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Original Research Article

Effectiveness Of Mulligan Mobilization with Movement Versus Conventional Physiotherapy Exercises in Type 2 Diabetic Individuals with Frozen Shoulder

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ABSTRACT

Background:

Introduction: Frozen shoulder frequently affects individuals with diabetes mellitus, resulting in pain, restricted shoulder mobility, and function. Conventional physiotherapy exercises are often prescribed to address these symptoms. Mulligan's Mobilization with Movement (MWM) is a manual therapy technique increasingly recognized for its benefits in joint dysfunctions.

Objective: Aim of this study is to evaluate and compare the effectiveness of Mulligan mobilization with Movement and Conventional Physiotherapy Exercises in Type 2 Diabetic individuals with Frozen shoulder.

Methods: A randomized controlled trial was conducted involving 30 Type 2 Diabetic participants diagnosed with Frozen shoulder. Participants were randomly divided into two groups: Experimental Group received Mulligan Mobilization with Movement, and Control Group received Conventional Physiotherapy exercises. Both groups were treated over a period of 4 weeks, with adjunctive ultrasound therapy and Moist heat provided to all the participants. Outcome measures including the Visual Analog Scale (VAS) for pain, shoulder range of motion (ROM) assessed using a goniometer, and Random Blood Sugar (RBS) levels. Evaluations were performed pre- and post-intervention.

Results: Both groups exhibited significant improvements in pain levels, ROM, and RBS values post-treatment ($p < 0.05$). However, Experimental Group (Mulligan Mobilization with Movement) demonstrated greater reduction in pain scores and superior improvements in shoulder ROM compared to Control Group (Conventional Physiotherapy Exercises) ($p < 0.01$). Although both groups showed slight reduction in RBS levels, there was no statistically significant difference between them.

Conclusion: Mulligan Mobilization with Movement is more effective than Conventional Physiotherapy Exercises in reducing pain and enhancing shoulder mobility in Type 2 Diabetic individuals with Frozen shoulder. While minor improvements in glycemic control were observed, further investigation to determine the sustained metabolic benefits of such physiotherapeutic interventions. Integrating MWM into routine rehabilitation may support more efficient functional recovery in Type 2 Diabetic population.

Keywords: Frozen shoulder, Mulligan Mobilization with Movement, Type 2 Diabetes mellitus, physiotherapy, Range of motion, Random blood sugar, Shoulder rehabilitation.

Background

Frozen shoulder is a painful and disabling condition characterized by a progressive loss of both active and passive range of motion (ROM) in the shoulder joint, typically without a known intrinsic cause or trauma. The term 'Frozen shoulder' is commonly used for Adhesive capsulitis [1,2]. First described by Duplay in 1872 as "peri-arthritis scapulo-humerale," the term "frozen shoulder" was later popularized by Codman and further refined by Captuli in 2009 [3].

The Frozen shoulder progresses through three clinical phases: the painful "freezing" phase (lasting 2–9 months), a "frozen" phase with marked stiffness (4–12 months), and a "thawing" phase with gradual return of motion (5–24 months) [4,5]. Frozen shoulder significantly affects daily activities such as dressing, grooming, and overhead reaching [6].

It is estimated that the prevalence of Frozen shoulder is 2–5% in the general population, with a notably higher incidence up to 10–34% in individuals with Type 2 diabetes mellitus [7,8]. Type 2 Diabetic individuals are also more prone to bilateral involvement and often experience more severe and longer-lasting symptoms [9]. The underlying pathophysiology in Type 2 Diabetics may involve non-enzymatic glycosylation of collagen, leading to capsular fibrosis and reduced capsular compliance [10].

Physiotherapy is the cornerstone of conservative treatment in Frozen shoulder, aiming to reduce pain, restore shoulder ROM, and improve functional capacity [11]. Conventional physiotherapy Exercises intervention typically involves Pendular (codman) exercise, Pulley exercise, finger ladder exercise and passive stretching exercises. Ibrahim et al. demonstrated that passive stretching was more effective than active exercise alone in improving shoulder ROM [12]. Griggs et al. reported that self-stretching protocols were successful in 90% of individuals in the frozen stage of the condition [13].

Among newer manual therapy approaches, Mulligan's Mobilization with Movement (MWM) has shown promising results. This technique combines sustained accessory joint glides with active physiological movement to reduce pain immediately and restore joint function [14]. Studies by Doner et al. and Goyal et al. confirmed that MWM significantly improves shoulder ROM and function compared to traditional mid-range or end-range mobilization techniques [15,16]. Reddy et al. also concluded that MWM was more effective than Conventional Physiotherapy Exercises in reducing pain and improving functional scores in individuals with Frozen shoulder.

Although the effectiveness of Mulligan Mobilization with Movement (MWM) in treating Frozen shoulder is increasingly supported by clinical research, there remains a notable lack of studies specifically addressing its impact in the Type 2 Diabetic population. Given the higher incidence, prolonged duration, and greater severity of Frozen shoulder in individuals with Type 2 Diabetes mellitus, it is crucial to explore rehabilitation strategies tailored to this subgroup. By utilizing outcome measures such as the Visual Analog Scale (VAS) for pain, shoulder range of motion (ROM) assessed with a goniometer, and Random Blood Sugar (RBS) levels, this study offers a more holistic understanding of both musculoskeletal and metabolic responses to physiotherapy. The primary objective is to evaluate and compare the effectiveness of Mulligan Mobilization with Movement and Conventional Physiotherapy Exercises in Type 2 Diabetic individuals with Frozen shoulder, thereby contributing to the advancement of focused, evidence-based therapeutic protocols for this High-risk population.

Objectives

General Objective

To evaluate the effectiveness of Mulligan Mobilization with Movement compared to Conventional Physiotherapy Exercises in improving clinical outcomes in Type 2 Diabetic individuals with Frozen shoulder.

Specific Objectives

1. To evaluate the reduction in pain severity following Mulligan Mobilization with Movement or Conventional Physiotherapy Exercises intervention.
2. To measure the improvement in Range of Motion (ROM) of the shoulder joint following Mulligan Mobilization with Movement or Conventional Physiotherapy Exercises intervention.
3. To compare the Random Blood Sugar (RBS) levels between the Mulligan Mobilization with Movement and Conventional Physiotherapy Exercises intervention.

Materials and Methods

Study Design

This study was a **randomized controlled trial** conducted on **30 Type 2 diabetic** participants **diagnosed with Frozen shoulder**. The participants were randomly allocated into two groups to compare the effectiveness of **Mulligan Mobilization with Movement (MWM)** and **Conventional Physiotherapy exercises**. The intervention duration was **four weeks**, with outcome measures assessed pre- and post-intervention to evaluate changes in pain, range of motion (ROM), and Random blood sugar levels.

Setting

The study was conducted at:

- Department of Physiotherapy, PDS Institute of Physiotherapy (Princess Durru Shehvar Children's & General Hospital), Purani haveli, Hyderabad.

Study Population

Inclusion Criteria:

- Male and female participants aged between 35–65 years.
- Diagnosed cases of **Frozen shoulder** (Stage II) with limited shoulder ROM and pain lasting more than one month.
- Confirmed Type II Diabetes Mellitus (controlled or moderately uncontrolled, with Random Blood Sugar [RBS] ≤ 250 mg/dL). Able to follow instructions and participate in the treatment protocol.
- No physiotherapy treatment received in the past four weeks.

Exclusion Criteria:

- Participants with **cervical or thoracic spine dysfunctions** (must be treated and resolved before inclusion).
- Any history of **intra-articular steroid injection** in the affected shoulder within the last three months.
- History of **fracture**, **shoulder surgery**, or **complete rotator cuff tear**.

- Presence of **tendon calcification**, **cervical rib**, or **neurological disorders** affecting shoulder function.
- Severe uncontrolled diabetes (Random Blood Sugar [RBS] > 250 mg/dL) or associated diabetic complications (e.g., diabetic neuropathy affecting the upper limb). Participants with any systemic musculoskeletal or inflammatory conditions (e.g., rheumatoid arthritis).

Data Collection

All eligible participants were initially screened based on inclusion and exclusion criteria. After obtaining **informed written consent**, participants were randomly allocated into two groups. **Experimental Group A (Mulligan Mobilization with Movement)** and **Control Group (Conventional Physiotherapy exercises)** using a simple **random card draw method** for group assignment.

Although the sampling technique was **convenience sampling**, group allocation was randomized to reduce selection bias.

- **Experimental Group (Mulligan mobilization with movement):** Participants received , **Mulligan Mobilization with Movement (MWM) for shoulder Flexion, abduction & Rotation**, thrice per week. Additionally, they were given a structured home exercise program.
- **Control Group (Conventional Physiotherapy exercise):** Participants received and **conventional physiotherapy exercises** focusing on pendular (codman) exercise, Pulley exercise, finger ladder exercise, passive stretching exercises, active-assisted exercise and passive mobilization techniques (thrice per week), along with a prescribed home exercise plan.

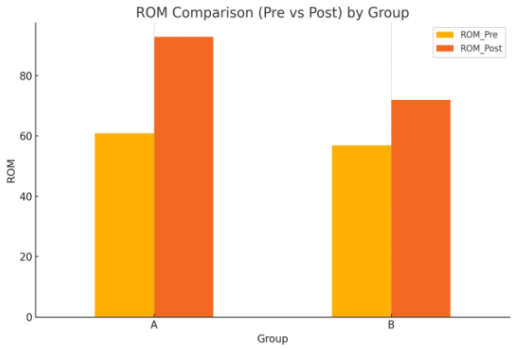
Both groups were given **Ultrasound therapy and Moist heat**

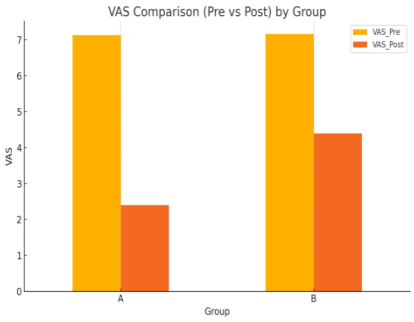
Data was collected **prospectively** using specially designed and validated **questionnaires and clinical assessment tools**, which included:

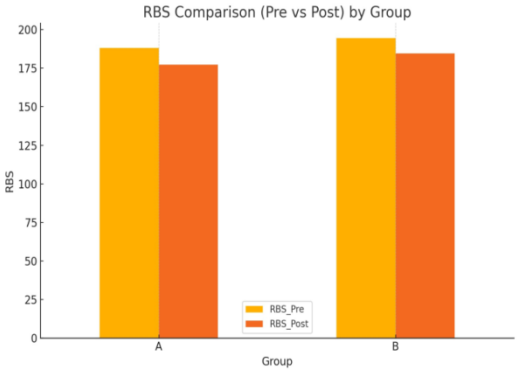
- **Visual Analog Scale (VAS)** for pain
- **Goniometric measurement** of shoulder joint range of motion (ROM)
- **RBS levels** to monitor diabetic status

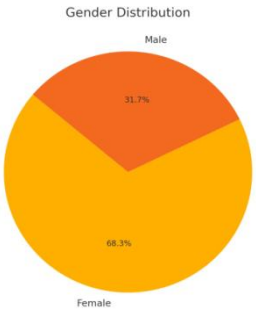
Baseline and post-treatment assessments were carried out for all participants after the **4-week intervention period**.

Outcome Measure	Time Point	Experimental Group A (Mulligan mobilization with movement)	Control Group B (Conventional Physiotherapy exercise)	Mean Difference	p-value
VAS	Pre-Intervention	7.12±1.258	7.11 ±1.102	0.010	0.974
	Post-Intervention	2.48±1.264	4.36±1.150	-1.877	<0.001
ROM	Pre-Intervention	60.87±10.714	56.88±11.206	3.990	0.164
	Post-Intervention	92.90±11.591	71.92±11.362	20.973	<0.001
RBS	Pre-Intervention	188.26±31.066	194.61±36.198	-6.350	0.469
	Post-Intervention	177.20±29.911	184.55±37.163	-7.347	0.403









RESULTS

This study aimed to evaluate the comparative effectiveness of Mulligan Mobilization with Movement (Experimental Group) versus Conventional Physiotherapy Exercises (Control Group) on three outcome measures: Random Blood Sugar (RBS), Visual Analog Scale (VAS) for pain, and Range of Motion (ROM).

1. Visual Analog Scale (VAS)

At baseline, pain scores were comparable between the groups (Experimental Group: 7.12 ± 1.26; Control Group: 7.11 ± 1.10), with a negligible mean difference of 0.010 ($p = 0.974$), indicating no significant initial variation. However, post-treatment scores showed a marked reduction in pain in Experimental (Mulligan Mobilization with Movement) Group (2.48 ± 1.26) compared to Control (Conventional Physiotherapy exercises) Group (4.36 ± 1.15), yielding a statistically significant mean difference of -1.88 ($p < 0.001$). These findings suggest that Mulligan Mobilization with Movement was more effective in reducing pain levels.

2. Range of Motion (ROM)

Pre-intervention shoulder ROM was slightly higher in Experimental Group (60.87 ± 10.71) than in Control Group (56.88 ± 11.21), though the difference was not statistically significant ($p = 0.164$). Post-intervention, Experimental (Mulligan Mobilization with Movement) Group showed a notable increase in ROM to 92.90 ± 11.59, whereas Control (Conventional Physiotherapy exercise) Group improved to 71.92 ± 11.36. The between-group mean difference of 20.97 was statistically significant ($p < 0.001$), indicating significantly improved mobility in the Mulligan group.

3. Random Blood Sugar (RBS)

At baseline, Experimental (Mulligan Mobilization with Movement) Group had a slightly lower RBS (188.26 ± 31.07) compared to Control (Conventional Physiotherapy exercise) Group (194.61 ± 36.20), with a non-significant mean difference of -6.35 ($p = 0.469$). After treatment, both groups showed a minor reduction in RBS levels: Experimental (Mulligan Mobilization with Movement) Group to 177.20 ± 29.91 and Control (Conventional Physiotherapy exercises) Group to 184.55 ± 37.16. However, the between-group difference of -7.35 remained statistically non-significant ($p = 0.403$), suggesting that neither intervention had a substantial impact on glycemic control.

DISCUSSION

The present study provides strong evidence supporting the efficacy of Mulligan Mobilization with Movement (MWM) over Conventional Physiotherapy exercises in improving clinical outcomes in Type 2 Diabetic individuals with Frozen shoulder. The study sample included both male and female participants, with a balanced gender distribution and an age range representative of the typical population affected by frozen shoulder, primarily between the fifth and seventh decades of life. Age-related degenerative changes and hormonal differences may influence shoulder pathology, and the inclusion of both sexes enhances the generalizability of the findings.

Pain reduction was significantly greater in the Experimental (Mulligan Mobilization with Movement) group. VAS scores decreased from 7.12 ± 1.26 to 2.48 ± 1.26 in Experimental (Mulligan Mobilization with Movement) Group, compared to a decrease from 7.11 ± 1.10 to 4.36 ± 1.15 in Control (Conventional Physiotherapy exercises) Group ($p < 0.001$). This substantial improvement aligns with the neurophysiological principles of the Mulligan technique, which combines sustained joint glides with active movement to influence mechanoreceptor activity and modulate pain. These results are consistent with prior studies such as those by Doner et al. [17] and Goyal et al. [18], who observed clinically meaningful reductions in pain with MWM in individuals with Frozen shoulder.

Range of Motion also improved significantly in the Experimental (Mulligan Mobilization with Movement) group, from 60.87 ± 10.71 to 92.90 ± 11.59, compared to an increase from 56.88 ± 11.21 to 71.92 ± 11.36 in the Control (Conventional Physiotherapy exercise) group ($p < 0.001$). The greater improvement in Experimental Group suggests superior biomechanical correction of positional faults, allowing for increased joint excursion. Mulligan [3] described how Mulligan Mobilization with Movement can restore normal joint mechanics, reduce restrictions, and promote functional mobility. This mechanistic explanation aligns with the clinical findings of Ibrahim et al. [19] and Doner et al. [17], who also reported enhanced ROM with manual therapy techniques.

Regarding metabolic parameters, both groups showed slight reductions in **Random Blood Sugar (RBS) levels** post-intervention. Experimental (Mulligan Mobilization with Movement) Group reduced from 188.26 ± 31.07 to 177.20 ± 29.91, and Control (Conventional Physiotherapy exercise) Group from 194.61 ± 36.20 to 184.55 ± 37.16. However, the difference between groups was not statistically significant ($p = 0.403$). This suggests that while physical activity and neuromuscular engagement may support metabolic improvements, the short duration of intervention and baseline variability limit definitive conclusions on glycemic control. Longer-term interventions may be necessary to observe significant metabolic effects.

Baseline comparisons revealed no statistically significant differences between groups in pre-intervention scores for VAS ($p = 0.974$), ROM ($p = 0.164$), and RBS ($p = 0.469$), confirming that the observed post-intervention changes can be attributed to the interventions rather than baseline disparities. The uniformity in demographic distribution, including age and gender, further strengthens the internal validity of the study.

These findings echo the work of Reeves [20] and Griggs et al. [13], who emphasized the chronic and debilitating nature of Frozen shoulder and the importance of early and effective rehabilitation strategies. Manual therapy techniques, such as those developed by Mulligan, may offer an efficient and non-invasive alternative to manage Frozen shoulder, especially in Type 2 Diabetic population where functional impairments are compounded by systemic metabolic limitations.

The present study supports the clinical application of MWM as a standard intervention in rehabilitation programs for shoulder dysfunction in Type 2 Diabetic individuals. As emphasized by Zuckerman and Rokito [2], individualized rehabilitation protocols, early intervention, and precise diagnostic frameworks are essential for optimizing functional outcomes. Future research should consider larger sample sizes, multi-centre trials, and extended follow-up periods to validate and expand upon these findings.

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