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Effect of Combined Kinetic chain exercise with Functional task training in Postmenopausal Women with knee osteoarthritis: A Case report

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ABSTRACT

Introduction: Osteoarthritis [OA] is a progressive degenerative joint disease that affects all structures of the joint. OA can affect all joints, but the most common sites are the knee, the hip and the hand. OA is an extremely prevalent rheumatic musculoskeletal disorder that affected 303 million people worldwide in 2017. Menopause is defined as the irreversible discontinuance of menstrual period due to associated decreasing ovarian functions.

Case Description: We are addressing the case of a 55-year-old postmenopausal women housewife she was a farmer. The patient was started a gradually pain in her right knee since 3 years and was aggravated since 15 days who had Osteoarthritis in her right knee. We created a 12 weeks treatment plan for this patient that incorporates a number of advanced therapy techniques, including closed kinetic chain exercise with Functional task training for exercise session. We created a through rehabilitation Programme for out Patient, who had osteoarthritis in her knee, & worked incredibly well. We assessed the efficacy of our outcomes measures using a variety of outcome, including WOMAC, KOOS score, NPRS and MMT. It was found to be more beneficial to provide modern Physiotherapy approaches for improving the overall health & quality of life of the patient.

INTRODUCTION

Osteoarthritis [OA] is a progressive degenerative joint disease that affects all structures of the joint. OA can affect all joints, but the most common sites are the knee, the hip and the hand [1]. OA is an extremely prevalent rheumatic musculoskeletal disorder that affected 303 million people worldwide in 2017[2]. Among the joints affected in OA, the knee is the most common. Menopause is defined as the irreversible discontinuance of menstrual period due to associated decreasing ovarian functions. Prevalence of knee OA in perimenopausal and postmenopausal women is reported to be high in many parts of India; 21.6% in Gudaspur, Punjab; 47.3% women in south Delhi and 28.3% in Guwahati, Assam, in Maharashtra 28.3% [3]. Recently, there has been recognition of the fact that closed kinetic chain exercise [CKC] are beneficial in managing knee joint Osteoarthritis. Physical exercise with the goal of enhancing performance in daily task is called functional task training. It entails using functional task performance to strengthen and modify postural techniques in response to environmental pressures. Co-ordination of functional motions and task - specific balancing needs are necessary for the kind of training. It involves several joints and muscle groups operating in various planes [4].

Case presentation:

We are addressing the case of a 55-year-old housewife she was a farmer. The patient was started a gradually pain in her right knee since 3 years and was aggravated since 15 days. Her pain was 8 on NPRS during activity 6 on NPRS & at rest 0. And pain aggravated long standing, stair climbing, cross leg sitting during farming and household work. She visited the orthopedic department on October 12, 2024, for the same reason, and after an X- ray was taken, Osteoarthritis in Right knee was diagnosed. She was then told to go physiotherapy outpatient department [OPD]. The patient current symptoms were stiffness in right knee in the morning and pain, swelling present particularly on the medial side of the knee joint [right> left]. Long term walking, farming activity and sit to stand transition caused more pain. Pain increased when sitting with folded legs and when flexing the knees.

Clinical finding:

Sr. no	Movements of the Right lower limb	Pre-treatment MMT grade	Post-treatment MMT grade
1.	Hip flexion	4/5	5/5
2.	Hip extension	4/5	5/5
3.	Hip abduction	4/5	5/5
4.	Hip adduction	4/5	5/5
5.	Knee flexion	**3/5**	**4/5**
6.	Knee extension	**3/5**	**4/5**
7.	Ankle plantar flexion	5/5	5/5
8.	Ankle dorsiflexion	5/5	5/5

The physical examination was performed following patient informed consent. The patient was cooperative, awake and aware of the person, place, and time. A thorough evaluation of the musculoskeletal system was conducted. There was no medical history for the patient. The examination of the bilateral lower limb, with particular attention to the right knee joint, was carried out. Mild swelling was observed at right knee joint as compared to left side and crepitus was present right knee joint. The hip and ankle joints of bilateral lower limb exhibited painless and complete quality of movement. The knee flexion for the right knee was 0 to 120 degrees, exhibiting a painful and incomplete quality of movement. The knee extension of bilateral knee joints exhibited a painful & complete quality of movement. The ankle, knee, and hip joints all had a full range of motion. Measurement of limb girth and length reveled a typical discrepancy of 1cm. The manual muscle testing for hip, knee and ankle joint is mentioned in the outcome measure section.

Investigations/ special test:

Special test like gridding test, Patellar Clark were found to be positive. Her radiographic finding on X- ray shows possible reduced joint space and osteophyte formation on right knee [Grade 1 according to Kellgren Lawrence scale.

Diagnosis:

Based on subjective and objective examination, investigation and special tests, the positive results helped to diagnosis the case as osteoarthritis right knee joint. [According to ACR clinical and radiographic criteria for O.A knee which has 91% sensitivity and 86% specificity].

Table: 1.1- Pre and post treatment outcome measure score of scale.

Table 2: Pre-treatment & post-treatment manual muscle testing grades of the right lower limb.

Sr.no	Outcome measures	Pre-treatment score	Post-treatment score
1.	NPRS	08 on activity on rest 1	02 on activity at rest 0
2.	Knee injury and osteoarthritis score [KOOS]	46/100	72/100
	Pain	10	20
	Symptoms	7	11
	Activities of daily living	13	21
	Sports and recreation function	4	10
	Quality of life	7	11
3.	Western Ontario and McMaster university osteoarthritis index [WOMAC]	25/100	10/100
	Pain	5	2
	Stiffness	4	1
	Function	21	7

Sr.no	Movements of the Left Lower limb	Pre-treatment MMT grade	Post-treatment MMT grade
1.	Hip Flexion	4+/5	5/5
562.	Hip Extension	4/5	5/5
3.	Hip abduction	3+/5	5/5
4.	Hip adduction	4/5	5/5
5.	Knee flexion	3/5	5/5
6.	Knee extension	3+/5	4-/5
7.	Ankle plantar flexion	5/5	5/5
8.	Ankle dorsiflexion	5/5	5/5

Table 3: Pre-treatment & post-treatment manual muscle testing grade of the left lower limb.

Therapeutic Intervention:

The patient was seen over duration of 12 weeks treatment plan. The purpose of the therapy was to determine short term effect on pain relief and improve functional task. The exercise is start from 1st week to 6th week are combined kinetic chain exercise (CKC) was given in the form of Quadriceps setting, straight leg raising (SLR), Full arc extension, cycling in the air, quadriceps setting exercise, wall slides and exercises for functional task training from 7th week to 12th week are sit to stand, standing star exercise, walking up & down a ramp while holding a weight, ascending & descending stairs while holding a weight in the preferred hand, walking indoors while passing a weighted ball from hand to hand with CKC protocol for postmenopausal women in right knee Osteoarthritis in for of alternate week day for maximum 12 weeks.

Table 4: shows the goal-specific treatment based on the patient's difficulty with daily activities under the supervision of a Physiotherapist.

Goals	Intervention
To inform the patient about her health status, the importance of physical therapy rehabilitation, & the requirements that will be fulfilled for continued rehabilitation.	Patient education involves informing the patient about osteoarthritis (OA), how to maintain an active lifestyle while protecting the joints, and how to control the disease's symptoms.
To enhance and develop muscular function	Exercise for quadriceps: quads sets (quadriceps setting), multiple-angle isometric exercise for quadriceps, short-arc terminal extension exercises for hamstrings: hamstrings sets multiple-angle isometric exercises for hamstring. Three sets 10 repetitions, with five-second hold.
To enhance muscle strength and functional activity.	A resistance training Programme was run. There was a provided eccentric exercise are sit to stand, standing star exercise, walking up & down a ramp while holding a weight.

Table 4: shows the specific exercise for CKC & FTT treatment based on the patient's with daily activities under the supervision of a Physiotherapist.

Combined kinetic chain Exercises (CKC) Protocol	Functional task Training (FTT) Protocol
Quadriceps setting: Patient in supine position was isometric ally contract the quadriceps muscle of the affected lower extremity by drawing up the patella while maintain the knee in extension. The contraction is held for a count of 10, repetition the exercise 10 times.	**Sit to stand:** First, the patient position is taking a seat in the chair and then slowly raise him off the chair by utilizing their legs. Continue these workouts for a total of 12 weeks on alternate days for one minute each time, four times with a 30-second rest in between.
Straight leg raising: The patient in a supine position was isometric ally contract his quadriceps and lift the lower extremity to achieve about 45degree of hip flexion while maintaining the knee in extension for 10 repts, the exercise for 10 times. From 3rd week SLR with weight will be commenced by strapping an ankle weight equivalent to her 10RM to the ankle region. The participant then lifts the lower extremity to about 45degree of hip flexion while maintaining the knee extension.	**Standing star exercise:** Participant will Perform these exercises on alternate days throughout the week for a total of 12 weeks, lasting about a minute each Four times, with a 30-second break in between.
Full- arc extension: the Patient in a high sitting position was having a weight corresponding to his 10 RM strapped to the leg of the affected lower extremity just above the ankle. The popliteal space will be protected with a roll of towel. Then lift the load Slowly through the range of 90° to 0° of knee flexion (full extension). The position is held For a count of 5. She will perform three bouts of ten repetitions of this exercise per Session but the foot will be rested on a stool between the bouts. This exercise was carried Out from the fourth week to the end of the Rehabilitation.	**Walking up and down a ramp while holding a weight**: was be done for a total of twelve weeks, repeat this exercise for one minute four Times with a 30-second break on alternating days of the week of rehabilitation.
Cycling in the air: The patient in a supine lying position will raise his legs with the hip joints flexed to about 90 degrees and knees bent to about 90 in the air. With slow and steady balance, the patient will perform the cycling movements of the lower limbs in the air continuously for two minutes. During the air cycling of the legs, the hands were Placed along the sides of the body. This exercise will be performed for the entire twelve Weeks of Rehabilitation.	**Ascending/descending stairs while holding a weight in the preferred hand:** performed for a maximum of 12 weeks, repeat this exercise for one minute four times with a 30-second break on alternating days of the week of rehabilitations.
Quadriceps Setting Exercise: The patient will sit on a chair with his back supported, knee extended and heel on the floor then pressed their heels against the Floor and thighs against the seat of the chair. The position will be held for a count of 10 after which the patient will relax. The exercise will be repeated ten times. This exercise was performed throughout the rehabilitation.	**Walking indoors while passing a weighted ball from hand to hand:** Continue this exercise for one minute, four times, with a 30-second break in between. On alternate week days for a maximum of 12 weeks rehabilitations [6].
Wall slides: In a standing position, the patient position his back up against the wall with hips and knees flexed to about 60 degrees. The position be held for 10 Seconds, after which the participant will return to the starting position and relax for 5 seconds. Ten repetitions of wall slides are carried out per exercise session. From week 3, participants will commence wall slides with weight by holding dumbbells in both Hands. This will be initiated with a weight equivalent to his 10RM and progressed by determining a new 10RM at the beginning of each week of rehabilitation [5].	

Quadriceps setting exercise:-

Full arc setting:-

Wall slides:-

Ascending / Descending while holding a weight in the preferred hand:-

Walking indoors while passing a weighted ball from hand to hand:-

Fig. 1 Combined kinetic chain Exercises (CKC) Protocol

Quadriceps setting exercise:-

Full arc setting:-

Wall slides:-

Ascending / Descending while holding a weight in the preferred hand:-

Walking indoors while passing a weighted ball from hand to hand:-

Fig. 2 Functional task Training (FTT) Protocol

DISCUSSION

In this case report was to see the effect of combined kinetic chain exercise with functional task training in postmenopausal women with knee osteoarthritis. Knee Osteoarthritis is degenerative disease for which early detection is critical. Rehabilitation can be started during this critical period of the disease to stop it from processing. Numerous studies have demonstrated the value of combined kinetic exercise with Functional task training for individuals with osteoarthritis in the knee. According, to Yang et.al. Functional task-resistant will develop muscle strength, which will then reflected in an improvement in the subjects physical capability. Studies have

shown that muscle strength grows, so does the speed at which people walk[7]. These results are attributable to the fact that functional task training influences neuromuscular, cognitive, and motor coordination & joint play in addition to reducing pain & improving muscle strength. Combined kinetic chain exercise consists of movement over multiple joints involving two or more muscles or muscle groups. These exercises will recruit more muscles in shorter period of time, with less shearing force, increased compression & improved joint stability. Similar results were seen in a study done by Shyam D.Ganvir et al., (2015) who found significant reduction occurs in pain & improvement in function due to improved quadriceps strength & therefore increases stability of the knee joint [8]. Patient with knee osteoarthritis may potentially benefit more from eccentric training & functional task training Programme [9]. Krupa Mehta (2021) concluded that 3 modes of kinetic chain exercise the CCE is more effective than OKCE & CKCE alone in reducing Pain, improving range of motion & functional task performance in patient with Knee osteoarthritis [10]. Similarly, We used this case study to implement a traditional treatment plan in postmenopausal women knee osteoarthritis that included a number combined kinetic chain exercise & Functional task training Rehabilitation this case study demonstrate the efficacy of our treatment plan for postmenopausal osteoarthritis in knee & suggest additional uses of it in clinical setting for this patient population.

CONCLUSION

We created a treatment plan for a patient with osteoarthritis in the knee for Postmenopausal women that included combined kinetic chain exercise with functional task training (CKC with FTT) exercise is effective in the treatment of knee osteoarthritis in postmenopausal women. The patients' functional activities, quality of life & pain were significantly improved after the treatment. Along with combined kinetic chain exercise Programme significantly increased muscle strength & improved involvement of functional task. The patient pain, functional task has increased as a result to be more advantage in term of enhancing the patient‘s general health and activity of daily living.

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