



# The Study on Intervention of Virtual Physiotherapy

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## INTRODUCTION

Physiotherapy or physical therapy is a health care profession which concern with physical activity, movement and physical potential of the individual<sup>1</sup>. It helps individual to restore his movement and functional activities.<sup>2</sup>

It also maximizes the strength, flexibility, function and overall, well-being by addressing the underlying physical issue. Physiotherapy treatment are basically provided for:

- Preventing injury and disability
- Managing acute and chronic condition
- Improving and maintaining optimal physical performance
- Rehabilitating and injury and effect of disease or disability
- Educating patients to prevent re-occurrence of injury

**The conditions on which treatment offered by the physiotherapist are:**

- **Cardiorespiratory:** In cardiorespiratory it provides support to the patient who is suffering from heart or lung disease or injuries or for the one who went under some heart surgery.
- **Cancer:** In cancer patient physiotherapy prevent stiffness in the particular area and also prevent fatigue muscle and restore strength in the adjacent part.
- **Incontinence:** In incontinence patient physiotherapy prevent pelvic floor dysfunction as well as incontinence.
- **Women health concern:** It means physiotherapy during pregnancy, birth, post-partum care, breastfeeding, menopause and loss of bladder and bowel control.
- **Musculoskeletal:** This is most common condition and mostly present in every individual it deals with the patient of musculoskeletal pain specially occur in neck and back.
- **Neurological:** It help in patient who have severe brain or spinal cord injury due to accident or some other injury like patients with stroke, Parkinson's or in children who is suffering from cerebral palsy.
- **Orthopaedics:** In this PT Prevent acute or chronic orthopaedic condition or if an individual has gone under some orthopaedic surgery like total knee replacement, THR, rotator cuff surgery etc.
- **Pain:** The main role of pain physiotherapy is to manage the pain and make patient get back to his daily life and do his daily activity.<sup>3</sup>

### Three of main approaches physiotherapist:

- Education and advice
- Movement and exercise
- Manual therapy

- **Education and advice**

The main aspect of physiotherapy is not focusing on just injured part but should focus on whole body. The important part of the treatment is regular exercise and maintain weight. The advice given to the patient by PT is very important and helpful. The advice can be related to the maintenance of posture, gait or body weight.

- **Movement and exercise**

Mostly exercise and movements are help in improving mobility and function of the individual. This may include:

- Exercises which are designed to improve movement and strength in a particular part of the body -these exercises patient should do regularly
- Activities that involve moving your whole body-The activity help in improving the injured area which affect the individual's mobility like walking or swimming (if possible)
- Exercises like hydrotherapy which can be done with warm water-by this exercise the muscles and joint are relaxed and gradually get stronger
- Advice and exercise to help you to increase or maintain your physical activity-in this advice is given to the patient that how to keep joint and muscles active
- Providing mobility aids-Crutches or walker or stick which help patient in walking

- **Manual therapy**

Technique where physiotherapist use their hands to manipulate or mobilize .This therapy is used to treat specific joint or muscle problem.

This can be helpful in :relieve pain and stiffness of particular joint or muscle, improve blood circulation, help in fluid drain more efficiently from parts of the body, improve the movement of different part of the body ,promote relaxation.

There are **other techniques** also which are used by physiotherapist:

- Acupuncture: The main aim of the techniques is to reduce pain at a particular joint by inserting needles in a particular area.
- TENS (Transcutaneous electric nerve stimulation): The main aim of this is also to reduce pain of the affected joint it's basically a battery-operated device in which electric current is delivered to the affected part
- Ultrasound: The main aim of this technique is also to reduce pain but it also includes decrease in spasm. Its high frequency sound wave which treats deep tissue injury by stimulating blood circulation .<sup>4</sup>

#### **Type of exercises**

- **Stretching Exercise**

Stretching exercise include when physiotherapist hold the muscle in its lengthened position to increase the flexibility. It helps to loosen the tight muscles to restore its normal joint movements If someone have tight muscle it will restrict which may increase the wear and tear of the joint. It also helps to improve your posture. It reduces the pain and soreness of the part.



FIGURE 1

- Resistance Exercise

Resistance exercise are the exercise which are performed with some type of weight(resistance)It can be weights, towel and TheraBand. The body of the patient response to the stress and when the muscles are not used to do any exercise then they respond stronger. The muscle adapts the way you keep them if you will keep muscle working then the muscle will respond that way otherwise it will respond weaker.



FIGURE 2

- Balance Exercise

Balance exercise are done when individual try to get his nerves and muscles to respond better. They are used to prevent fall in elderly or help in knee stability. After an injury or after a surgery the contact between nerves and muscle limit the body from functioning.



FIGURE 3

- Functional Activities

Functional activities are the activities which are done that make individual to get back on his daily activity in home or in office This activity include multiple joint and muscles. In initial phase the activity which you will start is with easy movement or with less resistance movements.<sup>5</sup>

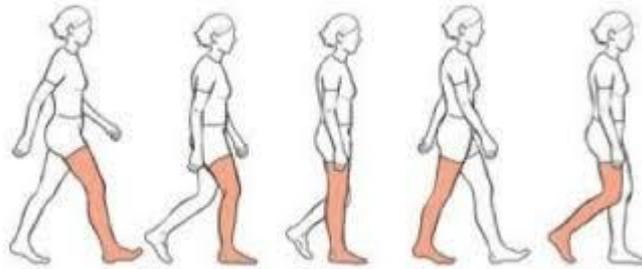


FIGURE 4

## VIRTUAL PHYSIOTHERAPY

Virtual physiotherapy or telerehabilitation physical therapy is an alternative way to do physiotherapy without one point of contact, this is done through online exercise program which can be seen in a application of the company in which patient is registered.



21

FIGURE 5

Virtual physiotherapy “force amplifier” for the physiotherapist that allow him to interact more with more patients at a less time .<sup>8</sup>

Virtual physiotherapy covers **certain conditions**:

- Joint pain
- Muscle pain
- Sports injuries
- Heart and lung conditions
- Neuromuscular conditions

The programme involves a personalised programme which is designed to relieve the symptom and restore lost movements. The videos are shared to the patient through the application which give the demo of every exercise before the main exercise and then patient can follow the exercise simultaneously at their comfort zone and at their comfort timing. Throughout the programme patient may receive the follow up calls to check on your progress.<sup>6</sup>

## BENEFITS OF VIRTUAL PHYSIOTHERAPY

- Convenient care: By increasing the popularity of VP its estimated to reduce patient travel and it also provide care whenever patient need the most. If you are at home, vacations all you need is a internet or Wi-Fi connection and you can do physiotherapy by seeing the videos.
- It also prevents chronic issue.
- Improve timeliness of the care: VP allow a much lower barrier entry for patient care. Even appointment scheduling with doctors is also easy
- It is effective: VP meet the same standard of practice as in-person appointment.
- Greater patient comfort: It is the best opportunity for patient to receive own social and vocational environment can lead to greater recovery outcomes.<sup>7</sup>

## TYPE OF VIRTUAL PHYSIOTHERAPY

- Musculoskeletal VR: It include the patients who want rehabilitation of muscles, ligaments and bones if injured or gone through surgery
- Post stroke VR: It include the patients that have survived a neural haemorrhage or blood clot to the brain.
- Cogitative VR: It include the patients with various psychological disorder, suffering from attention deficits/hyperactivity to eating disorder to post traumatic stress and phobia.
- It cost effective for the patient as patient don't have to spend lot of money on daily physiotherapy sessions
- There will be privacy for the patient as patient can do exercise on his own at his comfort time and in his comfort zone
- It is also beneficial for the PT as there is no need to travel regularly to patients' home for physiotherapy

## Why should anyone go for physiotherapy

The need of physiotherapy can be there at any age and to anyone whether the individual/patient is a small baby, young athlete or young professional, elderly patient, pregnant women or individual with any disability

There are few cases in which need of physiotherapy plays a very important role:

- Postural problem: This includes back pain, shoulder instability, muscle fatigue, poor muscle tone, muscle imbalance
- Joint pain: This includes the cases of arthritis, osteoporosis, poor aligned joints, joint instability, bursitis, degenerative joints, age related joint problem
- Joint injury: This includes the case of ankle sprain and strains, dislocation of the shoulder joint, joint hypermobility
- Surgery: After surgery physiotherapy plays a very important role for recovery it includes cases like total hip replacement, TKR, partial knee replacement, ACL reconstruction, spinal cord surgery, cardiac surgery, breast cancer surgery
- Soft tissue injury: This is most common injury in athletes and it includes cases like tennis elbow, golfers' elbow, rotator cuff injury, tendinitis
- Edema: Edema following sports or any surgery or any injury, swollen joints, chronic joint or muscles inflammation.<sup>9</sup>

## USER JOURNEY MAP/PATIENT JOURNEY MAP

A user journey map or patient journey map (in case of involvement of patients) and also commonly known as customer journey map is a visual design that describe the user flow through the site. It starts with initial contact

between the patient and doctor or between the client and the manufacturer and continuing the process of engagement into building long term trust.

It identifies the key interaction or touchpoints with the website or mobile application and then all the details about the patient as well as about the doctor can be seen.

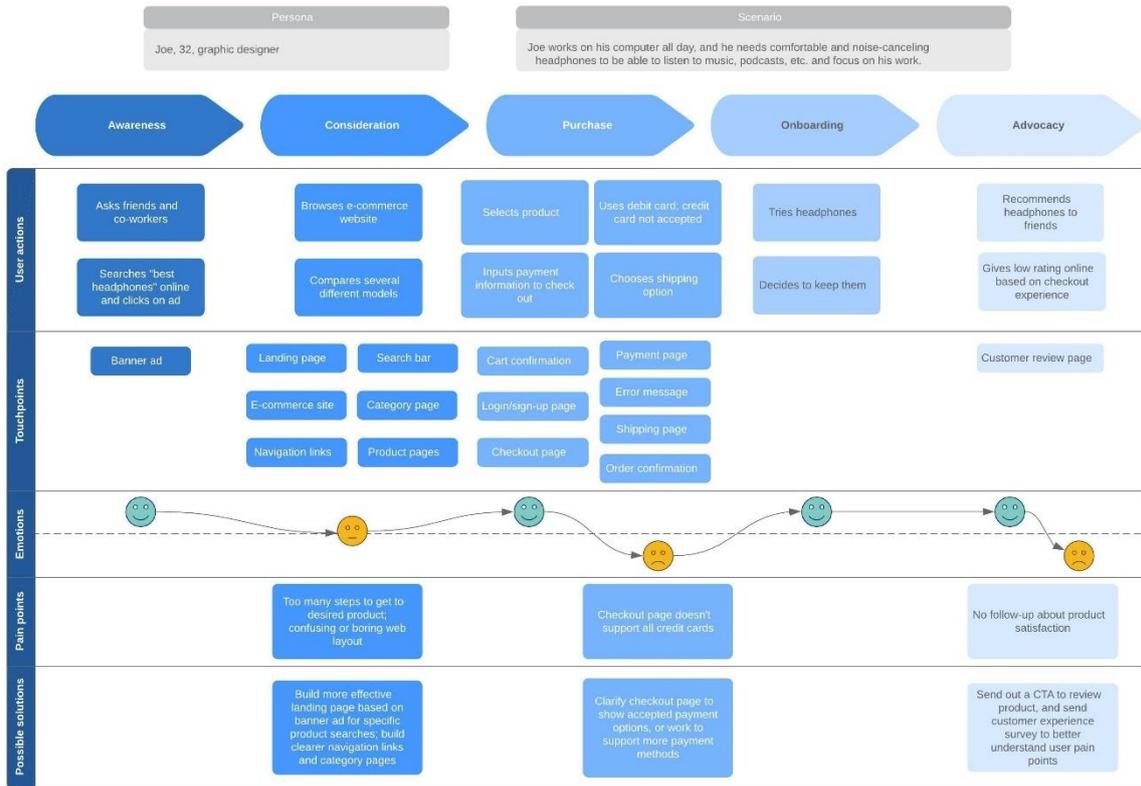


FIGURE 6

### IMPORTANCE OF USER JOURNEY

A user journey map is a vivid representation of the customer experience and it is very useful for the company to look at the app or at the website and then they can analyse what user want or what is the expectation of the user and then we can design the journey according to the user/customer. The process of the journey should be like it should consider all the points which customer wants be it customers feeling, questions. By this everyone in the organization can check what is the latest thing user want and how you can fulfil it. <sup>14</sup>

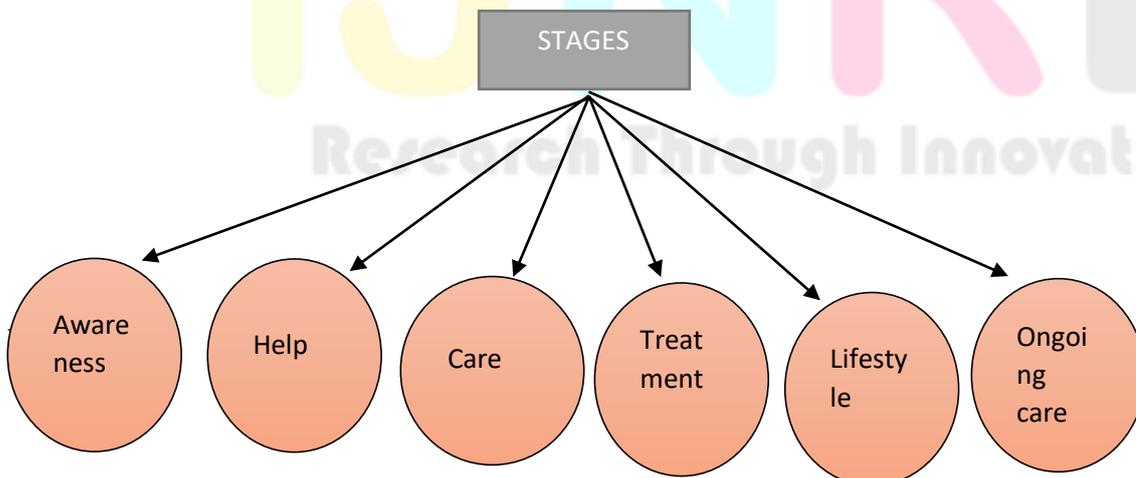


FIGURE 7

- **Awareness:** Awareness or alert means when patient can feel his own symptoms and research well about the symptoms and all the conditions related to the symptoms and then reach out to specific doctor or sometime, they ask questions online in some online site or in any health application
- **Help:** When the patient is aware about the symptoms then he contacts with the healthcare professions and take help from them
- **Care:** After contacting the healthcare professionals through phones then patient reach to the hospital and then medical professional assess them properly.
- **Treatment:** The healthcare provide patient with both on-site and follow up care via physiotherapy sessions, counselling and even diet
- **Lifestyle:** Lifestyle plays a very important part in any patients' life as when patient make change in there day-to-day life and take part in healing process like through physiotherapy then the chances of operation of injury can be cured
- **Ongoing care:** The patient manages his care between the visits and thus the engagement between the patient and doctor is easy and patient can maintain the good health with proper guidance by the doctor.<sup>12</sup>

## USER EMPATHY MAP

Empathy map is a tool that is design to understand the attitude of the patient/customer and also visually connect those finding to colleagues. By this an individual learn a lot about the needs of the user/patient. It consists of all the data that has been gathered from the user. While conducting a user journey the person who is making it learn a lot of things about the users that what they say what they feel what user think and what user does.



FIGURE 8

- **Says:** In this part of the empathy map the information that what users say is taken from previous data or from research papers. It may include that patient want recovery fast and ask his doctor for that.
- **Think:** This part mainly focuses on what is the thinking of user or patient regarding any treatment or any new intervention. There can be several questions which user think in his mind and want to ask. The questions can be that am I performing the exercise correctly or not
- **Feels:** This part of the empathy map describes the emotional state of the user or patient. They may have the questions related to new product, new treatment or new medications.
- **Does:** This part of the empathy map describe how the user or patient adapt the thing and then do it. Like if we have given patient to do some exercise than how he is doing the exercise or it can also be what action patient does take regarding particular exercise.<sup>15</sup>

## NEED OF THE STUDY

The available literature indicates the comparison between the traditional physiotherapy and virtual physiotherapy, what type of exercises can be taught in both and what is the technique used in both.

## AIM AND OBJECTIVE

The purpose of this study is to change traditional physiotherapy to virtual physiotherapy

- To find out the reasons that why patient don't do exercise in the absence of virtual physiotherapy
- To find out the challenges faced by patient, physiotherapist, care coach and care givers in both traditional and virtual physiotherapy
- To find out the score card used to assess the patients of TKR

## LITERATURE REVIEW

1. VIKKI WYLDE, JANE DENNIS, RACHAEL GOOBERMAN AND ANDREW DAVID BESWICK (2018): In this study they have studied that approximately 20% of patient experience chronic pain after TKR. The main aim of the study was to check the effectiveness of post discharge intervention in reducing the severity in chronic pain in 3 months after surgery. The registration of the protocol was based on the registration number. It was a randomized controlled trial. The initial outcome of the study was self-reported pain severity at minimum 12 months after TKR. They have included 17 patient's data from 2485 patients. The majority of patients have reviewed physiotherapy interference, nurse led interference, neuromuscular electrical stimulation interference and multidisciplinary interference. As per them no study found a difference in long term pain severity in home treatment and resulted in decrease in severity at 12 months. The conclusion of the study is that systematic review and narrative synthesis has no evidence that one type of physiotherapy intervention is more effective than another at reducing chronic pain.<sup>10</sup>
2. MIGUEL A. PADILLA-CASTANEDA, EDOARDO SOTGIU, MICHELE BARSOTTI, ANTONIO FRISOLI, PIERO ORSINI, ALESSANDRO MARTIRADONNA, CRISTINA LADDAGE AND MASSIMO BERGAMASCO: In this study they have studied that there are many advantages of telehealth rehabilitation, the use of telehealth physiotherapy need little attention specially in orthopaedics or musculoskeletal injuries. They have allowed patient to perform upper limb exercise and also participates in virtual reality games which help them to assist the exercises for strengthening and motion recovery. By this system the physiotherapist to review difficulty level on the motion capacity of the individual. They have also evaluated system through analysis of muscular activity of two healthy individuals, which defines that machine can allot working load during distinctive physiotherapy treatment profiles. They have created a group of 10 individual who are experiencing manual rehabilitation which is tested by the machine. After this individual have shard there experience that favourable option of machine through administered questionnaire.<sup>11</sup>
3. EMIL ROSENLUND HOEG, BEGUM BECERMEN, JON RAM BRUUN-PEDERSEN AND STEFANIA SERAFIN (2014): In this study they have studied that the structure and outcome of training which is organised to create gamified motor rehabilitation experience faced by the patient in virtual certainty and for older patient the exercise bikes have been created. In this training total five physiotherapist from two different healthcare have also participated in this training and gave there ideas which can be helpful for intervention of the rehabilitation process.

4. DAVID I BEN-TOVIM, MELISSA DOUGHERTY, TONY J O'CONNELL AND KATHERINE M McGRATH (2008): In this study they have studied that clinical resign is the process of redesigning and can also change the management to health care. The main focus is on the patient journey which is the primary focus for improvement and also uses the process mapping to identify that value steps should be added in the journey. It involves proper team which think and redesign the journey so that all the non-value part can be deleted and by adding just the valuable steps so that there can be proper flow in the journey and can also reduce the delay ,as mapping has reveals the poor coordination due to non-value steps. They used a method which involve doctors, managers, patients as well as care givers.<sup>13</sup>
5. BRUNA FERRIRA, WILLIAMSON SILVA, EDSON OLIVEIRA AND TAYANA CONTE: In this study they have studied a software product which is totally depend on the user experience. They have also met the user needs. They have adopted one technique name as personas this technique allow them to study and describe the user characteristics, goals and skills. They have also said in their study that empathy map can also used to describe the personas. The main goal of the empathy map is to create some percentage of empathy with user so that it can be easy for product team to understand the users. Initially they took 20 peoples for the study and they have learned about how to describe personas. After studying and understanding empathy map the peoples were asked to answer the questionnaire about the empathy map. Result shown that majority of subject are considering the empathy map and also said that in future majority of them will use empathy map for designing product.<sup>16</sup>
6. SARA R. PIVA, CHARITY G. MOORE, MICHAEL SCHNEIDER, ALEXANDRA B. GIL, GUSTAVO J. ALMEIDA AND JAMES J. IRRGANG (2015): In this study they have studied the outcome of total knee replacement that after surgery the functional restriction and physical exercise problems fails to resolves. The primary aim of the study is to compare the outcome of physical function and physical exercise between 3-12 weeks. The secondary aim of the study is to identify the baseline forecaster of recovery. The method of the study is to design protocol to compare between the three groups. Data will be collected at baseline that is 3 months and 6 months. The initial outcome is measured by WOMAC-PF (Western Ontario McMaster universities osteoarthritis index physical function subscale). Physical exercise is also measured by performance-based test. The secondary outcome include same performance-based test and physical activity assessed by patient report survey.<sup>17</sup>
7. JOSE MANUEL PASTORA-BERNAL, ROCIO MARTIN -VALERO AND MARIA JOSE ESTEBANEZ (2017):In the study they have studied that virtual physiotherapy have efficiency, strength and it plays a very important role in musculoskeletal disorder that provide opportunity to define new social policies and interference. The aim of this study is to investigate the effect of exercise virtually on orthopaedic condition as well as to describe a design a telerehabilitation. This study summarizes the level of evidence and grades of recommendation regarding VP. The method they used for study was assessed using Physiotherapy evidence database score and grade of recommendation. They found very strong proof in favour of VP in patient following TKR/THR.<sup>18</sup>

## **METHODOLOGY**

**STUDY AREA:** Daytoday Health, Bangalore

**STUDY DESIGN:** It is a comparative study.

**TYPE OF DATA & SOURCE OF DATA:** User journey and empathy map

**STUDY PERIOD:** March-May2020

## STATISTICAL SOFTWARE USED FOR DATA ANALYSIS: MIRO

**MODE OF DATA COLLECTION:** The study was done on real time observation by comparing traditional physiotherapy at home with virtual physiotherapy at home.

### INCLUSION CRITERIA:

- Patient undergone TKR surgery
- Observation of home physiotherapy and virtual physiotherapy which is currently done through video call

### EXCLUSION CRITERIA

- Osteoarthritis
- Accident
- Disability in lower limb
- Over weight

### PROCEDURE

While doing this study first we studied that what can be the major reasons that patient don't do physiotherapy in the absence of PT this is the most important aspect of the study as we know that in virtual rehabilitation physiotherapist won't be going personally to the patients home so we have collected the list of major reasons and why these reasons are there we also studied that from real time observation and by asking general questions from patients.

When we got the reasons of not doing exercise then we have addressed the challenges faced by the patients, PT, care coach and care givers. After the reasons and challenges we came out with the empathy map with the perspective of both patient as well as physiotherapist which include all the things what patient and PT think and feel, see, hear and do.

After studying the empathy map, we have prepared a protocol for post TKR surgery and in that protocol, we have divided it in four phases and 6 aspects that is mobilization and ambulation, mobilization of affected joint, strengthening of muscles, care of proximal and distal joints, phase wise physiotherapist goal and what is the ultimate patient's goal after physiotherapy.

After studying all these things, we have created a user journey for physiotherapy patient which include all these above criteria. We have also created a feedback form for virtual physiotherapy which will be asked from every patient after every session

### TECHNIQUE USED FOR VIRTUAL PHYSIOTHERAPY

- **ROM: Active** movement was checked in a lying & Sitting position. Knee flexion and extension was checked in both sides (left and right). There was normal found at the left knee joint in degree.
- **MMT:** Muscle Strength checked with help of a caregiver makes her to give resistance with the hand pressure to score of muscle in Grade.
- **Pain:** With the help NRS scale asked the patient to give a score & according to that she has given scale (1 to 10).

**TABLE 1: PAIN SCALE**

Rating	Pain Level
0	No Pain
1–3	Mild Pain (nagging, annoying, interfering little with ADLs)
4–6	Moderate Pain (interferes significantly with ADLs)
7–10	Severe Pain (disabling; unable to perform ADLs)

**HOW PATIENT ASSESS THE EFFECTIVENESS OF THE TASK GIVEN IN VIRTUAL CALL**

- Motivate the patient to perform exercise properly.
- Educate patient properly about every movement
- Reminding every day that she has get back to normal to range of motion, activities.
- Be with patients to make sure to monitor sets of exercise completely or not.
- According to the exercise plan & progression changing treatment plan.
- Keeping Target to resume to normal using scoring scales like OKS, KOOS, NRS
- Demonstrating the exercises to make her understand better.
- Ask questions from the patient related to pain and movements or prepare a checklist and ask the things from patient list vice
- Give patient a task to perform and then analyse the strength of the muscle
- Ask them to perform exercise repeatedly.

**RESULT****TABLE -2** Reasons why patients don't exercise in the absence of a physiotherapist and why these reasons are there?

REASONS	WHY REASONS HAPPEN
1. Not able to remember exercise	Geriatric cases, Parkinson's, difficulty in understanding.
2. Functional limitations	Fractures, weakness, Muscle wasting, busy schedule
3. Lack of support	Non availability of caregiver, geriatric caregiver,
4. Inactive lifestyle	Due to work, lack of interest
5. Pain	Joint restriction, osteoarthritis and rheumatoid arthritis
6. Gait problem	Surgery, artificial joint, Joint instability, Limb length discrepancy
7. Lack of knowledge	Geriatric, Uneducated, Poor understanding
8. Muscle weakness/Fatigue	Surgery, prolong bedridden, Geriatric, poor diet, immobilization.

9. Medications	Due to surgery, existing medical illness, nausea, drowsiness.
10. Obese	Hereditary, poor diet, Difficulty in bending
11. Swelling	Surgery effects, DVT, not elevated position
12. Geriatric	Muscle weakness, lack of knowledge, poor memory
13. Demotivated	Prolong medical illness, Medication side effects, Family problem, not optimistic.
14. Lack of proper diet	Gastritis, lack of knowledge about diet
15. Lack of sleep	Medication side effects
16. Fear of fall	Frequent fall, Geriatric, Muscle weakness, Obese, lack of mobility
17. Depression	Medication adverse effect, family problem,
18. Low self-efficacy	Ongoing medical problem like chronic pain
19. Balance problem	Parkinson, Stroke, Instability, Artificial joint, Flat foot, Immobilization, LLD.
20. Stiffness	Surgery, Muscle shortening
21. Heaviness at the incision	Surgery
22. Stroke	Existing Medical illness, Loss of balance
23. Anxiety	Medication, Hereditary

In this above table we have noted the reasons that why patient don't do exercise in the absence of physiotherapist and why these reasons are there by this list we can analyse that patient may suffer from these comorbidities and that's why he is giving such reasons.

TABLE-3 CHALLENGES OF THE REASONS					Daytoday can solve
REASONS	PHYSIOTHERAPIST	PATIENTS	CARE COACH	CARE GIVERS	
not able to remember exercise	*Late recovery *joint stiffness *	*Lifestyle change *pain	*To keep track on exercise and improvement *reminding exercise	* Maintain proper schedule *balance diet *balance sleep	Y
functional limitations	*patient's psychology * muscle weakness *balance problem * decrease in flexibility	*Decrease in physical activity like walking *depend on the family.	*Educate patient about the use of exercise and functional limitations.	*Due to dependency of the patient over family, patient need someone all the time for his daily activity.	Y
lack of support	*To build confidence of the patient. *To gain trust of the patient	*depression *chances of fall	*Balance problem *lack of mobility	*Busy schedule *not able to do follow up of exercise	Y
inactive lifestyle	*Stiffness in muscles *painful joints	*Inability to do exercise *obese	*Tough to handle patient. *Motivate them to do exercise	*occupation *increase in weight of the patient	Y
Pain	*To complete session with minimum pain. *To understand the intensity of the pain	*Inability to do the movement of the particular joint. *Not able to maintain proper position while sleeping	*Lack of movement and more of pain will cause inability to move the joint which can cause blood clot	*Restriction in movement cause pain which affect patient while doing ADLs	Y
gait problem	*To improve the gait * maintain proper position of patient while teaching exercise	*post-surgery if LLD occurs then patient lose confidence as well as balance *arthritis	*To build confidence of the patient	*To motivate patient to do exercise.	Y
lack of knowledge	*To make understand the effect of the particular exercise	*To learn the exercise properly without the support of family	*To change the mindset of the patient as well as family.	*Participation of care givers will be less as they will always have a fear of patient injury	Y
muscle fatigue/weakness	*Difficult to do resistance exercise	*Difficulty in breathing	*To assess the severity of the muscle fatigue	*To change the lifestyle and diet of the patient so that strength can be regain	Y
Medications	*After taking medicines the muscles will be relaxed and pain will be less so to find out the intensity of pain and degree of movement is difficult	*If patient is taking NSAIDS the chances of nausea all the day can be possible	*To make sure that medication intake can be decreased so that patient can be in his/her senses while doing exercise	*To manage the medication time of every medical problem with the medications prescribed post-surgery and exercise schedule	Y

Obese	*Teaching patient how to do exercise and motivating about doing exercise	*Increase the risk of further injury	*To help patient to change his daily routine motivate them to walk	*Motivating the patient to walk for a while	Y
Swelling	*Difficulty to increase range of the joint	*Fear and questions in mind due to swelling	*To teach patient about after effect of the surgery and recovery phase	*To explain patient that swelling will decrease simultaneously	Y
Geriatric	*Early fatigue and late recovery due to muscle weakness	*Difficulty doing exercise	*Explain patient the use of exercise post-surgery	*To make patient independently post-surgery	Y
Demotivated	*To deal with psychology of the patient and then start with the exercise	*To get motivated so that he can do ADLs	*Motivate patient to do exercise	*To understand the psychology of the patient and motivate them to recovery	Y
lack of proper diet	*It doesn't affect the patient's exercise schedule	*Can cause gastritis problem	*To make understand the patient and family the use of diet	*To follow the diet so that proper nutrition intake can be there which will help in recovery	Y
lack of sleep	*Patient will be sleepy during exercise	*Patient can't able to concentrate on exercise due to sleep	*Concentration of the patient over schedule	*To maintain proper sleep schedule of the patient	Y
fear of fall	*To make him fearless about the fall *gain trust *limb limping	*Fear of walking independently	*To motivate patient to walk and forget about the fear of fall	*To be with patient all the time as they won't walk due to this fear	Y
Depression	*To recover them both physically and mentally	*To motivate themselves for exercise and try to engage them with other work	*Provide counselling to the patient immediately	*To engage patient to some work and help them to quickly recover through exercises	Y
low self-efficacy	*To recover ongoing medical condition first before teaching exercises	*Not to get stress due to any medical condition like chronic pain	*To know about family, medical and every single history of patient	*Aware about other medical condition so that precautions can be taken properly	Y
balance problem	*To recover balance *to gain trust of the patient	*To do balancing exercises	*To make patient and family understand the effect of balancing exercise if there is loss in the balance	*in the absence of physiotherapist ask patient to do exercises which will improve their balance with their support and by trusting them	Y

Stiffness	*Decrease stiffness by proper exercise	*Try to do exercise beyond there range so that stiffness can be decrease	*To handle patient who will complain of pain due to stiffness of the joint	*To motivate patient to do exercises so that stiffness can be decrease	Y
heaviness at the incision	*Due to surgery this will happen which will restrict the range	*Patient will be uncomfortable	*Talk to the surgery doctor regarding this and then suggesting patient the things	*Try to do regular follow ups	N
Stroke	*To make them independently and teach them strengthening exercise which will help them to recover soon	*Due to ongoing medical problem its very tough for patient to exercise independently	*To motivate them to do strengthening exercise and tell them its use	*To be with patient when he tries to do exercise independently to correct their posture	Y
Anxiety	*Aware about the family history of anxiety or any medical condition	*Try to avoid medicines which cause anxiety	*To see all the medications patient is taking note it down as few medications cause anxiety	*If family support or family's financial condition is not good	Y

**TABLE- 3** Challenges faced by the patient, physiotherapist, care coaches and care givers

**TABLE- 4** PROTOCOL FOR TKR

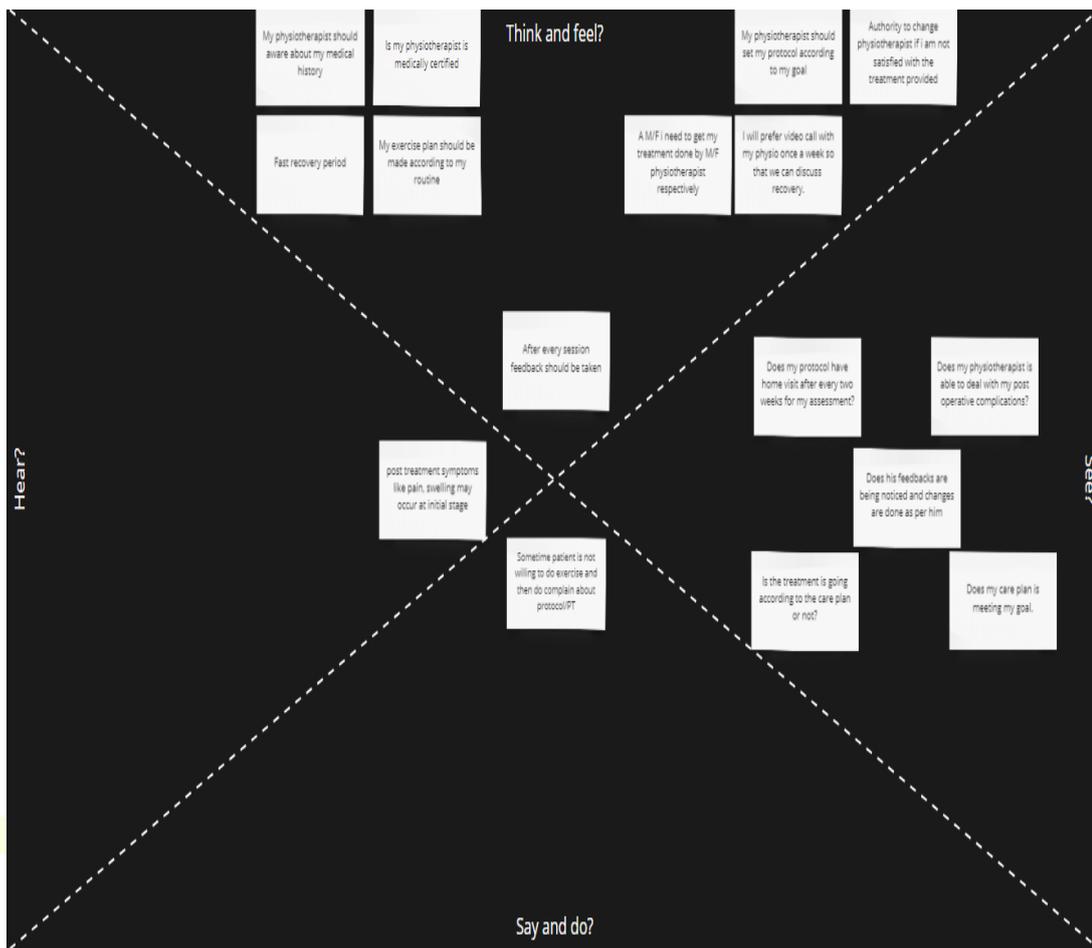
TREATMENT PROTOCOL OF TKR					
PHASES	MOBILIZATION AND AMBULATION	MOBILIZATION OF AFFECTED JOINT	EXERCISE FOR MUSCLE STRENGTHENING	PROXIMAL AND DISTAL JOINT	GOALS
PHASE 1(WEEK 1)	*Early mobilization off bed *Bed to chair with assistance *Assistance ambulation with walker and assistance.	*Gentle mobilization to the musculature, patella and adjacent part to avoid contracture	*Quadriceps muscle (Quadriceps sets) *Iliopsoas (the anterior hip flexors)(straight leg raise)	*Tibialis anterior (Ankle dorsiflexion)	*Passive and active ROM (<90 degree)

<p>PHASE 2(WEEK2-4)</p>	<p>*Continue the same at home *Start bed to chair independently *Bed to bathroom ambulation independently *Independently walk around the home with walker support alone * Ambulate to chair and dining room *Independently, able to sit on a high chair for progressively longer periods of time. *With week you can increase the frequency and duration of walk</p>	<p>*Gentle mobilization to the musculature, patella and adjacent part to avoid contracture.</p>	<p>*Hamstring muscles (hamstring carpet drag) *progressive flexion *Quadriceps muscle(Quadriceps sets) *Iliopsoas (the anterior hip flexors)(straight leg raise)</p>	<p>*Gluteal set (Tighten your buttocks) *Tibialis anterior (Ankle dorsiflexion) *Core stabilization exercise</p>	<p>*Increase range of motion &lt;10-degree extension to 100 degree)</p>
<p>PHASE 3(WEEK5-8)</p>	<p>* Walking upstairs , one step at a time, with support or assistance Getting up from chair or sofa without assistance, ability to do simple chores at home like dish washing, making a cup of coffee etc. * walking upstairs one foot on step with assistance, walking upstairs one step at a time independently, getting up from chair or sofa independently. Should be able to do a six minutes' walk by now. *Take a small walk ten to fifteen minutes out in the open, no</p>	<p>Continue soft tissue treatment, joint mobilization, patellar glides to increase range of motion.</p>	<p>*Gluteus maximus, minimums and Medius, Quadriceps, Hamstrings and calves (single leg stand) *Quadriceps muscle(Quadriceps sets) *Iliopsoas (the anterior hip flexors)(straight leg raise)</p>	<p>*Tibialis anterior (Ankle dorsiflexion) *Gluteal set(Tighten your buttock) *Tibialis anterior(Ankle dorsiflexion) *Core stabilization exercise</p>	<p>*Range of motion &lt;5-degree extension to 110 degree</p>

	<p>assistance required, may use a walking stick or tripod for support. *Single leg stance</p>				
<p>PHASE 4(WEEK8-12)</p>	<p>*Increase steadily the walking capacity to reach about 5000 steps per day *To resume nonprofessional goals</p>	<p>*Continue with same i.e., soft tissue treatment and gentle mobilization to the posterior muscular, patella and at the incision area to avoid contracture</p>	<p>Begin to incorporate activity specific training (i.e., household chores, gardening, sports activity), low impact activity until week 12, no twisting, pivoting after 12 weeks, patient should be weaned into home program with emphasis on a particular activity/sports</p>	<p>*Tibialis anterior (Ankle dorsiflexion) *Gluteal set(Tighten your buttock) *Tibialis anterior(Ankle dorsiflexion) *Core stabilization exercise</p>	<p>*Range of motion with in functional limit *Return to all functional activities</p>

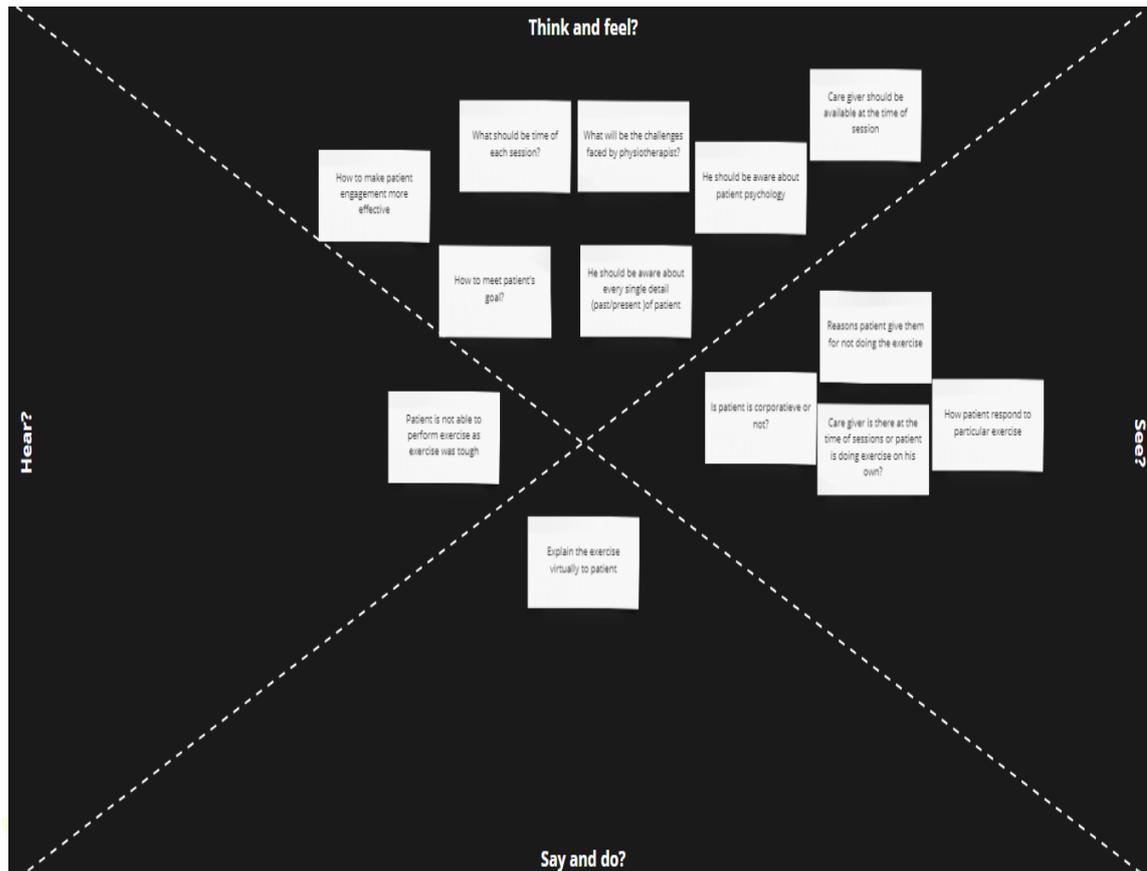
Research Through Innovation

**FIGURE 9: PATIENT EMPATHY MAP**



In this above figure, we have added the perspective of patient with virtual physiotherapy that what patient think and feel, what patient see, what patient say and do and what actually patient hear. These are some important aspects of this journey.



**FIGURE 10: PHYSIOTHERAPIST EMPATHY MAP**

In this above figure, we have added the perspective of patient with virtual physiotherapy that what patient think and feel, what patient see, what patient say and do and what actually patient hear. These are some important aspects of this journey.

## CHALLENGES OF VIRTUAL PHYSIOTHERAPY

- Clinical acceptance
- Therapist attitude toward VP as by this technology will cover all the treatment done by the physiotherapist
- It has also the absence of the remote communication
- Patient safety is another very important challenge faced as there are chances of re-injury due to over exercising or not maintaining proper posture while doing the exercise.<sup>8</sup>

## LIMITATIONS OF VIRTUAL PHYSIOTHERAPY

- Due to network issues, there was a problem in audio as well as video.
- No proper positioning of the phone.
- Need to demonstrate exercise many times.
- According to the exercise plan if we say without assistance the patient should perform but some caregivers thought assistance required.
- Day one is little tough to perform as they didn't understand proper position

- In case of mobilization, we have to teach caregivers about the position through video so that they can perform properly

## SCOPE FOR FURTHER STUDY

- The study was done on intervention of virtual physiotherapy for post TKR patients
- We can also do this for pre TKR surgery phase
- The study can be also done for any other joint and for other surgery as well
- The user journey can also include the role of hospital staff and care givers and also for daytoday health that how they can approach patient pre surgery.

## CONCLUSION

- Physiotherapy plays a very important role post TKR surgery the recovery phase should be designed in such a way that all physiotherapist should follow the same protocol in traditional PT and in VP.
- In virtual physiotherapy the ambulation and mobilisation part have to be taught to the care givers so that the chances of recovery are fast and chances of injuries should be less
- By studying empathy map for both physiotherapist as well as for patient we came to know about what they think, what they see, what they do and what they hear. The study of empathy map is very important for the user journey.
- User journey or patient journey map is created so that we can design the reasons challenges faced by the patients and also put details of empathy map with standardize protocol so that it is easy to keep track on patients virtually.

## REFERENCES

1. <https://www.physio-pedia.com/Physiotherapy> / Physical Therapy
2. <https://www.csp.org.uk/careers-jobs/what-physiotherapy>
3. <https://southvanphysio.com/what-is-physiotherapy/>
4. <https://www.nhs.uk/conditions/physiotherapy/how-it-works/>
5. <https://physiowinnipeg.com/blog/health-wellness/types-of-physiotherapy-exercises/>
6. <https://www.aviva.co.uk/health/health-products/physio-essentials/what-is-virtual-physiotherapy/>
7. <https://vancityphysio.com/pages/why-physio-is-important>
8. <https://www.researchgate.net/publication/8976715> Virtual Rehabilitation - Benefits and Challenges
9. <https://hcah.in/what-is-physiotherapy/>
10. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5855247/>
11. <https://www.hindawi.com/journals/jhe/2018/7438609/>
12. <https://www.evariant.com/faq/what-is-patient-journey-mapping>
13. [https://www.mja.com.au/system/files/issues/188\\_06\\_170308/ben11040\\_fm.pdf](https://www.mja.com.au/system/files/issues/188_06_170308/ben11040_fm.pdf)
14. <https://www.optimizely.com/optimization-glossary/user-journey-map/>
15. <https://careerfoundry.com/en/blog/ux-design/what-is-an-empathy-map/>
16. [https://www.researchgate.net/profile/Bruna\\_Ferreira6/publication/276207468\\_Designing\\_Personas\\_with\\_Empathy\\_Map/links/5552b16208aeaaff3bf00076/Designing-Personas-with-Empathy-Map.pdf](https://www.researchgate.net/profile/Bruna_Ferreira6/publication/276207468_Designing_Personas_with_Empathy_Map/links/5552b16208aeaaff3bf00076/Designing-Personas-with-Empathy-Map.pdf)
17. <https://bmc-musculoskeletal-disorders.biomedcentral.com/articles/10.1186/s12891-015-0761-5#Abs1>
18. <https://www.jmir.org/2017/4/e142/>
19. <https://orthoinfo.aaos.org/en/recovery/total-knee-replacement-exercise-guide/>

- 20. <http://balanceexercisekomemitsu.blogspot.com/2017/07/balance-exercises-after-knee-replacement.html>
- 21. <https://www.cornerstonephysio.com/virtual-physiotherapy/>
- 22. [http://www.orthopaedicscore.com/scorepages/oxford\\_knee\\_score.html](http://www.orthopaedicscore.com/scorepages/oxford_knee_score.html)
- 23. [https://www.orthopaedicscore.com/scorepages/knee\\_injury\\_osteopaedic\\_outcome\\_score.html](https://www.orthopaedicscore.com/scorepages/knee_injury_osteopaedic_outcome_score.html)

**ANNEXURE**

**A. OXFORD KNEE SCORE QUESTIONNAIRE**

Clinician's name (or ref)

Patient's name (or ref)

Please answer the following 12 multiple choice questions.

**During the past 4 weeks.....**

**1. How would you describe the pain you usually have in your knee?**

None

Very mild

Mild

Moderate

Severe

**7. Could you kneel down and get up again afterwards?**

Yes, easily

With little difficulty

With moderate difficulty

With extreme difficulty

No, impossible

**2. Have you had any trouble washing and drying yourself (all over) because of your knee?**

No trouble at all

Very little trouble

Moderate trouble

Extreme difficulty

Impossible to do

**8. Are you troubled by pain in your knee at night in bed?**

Not at all

Only one or two nights

Some nights

Most nights

Every night

**3. Have you had any trouble getting in and out of the car or using public transport because of your knee? (With or without a stick)**

- No trouble at all
- Very little trouble
- Moderate trouble
- Extreme difficulty
- Impossible to do

**9. How much has pain from your knee interfered with your usual work? (including housework)**

- Not at all
- A little bit
- Moderately
- Greatly
- Totally

**4. For how long are you able to walk before the pain in your knee becomes severe? (With or without a stick)**

- No pain > 60 min
- 16 - 60 minutes
- 5 - 15 minutes
- Around the house only
- Not at all - severe on walking

**10. Have you felt that your knee might suddenly give away or let you down?**

- Rarely / Never
- Sometimes or just at first
- Often, not at first
- Most of the time
- All the time

**5. After a meal (sat at a table), how painful has it been for you to stand up from a chair because of your knee?**

- Not at all painful
- Slightly painful
- Moderately pain
- Very painful
- Unbearable

**11. Could you do household shopping on your own?**

- Yes, easily
- With little difficulty
- With moderate difficulty
- With extreme difficulty
- No, impossible

**6. Have you been limping when walking, because of your knee?**

- Rarely / never
- Sometimes or just at first

**12. Could you walk down a flight of stairs?**

- Yes, easily
- With little difficulty

<input type="radio"/> Often, not just at first	<input type="radio"/> With moderate difficulty
<input type="radio"/> Most of the time	<input type="radio"/> With extreme difficulty
<input type="radio"/> All of the time	<input type="radio"/> No, impossible

The Oxford Knee Score is:

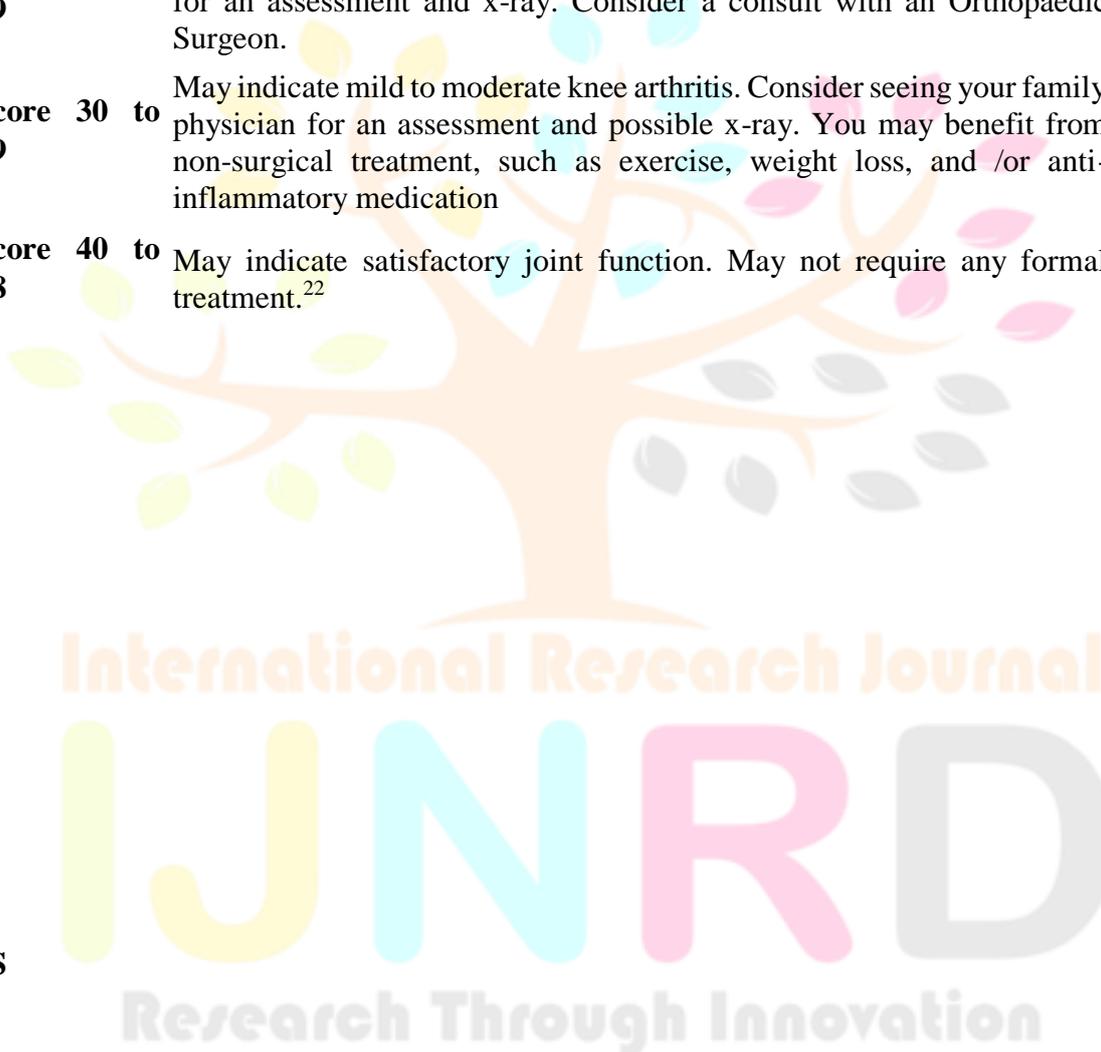
**Grading for the Oxford Knee Score**

**Score 0 to 19** May indicate severe knee arthritis. It is highly likely that you may well require some form of surgical intervention, contact your family physician for a consult with an Orthopaedic Surgeon.

**Score 20 to 29** May indicate moderate to severe knee arthritis. See your family physician for an assessment and x-ray. Consider a consult with an Orthopaedic Surgeon.

**Score 30 to 39** May indicate mild to moderate knee arthritis. Consider seeing your family physician for an assessment and possible x-ray. You may benefit from non-surgical treatment, such as exercise, weight loss, and /or anti-inflammatory medication

**Score 40 to 48** May indicate satisfactory joint function. May not require any formal treatment.<sup>22</sup>



**B. KOOS**

**INSTRUCTIONS:** This survey asks for your view about your knee. This information will help us keep track of how you feel about your knee and how well you are able to do your usual activities.

**Answer every question by ticking the appropriate box. If you are unsure about how to answer a question, please give the best answer you can.**

**Symptoms** - These questions should be answered thinking of your knee symptoms during the **last week**.

S1. Do you have swelling in your knee?

Never  Rarely  Sometimes  Often  Always

S2. Do you feel grinding, hear clicking or any other type of noise when your knee moves?

Never  Rarely  Sometimes  Often  Always

S3. Does your knee catch or hang up when moving?

Never  Rarely  Sometimes  Often  Always

S4. Can you straighten your knee fully?

Always  Often  Sometimes  Rarely  Never

S5. Can you bend your knee fully ?

Always  Often  Sometimes  Rarely  Never

**Stiffness** - The following questions concern the amount of joint stiffness you have experienced during the **last week** in your knee. Stiffness is a sensation of restriction or slowness in the ease with which you move your knee joint.

S6. How severe is your knee joint stiffness after first wakening in the morning?

None  Mild  Moderate  Severe  Extreme

S7. How severe is your knee stiffness after sitting, lying or resting **later in the day**?

None  Mild  Moderate  Severe  Extreme

**Subtotal:**

0

### Pain

P1. How often do you experience knee pain?

Never  Monthly  Weekly  Daily  Always

What amount of knee pain have you experienced the **last week** during the following activities?

P2. Twisting/pivoting on your knee

None  Mild  Moderate  Severe  Extreme

P3. Straightening knee fully

None  Mild  Moderate  Severe  Extreme

P4. Bending knee fully

None  Mild  Moderate  Severe  Extreme

P5. Walking on flat surface

None  Mild  Moderate  Severe  Extreme

P6. Going up or down stairs

None  Mild  Moderate  Severe  Extreme

P7. At night while in bed

None  Mild  Moderate  Severe  Extreme

P8. Sitting or lying

None  Mild  Moderate  Severe  Extreme

P9. Standing upright

None  Mild  Moderate  Severe  Extreme

Subtotal:

0

**Function, daily living** - The following questions concern your physical function. By this we mean your ability to move around and to look after yourself. For each of the following activities please indicate the degree of difficulty you have experienced in the **last week** due to your knee.

A1. Descending stairs

None  Mild  Moderate  Severe  Extreme

A2. Ascending stairs

None  Mild  Moderate  Severe  Extreme

For each of the following activities please indicate the degree of difficulty you have experienced in the **last week** due to your knee.

A3. Rising from sitting

None  Mild  Moderate  Severe  Extreme

A4. Standing

None  Mild  Moderate  Severe  Extreme

A5. Bending to floor/pick up an object

None  Mild  Moderate  Severe  Extreme

A6. Walking on flat surface

None  Mild  Moderate  Severe  Extreme

A7. Getting in/out of car

None  Mild  Moderate  Severe  Extreme

A8. Going shopping

None  Mild  Moderate  Severe  Extreme

A9. Putting on socks/stockings

None  Mild  Moderate  Severe  Extreme

A10. Rising from bed

None  Mild  Moderate  Severe  Extreme

A11. Taking off socks/stockings

None  Mild  Moderate  Severe  Extreme

A12. Lying in bed (turning over, maintaining knee position)

None  Mild  Moderate  Severe  Extreme

A13. Getting in/out of bath

None  Mild  Moderate  Severe  Extreme

A14. Sitting

None  Mild  Moderate  Severe  Extreme

A15. Getting on/off toilet

 None
         
  Mild
         
  Moderate
         
  Severe
         
  Extreme

For each of the following activities please indicate the degree of difficulty you have experienced in the **last week** due to your knee

A16. Heavy domestic duties (moving heavy boxes, scrubbing floors, etc)

 None
         
  Mild
         
  Moderate
         
  Severe
         
  Extreme

A17. Light domestic duties (cooking, dusting, etc)

 None
         
  Mild
         
  Moderate
         
  Severe
         
  Extreme

Subtotal:

0



**Function, sports and recreational activities** - The following questions concern your physical function when being active on a higher level. The questions should be answered thinking of what degree of difficulty you have experienced during the **last week** due to your knee.

SP1. Squatting

 None
         
  Mild
         
  Moderate
         
  Severe
         
  Extreme

SP2. Running

 None
         
  Mild
         
  Moderate
         
  Severe
         
  Extreme

SP3. Jumping

 None
         
  Mild
         
  Moderate
         
  Severe
         
  Extreme

SP4. Twisting/pivoting on your injured knee

 None
         
  Mild
         
  Moderate
         
  Severe
         
  Extreme

SP5. Kneeling

 None
         
  Mild
         
  Moderate
         
  Severe
         
  Extreme

Subtotal:

0

### Quality of Life

Q1. How often are you aware of your knee problem?

Never       Monthly       Weekly       Daily       Constantly

Q2. Have you modified your life style to avoid potentially damaging activities to your knee?

Not at all       Mildly       Moderately       Severely       Totally

Q3. How much are you troubled with lack of confidence in your knee?

Not at all       Mildly       Moderately       Severely       Extremely

Q4. In general, how much difficulty do you have with your knee?

None       Mild       Moderately       Severe       Extreme

Subtotal:

0

Thank you very much for completing all the questions in this questionnaire.

Knee Injury & Osteoarthritis Outcome

Score is

0

### C. PHYSIOTHERAPY ASSESSMENT QUESTIONNAIRE

Q1. How difficult was it to perform these physiotherapy exercises today?

- A. It was easy
- B. It was ok
- C. It was very difficult

Q2. Did you find today's physiotherapy exercises difficult to perform?

- A. Yes
- B. No

Q3. Did you experience any pain while performing these exercises?

- A. Yes
- B. No

Q4. Is there swelling at the operated area?

- A. Yes
- B. No

Q5. After this session did you experience muscle weakness?

- A. Yes
- B. No

Q5. Do you feel loss of balance while walking without support?

- A. Yes

B. No

Q6. Are you facing any issues while doing your regular activity?

A. Yes

B. No

