EFFECTIVENESS OF PRE-OPERATIVE STRENGTHENING EXERCISES ON FUNCTIONAL OUTCOME OF PATIENTS AFTER TOTAL KNEE REPLACEMENT SURGERY

BY

MALLI SERI. S

A DISSERTATION SUBMITTED TO THE TAMILNADU DR.M.G.R MEDICAL UNIVERSITY, CHENNAI, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF

MASTER OF SCIENCE IN NURSING

OCTOBER 2016

EFFECTIVENESS OF PRE-OPERATIVE STRENGTHENING EXERCISES ON FUNCTIONAL OUTCOME OF PATIENTS AFTER TOTAL KNEE REPLACEMENT SURGERY

Approved by the dissertation committee on : _____

Research Guide   : _____ _____

Dr. Latha Venkatesan,
M.Sc (N).,M.Phil (N).,Ph.D (N), M.B.A.,
Principal cum Professor,
Apollo College of Nursing,
Chennai – 600 095.

Clinical Guide   :_____

Mrs. Jaslina Gnanarani.J, M.Sc (N).,
Reader,
Medical Surgical department,
Apollo College of Nursing,
Chennai – 600 095.

Medical Guide   :_____

Dr. C. Lenin, MS (Ortho)
Consultant Knee Replacement and
Arthroscopic Surgeon,
Apollo Hospitals,
Greams Road,
Chennai – 600 006.

DISSERTATION SUBMITTED TO THE TAMILNADU DR.M.G.R MEDICAL

UNIVERSITY, CHENNAI, IN PARTIAL FULFILLMENT OF THE

REQUIREMENTS FOR THE DEGREE OF

MASTEROF SCIENCE IN NURSING

OCTOBER 2016

DECLARATION

I hereby declare that the present dissertation entitled "**An Experimental Study to Assess the Effectiveness of Pre-operative Strengthening Exercises on Functional Outcome of Patients after Total Knee Replacement Surgery"** is the outcome of the original research work undertaken and carried out by me under the guidance of **Dr. Latha Venkatesan,** M.Sc,(N)., M.Phil (N)., Ph.D (N)., M.B.A., Principal, Apollo College of Nursing, and **Mrs. Jaslina Gnanarani. J,** M.Sc (N)., Reader, Medical Surgical department, Apollo College of Nursing, Chennai – 600 095. I also declare that the material of this has not found in anyway, the basis for the award of any degree or diploma in this university or any other university.

M.SC (N) II YEAR

ACKNOWLEDGEMENT

Statement of Problem

An Experimental Study to Assess the Effectiveness of Pre-operative Strengthening Exercises on Functional Outcome of Patients after Total Knee Replacement Surgery

The Objectives of the Study were,

1. To assess the level of functional outcome between the control and the experimental groups of patients after Total Knee Replacement Surgery

2. To determine the effectiveness of pre-operative strengthening exercises on functional outcome by comparing the control and the experimental groups of patients after Total Knee Replacement Surgery

3. To assess the level of satisfaction of patients on pre-operative strengthening exercises among experimental group of patients after Total Knee Replacement Surgery

4. To find out the association between selected demographic variables and functional outcome among the control and the experimental groups of patients after Total Knee Replacement Surgery

5. To assess the association between selected clinical variables and functional outcome among the control and the experimental groups of patients after Total Knee Replacement Surgery

The Conceptual framework of the present study was based on King's Goal Attainment theory (Martha, 2013) given by Imogene King which was modified for the study. The study variables were pre-operative strengthening exercises and

functional outcome. An extensive literature review and guidance by the experts formed the foundations for the development of the demographic variable proforma, clinical variable proforma, WOMAC score and rating scale on the level of satisfaction about pre-operative strengthening exercises.

A quasi experimental research approach was used for achieving the objectives of the study. The present study was conducted in Apollo Main Hospitals. A sample size of 60 patients who met the inclusion criteria were chosen for the study. By purposive sampling technique, 30 patients in each group viz. the control and the experimental group were selected by the researcher for data collection.

The investigator used the demographic and clinical variables proforma of patients to obtain the baseline data. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) was used for assessing the scale of difficulty with sub scales on pain, stiffness and physical function and rating scale for assessing the level of satisfaction of patients regarding pre-operative strengthening exercises. The data collection tools were validated and reliability was established. After the pilot study, the data collection of the main study was conducted for a period of 6 weeks. The level of satisfaction regarding administration of pre-operative strengthening exercises was then assessed. The collected information was tabulated and analyzed by using appropriate descriptive and inferential statistics.

The Major Findings of the Study were,

➢ A significant percentage of the patients scheduled for TKR were in the age group of 61-70 years (40%, 46.6%) with the mean age and SD of 62.5+/-

SD 9.7, 61.6 +/- 8.4, were females (66.6%, 60%,), married (86.6%, 93.3%), non-vegetarian (60%, 80%), moderate workers (43.3%, 46.6%) with monthly family income Rs.50,000 - 1,00,000 (53.3%,56.6%) and graduates (53.3%, 53.3%) in control and experimental groups of patients respectively.

➢ Most of the patients scheduled for TKR had no previous history of surgery within 5 years (80%, 80%), no history of trauma (83.3%, 86.6%), had OA in the past 5-10 years (73.3%, 66.6%), had body mass index (80%, 86.6 %) within 22-25 in the control and the experimental groups respectively. Nearly half of the patients (43.3%, 50%) had no co-morbidity in both the groups. Only very few patients had knee pain for 8-12 hours (16.6%, 13.3%), had taken NSAID (50%, 56.3%) and analgesics (50%, 46.6%) and had not used any narcotics for pain in control and experimental groups respectively.

➢ The control group and the experimental group had average level of functional outcome (80%, 100%) in the first observation.

➢ In the second observation, 93.3% of the experimental group had achieved good functional outcome whereas the entire control group had only average level (100%) of functional outcome. But the experimental group of patients had average level of functional outcome of 6.6%. There was no one in poor level of functional outcome in the second observation.

➢ The mean and the standard deviation of WOMAC scale of difficulty on functional outcome in the first observation was (M = 49.9, SD = 3.67) for the experimental group whereas the mean and the standard deviation of the

control group was M =59.9, SD = 4.05. This was found to be statistically significant at p < 0.001.

➢ In the second observation, the mean and the standard deviation of WOMAC scale of difficulty on functional outcome (M= 28.0, SD = 2.80) in experimental group was less than that of the control group (M= 39.3, SD = 3.03). This was found to be statistically significant at p < 0.001 in the first and the second observations. This may be attributed to the effectiveness of the pre-operative strengthening exercises on functional outcome of patients after Total Knee Replacement surgery. Hence, the null hypothesis H_{O1} "There will be no significant difference in the functional outcome with pre-operative strengthening exercises among the control and the experimental groups of patients after Total Knee Replacement Surgery" was rejected.

➢ A majority of the patients in the experimental group were highly satisfied with the method of teaching pre-operative strengthening exercises (96.6%), the effectiveness of the therapy (100%) and the approach of researcher (100%).

➢ There was no significant association between the selected demographic variables, namely, age, gender, educational, marital status, nature of work, monthly family income and dietary habits in the control and the experimental groups of patients. Hence, the null hypothesis H_{O2} "There will be no significant association between selected demographic variables and functional outcome of patients among the control and experimental groups of patients after Total Knee Replacement Surgery" was retained.

- ➤ There was no significant association between selected clinical variables like co-morbidity, previous history of surgery within 5 years, BMI, history of trauma, duration of OA, frequency of exercises, duration of exercise, duration of knee pain in 24 hours and medication taken for pain in the control and the experimental groups of patients. Hence, the null hypothesis H_{O3} with regard to these variables was retained.

Recommendations

The researcher recommends the following:

- ➤ A similar study could be undertaken on a larger scale for more valid generalization.
- ➤ This study could be replicated in different settings.
- ➤ The study could be conducted for comparing different modalities of teaching exercises as eg. Simulation.
- ➤ The study could be conducted by using a variety of tools to assess the functional outcome.
- ➤ The study could be replicated by comparing individual and group methods of teaching exercises.
- ➤ This study could be replicated with a long term follow up.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

APPENDIX I

LETTER SEEKING PERMISSION TO CONDUCT STUDY

Apollo College of Nursing
(A unit of Apollo Hospitals Educational Trust)
(Recognised by the Indian Nursing Council and Affiliated to the Tamil Nadu Dr. M.G.R. Medical University, Chennai)

CO/0202/15   05.05.2015

To

Dr.Muralidharan.M
Director of Medical Education
Apollo Main Hospitals
Greams Road
Chennai- 600 006.

Respected Sir,

Sub.: To request permission for research study – Reg
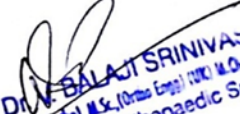
Greetings! As part of the curriculum requirement our 2nd year M.Sc. (N) student Ms.Malliseri.N has selected the following title for her Research Study.

"An Experimental study to assess the effectiveness of pre operative strengthening exercise on functional outcome of patients with Total Knee Replacement Surgery".

So I kindly request your goodselves to permit her to conduct study in your esteemed hospital.

Thanking you,

Dr. LATHA VENKATESAN
PRINCIPAL

Dr. V. BALAJI SRINIVAS
Consultant Orthopaedic Surgeon

Apollo Hospitals

Emergency Service
Dial 1066

APPENDIX II

LETTER PERMITTING TO CONDUCT THE STUDY

Apollo College of Nursing
(A unit of Apollo Hospitals Educational Trust)
(Recognised by the Indian Nursing Council and Affiliated to the Tamil Nadu Dr. M.G.R. Medical University, Chennai)

CO/0203/15

05.05.2015

To

Ms.Sunitha.D
Senior Nursing Superintendent
Apollo Main Hospitals
Greams Road
Chennai- 600 006.

Dear Madam,

Sub.: To request permission for research study – Reg

Greetings! As part of the curriculum requirement our 2nd year M.Sc. (N) student Ms.Malliseri.N. has selected the following title for her Research Study.

"An Experimental study to assess the effectiveness of pre operative strengthening exercise on functional outcome of patients with Total Knee Replacement Surgery".

So I kindly request your goodselves to permit her to conduct study in your esteemed hospital.

Thanking you,

Dr. LATHA VENKATESAN
PRINCIPAL

Regd. Office : 21, Greams Lane Off, Greams Road, Chennai - 600 006. Ph. : +91-44-2829 3333, 2829 0200 Website : www.apollohospitalseducation.com
Unit Office : Vanagaram to Ambattur Main Road, Ayanambakkam, Chennai - 600 095. Phone : 044 - 2653 4387 Fax : 044 - 2653 4923 / 2653 4386

Apollo Hospitals
CHENNAI

Emergency Service
Dial **1066**

APPENDIX III

ETHICAL COMMITTEE PERMITTING LETTER

Institutional Ethics Committee - Clinical Studies

Reg. No. : ECR/37/Inst/TN/2013

7 July 2015

To,

Ms. Malli Seri S.,
First year, M.SC (Nursing),
Department of Orthopedic Nursing,
Apollo College of Nursing, Chennai.

Ref: An experimental study to assess the effectiveness of pre operative strengthening exercise on functional outcome of patients with total knee replacement surgery.

Sub: Approval of the above referenced project and its related documents.

Dear Ms. Malli,

The Institutional Ethics Committee-Clinical Studies has received the following document submitted by you related to the conduct of the above-referenced study -

- Project Proposal

The Institutional Ethics Committee-Clinical Studies reviewed (through expedited review) and discussed the project proposal documents submitted by you at a specially convened meeting held on 7 July 2015.

The following members were present at the meeting held on 7 July 2015 at 2:00pm at Apollo Hospitals Educational Research Foundation, Conference Hall, Room No: 19, 2nd Floor, Krishnadeep Chambers, Wallace Garden, Chennai:

Name	Gender	Designation	Affiliation	Position in the committee
Dr. Rema Menon	F	Blood Bank Officer	Apollo Hospitals, Chennai	Member Secretary (Clinician)
Dr. Pradeep Kumar	M	Clinical Pharmacologist	Apollo Hospitals, Chennai	Member (Pharmacologist)
Dr. Rama Narasimhan	F	Senior Consultant- Internal Medicine	Apollo Hospitals, Chennai	SRSC Member (Clinician)
Dr. Sivagnanasundaram	M	Senior Consultant - Endocrinology	Madras High Court, Chennai	SRSC - Member (Clinician)

Institutional Ethics Committee - Clinical Studies

Reg. No. : ECR/37/Inst/TN/2013

		Endocrinology	Court, Chennai	(Clinician)

The Institutional Ethics Committee-Clinical Studies reviewed the proposal, its methodology and design of the study. The proposed thesis work is approved in its present proposal without any modifications.

The Institutional Ethics Committee-Clinical Studies review and approval of the report is only to meet their academic requirement and will not amount to any approval of the conclusion / recommendations as conclusive, deserving adoption and implementations, in any form, in any health care institution.

The Institutional Ethics Committee-Clinical Studies is constituted and works as per ICH-GCP, ICMR and revised Schedule Y guidelines.

Regards,

Dr. Rema Menon,
Member Secretary,
Institutional Ethics Committee-Clinical Studies,
Apollo Hospitals, Chennai.

Date: 7|7|2015

MEMBER SECRETARY
INSTITUTIONAL ETHICS COMMITTEE CLINICAL STUDIES
APOLLO HOSPITALS, AHEL
CHENNAI, TAMILNADU.

Apollo Hospitals Enterprise Limited,
21, Greams Lane, Off Greams Road, Chennai - 600 006, India, T : +91 44 2829 5045 / 6641 Fax : 91-44-2829 4449
Email : ecapollochennai@gmail.com

xvi

APPENDIX IV

LETTER SEEKING PERMISSION FOR CONTENT VALIDITY

From

      Malli seri.S,

      M.Sc (N) Second Year,

      Apollo College of Nursing,

      Chennai – 600 095.

To

Forwarded Through:

      Dr. LathaVenkatesan,

      Principal,

      Apollo College of Nursing.

Sub: **Requesting for opinions and suggestions of experts for establishing content validity for research tool**.

Respected Madam,

      I am a postgraduate student of the Apollo College of Nursing. I have selected the below mentioned topic for research project to be submitted to The Tamil Nadu Dr. M.G.R Medical University, Chennai as a partial fulfillment of Masters of Nursing Degree.

TITLE OF THE TOPIC:

      "An Experimental Study to Assess the Effectiveness of Pre-operative Strengthening Exercise on Functional Outcome of Patients after Total Knee Replacement Surgery"

      With regards may I request you to kindly validate my tool for its appropriateness and relevancy. I am enclosing the Background, Need for the study, Statement of the problem, Objectives of the study, Demographic Variable Proforma, Clinical Variable Proforma and Rating scale on satisfaction scale of patients scheduled for TKR. I would be highly obliged and remain thankful for your great help if you could validate and send it as soon as possible.

Thanking you,

Date: Yours sincerely,

Place: (Malli seri.s)

APPENDIX V

LIST OF EXPERTS FOR CONTENT VALIDITY

1. Dr. LathaVenkatesan, M.Sc (N).,M.Phil (N)., Ph.D (N).,

Principal,

Apollo College of Nursing,

Chennai – 95

2. **DR.V. Balaji Srinivasan**

M.S.Ortho, M.Sc,(Ortho Engg,) (UK),

M.Ch(Ortho) (UK), Consultant

Apollo Hospitals,

Greams Road,

Chennai – 600 006.

3. Prof. Lizy Sonia. A. M.Sc (N).,

Vice Principal,

Apollo College of Nursing,

Chennai – 95.

4. Dr. Vijayalakshmi. K. M.Sc (N)., M.A (Psy), M.B.A, Ph.D

HOD of Mental Health Nursing,

Apollo College of Nursing,

Chennai – 95.

5. Mrs. Jaslina Gnanarani.J. M.Sc (N).,

Reader, Medical Surgical Nursing,

Apollo College of Nursing,

Chennai – 95.

6. Mrs. Sasikala.D. M.Sc (N).,

Reader, Medical Surgical Nursing,

Apollo College of Nursing,

Chennai – 95.

7. Mrs. G. Kanchana. M.Sc (N).,M.Sc (Psy).,

Reader, Medical Surgical Nursing,

Apollo College of Nursing,

Chennai – 95.

8. Mrs. P Kasthuri. M.Sc (N).,

Reader, Medical Surgical Nursing,

Apollo College of Nursing,

Chennai – 95.

APPENDIX VI

CERTIFICATE FOR CONTENT VALIDITY

TO WHOMSOEVER IT MAY CONCERN

I hereby certify that I have validated the research tool of Ms.Malli seri.S, M.Sc. (Nursing) student who is undertaking research study on **''An Experimental Study to Assess the Effectiveness of Pre-operative Strengthening Exercise on Functional Outcome of Patients after Total Knee Replacement Surgery at Apollo Hospitals, Chennai''.**

Signature of Expert

Name and Designation

APPENDIX VII

LETTER SEEKING CONSENT FROM PARTICIPANTS

Dear participant,

I am Malli seri. S, M.Sc Nursing student of Apollo College of Nursing, Chennai. As a part of my study, a research on **"An Experimental Study to Assess the Effectiveness of Pre-operative Strengthening Exercises on Functional Outcome of Patients after Total Knee Replacement Surgery at Apollo hospital, Chennai"** is to be conducted.

I hereby seek your consent and co-operation to participate in the study. Please be frank and honest in response. The information obtained will be kept confidential and anonymity will be maintained.

Signature of the researcher

I ……………….. hereby consent to participate in this study.

Place:

Date:

Signature of the participant

APPENDIX VIII

CERTIFICATE FOR ENGLISH EDITING

TOWHOMSOVER IT MAY CONCERN

This is to certify that the dissertation entitled **"An Experimental Study to assess the Effectiveness of Pre-Operative Strengthening Exercises on Functional Outcome of Patients with Total Knee Replacement Surgery at Apollo Hospitals, Chennai"** by Malli Seri.S, II year M.Sc. Nursing student of Apollo College of Nursing, was edited for English Language appropriateness.

Prof. J.L. NARASIMHAN
New No.8, Second Main Road,
Block B - F1, Krishna Nagar,
Chromepet, Chennai-600 044.
Cell : 94446 54720
e-mail : profjln@yahoo.com

Signature

APPENDIX IX

PLAGIARISM ORIGINALITY REPORT

	Plagiarism Detector - Originality Report
	Plagiarism Detector Project:[http://plagiarism-detector.com] Application core version:935

Originality report details:	
Generation Time and Date:	06/06/2016 11:27:07 PM
Document Name:	Malli- Thesis.docx
Document Location:	C:\Documents and Settings\Administrator\Desktop\ Malli- Thesis.docx
Document Words Count:	112764

Important Hint: To understand what exactly is meant by any report value - you can click, "Help i will navigate you to the most detailed explanation at our web site.

Plagiarism Detection Chart:

Referenced (2.00%) Plagiarism (1.00%) Original (97.00%)
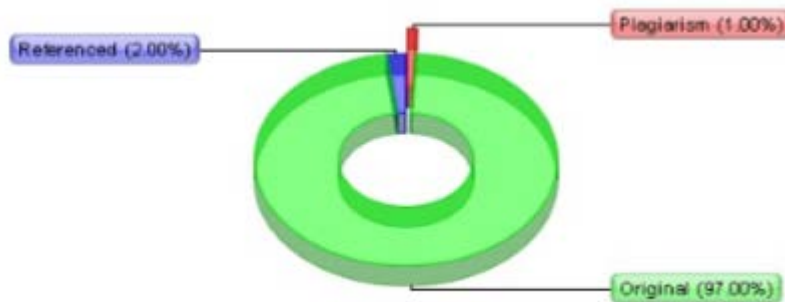
Referenced 2% / **Linked 0%**

Original - 97% / **1% - Plagiarism**

DEMOGRAPHIC VARIABLE PROFORMA

PROFORMA

The demographic proforma is used by researcher to collect information on demographic variables such as age, gender, education, marital status, type of family, nature of work, monthly family income and dietary habits.

INSTRUCTION

The investigator shall collect the information from the client and from the hospital records.

SAMPLE NO………………..

1. **Age in years**
   1.1   41- 50
   1.2   51– 60
   1.3   61– 70
   1.4   71 - 80
2. **Gender**
   2.1   Male
   2.2   Female
3. **Education**
   3.1   Primary education
   3.2   Secondary education
   3.3   Graduate
4. **Marital status**
   4.1   Unmarried
   4.2   Married
   4.3   Widowed

5. **Type of family**

    5.1   Nuclear family

    5.2   Joint family

6. **Nature of work**

    6.1   Sedentary

    6.2   Moderate

    6.3   Heavy

7. **Monthly family income Rs**

    7.1   >50,000

    7.2   50,000 – 1,00,000

    7.3   Above 1,00,000

8. **Dietary habits**

    8.1   Vegetarian

    8.2   Non-vegetarian

CLINICAL VARIABLE PROFORMA

PROFORMA

      The clinical variable proforma is used by researcher to collect information on clinical variables such as co- morbidity, previous history of surgery within 5 years, BMI, history of trauma, duration of OA in years, frequency of exercises, duration of exercise, duration of knee pain in 24 hours and medication taken for pain.

INSTRUCTION

      The investigator shall collect the information from the client and from the hospital records.

SAMPLE NO…………….

1.   **Co-morbidity**

    1.1   Coronary artery disease

    1.2   Diabetes mellitus

    1.3   COPD

    1.4   NIL

2.   **Previous history of surgery within 5 years**

    2.1   Minor

    2.2   Major

    2.3   Nil

3.   **BMI**

    3.1   18– 22

    3.2   22 – 25

    3.3   >25

4.   **History of trauma**

    4.1 Falls

    4.2 Ligament injury

    4.3 Fracture

    4.4   NIL

5. **Duration of OA in years**

    5.1   > 5   ☐

    5.2   5 – 10   ☐

    5.3   > 10   ☐

6. **Frequency of exercises**

    6.1.   Regular   ☐

    6.2.   Irregular   ☐

7. **Duration of exercise**

    7.1.   15 mts- 30 mts   ☐

    7.2.   < 30 mtS   ☐

8. **Duration of knee pain in 24 hours**

    8.1.   < 1 hour   ☐

    8.2.   1 - 4 hours   ☐

    8.3.   4 - 8 hours   ☐

    8.4.   8 - 12 hours   ☐

9. **Medication taken for pain**

    9.1   NSAID   ☐

    9.2   Analgesics   ☐

    9.2.   Narcotics   ☐

APPENDIX XII

The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

Name: _____

Date: _____

Instructions:

Please rate the activities in each category according to the following

Scale of difficulty:

0 = None, 1 = Slight, 2 = Moderate, 3 = Very, 4 = Extremely

Circle **one number** for each activity_____

PAIN	1. Walking	0	1	2	3	4
	2. Stair Climbing	0	1	2	3	4
	3. Nocturnal	0	1	2	3	4
	4. Rest	0	1	2	3	4
	5. Weight bearing	0	1	2	3	4
STIFFNESS	1. Morning stiffness	0	1	2	3	4
	2. Stiffness occurring later in the day	0	1	2	3	4
PHYSICAL FUNCTION	1. Descending stairs	0	1	2	3	4
	2. Ascending stairs	0	1	2	3	4
	3. Rising from sitting	0	1	2	3	4
	4. Standing	0	1	2	3	4
	5. Bending to floor	0	1	2	3	4

	6. Walking on flat surface	0	1	2	3	4
	7. Getting in / out of car	0	1	2	3	4
	8. Going shopping	0	1	2	3	4
	9. Putting on socks	0	1	2	3	4
	10. Lying in bed	0	1	2	3	4
	11. Taking off socks	0	1	2	3	4
	12. Rising from bed	0	1	2	3	4
	13. Getting in/out of bath	0	1	2	3	4
	14. Sitting	0	1	2	3	4
	15. Getting on/off toilet	0	1	2	3	4
	16. Heavy domestic duties	0	1	2	3	4
	17. Light domestic duties	0	1	2	3	4

Total Score: _____ / 96 = _____%

BLUE PRINT OF RATING SCALE ON LEVEL OF SATISFACTION OF PATIENTS AFTER TKR REGARDING PRE-OPERATIVE STRENGTHENING EXERCISES

Item Description	Questions	No. of Questions	Percentage
About the method of exercises	1, 2, 3, 4,5	5	50%
About the effect of the exercises	6,7,3	2	30%
About the Researcher	9,10	2	20%
Total		**10**	**100%**

RATING SCALE TO ASSESS THE LEVEL OF SATISFACTION OF PATIENTS AFTER TKR ABOUT PRE-OPERATIVE STRENGTHENING EXERCISES

PURPOSE

This questionnaire used by the researcher to know the level of satisfaction of pre-operative strengthening exercises among patients after Total Knee Replacement surgery.

INSTRUCTIONS

This rating scale has got three categories and each question with four options which describe the level of satisfaction. Please answer the following questions and describe your satisfaction level about pre-operative strengthening exercise. Please feel free and frank in answering these questions. Confidentiality will be maintained.

S.NO	ITEM	HS 3	S 2	DS 1	HDS 0
1.	Whether you were satisfied with the method of teaching exercises				
2.	Were you satisfied with the explanation regarding strengthening exercises				
3.	Were you satisfied with the privacy provided to perform the exercises				
4.	Were you comfortable with performing exercises				
5.	Whether you satisfied with duration of exercise				
6.	Were you satisfied with the benefits of the pre-operative strengthening exercises				

7.	Do you feel that it was not interfering with routine treatment?				
8.	Were you satisfied with the cost effectiveness of exercises				
9.	Were you satisfied with the approach of the researcher				
10.	Were you satisfied with the methods of data collection.				

SCORING KEY:

HS = Highly satisfied - 3

S = Satisfied - 2

D = Dissatisfied - 1

HSD = Highly dissatisfied - 0

The total score is converted into percentage and graded as given below.

INTERPRETATION

SCORING	INTERPRETATION
Highly Satisfied	76- 100%
Satisfied	51-75%
Dissatisfied	25-50%
Highly Dissatisfied	Below 25%

APPENDIX XV

PERMISSION FOR USING WOMAC SCALE

Seeking permission to use the tool - WOMAC

mallisri mallisri   ↩ Reply | ⌄
Thu 6/2
You; n.bellamy@uq.edu.au ⌄

Dear Mr.N.Bellamy,

With due respect, I , Ms.Malli seri Msc Nursing 2nd year student would like to state that as a part of my curriculum requirement I have planned for a study on "An Experimental Study to Assess the Effectiveness of Pre-Operative Strengthening Exercise on Functional Outcome of Patients with Total Knee Replacement Surgery at Apollo Hospitals, Chennai, India. For the same I would like to use the WOMAC scale as one of my tool for the academic purpose only.Please consider my request and grant me permission for the same.

Thanking you.

Sincerely,

Malli seri

APPENDIX XVI

DATA CODING SHEET

1. Age - Age in years

1.1 41 - 50

1.2 51 - 60

1.3 61 - 70

1.4 71 - 80

2. Gen - Gender

2.1 Male

2.2 Female

3. Ed - Education

3.1 Primary education

3.2 Secondary education

3.3 Graduate

4. Ms - Marital status

4.1 Unmarried

4.2 Married

4.3 Widowed

5. TF - **Type of family**

5.1 Nuclear family

5.2 Joint family

6. Wk - **Nature of work**

6.1 Secondary

6.2 Moderate

6.3 Heavy

7. Inc - Monthly family income Rs

7.1 >50,000

7.2 50,000 - 1,00,000

7.3 Above 1,00,000

8. Diet - Dietary habits

8.1 Vegetarian

8.2 Non-vegetarian

1. CoM - Co-morbidity

1.1 Coronary artery disease

1.2 Diabetes mellitus

1.3 COPD

1.4 NIL

2. Surg - Previous history of surgery within

5 years

2.1 Minor

2.2 Major

2.3 Nil

3 BMI - BMI

3.1 18 - 22

3.2 22 - 25

3.3 >25

4. Tra - History of trauma

4.1 Falls

4.2 Ligament injury

4.3 Fracture

4.3 Nil

5. OA - Duration of illness in years

5.1 >5

5.2 5 - 10

5.3 >10

6. Ex.F - Frequency of excercises

6.1 Regular

6.2 Irregular

7. D.Ex - Duration of excercise

7.1 15 mts - 30 mts

7.2 > 30 mts

8. D.Ex - Duration of knee pain

7.1 < 1 hour

7.2 1-4 hours

7.3 4-8 hours

7.4 8-12 hours

9. Med - Medication taken for pain

9.1 NSAID

9.2 Analgesics

9.3 Narcotics

APPENDIX XVII

PRE-OPERATIVE STRENGTHENING EXERCISES

Attached is an information illustrating of pre-operative strengthening exercises. Please do these exercises thrice a day before surgery (more if possible). The following exercises should be performed now and continue to practice until surgery. Do not do any exercises that are too painful. Please, stop any exercise that increases the pain.

PREPARING FOR KNEE REPLACEMENT SURGERY

1.	Ankle Pumps	10 reps (each leg)	3 times /day
2.	Quad Sets (Knee push-downs)	10 reps (each leg)	3 times/day
3.	Heel Slides (slide heel up and down)	10 reps (each leg)	3 times/day
4.	Gluteal sets (bottom squeezes)	10 reps (each leg)	3 times/day
5.	Short arc quads	10 reps (each leg)	3 times/day
6.	Abduction and adduction	10 reps (each leg)	3 times/day
7.	Wrist Flexion	20 reps (each arm)	3 times/day
8.	Armchair Push-Ups	20 reps	3 times/day
9.	Shoulder Extension	20 reps	3 times/day
10.	Elbow Flexion	20 reps	3 times/day
11.	Wall Push-up	20 reps	3 times/day

Remember to:
- ➢ Perform each exercise slowly.
- ➢ Do not hold your breath.
- ➢ Stop any exercise that is too painful.
- ➢ Perform these exercises 3 times a day (more if possible).

ANKLE PUMPS

With leg relaxed, gently flex your foot and point your toes (bend and straighten the ankle).
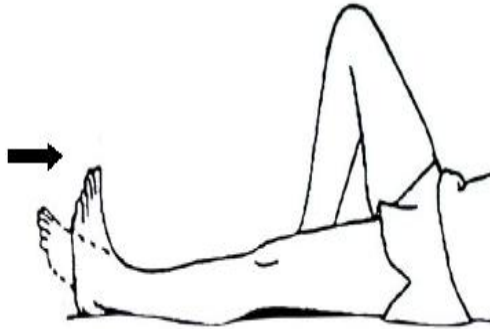
Repeat 10 times (each leg), every hour if possible.

QUAD SETS — (KNEE PUSH-DOWNS)

➢ Lie on your back, keep your knee straight.
➢ Push the back of your knee into the bed while tightening the muscle on the front of your high. Hold for 5 seconds, and then relax. Repeat 10 times (each leg), 3 times per day.
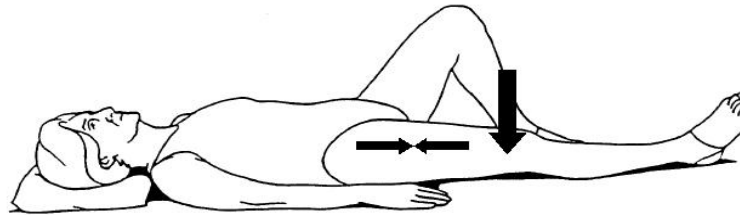
HEEL SLIDES — (SLIDE HEELS UP AND DOWN)

➢ Lie on your back, bend your knee by sliding your heel toward your bottom, and then straighten the leg. Bend your knee to a position that you can tolerate.
➢ Repeat 10 times (each leg), 3 times per day.

GLUTEAL SET — (BOTTOM SQUEEZES)

- ➢ Tense muscles and squeeze buttocks.
- ➢ Keep leg and buttock flat on the floor. Hold 5 seconds.
- ➢ Repeat 10 times (each leg), 3 times per day.
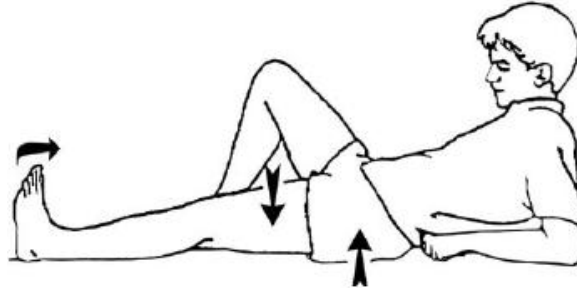
SHORT ARC QUAD

- ➢ Place a towel roll or pillow under your knee.
- ➢ Raise your foot off the bed surface by straightening your knee. Do not raise your thigh off the towel roll or pillow.
- ➢ Repeat 10 times (each leg), 3 times per day.
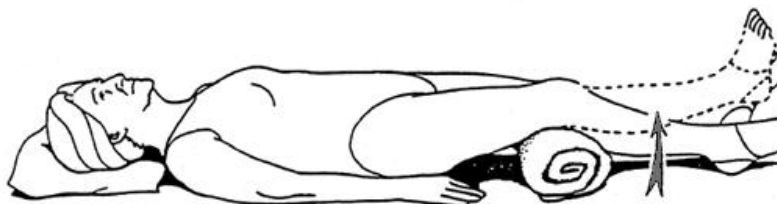
HIP ABDUCTION / ADDUCTION — (SLIDE HEELS OUT AND IN)

- ➢ Lie on back
- ➢ Slide leg out to the side and return to the center. Keep toes pointed up and knees straight.
- ➢ Hold 2 – 3 seconds, slowly relax.
- ➢ Repeat 10 times (each leg), 3 times per day.

EXERCISES TO HELP WITH WALKER OR CRUTCH USE

Do these exercises to build upper body strength. This helps to use a walker or crutches after surgery. Be sure to exercise both arms.

WRIST FLEXION

- ➢ With right palm up, bend wrist up.
- ➢ Repeat 20 times on each arm, 3 times per day.
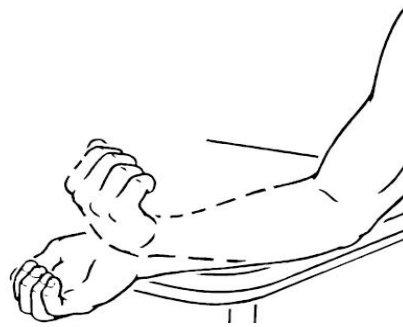
ARMCHAIR PUSH-UPS — (CHAIR STAND – RESISTED)

With hands on armrests, push up from chair. Use legs as much as necessary. Return slowly. Repeat 20 times, 3 times per day.
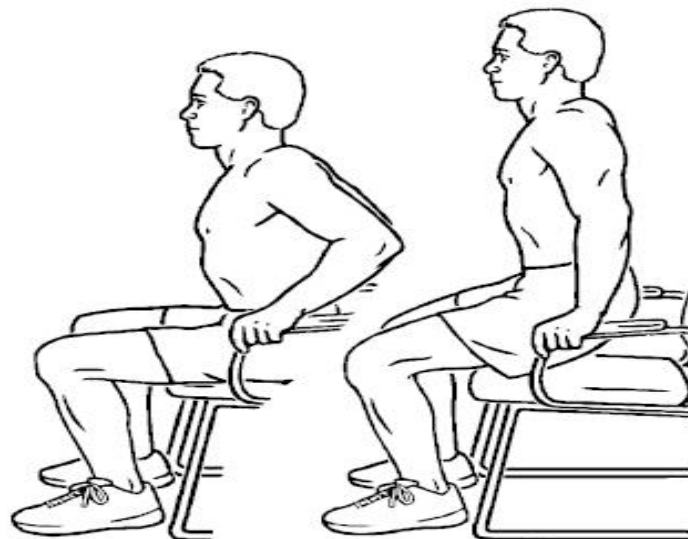
SHOULDER EXTENSION

➢ Bring arms straight back as far as possible without pain.

➢ Repeat 20 times, 3 times per day.
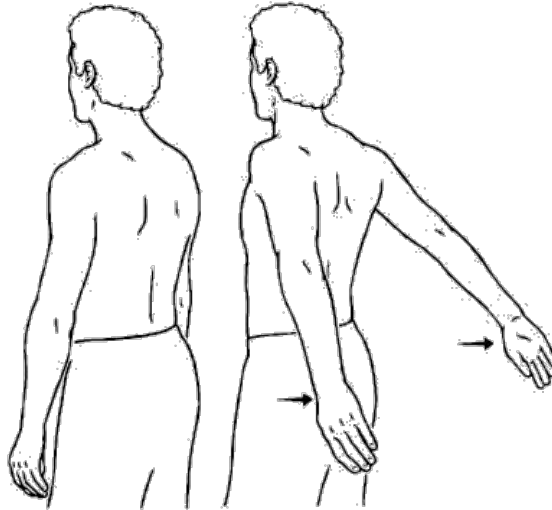
ELBOW FLEXION

➢ With right arm straight, thumb forward, hold a light hand weight or can, bend elbow. Return slowly.

➢ Repeat 20 times each arm, 3 times per day.
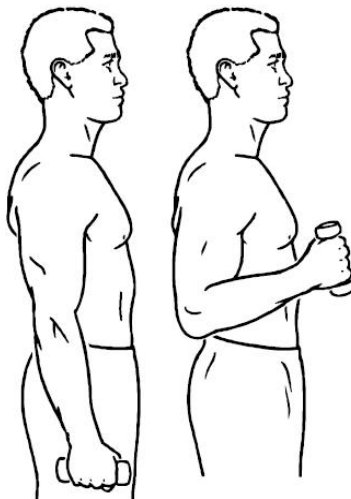
WALL PUSH-UP

➢ With arms slightly wider apart than shoulder width, and feet 8 - 10 inches from wall, gently lean body toward wall.

➢ Repeat 20 times, 3 times per day.
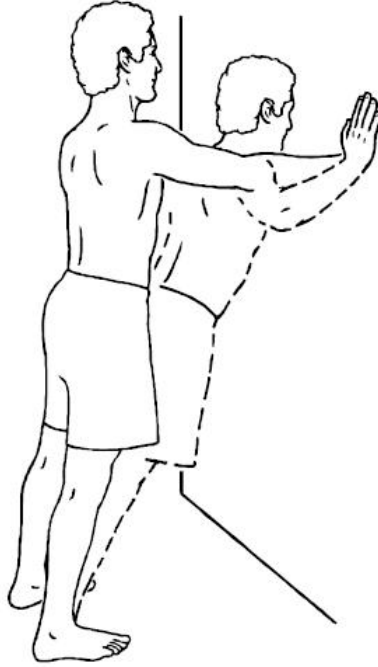
MASTER CODING SHEET - CONTROL GROUP

	Demographic variable								Clinical variable									O_1	O_2
	Age	Gen	Ed	Ms	TF	Wk	Inc.	Diet	CoM	Surg	BMI	Tra	OA	Ex.F	D.Ex	K.Pain	Med		
1	1.1	2.2	3.2	4.2	5.1	6.3	7.2	8.1	1.4	2.3	3.2	4.4	5.2	6.1	7.2	8.1	9.1	54	33
2	1.4	2.1	3.3	4.2	5.2	6.2	7.3	8.2	1.2	2.3	3.2	4.4	5.1	6.1	7.2	8.1	9.1	58	37
3	1.2	2.2	3.3	4.3	5.1	6.1	7.1	8.1	1.1	2.1	3.3	4.4	5.2	6.2	7.2	8.1	9.1	65	44
4	1.2	2.2	3.2	4.2	5.2	6.3	7.2	8.1	1.1	2.3	3.3	4.4	5.2	6.2	7.1	8.3	9.1	64	41
5	1.3	2.2	3.3	4.2	5.2	6.2	7.2	8.1	1.4	2.3	3.3	4.1	5.2	6.2	7.2	8.3	9.2	60	40
6	1.1	2.1	3.2	4.2	5.1	6.3	7.2	8.2	1.2	2.3	3.2	4.4	5.2	6.2	7.2	8.2	9.2	63	39
7	1.4	2.2	3.3	4.2	5.2	6.1	7.1	8.2	1.4	2.3	3.3	4.4	5.3	6.1	7.1	8.2	9.2	65	43
8	1.3	2.2	3.2	4.2	5.2	6.2	7.2	8.2	1.4	2.3	3.2	4.4	5.3	6.2	7.2	8.2	9.1	64	40
9	1.2	2.2	3.3	4.2	5.1	6.3	7.3	8.1	1.2	2.3	3.2	4.4	5.2	6.2	7.2	8.4	9.2	57	36
10	1.4	2.2	3.2	4.2	5.2	6.1	7.2	8.2	1.1	2.3	3.2	4.1	5.2	6.2	7.1	8.1	9.2	65	43
11	1.3	2.2	3.3	4.2	5.1	6.2	7.2	8.2	1.4	2.1	3.1	4.4	5.2	6.1	7.1	8.1	9.2	65	40
12	1.1	2.1	3.2	4.2	5.2	6.3	7.2	8.1	1.2	2.3	3.2	4.4	5.2	6.2	7.2	8.1	9.2	64	40
13	1.3	2.2	3.3	4.2	5.1	6.2	7.3	8.1	1.4	2.3	3.2	4.4	5.2	6.2	7.1	8.1	9.1	66	43
14	1.2	2.2	3.2	4.2	5.2	6.2	7.2	8.2	1.2	2.3	3.2	4.4	5.1	6.2	7.1	8.3	9.1	57	37
15	1.4	2.2	3.3	4.2	5.2	6.1	7.2	8.2	1.2	2.3	3.3	4.2	5.3	6.2	7.1	8.4	9.1	59	45
16	1.3	2.1	3.3	4.2	5.2	6.2	7.2	8.1	1.2	2.2	3.2	4.4	5.2	6.2	7.1	8.4	9.1	55	42
17	1.1	2.2	3.2	4.2	5.1	6.3	7.3	8.2	1.2	2.3	3.2	4.4	5.2	6.2	7.1	8.3	9.2	65	36
18	1.2	2.1	3.3	4.2	5.2	6.2	7.2	8.2	1.1	2.3	3.2	4.2	5.2	6.2	7.2	8.3	9.2	54	40
19	1.3	2.2	3.3	4.2	5.1	6.3	7.1	8.2	1.1	2.3	3.2	4.4	5.3	6.2	7.2	8.2	9.2	56	38
20	1.3	2.2	3.2	4.2	5.2	6.2	7.1	8.1	1.4	2.3	3.2	4.4	5.2	6.2	7.2	8.2	9.2	57	37
21	1.2	2.1	3.3	4.3	5.2	6.3	7.2	8.2	1.4	2.2	3.2	4.4	5.2	6.1	7.2	8.1	9.1	60	38
22	1.4	2.2	3.3	4.2	5.2	6.1	7.2	8.1	1.2	2.3	3.2	4.4	5.3	6.2	7.2	8.1	9.1	56	41
23	1.3	2.1	3.2	4.2	5.1	6.2	7.1	8.2	1.4	2.3	3.2	4.4	5.2	6.1	7.2	8.2	9.2	53	36
24	1.2	2.2	3.3	4.2	5.2	6.2	7.3	8.1	1.4	2.3	3.2	4.4	5.2	6.1	7.1	8.2	9.2	59	33
25	1.4	2.2	3.2	4.2	5.2	6.3	7.2	8.2	1.2	2.3	3.2	4.4	5.3	6.1	7.1	8.3	9.1	63	41
26	1.3	2.1	3.2	4.2	5.1	6.2	7.2	8.1	1.4	2.3	3.2	4.4	5.2	6.1	7.1	8.3	9.1	58	36
27	1.2	2.2	3.3	4.2	5.2	6.3	7.3	8.2	1.4	2.3	3.2	4.4	5.2	6.2	7.1	8.4	9.2	55	42
28	1.3	2.2	3.3	4.2	5.1	6.2	7.2	8.2	1.2	2.2	3.2	4.4	5.3	6.2	7.1	8.4	9.2	60	40
29	1.3	2.1	3.2	4.3	5.2	6.1	7.1	8.2	1.4	2.3	3.2	4.2	5.3	6.1	7.2	8.3	9.1	63	38
30	1.3	2.2	3.2	4.3	5.1	6.3	7.2	8.2	1.2	2.3	3.2	4.4	5.2	6.2	7.2	8.2	9.1	59	40

MASTER CODING SHEET EXPERIMENTAL GROUP

	Demographic variable								Clinical variable									O₁	O₂
	Age	Gen	Ed	Ms	TF	Wk	Inc.	Diet	CoM	Surg	BMI	Tra	OA	Ex.F	D.Ex	K.Pain	Med	O_1	O_2
1	1.3	2.1	3.2	4.2	5.1	6.1	7.2	8.1	1.4	2.3	3.2	4.4	5.2	6.1	7.2	8.2	9.1	44	27
2	1.3	2.2	3.2	4.2	5.2	6.2	7.2	8.2	1.1	2.3	3.2	4.4	5.3	6.2	7.2	8.2	9.2	50	28
3	1.3	2.2	3.3	4.1	5.2	6.1	7.1	8.2	1.2	2.1	3.2	4.1	5.2	6.1	7.2	8.2	9.1	57	26
4	1.4	2.1	3.1	4.2	5.1	6.2	7.2	8.1	1.4	2.3	3.2	4.1	5.2	6.2	7.2	8.3	9.1	53	30
5	1.2	2.2	3.3	4.2	5.2	6.3	7.3	8.2	1.4	2.3	3.2	4.4	5.3	6.2	7.1	8.3	9.1	49	30
6	1.3	2.2	3.3	4.2	5.1	6.3	7.3	8.2	1.4	2.3	3.2	4.4	5.2	6.1	7.2	8.1	9.2	53	27
7	1.3	2.1	3.3	4.2	5.1	6.1	7.1	8.1	1.2	2.3	3.2	4.4	5.2	6.2	7.1	8.1	9.2	54	28
8	1.2	2.2	3.3	4.2	5.2	6.3	7.3	8.2	1.1	2.3	3.2	4.4	5.3	6.2	7.2	8.1	9.2	57	22
9	1.2	2.1	3.2	4.2	5.1	6.2	7.2	8.2	1.4	2.3	3.2	4.4	5.2	6.1	7.1	8.2	9.1	50	25
10	1.3	2.2	3.3	4.2	5.2	6.2	7.2	8.2	1.4	2.3	3.2	4.4	5.2	6.2	7.1	8.3	9.2	52	27
11	1.2	2.2	3.2	4.2	5.1	6.3	7.1	8.1	1.2	2.2	3.2	4.4	5.3	6.1	7.2	8.4	9.1	55	24
12	1.4	2.2	3.2	4.2	5.2	6.2	7.2	8.2	1.4	2.2	3.3	4.4	5.2	6.1	7.2	8.4	9.1	53	33
13	1.1	2.1	3.3	4.2	5.2	6.2	7.2	8.2	1.2	2.3	3.2	4.4	5.2	6.1	7.2	8.3	9.1	51	24
14	1.3	2.1	3.3	4.2	5.2	6.1	7.2	8.2	1.2	2.3	3.2	4.4	5.3	6.1	7.2	8.3	9.1	46	28
15	1.1	2.1	3.2	4.2	5.2	6.3	7.2	8.2	1.4	2.3	3.2	4.4	5.3	6.2	7.1	8.2	9.1	48	31
16	1.3	2.2	3.2	4.2	5.1	6.1	7.3	8.1	1.4	2.3	3.2	4.4	5.2	6.1	7.2	8.2	9.2	46	28
17	1.3	2.2	3.3	4.2	5.1	6.2	7.1	8.1	1.2	2.3	3.2	4.4	5.2	6.1	7.1	8.1	9.1	55	27
18	1.1	2.2	3.3	4.2	5.1	6.3	7.2	8.2	1.4	2.3	3.3	4.4	5.2	6.2	7.1	8.1	9.2	45	33
19	1.3	2.1	3.2	4.2	5.1	6.2	7.2	8.2	1.3	2.3	3.2	4.4	5.1	6.2	7.2	8.1	9.2	48	27
20	1.2	2.2	3.2	4.2	5.2	6.2	7.3	8.2	1.2	2.3	3.2	4.4	5.3	6.2	7.1	8.1	9.2	48	25
21	1.4	2.1	3.3	4.2	5.1	6.1	7.2	8.2	1.4	2.2	3.3	4.4	5.2	6.2	7.1	8.2	9.1	48	29
22	1.3	2.2	3.3	4.3	5.2	6.2	7.1	8.2	1.4	2.3	3.3	4.4	5.2	6.1	7.2	8.2	9.1	48	27
23	1.2	2.1	3.2	4.2	5.1	6.3	7.2	8.2	1.4	2.3	3.2	4.4	5.3	6.2	7.2	8.2	9.1	45	30
24	1.3	2.2	3.3	4.2	5.1	6.2	7.3	8.2	1.2	2.3	3.3	4.4	5.2	6.1	7.2	8.4	9.2	47	28
25	1.2	2.1	3.2	4.2	5.2	6.3	7.1	8.2	1.3	2.3	3.2	4.4	5.2	6.1	7.1	8.3	9.2	54	31
26	1.4	2.2	3.3	4.2	5.2	6.1	7.3	8.2	1.4	2.3	3.2	4.4	5.2	6.1	7.2	8.3	9.1	48	24
27	1.3	2.1	3.2	4.2	5.1	6.2	7.2	8.2	1.2	2.1	3.2	4.2	5.3	6.1	7.1	8.1	9.2	45	31
28	1.3	2.1	3.2	4.2	5.2	6.2	7.2	8.2	1.4	2.3	3.3	4.4	5.2	6.1	7.2	8.2	9.2	49	29
29	1.3	2.2	3.3	4.2	5.2	6.2	7.2	8.2	1.3	2.1	3.2	4.1	5.2	6.2	7.2	8.3	9.1	51	32
30	1.2	2.2	3.3	4.2	5.1	6.3	7.2	8.2	1.2	2.3	3.2	4.4	5.2	6.2	7.1	8.4	9.1	49	31

APPENDIX XIX

PHOTOGRAPHS DURING DATA COLLECTION

xlv

INTRODUCTION

Background of the study

"Work out to work up"

"Move to live and live to move"

-Toni Sorenson

Musculoskeletal conditions are prevalent and pervasive**.** They constitute the most common cause of long term pain and physical disability. They affect millions of people globally. The Ontario health survey (1990) says, musculoskeletal conditions cause 40% of all chronic conditions, 54% of all long term disability. The prevalence is higher among women and increases markedly with age.

They constitute the main cause of disability among older age groups. Moreover, these give rise to pain and physical disability which alter the quality of life. The increasing number of old persons and changes in life style throughout the world find larger occurrence of musculoskeletal conditions. This has been approved by WHO and United Nations with their endorsement of Bone and Joint decade 2000-2010. Worldwide estimates are that 9.6% of men and 18% of women aged > 60 years have osteoarthritis.

Many of the functional problems experienced by the older adults are related to changes in the musculoskeletal system .Osteoarthritis (OA) is a common disease found among aged persons and one of the leading causes of disability. Incidence of knee OA is rising with increasing average age of general population.

In addition to that, Obesity, sedentary work, lack of exercises and trauma to joint have been linked to increased risk of Osteoarthritis. Joint-level factors such as injury, malalignment and abnormal loading of the joints may also contribute to musculoskeletal problems.

OA is one of the causes of disability in the world. The effects of musculoskeletal changes may range from mild discomfort to severe, chronic pain and immobility due to arthritis. This arthritis tends to occur in the hand joints, spine, hips, knees, and great toes. The lifetime risk of developing OA of the knee is about 46 percent, and the lifetime risk of developing OA of the hip is 25 percent, according to the Johnston County Osteoarthritis Project.

The knee joint is one of the strongest and most important joints in the human body. It allows the lower leg to move relative to the thigh while supporting the body's weight. Movements at the knee joint are essential for many everyday activities, including walking, running, sitting and standing. Knee stability and pain-free range of motion are important in going through daily routine without any specific problem.

Individuals with osteoarthritis of the knee often complain of joint pain, stiffness, and difficulty in purposeful movement. It is responsible for activity limitations, particularly walking and affects the quality of life. It is imperative to make the patient as active as possible with retarded demineralization resulting from disuse or extended immobilization. The aim of the treatment is to provide pain relief and improve the patient's functioning.

The therapeutic goals of osteoarthritis (OA) treatment are to improve joint mobility and reduce pain. Treatment options include exercise, weight reduction, physiotherapy, analgesics, anti-inflammatory drugs, intra-articular steroids and hyaluronic acids, arthroscopic surgery, and, in severe cases, total joint replacement with follow-up rehabilitation.

Total joint replacement surgery (TKR) is an effective intervention used increasingly for severe hip and knee osteoarthritis. Approximately 80% of patients are highly satisfied with the outcome. More women than men undergo knee replacement with most patients between 55 and 84 years old.

However, it is common for patients to experience difficulty in maintaining mobility and functional status after surgery. Functional status prior to TKR is a major predictor of outcome after the intervention. The individual maintains a higher level of functional outcome and recover rapidly in the rehabilitation process through increased physical activity prior to an anticipated orthopedic surgery. Thus, improving functional ability before the surgery plays a vital role in the outcome of patients in the post-operative stage. An exercise program is an essential part of the treatment for patients with musculoskeletal problems in both medical and surgical interventions

Regular exercises to restore knee mobility and strength and a gradual return to everyday activities are important for the patient's complete recovery. Patients who maximize leg strength prior to surgery experience increased rate of regaining functional ability in the post-operative period. The number of hours spent in post-operative rehabilitation can be decreased by taking time to exercise before surgery. Strength training is a type of physical exercise specializing in the use of

resistance for inducing muscular contraction which builds muscle strength, tendon and ligament strength and improve the function of the joints.

EULAR (European League against Rheumatism, (2000) recommendations bring out the importance of exercise as an effective treatment in reduction of pain and improvement of function in patients with moderate to severe knee osteoarthritis. They recommended exercises, especially those directed towards increasing the strength of the quadriceps and/or preserving normal mobility. Similarly, the OARSI (Osteoarthritis Research Society International, 2008) endorses the benefits of exercises in patients with knee Osteoarthritis, both on pain reduction and functional improvement.

This study helped the researcher to give appropriate findings in the clinical setting as evidence based practice for improving functional recovery after TKR by practicing pre-operative strengthening exercises. This study also helped to highlight the importance of exercises prior to surgery by creating awareness among nurses and patients and provide the much needed satisfaction.

Need for the Study

The prevalence of Osteoarthritis increases with age due to its irreversible nature. A bulletin of WHO (2003) reported that men < 45 years were affected than women whereas women > 55 years were frequently affected. OA is the sixth leading cause of years of living with disability at the global level. Rheumatoid arthritis is also a cause for musculoskeletal conditions leading to disability and associated with reduced life expectancy, particularly in patients with severe forms.

Approximately 50 million U.S. adults have physician-diagnosed arthritis. As the condition progresses, arthritis patients often require THR and/or TKR for maintaining mobility and quality of life. Nearly a million elective total knee and hip replacements are performed annually in the United States. During the past 20 years, total knee replacement surgeries have tripled and are projected to increase further. More than 90% of total knee replacements are performed for knee osteoarthritis, which affects approximately 14% of adults in the United States in their lifetimes. Moreover, patients with advanced knee osteoarthritis frequently become homebound prior to introduction of total knee replacement during 1970s. In contrast, now such patients are able to take up activities of daily living without any assistance after the introduction of TKR as reported in The New England journal of Medicine (2015).

The New England journal of Medicine also states that the number of total knee replacements performed each year in the United States has increased dramatically, from 31.2 per 100,000 person-years during the period 1971–1976 to 220.9 during the period 2005–2008. More than 670,000 total knee replacements were performed in the United States in 2012. The number of total knee replacements is expected to increase as the average age of the population increases highlighting the associated future economic burden.

The number of THRs is expected to grow by 174 percent (572,000 patients) during the period 2005 to2030 and TKRs by 673 percent (3.48 million). In recent years, the length of hospital stay following surgeries has decreased from an average of 9.1 days in 1990 to 3.7 days in 2008, while the cost of post-acute care in skilled nursing facilities and home health agencies has skyrocketed.

Osteoarthritis which is the most prevalent form of arthritis and the leading cause of disability in India affects over 15 million Indians each year. About 20 years ago, osteoarthritis was known as a disease of the elderly affecting those above 65. Presently, younger persons in the age group of 35 – 55 may have been diagnosed to have OA. This could be attributed to this trend in India including growing obesity, sedentary lifestyle, changing dietary habits and deficiency of vitamin D.

One of the earliest study community oriented program for the control of rheumatic diseases (COPCORD) was conducted in1996 on the Musculoskeletal disorders in India was carried in Village Bhigwan under the aegis of ILAR/ APLAR. The incidence of MSD was 12.8% among the 6034 screened villagers. The study also revealed that in almost one third of the patients (34%) with a Symptom-Related-Diagnosis while degenerative disorders (29%) and soft tissue rheumatism (20%) were seen. Inflammatory arthritis (11%) and Rheumatoid arthritis (4%) in particular were observed. The study speculates rheumatologic burden of India.

According to ICMR (2011), a study conducted on Rheumatic musculoskeletal disorders in the Urban Region of Pune, India, using the COPCORD Bhigwan Model, found the prevalence of musculoskeletal disorders to the extent of 14.1%.

Despite their enormous impact worldwide, MSDs do not receive the due attention due to perception of being less serious and unlike cardio-vascular diseases, other neurological diseases, AIDS, and Cancer, which are largely

considered fatal while the MSDs are considered, nonfatal but just chronic and were seen as a natural consequence of ageing.

There have been patients who returned to strenuous activity and walking more than a mile in a day after a total knee replacement with no significant restrictions of normal routine activities following knee replacement. Patients can even return to sports after TKR.

Getting stronger beforehand enables an easier time in post-surgery rehabilitation and physical therapy. When muscles are not in use, they become weak and do not perform well in supporting and moving the body. Having joint replacement surgery can correct the joint problem while regular exercise programs to strengthen the muscles and properly support the joint. So, preoperative strengthening exercises are emphasized for stabilizing the knee joint before surgery.

A randomized clinical Trial of Total Knee replacement was conducted by Soren & Ewa (2015) among patients who were eligible for TKR between surgical and non-surgical treatment. They conclude that the total-knee-replacement group had a significantly greater improvement in the $KOOS_4$ score and all the five subscales of KOOS than did the nonsurgical-treatment group. So, TKR is considered to be an effective treatment for knee osteoarthritis. Moreover, the patients underwent had a fewer adverse events like DVT and stiffness than nonsurgical-treatment group. Hence, there is need for patients progressing to surgical management participating in supervised exercise program before surgery for a faster post-operative recovery.

Pain and suffering from end-stage degenerative joint disease of the knee compromises a patient's ability to maintain gainful employment while TKR is successful in keeping the patient active. Getting a patient back to work not only gives him a sense of fulfillment, but also is economically beneficial to society. Ninety-eight percent of total knee replacement patients who were incapacitated during illness returned to work after surgery, 89 percent of them returned to their previous position based on a study presented at the 2013 Annual Meeting of the American Academy of Orthopedic Surgeons (AAOS).

Patients with joint replacement surgery have impaired balance and movement control. They were compelled to use assistive devices after surgery. Best fitness before undergoing a TKR surgery is an important requirement. This makes the recovery much faster and easier. It is very important to strengthen the entire body, not just the leg. Doing pre surgery exercises for knee surgery can speed up recovery and reduce the need for inpatient rehabilitation after surgery up to 73%, according to Wright (2012). He states that 50% of the outcome success was due to the patient's commitment to recovery starting with pre-habilitation.

Hence, appropriate physical activity is imperative for anyone with osteoarthritis, and it can significantly improve the outcome of a joint replacement operation. Patients who follow a program of exercise and rehabilitation, both before and after their surgeries, far better than those who do not resort to exercises but place very little stress on the joint.

A study conducted by Snow & Granata (2014) inferred patients receiving pre-operative physical therapy showed a 29 percent reduction in post-operative care. The data were analyzed from Medicare claim in USA, reported that 54.2

percent of the pre-operative physical therapy group required post-operative care services, compared to 79.7 percent of the patients who did not have pre-operative therapy. The decline in post-operative care services also resulted in cost reduction for each patient. Studies found post-op exercises improved the functional activities of daily living, walking, quality of life, muscle strength, and range of motion in the knee joint. Despite, joint replacement having excellent technical outcomes; significant variation in patient-reported functional improvement post-surgery does exist. The increasing use of TKR in the aging population makes to find strategies that maximize functional outcomes. In that, pre-operative strengthening exercises play a part in rehabilitation.

Functional status prior to TKR is a major predictor of outcome after the intervention. There is a significant increase in the functional status in the patients who have undergone TKR. Training in physical exercises results shows significant improvement in the functional outcome of the knee joint.

During the clinical experience, the researcher had come across patients after TKR surgery performing post-surgery rehabilitation exercises. Pain at the surgical site impairs their attention despite familiarity with the exercises. This creates difficulties for the patients in understanding and performing during post-operative period. Teaching exercises before surgery improves readiness to learn and practice in pre and post-operative period, in turn, strengthens the muscles. Hence, the researcher has under taken this study for assessing the effectiveness of exercises taught before surgery on functional capacity.

Statement of the Problem

An Experimental Study to Assess the Effectiveness of Pre-operative Strengthening Exercises on Functional Outcome of Patients with Total Knee Replacement Surgery at Apollo Hospitals, Chennai.

Objectives of the Study

1. To assess the level of functional outcome between the control   and the experimental   groups of patients after Total Knee Replacement Surgery

2. To determine the effectiveness of pre-operative strengthening exercises on functional outcome by comparing the control and experimental groups of patients after Total Knee Replacement Surgery

3. To assess the   level of   satisfaction of patients on pre-operative strengthening exercises among experimental group of patients after Total Knee Replacement Surgery

4. To find out the association between selected demographic variables and functional outcome among the control and the experimental groups of patients after Total Knee Replacement Surgery

5. To assess the association between selected clinical variables and functional outcome of patients among the control and the experimental groups of patients after Total Knee Replacement Surgery

Conceptual and operational Definitions

Effectiveness

The degrees to which objectives are achieved and the extent to which targeted problems are solved.

In this study, effectiveness refers to improvement in functional ability in patients after Total Knee Replacement surgery, as measured by WOMAC scale with sub-scales on pain, stiffness and physical function.

Pre-operative Strengthening Exercises

Exercises used for fortifying the strength of the muscles which are taught before surgery and practiced before and after surgery to avoid undue stress on the surgical site.

In this study, exercises such as ankle pumps, quad sets, heel slides, gluteal sets, short arc quads, abduction and adduction, wrist flexion, arm chair push-ups, shoulder extension, elbow flexion, wall push-up were demonstrated for half an hour along with video imagery two weeks prior to the scheduled date of the surgery. The researcher encouraged the patients to perform these exercises and observed their performance. Also, patients were explained the importance of exercises and asked to practice thrice a day to strengthen the muscles which can be practiced post-operatively for early recovery. This was ensured by asking patients prior to surgery.

Functional Outcome

It is a measurable goal that helps a patient to perform specific activities of daily living at ease without any discomfort.

In this study, functional outcome was assessed in terms of pain, stiffness and physical function such as walking, sitting, standing, getting on and off to toilet etc, by WOMAC with subscales on pain, stiffness and physical function on 5th POD and 6 weeks after surgery.

Pain is defined as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage"

Stiffness refers to the symptom of loss of range of motion or the sign of reduced range of motion.

Physical function explains the capacity to undertake awide range of tasks of daily living such as sitting, standing, getting in/ out of bath.

Assumptions

▸ Total Knee replacement surgery patients encounter difficulty in mobility in early post-operative period.

▸ Total knee replacement surgery reduces the activities of daily living in early post-operative period.

▸ Total Knee Replacement surgery patients require assistive devices for their mobility in early post-operative period.

▸ Use of assistive devices require muscle strength of arms and legs.

▸ Pre-operative strengthening exercises improve functional mobility.

Null Hypotheses

H_{O1}- There will be no significant difference in the functional outcome with pre-operative strengthening exercises between the control and the experimental groups of patients after Total Knee Replacement Surgery

H_{O2}- There will be no significant association between selected demographic variables and functional outcome of patients among the control and the experimental groups of patients after Total Knee Replacement Surgery

H_{O3}- There will be no significant association between selected clinical variables and functional outcome of patients among the control and the experimental group of patients after Total Knee Replacement Surgery.

Delimitation

This study is limited to patients who were scheduled for Total Knee Replacement Surgery.

Conceptual frame work

The conceptual framework deals with the interrelated concepts that are assembled together in some rational schemes by virtue of their relevance to a common theme. (Polit & Beck, 2012). The major concepts identified in this model are King's Goal Attainment theory (Martha, 2013). According to Imogene king, nursing is defined as a process of action, reaction and interaction where nurse and clients share information about their perception. Through perception and communication, they identify problems, which helps them in setting goals and take necessary actions. King Goal Attainment theory is based on the concepts of

personal, interpersonal and social systems including perception, judgment, action, reaction, interaction and transaction and perception.

Perception

A person imports energy from the environment and transforms, processes and stores it. The study assumes that there is interpersonal relationship between the nurse, investigator and participants. The Nurse investigator perceives that there is a need to strengthen the muscles by exercising before surgery which favors patient to ambulate after TKR surgery, in turn, promotes functional independence.

Judgment

Judgment refers to analyze the areas of action to be carried out. In this study the nurse investigator judges that pre-operative strengthening exercises for the betterment of functional outcome in patients after TKR surgery. Thus the researcher takes decision to implement the teaching exercises along with video imagery.

Action

Individual exports the perceived energy, as demonstrated pre-operative strengthening exercises along with video imagery by taking mental or physical activity. The nurse investigator observed the performance of doing exercises to maximize functional independence.

Reaction

Reaction is the experience or outcome that is expected as a part of goal attainment. The pre-operative strengthening exercises in experimental group

clients were highly satisfied. The nurse investigator emphasized the importance of performing exercises thrice a day. Also, the investigator makes arrangement for disseminating the information regarding pre-operative strengthening exercises, in turn, the patients were benefited.

Interaction

It refers to verbal and non-verbal behavior between an individual and the environment or among two or more individuals. It involves goal directed perception and communication. Actions lead to interaction where the nurse investigator executes her pre-operative strengthening exercises and observed the performance of exercises to improve functional capacity for the patients after TKR.

Transaction

Imogene king says that transaction occurs when two individuals mutually identify goals and means to achieve them. They reach an agreement about how to attain these goals and these about to realize them. In this study, subjects from the experimental group showed high level of satisfaction in performing exercises, reduction of pain, increased functional capacity and developed no complications.

Feed back

Outcome may either be satisfactory or unsatisfactory. Satisfactory shows the effectiveness of pre-operative strengthening exercises by reduction functional outcome scale of difficulty in pain, stiffness and physical function. The activity is planned again for unsatisfactory results. In this study, investigator appraise the level of satisfaction about pre-operative strengthening exercises through rating

scale, if the therapy is satisfactory it can be disseminated and to the control group too. If unsatisfactory the activity is planned again or other best method is adopted.

Projected Outcome

The study will be helpful to improve functional outcome of patients after TKR, in turn, obtains evidence for the nurse in promoting functional ability of the patients after TKR.

CLIENTS

Perception: Perceives pain and decreased physical function

Judgment: Pre-operative strengthening exercises maximize physical function and reduces pain

Action : Measures required to reduce pain & improve physical function

Reaction:
In control group – Standard care
In experimental group –
Demonstration of pre-operative strengthening exercises along with video imagery

Interaction:
In control group – Standard care
Experimental group - Observes the performance of pre-operative strengthening exercises strengthens muscles used for mobilization

Transaction: Performance of exercises & outcome Assessment - Pain, Stiffness, Physical function

NURSES

Action: Control group (no preoperative strengthening exercises)
Experimental group -Demonstration of pre-operative strengthening exercises with video imagery)

Judgment: Pre-operative strengthening exercises were required to strengthen muscles used for mobilization

Perception: Perceives pain & decreased physical function

Control group – Standard care

Experimental group – Pre-operative strengthening exercises

Standard care

Patient performs strengthening exercises before TKR

Unsatisfactory - No reduction in pain and improvement in physical function

Satisfactory- Reduction in pain and improvement in physical function

Figure.1 Conceptual framework based on Kings Goal Attainment Theory (Martha, 2013)

17

Summary

This chapter has dealt with the background of the study, need for the study, statement of the problem, objectives, operational definitions, hypotheses, assumptions, delimitations and conceptual framework.

Organization of the Report

Further aspects of the study are presented in the following five chapters.

Chapter – II : Review of literature

Chapter – III : Research methodology includes research approach, research design, setting, population, sample and sampling techniques, tool description, content validity and reliability of tools, pilot study, data collection procedure and plan for data analysis

Chapter – IV : Analysis and interpretation of data

Chapter – V : Discussion

Chapter – VI : Summary, conclusion, implications and recommendations.

CHAPTER II

REVIEW OF LITERATURE

The task of reviewing research literature involves the identification, selection, critical analysis and written description of existing information existing in the topic of interest. In this chapter, an attempt is made to bring out the available literature which helped in projecting the widened perspective of the study.

- **Literature related to Osteoarthritis**
- **Literature related to patients after TKR**
- **Literature related to the effectiveness of pre-operative strengthening exercises after TKR**

Literature related to Osteoarthritis

Lewek & Rudolph (2004) conducted a study for determining quadriceps femoris muscle weakness and activation failure in patients with symptomatic knee osteoarthritis. Muscle weakness was assessed using maximum voluntary isometric contractions (MVIC), Voluntary activation was tested by superimposing a train of electrical stimulation on a maximal effort volitional contraction of the quadriceps muscle. The patients with knee OA had significantly less quadriceps strength relative to body mass index (BMI) than the control group (p=0.010). This finding of the study supported the requirement of rehabilitation of weakened quadriceps through activation of muscle groups using various methods in patients with knee osteoarthritis.

A systematic review was conducted by Marita & Smith in 2014 for estimating the global burden of hip and knee osteoarthritis as part of the Global Burden of Disease 2010. The conclusion was that hip and knee OA was ranked as the eleventh highest contributor to global disability out of 291 conditions and 38th highest in DALYs. The global age-standardized prevalence of knee OA was 3.8% and hip OA was 0.85% with no discernible change between 1990 and 2010. Prevalence was higher in females than males. Year lost Disability (YLD) for hip and knee OA increased from 10.5 million in 1990 to 17.1 million in 2010.

A systematic study of literature for the period from from 2000 to 2012 conducted by Gouttebarge & Inklar(2014) for investigating to ascertain previous injury being a risk determinant for knee and ankle osteoarthritis informer professional football players. It was concluded that no studies inferred that injury as a risk determinant.

A cross sectional study was conducted by Prakash & Abhijit (2013) for locating the prevalence of Knee Osteoarthritis in the Indian Population. It was done across five sites, namely, Pune, Agra, Bangalore, Kolkata and Dehradun. The overall prevalence of Knee Osteoarthritis was 28.7%. The prevalence in Agra was 35.5% and26.6% in Bangalore. The prevalence in Kolkata, Dehradun, and Pune were (33.7%, 27.2%, 21.7%) respectively. The prevalence was higher in villages (31.1%) and big cities (33.1%) as compared to towns (17.1%) and small cities (17.2%).

Kumar & Gupta (2014) conducted a retrospective study on the rate of TKR surgeries in Military health care Institution, India. They concluded that 37 TKRs were performed in the period 1997 to 2002, as compared to 800 during 2007-

2012, denoting 20 times multifold. During 1997-2002, the mean age was 62.6 years (SD-9.224) compared to 65.8 years (SD-7.05). Higher level of awareness, education levels and acceptability of the procedure resulted in rise the rate of TKR. They inferred the rate of TKR as marginally higher amongst women as compared to men.

Plotnikoff & Karunamuni (2015) conducted a study for investigating the prevalence of self-reported knee and hip osteoarthritis stratified by age and sex and in association with modifiable factors. The study was conducted in Canada using randomly sampled data. It reveals significant differences in prevalence for males and females, being obese (BMI $>30\,kg/m^2$) was significantly associated with the prevalence of knee and hip OA. Individuals who stand or walk a lot, but do not carry or lift things during their occupational activities were 2.0 times less likely to have hip OA. It was 1.9 times lower in individuals consuming recommended or higher vitamin C intake to have hip OA.

A randomized study was conducted by Alkatan & Baker (2016) for evaluating the effect of swimming exercises compared with land based cycle training on joint pain, stiffness, and physical function in patients with osteoarthritis. Supervised exercise training was performed for 45 minutes/day, 3 days/week for 12 weeks. After the exercise interventions, there was significant reduction in joint pain, stiffness, and physical limitation accompanied by increases in quality of life ($p < 0.05$) in middle aged and older adults with OA. Similar benefits were seen in the pattern of both the exercises.

Atukorala & Makovey (2016) have examined the relationship between weight reduction and pain and functional improvement in persons with

symptomatic knee osteoarthritis participating in 18 week long community-based weight reduction program named Osteoarthritis Healthy Weight for Life. The enrolled participants are 1383 (71% females) and mean BMI was 34.4 (5.2) with 82% of participants obese at baseline. Achievement was 1304 persons (94%) achieved a > 2.5% reduction in body weight. The participants were assessed at baseline, 6 and 18 weeks for body weight and Knee Injury and Osteoarthritis Outcome Score (KOOS) subscales. This study confirmed weight reduction as a therapeutic intervention in KOA. The study recommended that participants were required to have weight loss ≥ 7.7% (95% CI 5.2-13.3) for achieving a minimal clinically improvement in function.

Seltan, Vriezekolk & Geenam(2016) have conducted a qualitative study for identifying the reasons for the specific choice of treatment in patients with hip or knee OA. Semi-structured in-depth interviews were held with 24 patients with OA. It was inferred that four themes had been involved in decision making in treatment modality. They were treatment characteristics such as accessibility, expectations about its effectiveness and risks, personal investment in terms of money and time, personal characteristics such as age, body weight, co morbidities and previous experience with a treatment and support and advice from the patient's social environment and healthcare providers.

Burnett & Kontulainen (2016) conducted a study for finding the differences in patellar sub chondral bone mineral density (BMD) between knee osteoarthritis patients with differing levels of pain at rest. Patients anticipating for Knee replacement were investigated. The groups were differentiated as mild to no pain and moderate to severe pain with WOMAC pain

score. BMD was measured by Quantitative computed tomography (QCT). This study identified that patients with high levels of pain at rest had reduced amounts of patellar density prior to TKR.

Literature related to patients after TKR

A Systematic analysis published in Health Quality Ontario (2005) inferred the effectiveness of TKR in terms of pain reduction and functional improvement for whom less invasive treatments had failed. Studies were examined from COCHRAINE data base, MED LINE, EMBASE, MED SCAPE with percentage and standard deviation of pre-operative and post-operative outcome. It revealed that patients after TKR surgery for osteoarthritis had substantial improvements in terms of reduction of pain and improvement of function. The other 19 studies integrated patient's age, prostheses and techniques for implanting the device in assessing the outcome. In all, it was concluded that TKR was effective in reducing pain and improving physical function.

A qualitative study was conducted by Woolhead & Donovan(2005), to investigate the outcomes of total knee replacement. In-depth interviews were conducted with 25 patients 3 months before TKR, and 6 months after surgery. Interviews were audio taped and transcribed. Individuals reported their outcome from TKR as good despite the continued experience of pain and immobility.

A prospective cohort study was conducted by Hamel& Maria (2008) for examining clinical outcome and decision making ability of Joint replacement surgery in elderly patients with severe osteoarthritis of the hip or knee. About 174 patients were sampled with the mean age of 75 years. Patients aged 65-74 years had improved in WOMAC scores by 24 points while those who

had no surgery improved0.5 points in WOMAC. The WOMAC score in aged 75 or older patients had increased by 19 where as it was 0.3 points among patients who did not have surgery. It was reported that elderly people having had taken several weeks to recover while they had experienced excellent long-term outcome.

A study was conducted by Wylde & Blom(2008) for determining return to sport activities after taking up any one of five procedures, namely THR, TKR, hip resurfacing, unicompartmental   knee replacement or patellar resurfacing. A postal survey was completed among 2085 patients between one and three years after operation. A total of 446 (61.4%) had returned to their sporting activities by one to three years after surgery and 192 (26.4%) were unable to do so due to pain. The drop was in high-impact sports like badminton, tennis and dancing.

A study conducted in China by Cheng & Shi in 2010 about the methods and effects of rehabilitation exercises after single total knee replacement. The samples of 38 patients were followed up ranging from 6 to 12 months by using HSS knee score system. The mean scores were 40.22 +/- 7.39 before surgery, and 87.47 +/- 6.60 points after rehabilitation. The difference was statistically significant (t = 31.56, P < 0.01) indicating rehabilitation training after single total knee replacement as the key to ensure the effects of the operation.

A study was conducted by Kandel & Sajina (2010) with elderly patients in Jerusalem. There were 63 patients, with mean age of 73, who had total knee replacement and participated in follow-up evaluation after one year. The study measured static and dynamic balance with a new computerized system called the Balance Master. Success of Total knee replacement surgery in relieving pain and improving the function in patients with advanced knee arthritis was explained.

The surgery significantly improved dynamic balance among elderly patients too. This improved balance is a significant quality-of-life change in elderly patients.

Jain, Wasnik & Mittal (2013) conducted a prospective study for evaluating the safety of simultaneous bilateral total knee replacement among study subjects of 124 women and 26 men (mean age, 66 years) underwent simultaneous bilateral TKR for tricompartmental osteoarthritis. At the 2-year follow-up, the mean range of motion improved from 95º to 129º (p=0.032), the mean KSS from 120 to 158 (p<0.001), and the WOMAC from 51 to 88 (p=0.002). It was concluded that simultaneous bilateral TKR is safe for the patients rather than performing surgery at different times.

Osteoarthritis of the hip or knee is known to limit sexual activity. A research paper presented at the Annual Meeting of the American Academy of Orthopedic Surgeons (2013) found that total hip or total knee replacement (TKR) surgery improves sexual function in 90 percent of patients. The sexuality and sexual activity were significant components of evaluating the functional outcome of total hip and total knee replacement was emphasized by the investigator Jose.

Rasul & Irfan (2014) has conducted an observational study in Lahore, Pakistan for finding quality of life before and after TKR. Quality of life was assessed in physical and mental components at baseline and after 1, 3 & 6 months after TKR. Mean score for physical health component at 6 months increased from 20.18 to 91.12±6.27 and mental health component score increased from 28.25 to 81.21±7.48, respectively. TKR resulted in a continuous improvement of quality of life of the patients.

Goodman& Johnson, (2016) conducted a study for determining the effectiveness of TKR in terms of pain, physical function and quality of life inpatients diagnosed with OA and Rheumatoid Arthritis. They sampled 4456 of patients scheduled for TKR, including 136 patients with RA. RA TKR had significantly worse preoperative Western Ontario and McMaster Universities Osteoarthritis Index pain (55.9 vs 46.6, p < 0.0001) and function (58.7 vs 47.3, p < 0.0001 when compared OA. Patients with RA undergoing primary TKR had excellent 2-year outcomes despite worst preoperative pain and function. In this contemporary cohort study, RA is not an independent risk factor for poor outcomes.

Literature related to the effectiveness of pre-operative strengthening exercises after TKR

Swank & Kachelma (2011)conducted a study for as certaining pre-habilitation prepares patients for Arthroplasty. One group of patients was assigned to an exercise program consisting of light resistance training, flexibility and step exercise, and light walking. Pre-rehabilitation group were exercised thrice a week for four to eight weeks before knee replacement surgery. Patients in the comparison group received standard pre-operative care. Patients who went through the pre-habilitation program showed improvements in a week before surgery. In particular, they had a 10 percent increase in extension strength in the leg scheduled for knee replacement and less pain while performing the functional tests. It was concluded that exercise before knee replacement or pre-habilitation enables improved recovery after surgery. However, the study did not compare post-operative recovery, as pre-operative performance of functional tasks has been

shown to be a predictor of post-operative performance of functional tasks, as pointed out by Swank.

A systematic review with meta-analysis of randomized controlled trials was done by Wallis & Taylor(2011) on pre-operative interventions for persons with hip or knee osteoarthritis awaiting joint replacement surgery for determining its benefit before and after joint replacement. Twenty-three RCTs involving 1461 participants awaiting hip or knee replacement surgery were examined. Meta-analysis provided moderate quality evidence that pre-operative exercise interventions for knee osteoarthritis reduced pain and functional improvement prior to knee replacement surgery.

A randomized clinical trial conducted by Rosal & Ayers(2011) for finding strategies to maximize functional outcomes. Theory-based telephone-delivered patient Self-Management Support was delivered prior to surgery and continued up to 9 weeks post-TKR. Assessments were conducted at baseline, eight weeks, and six- and twelve- months using SF36 (Physical Component Score). Improvement in physical function was achieved (80%) with the self-management support system for ensuring adherence and independence in performing exercises. Hence, it was inferred that that pre-TKR intervention has the potential to change the paradigm for successful post-TKR care.

Wylde & Livesey(2012) conducted a study to appraise the participation of leisure activity after joint replacement. Structured telephone interviews were conducted with 56 patients who had total hip replacement and 60 total knee replacement patients before and a year after joint replacement. The leisure activities were categorized into sports/exercise, hobbies, social activities and

27

holidays. The study findings reported that THR patients rating 82% of leisure activities as difficult to perform before surgery due to joint problems, which decreased to 25% by a year after surgery. TKR patients rated 86% of leisure activities as difficult to perform which decreased to 32% after surgery.

Huber, de Bie & Roos (2013) conducted a randomized controlled trial to test the effect of a pre-operative neuromuscular training program versus an attention control program on lower extremity function before and after surgery. They conducted a study among 80 participants, aged between 55-90 years, who were scheduled for TKR. The intervention group received a minimum of 8 and a maximum of 24 training sessions plus 3 educational sessions Pre-operative neuromuscular training program whereas the control group received the 3 educational sessions only. Assessments were performed immediately after the interventions prior to surgery and repeatedly after surgery. The outcome chair Stand Test and knee function, pain were assessed with the self-reported Knee Injury and Osteoarthritis Outcome Score (KOOS) in intervals before surgery, at 6 weeks, 3 months and 12 months after surgery. The finding of the study indicated the outcome of significant improvement in pain and physical function in interventional group who received pre-operative neuromuscular training.

Dwyer & Thomas (2014) conducted a retrospective study to examine enhanced recovery program for total knee replacement in association with the length of stay in the hospital. It was explained that the length of hospital stay was significantly shorter in the enhanced recovery than non-ER groups in overall patients (6 vs. 7.8 days, p=0.0003).

Stenquis & Elman(2015) conducted a qualitative study on physical activity and experience of total knee replacement in patients one to four years after surgery in the Dominican Republic. Qualitative interview was conducted in the Spanish, and the English among 18 Dominican patients in which 78% women who received TKR about their level of physical activity after surgery. The transcripts were analyzed using content analysis. They found most of the patients after TKR increased their participation in physical activities in several life domains. The study revealed the potential of TKR to let patients to return to physical activities.

A randomized trial was conducted in 2015, by Piva & Moore to compare exercise treatment methods for patients after total knee replacement with the objective of comparing the outcomes of physical function and physical activity among three groups such as clinic-based individual outpatient rehabilitative exercise during 12 weeks, community-based group exercise classes during 12 weeks, and the wait listed control group with usual medical care. About 240 older adults after TKR were randomized at least 2 weeks prior into one of the three treatment approaches. Data were collected at baseline, 3 months, and 6 months. The wait-listed control group was randomized to one of the 2 exercise groups after 6 months of study participation, and completed a 9-month follow-up. The primary outcome of physical function was measured using the WOMAC physical function subscale. The study recommended that exercise programs improve physical function and activity in post TKR patients and help tailor interventions according with patients' characteristics.

A randomized control trial was conducted by Herbold & Bonistall (2014) on the effectiveness of continuous passive motion after total knee replacement as part of inpatient rehabilitation. Among 140 samples ,the group 1 (n=71) received the usual exercises lasting for 3 hours per day and group 2 (n=70) received the addition of daily use continuous passive motion therapy for two hours per day throughout the length of their stay. The outcome measures were the active knee flexion ROM, active knee extension ROM length of stay, estimate of function using the FIM and Timed Up and Go test, girth measurement, and self-reported Western Ontario and McMaster Universities Osteoarthritis Index scores. They inferred that all the patients significantly improved from admission to discharge in all above outcome measures.

Ngus, Cathrone & Chen (2015) conducted contemporary clinical trials to enable appraisal of the effectiveness of home based versus clinic based rehabilitation in which participants were subjected to pre-operatively randomizing in either the Wi-Fi group or usual rehabilitative care group. Outcomes were assessed pre-operatively, 6-weeks after surgery and then at 18 weeks, 6 months and 1 year with WOMAC total score. It was concluded that this affordable technology could be used by many patients to rehabilitate at home to optimize the outcomes and to decrease the need for clinic-based or outpatient therapy from total knee replacement surgery. Hence, Tele-rehabilitation shows promising future in the postoperative management after total joint replacement.

Summary

This chapter has dealt with a review of literature related to the problem stated. It has helped the researcher to understand the impact of the problem understudy. There are 25 primary sources and 5 secondary sources obtained from journals and websites. It has helped the researcher to develop tools, collect, organize and analyse the data.

CHAPTER - III

RESEARCH METHODOLOGY

The methodology of research study is defined as the processes involved in collecting information from participants for the purpose of answering the research questions or analyze the research problem. It enables the researcher to project a blue print for the research undertaken. Research methodology involves a systematic procedure by which the researcher had a start from the initial identification of the problem to find its conclusion.

This chapter provides a brief description of the different steps undertaken by the researcher for the study. It involves research approach, research design, setting, population, sample and sampling technique, sampling criteria, selection and development of the instruments, validity and reliability of instruments, pilot study, data collection procedure and plan for data analysis.

The present study was conducted for assessing the effectiveness of pre-operative strengthening exercises on functional outcome of patients after Total Knee Replacement Surgery.

Research Approach

Research approach is the most significant part of any research. The appropriate choice of research approach depends on purpose of research study which is undertaken.

According to Polit and Beck (2012) experimental research is an extremely applied form of research and involving in finding out how well a program,

product, practices or policy is working. Its goal is to assess or evaluate the success of the program.

An experimental research is generally applied where the primary objective is to determine the extent to which a given treatment meets the desired results.

Experimental approach was considered most appropriate for accomplishing the objective of the study, since the researcher wanted to assess the effectiveness of pre-operative strengthening exercises on functional outcome of patients after TKR.

Research Design

According to Polit and Beck (2012), a research design is the overall plan for addressing research questions, including specification for enhancing the integrity of the study.

Quasi experimental design was used for the study. The design has the characteristics features as manipulation and control and randomization. A group of 30 samples assigned in the control and experimental groups by purposive sampling. Pre-operative strengthening exercises along with video imagery were demonstrated as manipulation to the experimental group.

In this study, Quasi experimental study in which posttest only design with time series was adopted.

$$O_1 \quad O_2$$

$$X \quad O_1 \quad O_2$$

- X - Pre-operative strengthening exercises

- O_1 - Assessment of functional outcome on 5th POD

- O_2 - Assessment of functional outcome 6 weeks after surgery

Intervention Protocol

Pre-operative strengthening exercises start with the non-affected leg to facilitate the bilateral transfer effect of motor learning. Exercises such as ankle pumps, quad sets, heel slides, gluteal sets, short and long arc quads, abduction and adduction, wrist flexion, arm chair push-ups, shoulder extension, elbow flexion, wall push-up were demonstrated for half an hour along with video imagery two weeks before the scheduled date of surgery. Patients were asked to perform the exercises and observed by the researcher. In addition, patients were explained the importance pre-operative strengthening exercises and the need to practice thrice a day to facilitate to do post-operatively. It was ensured by asking the patients prior to surgery. Post-operative assessment of functional outcome was done by WOMAC scale includes pain, stiffness and physical mobility on 5th POD and 6 weeks after surgery.

Variables

Independent variables

An independent variable is the variable that is believed to be the cause influencing the dependent variable which can be chosen and manipulated. It usually has an effect on the dependent variable.

In this study, independent variable is pre-operative strengthening exercises. Movement starts with the non-affected leg to facilitate the bilateral transfer effect of motor learning. Exercises were mainly performed in closed kinetic chains in the lying, sitting or standing position for achieving muscular co-activation in an appropriate position of the joints with hip, knee and foot well aligned. Exercises such as ankle pumps, quad sets, heel slides, gluteal sets, short arc quads, abduction and adduction, wrist flexion, arm chair push-ups, shoulder extension, elbow flexion, wall push-up were demonstrated for half an hour along with video imagery two weeks before the scheduled date of surgery. The performance of exercises was observed, the importance of exercises was explained and patients were asked to practice thrice a day for facilitating early recovery post operatively. It was ensured by asking the patients prior to surgery.

Dependent variables

The variable hypothesized to depend on or be caused by another variable is the dependent variable. (Polit& Beck 2012).A dependent variable is what is to be measured in the experiment. The dependent variable responds to the independent variable. It is called dependent because it "depends" on the independent variable.

In this study, the dependent variable is functional outcome and assessed after surgery by WOMAC scale that includes sub scales on pain, stiffness and physical mobility in 5th POD and 6 weeks after surgery.

Attribute variables

An attribute variable is a variable that cannot be manipulated or any characteristic that is inherent or pre-programmed and cannot be altered.

In this study, demographic variable proforma and clinical variable proforma of Total Knee replacement surgery are attribute variables. Demographic variables were age, gender, education, marital status, type of family, nature of work, monthly family income and dietary habits. Clinical variables were co-morbidity, previous history of surgery within 5 years, Body Mass Index, history of trauma, duration of OA, frequency of exercises, duration of exercise, duration of knee pain in 24 hours and medication taken for pain

Setting of the Study

The settings are the specific places where data collection is done. The study was conducted in the 1200 bedded multi speciality Apollo hospitals at Greams Road, Chennai. Apollo Main hospitals at Greams Road have a 10 bedded post-operative ward for orthopedics and a total of 100 beds for orthopedic patients with an average of 4 to 5 patients per day come for TKR.

Population

A Population is a complete set of persons or objects that possess some common characteristics that is of interest to the researcher. In this study, interventions were given to patients who were expected to have Total Knee replacement surgery.

Target population

In this study it was the patients who were scheduled for Total Knee replacement surgery during data collection.
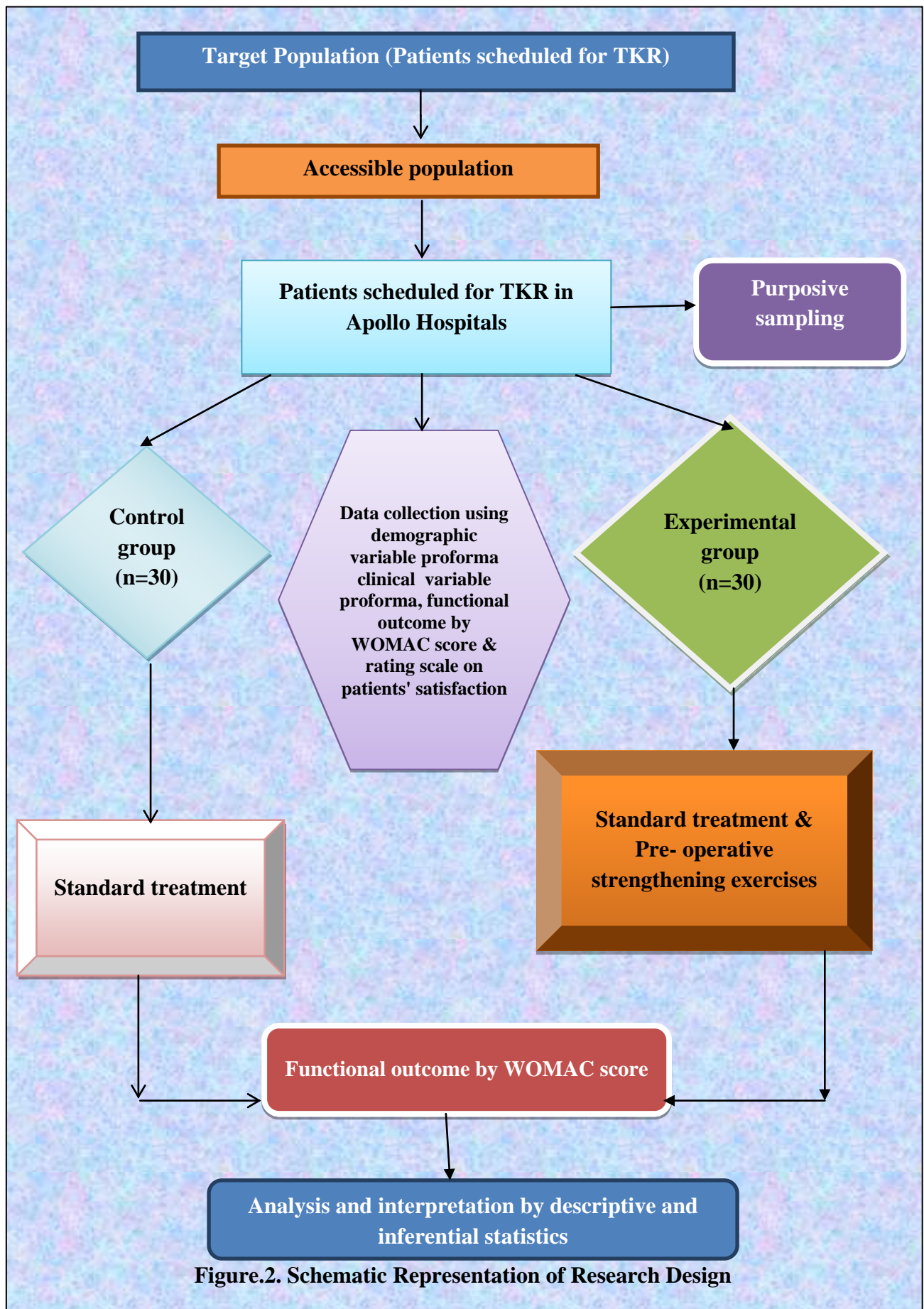
Figure.2. Schematic Representation of Research Design

Accessible population

In this study, accessible population includes male or female patients who were scheduled for Total Knee replacement surgery that satisfies the inclusion criteria at Apollo Hospitals, Chennai.

Sample

Sample is a subset of population selected for participation in a study (Polit and Beck 2012). A sample consists of patients scheduled for Total Knee joint replacement surgery in Apollo hospitals, Chennai who satisfied the inclusion criteria.

Sample size

The sample of this study consisted of 30 experimental and 30 control groups of patients who were scheduled for Total Knee Replacement surgery.

Sampling Technique

Sampling is the process of selecting a portion of the population to represent the entire population (Polit and Beck, 2012)**.** Purposive sampling technique was adopted for this study. Purposive sampling is also known as judgmental sampling in which the researcher chooses the sample based on who she thinks would be appropriate for the study.

In this study, the researcher selected the patients in the outpatient department, Apollo Hospitals. Patients who attended physician's clinic in the morning and posted for TKR after 2 weeks as the experimental group and other patients who attended physician's clinic in the evening and posted for TKR after 2 weeks considered as the control group.

Inclusion criteria

- Patients aged between 41 – 80 years

- Patients who were scheduled for Total Knee Replacement Surgery

- Patients who were willing to participate in the study.

Exclusion criteria

- Patients with sensory perceptual alterations.

- Unconscious patients

- Patients with acute pain at the time of data collection

Selection and development of study instrument

The present study was based on evaluating the effectiveness of pre-operative strengthening exercises on the functional outcome of patients after TKR surgery in Apollo Hospitals, Chennai. So, the data collection tools were developed through an extensive review of literature in consultation with experts and faculty. In this study, to assess the effectiveness of pre-operative strengthening exercises, the following tools were used.

➢ Demographic variable proforma

➢ Clinical variable proforma

➢ The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

➢ Rating scale on Level of Satisfaction of pre- operative strengthening exercises

Demographic variable proforma

The demographic variables consisted of age, gender, education, marital status, type of family, nature of work, monthly family income and dietary habits.

Clinical variable proforma

The clinical variable consisted of co-morbidity, previous history of surgery within 5 years, history of trauma, BMI, duration of OA in years, frequency of exercise, duration of exercise, duration of knee pain in 24 hours and medication taken for pain.

WOMAC score

The Western Ontario and McMaster Universities Osteoarthritis Index is a widely used set of standardized questionnaires measuring the scale of difficulty on the functional status of patients with musculoskeletal disorders specifically to knee and hip osteoarthritis for use in both clinical and research settings. The scale is developed by Dr. Nicholas Bellamy termed at Western Ontario and McMaster Universities Index in 1982.

The WOMAC was developed for use among patients with knee and / or hip OA, but it is being also used among patients with different conditions, including low back pain, rheumatoid arthritis, juvenile rheumatoid arthritis, systemic lupus erythematosus and fibromyalgia. The WOMAC is being extensively used in both observational / epidemiological studies and to examine changes following treatments including pharmacotherapy, arthroplasty, exercise, physical therapy, knee bracing, and acupuncture. It can be completed by patients in person, over the telephone or by computer.

Administration, scoring and Interpretation

Post-operative functional outcome was measured by Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scale of difficulty which consists of 24 items divided into 3 sub scales on pain, stiffness and physical

function. It measures five items for pain (score range 0–20), two for stiffness (score range 0–8), and 17 for functional limitation (score range 0–68). Each item has 5 possible answer options. The following values were assigned to each response of scale of difficulty 0= None; 1= Slight;2-Moderate; 3= Very; 4= Extremely. The obtainable score ranges from 0-96. Respondents are asked to extent to which they have bothered by each of the 24 items. The total score is obtained by the totaling the individual item scores. The lower WOMAC scores indicate improvements in pain, stiffness and physical function collectively better functional outcome. Higher scores on the WOMAC indicate worse pain, stiffness, and functional limitations.

INTERPRETATION ON FUNCTION OUTCOME

WOMAC SCORE	INTERPRETATION
0 - 32	Good
33 - 65	Average
65 - 96	Poor

Rating scale for patient satisfaction

In this study, it is the rating scale prepared by the investigator for identifying satisfaction of pre-operative strengthening exercises among experimental group of patients after TKR surgery. The Likert scale comprises of 10 items of satisfaction of participants regarding pre-operative strengthening exercises with 3 categories on the effects of the therapy, the method of teaching strengthening exercises and the approach of the researcher. It is a four pointed rating scale that includes the obtainable score of 0-30. The following values are

assigned to each response: Highly satisfied = 3; Satisfied = 2; Dissatisfied = 1; Highly Dissatisfied = 0. The total score is converted into percentage and graded as given below.

INTERPRETATION

SCORING	INTERPRETATION
Highly Satisfied	76- 100%
Satisfied	51-75%
Dissatisfied	25-50%
Highly Dissatisfied	Below 25%

Psychometric Properties of the Instruments

Validity

Content validity refers to the degree to which the items on an instrument adequately represent the universe of the content (Poilt & Beck 2012). The WOMAC scale is valid reliable tool developed by Dr. Nicholas Bellamy and permission has been granted by the author to use the tool as part of research. All WOMAC subscales on pain, stiffness and physical function were internally consistent with Cronbach's coefficient alpha of 0.91, 0.81 and 0-84 respectively.

Reliability

Reliability is the degree of consistency with which an instrument measures the attribute intended to measure (Polit& Beck, 2012). The reliability of the tools was determined by using inter rater technique. Karl Pearson's 'r' was computed

for finding out the reliability (r = 0.9). Test–retest reliability was satisfactory with interclass correlation coefficient of 0.86, 0.68 and 0.89 on pain, stiffness and physical function.

Rating scale on satisfaction regarding pre-operative strengthening exercises

This highly reliable that was assessed through split half method and found to be 0.8 by Pearson's correlation.

Pilot Study

According to Polit and Beck, (2012), a pilot study is a miniature or some part of the actual study, in which the instruments are administered to the subjects drawn from the population. It is a small scale version or trail run, done in the preparation for the major study. The purpose was to find out the feasibility and practicability of the study design and for pretesting of tools.

The pilot study was conducted among 12 patients after TKR, admitted in Apollo Main Hospitals, Greams road between 4th May and 9th May 2015. Six patients in the control group and six patients in the experimental group were selected by purposive sampling as study participants. The data was collected using the demographic variable proforma and clinical variable proforma for all the patients. Functional outcome was measured by WOMAC scale. After the pilot study, the study was found to be feasible and study instruments were found to be appropriate.

Protection of Human Rights

> The study was conducted after obtaining clearance from Ethical committee, Apollo Hospitals, Chennai and permission from Research and Medical guide.

> The permission to conduct the study was obtained from Principal, Apollo college of Nursing

> Consent was obtained from all the patients before the data collection

> Confidentiality was maintained throughout the study.

Data Collection Procedure

Data collection is the precise systematic collection of information relevant to the research purpose. The investigator collected the data from Apollo Main Hospitals Greams Road, after obtaining ethical clearance and proper administrative permission from the concerned authorities. The time schedule for observation was 8am to 5pm. The data collection period was from July 8th till September 8th 2015.

A group of 30 patients were selected from orthopedic OPD, Apollo Main Hospitals Greams Road as control and experimental groups. Patients who attended physician's clinic in the morning and posted for TKR after 2 weeks were considered as experimental group and other patients who attended physician's clinic in the evening and posted for TKR after 2 weeks were considered as control group.

Rapport was established through a brief introduction related to the research purpose. After the initial introduction by the researcher, informed consent was

obtained from the study participants. An assurance was given regarding confidentiality before the data collection procedure.

Patients who were scheduled for TKR had demonstration of pre-operative strengthening exercises along with video imagery 2 weeks before surgery, performance of exercises was observed, importance of exercises was explained and patients were asked to practice thrice a day. It was ensured by asking the patients on the prior to surgery.

Data was collected using demographic variable proforma, clinical variable proforma and WOMAC scale. The functional outcome was measured by WOMAC score on 5th POD and 6 weeks after surgery when they came for follow up. The questionnaires were answered by individual patients by using WOMAC scale of difficulty on pain, stiffness and physical function.

Problems faced during the process of Data collection

At least 2 weeks were required prior to surgery to teach and practice pre-operative strengthening exercises.

Plan for Data Analysis

Data analysis is the systematic organization, synthesis of research data and testing of null hypothesis by using obtained data. (Polit and Beck, 2012).

Analysis and interpretation of the data were carried out by using descriptive and inferential statistics. Descriptive statistics like frequency distribution, percentage, mean, standard deviation were used to describe demographic and clinical variables. The inferential statistics like independent t-

test was used to assess the effectiveness of pre-operative strengthening exercises among patients after TKR by comparing control and experimental group mean scores. Chi square test was used to find out the association between selected demographic / clinical variables and level of functional outcome among both the groups.

Summary

This chapter dealt with selection of research approach, research setting, population, sample size, sampling techniques, sampling criteria, selection and development of study instruments, validity, reliability of the study, pilot study, data collection procedure, problems faced during data collection and plan for the data analysis. The following chapter deals with analysis and interpretation of data using descriptive and inferential statistics.

CHAPTER IV

ANALYSIS AND INTERPRETATION

Data analysis is done to reduce, organize and give meaning to the data. The results obtained from data analyses require interpretation to be meaningful. Interpretation of data involves examining the results from data analysis forming conclusions, considering the implications for nursing, exploring the significance of the findings and suggesting further studies (Polit & Beck, 2012).

This chapter deals with analysis and interpretation of data including both descriptive and inferential statistics. Statistics is a field of study concerned with techniques or methods of collection of data, classification, summarizing, interpretation, drawing inference, testing of hypothesis, making recommendations. (Mahajan,2004)

The data in this study were investigated according to the objectives and hypothesis of the study. Analysis of the data was completed after the entire data was transferred to the master coding sheet. The data were tabulated and interpreted using appropriate descriptive and inferential statistics.

Organization of the Findings

The findings of the study were organized and presented under the following headings.

➢ Frequency and percentage distribution of selected demographic variables in the control and the experimental groups of patients scheduled for TKR

- Frequency and percentage distribution of selected clinical variables in the control and the experimental groups of patients scheduled for TKR

- Frequency and percentage distribution of level of functional outcome of WOMAC score in the control and the experimental groups of patients after TKR

- Comparison of mean and standard deviation of WOMAC Score on functional outcome between the control and the experimental groups of patients after TKR

- Frequency and percentage distribution of patients' satisfaction regarding pre-operative strengthening exercises among experimental group of patients after TKR

- Association between selected demographic variables and functional outcome in the control and the experimental groups of patients after TKR

- Association between selected clinical variables and functional outcome in the control and the experimental groups of patients after TKR

Table.1 Frequency and percentage distribution of selected demographic variables of the control and the experimental groups of patients scheduled for TKR

Demographic variables	Control group n = 30		Experimental group n = 30	
	f	p	f	p
Age in years				
41 – 50	4	13.3	3	10
51 – 60	8	26.6	9	30
61 – 70	12	40	14	46.6
71 - 80	6	20	4	13.3
Education				
Primary	0	0	1	3.3
Secondary	14	46.6	13	43.3
Graduate	16	53.3	16	53.3
Marital status				
Unmarried	0	0	1	3.3
Married	26	86.6	28	93.3
Widowed	4	13.3	1	3.3
Type of family				
Nuclear family	12	40	15	50
Joint family	18	60	15	50

Monthly family income (Rs.)				
>50,000	6	20	6	20
50,000 – 1,00,000	18	53.3	17	56.6
< 1,00,000	6	26.6	7	23.3
Dietary habits				
Vegetarian	12	40	6	20
Non- Vegetarian	18	16	24	80

The data in the table 1 revealed that most of the patients in the control and the experimental groups were married (86.6%, 93.3%). About half of them belonged to joint family (60 %, 50%), in the age group 61-70 years were (40%, 46.6%), had monthly income of Rs. 50,000 to 1,00,000 (53.3%. 56.6) and were non- vegetarian (60%, 80%) in the control and the experimental groups. In both groups 53.3% of patients were graduates.

Fig.3 shows that majority of the patients were females (66.6%, 60%) in the control and the experimental groups.

Fig.4 indicates that a significant number of patients were involved with moderate work (43.3, 46.6%) whereas (20%, 23.3%) of people employed with sedentary work in the control and the experimental groups.
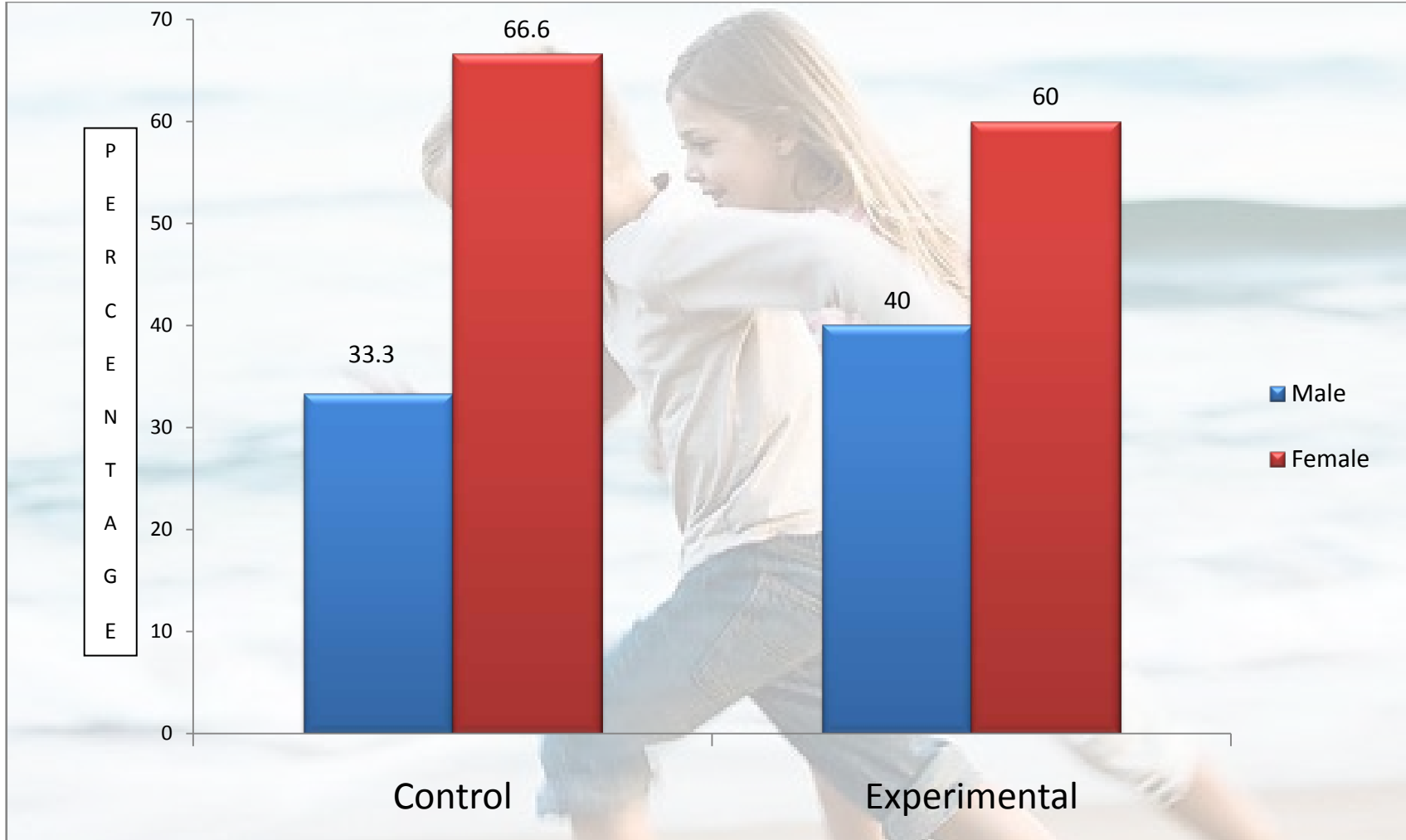
Figure.3.Percentage distribution of patients based on gender
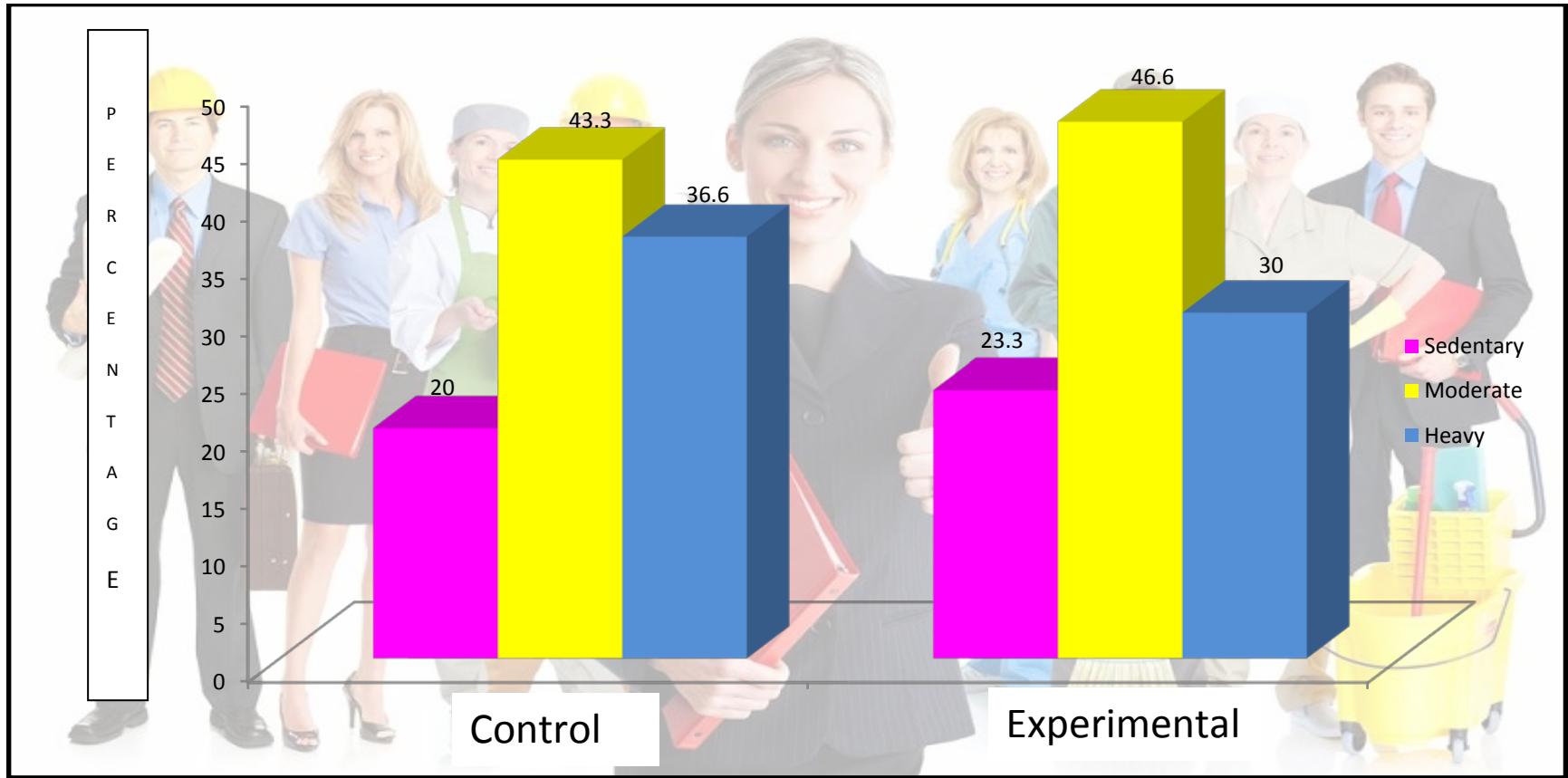
Figure.4 Percentage distribution of patients based on nature of work

Table.2 Frequency and percentage distribution of selected clinical variables of the Control and the Experimental groups of patients scheduled for TKR

Clinical variables	Control group n=30		Experimental group n=30	
	f	p	f	p
Co-morbidity				
Coronary artery disease	5	13.3	2	6.6
Diabetes mellitus	12	33.3	10	33.3
COPD	0	10	3	10
NIL	13	43.3	15	50
Previous history of Surgery within 5 years				
Minor	3	10	3	10
Major	3	10	3	10
NIL	24	80	24	80
History of trauma				
Falls	2	6.6	3	10
Ligament injury	3	10	1	3.3
Fracture	0	0	0	0
NIL	25	83.3	26	86.6
Duration of OA in years				
> 5	2	6.6	1	3.3
5 – 10	22	73.3	20	66.6
>10	8	26.6	9	30
Duration of exercises				
15 mts- 30 mts	16	53.3	12	40
>30 mts	14	46.6	18	60
Duration of Knee pain in 24 hours				
<1 hours	9	30	8	26.6
1-4 hour	8	26.6	10	33.3
4-8 hour	8	26.6	8	26.6
8-12 hour	5	16.6	4	13.3

The data in the table 2 reveal the absence of co- morbidity (43.3 %,< 50%) in the control and the experimental groups. Most of the patients had no previous history of surgery within 5 years (80%, 80%), no history of trauma (83.3%, 86.6%) in both the groups. A significant number of patients had OA in the past 5-10 years (73.3%, 66.6%), only very few patients had knee pain for 8-12 hours in 24 hours (16.6%,13.3%) in control and experimental groups respectively.

Figure.5 depicts most of the patients in the control and the experimental groups of patients having body mass index (80%, 86.6%) within 22-25 respectively.

Figure.6 indicates 33.3% patients having regular exercise program in the control group whereas 46.6% of patients in the experimental group having regular exercise pattern.

Figure.7 provides inference of that around half of the patients having taken NSAID (50%, 56.3%), in the control and the experimental groups respectively whereas no patients had taken narcotics.
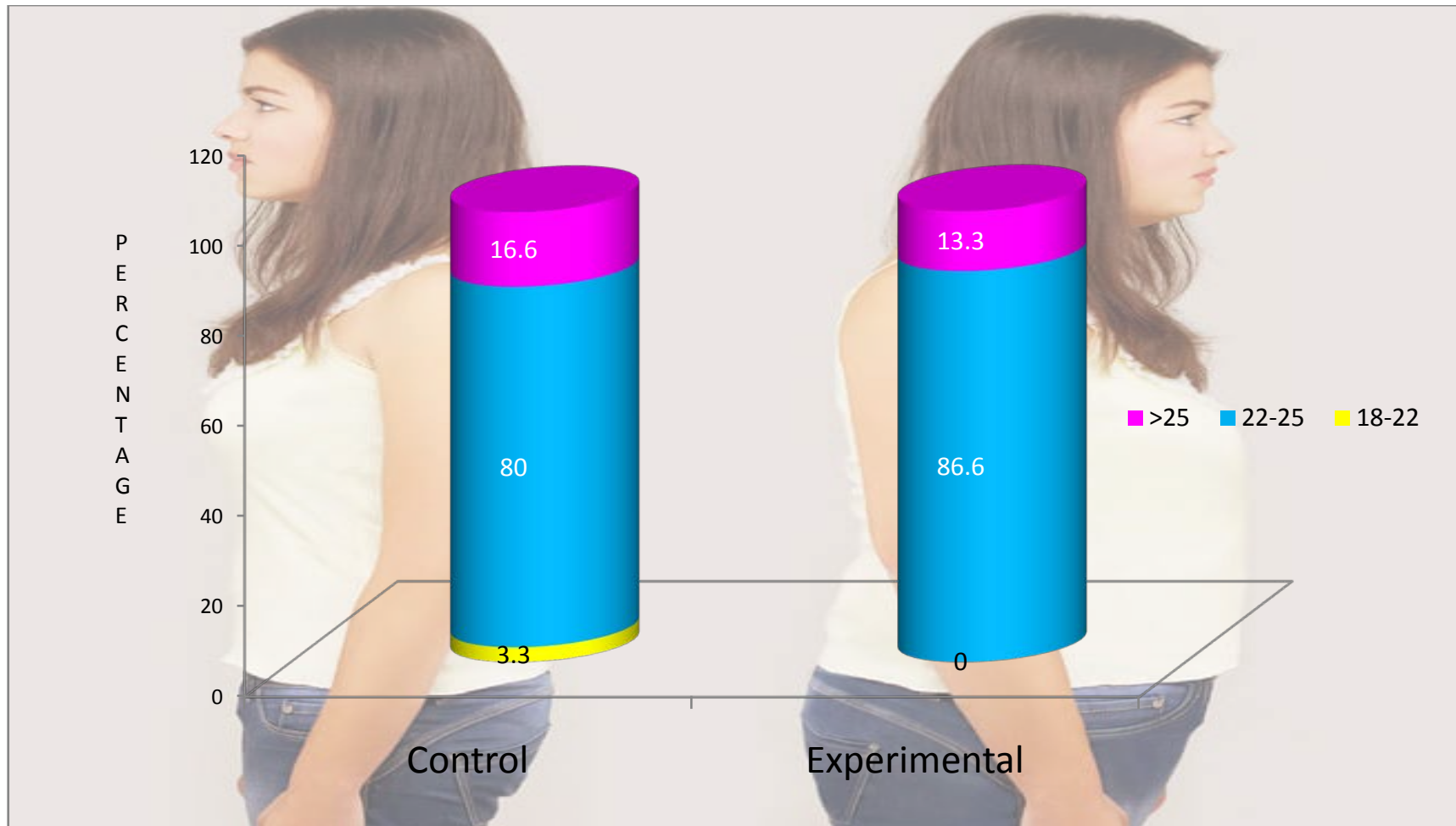
Figure.5. Percentage distribution of patients based on BMI
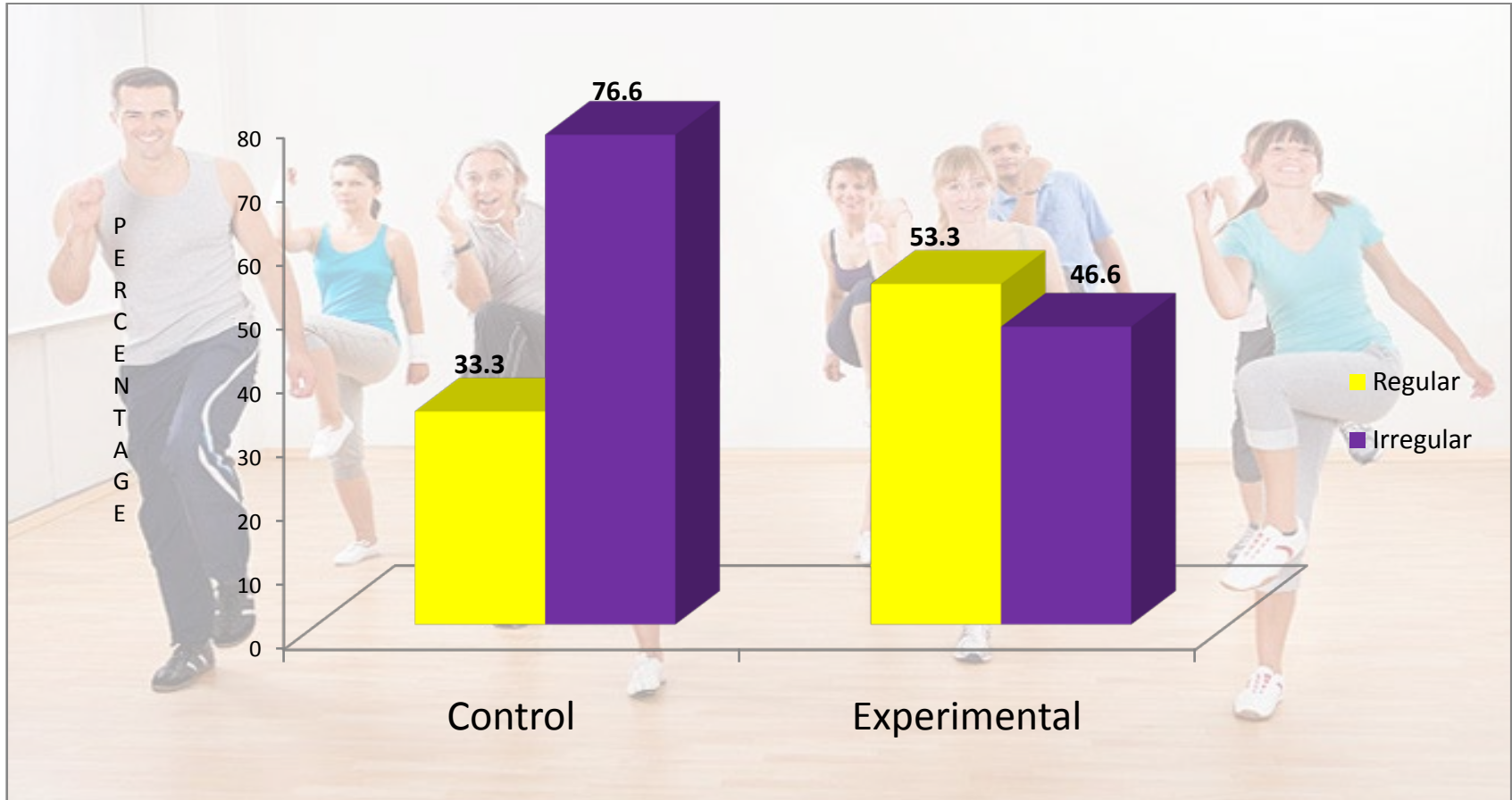
Figure.6. Percentage distribution of patients with frequency of exercises
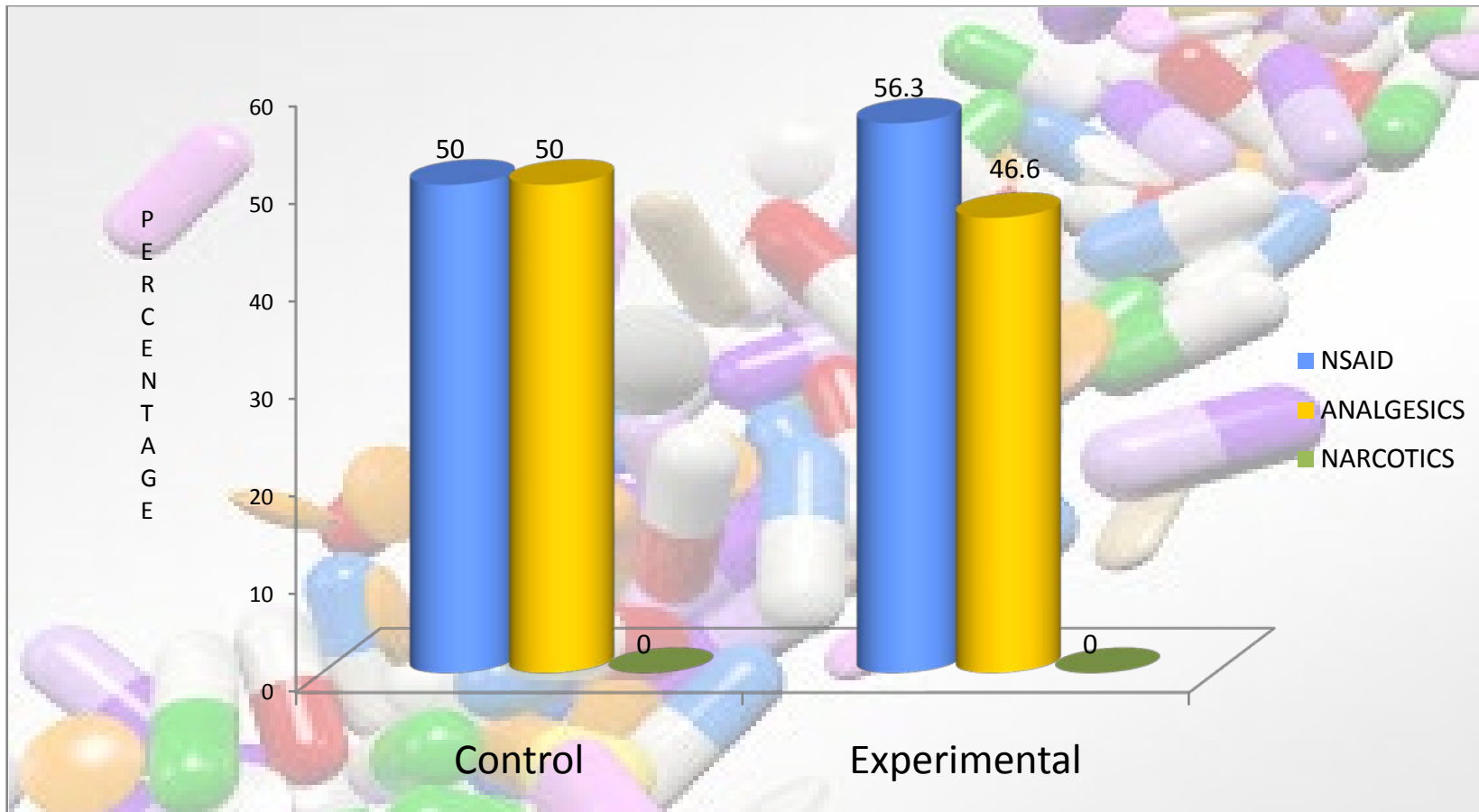
Figure.7. Percentage distribution of patients with medications taken for pain

Table.3 Frequency percentage distribution of level of functional outcome of WOMAC score in the control and the experimental groups of patients after TKR

Group	O_1						O_2					
	Good		Average		Poor		Good		Average		poor	
	n	p	n	p	n	p	n	p	n	p	n	p
Control group(n=30)	0	0	24	80	6	20	0	0	30	100	0	0
Experimental group(n=30)	0	0	30	100	0	0	28	93.3	2	6.6	0	0

Table.3 shows the control and the experimental groups having average level of functional outcome (80%,100%) in the first observation. In the second observation patients had good functional outcome (93.3%, 0%)and average functional outcome (100%, 6.6%) in the experimental and the control groups respectively.

Table.4 Comparison of mean and standard deviation of WOMAC Score on Functional outcome in the control group and the experimental groups of patients after TKR

Group	Functional outcome Scale of difficulty O_1			Functional outcome Scale of difficulty O_2		
	Mean	SD	t value	Mean	SD	t value
Control group (n=30)	59.9	4.05		39.3	3.03	
			9.12***			14.8***
Experimental group (n=30)	49.9	3.67		28.0	2.80	

***p<0.001

The data in table 4 depicts the mean and the standard deviation of WOMAC Scale of difficulty on functional outcome in the first observation was (M = 49.9, SD = 3.67) for the experimental group where as the mean and the standard deviation of the control group was (M =59.9, SD = 4.05). In the second observation, the mean and the standard deviation of WOMAC scale of difficulty on functional outcome (M= 28.0, SD = 2.80) in experimental group was less than those of the control group (M= 39.3, SD = 3.03). This was found to be statistically significant at p <0.001 in the first and the second observations and may be attributed to the

effectiveness of pre-operative strengthening exercises on the functional outcome of patients with Total Knee Replacement surgery. Hence the null hypothesis H_{O1} "There will be no significant difference in the functional outcome with pre-operative strengthening exercises among the control and the experimental groups of patients after Total Knee Replacement Surgery" was rejected.

Table.5 Frequency and percentage distribution of level of satisfaction score of pre-operative exercises in the experimental group of patients after TKR

Domain Experimental group (n=30)	Highly Satisfied		Satisfied		Dissatisfied		Highly Dissatisfied	
	n	p	n	p	n	p	n	p
Method of teaching exercises	29	96.6	1	3.3	-	-	-	-
Effectiveness of exercises	30	100	-	-	-	-	-	-
Researcher's Approach	20	100	-	-	-	-	-	-

Table .5 depicts that the most of the patients (99.6%) as highly satisfied with the method of teaching pre-operative strengthening exercises, 100% patients were satisfied with the effectiveness of the exercises and researcher's approach.

Table. 6 Association between selected demographic variables and functional outcome in the control and experimental groups of patients after TKR

Demographic variables	Control Group n = 30		χ^2	Experimental group n = 30		χ^2
	Up to mean	Above Mean		Up to Mean	Above mean	
Age in years						
≤ 60	7	5	1.83 df = 1	7	5	0.02 df =1
>60	6	12		11	7	
Gender						
Male	5	5	0.27 df =1	6	6	1.53 df =1
Female	8	12		13	5	
Nature of work						
Sedentary& Moderate	7	12	0.88 df =1	15	6	2.38 df =1
Heavy	6	5		3	6	

Note: categories under the variables are clubbed together for the sake of chi-square analysis.

It could be inferred from Table.6 indicates that absence of any significant association between selected demographic variables and the level of functional outcome. Hence, the null hypothesis H_{O2} "There will be no significant association between selected demographic variables and functional outcome of patients among the control and the experimental groups of patients after Total Knee Replacement Surgery" was retained.

Table.7 Association between the selected clinical variables and functional outcome in control and experimental group of patients after TKR

Clinical variables	Control group		χ^2	Experimental Group		χ^2
	Up to Mean	Above Mean		Up to Mean	Above Mean	
Co-morbidity						
Yes	7	10	0.07 df =1	11	4	1.25 df =1
No	6	7		7	8	
Previous history of surgery within 5 years						
Yes	1	5	1.02 df =1	2	4	1.05 df =1
No	12	12		16	8	
BMI						
≤25	13	12	2.71 df =1	17	9	0.10 df =1
>25	0	5		1	3	
History of trauma						
Yes	1	4	0.43 df =1	1	3	0.97 df =1
No	12	13		17	9	
Duration of OA in years						
≤10	11	11	0.64 df =1	13	8	0.10 df =1
>10	2	6		5	4	

Frequency of exercises						
Regular	7	3	2.86 df =1	11	5	2.03 df =1
Irregular	6	14		6	8	
Duration of exercise						
≤30 mts	4	12	3.22 df =1	5	7	2.80 df =1
>30 mts	9	5		13	5	
Duration of knee pain in 24 hours						
≤ 4 hours	8	8	0.62 df =1	12	7	1.37 df =1
>4 hours	5	9		5	7	
Medications taken for Pain						
NSAID	5	10	0.55 df =1	10	7	0.04 df =1
Others	7	8		9	4	

Note: categories under the variables are clubbed together for the sake of chi-square analysis.

Table.7 indicates the absence of any significant association between clinical variables like co-morbidity, previous history of surgery within 5 years, BMI, history of trauma, duration of OA, frequency of exercises, duration of exercise, duration of knee pain in 24 hours and medication taken for pain in the control and the experimental groups of patients. Hence, the null hypothesis H_{O3} "There will be no significant association between selected clinical variables and functional outcome of patients among the control and experimental groups of patients after Total Knee Replacement Surgery" was retained.

CHAPTER V

DISCUSSION

An Experimental Study to Assess the Effectiveness of Pre-operative Strengthening Exercises on Functional Outcome of Patients after Total Knee Replacement Surgery

Objectives of the Study

1- To assess the level of functional outcome between control and experimental groups of patients after Total Knee Replacement Surgery

2- To determine the effectiveness of pre-operative strengthening exercises on functional outcome by comparing the control and the experimental groups of patients after Total Knee Replacement Surgery

3- To assess the level of satisfaction of patients on pre-operative strengthening exercise among experimental group of patients after Total Knee Replacement Surgery

4- To find out the association between selected demographic variables and functional outcome among the control and the experimental groups of patients after Total Knee Replacement Surgery

5- To assess the association between selected clinical variables and functional outcome of patients among the control and the experimental groups of patients after Total Knee Replacement Surgery

Musculoskeletal disorders are the most common cause for long term pain and disability.   Osteoarthritis (OA) is a major cause of disability. Osteoarthritis (OA) is a chronic degenerative disorder characterized by cartilage

loss, by pain, swelling, and stiffness. The incidence and prevalence of OA are expected to increase among aging population. Despite the condition being irreversible, there are many treatment options available to help manage pain and keep people staying active. When medical treatment fails, TKR is an option for healthy living and independence in functional activities.

Knee replacement surgery was first performed in 1968. Since then, improvements in surgical materials and techniques have greatly increased its effectiveness. Total knee replacements are among the most successful procedures. More than 90% of people who have total knee replacement surgery experience a dramatic reduction in knee pain and a significant improvement in the ability to perform common routine activities of daily living.

Exercise is an integral measure for functional recovery in terms of pain reduction and physical functioning following TKR. In this regard, life-style interventions such as physical exercises which strengthen muscles used for mobility can be recommended to obtain good functional outcome after TKR surgery.

The present study was carried out upon 60 patients at Apollo Main Hospitals, Chennai to assess the effectiveness of pre-operative strengthening exercise on functional outcome of patients after Total Knee Replacement Surgery.

A quasi experimental research approach was used for achieving the objectives of the study. A sample size of 60 patients who meet the inclusion criteria were chosen for the study. 30 patients each in the control and the

experimental groups were selected through purposive sampling technique by the researcher for data collection.

The data was collected using demographic variable proforma, clinical variable proforma, WOMAC score developed by Nicholas Bellamy to assess functional outcome and rating scale on level of satisfaction regarding pre-operative strengthening exercises. The standardised tool WOMAC score was used for the data collection.

The data collection was done during a period of 6 weeks on selected samples. The study participants in the experimental group were demonstrated with pre-operative strengthening exercises along with video imagery for half an hour along with video imagery two weeks before the scheduled date of surgery, performance of exercises was observed and participants were advised to practice thrice a day. It was ensured by asking the patients on the prior to surgery.

The functional outcome was measured by WOMAC scale on 5th POD and 6 weeks after surgery when they came for follow up. The level of satisfaction regarding administration of pre-operative strengthening exercises was then assessed using rating scale in the experimental group of study participants.

The discussion is presented under the following headings

➢ Demographic variables of the control and the experimental groups of patients scheduled for TKR

➢ Clinical variables of the control and the experimental groups of patients scheduled for TKR

➢ Level of functional outcome among patients after TKR

67

- ➢ Effectiveness of the pre-operative strengthening exercises on functional outcome among patients after TKR

- ➢ Level of satisfaction score of pre-operative strengthening exercises among experimental group of patients after TKR

- ➢ Association between selected demographic variables and clinical variables on functional outcome in the control and the experimental groups of patients after TKR

Demographic variables of the control group and the experimental groups of patients scheduled for TKR

A significant percentage of the patients scheduled for TKR were in the age group of 61-70 years (40%, 46.6%) with the mean age and the SD of 62.5 +/- SD 9.7, 61.6 +/- 8.4, were females (66.6%, 60%), were married (86.6%, 93.3%), non-vegetarian (60%,80%), moderate workers (43.3%, 46.6%), had monthly family income of Rs. 50,000 - 1,00,000 (53.3%,56.6%) and graduates (53.3%, 53.3%) in the control and the experimental groups respectively.

Clinical variables of the control group and the experimental groups of patients scheduled for TKR

Most of the patients inthe control and the experimental groups had no previous history of surgery within 5 years (80%, 80%), no history of trauma (83.3%, 86.6%), had OA in the past 5-10 years (73.3%, 66.6%), had body mass index (80%, 86.6 %) within 22-25 respectively. Nearly half of the patients(43.3%, 50%) had no co-morbidity. Only very few patients had knee pain for 8-12 hours (16.6%, 13.3%), had taken NSAID (50%, 56.3%) and analgesics (50%, 46.6%) and not used any narcotics for pain in control and experimental respectively.

The first objective of the study was to assess the level of functional outcome between the control and the experimental groups of patients after Total Knee Replacement Surgery

Study findings indicate the presence of average level of functional outcome (80%, 100%) in the control and the experimental group in the first observation. In the second observation, 93.3% of the experimental group had achieved good functional outcome whereas the entire control group had average level (100%) of functional outcome. But the experimental group of patients had average level of functional outcome of 6.6%. There was no one with poor level of functional outcome in the second observation.

The smaller the WOMAC score depicts greater functional status. The WOMAC score in the experimental group inferred reduction on pain, stiffness and improvement in physical function when compared to the control group. So, it supports the evidence to practice muscle strengthening exercises before TKR for optimizing the outcome of the surgery.

The study findings are supported by Rosal & Ayers(2011) in a randomized study at a healthcare system in Massachusetts to evaluate pre-operative behavioral intervention of the self-management support system for improving physical activity adherence and functional outcomes following total knee replacement. Results support the conclusion that the above interventions were effective to enhance adherence to independent activity and exercise will optimize improvement in post-TKR function and patient autonomy, the ultimate goals of TKR.

A randomized trial was conducted in 2015 by Piva & Moore to compare exercise treatment methods for patients after total knee replacement to compare the outcomes of physical activity between 3 groups such as clinic-based individual outpatient rehabilitative exercise, community-based group exercise classes and the wait listed control group with usual medical care. Data were collected at baseline, 3 months, and 6 months. The study results were consistent with the above objective. Hence, pre-op strengthening exercises play a very important role in improving mobility should be made mandatory for all patients undergoing TKR.

The second objective of the study was to determine the effectiveness of pre-operative strengthening exercises on functional outcome by comparing the control and experimental groups of patients after Total Knee Replacement Surgery

Study findings revealed that the mean and the standard deviation of WOMAC Scale of difficulty on functional outcome in the first observation was (M = 49.9, SD = 3.67) for the experimental group was lower than control group (M =59.9, SD = 4.05). In the second observation the mean and the standard deviation of WOMAC Scale of difficulty on functional outcome (M= 39.3, SD = 3.03) in the experimental group whereas in the control group (M= 28.0, SD = 2.80). This was found to be statistically significant at P < 0.001 in the first and second observations.

The above study findings were consistent with the study conducted by Cheng & Shi (2010) in China. It revealed rehabilitation training after total knee replacement as the key to ensure the outcome of the surgery.

70

The findings are also supported by Huber, de Bie & Roos (2015) to assess the effectiveness of pre-operative neuromuscular training against education sessions of exercise therapy. Their study brought out evidence that exercise training of a high degree has better clinical outcome. Hence, the inference is that pre-operative neuromuscular training is necessary for satisfactory outcome and improves quality of life.

Hence the null hypothesis H $_{O1}$ "There will be no significant difference in the functional outcome with pre-operative strengthening exercises among the control and the experimental groups of patients after Total Knee Replacement Surgery" was rejected.

The conclusion is that despite the favorable outcome of total knee replacement (TKR), surgery alone fails to resolve the functional limitations and physical inactivity that existed prior to surgery. Significant variation in functional mobility exists among patients after TKR after surgery. Strengthening muscles prior to surgery through exercise improves surgery outcome. Hence, exercise can be considered as a part of intervention in addition to surgery for improving functional limitations. Exercises are feasible and cost-effective interventions for optimizing the physical well-being patients after TKR. It can reduce duration of stay after TKR while offering improvements in functional outcome.

The third objective of the study was to assess the level of satisfaction patients on pre-operative strengthening exercises among experimental group of patients after Total Knee Replacement Surgery

Most of the patients (99.6%) were highly satisfied with the method of teaching pre-operative strengthening exercises, 100% patients were satisfied with the effectiveness of exercises and the researcher's approach.

The fourth objective of the study was to find the association between selected demographic variables and functional outcome among the control and experimental group of patients after Total Knee Replacement Surgery

The finding of the chi square test indicated the absence of any significant association between selected demographic variables such as age, gender, education, marital status, type of family, nature of work, monthly income and dietary habits in control and experimental group. Hence the null hypothesis H_{02} stating that "There will be no significant association between selected demographic variables and functional outcome of patients among the control and the experimental groups of patients after Total Knee Replacement Surgery" was retained with regard to these variables.

These findings are contradictory to a study conducted by Mehta, (2015) conducted a cohort study to investigate whether women have poorer pain and functional outcomes following total knee replacement. The finding of the study reveals pain and function being less severe along with interventions that address mood while co-morbidity improves outcomes for women having TKR.

Lim & Chi (2015) conducted a study in Hong Kong revealed that women had poorer pre-operative knee flexion, Oxford Knee Score, KSS, and sub

scores of SF-36 when compared with men. However, they had achieved greater improvement in the above scores at 6 months and 2 years.

It indicates influence of pre-operative strengthening exercises on functional outcome of patients after TKR irrespective of these known variables.

The fifth objective of the study was to assess the association between selected clinical variables on functional outcome of patients among the control and the experimental groups of patients after Total Knee Replacement Surgery

There was no significant association between clinical variables like co-morbidity, previous history of surgery within 5 years, BMI, history of trauma, duration of OA, frequency of exercises, duration of exercises, duration of knee pain in 24 hours and medication taken for pain in the control and the experimental groups of patients. Hence the null hypothesis H_{O3} "There will be no significant association between selected clinical variables and functional outcome of patients among the control and the experimental groups of patients after Total Knee Replacement Surgery" was retained.

The results were supported by Clement & MacDonald,(2013) in a prospective study conducted by him to assess the effect of diabetes upon the Oxford knee score and patient satisfaction after TKR. It was concluded that diabetes was not a significant (p> 0.41) independent predictor of post-operative OKS and SF-12 physical score on multivariable analysis.

A retrospective study conducted by Liao & Huang (2015) to investigate the effects of obesity on functional mobility outcomes following post-TKR rehabilitation in Asian patients. Follow up of patients were done for 6 months

after undergoing TKR followed by 2 months of active rehabilitation. Outcome measures were recorded at baseline and at the 2-months and 6-months follow up assessments by using Western Ontario and McMaster Universities Osteoarthritis Index. The findings supported the inference that patients with class II/III obesity benefit from early post-TKR outpatient rehabilitation as well as patients with lower BMIs. No significant intergroup differences at the 2-months and 6-months follow up assessments were noticed. However, no such differences in functional capacity were elicited due to differences in clinical variables.

It indicates the beneficial effect of pre-operative strengthening exercises in improving physical function and activity of patients with various co-morbidities and BMI.

Summary

This chapter dealt with the objectives of the study, major findings of the demographic variables and clinical variables of the patients after TKR, mean and the standard deviation in the control and the experimental group, association between the selected demographic and clinical variables of patients after Total Knee Replacement Surgery.

CHAPTER-VI

SUMMARY, CONCLUSION, IMPLICATIONS,

RECOMMADATIONS AND LIMITATION

This is the most creative and demanding part of the study. This chapter gives a brief account of the present study including the conclusions drawn from the findings, nursing implications, recommendations and limitations of the study.

Summary

An Experimental Study to Assess the Effectiveness of Pre-operative Strengthening Exercise on Functional Outcome of Patients after Total Knee Replacement Surgery in Apollo Hospitals, Chennai

Objectives of the study were,

1- To assess the level of functional outcome between the control group and experimental groups of patients after Total Knee Replacement Surgery

2- To determine the effectiveness of pre-operative strengthening exercises on functional outcome by comparing the control and the experimental groups of patients after Total Knee Replacement Surgery

3- To assess the level of satisfaction of patients on pre-operative strengthening exercises among experimental group of patients after Total Knee Replacement Surgery

4- To find out the association between selected demographic variables and functional outcome among the control and the experimental groups of patients after Total Knee Replacement Surgery

5- To assess the association between selected clinical variables   and functional outcome of patients among the control and the experimental groups of patients after Total Knee Replacement Surgery

Null Hypothesis

H o$_1$: There will be no significant difference in the functional outcome with pre-operative strengthening exercises between the control and experimental groups of patients after Total Knee Replacement Surgery

H o$_2$: There will be no significant association between selected demographic variables and functional outcome of patients among the control and the experimental groups of patients after Total Knee Replacement Surgery

H o$_3$: There will be no significant association between selected clinical variables and functional outcome of patients among the control and the experimental groups of patients after Total Knee Replacement Surgery

The Conceptual framework of present study was based on King's Goal Attainment theory (Martha, 2013) given by Imogene King which was modified for the study. The study variables were functional outcome and pre-operative strengthening exercises. An extensive literature review and guidance by the experts formed the foundation for the development of the demographic variable proforma, clinical variable proforma, WOMAC score and the rating scale on level of satisfaction about pre-operative strengthening exercises.

A quasi experimental research approach was used to achieve the objectives of the study. The present study was conducted in Apollo Main Hospitals. A sample size of 60 patients who met the inclusion criteria were chosen for the

study. By purposive sampling technique, 30 patients in each control and experimental group were selected by the researcher for data collection.

The data collection tools were validated and the reliability was checked. The standardised tool WOMAC score was used for the data collection. Data for the main study was collected after the pilot study using demographic variable proforma, clinical variable proforma, WOMAC score developed by Nicholas Bellamy to assess functional outcome and rating scale on the level of satisfaction regarding pre-operative strengthening exercises.

The data collection was done for a period of 6 weeks on selected samples. The study participants in the experimental group were demonstrated pre-operative strengthening exercises along with video imagery were demonstrated for half an hour along with video imagery two weeks before the scheduled date of surgery, performance of exercises were observed, the importance of exercises were explained and participants were asked to practice thrice a day. It was ensured by asking patients prior to surgery.

The functional outcome was measured by WOMAC scale on 5th POD and 6 weeks after surgery when they came for follow up. The level of satisfaction regarding administration of pre-operative strengthening exercises was then assessed using the level of satisfaction rating scale in the experimental group of study participants. The collected data was tabulated and analyzed using descriptive and inferential statistics.

Major Findings of the Study

Demographic variables of control group and experimental group of patients scheduled for TKR

A significant percentage of the patients scheduled for TKR were in the age group of 61-70 years (40%, 46.6%) with the mean age and SD of 62.5 +/- SD 9.7, 61.6 +/- 8.4, were females (66.6%,60%), married (86.6%, 93.3%), non-vegetarian (60%,80%), moderate workers (43.3%, 46.6%), had monthly income of Rs. 50,000- 1,00,000 (53.3%, 56.6%) and graduates (53.3%, 53.3%) in the control and the experimental groups respectively.

Clinical variables of control group and experimental group of patients scheduled for TKR

Most of the patients inthe control and the experimental groups had no history of previous surgery within 5 years (80%, 80%), no history of trauma (83.3%, 86.6%), had the OA in the past 5-10 years (73.3%, 66.6%), had body mass index (80%, 86.6%) within 22-25 respectively. Nearly half of the patients(43.3%, 50%) had no co-morbidity. Only few patients had knee pain for 8-12 hours (16.6%, 13.3%), had taken NSAID (50%, 56.3%) and analgesics (50%, 46.6%) and not used any narcotics for pain in both the groups.

Effectiveness of pre-operative strengthening exercises on functional outcome among experimental group of patients after Total Knee Replacement surgery

The mean and the standard deviation of WOMAC Scale of difficulty on functional outcome in the first observation was(M = 49.9, SD = 3.67) for the experimental group which was lower than the control group (M =59.9, SD = 4.05). In the second observation the mean and the standard deviation of WOMAC Scale of difficulty on the functional outcome was(M= 39.3, SD = 3.03) in the experimental group whereas in the control group (M= 28.0, SD = 2.80). This was found to be statistically significant at p < 0.001 in the first and the second observations. Hence, this can be attributed to the effectiveness of pre-operative strengthening exercises. Hence the null hypothesis H_{01} stating that "There will be no significant difference in the functional outcome with pre-operative strengthening exercises among the control and the experimental groups of patients with Total Knee Replacement Surgery" was rejected.

Frequency and percentage distribution of the level of satisfaction score of pre-operative strengthening exercises among the experimental group of patients after TKR

In the present study, the researcher found that most of the patients (99.6%) were highly satisfied with the method of teaching pre-operative strengthening exercises, 100% patients were satisfied with the effectiveness of exercises and the researcher's approach. This depicts the demonstration of pre-operative strengthening exercises as effective intervention in improving the functional outcome of patients after TKR. All the participants eagerly participated, observed and demonstrated back the exercises learnt.

Association between selected demographic variables on functional outcome in control and experimental group of patients after TKR

The finding of the chi square test indicated the absence of significant association between selected demographic variables such as age, gender, education, marital status, type of family, nature of work, monthly family income and dietary habits in the control and the experimental groups. Hence, the null hypothesis H_{O2} stating that "There will be no significant association between selected demographic variables and the functional outcome of patients among the control and the experimental groups of patients after Total Knee Replacement Surgery" was retained with regard to these variables.

Association between selected clinical variables on functional outcome in control and experimental group of patients after TKR

In this study, no significant association was noticed between clinical variables like co-morbidity, previous history of surgery within 5 years, BMI, history of trauma, duration of OA, frequency of exercises, duration of exercise, duration of knee pain in 24 hours and medication taken for pain in the control and the experimental groups of patients. Hence, the null hypothesis H_{O3} "There will be no significant association between selected clinical variables and functional outcome of patients among the control and the experimental groups of patients after Total Knee Replacement Surgery" was retained with regard to these variables.

Conclusion

The findings of the study revealed pre-operative Strengthening exercises as effective intervention on functional outcome of patients with Total Knee Replacement Surgery.

Implications

Based on the findings, the researcher recommends the implications on Nursing Practice, Nursing Administration, Nursing Education, Nursing research. Assessment of the effectiveness of pre-operative strengthening exercises among TKR patients contributes a perception regarding different steps to be taken in all those fields for improving standards of nursing profession.

Nursing Practice

The findings of the study revealed that the need for implementing the practice of strengthening exercises as pre-operative feature in the hospital settings as it favors functional capability after the surgery in a manner similar to cardiac evaluation for surgical fitness. Those exercises should be recommended for patients to be taken up prior to TKR surgery. Exercise session should be scheduled mandatory in the pre-operative period for teaching the exercises.

Nursing education

With the emerging health care demands and newer trends in the field of nursing education, focus should be on the innovations for enhancing nursing care. Student nurses should be taught the clinical significance of the strengthening exercises before TKR. Demonstration of the proper techniques and use of videos

in the clinical setup helps the students to acquire an adequate knowledge and to incorporate it in their practice.

Nursing Administration

Considering today's technological advances and ever growing challenges of the health care needs, administrators have highest responsibility in providing opportunity for the nurses to use different modalities of teaching exercises by using advanced technology. This will enable the nurses to update their knowledge and acquire special skills in managing patients after TKR.

Nurse administrators should take adequate steps with growing bodies in formulating policies and protocols in providing patient education and plans for man power, money, materials, and methods and also find time to conduct successful and useful patient education programs. Nurse educator should provide opportunity for the nurses to attend various training programs**.** Quality indicating audits should be conducted periodically.

Nursing Research

Growing demand triggers heightened urgency to expand the evidence base to support maximizing functional capacity. There is a need for extensive and intensive research in this area to generate more specific database and to identify the benefit of exercise and to provide much information to practice. It opens a big avenue for research on innovative and alternative methods to improve functional outcome of patients after TKR. This will generate a larger scientific base.

Dissemination of the findings can be done through conferences, seminars, publications in professional, national and international journals and through World Wide Web. More research needs to be conducted with the use of locally available resources for improving the functional outcome of the patients after TKR. More theories can be generated on the basis of the research findings.

Recommendations

The researcher recommends the following:

- ➢ A similar study could be undertaken on a larger scale for more valid generalization.
- ➢ This study could be replicated in different settings.
- ➢ The study could be conducted for comparing different modalities of teaching exercises as eg. Simulation.
- ➢ The study could be conducted by using a variety of tools to assess the functional outcome.
- ➢ The study could be replicated by comparing individual and group methods of teaching exercises.
- ➢ This study could be replicated with a long term follow up.

Limitations

- ➢ Study findings cannot be generalized due to small sample size.
- ➢ Samples were selected using purposive sampling technique as it was not feasible to select by random sampling.

REFERENCES

Alkatan,M., & Baker, JR. (2016). Improved Function and Reduced Pain after Swimming and Cycling Training in Patients with Osteoarthritis, **Journal of Rheumatology,** 43(3): 666-72.

Atukorala,I., & Makovey. J. (2016).Is there a dose response relationship between weight loss and symptom improvement in persons with knee osteoarthritis? **Arthritis Care Research (Hoboken)**, 10.1002/ acr. 22805.

Badley, EM., & Rasooly, I. (1994).Relative importance of musculoskeletal disorders as a cause of chronic health problems, disability, and health care utilization: findings from the 1990 Ontario Health survey, **Journal of Rheumatology** (3):505-14.

Burnett ,W., &Kontulainen,S. (2016). Patella bone density is lower in knee osteoarthritis patients experiencing moderate-to-severe pain at rest.**J Musculoskeletal Neuronal Interact**, 16(1):33-9.

Cheng,N., & Shi,QY. (2010). Rehabilitation exercises after single total knee replacement, **ZhongguoGu Shang Chinese journal**, 23(3):220-1.

Chopra, A.,Relwani,J.,& Tandle,HS.,et.al.,WHO-ILAR COPCORD Study. WHO International League of Associations from Rheumatology Community Oriented Program from Control of Rheumatic Diseases, **Journal of the association Physicians India**, 49:240-246.

Chopra. A., Patil J. & Billempelly. V, (2001).Prevalence of rheumatic diseases in a rural population in western India: a WHO-ILAR COPCORD Study**, Journal of Association Physicians India.,**49:240-6.

Clement,D., & MacDonald,D. (2013),.Diabetes does not influence the early outcome of total knee replacement,**The Knee Journal**, 20(6):437-41.

De Car, MF.,& Vicenti,G. (2015). optimal improvement in function after total hip and knee replacement: how deep do you know your patient's mind? **Journal of Biological regulators & Homeostatic agents,** 95-102.

Dwyer,AJ., & Thomas,W.(2014). Enhanced recovery programme for total knee replacement to reduce the length of hospital stay, **Journal of Orthopedic Surgery (Hong Kong)**,22(2) 150-4.

Goodman,SM.,& Johnson,B. (2016). Patients with Rheumatoid Arthritis have Similar Excellent Outcomes after Total Knee Replacement Compared with Patients with Osteoarthritis, **Journal of Rheumatology.**43(1): 46-53.

Gouttebarge,V., & Inklaar,H. (2014). Risk and consequences of osteoarthritis after a professional football career: a systematic review of the recent literature, **Journal of Sports Medicine and physical Fitness,** 54(4): 494-504.

Hamel.M., & Maria,T. (2008)**.**Joint replacement surgery in elderly patients with severe osteoarthritis of the hip or knee: decision making, postoperative recovery, and clinical outcomes**, Archives of Internal medicine,** 168(13):1430-4.

Herbold,JA., & Bonistall, K.(2014). RCT trial of the effectiveness of continuous passive motion after TKR, Archives of physical medicine Rehabilitation,95(7), 1240-1245.

Huber,EO., de Bie,RA., & Roos,EM. (2015). Pre-operative neuromuscular training on functional outcome after total knee replacement, **BMC Musculoskeletal Disorder**.25:16,101.

Jain,S., Wasnik,S. & Mittal,A.(2013). Simultaneous bilateral total knee replacement, **Journal of orthopedic surgery** (Hong Hong)**,**19-22.

Jeffrey ,N. (2015). Parachutes and Preferences - A Trial of Knee Replacement, **The New England journal of Medicine,**373:1668:1669

Kandel, LA., Sajin, A., Litinezki D.(2010). et al. Static and dynamic balance during standing and walking and quality of life, in primary TKR. **Annual Meeting of the American Academy of Orthopaedic Surgeons,**#256.

Lewek,MD., & Rudolph,KS.(2006).Quadriceps femoris muscle weakness and activation failure in patients with symptomatic knee osteoarthritis, **Journal of Orthopaedic Research**, vol. 22: 1, 110–115, 2004.

Liao,CD., & Huang,YC.(2015). Body mass index and functional mobility outcome following early rehabilitation after a total knee replacement**, Journal of Arthritis Care Res (Hoboken)**, 14(5):799-808.

Lim, JB.,&Chi,CH.(2015). Gender difference in outcome after total knee replacement.**Journal of Orthopedic Surgery (Hong Kong)**, 23(2):194-7.

Mahajan,B.K.(2010). **Methods in Biostatistics**, 7th edition, Jaypee brothers, NewDelhi,73:7, 1316-1322.

Marita, C., & Smith, E. (2014), the global burden of hip and knee osteoarthritis: estimates from the Global Burden of Disease 2010 study, **Annals of Rheumatic disease,** 1136.

Martha,R.(2013), Nursing theory, Utilization & application, 5th Edition, 160-165.

Mehta,SP.(2015), Do women have poorer outcomes following total knee replacement? **Journal of Osteoarthritis cartilage,** 23(9), 1476-1482.

Negus,JJ., Cawthrone,DP., & Chen,JS.(2015) Patient outcomes using Wii-enhanced rehabilitation after total knee replacement, **Contemporary Clinical Trials**, 40:47-53.

Pendleton,A., Arden N., &Dougados ,M . (2000),EULAR recommendations for the management of knee osteoarthritis, **Annals of rhematic diseases**, the Eular Journal, 59:936-944.

Piva,SR., & Moore,CG. (2015), A randomized trial to compare exercise treatment methods for patients after total knee replacement, **BMC Musculoskeletal disorders**, 16:303.

Plotnikoff ,R., & Karunamuni,N. (2015), Osteoarthritis prevalence and modifiable factors, **BMC PublicHealth**, 15(1):1195.

Polit, DF.,& Beck, CT.(2010), Nursing ResearchGenarating and assessing evidence for nursing practise, 8[th]Edition,Lippincott, 250-300

Prakash Pal.,C & Abhijit,K.(2013), prevalence of osteoarthritis in the Indian population,16-20.

Rasul A.,& Irfan,A. (2014), Quality of life before and after total knee replacement, Rawal Medical Journal, 39(3): 289-291.

Rosal.M., & Ayers, D.(2011), A randomized clinical trial of a peri-operative behavioral intervention to improve physical activity adherence and functional outcomes following total knee replacement, **BMC Musculoskeletal disorders**, 12:226.

Rossmont.**(2014),** Can physical therapy before hip or knee replacement surgery improve outcomes? **Journal of Bone & Joint Surgery,**14(7): 255-260.

Salaffi,F., & Leardini G.(2003), Reliability and validity of the Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index in Italian patients with osteoarthritis of the knee, Journal of Osteoarthritis and cartilage 11(8):551-60.

Selten,EM., & Vriezekolk,JE., & Geenan,R. (2016), Reasons for treatment choices in knee and hip osteoarthritis: A qualitative study, **Annals of Rheumatic Diseases,** 74:1332.

Sharma,R.,& Mohan,V. (2012)Epidemiology of Musculoskeletal Conditions in India, ICMR ,10-50.

Snow, R.,& Granta,J. (2014), Associations between Preoperative Physical Therapy and Post-Acute Care Utilization Patterns and Cost in Total Joint Replacement. **The Journal of Bone & Joint Surgery**, 96 (19): e165.

Soren,T., & Ewa,M. (2015), A Randomized, Controlled Trial of Total Knee Replacement, **The New England journal of Medicine**, 373:1597-1606.

Stenquist,DA,, &Elman,SA. (2015) Physical activity and experience of total knee replacement in patients, American College of Rheumatology. **Arthritis Care Research (Hoboken)** 67(1):65-73.

Swank.(2011) Prehabilitation Before Total Knee Arthroplasty Increases Strength and Function in Older Adults With Severe Osteoarthritis. **Journal of Strength and Conditioning Research** 25 (2): 318.

Wallis,JA., & Taylor,NF. (2011), Pre-operative interventions (non-surgical and non-pharmacological) for patients with hip or knee osteoarthritis awaiting joint replacement surgery--a systematic review and meta-analysis, **Journal Osteoarthritis Cartilage**, 12:1381-95.

Woolf,AD., & Pfleger,B. (2003), Burden of major musculo skeletal conditions, **Bulletin of the World Health Organization,** 81:646-656.

Woolhead,G.,& Donovan,J. (2005), Outcomes of total knee replacement: a qualitative study, Oxford Journals Rhematology, 44:8, 1032-1037.

Wylde,V., & Livesey,C. (2012), Restriction in participation in leisure activities after joint replacement: an exploratory study, **Journal ofAge Ageing (Oxford),** 41(2): 246-9.

Wylde,V.,& Blom,A. (2008), Return to sport after joint replacement, **Journal of Bone Joint Surgery,** 90(7):920-3.

Zhang,W., & Moskowitz, RW.(2008), OARSI recommendations for the management of hip and knee osteoarthritis, **Osteoarthritis and cartilage**, 16, 137-162.