EFFECT OF INTENSIVE REHABILITATION ON FUNCTIONAL ABILITY AND LOCOMOTOR CAPACITY AFTER TOTAL KNEE ARTHROPLASTY

Protocol for a thesis submitted for partial fulfillment of the requirements for the MD Degree in Physical Medicine and Rehabilitation

By

Dalia Mohamed Ezz El Din
M.Sc. in Physical Medicine and Rehabilitation
Faculty of Medicine Ain Shams University

Under Supervision of

Professor Doctor/ Mahmoud Al Tayeb Nasser
Professor of Physical Medicine and Rehabilitation
Faculty of Medicine Ain Shams University

Professor Doctor/ Hala Abdul Hady Saleh
Professor of Physical Medicine and Rehabilitation
Faculty of Medicine Ain Shams University

Professor Doctor/ Mahmoud Ahmed El Sebai
Professor of Orthopedic Surgery
Faculty of Medicine Ain Shams University

Doctor/ Nadia Hamed Mahmoud Al Arousy
Assistant Professor of Physical Medicine and Rehabilitation
Faculty of Medicine Ain Shams University

Faculty of Medicine
Ain Shams University

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List of Abbreviations

AC : Articular cartilage.
ACL : Anterior cruciate ligament.
ACR : American College Of Rheumatology.
ADL : Acivities of daily living.
Amplitude Scaling b : Amplitude Scaling backward.
Amplitude Scaling f : Amplitude Scaling Forward.
AT : Adaptation Test.
BMI : Body Mass Index.
CCK : Constrained condylar knee.
CDP : Computerized dynamic posturography.
CKC : Closed kinetic chain.
CNS : Central nervous system.
COG : Center Of Gravity.
COMP : Cartilage oligomeric matrix protein.
COX : Cyclooxygenase.
CPM : Continous Passive Motion.
CV : Coefficient of variance.
DMOAD: Disease modifying osteoarthriris drugs.
ER : Estrogen receptors.
ERT : Estrogen replacement therapy.
H/Q : Hamstring / Quadriceps.
HA : Hyaluronic acid.
ICLH : Imperial College London Hospital.
IFR : Intensive functional rehabilitation.
IFR : Intensive functional rehabilitation.
IL : Interleukin.
IL1Ra : Interleukin 1 receptor antagonist.
J : Joule.
LCS : Low contact stress.
LOS : Limit of stability.
m RNA : Messanger Ribonucleic Acid.
MB : Mobile bearing.
MCT : Motor Control Test.
MMP : Matrix Metalloproteinases.

MRI : Magnetic Resonance Imaging.
msec : Millisecond.
6 MW :6 Minutes walk.
N-M : Neuten-Meter.
NO : Nitric oxide.
NSAIDs : Non Steroidal Anti Inflammatory Drugs.
OA : Osteoarthritis.
OARS : Osteoarthritis research society.
OKC : Open kinetic chain.
PCL : Posterior cruciate ligament.
PCR : Posterior cruciate retaining.
PFC : Press fit condylar.
PS : Posterior cruciate sacrifing.
PGs : Prostaglandins.
PMMA : Polymethylmethacrylate.
PWB : Partial Weight Bearing.
QOL : Quality of life.
r : Pearson Correlation coefficient.
RA :Rheumatoid arthritis.
ROM : Range of motion.
ROS Reactive Oxygen Species.
RP : Rotating plateform.
SAMe : S- Adenosyl- L – methionine.
SF : Synovial Fluid.
SLR : Straight Leg Raising.
SOT Sensory Organization Test.
TGF : Transforming Growth Factor.
THR : Total hip replacement.
TIMP : Tissue Inhibitors of Metalloproteinases.
TKA : Total knee arthroplasty.
TKR : Total knee replacement.
TNF : Tumour Necrosis Factor.
TU&G : Timed Up & Go.
VAS : Visual Analogue Scale.
VML : Vastus medialis Longus.
VMO : Vastus medialis oblique.
WBAT : Weight Bearing As Tolerated.

Weight Symmetry b : Weight Symmetry Backward.
Weight Symmetry f : Weight Symmetry Forward.
WOMAC : Western Ontario and Mc Master Universities Osteoarthritis Index.

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INTRODUCTION

Osteoarthritis (OA) of the knee is a major cause of disability among elderly (***Felon***., ***2000***). It may result in changes that affect not only intracapsular tissues but also periarticular tissues, such as ligaments, capsule, tendons, and muscle (***Pelletier***., ***1998***). With an aging population, the incidence of total knee arthroplasties (TKA) continues to increase(***Beaupre*** et al., ***2004***).

Subjects with knee osteoarthritis are known to have impaired proprioception compared with age matched controls (***Marks*** et al., ***1993***). Quadriceps strength and Proprioception are clearly important for balance control (***Hassan*** et al., ***2001***).

Severe osteoarthritis of the knee often leads to disabilities that interfere with locomotor function and activities of daily living. Total knee arthroplasty (TKA) becomes the treatment of choice when other conservative approaches have failed ***(Ouellet*** and ***Moffet***., ***2002***).

Treatment of the knee osteoarthritis does not end with surgical replacement, the ultimate goal is ensuring a pain free function of the joint to improve the patient's quality of life(QOL), therefore post operative rehabilitation is of utmost importance (***Abraham***., ***2004***).

Residual strength deficits as large as 35% were found in the knee extensor muscles one and two years after TKA for severe osteoarthritis (***Walsh*** et al., ***1998***). Reduction in gait speed ranging from 15% to 30% have been reported six months and one year after TKA (***Moffet*** et al., ***1998***).

Ouellet and ***Moffet*** (***2002***) found a large locomotor deficits are still present two months after TKA. The locomotor capacity two months after TKA is still far below the preoperative level of function that justified the TKA procedure.

Patients with relatively better quadriceps strength had a more normal gait (***Silva*** et al., ***2003***).

In light of these findings, it is relevant to question the intenisty and the duration of rehabilitation follow up after TKA, which is often restricted to a few supervised sessions during the short inpatient stay (7-10 days), followed either by an unsupervised exercise program performed at home or by only a few physiotherapy visits at home in the first two months after TKA (***Jones*** et al., ***2000***).

To judge the relevance and type of rehabilitation services that shoud be implemented in the first months following TKA, a first step is to obtain a more complete picture of early functional recovery (***Ouellet*** and ***Moffet***., ***2002***).

The results of studies performed in osteoarthritic populations strongly support the effectivness of an adapted and intensive rehabilitation program, to promote better functional ability and may positively influence long term outcomes such as health services utilization and knee prothesis longevity (***Moffet*** et al., ***2004***).

The effectiveness of an intensive functional rehabilitation (IFR) program in promoting better functional ability after a first TKA for severe osteoarthritis was supported by ***Moffet*** et al., (***2004***), where subjects could walked significantly longer distances in 6 minutes, had less pain, stiffness and difficulty in performing daily activities.

AIM OF THE WORK

The aim of this work is to evaluate the effectiveness of a pre and post operative exercise protocols and intensive functional rehabilitation (IFR) program in the first three months after primary TKA for severe osteoarthritis on functional ability and locomotor capacity.

Anatomy and Biomechanics of the Knee Joint

Anatomy of The Knee Joint

The knee is the largest synovial joint in the body. It consists of three distinct and partially separated compartments. Which form a complex hinge joint. Knee arrangement offers a fulcrum for propulsive muscles, and allows the limb to be folded away in confined spaces and to get closer to ground. The price of its mobility is a tendency to instability, to counter this tendency a complex ligament arrangement is present(**Stadring** et al., **2005**).

1- Articular Surface :

The bones of the knee joint consist of the distal femur with its two condyles, the proximal tibia with its two tibial plateaus, and the large sesamoid bone in the quadriceps tendon, the patella. The patella articulates with the intercondylar (trochlear) groove on the anterior aspect of the distal portion of the femur. It is a biaxial, modified hinge joint with two interposed menisci supported by ligaments and muscles and is a complex joint both anatomically and biomechanically (**Levangie** and **Norkin**., **2001**).

The structure of the knee permits the bearing of tremendous loads as well as the mobility required for locomotor activities. The weight bearing joints are the two condylar articulations of the tibiofemoral joint, with the third articulation being the patellofemoral joint (**Hall**., **2003**).

2- Capsule :

The capsule is a fibrous membrane of variable thickness. Anteriorly it is replaced by patellar tendon and does not pass