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RESEARCH ARTICLE

EFFECT OF ANGULAR JOINT MOBILIZATION v/s MAITLAND MOBILIZATION ON PAIN, RANGE OF MOTION AND FUNCTION IN PATIENTS WITH ADHESIVE CAPSULITIS OF SHOULDER: A PILOT STUDY

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ABSTRACT

Background: Which mobilization has better results in patients with frozen shoulder? What is Angular joint mobilization? Can we go beyond the conventional margins of concave-convex rule for deciding a glide during mobilizing a joint? **Objective**: H_0: Angular joint mobilization and Maitland Mobilization will have equal effects on pain, range of motion and function in patients suffering from periarthritis of shoulder. H_1: Angular joint mobilization will be more effective in reducing pain, increasing range of motion and improving function than Maitland Mobilization in patients suffering from periarthritis of shoulder. H_2: Maitland Mobilization will be more effective in reducing pain, increasing range of motion and improving function than Angular joint mobilization in patients suffering from periarthritis of shoulder. **Method**: It was a comparative pilot study.30 out of which 45 patients with PA fell into the inclusion criteria. 20 patients followed up for the entire duration of 2 weeks (3 sessions/week) and were included in the study. Hence there were 10 in each group.Both the groups received conventional treatment but one group received AJM and the other group received Maitland mobilization. The outcome measures were taken using Goniometer and SPADI. **Results**: The result of paired t-test between ROM and SPADI within the AJM group and Maitland group was significant. Hence proving that both have a significant effect in improving ROM and reducing pain and disability. The result of unpaired t-test between the differences of outcomes was not significant except for improving internal rotation. Hence proving there is no significant difference in improving ROM and reducing pain and disability between the both groups. Except for improving internal rotation, AJM is better than Maitland. But if we see clinically, patients in the AJM group were reported to have 36.10% improvement as compared to 25.80% in the Maitland group, i.e. 10.30% more than the other group. Similarly for abduction, there was 23.30% improvement due to AJM than 14.40% due to Maitland, i.e. 8.90% more. And clinically 2.40% for improving flexion, 4.60% for external rotation, 6.20% for reducing pain and 6.40% for reducing disability. **Conclusion**: Angular joint mobilization and Maitland Mobilization are equally effective in reducing pain, improving range of motion and improving function.

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INTRODUCTION

The term "frozen shoulder" also known as adhesive capsulitis diagnosis was originally thought to be "periarthritis." It is "thickening and contraction of the capsule which becomes adherent to the humeral head" (Nevaiser, 1945). Adhesive capsulitis is characterized by pain, stiffness, and limited function of the glenohumeral joint, which adversely affects the entire upper extremity. Patients typically describe onset of shoulder pain followed by a loss of motion (Boyle-Walker, 1997). The most common limitations in range of motion are flexion, abduction, and external rotation.

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The condition progresses in three stages: freezing (painful), frozen (adhesive) and thawing, and is often self-limiting (Adhesive capsulitis, 2010 and Hui Bin Yvonne Chan, 2017). In the freezing stage (2–9 months) there is a gradual onset of diffuse, severe shoulder pain that typically worsens at night (Prestgaard, 2017 and Dias, 2005). The pain will begin to subside during the frozen stage with a characteristic progressive loss of glenohumeral flexion, abduction, internal rotation and external rotation. (4–12 months) (Prestgaard, 2017 and Dias, 2005). During the thawing stage, the patient experiences a gradual return of range of motion that takes about 5–26 months to complete (Prestgaard, 2017 and Dias, 2005). Two types identified in the literature: Idiopathic and Secondary adhesive capsulitis (Lundberg, 1969). Idiopathic

("primary") adhesive capsulitis occurs spontaneously without a specific precipitating event (Brue, 2007). Secondary adhesive ¬capsulitis occurs after a shoulder injury, immobilization or surgery, or may be associated with another condition such as diabetes, rotator cuff injury or CVA.

Maitland mobilization: Maitland mobilization is based on the principle of brick wall theory. That is basically correlation of one's theoretical knowledge with clinical reasoning.

- It focuses on patient's signs and symptoms rather than the diagnostic title.
- It consists of accessory joint mobilization and physiological movements.

And has 4 grades as follows:

GRADE 1: small amplitude oscillatory movements in the initial range
GRADE 2: large amplitude oscillatory movements within the mid-range
GRADE 3: large amplitude oscillatory movements from mid to end range
GRADE 4: small amplitude oscillatory movements in the end range.

Angular Joint Mobilization: AJM is rotational joint mobilization (physiological movement) with joint axis shift.
AJM has three steps:

- Is the primary joint mobilization. The direction is determined by the limited motion of the long lever arm going into end range with overpressure to tolerance. This is done passively but can also be active or active assisted.
- The joint shift (assistive joint mobilization). This is sustained pressure but can also be overpressure. Joint shift includes not only glide, but also rotation, spin, compression, and distraction. The most joint structure stretching, lesser pain and increase in ROM will determine the direction of the joint shift. It does not follow the convex-concave rule as the approach plane is not parallel to the concave joint surface (not a flat surface).
- Is the combined movement, which is used at an advanced stage.

The primary joint mobilization grading in AJM is as follows: (annexture-1)

Grade I (a painful joint) is rotary oscillations which are applied with slight overpressure at the start of the pathological limit.
Grade II is rotary oscillations which are applied with overpressure and stopped before the end of the pathological limit.
Grade III (in a non-painful joint) is rotary oscillations with overpressure which are applied to the end of the pathological limit.

MATERIALS AND METHODS

Study Design: Comparative Pilot Study

Study Location: MAEER's Physiotherapy College, Talegaon Dahbade

Study Duration: August 2018 to February 2019.

Sample Size: 20.

Sampling type: Simple Random Sampling.

Materials: Goniometer and SPADI scale.

Inclusion criteria

1. Age: 40-60 years
2. Stage I & II of PA
3. Pain (≥4/10 on NRS)
4. Reduced shoulder ROM
5. Diagnosed by a physician
6. Capsular pattern present

Exclusion criteria

1. Stage III of PA
2. Unhealed fracture of humerus
3. Rotator cuff injury/tear
4. Subacromial bursitis
5. Glenohumeral joint instability
6. Bilateral PA
7. Rheumatoid arthritis
8. Cervical radiculopathy
9. Contra-indications of mobilization (joint fusion, severe osteoporosis)
10. Other associated neurological condition.

Procedure Methodology: 75 patients with shoulder pain were evaluated, out of which 45 were diagnosed with PA, out of which 30 patients fell into the inclusion criteria. With the dropout rate of 10, 20 patients followed up for the entire duration of 2 weeks and were included in the study. Written consent from all the patients was taken before the study started. Both the groups received conventional treatment but one group received AJM and the other group received Maitland mobilization. Passive ROM of shoulder joint using universal goniometer and SPADI for pain and disability was recorded.

Intervention

1. IFT (Ibrahim, 2014)
- Site: Shoulder joint
- Method: 4 pole
- Duration: 10 min

2. Hot pack
Site: Shoulder joint
- Duration: 10-15 min

3. Active assisted exercises for shoulder joint using:
- Wand for shoulder flexion, abduction, internal and external rotation.
- Finger ladder for flexion and abduction
- Codman's exercises
- Repetition: 10 times/session

4. Capsular stretching exercises:
- 10 sec hold 3 times/session

5. Shoulder isometrics for:
- Flexors, Extensors, Abductors, Internal and External rotators.
- Repetition: 10 with 10sec hold/ session

6. Scapular retraction exercises 10 repetition/ session
7. Mobilization for shoulder:

a) Angular joint mobilization (2017)

- Grade: I
- Duration: 2 min for each movement twice
- The joint shift for every movement will be determined by the most joint structure stretching, lesser pain and increase in ROM. The joint shift for every movement and session will be recorded.

b) Maitland mobilization:

- Grade: II/III
- 1-2 oscillation per second for 30 sec 4-5 sets

TOTAL TREATMENT SESSIONS: 6 sessions (3 sessions per week)
TOTAL DURATION: 2 weeks

Statistical Analysis: Data was analysed using 'GraphPadInStat v.3.Comparison between ROM and SPADI pre and post treatment was done by paired t-test. And between the two groups, at the end of the study was done by unpaired t-test.

RESULTS

Table 1 & 2 shows the result of paired t-test between ROM and SPADI within the AJM group and Maitland group was significant.

Interpetation: Both have a significant effect in improving ROM and reducing pain and disability. Table 3 shows the result of unpaired t-test between the differences of outcomes was not significant except for improving internal rotation.

DISCUSSION

- Even though it has been proved by a systematic review that Maitland and AJM work the best in PA shoulder patients, no other study directly compares the effectiveness of the two techniques to the best of my knowledge.
- And there is a lot of literature available on maitland since it is a well-known technique.
- Whereas there is a lack of research that has been published on AJM.
- Hence this study was done to compare the two techniques.
- Both the groups received conventional treatment but one group received AJM and the other group received Maitland mobilization.
- Maitland mobilization is based on the principle of brick wall theory. This is basically correlation of one's theoretical knowledge with clinical reasoning.
- It focuses on patient's signs and symptoms rather than the diagnostic title.
- And it consists of accessory joint mobilization and physiological movements.
- In a human rotary motion, all joint axes shift at least slightly during the motion (Hallström, 2006) and joint surfaces not only glide but also simultaneously roll on the opposite joint surface (arthrokinematic view) (Williams, 1989).
- And since shoulder joint is a multiaxial joint and movements occur in many planes.

Table 1.

AJM	Mean (pre)	Mean (post)	SD (pre)	SD (post)	P Value	significance
Flexion	111.7	144	13.833	17.055	<0.0001	significant
Abduction	80.4	113.2	8.72	13.256	0.0002	significant
Internal rotation	43.3	68.5	16.042	15.644	<0.0001	significant
External rotation	36.9	63.8	16.02	17.731	0.0002	significant
Pain	38.5	19.4	4.859	3.627	<0.0001	significant
Disability	51.2	26.6	11.104	8.099	<0.0001	significant

Table 2.

Maitland	Mean (pre)	Mean (post)	SD (pre)	SD (post)	P Value	significance
Flexion	99.4	125.2	19.529	17.203	<0.0001	significant
Abduction	77	98	12.293	7.52	0.0002	significant
Internal rotation	28.6	46.7	17.115	14.469	<0.0001	significant
External rotation	21.8	44.4	11.507	12.843	<0.0001	significant
Pain	38.2	22.1	5.073	6.244	<0.0001	significant
Disability	54.2	34.4	10.347	9.058	<0.0001	significant

Table 3.

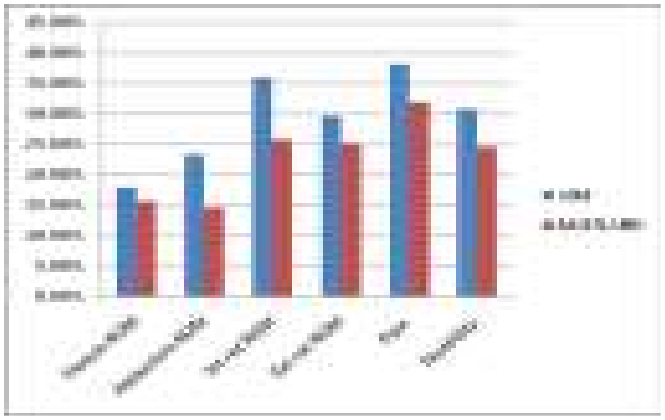
Outcome	AJM		Maitland		P value	Significance
	Mean	SD	Mean	SD		
FLEXION	32.3	15.011	26.3	9.764	0.1531	not significant
ABDUCTION	32.8	18.474	21.9	12.583	0.0719	not significant
INTERNAL ROTATION	25.2	9.065	16.1	5.934	0.009	Significant
EXTERNAL ROTATION	26.9	15.688	22.6	6.62	0.2275	not significant
PAIN	19.1	4.458	16	4.372	0.0674	not significant
DISABILITY	24.6	9.766	19.7	9.581	0.1365	not significant

Interpretation: Hence proving there is no significant difference in improving ROM and reducing pain and disability between the both groups. Except for improving internal rotation, AJM is better than Maitland.

- Baeyens *et al*. suggested redefining mobilization techniques for the glenohumeral joint in terms of rotation of the humerus and translation of the geometrical center of the humeral head.[18]

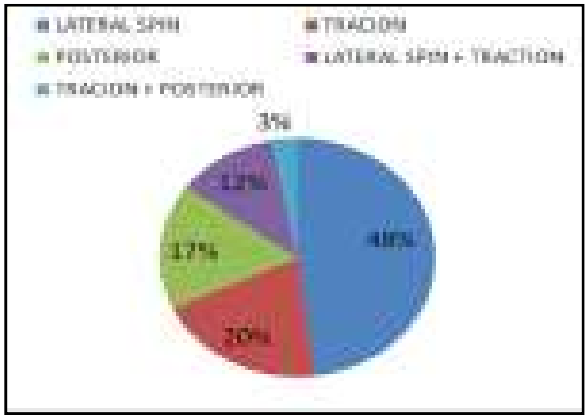
- The convex-concave rules of arthrokinematics, on their own merit, were not intended to serve as the unequivocal justification for deciding on the direction of the application of a manual glide maneuver (Neumann, 2012).
- The rule merely describes the arthrokinematic pattern that minimizes the inherent migration of the center of the convex member in the direction of the roll (Neumann, 2012).
- Restricted joint movement is thought to have restricted gliding and predominant rolling between the joint surfaces instead of restricted rotation (Neumann, 2012).
- Based on this background, the authors theorized that joint restriction was due to impaired rotation with possible joint axis shift impairment of the rotary motion joint.
- Kaltenborn hypothesis (convex-concave rule) suggests that a restricted joint movement (i.e., hypo mobility) is due to impaired joint gliding (Robert, 1994).
- However, when joint rolling occurs without its associated gliding, the instantaneous axis of movement shifts to an abnormal location (Kaltenborn, 2011). If this joint movement occurs based on Kaltenborn theory, then rolling will lead to dislocation, but dislocation does not occur on restricted joint movement.
- For example, the joint axis shifts superiorly rather than inferiorly in glenohumeral joint abduction movement (Poppen, 1976; Deutsch, 1996; Chen, 1999; Graichen, 2005; Nishinaka, 2008; Matsuki, 2006; Ibrahim, 2014).
- Many clinicians have found that posterior glide works better than anterior glide which contradicts the concave-convex rule.
- And since shoulder joint is a multiaxial joint and movements occur in many planes.
- So not just a glide according to the concave-convex rule but any glide, rotation or distraction which aligns the joint axis and improves the clinical picture should be given.
- Hence the authors revised the idea of joint mobilization and named it angular joint mobilization (AJM), which is rotational joint mobilization with joint axis shift.
- After the study was completed, statistical analysis of the results was done under the guidance of a statistician.
- Statistically the results show that both the techniques are equally effective in improving ROM, reducing pain and reducing disability. And that there is no significant difference between them.
- Except for improving internal rotation, AJM was proved better than Maitland.
- The patients in the AJM group were reported to have 36.10% improvement as compared to 25.80% in the Maitland group, i.e. 10.30% more than the other group.
- Similarly for abduction, there was 23.30% improvement due to AJM than 14.40% due to Maitland, i.e. 8.90% more.
- And clinically 2.40% for improving flexion, 4.60% for external rotation, 6.20% for reducing pain and 6.40% for reducing disability.

OUTCOME	AJM	MAITLAND	DIFFERENCE
Flexion ROM	17.90%	15.50%	2.40%
Abduction ROM	23.30%	14.40%	8.90%
Int rot ROM	36.10%	25.80%	10.30%
Ext rot ROM	29.80%	25.20%	4.60%
Pain	38.20%	32%	6.20%
Disability	30.90%	24.50%	6.40%



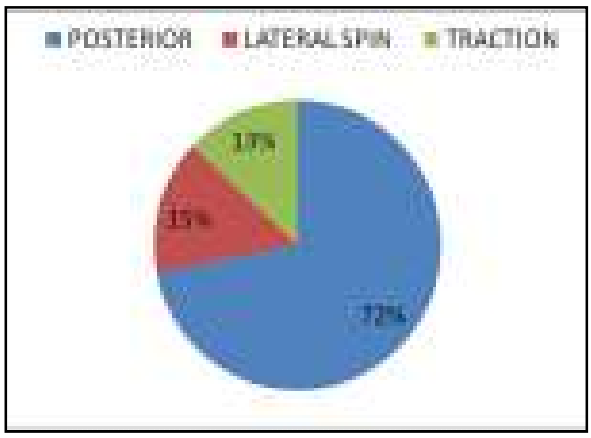
- In the AJM group for improving flexion, out of the 60 times, 39 times (65%) an inferior (longitudinal caudal) glide was applied, 11 times (18%) traction and 10 times (17%) a combination of traction and inferior glide was used.

- For improving abduction, out of the 60 times, 29 times (48%) lateral spin was applied, 12 times (20%) traction, 10 times (17%) posterior glide, 7 times (12%) a combination of traction and lateral spin and 2 times (3%) a combination of traction and posterior glide was used.



- For improving internal rotation, out of the 60 times, 54 times (90%) posterior glide was applied and 6 times (10%) traction was used.

- For improving external rotation, out of the 60 times, 43 times (72%) a posterior (longitudinal caudal) glide was applied, 9 times (15%) lateral spin and 8 times (13%) traction was used.



- Hence necessitating that we can go beyond the margins of rules governing joint mobilization to achieve the last few degrees of ROM which therapists struggle to restore.

Figure 1. Ajm to improve fexion

Figure 2. Ajm to improve abduction

Figure 3. Medial Rotation

Figure 4. Lateral Rotation

Conclusion

Angular joint mobilization and Maitland Mobilization are equally effective in reducing pain, improving range of motion and improving function.

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