

## Tele-rehabilitation and its Efficacy in Knee Osteoarthritis - Pilot Study

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### Abstract

Osteoarthritis (OA) is one of the most common, chronic and degenerative musculoskeletal joint disease/condition spread worldwide. Characterized by degeneration of cartilage and its underlying bone. Progressively, there will be loss of articular cartilage and remodelling of the underlying bone. Associated with significant health and welfare costs. OA condition has a major cause of pain and joint stiffness in especially elderly group. The specific causes of OA are still unknown. The onset of the disease is gradual and usually begins after or in the 40s, favouring obesity, advancing age and female gender. At some point, everybody will be affected by primary osteoarthritis, if we all live long enough. Rapid evolution of the technology, healthcare professionals began to adapt to this new evolution and then came into the practice of Tele-rehabilitation or Tele-consultation (telephone, skype or zoom) that involves the use of information and communication technology to deliver health-care services to people remotely in their home or other setup, outside the rehabilitation clinics, which is potentially associated with geographical isolation, reduced waiting and travel time and consequently reduced treatment expenses and flexibility. Services like therapeutic interventions, remotely monitoring the progress, patient education, consultation, training and people networking. With advancement of technology and high prevalence of OA, there is need to spread awareness about the disease, its prevention, and rehabilitation in the community.

**Keywords:** Tele-rehabilitation; Middle-aged; Musculoskeletal Disorders; Osteoarthritis; Physical Therapy; Pain

### Abbreviations

CPT: Conventional Physiotherapy Treatment; OA: Osteoarthritis; DJD: Degenerative Joint Disease; ROM: Range of Movement; ADL: Activities of Daily Living; WOMAC : Western Ontario and McMaster Universities Osteoarthritis Index

### Introduction

Osteoarthritis is one of the most chronic and degenerative joint disease, also a major cause of pain associated with joint stiffness in middle-aged and elderly, affecting more than 25% of the population and it may give rise to disability, leading to compensatory life patterns. Knee is one of the most affected-joint for osteoarthritis condition [1]. OA can affect either one (unilateral) or both (bilat-

eral) sides of the knee, most commonly found in the inner (medial) compartment of the knee joint [2,3]. OA is primarily a clinical diagnosis, initially, managed conservatively involving rehabilitation; supportive devices; exercises for strength, flexibility, and endurance; patient education; and modifications in activities of daily living. It may require surgical intervention in later stages, if significant impact to quality of life prevails. Other adjunctive measures to get relieve from pain include massage, heating pads, weight loss, acupuncture, and transcutaneous electrical nerve stimulation (TENS).

Worldwide, estimate shows 9.6% of men and 18.0% of women, > 60 years of age have symptomatic OA. OA is the 2<sup>nd</sup> most common rheumatologic problem. In India, prevalence is about 22% to 39%. Nearly, 45% of women > the age of 65 have symptoms, while 70% > age of 65 shows OA radiological findings. Radiological findings such as loss or narrowing of the joint space, osteophytes, sub-chondral cysts formation and sclerosis). OA was estimated to be one of the tenth leading cause of non-fatal burden [4]. OA affects 240 million people globally [5,6].

Pathological changes can be seen in OA joints it include various changes in different stages (stage 1 to 4 - minor, mild, moderate and severe). These pathological changes are – loss and destruction of articular cartilage, subchondral thickening, osteophytes formation and inflammation of the synovium, degeneration of ligament/menisci of the knee and hypertrophy of joint capsule [7]. Physical impairments include weakness in muscle and associated structures, referred pain or pain with movement, enlargement of the joint, altered muscle function, reduced proprioception and postural control, instability in joint, restricted joint ROM (range of movement) and fitness.

OA of the knee is divided into two types i.e. primary (idiopathic) and secondary osteoarthritis. Primary osteoarthritis is related to aging and wear and tear that comes along with it and specific cause is unknown. Also it is not caused due to existing disease or injury. Whereas, secondary osteoarthritis can be due to trauma or mechanical misalignment or disease. Secondary OA has more chances of affecting people at earlier age also. The severity of the disease can be graded according to radio graphical findings, but the treatment and approach towards both, is same [8,9]. Specific causes for OA remain unknown.

In United States, more than 20 million people already suffer from knee OA. By 2030, 20% of Americans (about 70 million people) aged above 65 years of age will be at risk for OA [10]. As per, one of the recent report published in one of the newspaper, The Times of India in 2010 regarding OA, over 40% of the Indian population in the age group of 70 years or above suffer from OA. Nearly, 2% of these undergo severe knee pain and disability [11].

A recent statement quoted by an eminent Healthcare Limited, in a nationwide campaign against chronic diseases, “India is expected to be the chronic disease capital, with 60 million people with arthritis, by 2025. The government, private sector, medical fraternity and NGOs should join in together against the onslaught of chronic diseases” [10,11].

Recently, India was ranked 2<sup>nd</sup> in the World after United States, reported 10,207,871 confirmed cases of OA knee and 147,901 deaths as per the World Health Organization (WHO), updated on 28<sup>th</sup> December 2020. Taking up digital-health-interventions, this has been the only feasible approach for many institutions to manage their clients/patients [12].

Current OA guidelines recommend, a sequence of PT modalities and weight reduction, increase in physical activity, and reduced intake of analgesics, reserving surgical procedure or joint replacement as the last resort for the management of OA symptoms [13]. Thus, there are several ways to rehabilitate the OA knee and they has been proven to be effective in terms of decreasing pain and regaining the lost ROM during the course of wear and tear of the articular cartilages or during the staging process (stage 2 or 3 of OA).

### Tele-rehabilitation or tele-consultation

During the global (COVID -19) pandemic, delivering the rehabilitative services towards OA knee was little difficult for people in remote areas, elderly group or those confined to home isolation. Majority of those suffering from OA were deprived of access to quality treatment. With advancement of the technology, Tele-rehabilitation or Tele-consultation was widely used across the globe to deliver therapy/exercises regime. People who could not commute to a nearby clinic due to painful condition of the knee, disability due to the any disease, underlying comorbidity or came in equation with the time need of Covid-19 pandemic, approached towards digital physiotherapy program [12]. However, the most widely used remedy for knee OA is rehabilitation. And this can be best delivered via exercises.

Physical therapy has been proven to be generally safe for OA patients across all diseased stages and additionally to improve balance and general well-being [14]. Even during Pre-Covid-19 phase, Tele-rehabilitation was used in India and world-wide, but people came to know about it and used it extensively with positive approach with the need of an hour.

### Description of the intervention

The treatment of knee OA is based on a multi-disciplinary and multi-factorial approach with emphasis on non-pharmacological treatments and active strategies [15]. During Covid-19, when social distancing was mandatory, a tailor-made-guided exercise program was one of the best feasible approach for performing or continuing the rehabilitation program [16]. Tele-rehabilitation is the delivery of rehabilitation services over telecommunication networks or Internet, including website, smartphone apps, video-conferencing systems, computer software, phone calls and health coaching. Interventions such as tele rehabilitation, are potentially of low cost, widely accessible and time efficient, would enable greater access to health-care support [17].

The effectiveness of tele-rehabilitation has been established in many developed countries; it is still an emerging practice in developing nations. Numerous studies from the developed world have concluded that remote rehabilitation is an effective alternative to centre or OPD based treatment for providing quality services with high-rate patient satisfaction. Some studies has also reported higher patient satisfaction levels with tele-rehabilitation therapy as compared to Rehabilitation-centred approach. The potential of digital or internet-based therapy in resource-poor nations needs to be assessed to reduce the economic costs and promote wider adoption of these services [12].

Tele-rehabilitation is the delivery of rehabilitation services over telecommunication networks or Internet, including website, smartphone apps, videoconferencing systems, computer software, phone calls and health coaching.

Therefore, taking a careful consideration of the age, activity level, and diagnosis of the patient/client is critical in developing a plan of care for most clinicians for the success of digital therapy [12]. Well-designed tele-rehabilitation programmes have the potential to improve health-care access and outcomes. Patients are generally satisfied with the services and usually understand tele-

rehabilitation as a new option to increase accessibility and complement traditional rehabilitative services. Tele-rehabilitation was well accepted by middle-aged and elderly with knee osteoarthritis.

### Objective

- To assess and introduce the benefits of tele-rehabilitation for patients with OA of the knee, in terms of pain and functional outcome.
- To compare the effect of tele-rehabilitation and conventional physiotherapy towards improving pain and the physical function of OA of the knee.

### Materials and Methods

#### Methodology

- Study Design - pilot experimental study
- Sampling - Simple random assigned
- Number of samples - 20 (10 members in each group)
- Group A - Tele-rehabilitation
- Group B - CPT (Conventional Physiotherapy)
- Study setting - Clinical set-up, Bengaluru.

#### Criteria of sampling

Inclusion criteria includes age group of 45-55 years, both the genders, condition - knee pain, diagnosed with grade 2 OA knee.

Exclusion criteria includes no traumatic history or condition (any possible trauma or history of fracture and previous surgical interventions), total hip or knee replacement and/or no limb length discrepancy.

#### Study duration

6 weeks.

#### Outcome measure

The outcome was measured based on two parameters - VAS Score and WOMAC SCALE. The VAS is 10-point scale to evaluate pain in the range of 0-10 with higher scores suggestive of greater pain intensity (0 being no pain and 10 being the worst imaginable pain). Patients were orally asked to state the numeric value on this scale which best describes the intensity of their pain in the last 24 hours. For every patient, two values (baseline and completion of treatment) were noted. The WOMAC is a widely used self-admin-

istered health status measure used in assessing pain, stiffness, and function in patients with OA of the hip or knee. Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), measures three dimensions – pain (5 questions), stiffness (2 questions) and function (17 questions). The feedback from all the patients was retrieved from the database for analysis.

**Methods**

- The subjects selected were given the consent form. The nature of the study were explained clearly to the subjects.
- They were divided into two groups-
  - Group A -Tele-rehabilitation treatment
  - Group B- Conventional physiotherapy treatment

**Intervention**

The patients in the tele-rehab group-A learned strengthening, endurance, flexibility, and active range of motion exercises. Then, they received descriptive charts containing descriptions and pictures detailing about the exercises explained to them and were asked to note down their activities. Patients were also asked to continue these exercises for three times a week for 6 weeks. Prior to each session they were advised to use a hot pack on their affected knee/s for 20 minutes. The physiotherapist was responsible to be touch with the client/patient via a phone or video call on every alternate days. In this way, the specialist remotely monitoring the progress of exercises and maintaining principles of daily activities, and improvement in symptom/s by using VAS score and WOMAC scale. The therapist also asked the patients to review their exercises as instructed in the charts.

In the CPT based group-B, patients were getting treatment in OPD or clinic setup three times a week for 6 weeks and underwent physiotherapy session with various electrotherapy modalities including electrical stimulation (TENS) for 15 minutes. The same exercises that were instructed to group -A were also instructed to group B, by the physiotherapist to client/patient/s to continue at home between the sessions. In this group, the patients were not allowed to consume any analgesics during the study.

Both the groups were assessed on measurable parameters and on specific timelines.

**Group A (Tele-rehabilitation)**

**Pre and post treatment evaluation**

Sl. no.	Pre-VAS score	Post-VAS Score
1	07	4
2	06	3
3	07	4
4	05	1
5	07	2
6	06	3
7	07	3
8	06	2
9	05	1
10	07	3

**Table 1**

Sl. no.	Pre WOMAC score	Post WOMAC Score
1	48	32
2	44	34
3	49	31
4	50	35
5	53	33
6	53	32
7	50	30
8	49	29
9	48	30
10	51	31

**Table 2**

**Group B (CPT)**

**Pre and post treatment evaluation**

Sl. no.	Pre-VAS score	Post-VAS Score
1	06	3
2	07	2
3	06	3
4	05	4
5	07	2
6	06	2
7	07	4
8	08	2
9	06	3
10	07	3

**Table 3**

Sl. no.	Pre WOMAC score	Post WOMAC Score
1	50	38
2	48	36
3	49	37
4	52	39
5	51	40
6	55	20
7	50	39
8	52	40
9	49	39
10	47	35

Table 4

Statistical analysis

Variable	Group I	Group II	Mann Whitney U	P value
	Median (Q <sub>1</sub> , Q <sub>3</sub> )	Median (Q <sub>1</sub> , Q <sub>3</sub> )		
Post VAS	3 (2, 3)	3 (2, 3)	46	0.75
Post WOMAC	32 (30, 33)	39 (36, 39)	10.50	0.003

Table 5

Inference

Mann Whitney U test was performed to compare median values of post VAS and post WOMAC between the groups. Post WOMAC was found to be significant between the groups (P value 0.003).

Variable	Group I				Group II			
	Pre Median (Q <sub>1</sub> , Q <sub>3</sub> )	Post Median (Q <sub>1</sub> , Q <sub>3</sub> )	Z	P value	Pre Median (Q <sub>1</sub> , Q <sub>3</sub> )	Post Median (Q <sub>1</sub> , Q <sub>3</sub> )	Z	P value
VAS	7 (6, 7)	3 (2, 3)	-2.85	0.004	7 (6, 7)	3 (2, 3)	-2.82	0.005
WOMAC	50 (48, 51)	32 (30, 33)	-2.82	0.005	50 (49, 52)	39 (36, 39)	-2.84	0.004

Table 6

Inference

Wilcoxon Signed Rank Test was performed to compare pre and post values VAS and WOMAC separately for Group I and Group II. It was found to be significant.

Strengths and Limitations: Uses of Tele-rehabilitation such as quick access to information, encourage to self-management of problem, time management at ease, educate patient about the condition, advice on common muscles and joint injuries. Some of the challenges associated with digital health interventions are difficulty to navigate through the system due to limited computer literacy, unreliable internet connection, and language barrier, inability to perform an actual physical assessment, patient privacy, and safety concerns. In our study we also found limitation in relatively small sample size, short duration and other grades of OA [18-20].

Results and Discussion

In this study, we evaluated the efficacy of tele-rehabilitation programme compared with CPT on physical function of patient with knee osteoarthritis.

Group A, Tele-rehabilitation group showed significant reduction in VAS Score compared to group -B, CPT, also showed significant improvement in WOMAC score compared to CPT. Hence, this shows the importance of incorporating Tele-rehabilitation in regular physiotherapy regimen.

The age and gender demographics of the patients in our study showed a uniform distribution. In all participants, we found improvement in terms of pain, quality of life and physical function. As both groups showed significant improvement in physical function and also decrease in pain. There is no significant difference between in tele-rehabilitation and CPT. This study also shows that tele-rehabilitation is effective in knee osteoarthritis as conventional physiotherapy. In the literature by various researchers, a high level of patient satisfaction with tele-rehabilitation was also reported [21-24]. Studies have revealed that patients with OA benefitted from enhanced management with telemedicine.

Technology assist to deliver rehabilitative services has many benefits for not only the clinician but also for patient/client as well.

It provides the patient with a sense of personal autonomy and empowerment, enabling them to take control in the management of their condition.

### Conclusion

Tele-rehabilitation intervention was effective in management of patients with OA of the knee and it produces a better outcome in terms of quality of life to conventional clinic-based physiotherapy as documented in this study. Hence,

- Tele-rehabilitation shows significant impact in participants with OA of the knee.
- Improvement in parameters of pain and quality of life following physiotherapy tele-rehabilitation or tele-consultation. Thus, Tele-rehabilitation needs to be accompanied with CPT.

Tele-rehabilitation can be considered in the management of patients with OA of the knee and more research should be carried out on the usability and effectiveness of Tele-rehabilitation in the management of other conditions amenable to physiotherapy. The future demands for healthcare are enormously outpacing the current methods of approach as can be seen here with just one disease. Suggestion for future research is that, Tele-rehabilitation need to be implemented in other clinical condition/s and their efficacy need to be recorded and analysed, in terms of more cost-effective and treatment-effective program of tomorrow.

### Author Contributions

S. Pal and M. Dey contributed to the editing of the manuscript. All authors contributed to the article and approved the submitted version.

### Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential.

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