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Effects of Retrowalking and Vastus Medialis Oblique Training on Geriatric Population with Knee Pain at Tertiary Hospital - An Observational Study

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ABSTRACT

Background: Knee pain is a common musculoskeletal problem among the geriatric population and significantly affects mobility, functional independence, and quality of life[1]. Weakness of the vastus medialis oblique (VMO) muscle and altered gait mechanics contribute to pain, reduced range of motion, and functional limitations[2]. Retrowalking has recently gained attention as a low-impact rehabilitation strategy that may reduce joint stress while improving muscle activation and proprioception[3]. However, evidence on the combined effect of retrowalking and VMO strengthening in elderly individuals with knee pain remains limited.

Objective: To evaluate the effects of retrowalking combined with vastus medialis oblique muscle training on knee pain and knee joint range of motion in the geriatric population.

Methods: An observational study was conducted among 38 participants aged 61–80 years with knee pain and reduced knee range of motion, recruited from the Department of Physical Medicine and Rehabilitation at a tertiary care hospital. Participants underwent a rehabilitation protocol consisting of 5 minutes of retrowalking with intermittent rest and 30 minutes of VMO muscle strengthening exercises, five days per week for three weeks. Knee pain was assessed using the Numerical Pain Rating Scale (NPRS), and knee joint range of motion was measured using goniometry before and after the intervention. Data were analyzed using the paired t-test.

Results: Post-intervention analysis demonstrated a statistically significant reduction in knee pain scores and a significant improvement in knee joint range of motion compared to baseline values ($p < 0.05$).

Conclusion: The findings suggest that retrowalking combined with VMO muscle training is an effective, low-cost, and feasible intervention for reducing pain and improving knee joint mobility in the geriatric population with knee pain.

Keywords: *Retrowalking, Vastus Medialis Oblique, Knee Pain, Geriatric Population, Range of Motion*

INTRODUCTION

Knee pain is one of the most common musculoskeletal complaints among the geriatric population and is a major cause of functional limitation, reduced mobility, and diminished quality of life. With increasing age, degenerative changes in the knee joint, particularly osteoarthritis, lead to pain, stiffness, reduced range of motion, and muscle weakness[1], thereby affecting activities of daily living and independence.

The prevalence of knee pain increases significantly after the age of 60 years, making it an important public health concern in the elderly population.

Quadriceps muscle dysfunction plays a crucial role in the development and persistence of knee pain. Among the quadriceps components, the vastus medialis oblique (VMO) is essential for maintaining patellar alignment and ensuring proper knee joint mechanics[2]. Weakness or delayed activation of the VMO has been associated with altered patellofemoral tracking, increased joint stress, and pain during functional activities[2] such as walking, stair climbing, and sit-to-stand movements. Strengthening of the VMO has therefore been widely incorporated into rehabilitation programs for knee pain and patellofemoral disorders[2].

In recent years, retrowalking (backward walking) has gained attention as an effective therapeutic exercise for knee rehabilitation. Retrowalking reduces compressive forces on the patellofemoral joint while simultaneously enhancing quadriceps activation, balance, and proprioception[3]. Vijaya Krishnan et al. (2021) demonstrated that retrowalking, when used as an adjunct to conventional therapy, resulted in significant reductions in pain and disability in patients with osteoarthritis of the knee[4] compared to balance training alone. These findings suggest that retrowalking may be a safe and effective intervention, particularly for older adults with knee pain.

Similarly, Palak Ramanlal Mistry et al. (2020) reported significant improvements in pain and functional outcomes following VMO strengthening in individuals with patellofemoral pain syndrome. Their study highlighted the importance of targeted VMO training in improving knee stability and reducing pain. Although both retrowalking and VMO strengthening have independently shown beneficial effects on knee pain and function, there is limited evidence exploring their combined effects, especially in the geriatric population.

Given the growing elderly population and the need for cost-effective, low-impact rehabilitation strategies, it is essential to investigate interventions that can safely improve knee pain and mobility. However, literature addressing the combined influence of retrowalking and VMO muscle training on knee pain and range of motion in older adults remains scarce. Therefore, this observational study was designed to evaluate the effects of retrowalking combined with vastus medialis oblique muscle training on knee pain and knee joint range of motion in the geriatric population.

Aim of the Study

To evaluate the effect of retrowalking combined with vastus medialis oblique muscle training on knee pain and knee joint range of motion in geriatric individuals with knee pain.

Objectives of the Study

To assess knee pain before and after retrowalking and VMO muscle training using the Numerical Pain Rating Scale (NPRS).

To evaluate knee joint range of motion before and after the intervention using goniometry.

To determine the overall effectiveness of retrowalking combined with VMO muscle training in improving knee pain and mobility in the geriatric population.

LITERATURE REVIEW

Knee osteoarthritis and age-related degenerative changes are major contributors to chronic knee pain and functional disability among older adults. Reduced quadriceps strength, altered joint mechanics, and impaired proprioception are commonly observed in individuals with knee pain, leading to difficulty in performing daily activities such as walking, stair climbing, and prolonged standing. Rehabilitation strategies targeting pain reduction and functional improvement remain a key focus in physiotherapy management of knee disorders in the geriatric population.

Retrowalking has emerged as an alternative gait training method with therapeutic benefits for individuals with knee pathology. Vijaya Krishnan et al. (2021) conducted a randomized controlled trial to compare the effects of retrowalking and balance training on pain and disability in patients with osteoarthritis of the knee. Sixty participants were allocated into three groups: conventional treatment alone, conventional treatment with retrowalking, and conventional treatment with balance training over a period of six weeks. Pain and functional disability were assessed using the Intermittent and Constant Osteoarthritis Pain Measure (ICOAP) and the Ibadan Knee/Hip Osteoarthritis Measure (IKHOAM). The results showed statistically significant improvements in pain and functional disability across all groups, with the retrowalking group demonstrating superior outcomes. The authors concluded that retrowalking is an effective adjunct to conventional physiotherapy in reducing pain and disability in individuals with knee osteoarthritis[4].

The role of the vastus medialis oblique muscle in maintaining patellar stability and optimal knee joint function has been well documented. Weakness or delayed activation of the VMO has been associated with patellofemoral pain and altered knee biomechanics. Strengthening of the VMO is therefore considered an important component of knee rehabilitation programs.

Palak Ramanlal Mistry et al. (2020) conducted a comparative study to evaluate the effects of VMO strengthening versus patellar taping in individuals with patellofemoral pain syndrome. Thirty participants were divided into two groups: one receiving VMO strengthening exercises along with conventional physiotherapy and the other receiving patellar taping with conventional treatment. Both groups underwent five treatment sessions per week for six weeks. Pain intensity was measured using the Visual Analogue Scale (VAS), and functional status was assessed using the Kujala Patellofemoral Scale (KPS). The study demonstrated significant improvements in pain and functional outcomes in both groups, with no statistically significant difference between them. The authors concluded that VMO strengthening, when combined with conventional physiotherapy, is effective in reducing pain and improving function[2] in individuals with patellofemoral pain syndrome.

Although individual studies support the effectiveness of retrowalking and VMO muscle strengthening in reducing knee pain and improving function, there is limited literature examining their combined effect, particularly in the geriatric population with knee pain and reduced range of motion. Most existing studies focus on younger populations or specific conditions such as patellofemoral pain syndrome or osteoarthritis independently.

Therefore, based on the existing literature and the observed gap, the present study aims to investigate the effects of retrowalking combined with vastus medialis oblique muscle training on knee pain and knee joint range of motion in the geriatric population.

MATERIALS & METHODS

Study Design

This study was designed as an observational study to evaluate the effects of retrowalking combined with vastus medialis oblique (VMO) muscle training on knee pain and knee joint range of motion in the geriatric population.

Study Setting

The study was conducted in the Department of Physical Medicine and Rehabilitation (PMR), PSG Hospitals, Coimbatore.

Study Population

Geriatric individuals presenting with knee pain and reduced knee joint range of motion who attended the outpatient department of PMR were considered for participation in the study.

Sample Size
A total of 38 participants were included in the study. The sample size was calculated using G*Power software (version 3.1.9.7).

Sampling Method
Convenience sampling technique was used to recruit participants based on the inclusion and exclusion criteria.

Inclusion Criteria
- Age between 61 and 80 years, both males and females
- Unilateral or bilateral knee involvement
- Knee pain score greater than 4 on the Numerical Pain Rating Scale (NPRS)
- Reduced knee joint range of motion less than 70 degrees
- Participants willing to participate and provide informed consent

Exclusion Criteria
- History of patellar subluxation or dislocation
- Previous knee surgery or intra-articular corticosteroid injection
- Knee ligament injury or instability
- Infection, malignancy, or inflammatory conditions affecting the knee
- Internal derangement of the knee, plica syndrome, or Osgood–Schlatter disease
- Neurological disorders
- Pathologies related to the hip, knee, or lumbar spine
- Other musculoskeletal conditions such as iliotibial band tightness, adductor muscle tightness, or sartorius muscle tightness

Study Duration
The total study duration was three months.
Intervention Protocol
All participants underwent a rehabilitation program consisting of:
Retrowalking: 5 minutes with intermittent rest periods
VMO muscle training exercises: 30 minutes
The intervention was administered five days per week for a duration of three weeks under the supervision of a physiotherapist.

Outcome Measures
Pain intensity: Assessed using the Numerical Pain Rating Scale (NPRS)
Knee joint range of motion: Measured using goniometry

Study Procedure
Participants meeting the inclusion criteria were recruited after obtaining informed consent. Baseline assessment of knee pain using NPRS and knee joint range of motion using goniometry was performed prior to the intervention. Following completion of the three-week intervention protocol, post-test measurements were recorded using the same outcome measures.

Statistical Analysis
Data were analyzed using appropriate statistical methods. Pre- and post-intervention values were compared using the paired t-test. A p-value of less than 0.05 was considered statistically significant.

RESULT
A total of 38 participants with knee pain and reduced knee joint range of motion were included in the study. All participants completed the intervention protocol, and no adverse events were reported during the study period.

Demographic Characteristics of Participants
The demographic details of the participants, including age and gender distribution, are presented in Table 1.

Table 1: Demographic Characteristics of the Participants (n = 38)

VARIABLE	FREQUENCY	PERCENTAGE%
Age (61 – 70 years)	22	57.9
Age (71 – 80 years)	16	42.1
Male	18	47.4
Female	20	52.6

Comparison of Pre-test and Post-test Knee Pain Scores

Knee pain intensity was assessed using the Numerical Pain Rating Scale (NPRS) before and after the intervention. A significant reduction in NPRS scores was observed following the intervention. The comparison of pre-test and post-test NPRS scores is shown in Table 2.

Table 2: Comparison of Pre-test and Post-test NPRS Scores

Parameter	Mean ± SD	t value	p value
Pre-test NPRS	6.42 ± 0.98		
Post-test NPRS	3.18 ± 0.87	14.62	<0.001

Comparison of Pre-test and Post-test Knee Joint Range of Motion

Knee joint range of motion was measured using goniometry before and after the intervention. Post-test measurements demonstrated a statistically significant improvement in knee joint range of motion compared to pre-test values. The results are presented in Table 3.

Table 3: Comparison of Pre-test and Post-test Knee Joint Range of Motion

Parameter	Mean ± SD (degrees)	t value	p value
Pre-test ROM	62.35 ± 6.21		
Post-test ROM	78.92 ± 5.84	16.08	<0.001

Overall Outcome of the Study

The results of the study indicate a statistically significant reduction in knee pain and a significant improvement in knee joint range of motion following retrowalking combined with vastus medialis oblique muscle training among the geriatric population.

DISCUSSION

The present observational study investigated the effects of retrowalking combined with vastus medialis oblique (VMO) strengthening exercises on knee pain and knee joint range of motion in the geriatric population. The results of the study demonstrated a significant reduction in pain intensity and a significant improvement in knee joint range of motion following the intervention period. These findings suggest that the combined exercise protocol was effective in improving knee function and reducing pain in elderly individuals with knee joint dysfunction.

The reduction in knee pain observed in the present study may be attributed to the biomechanical and neuromuscular benefits of retrowalking. Backward walking alters lower limb loading patterns and reduces anterior knee joint stress, thereby decreasing compressive forces acting on the patellofemoral joint. Previous studies have reported that retrowalking improves pain and functional ability in individuals with knee osteoarthritis. Vijaya Krishnan and Pithadia demonstrated that retrowalking produced significant improvements in pain and disability compared to balance training in patients with knee osteoarthritis[1]. Similarly, Sumathi et al. reported that retro walking was effective in improving pain and functional outcomes in individuals with knee osteoarthritis when compared with therapeutic exercises[3]. The findings of the present study are consistent with these studies, supporting the effectiveness of retrowalking as a beneficial rehabilitation intervention for knee pain.

Improvement in knee joint range of motion observed in the present study may be associated with enhanced quadriceps muscle performance, particularly strengthening of the vastus medialis oblique. The VMO plays a critical role in patellar stabilization and optimal knee joint biomechanics. Weakness or altered activation of the VMO has been linked to patellofemoral dysfunction and knee pain. Palak Ramanlal Mistry et al.

reported significant improvements in pain and functional outcomes following VMO strengthening exercises in individuals with patellofemoral pain syndrome[2]. Strengthening of the VMO may improve patellar tracking, reduce abnormal joint stress, and facilitate greater pain-free knee movement, which may explain the improvements in range of motion observed in the present study.

In addition to pain reduction and range of motion improvement, the combined intervention may have influenced neuromuscular control around the knee joint. Backward walking has been shown to modify muscle activation patterns around the knee. Osama Ragaa Abdelraouf and Amr Almaz Abdel-Aziem reported that backward walking significantly altered the VMO to vastus lateralis muscle activity ratio, favoring improved patellar stabilization in individuals with patellofemoral pain syndrome[4]. This altered muscle activation pattern may contribute to improved knee stability and reduced pain, supporting the rationale for combining retrowalking with VMO strengthening exercises.

The combined application of retro walking and VMO strengthening in the present study may have produced a synergistic effect. Retrowalking enhances proprioception, balance, and dynamic knee stability, while VMO strengthening improves muscular support and patellar alignment. Together, these mechanisms may explain the significant improvements in pain reduction and knee joint range of motion observed in the geriatric population. This combined approach appears particularly suitable for elderly individuals, as it is low-impact, easy to administer, and places minimal stress on the knee joint.

Despite the positive outcomes, certain limitations of the study should be acknowledged. The observational study design and convenience sampling method limit the ability to establish a cause-and-effect relationship and generalize the findings to a larger population. The absence of a control group restricts comparison with conventional physiotherapy alone. Additionally, the short duration of intervention limits assessment of long-term effects. Future studies employing randomized controlled trial designs with larger sample sizes and longer follow-up periods are recommended to further validate the effectiveness of retrowalking combined with VMO strengthening exercises.

CONCLUSION

The present observational study concludes that the combination of retrowalking and vastus medialis oblique (VMO) strengthening exercises is effective in reducing knee pain and improving knee joint range of motion in the geriatric population with knee pain. The findings suggest that this combined intervention enhances knee joint function through improved muscular activation, patellar stabilization, and reduced joint stress. Retrowalking along with targeted VMO strengthening appears to be a simple, low-impact, and clinically feasible rehabilitation approach for elderly individuals with knee joint dysfunction. However, due to the observational study design and short intervention duration, further randomized controlled trials with larger sample sizes and long-term follow-up are recommended to confirm and generalize these findings.

Declaration by Authors

Ethical Approval: Approved by the institutional ethics committee of PSG hospitals, Coimbatore

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Conflict of Interest: No conflicts of interest declared.

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