Original Article
Journal of Orthopaedic and Rehabilitation 2019 July-Dec; 4(2): 11- 15

# Comparison Between Mobilization With Movement And Ultrasound In Patients With De Quervain's Tenosynovitis

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## Abstract

Study objective: To find the additive effect of Mobilization with movement (MWM) and Ultrasound (US) as an adjunct to the conventional therapy in De Quervain's Tenosynovitis and compare the results.

Methods: Thirty Subjects, diagnosed with DeQuervain's tenosynovitis were included. Subjects were then randomly allotted into two group 'A' and group B.

Group A received Mulligan's MWM for wrist and 1st Carpometacarpal (CMC) joint and conventional therapy for 6 days.

Group 'B' received Pulsed ultrasound and conventional therapy for 6 days.

Results: Both groups showed significant (p=0.00) improvement in VAS, ROM, grip and pinch Strength and Michigan Scale post treatment. However, group A (Mulligan's MWM) showed significant improvement in VAS (p value<0.05), Pinch Strength (p<0.05) and Michigan Scale (p value =0.00) as compared to group B (Ultrasound).

Conclusion: This study concluded that, both group A and group B were effective in reducing pain, increasing ROM, pinch and grip strength and improving functional outcome of the patient. However, on comparison Mulligan's MWM showed more significant improvement than ultrasound.

Keywords: Grip strength, pinch strength, 1st CMC, MWM, US, hand.

## Background

De Quervain's disease is described as painful stenosing tenosynovitis in the first dorsal compartment of the hand and is caused by impaired gliding and inflammation of the tendons of the abductor pollicis longus (APL) and extensor pollicis brevis (EPB) muscles which pass through the first dorsal compartment at the radial styloid [1,2]. The age group commonly affected is 25-60 years. It is 10 times more common in females than in males.The disease is commonly seen in people who use their thumb repetitively for pinching, wringing, lifting, grasping or extension activities of the wrist such as typists, knitters, housewives, etc [3].
Individuals with De Quervains usually complain of having pain at radial styloid and difficulty in performing activities like lifting heavy weight, while extending the thumb, washing and wringing clothes, swelling is also often seen especially in chronic cases [4].Pain is especially aggravated by ulnar deviation of the wrist, abduction/extension of the thumb have been described as movements that create stress on tendons passing through the extensor retinaculum and may also cause weakness in grip and pinch strengths [5]. A thorough search of literature reveals a wide spectrum of treatments used to manage this condition which includes immobilization with a thumb spica, provocative activity avoidance, moist heat, phonophoresis with topical corticosteroids, interferential current, manual therapy, NSAIDs and corticosteroid injections [6-12].
The other modality which is used to treat DeQuervains tenosynovitis is therapeutic ultrasound. Despite of many years of clinical use, there is very little evidence supporting the effective use of therapeutic ultrasound in treating individuals with DeQuervains tenosynovitis [13,14].

Mulligan's Mobilization with Movement (MWM) is the only manual therapy technique that focuses on positional fault correction. In patients with DeQuervain's tenosynovitis, previous studies did not consider mal alignment which could result to persisting symptoms. This account for the failure of the conventional treatment approaches. Hence MWM technique is

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**Figure 1:** MWM for wrist (Radial glide to proximal row of carpal bones)

incorporated to correct positional fault [15].

## Methods

The study was conducted at Tertiary Hospital in Western India, using a randomized control trial. The study was approved by the Institutional Ethics Committee.The purpose and procedure of the treatment protocol was explained to the subjects and written informed consent was taken from each subject before participating in this study. Thirty subjects diagnosed with De Quervain's tenosynovitis with positive Finkelstein's test were included.

Patients were randomly allocated into two groups, group 'A' received Mulligan's MWM for wrist + exercises .Group 'B' received Ultrasound + exercises. (Table 1)

Pre and post 6 consecutive days of treatment, assessment was done using visual analogue scale (VAS) [18], Michigan Hand Outcomes Questionnaire (MHQ) [19], wrist range of motion

**Table 1:Exercises Protocol [1,27,28]:**

| DAY | EXERCISE | Dosage |
|---|---|---|
| 1 | 1. Thenar muscle group and Finkelstein's stretches | 15–20 second holds, 8–10 reps for each respective stretch. |
| | 2. Forearm extensor/flexor stretches | |
| 2 | 1. Grip strengthening by squeezing a sponge ball. | 5 sec, 3 sets for 10 repetitions |
| | 2. Eccentric of wrist extension, flexion | |
| | 3. Finger spring: Place a large rubber band around your fingers and thumb. Slowly open your hand and expand the rubber band with your thumb and fingers. | |
| 3 | Active eccentric movement of thumb abduction and extension. | 3 sets of 10 repetitions. |
| | 2. Strengthening of adductor pollicis and opponenspollicis by pulling the paper against the manual resistance | |
| 4 | 1. Eccentric ulnar deviation exercises with no concentric component. | 3 sets of 10 repetitions. |

**Figure 2:** MWM for 1st CMC joint (Dorsal glide to 1st Metacarpal)

(ROM) [20], grip strength by hand held Dynamometer [21]and pinch strength which included key pinch, pulp to pulp and tip to tip by Pinch gauge [22]. The patients were given 3 trials each and the average was considered [23].

Procedure for MWM:

Wrist MWM: Patient position- The patient was seated comfortably. The therapist grasps the lower end of the radius and ulna with one hand so that the web between your index finger and thumb lies over the distal end of the radius. The web between the thumb and index finger of the other hand lies medially over the proximal row of the carpal bones keeping the rest of the fingers and thumb from making contact with the patient. The therapist glides the carpals laterally. If this is painful, ever so slightly, direction of glide was altered to seek a pain-free glide. Provided this can be achieved, maintain the mobilization and have the patient actively move in the restricted direction [24].While giving

**Table 2: Comparison within Group A**

| MWM | MEAN± SD | | p value |
|---|---|---|---|
| | Pre | Post | |
| VAS | 6.4±1.765 | 1.33±0.816 | 0.0001* |
| Grip | 13.37±5.66 | 18.16±7.4 | 0.00* |
| Lateral Prehension | 4.22±1.32 | 6.35±1.50 | 0.00* |
| Pad to pad | 2.56±0.98 | 4.15±1.00 | 0.00* |
| Tip to tip | 2.26±2.01 | 4.02±1.99 | 0.00* |
| Michigan | 51.62±14.05 | 88.39±6.57 | 0.00* |
| ROM of Wrist Extension | 65.800±9.3 | 77.00±3.16 | 0.00* |
| ROM of Wrist Ulnar deviation | 25.06±7.57 | 29.53±1.35 | 0.03* |
| ROM of Wrist Radial deviation | 15.6±5.0 | 19.26±1.43 | 0.00* |
| ROM of Thumb Extension | 42.46±10.34 | 48.46±2.72 | 0.01* |
| ROM of Thumb Abduction | 60.80±11.81 | 68.2±3.05 | 0.008* |

*p value<0.05(statistically significant).

Table 3: Comparison within Group B

| ULTRASOUND | MEAN±SD | | p value |
|---|---|---|---|
| | Pre | Post | |
| VAS | 5.8±1.52 | 2.7±0.81 | 0.0001* |
| Grip | 12.25±5.39 | 16.62±7.27 | 0.00* |
| Lateral Prehension | 4.64±1.07 | 5.22±0.95 | 0.00* |
| Pad to pad | 2.86±1.02 | 3.64±0.83 | 0.00* |
| Tip to tip | 1.83±0.74 | 2.77±0.99 | 0.00* |
| Michigan | 56.99±11.17 | 77.55±14.05 | 0.00* |
| ROM of Wrist Extension | 67.86±8.24 | 73.13±4.86 | 0.002* |
| ROM of Wrist Ulnar deviation | 28.33±4.1 | 29.8±0.7 | 0.17 |
| ROM of Wrist Radial deviation | 15.73±4.18 | 18.0±2.0 | 0.00* |
| ROM of Thumb Extension | 40.33±8.33 | 44.40±4.7 | 0.006* |
| ROM of Thumb Abduction | 58.53±9.4 | 63.5±6.0 | 0.003* |

*p value<0.05(statistically significant).

mobilization, the glide was maintained and has the patient actively move the wrist in the painful and restricted direction with over-pressure.(Figure 1)

1st CMC joint MWM:

The therapist grasps the trapezium with index finger and thumb of one hand, and glide the 1st metacarpal dorsally with the other hand and patient was asked to do the offending movement of the thumb i.e. thumb abduction and extension, it has to be pain free, if this is painful, force or angle or direction of the glide was altered to gain the pain free movement [3]. While giving mobilization, the glide was maintained and has the patient actively move the thumb in the painful and restricted direction with over-pressure.(Figure 2)

Dosages for Wrist MWM and 1st CMC joint MWM : On the 1st day –Three repetitions of the aggravating movement while maintaining the glide are performed)

On the second day- 10 repetitions of the aggravating movement x 3 sets

For the next 4 consecutive days - 10 repetitions of the aggravating movement x 3 sets were given (Rule of three) [24].

Therapeutic Ultrasound:

Pulsed ultrasound with frequency of 3MHZ, intensity 0.8w/ cm2 for 6 minutes was given over the styloid process for 6 days [25,26].

## Results

The statistical analysis was done using SPSS version 22. The level of significance was set at p≤0.05. Within Group Analysis: Analysis of Range of motion, Grip strength, pinch strength, was done using Paired t –Test and that of pain on VAS and Michigan scale was analysed using Wilcoxon sign ranked test. Between Group Analysis: Analysis of Pain on VAS and functional outcome on Michigan scale between the groups was done using Mann-Whitney U test. Analysis of Range of motion, Grip strength, pinch strength between the groups was done using Independent 't' test.

## Discussion

The present study was undertaken to find the efficacy of Mulligan's mobilization with movement (MWM) and Ultrasound (US) in patients with DeQuervains tenosynovitis, and also to find out which therapy is better in terms of reducing pain, improving wrist and thumb ROM, grip and pinch strengths and functional abilities of the patients.

Pain:

It was seen that there was a significant reduction (p ≤0.05) in pain intensity, in both the group (Table 2 and 3). On comparison between the groups, group A showed significant reduction in pain intensity (p ≤0.05) than group B (Table 4).Reduction of pain in group A can be attributed to the neurophysiological and biomechanical mechanisms. Mulligan's premise, that mobilizations have neurophysiological effects in nature, the MWM provide some tactile stimuli to the soft tissues. The afferent nerve activity resulting from these tactile and compressive stimuli may influence the spinal cord neurons, inhibiting nociperception and the motor neuron pool and thus may provide a way to retrain the spinal cord circuit by allowing the patient to experience repetitive pain free motion. This may help to "switch off" maladapted spinal cord circuit, re-establishing normal levels of nociperception and motor neuron pool excitation [27,28].

Bio-mechanically the reduction in pain could be attributed to the corrective glide, where a disturbed joint isre-positioned to its place, and the active efforts of the patients thus activate the proper recruitment pattern of the muscles, thus reduce inflammation [26].

The reduction in pain on VAS in group B (Table 3) could be attributed to a) non thermal (biologic) effects of US, resulting due to mechanical alteration of the local, cellular environment induced by the ultrasound waves which may lead to modifications in cellular function resulting in a shorter inflammatory phase of healing, increased vascularity at the treatment site, and enhanced proliferation of fibroblasts. b) pain relief could also be due to acoustic, micro streaming and cavitation effects which increases the diffusion of ions and metabolites across the cell membrane, changes calcium and sodium ion permeability which enhance the tissue healing and thus reduce the pain [29].

The essential components for collagen production

Table 4: Comparison of post values between the groups:

| Outcome Measures | MWM | ULTRASOUND | p value |
|---|---|---|---|
| | Post | Post | |
| VAS | 1.33±0.81 | 2.73±1.48 | 0.01* |
| Grip | 18.16±7.43 | 16.62±7.27 | 0.57 |
| Lateral Prehension | 6.35±1.50 | 5.22±0.95 | 0.02* |
| Pad to pad | 4.32±0.87 | 3.64±0.83 | 0.03* |
| Tip to tip | 4.02±1.99 | 2.77±0.99 | 0.03* |
| Michigan | 88.39±6.57 | 77.55±7.13 | 0.0002* |
| ROM of Wrist extension | 77.00±3.16 | 73.13±4.8 | 0.016* |
| ROM of Wrist Ulnar deviation | 29.53±1.35 | 29.80±0.77 | 0.51 |
| ROM of Wrist Radial deviation | 19.26±1.43 | 18.00±2.00 | 0.05* |
| ROM of Thumb extension | 48.46±2.72 | 44.4±4.7 | 0.00* |
| ROM of Thumb abduction | 68.20±3.05 | 63.53±6.03 | 0.014* |

*p value<0.05(statistically significant).

cycloaminoglycan and hydroxyproline which could be increased following low dose pulsed ultrasound. This increased rate of collagen synthesis in tendon results in healing and increased tensile strength of tendon [29, 30].

On between group analysis, it was found that group A showed significant reduction in pain (Table 4) than group B. It is can be attributed to the fact that MWM reduces minor positional faults in the joints and in the present study the malalignment of the carpals and 1st CMC joint was corrected, which made the movement pain free [3]. 3These effects could be achieved by mobilization only.

Range of Motion:

It was noted that after MWM, there was increase in ROM at wrist and 1st CMC (Table 2) joint due to realignment of positional fault which in turn resulted in correct track for the joint and grossly improved the mobility and also enhanced the muscle function [16].

Group B also showed improvement in the wrist and 1st CMC joint ROM (Table 3) and the reason for this could be, as the tensile strength increase, there is improvement in the collagen fibril alignment, in turn reducing the inflammatory infiltrates and scar tissue in the tendons, thus improving the ROM [31].

Between group analysis showed that, group A had significant improvement in all joint ROM of wrist and 1st CMC joint ($p<0.05$) than group B (Table 4). The reason for this could be attributed to the correction of positional fault which is done by MWM technique.

Strength:

In the present study, bothMWM and US were effective in increasing the pinch strength and grip strength($p<0.05$) post 6 days intervention. But when compared between the groups, both group A and B showed no significant difference ($p>0.05$)for grip strength. Group Ashowed significant improvement ($p<0.05$) than group B with respect to pinch strength (Table 4).

Group B have showed improvement in pinch strength, and the possible reason for this could be, as there is decrease in inflammation of thickened extensor sheath, there is increase in the isometric activation of the abductor pollicis brevis and extensor pollicis brevis tendon [29].

MWM group showed significant improvement in pinch strength as compared to US group. This could be because MWM corrects the positional fault and alleviates the pain with movement, which also helps the muscle fibers to recruit in a proper manner and in turn allows the patient to contract the muscle to its maximum ability and these positive effects were maintained by the conventional therapy [16].

Conventional therapy included stretching, eccentric and isometric exercises of thumb and wrist muscles which are required for different pinches and grips in the daily activities. In the present study, stretching exercises showed positive effects on tenosynovitis which can be attributed to lengthening of muscle tendon unit [6]. The proposed mechanism was, passive manual stretch facilitating the laying down of collagen and regaining muscle length which decreasedthe muscle stiffness via passive viscoelastic changes or an indirect decrease because of reflex inhibition and consequent viscoelasticity changes from decreased actin myosin cross bridging. This helped in increasing the joint range of motion [32].

One of the studies hypothesized that eccentric loading is mainly used in functional activities of daily living and should be added in the treatment program [6]. Literature suggests that eccentric strengthening reduces pain as it helps in increasing the resting length of the muscle tendon unit and decreases the stress on the joint. In one of the study it was believed that, training the small muscles with inadequate blood supply would increase vascular supply thereby decreasing the degree of predisposition [33]. As both the groups received supervised exercises programme (stretching and strengthening exercises); it has been seen, that there is decrease in pain, improvement in grip and pinch strength and functional ability score.

Functional Activity:

As the subjects gained the range of motion and there is marked reduction in the level of pain their functional ability also improved. Both the groups showed a significant change in scores of MHQ ($p<0.05$) as seen in table2 and 3. But group A showed more significant improvement ($p=0.00$) as seen in table 4 than group B. The reason for improvement for the functional ability in MWM group could be due to the fact that, Mulligan's MWM restore the mobility and reduction in pain which enhances the confidence level of the patient to use the hand in the daily activities and thus decreasing the overall disability.

Thus, it can be concluded that MWM group proved to be more beneficial in recovery of pain and improving range of motion at wrist, 1st CMC joint, grip and pinch strength which usually get affected in De Quervain's Tenosynovitis and hence decrease in functional disability of the patients when compared to US group.

Scope for further research: Long term effects of the treatment can be evaluated.

## Conclusion

This study concluded that, both MWM and Ultrasound group were effective in reducing pain, increasing pinch and grip strength and improving functional outcome of the patient.However, on comparison MWM group showed more significant improvement in pain, wrist and 1st CMC ROM, pinch strength thus more reduction in functional disability of patients than US group.Both the treatment techniques were equally effective in improving grip strength of the patient.

## Acknowledgements

The authors would like to thank Dr Rachana Dabadghav (PT) for her statistical guidance and also all the participants of the study for actively participating in th

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## How to Cite this Article

Conflict of Interest: Nil
Source of Support: None

Jaiswal P R, Mahapatra R K, Bedekar N, Shyam A, Sancheti P. Comparison Between Mobilization With Movement And Ultrasound In Patients With De Quervain's Tenosynovitis. Journal of Orthopaedic and Rehabilitation 2019 July-Dec; 4(2): 11-15.