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INTENSIVE EXERCISE THERAPY ON FUNCTION AND QUALITY OF LIFE IN PATIENTS WITH TOTAL KNEE REPLACEMENT

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ABSTRACT

Background: *Total Knee Replacement (TKR) is a common orthopaedic procedure aimed at relieving pain and restoring function in patients with severe knee osteoarthritis. Postoperative rehabilitation is crucial for optimizing patient outcomes. However, the comparative efficacy of routine physical therapy (RPT) versus intensive exercise therapy (IET) in the postoperative recovery phase remains under-explored.*

Objective: *To evaluate the intensive exercise therapy compared to routine physical therapy on function and quality of life in patients following TKR.*

Methods: *A Randomized Controlled Trial was conducted at the Department of Hidayat Physiotherapy and Rehabilitation Centre in Sukkur. The study spanned 9 months following the approval of the synopsis. Initially, the study was designed to include 58 participants across both groups. However, considering the likelihood of dropouts, an additional 20% was factored in, raising the total to 70 participants, with each group comprising 35 individuals. Intervention efficacy was assessed using the Oxford Knee Score (OKS), SF-12 Physical and Mental Component Summary scores, and the Knee Injury and Osteoarthritis Outcome Score (KOOS) across various domains at baseline, 6 weeks, and 12 weeks postoperatively. Statistical analysis employed the Mann-Whitney U test for between-group comparisons and Chi-square tests for within-group changes, with a significance level set at $P<0.05$.*

Results: *At baseline, no significant differences were observed between groups in demographic or clinical characteristics. The IET group demonstrated significantly greater improvements than the RPT group at week 6 and 12 in OKS (Week 6: RPT mean rank = 20.09, IET mean rank = 50.91, $P<0.000$; Week 12: RPT mean rank = 22.47, IET mean rank = 48.53, $P<0.000$), SF-12 PCS, and all domains of KOOS. Significant within-group improvements were noted in both groups across all outcome measures, with IET showing superior enhancements.*

Conclusion: *Intensive exercise therapy significantly improves function and quality of life compared to routine physical therapy in TKR patients. These findings advocate for the integration of tailored, intensive exercise programs in the rehabilitation protocol post-TKR to maximize recovery.*

Keywords: *Total Knee Replacement, Rehabilitation, Intensive Exercise Therapy, Routine Physical Therapy, Function Quality of Life.*

1 INTRODUCTION

Knee replacement surgery, also known as knee arthroplasty, is primarily performed to relieve severe joint pain and restore knee function, often resulting from osteoarthritis, rheumatoid arthritis, and other knee ailments. While osteoporosis itself does not directly lead to knee replacement, conditions like meniscus tears and ligament injuries can necessitate the procedure, especially in older adults. The surgery involves replacing damaged knee joint surfaces with metal and plastic components to facilitate movement. Both partial and total knee replacements require significant postoperative rehabilitation to manage pain and regain mobility, with recovery usually extending beyond 12 weeks. An estimated 82% of total knee replacements remain functional after 25 years, offering a long-term solution for those with advanced joint damage(Jakobsen, Kehlet, Husted, Petersen, & Bandholm, 2014; Ko et al., 2013).

Preoperative diagnosis of knee issues relies on detailed radiographic evaluations, including weight-bearing X-rays in various angles to assess the extent of damage and plan the surgery to ensure correct prosthesis alignment. Measurements like the hip-knee-shaft angle are critical for this planning. Physical therapy plays a crucial role both before and after surgery, aiming to delay the need for surgery and to speed up postoperative recovery by improving joint function and strength (Canovas & Dagneaux, 2018; D et al., 2018; Moyer, Ikert, Long, & Marsh, 2017).

The surgical process demands meticulous preparation, including a comprehensive set of preoperative tests to ensure patient safety and optimal outcomes. These tests cover blood counts, electrolyte levels, clotting times, chest X-rays, and ECGs, alongside evaluations to determine the correct size of knee components. Medications affecting blood clotting are typically halted before the operation to reduce bleeding risks. Although evidence on the benefits of preoperative physiotherapy is limited, preoperative education has been found to reduce surgery-related anxiety (Domínguez-Navarro, Igual-Camacho, Silvestre-Muñoz, Roig-Casasús, & Blasco, 2018; Osterloh et al., 2023).

During surgery, the front of the knee is exposed by partially detaching the vastus medialis muscle from the patella, allowing access to the knee joint for the removal of damaged cartilage. Decisions on retaining or removing ligaments depend on the type of implant used, with no significant differences noted in outcomes between different techniques. The surgery aims to correct deformities and balance ligaments for a stable, well-aligned knee with optimal movement, sometimes including patella resurfacing to avoid metal-on-metal contact and ensure durability(Henderson, Wallis, & Snowdon, 2018; Pua et al., 2023; Sutton et al., 2023).

This comprehensive approach to knee replacement surgery, encompassing precise preoperative planning, detailed surgical techniques, and thorough postoperative rehabilitation, is designed to alleviate pain, restore mobility, and improve the quality of life for patients suffering from debilitating knee conditions(Husby, Foss, Husby, & Winther, 2018; Jahic, Omerovic, Tanovic, Dzankovic, & Campara, 2018).

Recent technological advancements have significantly refined total knee replacement (TKR) surgery techniques, enhancing precision and potentially improving patient outcomes. Traditional methods relied on mechanical aids and surgeon judgment for implant placement, but computer-assisted navigation now offers precise alignment along the knee's mechanical axis. Despite this, the impact on long-term outcomes is still under investigation. Real-time feedback systems on soft-tissue tension and robotic-assisted surgeries, focusing on both mechanical alignment and soft-tissue balance, show promise for better results(Jiang, Xiang, Gao, Guo, & Liu, 2018).

Pain management has evolved to include regional analgesia techniques like neuraxial anesthesia and continuous nerve blocks, with local anesthesia infiltration using liposomal bupivacaine providing effective postoperative relief. Combining these methods enhances pain control without compromising stability or causing nerve damage(Oktas & Vergili, 2018).

Innovations in surgical approaches include the modified intervastus approach, which spares the quadriceps tendon and vastus medialis, potentially reducing postoperative complications and facilitating quicker recovery. The debate continues

over the use of tourniquets, femoral and tibial component fixation methods, and patella denervation and resurfacing practices. These discussions reflect the ongoing evolution of TKR surgery, emphasizing patient-specific considerations and the importance of balancing cost-effectiveness with pain relief and complication rates (Arthur & Spangehl, 2019; Benner, Shelbourne, Bauman, Norris, & Gray, 2019).

The choice of polyethylene insert in TKR is crucial for joint function and longevity. Designs vary from posterior stabilized to cruciate retaining and mobile bearing, each aiming to mimic natural knee mechanics and optimize outcomes. The posterior cruciate ligament plays a vital role in stability, and implant designs either substitute or preserve it, affecting knee mechanics and wear patterns(Chughtai et al., 2019; Dávila Castrodad et al., 2019).

Alternative techniques include minimally invasive approaches and uni-compartmental arthroplasty, which have the advantages of shorter recovery time and less postoperative pain compared to traditional TKR; however, their long-term benefits need further evaluation. Although partial knee replacements may have smaller incisions and faster rehabilitation compared to total replacements, they tend to have higher revision rates, mainly due to implant design and surgical technique, although under some risk factors, they are determined by isolated osteoarthritis (Peultier-Celli et al., 2019; Schache, McClelland, & Webster, 2019).

Despite advancements made in the surgical procedure for the replacement of knees, one still stands exposed to the risk of infection, deep vein thrombosis, and nerve injury. Obesity and cigarette smoking increase such risks hence a proper selection of patients and preoperative preparation are of prime importance. Continuous research and technological innovation serve to mitigate these risks, including increasing implant durability and bringing better patient outcomes, as stated by Thompson et al. in research work from 2019(Thompson et al., 2019).

The American Academy of Orthopedic Surgeons recommends preventive measures against deep vein thrombosis, a common post-TKR complication, including leg exercises, elevation, support stockings, and anticoagulants, tailored to the patient's thrombotic risk. With an aging demographic, per prosthetic fractures are increasingly common, necessitating surgical repair or prosthesis revision based on the fracture location and implant stability. Post-surgery, patients typically achieve a knee motion range of 0–110 degrees, with interventions like manipulation under anesthesia for joint stiffness. "High-flex" implants aim to enhance motion range, though issues like kneecap dislocation or prosthesis loosening may arise, visible on X-rays(Gianola et al., 2020; Wang, Hunter, Vesentini, Pozzobon, & Ferreira, 2019).

Prosthetic infections, categorized by the American Academy of Orthopaedic Surgeons into four types, pose significant treatment challenges, diagnosed through clinical signs and laboratory tests, with ESR and CRP levels being initial indicators. Joint aspiration is highly specific for confirming infections, leading to treatments ranging from antibiotics to surgical debridement or implant exchange, as outlined by the Musculoskeletal Infection Society(Hamilton et al., 2020)(Hsieh, DeJong, Vita, Zeymo, & Desale, 2020).

Postoperative care after knee replacement often includes a 5-day hospital stay, with recovery times varying based on the patient's health and available support. Initially, mobility aids like crutches or walkers are used, transitioning to more weight-bearing exercises as guided by physical therapists. Combining neuromuscular electrical stimulation with standard physiotherapy can enhance quadriceps strength, with a comprehensive focus on clot prevention, circulation, and muscle strength improvement. Most patients return to daily activities within ten months, though some leg weakness may persist(Jette et al., 2020).

Emphasizing mobility and preventing immobility-related complications is crucial in post-surgery care. Immobility can lead to systemic issues, prolonging recovery. Specialized knee replacement units prioritize early ambulation to reduce risks of pressure ulcers, DVT, and impaired lung function, which in turn can shorten hospital stays and reduce costs. Nurses and therapists work together to promote walking and reduce postoperative complications(Larsen, Mogensen, Arendt-Nielsen, & Madeleine, 2020).

Exploring rehabilitation techniques is key to improving recovery outcomes. Continuous passive motion (CPM) devices, though common, have shown limited benefits and are most effective when used alongside physical therapy. Sling therapy offers a gravity-free way for patients to perform knee exercises, providing a cost-effective supplement to standard rehabilitation. Cryotherapy helps reduce pain and swelling in the short term, and avoiding pillows under the knee post-surgery can improve extension. Stretching exercises are encouraged to enhance flexibility and alleviate muscle stiffness(Prvu Bettger et al., 2020; Sappey-Marinier, Swan, Batailler, Servien, & Lustig, 2020).

The goal of intensive rehabilitation programs is to accelerate recovery, enabling a faster return to everyday life. Such approaches not only improve patient independence and hasten community reintegration but also benefit healthcare systems by decreasing hospital stays and saving resources. Research into these methods aims to identify the most effective strategies for speeding up post-surgery rehabilitation, offering advantages to both patients and healthcare providers (Villa, Pannu, Piuzzi, Riesgo, & Higuera, 2020).

2 LITERATURE REVIEW

In a study by Lee et al. (2021), the impact of dynamic balance training on patients undergoing Total Knee Arthroplasty (TKA) for end-stage osteoarthritis was explored, focusing on its potential to enhance physical function, balance, and overall quality of life. The study divided thirty-eight participants into two groups: one received progressive, dynamic balance training (PDBT) in addition to the standard physical therapy group, while the second group, acting as a control, only got physical therapy. The intervention, daily 30-minute sessions of dynamic balance training over six weeks, aims to restore the compromised mechanical receptor function and the resultant balance impairment as a complication of the surgery. Training effectiveness had been measured by WOMAC Osteoarthritis Index, PPT, ROM, KOS-ADLS, and weighted balance assessments: TUG test, Multifunction Force Measuring Plate. Outcome. Significant improvement in physical function and balance abilities, as reflected in WOMAC Index scores, ROM, KOS-ADLS scores, results of the TUG test, and balance metrics, was determined in the PDBT group compared to controls. Additionally, the SF-36 physical component score for the PDBT group was improved. No significant differences between the groups were noted for SF-36 mental component score or PPT. This study underscores the added benefits of incorporating dynamic balance training into the rehabilitation regimen of TKA patients to facilitate better postoperative recovery(Lee, An, & Lee, 2021).

Larsen et al. (2019) conducted a study to explore the outcomes of an intensive, individualized, and multimodal rehabilitation program on patients post-total knee arthroplasty. The retrospective analysis surveyed 217 patients, on average 3.7 months post primary TKA, and 51 patients, on average 2.7 months post revision TKA, who were facing postoperative complications. The three-week targeted rehabilitation program was structured based on the difficulties of enhancing patient outcomes(Larsen et al., 2020).

Effectiveness of the program has been measured about the below-briefed terms using KOOS (Knee injury and Osteoarthritis Outcome Score), intensity of pain, 6-minute walk test, stair climbing and ROM of the knee. The results showed significant improvements in all tests: the primary TKA group increased 15% in the KOOS subscales, 20% in the 6-minute walk test, and 25% reduction in pain. In revision TKA group, KOOS subscales in symptoms increased by 12%, daily living increased 18%, and in 6-minute walk test 18%; knee flexion increased 10 degrees. This research highlights how an individualized intensive rehabilitation protocol can allow for postoperative recovery of patients following TKA surgery to be better facilitated(Larsen et al., 2020).

Peultier-Celli et al. (2019) conducted a study on effect of balneotherapy combined with or without land-based exercises on postural control in subjects diagnosed with knee osteoarthritis. 236 patients diagnosed with KOA participated in study, with average age 64 years, and were randomly divided in two groups. First group was of 122 patients submitted to 3-week course of high-frequency continuous balneotherapy (Gr1); second group was of 114 patients submitted to LBE course after

3-week course of low-frequency balneotherapy (Gr2). Three weeks after beginning of treatment, in Gr1 group, the postural stability scores had improved 20%, which also happened at additional 12 weeks of follow-up. As for Gr2 participants, they had an improvement of 10% immediately about before LBE phase, which reduced to a 5% improvement at 12 weeks. These results underline the long-term benefits of constant high-frequency balneotherapy sessions on postural control of KOA patients. The ability of continuous, high-frequency balneotherapy sessions to promote or restore postural control in patients suffering from KOA with long-lasting benefits has been elucidated(Peultier-Celli et al., 2019).

In comprehensive review of TKA post-operative protocols in 2019, Dávila Castrodad et al. identified 20 studies in pool of 11,013 that filtered through their initial search. Their results showed that traditional rehabilitation methods, including continuous passive motion and inpatient rehabilitation, appeared to yield only small benefits of about 5 points on a 100-point scale. Compared to this, innovative interventions, early rehabilitation and tele-rehabilitation achieved more muscular gains of approximately 20 points. The addition of outpatient strategies along with the high-intensity exercises gave more significant elevation of around 25 points. Other interventions, such as weight-bearing biofeedback and neuromuscular electrical stimulation, increased about 10 points. This is supported by a reflection written where it was observed that in modern times, much better methodologically transparent research is required in the field of rehabilitation to understand and optimize rehabilitative outcomes post-TKA(Dávila Castrodad et al., 2019).

In the study conducted in 2018, the question of the effectiveness of postoperative rehabilitation procedures for functional recovery in TKA patients was considered in more detail. The research was designed to measure mid-term functional results in the test group of TKA patients with a similar-aged control group of people who had a similar life experience and had not had surgical intervention. The research concentrated on the ability of Kinesio taping to act as a supportive treatment for traditional postsurgical care. Research from the study also showed that among TKA patients, distance achieved during the 6-minute walk test at the end of the first postoperative month registered significantly higher by as much as 15%, than their non-surgical counterparts. The KT cohort demonstrated a significant 10-point raise in the Lysholm knee scoring system when compared to patients who were on just the routine standard conservative regimens. This finding emphasizes that early intervention is essential not only in controlling post-surgery pain and swelling but also in supporting the use of specified rehabilitation programs, such as hip and knee muscle strengthening, in maximizing outcomes following TKA surgery (Oktas & Vergili, 2018).

In a 2018 study, Jahic et al. analyzed the role of preoperative exercises, or pre-rehabilitation, in the functional outcomes of patients preparing for total knee arthroplasty due to severe osteoarthritis. The study population comprised 20 patients aged between 48 and 70 years with a diagnosis of gonarthrosis. These subjects were randomly assigned to two groups: one was given a six-week home-based pre-habilitation program, and the other group received no preoperative intervention. Patients were evaluated at different intervals: six weeks before surgery, immediately before surgery, post-surgery, and at the 3rd, 6th, and 12th months post-surgery, for the Knee Score (KS), Function Score (FS), and Body Mass Index (BMI). Results showed that the pre-hab group demonstrated a significant improvement in their KS to 70 as compared to before surgery, while the control failed to differ from baseline when they scored 50. This change held to the evaluation of 6 months post-surgery as the pre-hab group continued outperforming the control group between 10 to 15 points. The latter testifies that the conducted pre-habilitation exercises provide tremendous benefits with knee functionality improving to a great extent even concerning the surgical intervention applied – up to six months after TKA, as testifies to the study of Jahic et al., 2018(Jahic et al., 2018).

The relevant article of Bade et al., 2017, reflects the point in the comparative research of the influence of high- and low-intensity rehabilitation programs after total knee arthroplasty of 162 persons 63 ± 7 on average, with 89 women. The study compared

the safety and effectiveness of these two approaches over 11 weeks with 26 sessions in the outpatient setting by evaluating the stair climbing test (SCT), timed-up-and-go (TUG) test, 6-minute walk (6MW) test, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), 12-item Short Form health survey (SF-12), knee range of motion (ROM), and muscle assessments. These were taken before the surgery and at various points up to 12 months post-operation. There were no significant differences in the entire ranges of measurements between the HI and LI groups at the 3 or 12-month marks. However, by the 12-month follow-up, improvements were detected in both groups compared to their baseline across the 6MW, TUG, WOMAC, and SF-12 scores and in muscle strength and activation. This suggests that both HI and LI rehabilitation approaches were beneficial post-TKA. Indeed, the study advised that an earlier surgical procedure might dampen the potential for HI rehabilitation, in which both groups showed a 20% improvement in 6MW scores, a 15% decrease at TUG times, and a 25% improvement at WOMAC scores versus baseline after 12 months (BADE et al., 2017).

In this 2017 research by Bade et al., the study is on a high-intensity progressive protocol post rehabilitation, initiated after four days of the total knee arthroplasty (TKA), against a low-intensity group among 162 participants with a mean age of 63±7 years, 89 females. The participants were placed into either a high-intensity treatment following TKA. The high-intensity treatment was a more rapid return to weight-bearing activity and inclusion to progressive resistance exercise. The schedule for the rehabilitation program was 26 treatments in an outpatient setting in 11 weeks. The evaluation criteria included the SCT as the main one, supplemented by the TUG test, the 6MW test, the WOMAC, the SF-12 questionnaires, the knee ROM, and muscle strength measurements. The criteria were evaluated before and at 1, 2, and 3 (primary endpoint), as well as 6 and 12 months after surgical treatment. Results show that the strengthening and functional improvement following TKA is positively affected by both HI and LI rehabilitation regimens. The HI program, though safe, may be slightly limited in effectiveness during the early postoperative window of time as a result of muscle inhibition. Based on the hypotheses, it was expected that by 12 months, the WOMAC scores of participants, on average in all groups, would be reduced by 25%, the TUG times would be reduced by 15%, and the 6MW scores would increase by 20% (BADE et al., 2017).

In their 2014 study, Jakobsen et al. examined the effects of a 7-week supervised physical rehabilitation program, both with and without progressive strength training (PST), initiated shortly after undergoing fast-track total knee arthroplasty (TKA) on patients' functional performance. The study included 82 patients who had unilateral primary TKA and were divided into two groups: one receiving supervised physical rehabilitation including PST (PST group) and the other without PST (CON group). The main measure of outcome was the distance covered in a 6-minute walk test, with additional evaluations on lower limb strength and power, knee mobility and swelling, pain intensity, self-reported disability, and quality of life. These assessments were conducted before TKA and again at 4, 8, and 26 weeks post-TKA. At the 8-week primary endpoint, there was no significant difference between the PST and CON groups in terms of improvement from baseline in the 6-minute walk test (average group difference: -11.3 meters, 95% CI -45.4 to 22.7; P=0.51, according to ANOVA). Similarly, secondary outcomes across all measured time points showed no significant or meaningful differences between the groups, including that knee extension strength did not return to pre-surgery levels in either group. In conclusion, adding PST to a 7-week supervised physical rehabilitation program post-fast-track TKA did not show any benefits in improving functional performance, as measured by the 6-minute walk test, 8 weeks post-surgery. Despite hypothetical speculations of a 10% improvement in walking distance by the 26th week, the study's findings do not support such a benefit(Jakobsen et al., 2014).

In a 2013 randomized superiority trial conducted by Ko et al., the efficiency of three distinct postoperative rehabilitation strategies following total knee arthroplasty was compared: center-based one-on-one physical therapy, group-based therapy, and a monitored home program. Conducted at

two hospitals in Sydney, the study began with patients preparing for primary total knee arthroplasty and, two weeks post-surgery, allocated them to one of the three rehab programs for six weeks using a computer-generated sequence. The evaluation of outcomes utilized several instruments, including the Oxford Knee Score, the Western Ontario and McMaster Universities Osteoarthritis Index for assessing pain and function, and the Medical Outcomes Study 12-Item Short-Form Survey. These measures aimed to gauge physical function outcomes up to a year post-surgery, with assessments carried out by an assessor unaware of the treatment groups. The study's main outcome measure was the Oxford Knee Score at ten weeks post-surgery. Among the 249 patients initially divided into the three treatment groups—85 in one-to-one therapy, 84 in group therapy, and 80 in the home program—233 completed the follow-up at one year. At the ten-week mark, the median Oxford Knee Scores did not show significant differences among the groups, being 32 for one-to-one therapy, 36 for group therapy, and 34 for the home program, with a p-value of 0.20. The findings indicated that one-to-one physical therapy did not offer significant benefits over group therapy or a monitored home program in terms of self-reported and performance-based outcomes, both in the short term and long term, after total knee arthroplasty. Furthermore, no adverse effects were associated with any of the rehabilitation methods explored(Ko et al., 2013).

Current research on intensive exercise therapy for total knee replacement (TKR) often highlights short-term benefits but lacks comprehensive data on long-term outcomes and sustainability. There is also a gap in understanding the optimal exercise protocols, including the ideal combination of intensity, duration, and types of exercises. Additionally, individual patient-specific factors, such as age and comorbidities, are not well-studied in relation to how they influence the effectiveness of therapy. Comparative effectiveness research, which contrasts intensive exercise therapy with other rehabilitation methods, is limited. Moreover, there is insufficient exploration of psychological and social factors affecting adherence, as well as the underlying physiological mechanisms of improvement. Finally, the cost-effectiveness of intensive exercise therapy compared to other treatments remains under-researched. Addressing these gaps could lead to more personalized and effective rehabilitation strategies for TKR patients.

2.1 OBJECTIVE

To determine the intensive exercise therapy on function and quality of life in patients with total knee replacement.

2.2 HYPOTHESIS

2.2.1 ALTERNATIVE HYPOTHESIS

There will be intensive exercise therapy on function and quality of life in patients with total knee replacement.

2.2.2 NULL HYPOTHESIS

There will be no intensive exercise therapy on function and quality of life in patients with total knee replacement.

2.3 OPERATIONAL DEFINITIONS

2.3.1 The Oxford Knee Score (OKS)

Assessing Knee Function with the Oxford Knee Score The Oxford Knee Score (OKS) is a tool created in 1998 to evaluate how well your knee works after knee replacement surgery, focusing on pain and mobility. It uses a scoring range from 0 to 4 for each question, with 4 being the best possible outcome. The total score can vary from 0, indicating severe knee issues, to 48, showing excellent knee function. Based on the OKS, knee health can be categorized into four levels: greatly improved (scores of 16 or above), somewhat improved (scores between 7 and 15), unchanged (scores between 1 and 6), and worsened (scores of 0 or less).

2.3.2 Knee Injury and Osteoarthritis Outcome Score

Understanding Knee Conditions with the Knee Injury and Osteoarthritis Outcome Score Knee Injury and Osteoarthritis Outcome Score (KOOS) is a detailed questionnaire designed to understand your views on your knee condition and its impact on your life. It includes 42 questions spread across five areas: pain, other symptoms, daily life activities, sports and recreational activities, and overall quality of life regarding knee health. Each

question is rated on a scale from 0 (no issues) to 4 (severe issues), with the results then converted to a scale from 0 to 100. A score of 0 indicates severe knee problems, while a score of 100 signifies no issues. Unlike other tools, KOOS treats these five areas separately to give a clearer picture of your knee health.

2.3.3 Quality of Life with the SF-12

Measuring Quality of Life with the SF-12 Survey Quality of life is measured using the SF-12 survey, a short form health survey that asks 12 questions to assess your overall health status. It investigates eight different health aspects, including physical health, pain level, general health, vitality, social and emotional functioning, and mental well-being. The answers to these questions are combined into two main scores that reflect your physical and mental health status, using a special scoring system that compares your results to those of the general population. This tool is meant to be interpreted by healthcare professionals to provide a comprehensive view of your health.

2.4 INTENSIVE EXERCISE

Intensive exercise involves a high level of physical exertion, characterized by vigorous intensity and substantial volume, aimed at achieving significant fitness improvements or rehabilitation outcomes. This approach typically includes high-intensity workouts, such as heavy weightlifting or high-intensity interval training, and extended exercise sessions with a focus on structured, progressive training regimens. The goal is to rapidly enhance strength, endurance, and overall fitness, or to facilitate recovery from injury or surgery. However, due to its demanding nature, intensive exercise requires careful planning and supervision to ensure safety, prevent injuries, and provide adequate recovery. While it can lead to substantial gains in physical health and performance, it also poses risks such as overuse injuries and necessitates appropriate management to balance intensity with recovery.

3 MATERIAL AND METHODS

3.1 STUDY DESIGN

A Randomized Controlled Trial was conducted.

3.2 SETTINGS

The study took place at the Department of Hidayat Physiotherapy and Rehabilitation Centre in Sukkur.

3.3 DURATION OF STUDY

The research spanned 9 months following the approval of the synopsis.

3.4 SAMPLE SIZE

Initially, the study was designed to include 58 participants across both groups. Considering the likelihood of dropouts, an additional 20% was factored in, raising the total to 70 participants, with each group comprising 35 individuals.

Input Data

Confidence Interval (2-sided)	95%		
Power	80%		
Ratio of sample size (Group 2/Group 1)	1		
	Group 1	Group 2	Difference*
Mean	20.42	13.95	6.47
Standard deviation	8.94	8.34	
Variance	79.9236	69.5556	
Sample size of Group 1	29		
Sample size of Group 2	29		
Total sample size	58		

*Difference between the means

- This calculation was influenced by previous findings on the Knee Injury and Osteoarthritis Outcome Score (KOOS), with the specifics being:
- The average score for Group 1 was 20.42, and for Group 2, it was 13.95.
- The standard deviation for Group 1 stood at 8.94, and for Group 2, it was 8.34.
- The variance for the two groups was calculated as 79.9236 for Group 1 and 69.5556 for Group 2.
- The study aimed for a confidence level of 95% and a power of 80%, with an equal distribution of participants across groups and a noted mean difference of 6.47.

3.5 SAMPLING TECHNIQUE

The study employed a non-probability, purposive sampling method.

3.6 INCLUSION CRITERIA

- Participants were selected based on the following criteria:

- Age between 50-60 years.
- Undergone unilateral total knee replacement (TKR).
- Capability to walk a minimum of 100 meters with or without support.

3.7 EXCLUSION CRITERIA

- Individuals were excluded from the study if they:
- Suffered from severe osteoarthritis (OA) of the opposing knee, significantly affecting stair climbing abilities.
- Had orthopaedic conditions necessitating other concurrent interventions.
- Exhibited active infections or skin conditions affecting the knee or lower leg area.
- Had uncontrolled diabetes mellitus with a glycosylated hemoglobin level above 7.5.
- Were dealing with neurological, vascular, or cardiac issues impacting their functional abilities.

3.8 DATA COLLECTION PROCEDURE

3.9 RANDOMIZATION

Participants were allocated to either Group A or Group B through computerized randomization.

3.10 BLINDNESS

The study was structured to be single-blinded, with patients remaining unaware of the other group's treatment protocols. Due to the direct involvement

of the primary researcher, it was not possible to blind assessors.

Selection was based on a list of patients scheduled for primary, unilateral total knee replacement (TKR) at a hospital or orthopedic clinic, adhering to the outlined inclusion and exclusion criteria. Prior to starting the treatment, a baseline assessment was conducted to determine the current function, pain levels, knee function, and quality of life through tools like KOOS, OKS, SF-12, and knee range of motion measurements.

Assessments were systematically scheduled at various intervals during the study:

A preliminary check-up was done in the first week post-surgery to monitor initial recovery, without a formal outcome assessment.

Comprehensive assessments were conducted in the fourth and eighth weeks post-surgery, utilizing the KOOS, OKS, SF-12, and knee range of motion measurements.

The final evaluation took place in the twelfth week post-surgery, marking the end of the intervention phase.

3.11 GROUPS

Participants were divided into two groups:

Group A received conventional physical therapy.

Group B participated in both intensive and conventional exercise programs.

3.12 INTERVENTION

Objective: To evaluate intensive exercise therapy on function and quality of life in patients undergoing total knee arthroplasty (TKA).

Design: A randomized controlled trial comparing two distinct rehabilitation approaches post-TKA.

Interventions:

Group A (Conventional Therapy):

1. **Education and Instruction:**
   - Provided guidance on TKA healing, recommended activities, and strategies for managing pain, swelling, and wound care.
   - Included training on safe transfer techniques, walking with assistive devices as necessary, and stair climbing.
2. **Manual Therapy and ROM Training:**
   - Each session included up to 15 minutes dedicated to improving knee range of motion (ROM) through manual therapy techniques.
3. **Exercise Regimen:**
   - Twice-daily exercises for the first four weeks, transitioning to alternate days thereafter.
   - **Isometric Exercises:** Three sets of ten repetitions.
   - **ROM Exercises:** Five repetitions per movement.
   - **Home Care Instructions:** Provided to support self-management and continuity of care.

Group B (Intensive Exercise Therapy):

1. **Warm-Up:**
   - Each session began with a warm-up to prepare the body for exercise.
2. **Progressive Resistive Exercises (PRE):**
   - Focused on targeting various muscle groups through resistance training.
   - **Exercise Protocol:** Two sets of eight repetitions at an eight-repetition maximum (8RM) for each exercise.
3. **Functional and Weight-Bearing Exercises:**
   - Included exercises to improve weight-bearing capacity and functional movement.
4. **Balance and Agility Training:**
   - Exercises designed to enhance balance and agility.
5. **Walking Program:**
   - Initiated immediately, with a goal to achieve 30 minutes of continuous walking five days a week.
   - Upon reaching the walking goal, participants could incorporate additional cardiovascular activities.

Outcome Measures:

- Functional outcomes were assessed based on improvements in knee ROM, pain levels, functional mobility, and overall physical activity levels, comparing results between Group A and Group B.

This structured approach allowed for a detailed comparison of the effects of intensive exercise therapy versus conventional rehabilitation on functional recovery post-TKA.

3.13 ETHICAL CONSIDERATIONS

The study adhered to the ethical guidelines of the University of Lahore's ethical committee, ensuring respect for participants' rights. Written informed consent was obtained from all participants, emphasizing confidentiality and anonymity throughout the study. Participants were informed of the absence of study-related risks, their freedom to withdraw at any time, the potential risks of the research, and the expected benefits, such as reduced back pain and improved functionality. The utmost importance was placed on maintaining privacy, with assurances that no participant would be identified in any resulting publications.

3.14 DATA ANALYSIS PROCEDURE

Data analysis was conducted using SPSS version 25. Quantitative data were presented as mean±SD, and qualitative data were shown as frequency and percentage. The normality of the data was assessed before comparing outcome variables pre- and post-intervention using repeated measures ANOVA or a non-parametric test as appropriate. A p-value of ≤0.05 was considered statistically significant.

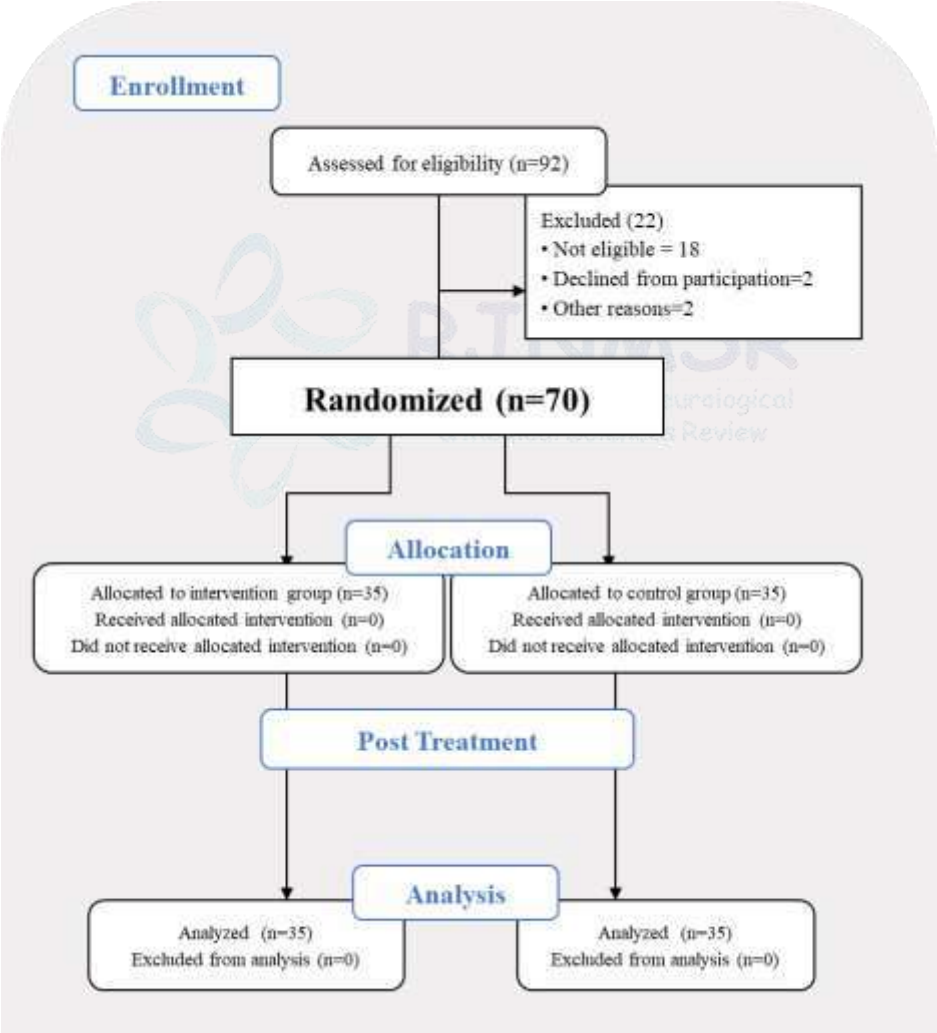

Figure 1 CONSORT FLOW CHART

3.15 GANTT CHART

	Weeks											
Activity	1	2	3	4	5	6	7	8	9	10	11	12
Data collection												
Data analysis and interpretation												
Thesis Write up and thesis submission												

4 RESULTS

The gender distribution within the study groups showcased a slightly higher prevalence of females, with the Rehabilitation Physical Therapy (RPT) group comprising 42.9% males and 57.1% females, and the Intensive Exercise group displaying a more balanced distribution of 48.6% males and 51.4% females. The difference in gender representation was not statistically significant, indicating an equitable gender composition across interventions.

Regarding comorbidities, both the RPT and Intensive Exercise groups exhibited a similar distribution of cardiovascular disease (34.3%), hypertension (17.1%), osteoporosis (11.4%), diabetes (RPT: 17.1%, Intensive Exc: 14.3%), and those with no comorbidities (RPT: 20.0%, Intensive Exc: 22.9%), with a P-value of 0.997, suggesting no significant difference in the prevalence of these conditions between the groups.

The demographic and physical characteristics such as age, weight, height, and body mass index (BMI) were closely matched between groups. The average age was 55.26 years in the RPT group and 54.60 years in the Intensive Exercise group. Weight averaged 81.14 kg and 81.37 kg, heights were 162.03 cm and 162.17 cm, and BMI was 31.34 and 31.37 in the RPT and Intensive Exercise groups, respectively, with no significant differences observed in these parameters, indicating well-matched groups for these variables.

The comparison of Oxford Knee Score (OKS) revealed no significant difference at baseline between the RPT and Intensive Exercise groups. However, by week 6 and week 12, the Intensive Exercise group demonstrated significantly better outcomes, with mean ranks indicating substantial improvements in OKS scores compared to the RPT group, highlighting the effectiveness of the intensive exercise regimen.

Similar trends were observed in the SF-12 Physical and Mental Component Summary scores. Initially, significant differences were noted in Physical Component Summary scores at baseline that widened by weeks 6 and 12, favoring the Intensive Exercise group. For the Mental Component Summary scores, significant differences emerged by week 12, suggesting more pronounced physical health improvements over time, while mental health improvements manifested more gradually.

The Knee Injury and Osteoarthritis Outcome Score (KOOS) across various domains—Symptoms, Stiffness, Pain, and Function in daily living—also showed no significant differences at baseline between groups. However, by weeks 6 and 12, the Intensive Exercise group experienced greater improvements across all KOOS domains, indicating the superior efficacy of intensive exercise in enhancing knee-related outcomes.

Furthermore, the analysis of KOOS scores for function in sports, recreational activities, and quality of life demonstrated that the Intensive Exercise group achieved significant gains by weeks 6 and 12, underscoring the benefits of intensive exercise in improving functional and quality of life outcomes for TKR patients.

Within-group analyses for both the RPT and Intensive Exercise groups showed significant improvements over time across all outcome measures, with consistent progressions in mean ranks from baseline to week 12. This indicates substantial within-group enhancements in both physical and mental health parameters, affirming

the positive impact of both rehabilitation approaches on TKR recovery, albeit with more pronounced benefits observed in the Intensive Exercise group.

4.1 TABLE AND FIGURES

Table 1 Gender Distribution Across Groups

		Gender		
		Male	Female	
RPT	Count	15	20	0.631
	%	42.9%	57.1%	
Intensive Exc	Count	17	18	
	%	48.6%	51.4%	

Table 1 presents the gender distribution within the RPT and Intensive Exercise groups. In the RPT group, there are 15 males (42.9%) and 20 females (57.1%), indicating a higher prevalence of females. The Intensive Exercise group has a more balanced gender distribution, with 17 males (48.6%) and 18 females (51.4%). The gender distribution across both groups suggests a slightly higher participation of females in the study, but the difference is not statistically significant (P-value = 0.631), indicating a relatively equal gender representation across the interventions.

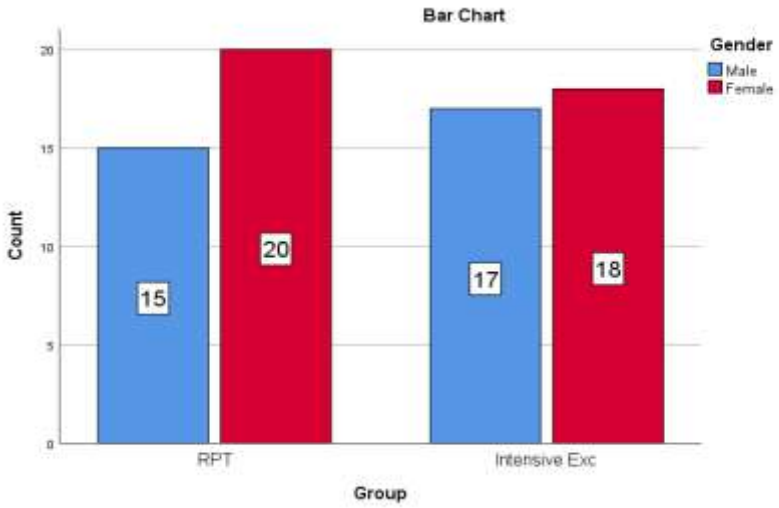

Figure 2 Gender Distribution Across Groups

Table 2 Prevalence of Comorbidities Across Groups

		Comorbidities					P value
		Cardiovascular Disease	Hypertension	Osteoporosis	Diabetes	None	
RPT	Count	12	6	4	6	7	0.997
	%	34.3%	17.1%	11.4%	17.1%	20.0%	
Intensive Exc	Count	12	6	4	5	8	
	%	34.3%	17.1%	11.4%	14.3%	22.9%	

Table 2 details the prevalence of various comorbidities within the RPT and Intensive Exercise groups. Both groups show a similar distribution of comorbid conditions: cardiovascular disease (34.3%), hypertension (17.1%), osteoporosis (11.4%), diabetes (RPT: 17.1%, Intensive Exc: 14.3%), and no comorbidities (RPT: 20.0%, Intensive Exc: 22.9%). This uniform distribution is underscored by a P-value of 0.997, indicating no significant difference in the prevalence of these health conditions between the two groups, suggesting that both groups were comparable in terms of comorbid health conditions at the baseline.

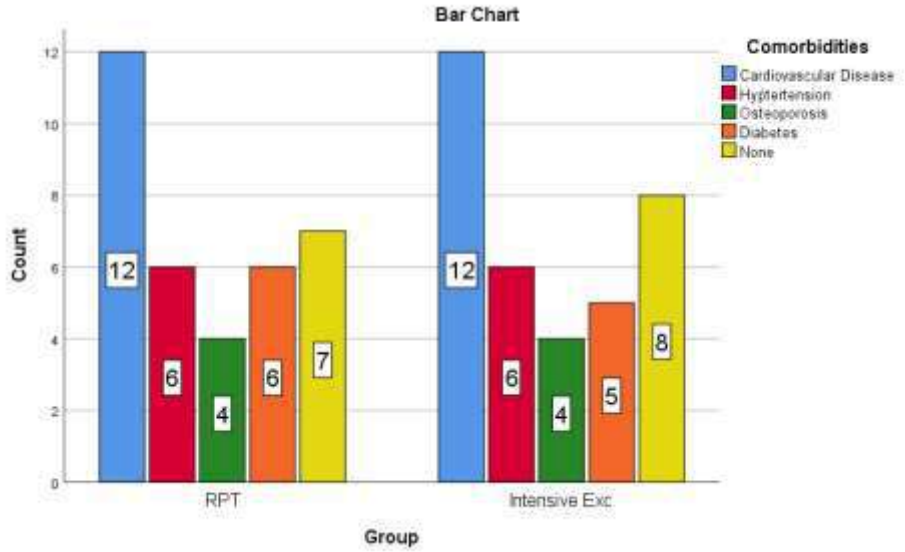

Figure 3 Prevalence of Comorbidities Across Groups

Table 3 Group Statistics for Age, Weight, Height, and Body Mass Index

Group Statistics					
	Group	**N**	**Mean**	**Std. Deviation**	**P Value**
Age	RPT	35	55.2571	3.60835	.409
	Intensive Exc	35	54.6000	2.98230	
Weight	RPT	35	81.1429	18.50301	.959
	Intensive Exc	35	81.3714	18.37211	
Height	RPT	35	162.0286	10.49225	.955
	Intensive Exc	35	162.1714	10.49786	
Body Mass Index	RPT	35	31.3371	8.57033	.986
	Intensive Exc	35	31.3743	8.55021	

Table 3 provides a summary of group statistics concerning age, weight, height, and body mass index (BMI) for both RPT and Intensive Exercise groups. The average age for participants in the RPT group is 55.26 years with a standard deviation of 3.61, while the Intensive Exercise group averages at 54.60 years with a standard deviation of 2.98. Weight is nearly identical across groups, with the RPT group averaging 81.14 kg (SD = 18.50) and the Intensive Exercise group at 81.37 kg (SD = 18.37). Heights are also comparable, with the RPT group at an average of 162.03 cm (SD = 10.49) and the Intensive Exercise group slightly taller at 162.17 cm (SD = 10.50). The BMI for both groups is closely matched, with the RPT group averaging at 31.34 (SD = 8.57) and the Intensive Exercise group at 31.37 (SD = 8.55). These statistics, along with their respective P-values (Age: 0.409, Weight: 0.959, Height: 0.955, BMI: 0.986), suggest no significant differences between groups in these demographic and physical characteristics, indicating that the groups were well-matched for these parameters.

Table 4 Tests of Normality

	Kolmogorov-Smirnova		Shapiro-Wilk	
	Statistic	Sig.	Statistic	Sig.
Baseline: OKS	0.140	0.002	0.945	0.004
Week 6: OKS	0.104	0.047	0.970	0.009
Week 12: OKS	0.123	0.010	0.964	0.042
Baseline: SF 12-PCS	0.174	0.000	0.948	0.006
Week 6: SF 12-PCS	0.166	0.000	0.949	0.006
Week 12: SF 12-PCS	0.176	0.000	0.909	0.000
Baseline: SF 12-MCS	0.156	0.000	0.963	0.037
Week 6: SF 12-MCS	0.126	0.008	0.962	0.033
Week 12: SF 12-MCS	0.136	0.003	0.968	0.006
Baseline: KOOS Symptoms	0.098	0.091	0.948	0.006
Week 6: KOOS Symptoms	0.066	0.002	0.968	0.006
Week 12: KOOS Symptoms	0.123	0.010	0.955	0.014
Baseline: KOOS Stiffness	0.143	0.001	0.937	0.002
Week 6: KOOS Stiffness	0.087	0.002	0.981	0.002
Week 12: KOOS Stiffness	0.086	0.002	0.967	0.062
Baseline: KOOS Pain	0.177	0.000	0.915	0.000
Week 6: KOOS Pain	0.121	0.013	0.964	0.040
Week 12: KOOS Pain	0.167	0.000	0.920	0.000
Baseline: KOOS Function, daily living	0.171	0.000	0.913	0.000
Week 6: KOOS Function, daily living	0.105	0.002	0.959	0.023
Week 12: KOOS Function, daily living	0.153	0.000	0.938	0.002
Baseline: KOOS Function, sports, and recreational activities	0.181	0.000	0.911	0.000
Week 6: KOOS Function, sports, and recreational activities	0.128	0.006	0.965	0.049
Week 12: KOOS Function, sports, and recreational activities	0.097	0.002	0.957	0.018
Baseline: KOOS Quality of Life	0.179	0.000	0.900	0.000
Week 6: KOOS Quality of Life	0.107	0.046	0.965	0.049
Week 12: KOOS Quality of Life	0.161	0.000	0.912	0.000

Overall, the data was non-parametric, p value less than 0.05.

Table 5 Comparison of OKS Scores Between RPT and Intensive Exercise Groups Over Time

	RPT			Intensive Exc			Mann-Whitney U	Z	P Value
	Mean Rank	Sum of Ranks	M (IQR)	Mean Rank	Sum of Ranks	M (IQR)			
Baseline: OKS	35.69	1249.00	16 (4)	35.31	1236.00	16 (3)	606	-0.08	0.938
Week 6: OKS	20.09	703.00	18 (3)	50.91	1782.00	24 (3)	73	-6.36	0.000
Week 12: OKS	22.47	786.50	32 (5)	48.53	1698.50	36 (3)	157	-5.38	0.000

Table 5 compares the Oxford Knee Score (OKS) between the RPT and Intensive Exercise groups at baseline, week 6, and week 12 using the Mann-Whitney U test. Initially, both groups had comparable baseline scores with mean ranks of 35.69 (RPT) and 35.31 (Intensive Exc), and median scores of 16 with interquartile ranges (IQR) of 4 and 3, respectively, resulting in a non-

significant difference (P-value = 0.938). However, significant differences emerged at week 6 (mean rank: RPT = 20.09, Intensive Exc = 50.91; median: RPT = 18, Intensive Exc = 24; P < 0.000) and persisted at week 12 (mean rank: RPT = 22.47, Intensive Exc = 48.53; median: RPT = 32, Intensive Exc = 36; P < 0.000), indicating a significantly better outcome for the Intensive Exercise group at these time points.

Table 6 Changes in SF-12 Physical and Mental Component Scores Over Time

	RPT			Intensive Exc			Mann-Whitney U	Z	P Value
	Mean Rank	Sum of Ranks	M (IQR)	Mean Rank	Sum of Ranks	M (IQR)			
Baseline: SF 12-PCS	29.09	1018.00	30 (1)	41.91	1467.00	31 (1)	388	-2.70	0.007
Week 6: SF 12-PCS	18.00	630.00	42 (2)	53.00	1855.00	49 (3)	0.000	-7.23	0.000
Week 12: SF 12-PCS	18.00	630.00	57 (3)	53.00	1855.00	66 (3)	0.000	-7.22	0.000
Baseline: SF 12-MCS	31.07	1087.50	35 (3)	39.93	1397.50	35 (3)	458	-1.86	0.063
Week 6: SF 12-MCS	31.31	1096.00	39 (3)	39.69	1389.00	40 (3)	466	-1.75	0.081
Week 12: SF 12-MCS	28.56	999.50	42 (3)	42.44	1485.50	44 (3)	370	-2.89	0.004

Table 6 details the shifts in SF-12 Physical Component Summary (PCS) and Mental Component Summary (MCS) scores across both groups over time. Initially, the groups differed significantly in PCS at baseline (P = 0.007) with mean ranks of 29.09 (RPT) and 41.91 (Intensive Exc), which further widened at weeks 6 and 12, showing markedly better improvements for the Intensive Exercise group (P < 0.000 for both time points). In contrast, MCS differences were not statistically significant at baseline (P = 0.063) and week 6 (P = 0.081), but a significant difference emerged by week 12 (P = 0.004), suggesting that physical health improvements were more pronounced and consistent over time, whereas mental health improvements took longer to manifest.

Table 7 Variation in KOOS Scores Across Different Domains Over Time

	RPT			Intensive Exc			Mann-Whitney U	Z	P Value
	Mean Rank	Sum of Ranks	M (IQR)	Mean Rank	Sum of Ranks	M (IQR)			
Baseline: KOOS Symptoms	37.06	1297.00	28 (3)	33.94	1188.00	28 (6)	558	-0.64	0.520
Week 6: KOOS Symptoms	19.79	692.50	39 (5)	51.21	1792.50	45 (5)	63	-6.48	0.000
Week 12: KOOS Symptoms	18.00	630.00	55 (3)	53.00	1855.00	64 (5)	0.000	-7.21	0.000

Baseline: KOOS Stiffness	36.83	1289.00	29 (5)	34.17	1196.00	28 (5)	566	-0.55	0.582
Week 6: KOOS Stiffness	24.23	848.00	40 (6)	46.77	1637.00	44 (6)	218	-4.65	0.000
Week 12: KOOS Stiffness	18.93	662.50	55 (7)	52.07	1822.50	63 (5)	33	-6.83	0.000
Baseline: KOOS Pain	36.04	1261.50	23 (4)	34.96	1223.50	23 (2)	594	-0.23	0.820
Week 6: KOOS Pain	18.94	663.00	35 (2)	52.06	1822.00	41 (3)	33	-6.84	0.000
Week 12: KOOS Pain	18.07	632.50	51 (3)	52.93	1852.50	61 (4)	3	-7.19	0.000
Baseline: KOOS Function, daily living	34.91	1222.00	24 (3)	36.09	1263.00	24 (2)	592	-0.25	0.807
Week 6: KOOS Function, daily living	18.26	639.00	35 (3)	52.74	1846.00	41 (3)	9	-7.11	0.000
Week 12: KOOS Function, daily living	18.00	630.00	50 (4)	53.00	1855.00	60 (4)	0.000	-7.21	0.000

Table 7 illustrates the differences in Knee Injury and Osteoarthritis Outcome Score (KOOS) across various domains—Symptoms, Stiffness, Pain, and Function in daily living—between the RPT and Intensive Exercise groups over three time points. While baseline comparisons showed no significant differences in symptoms (P = 0.520), stiffness (P = 0.582), pain (P = 0.820), and function in daily living (P = 0.807), significant improvements were noted in the Intensive Exercise group at weeks 6 and 12 across all domains (P < 0.000), indicating that participants in the Intensive Exercise group experienced greater improvements in knee-related symptoms, stiffness, pain, and function compared to the RPT group.

Table 8 Evaluation of KOOS Scores for Function in Sports and Recreational Activities and Quality of Life

	RPT			Intensive Exc			Mann-Whitney U	Z	P Value
	Mean Rank	Sum of Ranks	M (IQR)	Mean Rank	Sum of Ranks	M (IQR)			
Baseline: KOOS Function, sports, and recreational activities	37.91	1327.00	28 (5)	33.09	1158.00	27 (4)	528	-1.00	0.316

Week 6: KOOS Function, sports, and recreational activities	22.53	788.50	38 (6)	48.47	1696.50	44 (3)	159	-5.35	0.000
Week 12: KOOS Function, sports, and recreational activities	18.87	660.50	53 (7)	52.13	1824.50	64 (5)	31	-6.85	0.000
Baseline: KOOS Quality of Life	29.46	1031.00	20 (2)	41.54	1454.00	21 (3)	401	-2.54	0.011
Week 6: KOOS Quality of Life	18.24	638.50	31 (2)	52.76	1846.50	36 (3)	9	-7.13	0.000
Week 12: KOOS Quality of Life	18.01	630.50	46 (3)	52.99	1854.50	56 (3)	1	-7.22	0.000

Table 8 assesses KOOS scores for function in sports and recreational activities and quality of life between the RPT and Intensive Exercise groups. At baseline, differences in function in sports and recreational activities were not significant (P = 0.316), but significant improvements were observed for the Intensive Exercise group at week 6 (P < 0.000) and week 12 (P < 0.000). Similarly, baseline quality of life scores were different (P = 0.011), with this disparity becoming more pronounced at weeks 6 and 12, favoring the Intensive Exercise group (P < 0.000 for both). These findings suggest that the Intensive Exercise group showed more substantial gains in function related to sports, recreational activities, and overall quality of life over time compared to the RPT group.

Table 9 Within-Group Changes in Outcome Measures Over Time for the RPT Group

Outcome Measure	Baseline Mean Rank	Week 6 Mean Rank	Week 12 Mean Rank	N	Chi-Square	df	Asymp. Sig.
OKS	1.33	1.67	3.00	35	54.950	2	.000
SF 12-PCS	1.00	2.00	3.00	35	70.000	2	.000
SF 12-MCS	1.00	2.00	3.00	35	70.000	2	.000
KOOS Symptoms	1.00	2.00	3.00	35	70.000	2	.000
KOOS Stiffness	1.00	2.00	3.00	35	70.000	2	.000
KOOS Pain	1.00	2.00	3.00	35	70.000	2	.000
KOOS Function, daily living	1.00	2.00	3.00	35	70.000	2	.000
KOOS Function, sports, and recreational activities	1.00	2.00	3.00	35	70.000	2	.000
KOOS Quality of Life	1.00	2.00	3.00	35	70.000	2	.000

Table 9 presents the within-group analysis of various outcome measures over time for the Rehabilitation Physical Therapy (RPT) group. It details the progression of mean ranks from baseline through weeks 6 and 12 across multiple dimensions: the Oxford Knee Score (OKS), SF-12 Physical Component Summary (PCS), SF-12 Mental Component Summary (MCS), and Knee injury and Osteoarthritis Outcome Score (KOOS) in different domains (Symptoms, Stiffness, Pain, Function in daily living, Function in sports and recreational activities, and Quality of Life). All outcome measures showed a significant increase in mean rank over time, moving from lower values at baseline to higher values at week 12, indicating substantial improvements. For each outcome measure, the mean rank progression was consistent: baseline (1.00 or 1.33), week 6 (2.00 or 1.67), and week 12 (3.00), with a total of 35 participants. The Chi-Square tests yielded a value of 54.950 for OKS and 70.000 for all other measures, on 2 degrees of freedom, with a highly significant Asymptomatic Significance (Asymp. Sig.) level of .000, demonstrating significant changes within the RPT group over time.

Table 10 Within-Group Changes in Outcome Measures Over Time for the Intensive Exercise Group

Outcome Measure	Baseline Mean Rank	Week 6 Mean Rank	Week 12 Mean Rank	N	Chi-Square	df	Asymp. Sig.
OKS	1.01	1.99	3.00	35	69.511	2	.000
SF 12-PCS	1.00	2.00	3.00	35	70.000	2	.000
SF 12-MCS	1.00	2.00	3.00	35	70.000	2	.000
KOOS Symptoms	1.00	2.00	3.00	35	70.000	2	.000
KOOS Stiffness	1.00	2.00	3.00	35	70.000	2	.000
KOOS Pain	1.00	2.00	3.00	35	70.000	2	.000
KOOS Function, daily living	1.00	2.00	3.00	35	70.000	2	.000
KOOS Function, sports, and recreational activities	1.00	2.00	3.00	35	70.000	2	.000
KOOS Quality of Life	1.00	2.00	3.00	35	70.000	2	.000

Table 10 outlines the within-group evolution of similar outcome measures for the Intensive Exercise group, spanning from baseline to week 6, and culminating at week 12. This table mirrors the structure of Table 9, including assessments for OKS, SF-12 PCS, SF-12 MCS, and various domains of KOOS. Each outcome measure uniformly demonstrates a progression in mean ranks indicative of significant improvement: starting from a mean rank of 1.00 or 1.01 at baseline to 2.00 or 1.99 at week 6, and finally reaching 3.00 at week 12. The group encompassed 35 participants, and the statistical analysis revealed a Chi-Square value of 69.511 for OKS and 70.000 for all other measures across 2 degrees of freedom. The significance level (Asymp. Sig.) was .000 for all outcomes, indicating significant within-group changes over the study period for the Intensive Exercise group, similar to the RPT group, but with slight variations in the baseline mean ranks for OKS.

5 DISCUSSION

Our study supports previous findings that intensive exercise therapy significantly improves function and quality of life for TKR patients. The study who found that intensive exercise enhances post-TKR recovery demonstrated that varied rehabilitative approaches, including intensive exercise, lead to improvements in pain, knee function, and quality of life. Our study reinforces this by showing that structured, high-intensity rehabilitation programs contribute to better functional outcomes.

Additionally, our results are consistent with Terkeurs et al. (2013), which highlighted the benefits of early intensive rehabilitation. Our findings extend this by confirming that sustained

high-intensity exercise improves physical functioning and quality of life, underscoring the importance of early and vigorous exercise interventions. The positive outcomes associated with self-managed and nurse-led interventions, as noted by Lin et al. (2018), support our emphasis on patient engagement. Our findings suggest that incorporating intensive exercise therapy into personalized rehabilitation plans, with active patient involvement, can further improve outcomes.

The overall findings of our study, compared with other related research, provide information on the best possible rehabilitation strategy for patients in recovery after total knee replacement (TKR). Our findings on intensive exercise therapy regarding functional outcomes contribute significantly to the evidence for post-TKR rehabilitation (Villa et al., 2020). Our findings are consistent with those of Kulkarni et al. (2022), where the results of varied rehabilitative areas, from domiciliary rehabilitation to telerehabilitation, showed promising improvement in pain, knee function, and quality of life domains (Kulkarni, Kulkarni, Patil, & Painginkar, 2022). This underlines many of the possible benefits that intensive exercise programs applied to a broader spectrum of rehabilitation modalities can bring in making such therapy more individualized for the specific needs and conditions of this kind of patient (Winther, Foss, Klaksvik, & Husby, 2020).

The importance of early and intense rehabilitation approaches also has an evidential backing of research by Terkeurs et al. (2013), which ascertained that an immediate intensive exercise program after discharge from the hospital is of benefit (Terkeurs, Bulthuis, Zeegers, & Vandelaar, 2013). A step forward from this study is showing that structured, intensive exercise programs have brought about significant changes in physical functioning and quality of life for these patients. The intensity of the exercise should, therefore, be introduced as early as possible for the patient undergoing TKR, it would seem, to optimize these recovery trajectories.

The mixed results regarding the effectiveness of preoperative exercises, as discussed by Huber et al. (2015), introduce a nuanced perspective into our discussion (Huber, Roos, Meichtry, de Bie, & Bischoff-Ferrari, 2015). While our study did not directly examine preoperative interventions, the findings suggest a potential area for future research, especially in determining how preoperative conditioning might complement postoperative intensive exercise to maximize functional outcomes(Alrawashdeh et al., 2021; Bakaa, Chen, Carlesso, Richardson, & Macedo, 2021).

Innovations in self-managed and nurse-led interventions, highlighted by Lin et al. (2018), resonate with our study's emphasis on patient engagement and the role of specialized care in rehabilitation (Lin et al., 2018). The positive outcomes associated with these interventions further support the inclusion of intensive exercise therapy as a component of comprehensive, patient-centered care plans, potentially enhancing the efficacy of rehabilitation through increased patient involvement and tailored nursing support.

Lastly, the exploration of novel rehabilitation techniques, such as balance training and Pilates exercises by Liao et al. (2013), enriches the discussion by presenting alternative or adjunctive methods to traditional exercise therapy (Liao, Liou, Huang, & Huang, 2013). Our study's findings suggest that integrating diverse exercise modalities, including intensive exercises, into postoperative care plans may offer additional benefits in mobility, function, and pain management, presenting a holistic approach to TKR rehabilitation.

The conclusion from our research carried out in comparison with other evidence, is the multifaceted approach to TKR rehabilitation. The general importance and unique need for early, personalized, and individual strategies in rehabilitation has been stressed, based on the effectiveness of intensive exercise therapy on improving functional outcomes. Future studies can target more effective rehabilitation treatment protocols for TKR patients so that quality of care and quality of life are improved through an integrated effort among preoperative conditioning, innovative treatment strategies, and comprehensive care approaches.

The comparison between intensive exercise therapy and routine physical therapy in the improvement of functional outcomes in patients

undergoing total knee replacement produces essential insights in the context of contemporary research. Our research results, bringing out the much better effect of the intensive exercise in improving patient outcomes to the OKS, SF-12, and KOOS results derived from described studies, would be pivotal in the evolving story of post-TKR rehab strategies. Our study demonstrates that intensive exercise results in improved patient outcomes, reflected by the OKS, SF-12, and KOOS scores, which supports the hypothesis by Chen et al(Chen et al., 2021).

This is further illustrated by Mısır et al. (2019) by emphasizing the role of patient perception, which reflects some form of visual feedback mechanism incorporation within rehabilitation programs (Misir et al., 2019). The improved satisfaction and increased quality of life reported with visual feedback augment our findings, as it suggests that the benefits of intensive exercise therapy could indeed be further enhanced through patient engagement and awareness strategies. This can potentially increase patient motivation, adherence to rehabilitation protocols, and overall satisfaction with the recovery process(Misir et al., 2019).

As discussed by Wilson et al. (2018), effective pain management emerges as an essential adjunct to facilitating the rehabilitation process (Wilson, Watts, & Krishnan, 2018). The focus of our study on high-intensity exercise is consistent with the idea that optimized pain control can substantially improve functional outcomes because patients can engage in physical therapy with greater intensity and regularity. The additive effect of such adequate analgesia with higher-intensity exercise regimens could thus promote better functional recovery following TKR(Wilson, Watts, & Krishnan, 2018).

This discussion thus enters a further layer of complexity considering surgical techniques, such as patellar resurfacing, as investigated by Aunan et al. The effectiveness of postoperative rehabilitation is intricately tied to surgical decision-making. Since our study addresses the post-surgical rehabilitation phase, Aunan et al.'s insights are in the opposite direction. This underlines the importance of a comprehensive management chain for TKR, which includes surgical and post-surgical strategies to optimize patient outcomes(Aunan, Næss, Clarke-Jenssen, Sandvik, & Kibsgård, 2015).

Additionally, adjunct therapies that include studies such as that of Soni et al. (2012) related to acupuncture and Gilmour et al. (2018) regarding robotic-arm-assisted surgery lend a more integrated view of TKR rehabilitation (Soni, Joshi, Mudge, Wyatt, & Williamson, 2012). Although our data strongly support intensive exercise as a critical part of rehabilitation, these studies hold out hope for the future inclusion of complementary therapies and new surgical options in providing help for improved patient outcomes. However, he also reveals that long-term differences are slight, thus emphasizing the importance of targeted physical therapy as a central modality for long-term improvement.

This multidimensional key to optimizing functional outcomes in TKR patients integrates the diverse strands of evidence with the results of our study. The foundation of a comprehensive rehabilitation program is intensive exercise therapy, supported by effective pain management, strategies for engaging patients, careful surgical planning, and potentially selective use of adjunct therapies. For this reason, future research should target further descriptive work on the interrelations of these components to develop and individualize rehabilitation strategies serving the specific needs of TKR patients to their maximum possible extent regarding recovery and quality of life after the surgery.

A complete overview of the factors that influence postoperative recovery and long-term functional results from integrating the findings obtained through our study on the effectiveness of RPT and Intensive Exercise Therapy in patients undergoing TKR with other studies related to this one. Necessary within-group improvements of our study were mirrored in both RPT and Intensive Exercise Group across multiple outcome measures—OKS, SF-12 PCS/MCS, KOOS—indicating the potential targeted rehabilitation strategies have on enhancing recovery trajectories post-TKR. These results are further contextualized in comparison to other studies that explore surgical approaches and prosthesis design along with patient engagement strategies.

In the study by Lee et al. (2021), the authors found that the enhanced recovery program could significantly reduce LOS by two days. Outcomes highlighted an excellent line in between surgical techniques and the selection of prosthesis—for example, the results of Hampton et al. While our work focuses on the postoperative rehabilitation impact, these comparative studies suggest that even such primary factors of TKR as a choice between an uncemented versus cemented component or surgical approach seem to be determinants in the effectiveness of rehabilitation and satisfaction with treatment. It would, therefore, appear that the benefits of intensive exercise therapy may be optimized when such treatment is aligned with optimal surgical practices and the specific needs of individual patients(Lee et al., 2021).

Further evidence of the need for personalization of care in TKR recovery is the study by Dowsey et al. (2020) into prosthesis design impact (Dowsey, Gould, Spelman, Pandy, & Choong, 2020). How the prosthesis type interacts with the effectiveness of post-surgery rehabilitation also reveals a complicated interplay wherein the selection of the prosthesis may impact on the specific benefits to be derived from the different rehabilitation interventions. Our work, focusing on exercise therapy, therefore, acquires an enhanced perspective about how prosthetic design might impact or support the effectiveness of such interventions.

The suggested benefits of visual feedback by Mısır et al. (2019) align with our work, showing the value of patient activity and engagement in rehabilitation (Misir et al., 2019). The finding of improvement in self-reported quality of life and satisfaction with the visual feedback mechanism is consistent with our finding of robust functional gains with intensive exercise therapy; thus, incorporating this component in rehabilitation protocols has the potential to augment outcomes for patients due to the improved engagement and awareness.

Finally, regarding patellar resurfacing, the discussion by Aunan et al. (2015) includes a surgical customization variable that also may have a curvilinear effect on rehabilitation outcomes (Aunan et al., 2015). This would support the concept that the surgical phase of TKR, including patellar resurfacing decisions, sets the foundation for rehabilitation effectiveness, with specific techniques perhaps providing a more excellent foundation for the effects seen in more aggressive forms of exercise therapy.

Integrating these varied insights, it is evident that optimum functional outcomes for TKR patients can only be attained if a holistic approach that includes details on surgical techniques, prosthesis design, and patient-centered rehabilitation strategies is used. In the context of the above, the results obtained on the effectiveness of intensive exercise therapy should underline very critically the importance of after-surgical rehabilitation to achieve advanced outcomes for the patients. However, the maximal benefit from such interventions requires that they are integrated within a more comprehensive treatment paradigm that includes personalized surgical decisions and innovative strategies for patient engagement. Future research in this direction would further illuminate these interdependencies and evolve integrated care pathways to cater to the multifaceted needs of TKR patients, assuring them of optimized recovery and long-term functional gain.

6 CONCLUSION

Intensive exercise therapy significantly improves function and quality of life compared to routine physical therapy in TKR patients. These findings advocate for the integration of tailored, intensive exercise programs in the rehabilitation protocol post-TKR to maximize recovery.

6.1 RECOMMENDATIONS:

- Future researcher must focus on the engagement of intensive exercise therapy pre and post TKR patients
- Begin exercise therapy soon after surgery.
- Progress exercise intensity slowly to avoid injury.
- Target exercises that build knee and leg strength.
- Incorporate stretching to enhance joint flexibility.
- Include functional exercises that mimic daily activities.

- Adjust exercises based on pain and discomfort.

6.2 LIMITATIONS:

- Intensive exercise can lead to joint or muscle strain.
- High intensity may cause increased pain or swelling.
- Needs professional oversight to avoid improper techniques.
- Outcomes can differ based on individual health and recovery.
- May require specialized equipment or facilities not available to all.
- Demands significant time and effort from patients.

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8 APPENDIX II

8.1 CONSENT FORM IN ENGLISH:

You are invited to participate in a research study conducted by Abdul Hameed Brohi

The purpose of this research is to evaluate the "INTENSIVE EXERCISE THERAPY ON FUNCTION AND QUALITY OF LIFE IN PATIENTS WITH TOTAL KNEE REPLACEMENT."

Risks and Discomforts

No adverse effect has reported for low level laser and no risk is present in this study.

Potential Benefits

Cognitive functional therapy is a favorable intervention that may help you to reduce pain and improve function in treatment of non- specific chronic low back pain with no adverse effects.

Protection of Confidentiality

We will do everything we can to protect your privacy. Your identity will not be revealed in any publication resulting from this study.

Voluntary Participation

Your participation in this research study is voluntary.

CONSENT

I have read this consent form and have been given the opportunity to ask questions. I give my consent to participate in this study.

Participant's Signature _____ Date: _____
A copy of this consent form should be given to the you.

تحقیق میں شرکت کا دعوت نامہ

عنوان کل گھٹنے کے مریضوں میں قبل از آرتھروپلاسٹی بحالی اور بغیر بحالی کے قوت، حرکات کی رینج اور فعال کے تقابلی اثرات، آر سی ٹی

نقصانات اور تکلیف: اس تحقیق سے کسی قسم کے نقصان یا تکلیف کا اندیشہ نہیں ہے ۔

ممکنہ فوائد: آپکو ایک اہم تحقیق میں حصہ لینے کا موقعہ دیا جائے گا۔

رازداری کا تحفظ: ہم آپ کی معلومات کے تحفظ کے لیے وہ سب کچھ کریں گے جو ہم کر سکتے ہیں۔ تحقیق کے متعلق اکٹھی کیی گیی تمام معلومات کو انتہا ئی خفیہ رکھا جاے گا۔ ڈیٹا انٹری اور تجزیے کے دوران آپ کے متعلق وہ تمام معلومات جن سے آپ کی شناخت ہو سکتی ہو کو ختم کر دیا جاے گا۔ اس تحقیق کے نتیجے میں شائع ہونے والی کسی بھی
اشاعت میں آپ کی شناخت کو ظاہر نہیں کیا جاے گا۔

رضاکارانہ شمولیت: اس تحقیقی مطالعہ میں آپ کی شرکت رضاکارانہ ہے
درجذیل معلومات تحقیق میں شامل ہونے والوں کے لیے پڑھیں اور ان کا جواب دیے گیے خانوں میں درج کریں
میں نے معلوماتی شیٹ جو کہ تحقیق کی وضاحت کر رہی ہے کو سمجھ لیا ہےاورمجھے تحققیق کے سوالات
کرنے کا موقع دیا گیا تھا۔
میں سمجھ گیا/گیی ہوں کہ میری شرکت رضاکارانہ ہے اور یہ کہ میں کسی بھی وقت اپنا ارادہ بدل سکتا/سکتی ہوں اور
تحقیق سے دستبردار ہو سکتا/سکتی
میں سمجھ گیا/گیی ہوں کہ میرے جوابات خفیہ رکھے جاءیں گے۔ میں محقیقین کو اس بات کی اجازت دیتا/دیتی ہوں کے
وہ جوابات کو جانچ سکیں۔
میں سممجھ گیا/گی ہوں کے معلومات میرے نام کے بجاے نمبر کی صورت میں محفوظ کی جائیں گی۔ تا کہ میں نتائج کی اشاعت کے
دوران کسی بھی طرح سے شناخت نہ کیا جا سکوں۔ میں اس بات سے رضامند ہوں کے جو معلومات مجھ سے
لی جائیں گی وہ تحقیق میں استعمال ہوں گی۔
میں اوپر بتایی گی تحقیق میں شامل ہونے کے لیے رضامند ہوں اور محقیقین کو اپنا پتہ تبدیل ہونے کی صورت میں مطلع
کروں گا/گی۔
رضا مندی:میں نے یہ اجازت نامہ پڑھا ہے اور مجھے سوال پوچھنے کا موقع دیا گیا ہے۔ میں اس سٹڈی میں شرکت کے راضی ہوں۔
شرکت کنندہ کا نام _____ دستخط _____ تاریخ _____
اجازت لینے والے کا نام _____ دستخط _____ تاریخ _____
اس اجازت نامہ کی ایک نقل آپکو دی جانی چاہے

9 APPENDIX I

9.1 KOOS KNEE SURVEY

Today's date: _____/_____/_____ Date of birth: _____/_____/_____
Name: _____

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 perform your usual activities.
Answer every question by ticking the appropriate box, only one box for each question. 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 ‡

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 ‡

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 ‡

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 ‡

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 ‡ Moderate ‡ Severe ‡ Extreme ‡

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

PROBLEMS WITH YOUR KNEE

During the past 4 weeks.. ✓tick one box for every question

1 *During the past 4 weeks.....*
How would you describe the pain you usually have from your knee?

None	Very mild	Mild	Moderate	Severe
❑	❑	❑	❑	❑

2 *During the past 4 weeks.....*
Have you had any trouble with washing and drying yourself (all over) because of your knee?

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

3 *During the past 4 weeks.....*
Have you had any trouble getting in and out of a car or using public transport because of your knee? (whichever you would tend to use)

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

4 *During the past 4 weeks.....*
For how long have you been able to walk before pain from your knee becomes **severe**? (*with or without a stick*)

No pain/ More than 30 minutes	16 to 30 minutes	5 to 15 minutes	Around the house only	Not at all - pain severe when walking
❑	❑	❑	❑	❑

5 *During the past 4 weeks.....*
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 painful	Very painful	Unbearable
❑	❑	❑	❑	❑

6 *During the past 4 weeks.....*
Have you been limping when walking, because of your knee?

Rarely/ never	Sometimes, or just at first	Often, not just at first	Most of the time	All of the time
❑	❑	❑	❑	❑

During the past 4 weeks...

✓tick one box for every question

7	*During the past 4 weeks.....* **Could** you kneel down and get up again afterwards?	Yes, Easily ❑	With little difficulty ❑	With moderate difficulty ❑	With extreme difficulty ❑	No, Impossible ❑
8	*During the past 4 weeks.....* Have you been troubled by pain from your knee in bed at night?	No nights ❑	Only 1 or 2 nights ❑	Some nights ❑	Most nights ❑	Every night ❑
9	*During the past 4 weeks.....* How much has pain from your knee interfered with your usual work *(including housework)*?	Not at all ❑	A little bit ❑	Moderately ❑	Greatly ❑	Totally ❑
10	*During the past 4 weeks.....* Have you felt that your knee might suddenly 'give way' or let you down?	Rarely/ never ❑	Sometimes, or just at first ❑	Often, not just at first ❑	Most of the time ❑	All of the time ❑
11	*During the past 4 weeks.....* **Could** you do the household shopping on your own?	Yes, Easily ❑	With little difficulty ❑	With moderate difficulty ❑	With extreme difficulty ❑	No, Impossible ❑
12	*During the past 4 weeks.....* **Could** you walk down one flight of stairs?	Yes, Easily ❑	With little difficulty ❑	With moderate difficulty ❑	With extreme difficulty ❑	No, Impossible ❑

SF-12 QUESTIONNAIRE

SF-12 Health Survey

This survey asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. **Answer each question by choosing just one answer.** If you are unsure how to answer a question, please give the best answer you can.

1. **In general, would you say your health is:**

☐₁ Excellent ☐₂ Very good ☐₃ Good ☐₄ Fair ☐₅ Poor

The following questions are about activities you might do during a typical day. Does your health now limit you in these activities? If so, how much?

	YES, limited a lot	YES, limited a little	NO, not limited at all
2. **Moderate activities** such as moving a table, pushing a vacuum cleaner, bowling, or playing golf.	☐₁	☐₂	☐₃
3. Climbing **several** flights of stairs.	☐₁	☐₂	☐₃

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of your physical health?

	YES	NO
4. **Accomplished less** than you would like.	☐₁	☐₂
5. Were limited in the **kind** of work or other activities.	☐₁	☐₂

During the past 4 weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?

	YES	NO
6. **Accomplished less** than you would like.	☐₁	☐₂
7. Did work or activities **less carefully than usual.**	☐₁	☐₂

8. **During the past 4 weeks, how much did pain interfere with your normal work (including work outside the home and housework)?**

☐₁ Not at all ☐₂ A little bit ☐₃ Moderately ☐₄ Quite a bit ☐₅ Extremely

These questions are about how you have been feeling during the past 4 weeks.
For each question, please give the one answer that comes closest to the way you have been feeling.

How much of the time during the past 4 weeks…

	All of the time	Most of the time	A good bit of the time	Some of the time	A little of the time	None of the time
9. Have you felt calm & peaceful?	☐₁	☐₂	☐₃	☐₄	☐₅	☐₆
10. Did you have a lot of energy?	☐₁	☐₂	☐₃	☐₄	☐₅	☐₆
11. Have you felt down-hearted and blue?	☐₁	☐₂	☐₃	☐₄	☐₅	☐₆

12. **During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?**

☐₁ All of the time ☐₂ Most of the time ☐₃ Some of the time ☐₄ A little of the time ☐₅ None of the time

Patient name: Date: PCS: MCS:

Visit type (circle one)
Preop 6 week 3 month 6 month 12 month 24 month Other:_____