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Research Article

The Effect of Early Range of Motion Exercises on Pain Relief After Total Knee Replacement Postoperatively Versus Patients Advised Knee Immobilization; A Comparative Study

Imran Manzoor[1], Rizwan Khan Lodhi[2], Imanullah Riaz[3], M. Mujeeb Ur Rehman[4], Muhammad Ahmed[5], Muhammad Waseem[6]

Affiliations:

[1] Associate Professor, Orthopedic, Continental Medical College, Lahore.
[2] Assistant Professor, Orthopedic, Continental Medical College, Lahore.
[3] Postgraduate Resident, Orthopedic, Continental Medical College, Lahore.
[4] Postgraduate Resident, Orthopedic, Continental Medical College, Lahore.
[5] House Officer, Department of Orthopedic, Continental Medical College, Lahore.
[6] Assistant Professor, Rai Foundation Medical College, Sargodha.

***Corresponding Author: Imran Manzoor**

Abstract:

Objective: The study aims to assess the effect of early range of motion exercises on pain relief after total knee replacement post operatively as compared to patients who are advised knee immobilisation post operatively

Methodology: This is a comparative convenient non random sampling study conducted at Department of Orthopedic Surgery Hayat Memorial Teaching Hospital Lahore over 12 weeks .A total of 20 patients who had undergone total knee replacement were included in the study.10 patient were started with early (From 1st post operative day) range of motion exercises and 10 patient were advised knee immobilisation postoperatively . Progress in pain relief and range of motion were scored according to Wong Baker Pain Scoring and Maitland range of motion scoring scale respectively according to the questionnaire provided to patient for pain scoring as well range of motion scoring. Data entry and analysis were performed using spsss version 23 .

Result: Our study found that the patients who were started with early range of motion exercises had comparatively better pain relief scores as compare to patients who were advised knee immobilisation postoperatively. Similarly the patient who were started with

early range of motion exercises postoperatively (1st day) faired better range of motion scores at knee postoperatively.

Key Words: Total knee Replacement, Range of motion exercises, Pain Relief, Immobilisation.

Introduction

Total knee replacement TKR is performed to restore function and relieve pain in patients with severely damaged knees. The surgery involves replacement of both medial and lateral femorotibial joints and patellofemoral joints. (1). Following total knee replacement there is no benefit to the use of continuous passive range of motion exercises or cryotherapy devices, but there are promising benefits from the use of paddling exercise exercises, weight training and balance, and sensory motor training as a jumped to a multidisciplinary program after replacement. (2) . Total knee arthroplasty successfully, alleviate pain from knee osteoarthritis, but muscle strength and functions are reduced for a long period postoperatively. Post operative early active resistance exercises may play a relevant role in reducing pain in long-term. (3)

There have been studies that propose range of motion exercises beginning in the early postoperative stage are advantageous in reducing postoperative pain.(4). Early range of motion exercises are recommended after TKR to achieve better pain control. Although it is advised group-based exercises rather than individually performed exercises to achieve better pain relief.(5). Early range of motion exercises after total knee replacement are recommended for the purpose of relief of pain, although it is not specified what is the appropriate time to start these exercises to gain maximum benefit for pain relief.It is also highlighted that early range of motion exercises after knee replacement are beneficial for pain relief.(6). The frequency of knee pain among women was very high. Due to this knee pain, many daily life activities, including rising from bed, lying in bed, using toilet or bending on the floor is compromised. (7)

Some studies supported early range of motion exercises for pain relief, although it is recommended that early range of motion exercises should be augmented with cryotherapy. It is not specified that what is the most appropriate time to start the exercises or their effects after three and six weeks as compared to the control group who did not start early range of motion exercises.(8). Rehabilitation following total knee arthroplasty continues to pose a challenge for both patients and providers. Additionally, guidelines vary considerably between institutions, often leaving therapy regimes to the discretion of the provider. The lack of clear guidelines for rehabilitation may contribute to inadequate recovery of strength and range of motion, resulting in less optimal functional outcomes.(9). Many techniques have been advised for the relief or reduction of pain after total knee replacement, but no mention was made of whether early range of motion actually relieves pain. Rhonda Alama, Morad Chughtai et al. reported that current standards of care are composed of multimodal pain management, including opioids, non-steroidal anti-inflammatory drugs, gabapentin aids, peripheral nerve blocks, and periarticular injections. Newer modalities include delayed-release local anesthetics and cryo nucleolysis.(10). Early commencement of physiotherapy as compared to late start of range of motion exercises (on the third postoperative day) required less opioid analgesics compared to the control group where range of motion exercises were started on the late..(11).Postoperative day-zero early mobilization can result in reduced pain and an increase in walking speed at one month. Significant changes were observed in postoperative pain, knee strength, and range of motion subscales at three months in those who started late.(12)

There is confusion regarding when to start range of motion exercises after total knee replacement postoperatively, and also whether it is beneficial for the relief of pain along with prescribed analgesic treatment. Additionally, it is confusing as to what time after the operation maximum pain relief can be expected.

Usually after total knee replacement, analgesics are prescribed for pain relief postoperatively. There is confusion whether range of motion exercises in the first few days actually contribute to the relief of pain or if they actually exacerbate the pain. It is

also unclear whether the pain relief is better at the first, third, and sixth weeks as compared to patients who were advised knee immobilizers in the early days postoperatively after total replacement and then at the third and sixth weeks.

Objective

The aim of our study is to access whether early range of motion exercises relieves the postoperative pain after total knee replacement as compared to immobilization of the knee joint postoperatively.

Operational Definition

Range of motion exercises : (Maitland Range Of Motion Scoring Scale Of a Joint)(13) 120°: Full (Score: 4) , 90°: Limited (Score: 3) , 60°: Significant limitation (Score: 2) , 30°: Severe limitation (Score: 1). **Pain relief with score**: (The Wong-Baker Faces Pain Rating Scale)(14) 0: No pain ,1-2: Mild pain ,3-4: Moderate pain ,5-6: Severe pain ,7-8: Very severe pain ,9-10: Worst pain. **Total knee replacement** : (Johns Hopkins University Definition 2025)(15).

Also called knee arthroplasty is a surgical procedure to resurface a knee damaged by arthritis. Metal and plastic parts are used to cap the ends of the bone that form the knee joint. **Immobilization** : (Zhirong Zhang . Rheumatology Current Research Volume 13 , issue 1 2023)(16). Is a technique used to restrict a movement of a joint , either partially or completely for a specific period. It can be achieved through a verity of methods , including the use of casts , braces , splint , and slings.

Hypothesis

Early range of motion exercises may lead to better pain relief after total knee replacement as compared to immobilization of the knee joint postoperatively.

Materials and Methods

Study Design: Comparative, corss sectional, prospective.

Sampling Technique: Convenient Non-Random Sampling

Setting: Continental Medical College

Duration: Three months

Sample Size: 20 patients (calculated according to Tabachnick, Fiddell, W. Lawrence Neuman. Formula 1:10 i.e ten participants per one question / item) (17)

Sample Selection

Inclusion Criteria:

- Patients aged 40–70 years who underwent total knee replacement.
- Severe grade 4 osteoarthritis in one or both knees as an indication for operation.

Exclusion Criteria:

- No pathological cause like tumor or infection as indications for total knee replacement.

Data Collection Procedures

Ethical approval of the study was taken from the institutional ethical review board committee. After obtaining ethical approval, patients were included in the study as per the inclusion and exclusion criteria. Data was collected from the inpatient and outpatient register of the orthopedic department of Continental Medical College. Patients were instructed to visit after one, three, and six weeks. A questionnaire was given to both groups of patients regarding pain relief, and range of motion was be measured. Pain scores were evaluated using the Visual Analog Scale (VAS). Pain scores of both groups were evaluated and compared, and inferences were drawn.

Data Analysis

Data entry and analysis were carried out with the help of SPSS version 25.

Urdu consent form

Attached

Questionnaire

Attached

Data Collection Instrument

Questioner performa

WONG – BAKER PAIN SCORING SCALE

	No pain	0
Pain	Mild pain Moderate pain Severe pain Very severe pain Worst pain	2 4 6 8 10

MAITLAND RANGE OF MOTION

	Upto 30°	1
ROM	30 – 60° 60 -90° 90-120° Full upto 135°	2 3 4 5

Patient with Early ROM (Table #1)

Pain Relief Score

No of patients	1st week	3rd week	6 week
1	6	4	2
2	4	2	0
3	4	2	0
4	6	2	0
5	4	2	2
6	4	4	4
7	4	2	0
8	4	4	2
9	6	4	0
10	4	4	0
11	6	4	2
12	6	4	4
13	4	0	0
14	4	2	0
15	6	2	0
16	4	2	0
17	4	0	0
18	4	2	0
19	6	4	2
20	4	2	0
Total score	94	52	18
Average score	4.7	2.6	0.9

Patient with Early ROM (Table #2)

Range of motion score

No of patient	1st week	3rd week	6 week
1	2	3	4
2	2	4	4
3	3	4	5
4	1	3	4
5	3	4	4
6	2	4	4
7	3	3	4
8	2	3	4
9	3	3	5
10	3	4	5
11	1	3	4
12	2	4	4
13	3	3	5
14	3	4	5
15	2	4	5
16	1	4	5
17	1	3	4
18	2	4	4
19	3	4	4
20	3	4	4
Total score	45	72	88
Average score	2.2	3.6	4.4

Patient with knee immobilizers (Table #3)

Pain relief score

No of Patient	1st week	3rd week	6 week
1	8	6	4
2	6	4	2
3	4	2	2
4	6	4	2
5	8	6	4
6	4	4	4
7	4	4	4
8	6	4	6
9	4	4	4
10	6	6	4
11	4	4	4
12	4	6	4
13	6	6	4
14	6	6	6
15	8	6	6
16	4	4	6
17	4	6	4
18	8	6	2
19	6	4	2
20	4	4	4
Total score	114	98	80
Average score	5.7	4.9	4

Patient with knee immobilizer (Table #4)

Range of motion score

No of patient	1st week	3rd week	6 week
1	1	1	3
2	1	2	3
3	1	2	3
4	1	2	3
5	3	3	3
6	2	3	4
7	2	3	3
8	1	2	3
9	1	3	4
10	3	3	4
11	2	4	4
12	2	3	3
13	2	4	4
14	3	4	4
15	1	3	3
16	1	4	4
17	2	2	3
18	1	3	3
19	2	4	4
20	1	3	3
Total score	35	61	71
Average score	1.75	3.05	3.55

Results :

The aggregated pain score for patient who started ROM exercises after TKR were 94(4.7) ,52(2.6) and 18(0.9) at first ,third and 6 week respectively. Lesser pain score denotes less pain on Wong Baker Pain Scoring system (22). Similarly aggregated pain scores for patients who were advised knee immobilisation by applying knee immobiliser brace were 114 (5.7) ,98(4.9) and 80 (4.0) at 1st ,3rd ,and 6 week respectively. Higher pain scores denotes more pain at Wong Baker Pain Scoring system (22). Aggregated range of motion score for patient who started early exercises were 45(Ave2.2)., 72 (Av 3.6) and 88 (Ave 4.4) at first 3 and 6 week respectively. Higherscores denotes better range of motion at the joint . Similarly range if motion scores for patient who started exercises late scored 35 (Av 1.7) ,61 (Avr 3.05) and 71 (Avg 3.55) at 1st ,3rd and 6 week respectively on Maitland range of motion Scores (13) .Lesser scores denotes lesser range of motion achieved at knee joint.

Discussion:

In this study validated questionnaire were used to assess whether pain features relief by early ROM exercises after total Kneee replacement or these exercises actually aggregated the pain postoperatively.

Multiple studies supported hypothesis that early ROM exercises contributed to relief of pain (2) ,(3),(4),(5).it was also hypothesised that late starting of ROM exercises cause more post operative pain ,knee strength and less overall range of Motion achieved at 3 months as compared to those who started early (12).Neil Artz et all surmised in their study that compared with controls receiving minimal or no physiotherapy ,patient receiving physiotherapy exercises had improved physical functions at 3 to 4 months along with pain relief (18) .

Conclusion:

Our study suggest that patients who started early ROM exercises had better pain score at first ,third and Sixth weeks as compared to pain score for patient who were advised knee immobilisation by applying knee immobiliser braces .

Our studies also pointed out the improvement in overall range of motion if exercises are started early .Similarly range of motion score for patients who started range of motion exercises late scored less on Maitland range of motion scores .Less scores denotes poor range of motion achieved at 1^{st},3^{rd} ,6 week postoperatively.

So we conclude that early Range of motion exercises should be started to achieved more pain relief and more achievement of range of motion at the knee joint post operatively after total knee replacement.

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