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A Multimodal Physiotherapy Treatment for Patient with Anterior Knee Pain Using Manual Therapy and Targeted Exercise -A Case Report

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Knee pain, Movement system impairment, Mulligan, Maitland, Good health and well being

Abstract

Background: The most frequent musculoskeletal complaint is anterior knee pain. These complaints are often the result of muscle imbalance, joint malalignment and alterations in biomechanics, particularly of the lower limb. Symptoms of anterior knee pain can be efficiently managed, and overall function enhancement can occur, through the application of a movement system-based approach that targets deficits in neuromuscular control, joint mobility and/or the kinetic chain.

Materials and methods: A 45year-old female referred to the clinic with left anterior knee pain of six months duration that worsened with prolonged sitting, crouching, and climbing stairs. The patient's Knee Outcome Survey-Activities of Daily Living (KOOS-ADL) was 73% and before treatment her Numeric Pain Rating Scale (NPRS) was 6/10. The clinical exam demonstrated weakness in the VMO, tight hamstrings, tight iliotibial band, restriction of patellar mobility, excess external tibial torsion, and flat foot.

Results: Post-intervention assessments revealed a reduction in NPRS from 6/10 to 2/10 and an improvement in KOOS-ADL score from 73% to around 89%. Improved patellar mobility and muscle flexibility. Strengthened hip and knee stabilizers. Reduced dynamic valgus and aberrant movement patterns.

Conclusion: patient with knee pain, a movement system-based physiotherapy strategy that combined manual therapy, corrective exercises, and patient education successfully decreased pain and enhanced function. These results underline the significance of treating both local and global biomechanical variables and support the adoption of tailored impairment-based therapies

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INTRODUCTION

knee pain represents one of the most common musculoskeletal complaints in an outpatient physical therapy setting [(1)]. According to different reports, knee pain occurs in 10%-50% of the population[(2)]. the mechanical axis of the knee predicts the load bearing distribution over the joint surfaces. The medial compartment is the load-bearing zone, carrying 60-70% of the load in a normally aligned knee. Any change in the valgus or varus direction affects loading pattern. It is postulated that abnormal compartmental loading will direct increased stress on the articular cartilage and other joint tissues with degenerative breakdown[(3)] .The influence of tibial and femoral motions on the biomechanics of the patellofemoral joint is significant, yet their effects on patellar kinematics are dissimilar. During external tibial rotation such as movement of the tibial tuberosity laterally, the patellar tendon exerts a rotary pull on the distal pole of the patella turning the superior part of the patella medially about the patella's axis. A similar inverse occurs during internal tibial rotation where the superior patellar aspect displaces in a lateral direction around an anteroposterior axis that is located near to the centre of the patella due to medialisation of the tibial tuberosity [(4)]

Among various manual therapy procedures, Maitland manual therapy may be a suitable treatment option for reducing knee OsteoArthrites pain sensitivity. The goal of accessory techniques using Grades I and II and physiological techniques using Grade II in non-end-range joint positions is to reduce pain. In addition to reducing pain, accessory and physiological treatments used with Grade III and IV joints in end-range positions also improve the periarticular tissues' flexibility [(5)]. Brian Mulligan recommends the manual therapy method known as Mobilization with Movement (MWM) to alleviate joint pain, stiffness, and dysfunction. In this method, While the physiotherapist applies a prolonged glide parallel to or perpendicular to the joint, the patient actively performs the painful movement. The goal of this approach is to restore the joint's complete range of motion and pain-free function [(6)]. Understanding the mobility impairment that caused the pain and concentrating therapy techniques on it is one method that could increase the efficacy of treatment. Abnormal alignment and movement impairment of the lower extremities, such as knee valgus, knee varus, or tibia relative to femur, can be signs of mobility impairment [(7)].

A comprehensive physiotherapy strategy is necessary for the effective care of anterior knee pain, addressing both proximal (hip and core) and distal (ankle and foot) factors in addition to the affected knee. Supported by evidence-based clinical reasoning, treatment approaches include neuromuscular re-education, therapeutic exercise, manual therapy, and patient-specific functional training.

Case Description

Patient History

A 45-year-old female (BMI:19.5) with history of pain in left knee of 6 months duration attended to the physiotherapy outpatient department. This patient had strong pain and disability in even a moderate ADL including stair climbing (especially over 2 steps), sitting chair and sitting with knee flexed on a chair for a long time. The use of squatting and floor sitting were also impaired. After she propped her leg on two cushions, she felt better. One month prior to her, she presented to an orthopaedic for the first time who gave the patient Vioxx 25mg and told her to use ice packs and he affected knee had not been previously traumatized or injured. The patient had a history of type 2 diabetes mellitus, medically controlled. The patient was under treatment in the past month because of pain in the shoulder and the knee however, interventions were insufficiently documented. The patient reported having developed symptoms insidiously and having had them for 6 months. He

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describes the discomfort as constant and localized over the anterosuperior aspect of the left knee. she feels dull aching pain with an intensity 6/10 on the Numeric Pain Rating Scale (NPRS).

According to some studies, they have a 24-h pain pattern; symptoms are more severe in the morning and less so in the evening. There were no complaints of joint locking, giving way or noisy clicking. But she also is aching, aching so much that she can hardly do anything for herself in her daily routine.

The activity of daily life scale for knee outcome was achieved by the patient. The ADL, KOOS Survey is a valid measurement of knee pain and function. The patient score was 73 percent.

Clinical findings:

On Observation

On Observation of the posterior line of vertical creases posteriorly connected with the insertion of the hamstrings made it easier to determine the femoral axis. The medial and proximal part of the hamstring was more prominent than the lateral part when the patient stood with the hamstrings medially rotated. The postural examination revealed external tibial torsion with flat foot and decreased medial arch in anterior plane. An incomplete knee flexion/extension, unable to fully lock the knee was seen lateral.

On Palpation

On Palpation There was medial joint line pain with palpation for the patient with Meniscus tear can be indicated by tenderness over the articular surface of the patella joint line. The patient did not complain of locking or buckling; the test for meniscus integrity was negative.

Physical Examination

The active range of motion of the left knee was slightly restricted compared to the passive range of motion, suggesting possible muscle inhibition or pain inhibition. Complete flexion and end-point extension were prevented and functional ROM was limited.

Patellar glide testing showed a significant decrease in range of motion, particularly in the superior-inferior direction. Tibial glide restriction present. This demonstrated patellofemoral joint hypomobility that could potentially be involved in causing anterior knee pain during activities of deep flexion such as ascending and descending stairs and while squatting.

The flexibility tests indicated tight hamstrings during passive SLR and tight calf muscles and restricted dorsiflexion of ankle at knee extension and flexion. Unilateral limitation in the length of the iliotibial band during Ober test. He was found to have vastus medialis oblique weakness with manual muscle testing, which is important for patellar tracking and stability.

An imbalance in the lateral and medial quadriceps fibres can cause patellofemoral malalignment and increased joint stress.

Timeline:

Therapeutic intervention:

Week 1:

a. Goals:

Reduce pain and swelling and restore initial joint mobility And begin neuromuscular re-education

b. Treatment & Dosage:

Interferential Therapy (IFT): 15 minutes time applied to the peri-patellar area for reduction in inflammation and pain. Maitland Mobilization: Tibial Anteroposterior Glide (Grade II):

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Table 1

Baseline characteristics of the patient

Age	45 years
Height	150 cm
Weight	55 kgs
BMI	19.5
Knee Range of motion: Active knee flexion:	 90 Degree
Passive knee flexion	110 Degree
Active knee extension	10 Degree
Passive knee extension	5 Degree
Push pull Dynamometer Knee extensors	 14.2 kgs
Hip Abductors	12.8 kgs

Completed for 3 order sets × 30 seconds duration to allow for accessory motion. Patellar Inferolateral Glide (Grade II): Provided for 3 order sets × 30 seconds duration to ensure patellar mobility. Mulligan Mobilization with Movement (Medial Glide): Completed for 3 order sets × 10 repetitions, with active motion flexion-extension to correct positional faults within the joints.

c. Patient education:

It is advised to prevent dynamic valgus by keeping the knee in line with the toes during locomotion and functional duties. Based on the movement impairment system, instructed to use the gluteal muscles, also known as the "squeeze seat muscle," when walking in order to correct the hip fault Offered techniques for pain-relieving posture and suggested avoiding activities that aggravate the condition.

Week 2

a. Goals

Promote extensibility and flexibility Start strengthening the stabilizing muscles specifically.

b. Treatment and Dosage

Stretching (Hamstring, Calf, IT Band):Static holds for 30 seconds, repeated 3 times for each muscle group, 2 times per day. Foam Roller Release to IT Band: 2 minutes (each leg) with foam roller, done 2 times per day to help decrease soft tissue limitation. Strength Exercises: Vastus Medialis Oblique (VMO): Isometric and isotonic knee extension exercises (60% 1RM) at 3 sets of 10 reps, will progress weekly. Lateral Rotators of Hip (Gluteus Medius, Piriformis): Resistance band exercises (clamshells, monster walks) at 3 sets, of 10-12 reps, moderate intensity, 3-4 times a week.

c. patient education

It is advised to prevent abnormal gait pattern by avoidance of knee valgus and proper hip activation

Week 3

a. Goals

Improve functional strength and endurance of knee and hip musculature and enhance dynamic knee control during functional activity and prepare the patient for independent home exercise and activity modification

b. Treatment and dosage

Progressive strengthening exercise

Closed kinetic chain exercise, Mini squats, sit to stand from chair, Step up and step down

Quadriceps strengthening

Terminal knee extension with resistance band, Straight leg raise with external Rotation

3 set x 10 Repetitions

c. Patient Education

Educated the patient on long term Activity modification including, avoid prolong sitting with

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knee flexed beyond comfort. Use arm support while rising from low chairs

Table-2 Timeline of clinical events, Assessment, Intervention, and outcome

Time point	Clinical events	Assessment findings	Intervention	outcomes
6 Months	Insidious onset of left anterior knee pain. Pain aggravated by stair climbing Squatting prolong sitting.no trauma or injury	-	-	-
1 Months Before physiotherapy visit	Orthopaedic consultation prescribed medicine. pain persisted. Type2 Diabetes present	-	Medication & Advice	NO functional improvement
Initial visit (Baseline)	Constant dull Aching Anterior Knee pain. Difficulty with ADLS (stair, floor sitting). Morning pain worse	NPRS: 6/10 KOS-ADL: 73% External tibial torsion, flat feet. Limited knee flexion& incomplete extension. Restricted patellar glide (sup–inf). Tight hamstrings, ITB, calf muscles. Limited ankle dorsiflexion. VMO weakness. Medial joint line tenderness	-	Confirmed Movement system impairment leading to anterior knee pain
week 1	Patient reports ongoing functional limitation	Pain persists with flexion & stair activity	Modalities Manual therapy Education	Immediate response: Reduced Discomfort post session
week 2	Reports mild relief after week 1	Persistent tightness continued VMO weakness	Stretching and strengthening	Clinically improves muscle activation

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Week 3	Reports pain relief after week 2	Reduced strength and endurance	Progressive resistance isometrics	Improves the muscle strength

Outcome:

Clinical improvement in pain levels

Table 3 NPRS:

INITIAL SCORE	6/10
POST INTERVENTION	2/10

Table 4 KOOS:

KOOS subscale	Baseline	Post intervention
pain	60/100	85/100
symptoms	65/100	80/100

Table 5 Range of Motion Degrees:

	Baseline	3 rd. Visit	Difference
Active knee flexion	90 Degree	115 Degree	25 Degree
Passive knee flexion	110 Degree	125 Degree	15 Degree
Active knee extension	-10 Degree	-2 Degree	8 Degree
Passiveknee extension	-5 Degree	0 Degree	5 Degree

Table 6 Physical Performance Test Outcomes

Test	Pre intervention	Post intervention
Sit to stand	8 reps	13 reps
Step down pain (NPRS)	5/10	1/10
Single leg stance	12 sec	28 sec
Push pull Dynamometer Knee extensor	14.2Kgs	16.4Kgs
Hip Abductors	12.8Kgs	14.2Kgs

Discussion:

Knee pain is a multifaceted condition influenced by biomechanical, structural and neuromuscular factors, particularly in middle-aged women. The patients in this case had an ongoing pain in the anterosuperior part of the knee predominantly aggravated with functional activities (i.e. prolonged sitting and stairs). The clinical findings, including tights patellofemoral joints, VMO weakness, tight hamstrings, tight IT bands, and foot pronation.

The Movement System Impairment (MSI) model served as the foundation for the treatment strategy, which placed a strong emphasis on the significance of muscle control and segmental alignment. Poor kinetic chain alignment was suggested by the flat feet and high external tibial torsion, which led to improper patellofemoral tracking and stress. Changes in tibial rotation have a substantial impact on patellar mechanics and pressure distribution, according to Lee et al., which supports the patient's aberrant loading.

The positional faults were discovered these were treated with manual therapy aiming to use techniques such as Maitland's, and Mulligan's MWM. In AKP subjects, these techniques have been shown to be effective at reducing pain and correcting malalignment of the patella.

Stretching focused on the tight posterior chain and IT band, the tightness of which is commonly

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associated with knee pain with excessive patellar lateral traction. Strengthening of the hip abductors and VMO was targeted to address the neuromuscular control required for reducing dynamic valgus and controlling the knee during functional activities.

Patient education, log roll, non-stimulating activities and proximal stabilizers were emphasized. The approach was broad and included global kinetic chain and local dysfunction.

Conclusion

An individualized physiotherapy approach to the patient's movement system impairment encompassing manual therapy, strength training, and flexibility exercises resulted in a significant reduction in pain and improvement in function in a patient with in knee pain. The patient's NPRS score improved from a 6/10 to a 2/10 and KOOS-ADL score improved from 73% to 89%, demonstrating the potential of individualized, impairment-based rehabilitation strategies to manage patellofemoral pain.

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