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Research Article

IMMEDIATE EFFECT OF MULLIGAN TAPING VS MOBILIZATION WITH MOVEMENT IN SHOULDER IMPINGEMENT

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ABSTRACT

Background: Out of all the shoulder disorders, shoulder impingement is the most commonly reported. Shoulder impingement is one of the important cause of shoulder pain. Patients with a history of chronic occupational or sports related shoulder stress are at increased risk for developing this disorder.

Methodology: This was an interventional pre/post study. 30 patients with positive Hawkins and/or Neer impingement test were taken for the study as subjects. They were then divided into two groups of 15 each – Group A and Group B. Both the groups were assessed and reassessed for (i) pain status using NRS (Numerical Rating Scale) both at Rest & Activity (ii) Shoulder Flexion, Extension, Abduction, Adduction, Internal & External Range of Motion (ROM) & (iii) Functional scale SPADI (Shoulder pain and disability index) pre and post the intervention. Group A was implemented with Posterolateral Mulligan taping and Group B was implemented with Mulligan's Posterolateral Glide Movement with Mobilization. The mean of the difference of pre and post techniques was taken. Comparison between the immediate effects of both the techniques was done using unpaired t-test.

Results: Mulligan Taping technique promoted significant reduction in NRS both at rest and on activity ($p < 0.001$), Shoulder Flexion ($p=0.0010$), Abduction (0.0009), Internal rotation ROM ($p=0.0009$) & SPADI percentage ($p=0.0029$) as compared Mulligan's Movement with Mobilization technique.

Conclusions: Mulligan Taping is more effective as compared to Mulligan's Movement with Mobilization technique in decreasing Pain status through NRS at rest & activity, Increasing Shoulder Flexion, Abduction and Internal rotation range of motion and improvising SPADI percentage.

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INTRODUCTION

In our day to day life unknowingly we are exposed to various types of stress and more tend to stress the musculature. Maximum movements are taken place through shoulder joint hence it's a more of mobility joint rather than stability as compared to hip joint. While providing mobility, the stability of this joint is taken care by tendons of rotator cuff. Shoulder impingement is defined as mechanical compression and irritation of the soft tissues in the suprahumeral space. It is the most common cause of shoulder pain^{21,22}. Impingement of the inflamed rotator cuff tendons and the overlying subacromial bursa between the coracoacromial arch and the humeral tuberosities is an important cause of shoulder pain and disability²³. Pathologically, this ailment is associated with subacromial bursitis as well as rotator cuff (largely supraspinatus) and bicipital tendon inflammation, with or without frank degenerative changes in the tendons^{24,25}. The

cause of impingement is multifactorial, involving both structural and mechanical impairments. Impingement syndrome is often used as diagnosis when the patient's signs and symptoms are related to pain with overhead reaching, a painful arc mid-range, and positive impingement tests.^{20,21}

Other test results may more specifically identify the tissues involved, faulty biomechanics associated with the condition, or the degree of instability or injury. Symptoms that derive from impingement are usually brought on with excessive or repetitive overhead activities that load the shoulder joint, particularly in the midrange. Impingement syndromes are generally classified as intrinsic or extrinsic.

Intrinsic factors are those that comprise the integrity of the musculotendinous structures and include vascular changes in the rotator cuff tendons, tissue tension overload and collagen disorientation and degeneration^{1,2}. Extrinsic factors involve because of the mechanical wear of the rotator cuff against the

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anteroinferior one-third of the acromion in the suprahumeral space during elevation activities of the humerus.

Impingement syndromes have varying etiological factors and therefore can be categorized in several ways as follows, Based on the degree or stage of pathology of the rotator cuff (Neer's classification of rotator cuff disease)⁴

- Stage1, Edema, hemorrhage(patient usually <25 years of age)
- Stage2, Tendonitis/bursitis and fibrosis(patient is usually 25 to 40 years of age)
- Stage 3, Bone spurs and tendon rupture(patient is usually >40 years of age)

Based on the Impaired Tissue²⁶

- Supraspinatus tendonitis
- Infraspinatus tendonitis
- Bicipital tendonitis
- Superior glenoid labrum
- Subdeltoid (subacromial) bursitis
- Other musculotendinous strains(specific to type of injury or trauma) like anterior- from the overuse with racket sport (pectoralis minor, subscapularis, coracobrachialis, short head of biceps strain) and inferior – from motor vehicle trauma (long head of triceps, serratus anterior).

Various types of treatment involving conservative management, modalities, cross fiber massage, Maitland, mulligan mobilization is effective in treatment of shoulder impingement.

According to Aimie F. Kachingwe, EdD, Beth Phillips, *et al.* (2008), manual therapy is effective than therapeutic exercise in treatment of shoulder impingement.

According to PALMA TEYS *et al.* (2012), mulligan techniques are effective in management of shoulder impingement.

The Mulligan Concept (Brian Mulligan FNZSP (Hon), Diploma M.T.)

“Mobilizations’ with Movement”: A new approach. It is stating the obvious that many different manual therapy concepts and procedures are taught, and all have a place in the treatment of patients. However, all the techniques in the Mulligan Concept, when indicated, are expected to bring about an immediate improvement in the patient's condition. This is important in manual therapy, as endless perseverance with no lasting benefit to the patient cannot be justified. This new approach has been found to be able to restore functional movements in joints (often in one treatment session), even after many years of restriction, which questions the text books that speak of adaptive shortening. Spectacular results are often obtained using mobilizations with movement (MWM).” Mobilization With Movement is the concurrent application of pain free accessory mobilization with active or passive physiological movement.

Mulligan (mobilization with movement) is the concurrent application of pain free accessory mobilization with active/passive physiological movement.

According to **Mulligan, BR; manual, ed4 wellington**, movement with mobilization (Mulligan Glide) is useful in modifying joint tracking and reinforcing full movement when there is painful restriction of shoulder elevation because of shoulder impingement.

According to BR MANUAL, ed4, New Zealand, press 1999, Mulligan-taping is a technique that involves application of the tape in direction that compliments the applied mulligan glide passive force to the joint / soft tissue. Thus, it helps in sustaining the glide.

Taping is widely used in the field of rehabilitation as both means of treatment and prevention of sports-related injuries. The essential function of most tape is to provide support during movement. Some believe that tape serves to enhance proprioception and, therefore to reduce the occurrence of injuries. The most commonly used tape applications are done with nonstretch tape. The rationale is to provide protection and support to a joint or a muscle³⁴.

MATERIALS AND METHODS

Materials Used

- Universal full scale goniometer
- Numerical rating scale
- Shoulder pain and disability index

Study Design

- Type of Study : COMPARATIVE
- Duration of study : 1 year
- Area of Study : Metropolitan

Sample Design

- Sample size : 30 (group A =15, group B=15)
- Sample population: Subjects with shoulder impingement. Age between 25 to 40 years
- Sampling: Convenient

Inclusion Criteria

- Subjects willing to participate.
- Subjects with shoulder impingement with At least one positive impingement test: neers test, Hawkins Kennedy's test, jobe's test.
- Painful arc midrange.
- PAIN on anterolateral aspect of shoulder.
- Age group between 25 to 40 years.
- NRS SCORE less than 4/10

Exclusion Criteria

- Fibromyalgia
- Traumatic shoulder injury (fracture, infective conditions).
- Numbness or tingling in upper extremity
- Previous shoulder or neck surgery
- Any systemic illness.
- Shoulder condition like adhesive capsulitis, Labral tear, shoulder instability and rotator cuff injuries.
- Cervical pathologies.

Procedure

- A written consent form was taken from the subject in the language best understood by them.
- Screening of the subject was done as per the inclusion criteria. 30 subjects with shoulder impingement were taken and was further divided in two group A & B consisting of 15 subjects each.
- Before application of mobilization with movement and mulligan taping, a pain score on numerical rating scale, active shoulder range of motion was taken by using full scale goniometer and shoulder pain and disability score was taken.
- And after APPLICATION of mulligan taping and mobilization with movement, pain score and active shoulder range of motion using full scale goniometer and shoulder pain and disability index was taken.
- All patients irrespective of what treatment they receive before the application of MWM OR MULLIGAN TAPING were given therapeutic ultrasound of 1.2 watt/cm² for 7 minutes of 1 MHz frequency followed by shoulder range improving exercises for flexion, abduction and rotation.

Posterolateral Mulligan Taping

- Patient position: sitting on a chair with back supported.
- Method: first place a under wrap and make sure there is no tension or pull while applying it.
- Tape is anchored medially to the head of the humerus. The therapist stands on the opposite side of the affected shoulder and applies a Posterolateral glide to the glenohumeral joint from the palm of one hand.
- The therapist pulls one end of the tape around the shoulder in the poster lateral direction using the other hand.
- Tape is secured on the medial border of the scapula.
- Precautions: Tape should not be over the deltoid or else it will come out on shoulder abduction.

Posterolateral Mulligan Glide (mobilization with movement):

- Subject position: sitting on a chair with arm by the side and head in neutral position.
- Therapist position & procedure: stand on the side opposite to affected shoulder and reach across the patient’s torso to stabilize the scapula with palm of one hand, while the other hand is placed over the anteromedial aspect of the humerus.
- Apply a graded Posterolateral glide of the humeral head on the glenoid.
- Request the patient to perform previous painful active shoulder abduction, elevation.
- Maintain the Posterolateral glide mobilization throughout elevation and return to neutral and apply 3 sets of 10 repetitions glide
- Ensure that no pain is experienced during the procedure.
- The data will be statistically analyzed using paired T test within the group and unpaired T test between two groups.

RESULTS

Table 1 Shows the comparison between pre and post values of NRS of Posterolateral Mobilization with movement Glide.

Posterolateral MWM Glide	PRE mean	POST mean	P value P=<0.05	Standard Deviation PRE	Standard Deviation POST
NRS (REST)	4	2	<0.0001(S)	0.6399	1.033
NRS (ACTIVITY)	4	2	<0.0001(S)	0.6399	0.6779

*S: Significant

Table 2 Shows the comparison between pre and post ranges of Shoulder Flexion, Shoulder Abduction and Shoulder Internal rotation of Posterolateral MWM glide.

Shoulder movement	Pre	Post	P Value P=0.05	Standard deviation pre	Standard deviation post
Shoulder flexion	165	175	0.0010 (S)	5.499	4.546
Shoulder abduction	161.7	169.9	0.0009 (S)	6.726	5.444
Shoulder Internal rotation	65	75	0.0009 (S)	4.140	7.056

*S: Significant

Table 3 Shows the comparison between the pre and post SPADI percentage of Posterolateral MWM glide.

Spadi	PRE mean	POST mean	P VALUE p=<0.05	Standard deviation Pre	Standard deviation post
Spadi	21.22	11	<0.0001(S)	4.058	4.877
Spadi (pain)	24.8	12.53	<0.0001 (S)	6.879	7.763
Spadi(disability)	19	10.17	<0.0001 (S)	3.105	3.625

*SPADI: Shoulder Pain And Disability Index *S: Significant

Table 4 Shows the comparison between the pre and post values of NRS on rest and activity of Posterolateral Mulligan Taping.

Nrs	PRE Mean	POST Mean	P VALUE p=<0.05	Standard deviation pre	Standard deviation post
Nrs (rest)	4	1	<0.0001 (S)	0.7432	0.7746
Nrs (activity)	4	1	<0.0001 (S)	0.3519	0.6211

*S: Significant

Table 5 Shows the comparison between the pre and post ranges of shoulder flexion, shoulder abduction and internal rotation of Posterolateral Mulligan taping.

Shoulder movement	Pre Mean	Post mean	P value p=<0.05	Standard deviation pre	Standard deviation post
Shoulder Flexion	170	180	<0.0001 (S)	9.424	3.086
Shoulder Abduction	165	180	<0.0001 (S)	8.194	4.577
Shoulder Internal Rotation	75	90	<0.0001 (S)	5.3	3.105

*S: Significant

Table 6 Shows the comparison between the pre and post SPADI percentage of the Posterolateral Mulligan Taping

Spadi	PRE mean	POST mean	P value p<0.05	Standard deviation pre	Standard deviation post
Spadi	22.04	5.387	<0.0001 (S)	5.418	4.542
Spadi(pain)	25.73	6.53	<0.0001 (S)	5.399	5.630
Spadi (disability)	19.83	4.45	<0.0001 (S)	6.544	4.070

*S : Significant

Table 7 Shows the comparison of the post values of NRS between Posterolateral MWM glide (Group A) and Posterolateral Mulligan Taping (Group B)

Nrs	Group A mean	Group B mean	P value p<0.05	Standard deviation Group A	Standard deviation Group B
Nrs (rest)	2	1	0.0001 (S)	1.033	0.7746
Nrs (activity)	2	1	0.0001 (S)	0.6779	0.6211

*S: Significant

Table 8 Shows the comparison of the post values of shoulder flexion, shoulder abduction and shoulder internal rotation between the Posterolateral MWM glide (Group A) and Posterolateral Mulligan Taping. (Group B)

Shoulder movements	Group A Mean	Group B mean	P value p<0.05	Standard deviation Group A	Standard deviation Group B
Shoulder flexion	175	180	0.0014 (S)	4.546	3.086
Shoulder abduction	170	180	0.0006 (S)	5.444	4.577
Shoulder internal rotation	75	90	<0.0001 (S)	7.056	3.105

*S : Significant

Table 9 Shows the comparison of the post SPADI percentages between the Posterolateral MWM glide (group A) and Posterolateral Mulligan Taping (Group B)

Spadi	Group A Mean	Group B mean	P value p<0.05	Standard deviation Group A	Standard deviation Group B
Spadi	11	5.38	0.0029 (S)	4.877	4.542
Spadi pain	12.53	6.53	0.0221 (S)	7.763	5.630
Spadi disability	10.17	4.45	0.0004 (S)	3.625	4.070

*S: Significant

Table 10 Shows the comparison of all the outcome measures i.e, Nrs, Shoulder Ranges And Spadi Percentages between the Posterolateral MWM glide (Group A) and Posterolateral Mulligan Taping (Group B)

Name	Group A post Mean	Group B Post Mean	P value (p<0.05)	Standard Deviation Group A	Standard Deviation Group B
Flexion	175	180	0.0010 (S)	4.54	3.08
Extension	60	60	NS	0	0
Abduction	170	180	0.0009 (S)	5.44	4.57
Adduction	180	180	NS	0	0
Internal rotation	75	90	0.0009 (S)	7.05	3.10
External rotation	90	90	NS	0	0
Nrs rest	2	1	0.0001 (S)	1.03	0.77
Nrs activity	2	1	0.0001 (S)	0.67	0.62
Spadi	11	5.38	0.0029 (S)	4.87	4.54
Spadi pain	12.53	6.53	0.0221 (S)	7.76	5.63
Spadi Difficulty	10.17	4.45	0.0004 (S)	3.625	4.07

*S:Significant , *NS: Not Significant.

RESULTS

Group A (Posterolateral mulligan glide) & B(mulligan taping) were compared using unpaired t-test, the p value was found-

- The NRS (both of REST & ACTIVITY) status was found to be p=<0.0001 i.e statistically significant.
- The shoulder flexion range of motion was found to be p =<0.0010, shoulder abduction range of motion was found to be p=0.0009 and shoulder internal rotation was found to be p=0.0009, which is also statistically significant.
- The SPADI percentage was found to be p=0.0029, which is also statistically significant.

DISCUSSION

Shoulder pain is a disabling symptom frequently encountered in primary care. The estimated prevalence of shoulder complaints is 7–34%, with about 14.7 new cases per 1000 patients per year seen in clinics^{23, 24, and 25}. Of all the shoulder disorders, shoulder impingement syndrome (SIS) is the most commonly reported, accounting for 44–65% of all shoulder pain complaints. Shoulder impingement is of important cause of shoulder pain^{24, 25}. Patients with a history of chronic occupational or sports related shoulder stress are at increased risk for developing this disorder.

Several treatments have been advocated for shoulder impingement like according to Aimie F.Kachingwe, EdD, Beth Philips, *et al.*(2008), manual therapy is effective than therapeutic exercises in treatment of shoulder impingement. Whereas Palma Teys *et al.*(2012) has concluded that mulligan techniques is effective in management of shoulder impingement. Mulligan’s mobilization with movement has been proved effective in getting an impaired joint back to its function by reversal of positional fault.

Through this study we have tried to find the immediate effect of mobilization with movement compared to mulligan taping in shoulder impingement. Here, we documented changes in NRS, shoulder range of motion and SPADI percentage in our patients post the treatment.

Table 1, 2 & 3 shows respectively, the comparison between the pre and post values of NRS, Shoulder range of motion and SPADI percentage on application of MWM Posterolateral glide.

Hetherington 1996; Mulligan 1999, have described positional faults hypothesis for MWM by reference to plantarflexion – inversion sprain injury of the ankle. Mulligan hypothesized that distal fibula subluxes anteriorly and caudally during plantarflexion-inversion sprain injury of ankle and Hetherington proposed that subsequent adhesions and effusions maintains this positional faults at the inferior tibio fibular joint. It validated by dramatic improvement in pain free range of inversion and improved function that is brought about by AP glide MWM technique on the distal fibula.

Kavanagh (1999) measured change in bone position with application of AP glide MWM of the inferior tibio-fibular joint in subjects of acute and chronic ankle sprains. The posterior displacement that occurred at distal fibula during MWM was recorded with potentiometer and plotted against the applied

force thus describing the force displacement relationship for this technique. The author claimed that the data supported the proposal of anterior-caudal positional fault of the inferior tibio-fibular joint in ankle sprain patients with the acute showing more posterior displacement

We can co-relate the same with our study, that changes in the shoulder range of motion can be noted using full scale goniometer, Pain score could be noted through NRS and functional score can be monitored through SPADI percentage. Thus we can say that although there are significant immediate effects of MWM, the patients can be treated on subsequent visits to further reduce the pain, improve the shoulder range of motion, SPADI score and have an enhanced carryover effect.

A study done by Aimie *et al*, suggested that the MWM group had a higher percentage of change from pre to post treatment on all three pain measures (VAS, Neer, Hawkins Kennedy) (Aimie *et al*, 2008). It is likely that the movement produced by MWM techniques resulted in pain reduction through activation of mechanoreceptors inhibiting nociceptive stimuli through the gate control mechanism or through facilitation of synovial fluid nutrition (Melzack *et al*, 1965; Wall 1978; Threlkeld 1992). MWM also has an hypoalgesic and sympathetic nervous system (SNS) excitation effect (Wally *et al*, 1999). Therefore in our study we found that because of pain reduction the NRS scales have improved post Mulligan MWM Posterolateral glide treatment improving patients functions. Our study concludes that Mulligan MWM Posterolateral glide helps in correcting positional fault by repositioning the joint causing it to track normally, thus helping to improve range of motion which has also been proved in our study that there is significant improvement in shoulder flexion, abduction and internal rotations post MWM Posterolateral glide values when compared to pre treatment ones.

A study done, by Aimie *et al*, 2008 have shown that MWM with supervised exercise showed the highest percentage of change in decreasing pain and improving functions from pre to post treatment. Since the SPADI function test is based on shoulder pain with functional activities thus, interventions resulting in pain reduction would also result in an improved SPADI score. One of the case report done by Lucy *et al*, 2006 concludes that MWM may be an effective treatment intervention for patients with impingement which has an improvement in SPADI scores, which is proved in our study. Our study also concludes that there has been noted significant decline of post MWM Posterolateral glide SPADI percentage when compared to SPADI percentage of pre treatment.

Table 4, 5, & 6 shows respectively, the comparison between the pre and post values of NRS, Shoulder range of motion and SPADI percentage on application of MWM Posterolateral mulligan taping.

According to Anne Hickey, Dianne Hopper *et al* (2016) there is significant reduction of pain perceived in patient suffering from patellofemoral pain post mulligan taping for the affected knee. Ina Diener PhD, Akram Amro *et al* (2010) found that adding MWM and taping techniques resulted in better outcomes than traditional physiotherapy treatment alone.

Vicenzino (2003) concluded in his research that elbow taping techniques significantly improved PFGS by 24% from baseline

and thus the treatment effect was greater than that of placebo and control conditions. Also Vicenzino & Wright (1995) applied MWM and combined it with taping and found significant changes in pain free grip force, VAS (visual analog scale) and function when compared with traditional treatment.

Samantha Fernandes *et al* (2010) conducted a study on comparative effect of mulligan mobilization with movement and mulligan taping in SI joint dysfunction, where patient who received mulligan taping showed significant reduction in VAS score post taping and similar significance has been noted in our study where patient who received MWM Posterolateral Mulligan taping showed immediate reduction in NRS value post taping. Pain modulation via gate control theory is one plausible explanation for such a change, because it has been proposed that tape stimulates neuromuscular pathways via increased afferent feedback. Under gate control theory an increase in afferent stimulus to large diameter nerve fibers can serve to mitigate the input received from a small diameter nerve fibers conducting nociception²⁸.

The cause of positional faults has been suggested to be due to changes in the shape of articular surfaces, thickness of the cartilage, orientation of the ligaments and capsules, posture or direction of the pull of muscles and tendons^{29, 30}.

According to Mulligan B (2004), Palma TEYS, Leeane, *et al* (2006) MWM corrects this by repositioning the joint causing it to track normally, Further Mulligan (2004) Also states that effect of MWM's can be maintained further via taping and self MWM which further enhance the possible lasting effect. Thus in the present study it is feasible to postulate and note that there is significant improvement in shoulder flexion, abduction and internal rotation range of motion post MWM Posterolateral mulligan taping. Lucy *et al*, 2006 concludes that MWM may be an effective treatment intervention for patients with impingement which has an improvement in SPADI scores, O'Brien and Vicenzino (1998) investigated the effect of MWM on lateral ankle sprains. It produced immediate improvements in pain, ROM and function with each treatment session And considering the above improvement in shoulder range of motion and reduction in pain, we study also concludes that there has been significant improvement in SPADI percentage post MWM Posterolateral Mulligan taping when compared to pre.

Table 7, shows the comparison between MWM Posterolateral glide and MWM Posterolateral Mulligan taping, there has been significant difference in post values of NRS of MWM Posterolateral Mulligan taping when compared to MWM Posterolateral glide

Table 8, shows there is a significant improvement in post values of shoulder flexion, shoulder abduction and shoulder internal rotations of patients who received MWM Posterolateral Mulligan taping when compared to MWM Posterolateral glide.

Table 9, shows there is significant reduction in post treatment SPADI percentage of MWM Posterolateral Mulligan taping when compared to MWM posterolateral Mulligan glide

And as proposed by Mulligan (2004) who states that effect of MWM's can be maintained further via taping and self MWM

which further enhance the possible lasting effect, which helps us to conclude that MWM Posterolateral Mulligan taping sustains the glide for longer time in comparison to MWM Posterolateral Mulligan glide and hence it's MWM Posterolateral Mulligan taping is better technique of treatment than MWM Posterolateral Mulligan glide in management of shoulder impingement. The comparison of the immediate effect in both the groups

Table 10 shows A and B addressing all the outcome measures. The pain status (NRS), shoulder range of motion and SPADI SCALE was found to be significantly reduced in the MWM Posterolateral Mulligan glide as compared to the MWM Posterolateral Mulligan taping group. We can say that mobilization with movement Posterolateral Mulligan taping is effective treatment technique and gives an instant effect. Addition of MWM Posterolateral Mulligan taping to our treatment will lead to quick but sustain recovery thus avoiding further visits. It is thus an important adjunct to other form of therapies.

CONCLUSION

It can be conducted that Posterolateral Mulligan Taping is more effective than Posterolateral Mobilization with movement glide in reducing pain status documented through NRS

It can be concluded that Posterolateral MULLIGAN TAPING mobilization with movement is effective than Posterolateral Mobilization with movement glide in improving ranges of shoulder flexion, abduction and internal rotation

It can also be concluded that Posterolateral Mulligan taping is effective than Posterolateral Mobilization with movement in reducing SPADI PERCENTAGE, It thus helps in alleviating disability which further can lead to return to ADL's and improved functional performance of the individuals.

Eventually, it can be concluded that Posterolateral Mulligan Taping is effective than Posterolateral mobilization with movement glide in treatment of shoulder impingement.

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