overline{X}$ ± S.D.	t	S/Ns
0	80.98±6.78	69.77±14.4	2.39	S
3	73.83±6.61	64.27±14.35	2.03	NS
6	65.13±6.67	58.97±14.78	1.28	NS
9	58.04±6.78	52.96±14.5	1.06	NS

When paired t test was used to compare 0 and 9th sessions of group A, the t value was found to be 40.16 which was significant. Similarly of the group B was 22.72 which was significant (table 7).

Table 7. Comparison of Improvement in Mean of SPADI within Group A&B between 0-9 sessions

G	SESSION 0	SESSION 9	Mean Difference	t	S/NS
A	80.98 ± 6.7	58.0 ± 6.78	22.93	40.16	S
B	69.73 ± 14.4	52.9 ± 14.53	16.77	22.72	S

G stands for Group

The major goal in mobility of the glenohumeral joint in caudal or posterior direction is to increase its abduction range of motion. The results from the present study suggest that caudal and antero-posterior glide mobilisation at the end of available range is effective in improving glenohumeral abduction ROM in patients of adhesive capsulitis.

The detailed mechanical behavior and biomechanical changes that occur with caudal glide mobilisation are not very clear. The tissue targeted for stretching during caudal glide procedure is believed to be the caudal glenohumeral ligament as the head of humerus glide downward relative to the glenoid fossa. This is based on concavo-convex rule.

Antero-posterior glide can effectively be used to increase abduction range of motion when given at the end of available range. It can be used as a substitute to caudal glide, though caudal glide being the most effective.

The study of *Hsu et al (2000a, b and c)* and *Hsu & Hedman (2000)* also supports the results of present study. The findings of *Poppen & Walker (1976)* and *O'Brien and Bowen (1995)* and & *Warren et al (1984)* on capsular restraints to anterior-posterior and caudal stability provided the rationales for choosing antero-posterior glide at nearly end range of abduction when treating glenohumeral abduction hypomobility.

The studies of *Hsu et al (2000a, b & c)* states that anterior, posterior and axillary pouch of inferior glenohumeral ligament are primary restraints to the abduction of the glenohumeral joint. Stretching of these capsular ligaments in then opinion can lead to improvement in abduction ROM *(Wyke, 1972)*.

Antero-Posterior mobilisation of the glenohumeral joint is usually indicated in hypomobility in the direction of flexion, internal rotation and horizontal adduction in accordance with Concave-Convex Rule and Circle Stability Concept. The tissue targeted for stretching is believed to be the posterior capsule of glenohumeral joint since it is located directly in the direction of translation movement and thus acts as a primary restrainer.

The use of Antero-posterior glide to improve glenohumeral abduction ROM is although clinically popular it appears to contradict the Circle Stability Concepts and the Concavo-Convex rule. According to *O'Brien and Bowen (1995)*, the primary constraints to the posterior displacement of the humeral head in the glenoid fossa appear to be position dependent. When the arm is positioned at 45^0 of abduction the posterior joint capsule provides the primary restraint to the posterior displacement of humeral head. With the arm close to 90^0 of abduction, however, the inferior glenohumeral ligament complex becomes the primary passive stabilizer against anterior posterior instability. At this position the posterior band of the inferior glenohumeral ligament so also the primary stabilizer against inferior translation of the humeral head on the glenoid. Thus as the

glenohumeral joint approaches end range of abduction the posterior band of the inferior glenohumeral ligament becomes the primary structure against inferior gliding of humeral head on the glenoid fossa. In this position Antero-Posterior glide will most effectively stretch the posterior band of the inferior glenohumeral ligament releasing the tightened posterior band and allowing more inferior glide of the humeral head to occur during abduction.

Selecting an appropriate joint position could be a very important factor in the success of the joint mobilisation procedure. Several authors *(Goldstein 2004)* have advocated that resting position is not the most effective position for increasing ROM of the joint treated. Results of various studies *Hsu et al (2000a, b and c)* showed that mobilisation of glenohumeral joint at its resting position is less effective than the end range position in improving abduction ROM. This may be because the periarticular tissue that limits joint ROM is most stretched when the joint is positioned close to the restricted range.

The SPADI is a shoulder region functional status measure that is responsive to clinical change. There is remarkable increase in functional status of the patient following mobilisation procedure. There was a marked decrease in pain and disability following treatment session especially in group A followed by group B .There is no previous study as per the supporting article of similar study.

As the increase in abduction ROM was seen there was remarkable decrease in pain and disability in the similar fashion.

Limitation of the Study

1. Number of subjects was less.
2. No control group was taken.
3. No groups had similar patients with the same degree of involvement.
4. Age variation was there from 40-65years.
5. Patients built was variable
6. Adhesive capsulitis is a self-limiting disease so the actual improvement through the treatment cannot be evaluated.
7. Photographic method for measurement of abduction ROM was not used.
8. Marked amount of tissue resistance is experienced while applying the glide which has not been taken into consideration
9. Proper strengthening program was not followed after mobilisation sessions due to lack of time.

Conclusions

This study provides preliminary evidence that antero-posterior glide is also effective in improving glenohumeral abduction ROM when given at the end of available range. However, it is less effective than the traditional caudal glide mobilisation.

Clinical Implication

This study provides some evidence for the use of both Antero posterior and inferior glide performed close to the end range of abduction to increase the abduction ROM. This study also states that inferior glide is most effective in increasing abduction ROM. The significant increase in abduction range seen after Antero posterior glide procedure performed at a joint angle close to its end might be a good alternative for treating abduction hypomobility. This is because inferior glenohumeral ligament is preferentially stressed in this position.

Patient's functional recovery was evaluated using SPADI. A significant

improvement in functional activities was in the same pattern as for the improvement in the abduction ROM. This provides an evidence for the functional rehabilitation of the patient.

References

Codman E.A. 1934. In: *The Shoulder*, Ed. Thomas Todd. Boston.

Dan, L., Riddle, J. and M. Rothstein 1987. Goniometric Reliability in Clinical Setting Shoulder Measurements. *Physical Therapy.* **67(5):** 668-73.

Goldstein, B. 2004. Shoulder Anatomy and Biomechanics. *Physical Medicine Rehabilitation Clinics of North America.* **15:** 313-49.

Henricus, M. V. and Obesmann, W. R. 2000. End Range Mobilisation Technique in Adhesive Capsulitis of the Shoulder Joint: A Multiple Subject Case Report. *Physical Therapy*, **80(12)**: 1204-12.

Howel, S.M., Galinat, B.J., Renzi, A. J. and Marone, P.J. 1988. Normal and Abnormal Mechanics of Glenohumeral Joint in Horizontal Plane. *Journal of Bone Joint and Surgery* (Am). **70:** 227-32.

Hsu, A. T. and Hedman, T. 2000. Change in Abduction and Rotational Range of Motion in Responses to Simulated Dorsal and Ventral Translational Mobilisation of Glenohumeral Joint. *Physical Therapy*, 82**(6).** 544-56

Hsu, A. T., Ho, C., Jia., C., Chih, H. 2000a. Determining the Resting Position of Glenohumeral Joint: A Cadaver Study. *Journal of Orthopaedic and Sports Physical Therapy*, **32:** 605-12.

Hsu, A. T., Ho, L. S., Ho, T. and Hedman 2000b. Immediate Response of Glenohumeral Abductor Range of Motion to a Caudally Directed Translational Mobilisation: A Fresh Cadaver Simulation. *Archives Physical Medicine Rehabilitation,* **81:** Nov. 1516-16

Hsu, A. T., Ho, L. S., Ho, T. and Hedman 2000c. Joint Position during Anterior-Posterior Glide Mobilisation: It's Effect on Glenohumeral Abduction Range of Motion. *Archives Physical Medicine Rehabilitation,* **81:** Feb, 210-40

Kevin E W, Christopher, A. A., James, and Andrews, R. 1997 Current Concept: The Stabilizing Structure of the Glenohumeral Joint. *Journal of Orthopedics and Sports Physical Therapy*, **26(6)**: 364-79

Lippman, R. K. 1943. Frozen Shoulder Periarthritis Bicipital Tenosynovitis. *Archives Surgery.* **47:** 283.

Maitland, G.D. 1983. Treatment of Glenohumeral Joint by Passive Movement. *Physiotherapy*, **69(1)**: Jan 3-7.

Neer, C.S., Satterlee, C.C. and Dalsey, R.M. 1989. On the Value of Coracohumeral Ligament Release. *Orthopedic Trans.*, **13:** 235.

Norkin, C.C. and White, D. J. 1995. Measurement of Joint Motion. In: *A Guide to Goniometry.* 2nd Ed., Davis Philadelphia.

O'Brien, S.J. and Schwartz, H.S. 1995. Capsule Restraint to Anterior Posterior Motion of Abducted Shoulder Biomechanical Study. *Journal of Shoulder and Elbow Surgery.* **4(2)**: 298-05.

Poppen, N.K. and Walker, P.S. 1976. Normal and Abnormal Motion of Shoulder. *Journal of Bone Joint Surgery (Am).* 58, 195-201.

Richard, W., Bowling, A. P. and Rockar, J.R. 1986. Examination of Shoulder Complex. *Physical Therapy*, **66(12)**: 1866-77.

Uitvlugt G, Detrisae, D.A. and Johson, L.L. 1993. Arthroscopic Observation Before and After Manipulation of Frozen Shoulder. *Arthroscopy*, **9:** 181

Warren RF, Karnblatt, I.B. and Morehand, R.1984. Static Factors Affecting Posterior Shoulder Stability. *Orthopedic Trans.*, **8:** 89-93

Wyke, B. 1972. Articular Neurology: A Review, *Physiotherapy*, **58**: 94