

**THE POSTOPERATIVE STATUS OF TOTAL KNEE
ARTHROPLASTY (TKA) PATIENTS ON DISCHARGE
FROM AN ACUTE SETTING IN JOHANNESBURG
HOSPITALS, SOUTH AFRICA**

Neeta Khandoo

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Witwatersrand, Johannesburg in partial fulfilment of the requirements for the
degree of Master of Science in Physiotherapy

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DECLARATION

I, Neeta Khandoo declare that this thesis is my own work. It is being submitted for the degree of Master of Physiotherapy in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.

_____ day of _____ 2009

DEDICATION

To my parents

ABSTRACT

Introduction

There is little known about the acute status of TKA patients, as many studies have focused on the long-term outcomes (Aarons et al., 1996). Knowing the acute status can aid physiotherapists in planning postoperative treatment protocols and help with discharge planning.

This research examines the postoperative status of total knee arthroplasty (TKA) patients on discharge from an acute setting. The objectives of the study were to establish pain, ROM of the operated knee, functional level, socio-demographic factors, clinical data and the relationship between identified factors and postoperative functional status of TKA patients in the acute setting.

Materials and Methods

This study is classified as a quantitative, cross-sectional design. Sociodemographic and clinical data, pain, range of movement (ROM) and function of TKA patients were collected on day three post operation. A self-designed data capture sheet, the goniometer, VAS (Visual Analogue Scale) and ILOA (Iowa Level of Assistance) were used to measure data.

Results

Forty-four patients were assessed. There were 41% males and 59% females. The average age was 67 years and BMI was 30kg/m². All patients had decreased ROM and 82% had poor quadriceps strength. Pain on walking was 5.8 on the VAS and correlated with the ILOA score. Pain on rest was 3.3 and when climbing stairs was 2.4. Sixty-one percent of subjects performed supine to sit, 59% performed sit to stand and 43% performed ambulation independently. Men performed better with an ILOA score of 24. Females had an ILOA score of 31. Length of stay (LOS) was 5.7 days. Females, older subjects and those with no medical conditions were more likely to stay in hospital for longer.

Conclusion

Knowledge of these factors will help to give patients a likely prognosis following a TKA and target future rehabilitation. Patients should receive adequate pain control to improve their functional ability. More attention should be given to female patients as they perform worse than men. Patients in this population should be referred for outpatient physiotherapy post-discharge, as their status on day three post operation reflected poor ROM, quadriceps muscle strength and function which may affect their rehabilitation outcome.

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NOMENCLATURE AND OPERATIONAL DEFINITIONS

AKSS – American Knee Society Score

BMI – Body Mass Index

CPM – Continuous passive motion

ILOA – Iowa Level of Assistance

ICU – Intensive care unit

KSKS – Knee Society Knee Score

LOS – Length of stay

OA – Osteoarthritis

RA – Rheumatoid arthritis

RCT – Randomised controlled trial

ROM – Range of movement

TKA – Total knee arthroplasty

VAS – Visual Analogue Scale

WHO – World Health Organisation

WOMAC – Western Ontario and McMaster Universities Osteoarthritis Index

Operational definitions

Acute, in this instance, refers to the time of operation to discharge from hospital.

The functional status on discharge from the acute setting includes: supine to sit, sit to stand, ambulation, ascending and descending stairs, as well as ambulation velocity.

CHAPTER 1

1.0 INTRODUCTION

This chapter gives the background to the study and includes surgical protocol, postoperative protocol, discharge criteria and post-discharge criteria, instruments to determine knee status, problem statement, research question, operational definitions, aims and objectives of the study.

1.1 Background

According to Symmons et al. (2000), osteoarthritis (OA) is a 'condition characterised by focal areas of loss of articular cartilage within synovial joints, associated with hypertrophy of bone (osteophytes and subchondral bone sclerosis) and thickening of the capsule'. Radiographically, there is usually joint space narrowing and osteophyte formation (Symmons et al., 2000).

This chronic disease has a global impact on health and physical impairment. In 2002, there was a prevalence of 143.7 million people affected by OA, worldwide (WHO, 2007). Most people affected by OA of knee tend to be women who are overweight, have suffered previous trauma or are involved in an occupation requiring repeated knee flexion (Symmons et al., 2000). According to the World Health Organisation (WHO), up to 40% of people over 70 years of age suffer from OA of the knee, and they generally have co-morbid diseases (Palmer & Cross, 2004). People affected by OA usually experience pain in and around the joint, morning stiffness (Hochberg et al., 1995), deformity, instability, swelling (Palmer & Cross, 2004) and loss of function. About 40% of people who are 40 year-olds display this 'degenerative and reparative process' radiologically, yet only 50% of these people are symptomatic (Palmer & Cross, 2004).

Total knee arthroplasty has been found to be effective in the management of pain (Palmer & Cross, 2004), functional status and quality of life in people suffering from OA, rheumatoid arthritis (RA) and related conditions (Zavadak et al., 1995).

However, Franklin et al. (2006) states that although most experience pain relief, there is variation of achievement of functional aspects. Reasons for this have been explored in a study by Heck et al. (1998) where it is said that age, gender and length of stay are all 'factors associated with absence of complications'.

In New Zealand, the reason for the increase in frequency of TKA is the increase of the average age of the population (Pennington, 2003). Developed countries tend to be better equipped to perform these operations, and candidates are generally better educated and on a higher economic level (Crowninshield et al., 2006). The older generation is also becoming more educated. These changes in demographics may influence patient-related factors, and hence outcomes of the TKA (Crowninshield et al., 2006).

The aim of the arthroplasty is to resurface the tibiofemoral joint to allow better articulation and to reciprocate normal kinematics of the knee (Palmer & Cross, 2004). Another aim of surgeons is to correct valgus deformity through the release of lateral structures (Elson & Brenkel, 2006). The most common approach is the medial parapatellar approach. This has been shown to give better radiological results, but more pain in the short term than the minimally invasive mid-vastus approach (Chen, 2006). Soft tissue and bony alignment can be ensured using the Tensor/ Balancer system (Winemaker, 2002). The Tensor/ Balancer system is important as malalignment can lead to failure of the operation (Winemaker, 2002). Prostheses consist of a femoral and tibial component. The femoral or tibial component can be cemented, hybrid (one component cemented and the other uncemented) or uncemented (Zavadak et al., 1995). The type of prosthesis used depends on the surgeons' protocol.

1.2 Surgical protocol

The surgical protocol of the surgeons at two hospitals in Johannesburg (Olivedale Clinic and Morningside Medi-clinic) use the medial parapatellar

approach, with a hybrid prosthesis (tibial component cemented). The posterior cruciate ligament is spared and the Tensor/ Balancer system is used to guarantee alignment. Each operation lasts approximately one hour and twenty minutes. In terms of anaesthetics, a spinal (infused with morphine) as well as a femoral block (which stays in for approximately 48 hours) is used. The patients are usually nursed in an intensive care unit (ICU) or high care unit for the first 24 - 48 hours postoperatively. Patients do not receive physiotherapy treatment on the day of their operation. Post-operative protocols differ amongst various institutions.

1.3 Post-operative protocol and patient status

Some institutions advocate preoperative, while most ensure postoperative rehabilitation (Munin et al., 1995). At these Johannesburg hospitals (Olivedale Clinic and Morningside Medi-clinic), physiotherapy treatment starts on the first day post operation in the high care unit or ICU. Physiotherapists aim to prevent contractures (Lenssen et al., 2006) decrease pain and swelling and improve knee and functional mobility in preparation for discharge (Oldmeadow et al., 2002).

Treatment protocols as recommended by the surgeons are as follows (Van der Plank, 2007 and Rogan, 2008):

Day one: bed exercises that would include:

- foot pumping
- quadriceps co-contraction
- straight leg raises and heel slides)
- respiratory exercises (deep breathing exercises and clearance of secretions)
- sitting out into a chair (for as long as can be tolerated).

Day two: bed exercises are continued and patients are mobilised (full weight-bearing or as much weight as tolerated) with walking frame or crutches.

Day three: should patients be efficient with crutches, they may attempt to ascend and descend four steps.

This postoperative protocol is comparable with international studies. In a Netherlands hospital, Lenssen et al. (2006) administered treatment of active and passive mobilisation of the knee, quadriceps strengthening and functional activities (such as supine to sit, sit to stand, walking and stair-climbing). Patients in a study by Forrest et al. (1998), were also seen by a physiotherapist on day one post operation, and expected to be able to walk within their homes, with a walker or crutches, before being discharged home.

Criteria for discharge reported by Forrest et al. (1998) include self-ambulation, walking up or down stairs, knee flexion range of at least 90° (Pennington, 2003) and medical stability. Due to reasons, such as finances, physiotherapists are under pressure to increase the discharge rate of patients (Oldmeadow et al., 2002). Early discharge can sometimes result in transfer to an inpatient facility. A study by Bozic et al. (2006), states that clinical, demographic and socioeconomic factors all affect the decision to discharge a patient to an inpatient rehabilitation centre.

1.4 Discharge criteria and post-discharge protocol

Similar to discharge criteria reported by Forrest et al. (1998), Johannesburg hospitals require knee flexion of approximately 90°, independent mobilisation with a walking frame and medical fitness. At two weeks post operation patients revisit the surgeon and staples are removed. Should the subjects' post-discharge status not be satisfactory (mainly due to poor knee range of movement), outpatient physiotherapy can be recommended for the subjects. There is debate as to whether there is a need for outpatient physiotherapy post-discharge. A study by Rajan et al. (2004) found no statistical or clinical difference between patients receiving outpatient physiotherapy and yet Aarons et al. (1996) recommends outpatient physiotherapy to improve ROM and muscle strength. In

the Johannesburg setting, at six weeks post operation the patient is x-rayed and should mobilise independently with or without walking aid (with relation to their preoperative condition).

1.5 Instruments used to determine knee status

The status of TKA patients have been measured using various instruments, such as the American Knee Society Score (AKSS), Oxford Knee Score, Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scale and the Iowa Level of Assistance (ILOA).

The AKSS consists of two parts: the Knee Score (KSS), which objectively measures patient perception of pain as well as ROM, stability and alignment, while the Functional Score measures certain activities (walking and climbing stairs). The functional score was shown to have poor reliability and responsiveness (Lingard et al., 2001; Liow et al., 2000). The KSS is not suitable for the acute setting, as stability tests cannot be performed at this acute stage. The Oxford Knee Score which is a questionnaire measuring pain and function. The WOMAC score which measures pain, stiffness and function.

The outcome measure used to test functional ability was the ILOA score. The ILOA measures acute functional level and was found to be reliable, valid and responsive for acute (two to six days post operation) clinical function of total hip and knee arthroplasty patients (Shields et al., 1995). It is a measure of four activities: supine to sit, sit to stand, ambulation and stair climbing, as well as ambulation velocity. It is graded from zero to six, with zero being fully independent and six representing an inability to test for 'reasons of safety' (Shields et al., 1995). Points are also allocated for use of an assistive device, with zero being no assistive devices and five being the use of a frame or rollator (Jesudason & Stiller, 2002) (Appendix 5). Therefore the greater the score, the more assistance is needed to complete functional activities.

There are two more outcome measures used in this study - the Visual Analogue Scale (VAS) and goniometry. The VAS measures patient perception of pain. The VAS consists of a 10cm line on a continuum, with zero representing no pain and 10 representing severe pain (Crichton, 2001). It has been shown to be comparable to other methods of measuring 'subjective knee complaints' (Flandry et al., 1991). Goniometry has been a universally accepted method of testing joint ROM (Brosseau et al., 1997) and specifically knee flexion in arthroplasty patients (Edwards et al., 2004). The clinometric attributes and limitations of each outcome measure will be discussed in Table 2.5.1 in Chapter 2.

Patients usually expect an improvement in pain, ROM and knee function postoperatively (Heck et al., 1998), and therefore it is important for all these measures to be taken into account. For the acute status of patients, the VAS was considered suitable for measuring pain (with aspects taken from the KSKS pain score), goniometry suitable for measuring ROM and the ILOA suitable for measuring function. Apart from these clinical features as a measure of success, length of stay (LOS) can also be a measure of outcome.

LOS also varies amongst studies from 3.4 (Bindelglass et al., 1999) to 9.3 (Oldmeadow et al., 2003) days. Knowing factors which may influence LOS, can help physiotherapists who lack the information to predict the average LOS of TKA patients in an acute ward (Oldmeadow et al., 2002).

1.6 Problem statement

There is little known about the acute status of TKA patients, as many studies have focused on the long-term outcomes (Aarons et al., 1996). Knowing the acute status can aid physiotherapists in planning postoperative treatment protocols and help with discharge planning.

1.7 Research Question

What is the postoperative status of TKA patients on discharge from an acute setting, and which factors affect functional status?

1.8 Aim of the study

To establish the postoperative status of TKA patients on discharge from an acute setting

1.9 Objectives of the study

1. To establish pain, ROM of the operated knee and functional level of TKA patients in the acute setting
2. To establish socio-demographic factors and clinical data of TKA patients in the acute setting
3. To establish the relationship amongst identified factors as well as between factors and postoperative functional status of TKA patients in the acute setting

1.10 Significance and conclusion

Most studies have looked at long term functional abilities of TKA. Aarons et al. (1996) said that there is little known about short-term status of TKA patients. While long term status determines the success of the operation, with regards to improving pain, stiffness and decreased function. Long term status does not aid the planning of inpatient rehabilitation protocols or discharge from the acute setting. The importance of knowing the short-term status is that one is able to give patients an accurate prognosis of their surgery and the ability to deal with any problems which may arise (Wasielowski et al., 1998). This study focussed on the acute status and therefore gave physiotherapists and patients' baseline information about the postoperative status of the patients. Information such as

pain, stiffness and function to TKA patients on discharge from the acute setting will contribute to prognostic knowledge and treatment planning in the short term.

CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter will discuss the epidemiology, pathology and management of osteoarthritis (OA) with focus on the global and local situation. Indications for total knee arthroplasty (TKA), as well as the reason why it is the choice of treatment, beyond conservative methods, are also discussed.

The sociodemographic and clinical data associated with TKA patients, surgical concerns and physiotherapy treatment, which may affect outcome and possibly cause complications, are explained. Various outcome measures are compared to explore suitability for use in assessing TKA patients during the acute phase. Finally, discharge outcomes will be discussed to give a common view of discharge criteria and length of stay, as well as the reason why this is important for physiotherapists.

2.2 Osteoarthritis

2.2.1 Pathology

OA is the most common degenerative joint condition (Mamlin et al., 1998). It is prevalent in weightbearing joints (Tidswell, 1998). The first stage is the degeneration of the articular cartilage, causing joint space narrowing. It is followed by the formation of subchondral bone cysts and osteophytes (Rosneck et al., 2007). Subsequently, this causes subchondral sclerosis and remodelling of the bone leading to osteophyte formation (Tidswell, 1998). Radiographs are used to confirm these changes (Ehrlich, 2003).

Clinically, patients complain of stiffness of affected joints on waking and constant pain worsened by weightbearing (Palmer, 2004). Initially, the pain may only be in

one compartment. It then moves throughout the knee in the later stage (Kelley, 2006). The pain tends to be a combination of nociceptive and neurogenic due to the fact that nerve endings are absent in cartilage, but numerous in subchondral bone (Olaogun et al., 2003). Patients often present with anatalgic gait, aggravated by factors such as excessive exercise, cold weather, prolonged sitting and standing (Kelley, 2006). They also present with crepitus, knee effusion, knee locking (caused by osteophytes or meniscal damage), poor balance, genu valgus deformity and weak quadriceps (Rosneck et al., 2007; Kelley, 2006).

The two classifications of OA are: primary and secondary. Primary OA refers to the degeneration of the joint in relation to ageing. Secondary OA occurs following injury to the joint, varus/ valgus alignment or intra-articular damage (Kelley, 2006). Some of the risk factors associated with OA are genetics, microtrauma (to ligaments or meniscus), increased cytokine activity and obesity (Rosneck et al., 2007).

2.2.2 Epidemiology of OA

It is expected that there will be a rise in incidence of osteoarthritis due to the increased life expectancy of the population (Ehrlich, 2004). OA has a higher prevalence in females than males in the same age category (Felson & Zhang, 1998). Women are at twice the risk of developing bilateral TKA (March & Bagga, 2004). Women from 75-84 years old have an incidence of 37.5% and women older than 85 years have an incidence of 50%, (Crowninshield et al., 2006). The reason why there is poorer knee function after the age of 85 years is due to the wear and tear of the joint as a result of aging (Noble et al., 2005).

OA is also linked to obesity (for every two units of BMI gain, the risk of knee OA rises to 36%), major joint trauma (damage to a meniscus and cruciate ligaments increase the risk of developing OA by five to ten times). OA can be due to

abnormal joint kinematics in recreational physical activity (such as elite athletes, weightlifters and male soccer players) and certain physical jobs (involving kneeling, squatting, heavy lifting, repeated knee bending and stair-climbing) causing wear and tear of the cartilage (Felson & Zhang, 1998; March & Bagga, 2004, Milne et al., 2000).

According to the South African Arthritis Foundation (2008), 10% of South Africans suffer with arthritis. Factors that have been found to contribute to OA in South Africans are overused or damaged joints and hereditary factors (Arthritis Foundation of South Africa). OA is the most common orthopaedic condition prevalent in Australia (about 15% of the population), leading to joint replacements of the hip and knee (March & Bagga, 2004). In the United Kingdom about 20 - 30 per 1000 are developing newly radiologically diagnosed cases of hip, knee and spine OA (March & Bagga, 2004). However, it is the most prevalent in the USA (Hochberg et al., 1995).

2.2.3 Current management of osteoarthritis of the knee

According to the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), hip or knee OA is said to be responsive to non-steroidal anti-inflammatories (NSAID's) and successfully treated arthroplasty (Bellamy et al., 1988). General practitioners, rheumatologists and surgeons have different treatment approaches. General practitioners are more likely to prescribe NSAID's as well as oral and intra-articular corticosteroids, as compared with rheumatologists, who often prescribe nondrug treatment, such as:

- pain management (hot or cold therapy)
- physiotherapy
- exercise
- minimising mechanical stresses (by using a walking stick, wearing a shoe orthotic and knee braces)
- education about the condition
- behaviour modification (Mamlin et al., 1998; Milne et al., 2000).

Behaviour modification involves avoidance of standing for extended periods of time, squatting and kneeling as these can all cause pain (Milne et al., 2000). Exercise therapy can be useful in reducing some pain and improving knee function (Milne et al., 2000). Physiotherapy should aim to improve ROM through the use of active and passive exercises, muscle strength of quadriceps and hamstrings, cardiovascular fitness for weight loss and proprioception to prevent additional stresses on the joint caused by loss of balance (Milne et al., 2000; Kelley, 2006). Using a walking aid on the contralateral side or shock-absorbing shoes can reduce pain by minimising the forces transmitted through the knee during walking (Milne et al., 2000). All these non-drug options can help in the early stages of OA, but may not improve pain in the later stages. This is usually when the patient consults an orthopaedic surgeon.

With regards to surgical approaches, TKA, unicompartmental knee arthroplasty, arthroscopy, minimally invasive TKA and computer-assisted techniques are used (Rosneck et al., 2007). Knee arthroscopy is used to provide symptomatic relief by clearing away osteophytes and 'loose bodies' (Rosneck et al., 2007). There are four grades to classify the severity of OA using the loss of joint space as a measure, with grade one being mild (where the joint space is preserved) and grade four being severe (with loss of articular cartilage). For severe OA, TKA has become an effective treatment where conservative methods have failed (Mamlin et al., 1998; Rosneck et al., 2007).

2.3 Total Knee Arthroplasty

2.3.1 Indications for surgery (TKA)

TKA has been found to improve pain and function (Rosneck et al., 2007). There are various conditions that are indicated for TKA of which rheumatoid arthritis (RA) and OA are included (as discussed in section 2.2.1 and 2.2.2 in Chapter 2). Osteonecrosis and trauma (meniscal tears and cruciate ligament damage) may

result in unequal loading distributed throughout the knee joint, causing 'pathological stresses', therefore requiring TKA (Milne et al., 2000).

TKA's are usually performed on people suffering with painful, stiff, swollen, deformed (flexion contracture or varus or valgus deformity) or unstable knees (Palmer & Cross, 2004), and loss of function (Tidswell, 1998; Laskin, 1999). Important diagnostic criteria of patients hoping to qualify for a TKA include: difficulty in standing from a chair, stair-climbing, as well as decreased ambulation speed (Milne et al., 2000). Patients with OA who are eligible are usually over 55 years old (Tidswell, 1998). Joint space narrowing of more than 50% in weight-bearing knees is an important indication for TKA (March & Bagga, 2004).

2.3.2 Epidemiology of TKA

Globally, there has been a reported increase in the number of people receiving total joint replacements (Forrest et al., 1998), even though it is elective (Laskin, 1999). In the United States of America 40.4 TKA's per 10 000 people were performed in year 1990, as compared with 54.7 TKA's per 10 000 people in year 2000 (Jain et al., 2005). The American Orthopaedic Association states that the total number of TKA's will rise from 300 000 in year 2003 to a predicted 474 319 in 2030 (Teeny et al., 2005). About 20 000 TKA's were performed in Australia in year 2004, with approximately 95% being performed due to OA (March & Bagga, 2004). No statistics are currently available regarding the amount of TKA's performed in South Africa per year.

The number of patients between 40 and 59 years old who have undergone TKA's has increased. This is possibly due to the fact that the materials used in prostheses in recent years are more durable than before, and will therefore have a greater lifespan (Jain et al., 2005).

Crowninshield et al. (2006) maintains that people receiving total joint replacements are now 'almost 20 % heavier, more physically active' and 'live more than 25% longer'. There is also twice the need for knee replacements, as compared to hip replacements and this is attributed to knee arthritis being linked to obesity (March & Bagga, 2004). Besides obesity, there are other sociodemographic and clinical factors which are associated with TKA.

2.3.3 Sociodemographic and clinical data (associations with TKA)

Certain factors affect the outcomes of discharge status. However, more research into these factors is needed to form an accurate view of the patient (Franklin et al., 2006).

Studying whether sociodemographic, functional and clinical data, have an impact on status following TKA, is of importance to the Orthopaedic surgeon and physiotherapist, as it is their responsibility to make decisions regarding discharge (Munin et al., 1995). While there is pressure to discharge patients from the acute setting, due to financial reasons and the need for beds, it is important to predict whether patients should be discharged home or to a step-down ward (Munin et al., 1995). Other than financial reasons, co-morbid diseases can affect discharge destination.

The majority of TKA patients are those who have co-morbid disease such as hypertension, diabetes and hypercholesterolaemia (Palmer & Cross, 2004). This is said to increase the length of stay, therefore knowledge of these co-morbid conditions can allow the physiotherapist to aggressively treat these patients (Wasielewski et al., 1998). In a retrospective study of sixty-two knee arthroplasties, by Forrest et al. (1998), there was no correlation between BMI and LOS, but a 'statistically significant correlation' between age and LOS. Munin et al. (1995) studied various clinical factors such as age, sex, BMI, indication for surgery and LOS. Munin et al. (1995) concluded that those in need of further

inpatient rehabilitation were older, predominantly female, had more co-morbid diseases, lived alone, had higher pain levels, a smaller degree of active knee flexion and lower levels of independent function (four of these being ambulation to 100 feet (30.48 metres), sit-to-stand, supine-to-sit and lower limb dressing). Some reasons why there is variation in patients' functional progress in the immediate postoperative period may include: age, sex, underlying diagnosis, patients' preoperative functional status, individual surgeons' protocols, associated co-morbid conditions, complications, patients' preoperative preparation (including education programs), and patients' ability to comply with the rehabilitation program (Zavadak et al., 1995).

Similar results, on age affecting transfer to a post-discharge rehabilitation unit, were found in a study by Forrest et al. (1998) where the average age for the sample in their study was 63.4 years, whereas the average age for those admitted to a post-discharge rehabilitation unit was 70.8 years. These results are in-keeping with results of a study by Bozic et al. (2006) which also states that age, female gender, increased pain, increased co-morbid disease and living alone as factors influencing discharge to a step-down ward. A quantitative, cross-sectional study by Laskin (1999) concluded that there is a high success rate of TKA's in patients over 85 years old. This was based on indicators of ROM, pain relief and activities of daily living (ADL's) on a sample of 62 patients older than 85 with unilateral, tri-compartmental total knee replacements.

Knowledge of these sociodemographic and clinical data gives health care professionals the ability to furnish patients with realistic expectations (Aarons et al., 1996). Apart from sociodemographic and clinical data, the TKA mechanism is important to the success of the operation and physiotherapists working with TKA's should have an understanding of them.

2.3.4 Methods and types of approaches of TKA

TKA prostheses have developed and changed considerably over the past four decades. The first total joint replacements of the knee were hinge joints in the 1950's (Palmer & Cross, 2004). Insall (1989) then developed a total condylar prosthesis which did not follow the biomechanics of a normal knee. It was further revised to improve the normal kinematics and knee range of motion (Palmer & Cross, 2004).

The majority of surgeons perform the medial parapatellar approach, although some use the lateral or subvastus approach (Palmer & Cross, 2004). Surgical technique and implant design affect outcomes (Crowninshield et al., 2006). The medial parapatellar approach provides good exposure to all knee compartments (www.zimmer.co.za). This approach needs less transfusion and leads to better flexion postoperatively (Chen, 2006). This is due to the arthrotomy only extending about 2cm into the quadriceps tendon (www.zimmer.co.za).

The TKA should achieve a 'stable, well-aligned tibiofemoral and patellofemoral joint' (Winemaker, 2000). TKA usually comprises of clearing osteophytes before resurfacing of the femoral condyles as well as the tibial plateau, and sometimes the patella (Tidswell, 1998). It is followed by soft-tissue balancing (Winemaker, 2000). The Tensor/ Balancer device was designed to measure the gap in 90° flexion and asymmetry according to the posterior condyles of the femur. It has been shown to be accurate for gap measures (Winemaker, 2000). To correct excessive valgus alignment, release of the lateral structures can be performed (Elson & Brenkel, 2006). The anterior cruciate ligament is removed and where possible, the posterior cruciate ligament is spared or removed. Sparing the posterior cruciate ligament is beneficial in terms of pain (Elson & Brenkel, 2006).

Holes are then drilled into the proximal part of the tibia and the distal part of the femur. The implants are inserted thereafter. The implants are made of metal components and polyethylene. These metal implants are designed to provide the patient with maximal flexion (Edwards et al., 2004). This is worth noting as previous studies have noted that minimum flexion needed for 'level gait is 67°; stair ascent 83°; stair descent 90°; rising from a chair 93°; and tying a shoe, 105°' (Edwards et al., 2004). The components can be cemented, hybrid (one component cemented and the other uncemented) or uncemented (Zavadak et al., 1995). There are two types of prostheses: fixed and mobile bearing. Fixed prostheses are attached to the bone, while mobile prostheses allow more movement. There is debate to whether the mobile or fixed bearing prostheses produce better outcomes. A Cochrane review compared mobile with fixed bearing prostheses, and found that after a year, the subjects with a mobile bearing knee had less pain and better function (Jacobs et al., 2004). However, long term follow-up of seven years showed no differences between the two prostheses. The Low Contact Stress (LCS) total knee prosthesis allows the polyethylene spacer component to rotate with the femoral component. The relevance of this is that it mimics the rotation of a normal knee and puts less strain on the joint (Haverbush TJ, 2006). Tibial rotation and femoral roll back are essential for ascending and descending stairs (Banks et al., accessed 2008).

2.3.5 Outcomes of TKA

TKA can reduce pain and improve function (Palmer & Cross, 2004; Laskin, 1999) for knee arthritis which does not respond to conservative care (Forrest et al., 1998). There is also an improvement in ROM, as compared to preoperative status (Heck et al., 1998). However, TKA patients experience more symptoms in weightbearing activities and do not perform as well as people in the same age group who had not had a TKA (Noble et al., 2005). This was based on a study of 500 patient responses to a questionnaire related to functional activities. Two hundred and forty three patients who had undergone a TKA within a year were compared to 257 of their age-matched peers who did not have any knee

symptoms. From that study, it can be concluded that 'TKA does not restore normal function' while patients often expect normal function after TKA (Noble et al., 2005). Surgeons expect improvement in function, therefore they are reported to be more satisfied with the results than the patients (Bullens et al., 2001). Contributing factors to patients' dissatisfaction can be lack of flexibility due to scar tissue, decreased strength and control due to muscles in the lower limb (Noble et al., 2005). Outcomes of TKA are not always positive as complications can occur.

2.3.6 Possible complications of TKA

The National Institutes of Health Consensus Panel noted that there are differences in outcomes obtained despite good quality implants, as postoperative complications may occur or there may be a variation in rehabilitation (Franklin et al., 2006). Common complications include thromboembolism (due to prolonged immobilisation, anaesthesia and surgery to the lower limb) and infection (a leading cause of revision TKA), and less commonly, pulmonary embolism, wound infection, pneumonia, myocardial infarction and death (Palmer & Cross, 2004; Rosneck, 2007). Occasionally, primary TKA can lead to stiffness of the joint – about 1.3% in 1000 primary TKA's at thirty two months postoperatively (Kim et al., 2004). Kim et al. (2004) defined stiffness as a flexion contracture $\geq 15^\circ$ and $< 75^\circ$ flexion. Stiffness can be attributed to limited preoperative range, surgical approach and patient motivation (Kim et al., 2004). Stiffness is an indication for revision; however, it has been found that patients scored lower when assessed on the Knee Society Score (KSS) in the post-revision (Deehan et al., 2006).

Pain can also be a complication, with intra-articular or extra-articular causes. Intra-articular causes can be due to infection, loosening of the prosthesis, instability, arthrofibrosis and maltracking of the patella. Extra-articular causes can be due to vascular claudication, anserine bursitis, spinal disorder, tendonitis, stress fracture and hip OA (Rosneck et al., 2007). Younger patients and those

with bilateral TKA's are less likely to experience postoperative pain (Elson & Brenkel, 2006).

It is postulated that increased activity levels and weight may reduce the longevity of the implant (Crowninshield et al., 2006). TKA patients also progress slower than THA patients, as they find the rehabilitation more demanding. This is due to TKA patients finding exercises more challenging than for THA, but mobilisation easier than THA patients (Aarons et al., 1996; Zavadak et al., 1995; Roos, 2003).

2.4 Postoperative TKA physiotherapy treatment

The success of a TKA does not only rely on surgical skill, but also effective rehabilitation postoperatively (Peerbhoy et al., 1999). The primary goal of postoperative physiotherapy is to prepare the patient for discharge by ensuring adequate functional independence (Lenssen et al., 2006). Functional independence is aided by early mobilisation of the patient post-op (Roos, 2003).

There is pressure to shorten the length of stay for financial reasons and to make more beds available (Oldmeadow et al., 2004), thereby enforcing a more intensive rehabilitation regime (Lenssen et al., 2006). According to a study by Lenssen et al. (2006), aggressive rehabilitation improves the chances of achieving better knee flexion. However, a randomised controlled trial (RCT) by Lenssen et al. (2006) states that there is no difference between patients receiving one or two sessions daily.

Although there is pressure to decrease length of stay, standards of care should not be compromised (Wang et al., 1998). It is important that physiotherapists achieve suitable results in terms of meeting the needs of the hospital and patient (Oldmeadow et al., 2002). Patients are spending less time in the acute setting, and this may diminish the possible results obtained from physiotherapy treatment (Oldmeadow et al., 2002). The decreased LOS in the acute setting has said to impact knee ROM at six weeks postoperatively (Teeny et al., 2005).

Postoperative rehabilitation usually consists of passive and active knee mobilisation, quadriceps strengthening and functional activities (Lenssen et al., 2006). However, the exact program for quadriceps training is not known, even though good quadriceps strength is correlated to function (Franklin et al., 2006). Jesudason & Stiller (2002) disagree with bed exercises for hip arthroplasty patients (hip and knee flexion; hip and knee extension in neutral; hip abduction; hip adduction to neutral; ankle dorsi- and plantarflexion; static quadriceps contraction and inner range quadriceps contraction over a rolled up towel). They randomly allocated 42 subjects into a control and an experimental group. The control group only received mobilisation, while the experimental group received exercises and mobilisation. After testing there were no improvements in hip pain, joint ROM or function in the experimental group. However, this has not been explored for TKA patients. The effect of continuous passive motion (CPM) has been studied and seen not affect to knee ROM (Roos, 2003; Teeny et al., 2005).

Franklin et al. (2006) hypothesises that independent activity (measured with a step activity monitor) and home exercises (leg exercises given to patients in hospital) post-discharge influences long-term outcome. However, RCT of 120 subjects by Rajan et al. (2004) states that there is no statistical difference between ROM of groups that receive post-discharge outpatient physiotherapy as compared to those who do not attend physiotherapy. The reliability of this study is questionable as it did not test other important outcomes, such as function and pain, and the type of intervention given at outpatient level. In order to measure outcomes, various outcome measures have been developed.

2.5 Outcome measures

Outcome measures are commonly used to determine the effect of surgical and physiotherapy intervention following a TKA. In addition to outcome measures, clinical assessment plays an important role in determining the outcomes of surgical, medical and therapeutic interventions of OA (Sun et al., 1997). It is

important to justify the effectiveness of orthopaedic and physiotherapy treatment for TKA, as well as their limitations (Lenssen et al., 2007). To justify effectiveness of treatment, tools such as goniometry to measure ROM and radiographs to measure alignment are used. Various surgeons and therapists measure ROM in TKA patients during the early postoperative days. A problem of goniometry is reproducibility due to varying clinical setting, condition and examiner (Lenssen et al., 2007). Radiographs are said to be the most accurate outcome measure for alignment, following a TKA (Edwards et al., 2004). However, OA which presents on radiographs may not always describe a patient's functional ability or symptoms (Mamlin et al., 1998), as only 30-40% of these patients are symptomatic (Milne et al., 2000). For this reason one should not base the diagnosis solely on radiographs, but must add the results of the clinical assessment.

Outcome measures to measure pain and function have been developed. The measurement of pain is subjective (Olaogun et al., 2003), therefore the Visual Analogue Scale (VAS) is said to measure patients' perception from no pain to severe pain (Crichton, 2001).

Terwee et al. (2006) stated that the most valid outcome measures of function are those which include variation of activities, as patients with OA sometimes struggle with more than one activity. The ILOA received the best scores when compared with 25 other performance-based tests (Terwee et al., 2006). Milne et al., (2000) states that patients with OA struggle with rising from a chair, climbing stairs and ambulation speed. These activities mentioned above are incorporated in the ILOA, therefore it was found suitable for use in this study.

Table 2.5.1 below shows the number of outcome measures that were found to be appropriate for use in an acute setting post-TKA. The outcome measures are described according to variables measured, clinometric attributes and limitations.

Table 2.5.1 Comparison of various outcome measures

OUTCOME MEASURE & VARIABLES MEASURED	CLINOMETRIC ATTRIBUTES	LIMITATIONS
Visual Analogue Scale (VAS) Pain	- Valid (Flandry et al., 1991) - Reliable for knee OA (Olaogun et al., 2003)	Subjective (Bullens et al., 2001)
Knee Society Score (KSS) - Pain, stability and ROM (Deductions for flexion contracture, extension lag and malalignment) - Functional score for walking and stair-climbing (Deductions for walking aids) 67% of score based on subjective items (Sun et al., 1997)	- Good convergent construct validity (Lingard et al., 2001) - KSKS responsive for TKA (Lingard et al., 2001) - Increasing age or medical condition will not affect (Insall et al., 1989) - high correlation to pain and function scores of the WOMAC (Lingard et al., 2001).	- Completed by clinician - Limited knowledge of functional activities besides walking and stair-climbing (Noble et al., 2005) - Functional score was the least responsive (Lingard et al., 2001) - Poor face validity (Lingard et al., 2001) - Variability in inter-and intra-rater reliability (Liow et al., 2000)
Iowa Level Of Assistance (ILOA) Acute function with levels of assistance	Reliable, valid, responsive for 2 to 6 days post-op & sensitive (Terwee et al., 2006; Jesudason &	- Purely objective (Sun et al., 1997) - Only measures one clinical component (Sun et al., 1997)

OUTCOME MEASURE & VARIABLES MEASURED	CLINOMETRIC ATTRIBUTES	LIMITATIONS
	• Stiller, 2002; Shields et al., 1995) • Typical of discharge criteria and components well described (Jesudason & Stiller, 2002)	
Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) • Pain, stiffness and physical function	• Responsive to measuring TKA outcomes (Lingard et al., 2001) • Good test-retest reliability (Sun et al., 1997)	• 100 % subjective (Sun et al., 1997)
Goniometry • Range of Motion	• Reproducible, therefore 'valid comparisons can be made' (Edwards et al., 2004)	• Low inter-rater reliability for active extension and flexion of the knee in sitting with the hip at 90° flexion, in the acute phase of TKA (Lenssen et al., 2007)
SF 36 Physical composite • Bodily pain • Physical function	• None found	• Responsive to measuring TKA outcomes (Lingard et al., 2001)

In table 2.5.1 above, the outcome measures used for this study were VAS, ILOA and goniometry. The only limitation of the VAS and ILOA is they are completely subjective measures. The limitation of goniometry was found in a study by

Lenssen et al. (2007). A low inter-rater reliability was found for active extension and flexion of the knee.

Validity of the ILOA has been attained in a previous study by using it to assess both hip and knee arthroplasty (Shields et al., 1995). Validity and reproducibility of clinical goniometry has been noted by comparing it to radiographic and visual estimation (Edwards et al., 2004). The VAS has been shown to be valid for measuring 'subjective knee complaints' (Flandry et al., 1991), as well as reliable and concurrently valid in a Nigerian knee osteoarthritis study (Olaogun et al., 2003).

Another important aspect of determining the condition of patients is the discharge status as discussed in section 2.6.

2.6 Discharge status

Discharge criteria often include 90° of flexion, mobilising up and down stairs with a walking aid, as well as functional independence (Pennington, 2003). To complete most activities of daily living 90° of knee flexion is suitable (Laubenthal et al., 1972). However, physiotherapists often struggle to get patients to pre-determined discharge criteria (Wasielowski et al., 1998). In a study by Wasielowski et al. (1998), a pre-determined discharge date was set at day five post operation. However, only nine percent of 65 patients in their study were able to be discharged by day five. Reason for this was inadequate functional level for discharge.

In the acute phase, it is imperative to know baseline functional levels, such as independence of supine-sit, sit-stand and ambulation. The reason is that, for example, patients may not be able to use the toilet without assistance or ambulate.

Failure to ambulate also increases the chance of bedsores and infection (Zavadak, 1995). Inability to be independent in functional activities, also does not allow the patient to be discharged to a destination without nursing care (Zavadak, 1995). In a study by Oldmeadow et al. (2002), 56 % of patients had independent and sufficient transfers from bed to chair. However, only 36 % of patients were discharged home and the remainder was discharged to a step-down facility. From Oldmeadow's (2002) study, the status of 35 TKA patients on discharge from three Melbourne Hospitals was examined. The decision by a clinician to discharge must be made early during the postoperative stage (Oldmeadow et al., 2003). Therefore a tool to incorporate factors known to influence outcome (such as medical status, sex and age) should be used to predict LOS (Oldmeadow et al., 2003; Bozic et al., 2006; Roos, 2003).

In an epidemiological study in the USA by Jain et al. (2005), the rate of discharge to an step-down facility had increased from 1990 to 2000, while the LOS had decreased due to financial reasons (Jain et al., 2005). Due to the large number of TKA's done in the USA, even a small change on LOS will have a large impact on hospital resources (Teeny et al., 2005). This is argued by Healy et al. (1997), who states that 80.1% of the patients' medical costs (in their institution) were incurred during the first 48 hours of the hospital stay. These costs include time spent in the operating room, nursing units, recovery room and items billed to the pharmacy. In their study, they suggest reducing these costs, instead of LOS.

A retrospective study by Teeny et al. (2005), introduced a targeted joint arthroplasty program in their setting. They found that setting realistic rehabilitation goals such as quadriceps and gluteal strengthening, sit to stand transfers and gait training can assist in reducing LOS. The literature on LOS from 1990 to 2005 varies from study to study, as shown in table 2.6.1 below.

Table 2.6.1 Average length of stay

AUTHOR & DATE	Number of subjects	LOS	Factors affecting LOS
Jain et al. (2005)	161 735 176 400 104 873	4.3 (1998-2000) 5.4 (1994-1997) 8.7 (1990-1993)	• Increased financial pressures • Increased transfers to step-down facilities
Teeny et al. (2005)	110	3.7 (1998) 5.4 (1994)	• Implementing TKA programs and clinical pathways
Oldmeadow et al. (2003)	320	9.3	• Age • Gender • Preoperative walking distance and use of walking aid
Oldmeadow et al. (2002)	105	6.5	• Functional mobility
Bindelglass et al. (1999)	50	3.4	• Function
Forrest et al. (1998)	62	8.2	• Age
Heck et al. (1998)	291	6.9	• None given

From table 2.6.1, the variability of LOS between studies is clearly visible. In the study by Jain et al. (2005), one can see the decrease of LOS from 1990-1993 and 1998-2000. Function and age were the most common factor influencing LOS.

On comparison, not all the studies used the same methodology. Oldmeadow et al. (2002) was a prospective observational study, Jain et al. (2005) was a longitudinal epidemiological study, Heck et al. (1998) was a prospective observational cohort, while Forrest et al. (1998) and Bindelglass et al. (1999) were retrospective studies. The populations also differed among the studies. In both Oldmeadow's (2002 and 2003) studies, patients were chosen whether they had total or hemi- knee replacements, whether they had osteoarthritis or

rheumatoid arthritis and whether it was a primary or revision procedure. In Forrest's (1998) study, the selection criteria was broad as only TKA patients who suffered from preoperative trauma or neoplasms were excluded. An epidemiological study by Jain et al. (2005) included only primary TKA's. Teeny et al. (2005) performed a study on primary, unilateral TKA's, who did not have a contralateral TKA or THA within six months of their operation. It is therefore difficult to build a clear and uniform picture of the outcomes from these studies because of the differences in methodology, population group and exclusion criteria.

2.7 Conclusion

From the literature review, OA is the most common indication for TKA as the incidence of OA rises with increased life expectancy. TKA is the surgical method for severe OA. There are many types and approaches of TKA's. These can affect the outcomes of TKA. Certain sociodemographic and clinical data as well as physiotherapy intervention may be factors affecting the outcomes of TKA as well.

TKA can improve pain, ROM and function. In order to measure data, outcome measures are used. To measure pain in this study, the VAS is used, for ROM goniometry is used and for function, the ILOA score is used. The importance of measuring functional data is it will give us objective data instead of 'clinical judgment' by the surgeon (Wang et al., 1998). This may allow us to target rehabilitation in order to improve short term outcomes, decrease LOS and decide on the need for post-discharge rehabilitation.

CHAPTER 3

3.0 METHODOLOGY

3.1 Introduction

This chapter focuses on the design and methodology of the study.

3.2 Research design

This study is classified as a quantitative, cross-sectional design.

3.3 Subjects

3.3.1 Population and study setting

All patients who met the inclusion criteria and were admitted to Olivedale Clinic and Morningside Medi-Clinic for a TKA procedure were considered as the study population. Consecutive sampling was applied and a sample of convenience was chosen from the population. Similar studies found in the literature, such as Oldmeadow et al. (2002) used 35 subjects. As there was no intervention no power calculation could be done. Every patient who met the criteria was included in the study.

3.3.2 Inclusion Criteria:

All patients admitted between October 2007 and June 2008 (until a suitable sample size was achieved) to Olivedale Clinic and Morningside Medi-Clinic for an initial unilateral TKA, without any complications which could affect outcome negatively (Lenssen et al., 2006), were eligible for inclusion to the study.

3.3.3 Exclusion Criteria:

- Bilateral knee arthroplasty. Those undergoing bilateral knee arthroplasty are more likely to complain of postoperative knee pain (Elson & Brenkel, 2005)
- Revision TKA (Lenssen et al., 2006). A lower score is achieved on the KSS with each revision (Deehan et al., 2006)
- Metastatic disease or trauma (Oldmeadow et al., 2002)
- Excludable illness i.e. rheumatoid arthritis, gout, pseudogout, psoriatic arthritis, systemic lupus erythematosus or knee infection (Heck et al., 1998)
- Prolonged hospital stay for medical reasons (Oldmeadow et al., 2004)
- Joint problems in the other knee (Heck et al., 1998)

3.4 Instrumentation

- A socio-demographic and clinical data sheet was used to capture data (Appendix 4). The following data was outlined:
 - Socio-demographic data consisting of age, gender and employment (Zavadak et al., 1995; Heck, 1998)
 - Clinical data consisting of height, weight, co-morbid diseases, medical reason for operation, previous level of function, and use of walking aid based on aspects of the KSKS, and LOS in hospital
- The VAS, based on aspects of the KSKS was used to assess patients' pain (when walking, climbing stairs and at rest) (Appendix 5)
- A universal goniometer was used to assess the ROM, extension lag and flexion contracture of the operated knee (Appendix 5)
- The ILOA was used to test patients' function (supine to sit, sit to stand, ambulation over, climbing stairs and ambulation velocity) (Appendix 5)

3.4.1 Reliability and Validity of instruments

The ILOA is reliable, valid and responsive for two to six days post-operatively and sensitive (Terwee et al., 2006; Jesudason & Stiller, 2002 and Shields et al., 1995). Flandry et al., 1991 found the VAS to be valid and Olaogun et al., 2003 found it to be reliable for OA. Goniometry is reproducible, therefore 'valid comparisons can be made' (Edwards et al., 2004).

Inter-rater reliability of the score did not need to be attained, as only one examiner was used to collect data. Intra-rater reliability was gained by piloting 10 subjects of the population. The patient was assessed, and after 90 minutes re-assessed (Shields et al., 1995). To omit bias, an independent observer was asked to scribe.

3.5 Procedure

3.5.1 Ethical consideration

Ethical clearance was obtained from Human Research Ethics Committee (Medical) of the University of the Witwatersrand (protocol number M070415) (Appendix 7).

Permission to conduct this study was asked from Netcare, Medi-Clinic and the directors of Olivedale Clinic and Morningside Medi-Clinic, as well as the relevant surgeons (Appendix 1 & 2).

Patients were given subject information sheets and asked to sign informed consent forms (Appendix 3) at the beginning of the assessment, if they wished to participate. Only patient numbers (not names) were written on the forms.

3.5.2 Sample size

The number of subjects needed for the study was determined by the help of biostatistician and sample sizes of previous studies regarding short term and discharge status following TKA. Oldmeadow et al. (2002) compared the data of 35 patients at three Melbourne Hospitals. Oldmeadow's (2002) research was centred on hospital stay and discharge outcomes. A study by Bindelglass et al. (1999) utilised 50 patients for their study to report on the need of step-down care post-discharge. Another study on short term recovery after hip and knee arthroplasty by Aarons et al. (1996) only 23 subjects were TKA patients.

The original sample size estimated at 60 subjects. This was calculated from the number of TKA's performed per month in the previous year. However, the actual number of TKA's performed was less for the period of this research. Therefore, a sample size of 44 was gained. The first 10 subjects were included in the pilot study and again in the main study as no problems were found. They were assessed using the same outcome measures as described in section 3.5.3.

3.5.3 Data Collection

All TKA patients meeting the inclusion criteria, who have signed consent forms, were assessed on day three postoperatively to ensure that all patients had received the same postoperative treatment. The earliest discharges are made on day three, therefore day three for data collection was chosen, so as not to miss any patients. A study on the reproducibility of goniometric measurements by Lenssen et al. (2007) also assessed patients on day three. Their sociodemographic (age, gender, employment) and clinical data (LOS, medical conditions, reason for operation, pre-operative physiotherapy and walking history) was gathered from the patient in an interview and entered on to a self-designed capture sheet by the examiner (Appendix 4). Patients' perception of pain was assessed using the VAS. ROM and other factors (flexion contracture, extension lag) were measured using goniometry. Function (supine to sit, sit to

stand, ambulation, ascending and descending stairs, as well as ambulation velocity) was assessed using the ILOA.

The sections below describe standardised procedures undertaken when measurements and observations were done.

3.5.3.1 Pain

The patient was positioned in the half-lying position with one pillow under the head. The examiner was seated next to the bed on a chair. The examiner asked whether the patient experiences pain when walking, when using stairs and at rest on the day of the assessment. If there was pain, questions, related to intensity, were posed and the patient was asked to mark on a 10cm line the point which best represented the pain, with zero being no pain and ten severe pain (Petty & Moore, 2000). (Appendix 5) Patients had the option of receiving pain medication six hourly, therefore not all patients' pain was adequately controlled.

3.5.3.2 Range of Motion (ROM)

Knee range of motion was measured with the patient in supine, by means of a universal goniometer (Liow, 2000). The reason for taking this measurement in supine was that a study based in the Netherlands, found the lowest inter-rater agreement while measuring passive knee flexion with the hip in 90° flexion. These values taken in supine are often slightly less, than if the same measurement was taken of the subjects' knee when measured in sitting. This is possibly due to there being more ability to move in the sitting position, as the hips are not stabilised against the examination table (Lenssen et al., 2007).

For the measurement of ROM, the patient was in a supine position with the knee in extension. The axis was placed on the lateral femoral condyle, with the distal

arm in line with tibial shaft, facing the lateral malleolus and the proximal arm in line with the femoral shaft, facing the greater trochanter (Edwards et al., 2004).

- Extension – This was read with the knee in extension. If the reading was not 0°, it was noted as a flexion contracture.
- Flexion - The patient was asked to slide the heel of the leg towards the buttocks, thereby flexing the leg maximally, producing an angle greater than 0° between the lower leg and thigh. The reading of this angle was taken. (Appendix 5)
- Flexion contracture - This was noted when measuring the knee ROM. It is the difference between full extension and neutral (the upper thigh being at 180° to the lower leg). A flexion contracture is defined as fibrosis of muscle or connective tissue resulting in shortening and deformity of a joint by Martin (2000).
- Extension lag – The patient was seated over the edge of the bed, with the distal part of the thigh supported by a pillow. The patient will be asked to actively extend the knee. The measured difference between active and passive extension ROM is the lag. A difference between active and passive ROM denotes quadriceps weakness. (Appendix 5)

3.5.3.3 Function

The patient was asked to perform supine to sit, sit to stand, walking for 4.57m as well as ascend and descend stairs. They were graded according to how much help is needed from the therapist, with 0 being no help to 5 being failed maximal assistance. They were also tested on ambulation velocity over 13.4 m, with 0 being ≤ 20 s and 6 being > 70 s. Points were allocated for use of a walking aid, with 0 being no use assistive device and 5 signifying the use of a frame or rollator (Shields et al., 1995). The minimum score which can be obtained on the ILOA is 0. This can be obtained if the patient is independent in all five tasks (5 x 0) and does not use an assistive device (4 x 0). The maximum score which can be obtained is 50. This can be obtained if the patient cannot perform tasks due to

medical or safety reasons (5 x 6) and the walking aid used would have been a frame (4 x 5) (Jesudason & Stiller, 2002). (Appendix 5)

3.5.3.4 Pilot study for intra-rater reliability of objective measures

The aim of the pilot study was to gain the intra-rater reliability of the objective measures and find any problems which may occur later in the main study. Goniometric measurements and the ILOA score were taken by the examiner and repeated after one and a half hours. No problems were found on piloting the first 10 subjects.

Intra-rater reliability of goniometry and ILOA

The Rho co-efficient for ROM (extension, flexion, extension lag and flexion contracture) was 0.87. The Rho co-efficient for goniometry was good for intra-rater reliability. This indicates that the examiner was able to reproduce her readings, when measuring the knees a second time.

The intra-class correlation co-efficient for the ILOA score was 1.0. The Rho co-efficient for ILOA Score was 100%, therefore there was excellent intra-rater reliability. (0.91 - 1.0 = excellent, 0.81 - 0.90 = good, 0.71 – 0.80 = average, ≤ 0.7 poor). This indicates that the examiner was a 100% accurate on scoring the ILOA score for the pilot studies.

3.5.4 Data Management

Data base design, data entry and cleaning were done using Epi-info.

3.5.5 Statistical analysis

Prior to analysis descriptive statistics was done. Measures of central tendency and measures of spread were used to describe numerical variables (interval and ratio) and 95% confidence interval was reported.

For intra-rater reliability, intraclass correlation (ICC) test was used. To test for associations between socio-demographic and clinical variables, students t test (for numerical) and Chi squared (pairs of categorical) were used.

The VAS, goniometry and ILOA were compared against socio-demographic and clinical data using a multivariate regression. Correlation between age and gender was done using the t-test. Correlation between gender and function were done using Chi-squared and ages and function was done using ANOVA. The reason why different tests were used is that age is a continuous variable and can be classified as interval data, whereas gender is nominal data with only 2 variables. To determine which medical condition groups had a longer LOS, a Kaplan-Meier Estimate of medical conditions was done. A Cox regression was done to determine the effect of age, BMI, gender and pain on LOS. Statistical significance was assessed at the 5% level of significance. The statistical analysis was done using STATA 9.1.

CHAPTER 4

4.0 RESULTS

4.1 Introduction

The purpose of this chapter is to report the results of this study's findings. The following results are presented:

- Pain, range of movement (ROM) of the operated knee and functional level of TKA patients
- Socio-demographic factors and clinical data of TKA patients
- The relationship between identified factors and postoperative functional status of TKA patients

4.2 Description of sample

A total of fifty-four patients underwent a TKA. The following 10 patients were excluded:

- Three patients due to prolonged hospital stay for medical reasons
- Three patients for medical conditions,
- One patient had a bilateral TKA,
- One patient consented to the sociodemographic and clinical questionnaire, but not to the goniometry and Iowa Level of Assistance (ILOA) testing, and therefore had to be excluded
- One patient refused to be tested
- One patient had been discharged before the researcher had been able to collect data (morning of day three).

The first 10 patients were used for the intra-rater reliability study. There were no problems with the pilot patients therefore they were included with the 34 patients into the sample. Forty-four patients were eligible for inclusion and consequently consented to the research. The table 4.1 below presents the details of the sample.

Table 4.1 Sample details

Number of patients participated	54
Number of patients included	44
Number of patients excluded	10
Numbers of patients used to derive results for main study	44
Number of patients used for pilot study	10

4.4 Results of the main study

Socio-demographic data, clinical data using a self-designed data capture sheet (Appendix 4), pain as measured by the modified Visual Analogue Scale (VAS), ROM as measured by goniometry and function as measured by the ILOA score of 44 subjects was collected and assessed (Appendix 5). From these tools the following results were found.

4.4.1 Length of stay

On average, the length of stay was 5.7 days. The minimum stay was 3.5 and maximum stay was nine days.

4.4.2 Sociodemographic data

The following section presents descriptive results on sociodemographic data (age, gender and employment status). The distribution of ages is seen in table 4.2 below.

Table 4.2 Age distribution

<50 years	50-59 years	60-69 years	70-79 years	>80 years
1	6	18	15	4

Thirty-three (75%) patients were between 60 and 79 years. Eighteen (41%) subjects were between 60 and 79 years old and 15 (34%) subjects were between 70 and 79 years old.

Gender distribution and employment status is presented in table 4.3 below.

Table 4.3 Sociodemographic data

Variable	Male n (%)	Female n (%)
Gender	18 (41%)	26 (59%)
Employment status		
• Retired	7 (39%)	16 (62%)
• Unemployed	0	1 (4%)
• Self-employed	4 (22%)	2 (8%)
• Employed part-time	5 (28%)	6(23%)
• Employed full-time	2 (11%)	1(4%)
• Boarded	0	0
• Retrenched	0	0

Twenty-six (59%) subjects were female and 18 (41%) were male. Sixteen (62%) females and seven (39%) males were retired, making this the largest group.

4.4.2 Clinical data

The following section presents anthropometric data of males and females, as well as numbers of existing medical conditions. Table 4.4 below presents the mean and standard deviation of height, weight and BMI for males and females.

Table 4.4 Anthropometric data with respect to males and females

Variable	Male (mean)	Male (SD)	Female (mean)	Female (SD)
Weight	92	19.4	80	15.1
Height	178	8.9	159	8.5
BMI	29	5.3	31	4.6

The average weight of the subjects was 84.7 kg and the average height was 167 cm. Body mass index (BMI) was calculated as weight (in kg) divided by height squared (in metres). The average BMI was 30 kg/m².

Table 4.5 below presents the prevalence of medical conditions among the subjects.

Table 4.5 Existing medical conditions

Condition	Number n (%)
Hypertension	28 (64%)
Hypercholesterolaemia	11 (25%)
Hypothyroidism	4 (9%)
Diabetes	9 (20%)
None	12 (27%)

The most common existing medical condition was hypertension, with 28 subjects (64%) suffering from it.

Thirty seven subjects (84%) underwent the TKA due to symptoms of primary osteoarthritis, while seven (16%) had secondary osteoarthritis.

4.4.3 Preoperative history

The following section presents the preoperative history with regards to preoperative physiotherapy (table 4.6), average distance walked (table 4.7), ability to ascend and descend stairs (table 4.8) and use of a walking aid (table 4.9).

Table 4.6 Preoperative physiotherapy received

Variable	Number of subjects n (%)
Subjects who did not received pre-operative physiotherapy	35 (80%)
Subjects who did receive pre-operative physiotherapy	9 (20%)
• 1 to 3 times a year	5 (11%)
• 1 to 3 times a month	1 (2%)
• 1 to 3 times a week	3 (7%)

Table 4.7 Preoperative walking history

Variable	Number of subjects n (%)
Walked just within the house	3 (7%)
Walked less than 1 km	24 (55%)
Walked between 1 and 2km	2 (5%)
Walked 2 km	6 (14%)
Walked unlimited	8 (18%)

Table 4.8 Ability to ascend or descend stairs preoperatively

Variable	Number of subjects n (%)
Did not use a handrail when walking up and down stairs	6 (14%)
Needed to use a handrail when walking up and down stairs	36 (82%)
Climbed neither up or down stairs	2 (5%)

Table 4.9 Use of walking aids preoperatively

Variable	Number of subjects n (%)
Did not use a walking aid	38 (86%)
Used a walking stick	4 (10%)
Used a walking frame	2 (5%)

Thirty-five (80%) of patients did not receive preoperative physiotherapy, while nine (20 %) received some physiotherapy. According to patients' preoperative walking history, 24 (55%) of patients could walk less than one kilometre before the operation. Before the operation, 36 (82%) patients needed to use a handrail to climb stairs. Thirty-eight (86%) patients did not use any walking aid preoperatively.

4.4.4 Pain

This section presents the pain results as measured by the VAS. The mean subjective measure of pain when walking, on the day of assessment was an average of 5.8 out of 10 on the VAS. At day three post operation, 30 subjects could not walk up stairs yet. For those who had walked up and down four steps,

the subjective measure of pain was 2.4 out of 10. The mean for pain at rest, on the day of assessment was 3.3 on the VAS.

4.4.5 Range of movement

This section presents ROM results as measured by a goniometer. When measured in supine, the average extension measure was 14.8°, flexion was 61.8° and flexion contracture was 14.8°. Quadriceps lag, measured over a pillow, was 11°. The prevalence of ROM is discussed in table 4.10.

Table 4.10 Prevalence of range of movement amongst subjects

Measure (degrees)	Subjects n (%)
Extension (0° - 10°)	16 (36%)
Extension (> 10°)	28 (64%)
Flexion (< 60°)	18 (41%)
Flexion (60° - 90°)	26 (59%)
Flexion contracture (0° - 10°)	16 (36%)
Flexion contracture (> 10°)	28 (64%)
Quadriceps lag (0° - 10°)	16 (36%)
Quadriceps lag (> 10°)	28 (64%)

According to table 4.10, there is equal prevalence among extension ROM, flexion contracture and quadriceps lag in the > 10° group of 28 (64%) subjects. The prevalence of flexion between 60° and 90° was 26 (59%) subjects.

Deleted:

4.4.6 Function

This section presents the level of assistance as measured by the ILOA score. Table 4.11 below presents the distribution of ILOA scores among subjects.

Table 4.11 Distribution of subjects with respect to functional aspects of the ILOA score

Variable	Independent	Standby assistance	Minimal assistance	Moderate assistance	Maximal assistance	Not tested
Supine to sit	27	2	9	4	0	0
Sit to stand	26	7	7	4	0	0
Ambulation	19	15	5	4	0	1

By day three post operation 27 subjects could move from supine to sit independently. Twenty six subjects could rise from sit to stand independently. However, only 19 subjects could perform ambulation independently and 15 subjects needed minimal assistance.

Table 4.12 below presents the distribution of ambulation speed among subjects.

Table 4.12 Distribution of subjects with respect to ambulation velocity of the ILOA score

	Speed (seconds)						
Variable	<20	21-30	31- 40	41-50	51-60	61-70	>70
Ambulation velocity	2	0	0	1	6	6	29

Twenty-nine subjects managed an ambulation velocity of more than 70 seconds over 13.4m. The mean level of assistance, measured on the ILOA (the total of supine to sit, sit to stand, ambulation and ambulation velocity) was 12.2 out of a maximum of 30 points.

Twenty-two patients used two elbow crutches as their assistive device (scoring a mean of 12 points on the assistive device score) and 22 used a walking frame (scoring a mean of 20 on the assistive device score) on day three post operation. Therefore, the mean ILOA score was 28.2 out of a maximum of 50 points.

4.5 Comparison of male and female functional scores, BMI and age

This section presents the results of gender differences with regards to the ILOA score, BMI and age. Table 4.13 below presents the averages of age, BMI and the ILOA among males and females.

Table 4.13 Gender means for age, BMI and ILOA Score

Variable	Age (mean)	Age (SD)	BMI (mean)	BMI (SD)	ILOA Score (mean)	ILOA Score (SD)
Males (0)	65	10.5	28	5.3	24	7.4
Females (1)	68	7.1	31	4.6	31	8.0

The average age for men was 65 and for females was 68 years. Men had an average BMI of 28 kg/m² and women had an average of 31kg/m². Males and females were significantly different in terms of function and level of assistance needed as indicated on the ILOA score. Men performed better in the ILOA score with an average of 24 points and women with 31 points.

4.6 Range of movement in relation to BMI and pain

This section presents BMI and pain (at rest and while walking) correlated to ROM. Table 4.14 below presents the results of BMI and pain correlated to ROM.

Table 4.14 ROM as correlated with BMI and pain (at rest and walking)

Variable	BMI (SD)	BMI (p value)	Pain rest (SD)	Pain rest (p value)	Pain walking (SD)	Pain walking (p value)
Extension	-0.03	0.86	-0.07	0.66	0.21	0.18
Flexion	-0.24	0.11	0.03	0.86	-0.23	0.12
Extension lag	0.01	0.95	-0.17	0.26	0.04	0.78
Flexion contracture	-0.20	0.19	-0.06	0.71	0.14	0.38

No correlation was found between the ROM (extension, flexion, extension lag and flexion contracture) and variables of:

- BMI
- pain (at rest and walking):

4.7 Correlation of function and medical conditions, preoperative function, pain, BMI

In order to find out whether medical conditions, preoperative functional history, pain (at rest, while walking and when climbing stairs) and BMI have an influence on ILOA score, statistical tests were performed. There were no correlations between ILOA score and BMI, pain at rest and pain when climbing stairs. A correlation was found between the ILOA and pain while walking. A p-value of 0.04 was generated, representing a correlation. The Rho value was 0.3. The scatter plot graph, representing ILOA score and pain while walking, is presented in Figure 4.1 below.

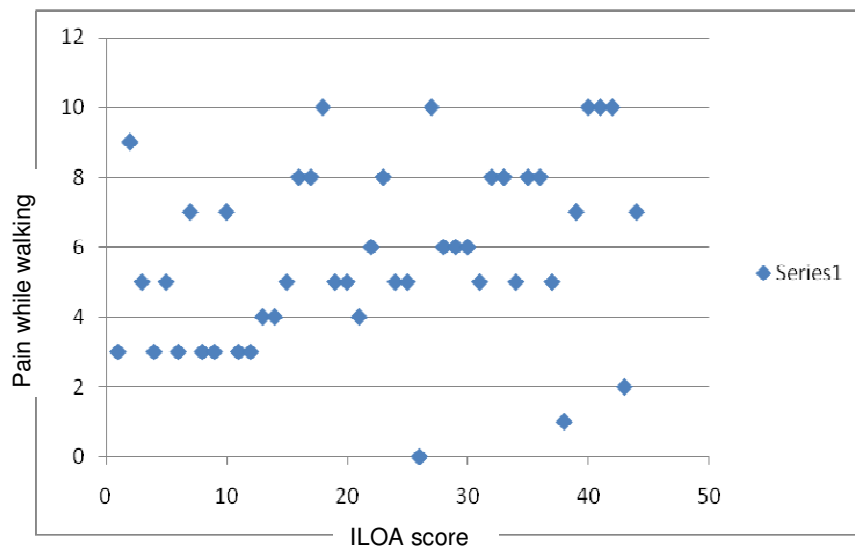


Figure 4.1 Correlational graph of pain while walking and ILOA score

Figure 4.1 presents the correlation between pain while walking and the ILOA score. The less pain experienced by the patients, the less assistance was needed to complete functional tasks. The more pain experienced by the patients, the more assistance was needed to complete functional tasks.

Twelve subjects had no existing medical conditions, 18 had one condition, seven had two conditions and the remaining seven had three conditions. As subjects with two or three conditions formed very small groups on their own, it was decided to group these subjects together for statistical analysis, as shown in Table 4.15 below.

Table 4.15 Grouping of existing medical conditions

Conditions	Numbers n (%)
Group 0: None	12 (27%)
Group 1: 1 condition (hypertension, hypercholesterolaemia, diabetes)	18 (41%)
Group 2: 2/3 conditions (hypertension + hypercholesterolaemia+ hypothyroidism/ diabetes)	14(32%)

In order to see whether the groups (number of medical conditions) have lower or higher ILOA scores, a Bartlett's test was done. The p-value was 0.58, which expresses that there was no association. Table 4.16 below presents the mean ILOA scores for the various medical condition groups.

Table 4.16 Mean ILOA score of subjects in medical condition groups

Medical conditions	Subjects	Mean (ILOA Score)	SD (ILOA Score)
0	12	27.2	9.8
1	18	27.3	9.2
2	14	30.1	6.4

Patients in group 0 and 1, had similar ILOA scores (27.2 and 27.3), while patients in group 2 had a score of 30.1. Overall, no correlation was found between medical conditions and ILOA score.

4.8 Length of stay with age, BMI, gender and pain

In order to see if length of stay was influenced by age, BMI, gender and pain (at rest or when walking) a Cox regression was done. The results of the factors that had an influence are shown in tables 4.17 - 4.20.

The effect of LOS on medical conditions is presented in Table 4.17 below.

Table 4.17 Effect of LOS on medical conditions

Variable	Hazard ratio	Standard Error	z	P>z	95% Confidence Interval
Group 1	0.13	0.39	0.34	0.74	-0.63 - 0.89
Group 2	0.27	0.42	0.65	0.52	-0.54 - 1.08

The effect of LOS on age and medical conditions is presented in Table 4.18 below.

Table 4.18 Effect of LOS on age and medical conditions

Variable	Hazard ratio	Standard Error	z	P>z	95% Confidence Interval
Group 1	0.14	0.39	0.36	0.72	-0.62 - 1.0
Group 2	0.32	0.43	0.76	0.45	-0.51 - 1.16
Age	0.01	0.02	0.60	0.55	-0.03 - 0.05

The effect of LOS on gender and medical conditions is presented in Table 4.19 below.

Table 4.19 Effect of LOS on gender and medical conditions

Variable	Hazard ratio	Standard Error	z	P>z	95% Confidence Interval
Group 1	0.17	0.39	0.44	0.66	-0.59 - 0.93
Group 2	0.24	0.41	0.59	0.55	-0.57 - 1.06
Gender	-0.27	0.32	-0.85	0.40	-0.91 - 0.36

The effect of LOS on age, gender and medical conditions is presented in Table 4.20 below.

Table 4.20 Effect of LOS on age, gender and medical conditions

Variable	Hazard ratio	Standard Error	z	P>z	95% Confidence Interval
Group 1	0.21	0.40	0.53	0.60	-0.57 - 1.0
Group 2	0.33	0.43	0.76	0.44	-0.52 - 1.18
Gender	-0.33	0.33	-0.99	0.32	-0.98 - 0.32
Age	0.02	0.02	0.79	0.43	-0.02 - 0.06

A confounder is a variable which has a hazard ratio change of between 15 and 20%. Age and gender were confounders, but age had a greater change. The older the subjects, the more likely they were to stay longer in the acute setting. Females were more likely to stay in the acute setting, for longer, than males. There was no significant difference between medical conditions and LOS. When doing a Cox regression (adjusted with age and gender), people in group 2 (two or three medical conditions) left the acute setting sooner than those in group 1 (one medical condition) and group 0 (no medical conditions).

The influence of medical conditions on LOS is shown in a Kaplan-Meier Estimate graph in Figure 4.2 below. Each line represents a different group. At LOS of four days, the first lot of patients was discharged. At four and 6.5 days, the groups overlap, representing similar data for the different groups. In the last part of the graph (beyond 6.5 days), it shows that group 2 left first, followed by group 1 and lastly group 0.

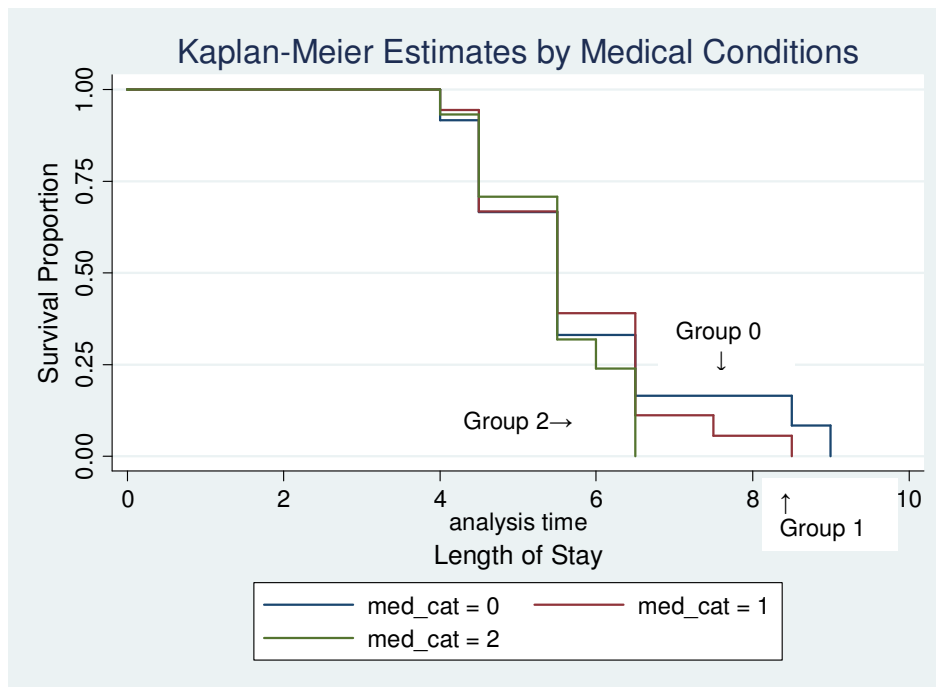


Figure 4.2 Influence of number of medical conditions on LOS

Table 4.12 presents the number of subjects in each of the medical condition groups as well as the percentage distribution of the population as expressed in LOS.

Table 4.21 LOS amongst medical condition groups

Variables		Percentage of population as expressed in LOS (days)		
Groups	Number of subjects	25%	50%	75%
0	12	4.5 days	5.5 days	6.5 days
1	18	4.5 days	5.5 days	6.5 days
2	14	4.5 days	5.5 days	6.5 days

The median LOS was identical amongst the groups. For example, in group 0, 25% of their 12 subjects (three) left on 4.5 days, 50% of their subjects (six) left on 5.5 days and the last 25% of subjects (three) left on 6.5 days. The percentage was true for the other groups, although the number of subjects differed.

BMI and pain (rest and walking) did not influence LOS. Pain (while ascending or descending stairs) was not considered, as not all the subjects climbed stairs on day three post operation.

4.9 Conclusion

On average, the length of stay was 5.7 days. Twenty-six subjects were females. Thirty-three subjects were between 60 and 70 years old. The majority of males (seven) and females (sixteen) were retired. Both groups can be classified as clinically overweight. Hypertension was the most common pre-existing medical condition. The most common reason for undergoing the TKR was primary osteoarthritis. This is to be expected, as rheumatoid arthritis and trauma patients were excluded.

Thirty five subjects had not been for preoperative physiotherapy for their knee. They could walk less than one kilometre, used a handrail when ascending or descending stairs and did not use a walking aid preoperatively.

Pain on walking had a mean value of 5.8 on the VAS, and pain at rest a mean value of 3.3 on the VAS. By day three post operation, 41 patients had not achieved 90° flexion or full extension. Thirty-six (82%) subjects also had weak quadriceps, as measured during active extension.

For supine to sit, sit to stand and ambulation, many patients were either independent or needed standby assistance. Males fared better as they had a lower ILOA score, which depicted a better functional score than females.

Females, older subjects and those with one or no medical conditions were more likely to stay longer in hospital.

CHAPTER 5

5.0 DISCUSSION

5.1 Introduction

The aim of this chapter is to discuss the results of the study. There are important factors which emerged from this study and can influence the outcome of TKA's in the acute setting. Acute, in this instance, refers to the time of operation to discharge from hospital.

Factors, including pain, range of movement (ROM), sociodemographic and clinical data were identified and their influence on functional status (supine to sit, sit to stand, ambulation, ascending and descending stairs, and ambulation velocity) and length of stay (LOS) are discussed in the following chapter.

5.2 Sociodemographic data

One of the objectives of this study was to identify the sociodemographic factors. This study defined sociodemographic data as age, gender and employment status.

In this study eighteen (41%) subjects were between 60 and 70 years old. This is to be expected, as an American profile from 1986-2002, states that arthritic changes in the over 65 years population, are considered normal (Crowninshield et al., 2006). The age range of this study's subjects was comparable to other studies. Kennedy et al. (2002) studied gender and group differences in total hip arthroplasty (THA) and TKA candidates. Males and females in this study were of similar ages to the population of Kennedy et al. (2002). Males in both this study and Kennedy et al. (2002) were 65 years old while females were 67 years old and in this study 68 years old. This illustrates that this study's sample is comparable to other study groups. The reason why females can be older at the time of the operation is usually because they are concerned about being unable

to take care of their families, when recovering from their TKA and therefore delay the operation (Escobar et al., 2007). Because females are older at the time of operation, their rehabilitation can be expected to be lengthened.

With regards to gender, 26 (59%) subjects in this study were female. Other studies have reported a similar number of females in their population. A study determining gender and group differences in TKA (Kennedy et al., 2002), and another study on knee ROM following TKA (Milner et al., 2003) stated that they had 401 (59%) females in their population. In a study on sociodemographic factors affecting TKA outcomes, in the United Kingdom (UK), United States of America (USA), Australia and Canada, Davis et al. (2008) found that the majority of participants for TKA's were also female. Similarly, Lingard et al. (2004) when testing the validity and responsiveness of certain outcome measures had a female population of 59%. All these studies support Crowninshield et al., 2006, who states that females are more likely to need total joint replacements. The ability of females to perform functionally will be discussed in section 5.2.1 below and their effect on LOS in section 5.7.1.

Eleven (61%) men were employed (self-employed, part-time or full-time) and 16 (62%) of the women were retired. This is to be expected, as most of the women in our sample are beyond the retiring age of 60 years in South Africa (Social Assistance Act, 2004). Davis et al. (2008) also found that most of the TKA patients in their setting are retired at the time of the operation. Davis' (2008) result is in contrast with the findings of Crowninshield et al. (2006) which states that females are more likely to be in employment than men, at the time of having a joint replacement. The clinical implications of knowing sociodemographic data is that they play a role in deciding the destination of a patient at discharge (Teeny et al., 2005; Jain et al., 2005 and Oldmeadow et al., 2002). Determining sociodemographic data, specifically gender differences, assists in defining a profile for subjects. In addition it helps to predict the TKA outcome and identify possible problems that may influence treatment. For example, a person who is in

employment may not be able to attend outpatient physiotherapy as readily as a retired person. Women for example may require exercise programmes that focus on some of the gender associated problem related to hormonal changes at an older age. Gender profiles are discussed in section 5.2.1 below.

5.2.1 Gender correlated with function, BMI and age

Other important correlations found to define postoperative status are the gender differences of function, BMI and age.

The female population was older than the male. This could have contributed to the large difference in the ILOA score, with men faring better than women. The functional levels are comparative to a study by Kennedy et al. (2002), where women performed worse functionally, than men. A study by Escobar et al. (2007) also found a correlation between gender and postoperative function, with women having a greater improvement in function than men, after their six month follow-up.

Even though the female population had slightly higher BMI scores than the males, and can be considered as obese, the men can be classified as clinically overweight. These high BMI scores are considered to be normal in the USA, with their peak incidence in obesity around the time that they may have a total joint replacement. In South Africa BMI is also representative of the population, as a large part of the population can be considered overweight or obese. In this study the correlation between BMI and LOS was determined in order to ascertain if BMI affects subjects' LOS. Knowledge of this can assist physiotherapists to provide more frequent or intense therapy to those who are expected to stay longer in hospital.

5.3 Clinical data

Another objective of this study was to identify clinical data. This study defined clinical data as: reasons for operation, anthropometric data (weight, height and

BMI), co-morbid diseases, preoperative physiotherapy, preoperative walking history and preoperative use of a walking aid. According to this population primary osteoarthritis was the most common reason for undergoing this operation. As increased body weight can lead to knee arthritis, it is not surprising that the average BMI of this population was 30 kg/m². Normal BMI is said to be between 20 – 25 kg/m², therefore it can be interpreted that the average person in this sample is moderately obese (Spicer et al., 2001). Patients with a BMI of more than 40 kg/m² can be classified as morbidly obese (Spicer et al., 2001). Milner et al. (2003) also had a mean BMI of 29.5 kg/m² in their study. Davis et al. (2008) found that average BMI's of TKA patients in UK, US, Australia and Canada were between 27 and 31 kg/m². Kennedy et al. (2002) also found females with a slightly higher BMI than males. This is the case in this study, with men having a slightly lower BMI than women. During physiotherapy, patients with a greater body weight and BMI often pose greater difficulty in the first three days post operation. The therapist usually needs additional assistance to help patients complete certain functional activities. Another problem is that people with increased BMI also have co-morbid diseases. Knowing patients' co-morbid diseases will help physiotherapists determine patients' average LOS (as discussed in section 5.7.1), thereby determining the type and frequency of physiotherapy treatment.

There is a link between diabetes and hypertension in obese people, with a higher incidence of these diseases among those who are obese than people with a healthy weight (Crowninshield et al., 2006). Hypertension was the most common co-morbid disease, followed by hypercholesterolaemia and diabetes. Gandhi et al. (2006) found that the majority of patients in their study also suffered with hypertension and reported that 24 (53.3 %) the patients had one co-morbidity. A different result is reported by Davis et al. (2008) who found that between 40 and 54% of TKA patients in their settings had two or more co-morbidities. In this study the figures were higher as 63% of the population had one or more co-morbid disease.

When asked, patients described their co-morbid diseases, patients were aware of their health status which meant that they had been screened preoperatively by a medical practitioner for this important factor. A limitation of this study is that patients were not assessed preoperatively and it would be advisable to include a thorough assessment of the co-morbidities in order to inform the contraindications of physiotherapy intervention.

Thirty-five (80%) patients did not receive preoperative physiotherapy. Preoperative physiotherapy would have included exercises, electrotherapy to reduce pain and soft tissue techniques to reduce muscle spasm. It is difficult to ascertain whether preoperative physiotherapy could have improved this study's population's postoperative outcomes or delayed them undergoing a TKA. Correlation of preoperative and postoperative function was understated in this study, as preoperative function was not tested. Preoperative physiotherapy can improve symptoms of OA of the knee by achieving a larger ROM, improving muscle strength of quadriceps and hamstrings, ensuring cardiovascular fitness and proprioception (Milne et al., 2000; Kelley, 2006). It is reported that improving these symptoms may improve walking.

Twenty-four (55%) patients could walk less than one kilometre preoperatively. Many patients reported that pain on walking limited their preoperative walking distance. Thirty-six (82%) of patients needed the support of a handrail when walking up and down stairs. Knowing the walking and stair-climbing history will allow physiotherapists to predict their rehabilitation needs and postoperative function. Patients, who struggled to walk long distances or needed assistance to climb stairs, may have diminished exercise tolerance and poor lower limb strength. These patients with reduced exercise tolerance would need to take frequent rests when undergoing gait training and special attention paid to bed program for lower limb strengthening.

Jones et al. (2003), concluded that preoperative joint function, co-morbid conditions, walking distance, and use of walking devices were useful tools in determining function at six months post operation, than preoperative joint ROM. Davis et al. (2008) states that preoperative function and pain are good indicators of postoperative outcome (good preoperative function can lead to good outcomes and vice versa). The correlation between preoperative function and postoperative function is discussed in section 5.6.1. As this study did not measure preoperative pain, correlating pain with function could not be made and therefore cannot be compared to this finding.

5.4 Pain

Even though this study did not measure preoperative pain, subjects' postoperative pain was measured. Patients in this study group were allowed to weight-bear postoperatively as much as their pain allowed. Patients reported an average of 5.8 out of 10 on the VAS experienced while walking. This figure is high and may suggest that pain was not controlled adequately by medication. The pain experienced at rest averaged 3.3 on the VAS and was 25 % lower than pain while walking. The pain experienced by patients while walking can explain why some patients may be reluctant to participate in their rehabilitation. Ascending and descending stairs is the highest functional level a TKA inpatient can achieve. By day three post operation, 30 subjects (61%) had not yet attempted stairs, as they were either mobilising on a frame or their crutch-walking was not satisfactory. The remaining 14 (39%) subjects had minimal pain of 2.7 on the VAS when climbing stairs. Those subjects with low pain scores performed better functionally as a result of a lower level of pain. From these findings one can deduce that if patients' pain levels are controlled before having physiotherapy, they will achieve higher function ability. To find out whether these figures were comparable with other studies, results from those studies were examined.

A study by Bullens et al. (2001) compared subjective and objective outcome measures which centred on patient satisfaction. After a five year follow-up, pain was recorded as 8 out of 10 on the VAS. Bullens' (2001) figure was considerably higher than this study's average indicating a higher level of pain experienced. A comparison cannot be drawn with this as Bullens' (2001) follow-up was long-term and pain was not divided into walking, at rest and stair climbing. What can be drawn from that study is that at five years, patients were not satisfied with the amount of pain experienced after having their TKA. A short-term study by Aarons et al. (1996) documenting recovery following TKA, reported pain of 6.91 on the VAS at seven days post operation. This study used a sample size of 23 subjects and two of those subjects had undergone revision TKA's. Due to the small sample size, there are not enough subjects to minimise the play of chance.

Another objective of this study was to correlate the patients' level of function and postoperative pain. A correlation was found with ILOA score and pain when walking. Patients who had lower ILOA scores (therefore a lower functional level) had more pain when walking. This result indicates the need to control postoperative pain to improve functional scores.

Patients also reported pain on flexing the knee, which was reportedly worse than pain while walking. The pain on flexing could have been as a result of stretching the surgical incision and swelling, which could have also influenced ROM.

5.5 Range of movement

In this study all patients had decreased ROM at day three post operation. One of the main goals of a TKA and the postoperative physiotherapy is to improve knee ROM. Knowing the ROM in the acute state will provide guidance to the physiotherapist for those patients who may need continuous passive motion (CPM) treatment to improve joint ROM and prevent stiffness.

Forty (90%) patients had a flexion contracture, which is problematic as insufficient knee extension results in the inability to heel-strike when walking on the operated leg, resulting in a poor gait pattern. Knee flexion measurements of 41 (93%) subjects were less than 90°. This is less than the required ROM for discharge. Poor knee flexion does not allow the patient to climb stairs (which requires 83°), descend stairs (which requires 90°), rising from a chair (which requires 93°) and tying a shoe (which requires 105°) (Edwards et al., 2004). The subjects of this study had to rise from a chair, ascend and descend stairs even if their knee ROM was less than the recommended 83° to 93°. Subjects were able to perform these activities with reduced ROM as they compensated with excessive hip movement. Excessive hip movement on the operated side will cause muscle imbalances, affecting the patients' biomechanics, and result in lumbar strain.

Only long term studies have been performed on the ROM following TKA. Kim et al., 2004 found that there was a prevalence of 1.3% limited ROM in 1000 TKA's at 32 months postoperatively. Gandhi et al. (2006) had an incidence of 3.7% of knee stiffness (defined as less than 90° at one year post operation) in 1216 TKA's. Stiff knees may be attributed to poor surgical skill, poor postoperative rehabilitation due to lack of therapist skill and/or lack of co-operation from the patient. In the acute stage reduced ROM is not unexpected and the therapists' role is to recognise patients who may struggle to achieve sufficient ROM and educate them with regards to a bed program. Gandhi et al. (2006) and Kim et al. (2004) found that preoperative knee flexion influenced postoperative knee flexion – the better the preoperative flexion, the better the outcome and therefore they suggest preoperative physiotherapy to improve the preoperative ROM of the knee.

In a one year post operation study to determine predictive factors for stiff knees following TKA's, Gandhi et al. (2006) concluded that medical conditions do not affect knee ROM. In Gandhi's (2006) study, BMI did not influence ROM. This is

at odds with the long-term study by Milner et al. (2003), who reported that patients with a higher BMI had less flexion and extension at a 12 month follow-up.

As mentioned above significance of knowing postoperative knee ROM is that it can determine functional ability and also help to target post-discharge physiotherapy. Milner et al. (2003) found that patients with ranges less than 95° at 12 months scored lower, in functional terms, during the same period. The researchers hypothesized that function would correlate with ROM; however, the results of this study did not correlate function with knee ROM. Even though all patients had limited ROM, they were still able to perform many of the functional activities. An explanation could be that patients with decreased knee ROM can compensate when walking by using their hip in an unnatural manner (Milner et al., 2003) to perform various functional activities. Patients with poor knee ROM must be referred for outpatient physiotherapy to prevent lumbar strain and improve their ability to complete various activities of daily living (ADL's). Severity of the lack of ROM will be able to guide the frequency and time frame of treatment needed. Subjects did not have the required ROM or quadriceps strength for discharge.

5.6 Functional status

In order to understand the status of TKA in depth it was important to determine patients' functional level as measured by the ILOA scores. Functional status in this study was measured using the Iowa Level of Assistance (ILOA) score on day three post operation and the components include: supine to sit, sit to stand, ambulation, ascending and descending stairs and ambulation velocity. Thirty-one (70%) patients were independent (level zero) or needed standby assistance (level one) for supine to sit, 33 (75%) patients were independent or needed standby assistance for sit to stand and 34 (77%) patients were independent or needed standby assistance for ambulation. (Appendix 6 provides the ordinal

scale and definitions for level of assistance.) According to the definitions, 31(70%) patients needed no supervision or nearby supervision for supine to sit, 33 (75%) patients needed no supervision or nearby supervision for sit to stand and 34 (77%) patients no supervision or nearby supervision for ambulation.

These results are to be expected of TKA patients on day three post operation, as patients were mobilised out of bed by a physiotherapist from day two, therefore by day three they should be able to perform supine to sit, sit to stand and ambulation with little assistance. In addition, 28 (63%) patients were discharged on day three or four post-operation. In order to be discharged from Olivedale Clinic and Morningside Medi-Clinic, patients need to be able to perform supine to sit, sit to stand and ambulation independently.

Twenty-nine patients took more than 70 seconds to walk 13.4m. This is slower than normal walking speed. According to www.USroads.com, the average walking speed is 1.2m/ second. Therefore, the average walking speed for 13.4m should be 11 seconds. This is at least 59 seconds slower than the average ambulation speed of those 29 patients. Poor ambulation speed in TKA patients could be as a result of pain, poor proprioception and lack of confidence in walking.

In this study the mean level of assistance needed to complete functional tasks was approximately 12.2 out of 30 points (41%) on the ILOA scale. From these results, on average, patients needed level two or three (minimal or moderate) assistance to complete functional tasks, which is a good functional level. In a study by Oldmeadow et al. (2002) patients were discharged at day four, five and six post operation. In Oldmeadow's (2002) study 105 patients were assessed on day of discharge. Thirty six percent of patients who were discharged home and 20% of patients who were discharged to rehabilitation had a level zero of assistance (independent). Seven (16%) patients had a level one of assistance (standby) and 12 (28%) of patients had a level two or more of assistance

(minimal, moderate or maximum). Had the authors of this study assessed patients of day of discharge, it would have introduced a confounding variable and the findings may have been similar to Oldmeadow's (2002) study.

In a prospective observational study where patients were followed-up after six months, patients seemed to perform better, functionally, if their preoperative function was good (Escobar et al., 2007). A limitation of this study is that patients' function was not tested preoperatively and therefore the change in function cannot be established. However, this study focussed on acute status and comparing postoperative long term function with preoperative function was not the focus of this study. The study focussed on aspects that are described in the ILOA and attainable in the short term.

5.6.1 Correlation of function with medical conditions, preoperative function and BMI

Another objective of this study was to establish if the number of medical conditions had an influence on functional level. The ILOA scores amongst the three medical condition groups (group zero with no medical conditions, group one with one medical condition and group two with two or three medical conditions) did not differ significantly. These results reveal that the number of medical conditions does not affect the acute functional outcome of a TKA patient. This finding is in contrast to a study by Escobar et al. (2007) who found a correlation between medical conditions and poor function. A reason for this finding can be their large sample size of 640 patients.

Lastly, BMI and ILOA scores were correlated. In this study, there was no correlation between BMI and functional level. However, other studies documented differences in functional scores of patients within certain BMI ranges. Spicer et al. (2001) performed a study comparing the Knee Society Score (KSS) of TKA's patients with a BMI of over or under 30 kg/m². Those who have a BMI score lower than 30 kg/m² had higher pre- and postoperative KSS

scores. However, the group that had the highest difference between pre- and postoperative scores was the group between 35 - 39.9 kg/m². In Spicer's (2001) study, they found that revision and prosthesis survivorship rates were the same among obese and non-obese patients, even though obese patients have lower activity levels. From Spicer's (2001) study, those with higher BMI's will have poor function levels and will need more assistance to reach discharge criteria.

5.7 Length of Stay

The functional level of patients often determines the LOS of TKA patients. On reviewing the literature similar studies were interested in length of stay as a prognostic factor, therefore this was included as a variable in the analysis. The purpose of establishing the average LOS was to determine which factors affected LOS as those factors have economic implications (as discussed in section 5.7.1 below). In establishing the acute status of TKA patients' LOS is one of the factors that define postoperative status. LOS was established at 5.7 days in this study. This is comparable with other studies that found LOS to be 5.4 days (Teeny et al., 2005 and Jain et al., 2005). In these two studies, Teeny et al. (2005) aimed to discover the outcomes of a program implemented to decrease LOS while Jain et al. (2005) performed an epidemiological study to determine the longitudinal trends of TKA.

A study whose methodology was more comparable to this study was by Oldmeadow et al. (2002) where the researcher aimed to examine outcomes at discharge. The average LOS in Oldmeadow's (2002) study was 6.5 days. Studies by Teeny et al. (2005) and Jain et al. (2005) were set in the United States of America and Oldmeadow's (2002) study was set in Melbourne, Australia, where they refer many of the patients to a step-down or rehabilitation centre. Reasons for referral to a step-down ward include availability of beds and poor functional status. The difference, however, is that the patients in the Johannesburg setting were all discharged back home, and not to a step-down

facility. The patients referred to step-down wards, unlike the patients in South Africa would have continued treatment and would have a better chance of good results in the long term. As subjects from this study were discharged straight home, it is important to know the clinical factors which influence LOS and function. This would influence the intensity of the home programme and the type of education given to the patient.

In order to predict functional status following TKA, it is important to find the link between variables and status.

5.7.1 Length of stay correlated with BMI, medical conditions, age, gender and pain

From the results LOS was not correlated with BMI and pain. Therefore increased BMI or pain experienced did not affect patients LOS in hospital. However, from the results, one can conclude that older subjects and female subjects stayed longer in hospital. This information will help clinicians to estimate LOS and factors affecting LOS for these patients in future.

In terms of medical conditions, one would have expected those with two or three conditions to stay longer, however this is not the case. The reasons why patients with two or three conditions did not stay longer, can be that patients who had too many complications were not selected for the operation in the first place, or excluded as they did not meet the criteria of the research. Those who had two or three medical conditions were therefore carefully selected, as their conditions were under control. This is of importance, as having co-morbid conditions monitored will reduce the risk of postoperative complications. The value of knowing the effect of the number of co-morbidities on LOS will further help physiotherapists to estimate LOS for TKA patients and with this information tailor their rehabilitation programmes according to their needs. Clinically, extra care and attention should be paid to female and older patients.

5.10 Limitations

A limitation of this study is that patients were not assessed preoperatively and it would be advisable to include a thorough assessment of the co-morbidities in order to inform the contraindications of physiotherapy intervention and possible effects on postoperative function.

Correlation of preoperative and postoperative function was understated in this study, as preoperative function was not tested. The change in function can therefore not be established. However, this study focussed on acute status and comparing postoperative long term function with preoperative function was not the focus of this study. The study focussed on aspects that are described in the ILOA and attainable in the short term.

As this study did not measure preoperative pain, a comparison with postoperative pain could not be made. Patients also had the option of taking six-hourly pain medication. As patients took their pain medication irregularly, examinations took place at various times before and after taking the medication. This was not accounted for, thus the researcher did not control for bias of pain.

5.11 Conclusion

From the discussion, a larger female population and age band of 60 to 80 year olds is comparable to the demographic results of other TKA studies. As increased body weight can lead to arthritis, it is not surprising that the average TKA patient in this study was clinical obesity. Hypertension was the most prevalent co-morbid disease with 28 (64%) of subjects suffering with it. This is also unremarkable as there is a link between diabetes and hypertension in obese people. Dizziness in hypertensive patients, for example, will affect the ability of physiotherapists to mobilise patients.

From the preoperative history patients struggled to walk long distances and needed the support of a handrail to climb stairs. Knowing the walking and stair-climbing history will allow physiotherapists to predict postoperative function, as there is a correlation between preoperative and postoperative function. Males performed better in their ILOA scores. A reason for this could be that females were on average three years older than males. In this study pain while walking was correlated with function. If pain is controlled, functional level in TKA patients may be improved.

All patients experienced decreased ROM and quadriceps strength. Although LOS was not correlated to ROM, there were correlations between LOS and age, gender and number of co-morbid conditions. Older patients, female patients and those with fewer co-morbid conditions were more likely to stay in hospital for longer. This knowledge will help physiotherapists to estimate LOS for TKA patients in the future.

CHAPTER 6

6.0 CONCLUSION

The overall aim of this study was to establish the postoperative status of TKA patients on discharge from an acute setting. The objectives were to determine the sociodemographic data, clinical data, pain, ROM and functional status of TKA patients in the South African context. The average LOS in the two hospitals was 5.7 days. There were 18 (41%) males and 26 (59%) females in this population. Females (average of 68 years) were older than males (average of 65 years). Males and females were clinically obese with a BMI of 30kg/m². The gender, age and anthropometric data of this study correlated with previous studies. According to preoperative history, 35 (80%) subjects did not receive physiotherapy, 24 (55%) subjects could walk less than one kilometre and 36 (82%) subjects needed the support of a handrail. Studies suggest that preoperative function can influence postoperative function. Results of this study's postoperative function stated that subjects needed 41% assistance on day three, which can be considered minimal to moderate, to complete functional tasks.

Another objective was to determine how identified factors influenced functional status. From this study, females were more likely to perform poorly with functional tasks and stay in hospital for longer. This can help physiotherapists to set realistic rehabilitation goals for female subjects.

Postoperatively, subjects in this study experienced the most pain while walking. A correlation was found with ILOA score and pain when walking. This result suggests that controlling postoperative pain can improve functional scores.

Subjects did not have the required ROM or quadriceps strength for discharge. All of the patients did not have the criteria of 90° flexion range, and 64% did not have adequate quadriceps strength or extension range. The significance of knowing postoperative knee ROM is that it can determine functional ability and

also help to target post-discharge physiotherapy as well as anticipate and counter compensatory movements that can cause other biomechanical problems. A recommendation for patients with poor knee ROM is to refer them for outpatient physiotherapy. Severity of the lack of ROM will be able to guide the frequency and time frame of treatment needed.

Knowing which factors can affect outcome, will allow hospitals with limited resources to prioritise these patients who are more in need than others. Other literature on factors affecting short-term outcome could not be found, and therefore cannot be compared to this study's findings.

A strong point of this study is the use of universally accepted outcome measures which make this study repeatable. This study can be repeated in other areas, such as the public health sector, to get a broader view of the short term status of TKA patients. Preoperative examination can also be performed in a repeat study to compare pain, ROM and function with postoperative status.

The goal of a TKA is to provide the patient with a stable and painless knee with sufficient ROM to perform ADL's (Gandhi et al., 2006). As many studies only focused on the long-term status of TKA patients (Aarons et al., 1996), this study examined the short-term status. The value of this is to furnish patients and the therapist with knowledge of their acute postoperative status and appropriate rehabilitation programme that will influence their prognosis.

APPENDIX 1

Letter to hospital management

Flat 31
The Crest
Naivasha Rd
Sunninghill
Johannesburg
2019
29 March 2007

Dear Sir/ Madam

Re: Permission to conduct study

Hello. My name is Neeta Khandoo. I am a second year MSc Physiotherapy student at the University of the Witwatersrand and am employed by Nissen and Swift Physiotherapists. My interest lies in rehabilitation following Orthopaedic surgery, and specifically knee arthroplasty. My proposed topic for my research report is 'The postoperative status of total knee arthroplasty (TKA) patients on discharge from an acute setting in Johannesburg Hospitals, South Africa'.

It is found that little is known about patients undergoing knee arthroplasty patients in an acute setting in South Africa. This study would therefore benefit TKA patients in terms of giving them an accurate picture of their postoperative status with regards to their specific clinical condition.

I would like to gain your permission to conduct my study at Morningside Clinic. Aspects from the Knee Society Knee Score (KSKS) and the complete Iowa Level of Assistance (ILOA) score will be used to assess them. The tests I will conduct are non-invasive and include the completion of a questionnaire, measurement of joint range and observation of functional activities (such as walking and ascending and descending stairs). Data collection should last approximately 6 months (from June to November), or until I've collected data from 60 patients. Ethical approval will be obtained before commencing this report. It is completely voluntary and confidential. Should patients agree to participate, they will be asked to sign informed consent forms (attached is a copy of the form).

If you have any queries, please contact me on 082 4722 867 or at nkhandoo@hotmail.com. I look forward to your favourable response.

Yours faithfully

Neeta Khandoo

APPENDIX 2

Letter to surgeon

Flat 31
The Crest
Naivasha Rd
Sunninghill
Johannesburg
2019
29 March 2007

Dear Sir

Re: Permission to conduct study

Hello. My name is Neeta Khandoo. I am a second year MSc Physiotherapy student at the University of the Witwatersrand and I am employed by Nissen and Swift Physiotherapists. My interest lies in rehabilitation following Orthopaedic surgery, and specifically knee arthroplasty. My proposed topic for my research report is 'The postoperative status of total knee arthroplasty (TKA) patients on discharge from an acute setting in Johannesburg Hospitals, South Africa'. (Please find attached copy of my research proposal.)

It is found that little is known about patients undergoing knee arthroplasty patients in an acute setting in South Africa. This study would therefore benefit TKA patients in terms of giving them an accurate picture of their postoperative status with regards to their specific clinical condition.

I would like to gain your permission to conduct my study using patients from your clinic as subjects. Aspects from the Knee Society Knee Score (KSKS) and the complete Iowa Level of Assistance (ILOA) score will be used to assess them. The tests I will include are non-invasive and will include the completion of a questionnaire, measurement of joint range and observation of functional activities (such as walking and ascending and descending stairs). Data collection should last approximately 6 months (from June to November), or until I've collected data from 60 patients. Ethical approval will be obtained before commencing this report and participation will be completely voluntary and confidential. Should patients agree to participate, they will be asked to sign informed consent forms (attached is a copy of the form).

If you have any queries, please contact me on 082 4722 867 or at nkhandoo@hotmail.com. I look forward to your favourable response.

Yours faithfully
Neeta Khandoo

APPENDIX 3

Information Sheet

Good day,

I am Neeta Khandoo, a physiotherapist, from the University of the Witwatersrand. I am trying to find out how knee replacement patients cope on discharge from the hospital. For this study, I require 60 patients, who have undergone this operation, to agree to me carrying out an assessment on them.

Why am I doing this? Research has been done in some countries, such as Australia and America about the long term condition of knee replacement patients. Not much is known about the condition of South African patients when they leave the hospital after the operation.

Why is this important? To give both patients realistic expectations about what they should be experiencing (in terms of pain, stiffness and mobility) when they are discharged from hospital.

What do I expect from the participants of this study? The American Knee Society has developed an assessment to find out about the condition of the knee. Using a few questions from there, I will ask you how you managed to walk before the operation and how much pain you feel after the operation. I also wish to find out if the knee is stiff, by measuring the amount you can bend and straighten it. The last part of the assessment requires me observe you getting out of bed and walking. This questioning and testing should last approximately 30 minutes. These are standard tests done on knee replacement patients worldwide. They will not cause any damage.

Are there any benefits to the participants? Yes, should any problems be picked up, you will be informed. I will then refer you to the appropriate service.

Do I have to participate? This is entirely voluntary. Once again, your treatment will not be compromised. This information will not be shared with anyone.

May I withdraw from the study? You are welcome to withdraw at any time.

What about confidentiality? Only codes will be used on the result sheet. I am the only person who will have access to the names.

If you have any queries, more information can be obtained from me at 082 4722 867.

If you are willing to participate, please complete and sign the form below.

Thank you

Neeta Khandoo

Consent form

I agree to participate in the study regarding knee replacement patients

Name: _____ Signature: _____

Date: ____/____/2007

Witness: _____ Signature: _____

Date: ____/____/2007

APPENDIX 4

Sociodemographic and clinical data capture sheet

Patient number: _____

Date: _____

Length of stay: _____

Please complete the following form by entering your age, and ticking the relevant boxes.

Socio-demographic data

1. Age: _____

2. Gender: 1) M ☐
2) F ☐

3. Employment: 1) Retired ☐
2) Unemployed ☐
3) Self-employed ☐
4) Employed full time ☐
5) Employed part time ☐
6) Boarded ☐
7) Retrenched ☐

Clinical data (with aspects taken from the KSKS)

4. Weight: _____

5. Height _____

6. Existing medical conditions:

7. Medical reason for operation (i.e. diagnosis):

8. Did you receive any physiotherapy preoperatively? : Y ☐
N ☐

8.1. If so, how often? 1) 1 to 3 times a year ☐
2) 1 to 3 times a month ☐
3) 1 to 3 times a week ☐

9. Before the operation, could you walk
- 1) Unlimited ☐
 - 2) For 2 km ☐
 - 3) Between 1-2km ☐
 - 4) Less than 1km ☐
 - 5) Within your house ☐
10. With regards to stairs, could you walk
- 1) Up and down ☐
 - 2) Up and down using a handrail ☐
 - 3) Neither up or down ☐
11. Before the operation, were you walking with
- 1)-out any walking aid ☐
 - 2) A walking stick ☐
 - 3) Two walking sticks ☐
 - 4) Crutches or walking frame ☐
 - 5) Other walking aid ☐

APPENDIX 5

Patient assessment form

Patient number: _____

VISUAL ANALOGUE SCALE (with aspects from KSKS)

PAIN when walking

0 1 2 3 4 5 6 7 8 9 10

PAIN when climbing stairs

0 1 2 3 4 5 6 7 8 9 10

PAIN at rest

0 1 2 3 4 5 6 7 8 9 10

GONIOMETRY

ROM : °- °

EXTENSION LAG: _____ °

FLEXION CONTRACTURE: _____ °

APPENDIX 5 continued

Patient number: _____

ILOA SCORE (Shields et al, 1995)

ACTIVITY	0	1	2	3	4	5	6
Supine to sit							
Sit to stand							
Stair climbing							
Ambulation							
Ambulation velocity							

Ordinal Scale for Grades of functional activity (Shields et al, 1995)

- 0 = Independent
- 1 = Standby assistance
- 2 = Minimal assistance
- 3 = Moderate assistance
- 4 = Maximal assistance
- 5 = Failed maximal assistance
- 6 = Not tested

Ordinal Scale for Assistive devices (Jesudason & Stiller, 2002)

- 0 = no assistive device
- 1 = one walking stick or crutch
- 2 = two walking sticks
- 3 = two elbow crutches
- 4 = two crutches
- 5 = frame (standard or rollator)

Ordinal Scale for Ambulation velocity (Shields et al, 1995)

- 0 = ambulates 13.4 m in ≤ 20 s
- 1 = ambulates 13.4 m in 21-30s
- 2 = ambulates 13.4 m in 31-40s
- 3 = ambulates 13.4 m in 41-50s
- 4 = ambulates 13.4 m in 51-60s
- 5 = ambulates 13.4 m in 61-70s
- 6 = ambulates 13.4 m in > 70 s

APPENDIX 6

Ordinal scale and definitions for level of assistance (Jesudason & Stiller, 2002)

Ordinal Scale	Level of assistance
0 – Independent	No assistance or supervision is necessary to safely perform the activity with or without assistive devices, aids or modification
1 – Standby	Nearby supervision is required for the safe performance of the activity; no contact
2 – Minimal	One point of contact is necessary for the safe performance of the activity including helping with the application of the assistive device (part of ambulation), getting leg(s) on or off the leg rest and stabilising an assistive device
3 – Moderate	Two points of contact are necessary (by one or two persons) for the safe performance of the activity
4 – Maximal	Significant support is necessary at a total of three or more points of contact (by one or more people) for the safe performance of the activity
5 – Failed	Attempted activity, but failed with maximal assistance
6 - Not tested	Due to medical reasons or reasons of safety, test was not attempted

APPENDIX 7

Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Division of the Deputy Registrar (Research)

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

R14/49 Khando

CLEARANCE CERTIFICATE

PROTOCOL NUMBER M070415

PROJECT

The Postoperative Status of Total Knee
Arthroplasty (TKA) Patients in a Johannesburg
Hospital, SA

INVESTIGATORS

Miss N Khando

DEPARTMENT

Department of Physiotherapy

DATE CONSIDERED

07.05.04

DECISION OF THE COMMITTEE*

APPROVED UNCONDITIONALLY

Unless otherwise specified this ethical clearance is valid for 5 years and may be renewed upon application.

DATE 07.05.11

CHAIRPERSON


(Professors PE Cleaton-Jones, A Dhai, M Vorster,
C Feldman, A Woodiwiss)

*Guidelines for written 'informed consent' attached where applicable

cc: Supervisor: Myerwa H

DECLARATION OF INVESTIGATOR(S)

To be completed in duplicate and **ONE COPY** returned to the Secretary at Room 10005, 10th Floor,
Senate House, University.

I/We fully understand the conditions under which I am/we are authorized to carry out the abovementioned
research and I/we guarantee to ensure compliance with these conditions. Should any departure to be
contemplated from the research procedure as approved I/we undertake to resubmit the protocol to the
Committee. I agree to a completion of a yearly progress report.

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX 8

Letter of approval of title



Ms N Khandoo
25 Gardenia Street
Braelyn Heights
East London
5201
South Africa

Faculty of Health Sciences
Medical School, 7 York Road, Parktown, 2193
Fax: (011) 717-2119
Tel: (011) 717-2075/6

Reference: Mrs Alison Mclean
E-mail: mcleanam@health.wits.ac.za
06 July 2007
Person No: 0000720A
PAG

Dear Ms Khandoo

Master of Science in Physiotherapy: Approval of Title

We have pleasure in advising that your proposal entitled "*The postoperative status of total knee arthroplasty (TKA) patients on discharge from an acute setting in a Johannesburg hospital, South Africa*" has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

A handwritten signature in black ink, appearing to read "S. Benn".

Mrs Sandra Benn
Faculty Registrar
Faculty of Health Sciences

APPENDIX 9

Change of title



Faculty of Health Sciences
Medical School, 7 York Road, Parktown, 2193
Fax: (011) 717-2119
Tel: (011) 717 2746

Reference: Ms Tania Van Loeve
E-mail: tania.vanleeve@wits.ac.za
17 June 2008
Person No: 0000720A
TAA

Ms N Khando
25 Gordon's Street
Brooklyn Heights
East London
5201
South Africa

Dear Ms Khando

Master of Science in Physiotherapy: Change of title of research

I am pleased to inform you that the following change in the title of your Research Report for the degree of has been approved:

From: **The postoperative status of total knee arthroplasty (TKA) patients on discharge from an acute setting in a Johannesburg hospital, South Africa**
To: **The postoperative status of total knee arthroplasty (TKA) patients on discharge from an acute setting in Johannesburg hospitals, South Africa**

Yours sincerely

Mrs Sandra Fern
Faculty Registrar
Faculty of Health Sciences

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