CHAPTER 2

LITERATURE REVIEW

1. Introduction

This chapter will cover various components that are contained in the researcher's research question: Does a mobility regimen on its own, have the same functional outcome as a programme of bed exercises and mobilisation in patients following primary total hip arthroplasty, at discharge from hospital?

The researcher will focus on the following components:

- The role of primary THA as an effective form of management of chronically painful hip joints. This will include indications, types of THA and complications that may arise.
- The role of physiotherapy in the management of patients in the acute postoperative phase of THA.
- The reliability and validity of the outcome measures used in this study namely, the ILOA Scale to measure function; VAS to measure resting pain and goniometry to measure range of hip motion.

The search engines utilised by the researcher are Pubmed and PEDRO. There were no specifications made to limit the search with regard to time.

2. Primary total hip arthroplasty as a treatment tool:

THA involves the surgical replacement of the femoral head and the acetabulum by an artificial prosthesis. John Charnley pioneered this surgical procedure in 1962 (Moreland, 1993). There have been numerous changes and advancements since the original concept was introduced, making THA one of today's most widely used and successful orthopaedic procedures. In a study conducted at the Iowa Methodist Medical Center, between 1970 and 1972, the authors followed up their THA patients for a minimum period of 20 years postoperatively. It was found that the patients who had survived this period of

time felt that the outcome of the procedure was satisfactory (96% of patients). It was also found that in the vast majority of patients (85%) had reprieve from their pain at the twenty year post-THA assessment. (Schulte et al, 1993).

2.1 The indications for THA

"The advent of total joint arthroplasty has revolutionized the management of osteoarthritis (OA), rheumatoid arthritis (RA), and related conditions by dramatically improving the functional status and quality of life of individuals disabled by these disorders." (Zavadak et al, 1995). THA is used to treat a wide variety of hip disorders which include OA, RA, comminuted intracapsular proximal femoral fractures and ankylosed hips (Hall & Brody, 1999; Kilgus et al, 1990; Anderson et al, 1979). The cardinal indication for performing THA, is pain that is so severe that it inhibits the patients ability to carry out activities of daily living (Hall & Brody, 1999; Shih et al, 1994).

Prior to patients undergoing THA, patients must have a trial of conservative management before the surgical approach is adopted. Conservative management consists of the use of the following treatment options as indicated by Moreland (1993):

- Prescription of non-steroidal anti-inflammatory medications.
- The use of assistive appliances, for example a walking stick, to decrease the loading on an already damaged joint.
- The reduction of the patients' activity levels.
- The patient losing weight if indicated in overweight individuals.

The role of physiotherapy as a component of the conservative management approach was not mentioned by Moreland (1993). Tak et al (2005), conducted a randomised controlled trial to evaluate the effect of an eight-week program with strength training and lifestyle advice, for patients who had OA of the hip and were more than 55 years old. Data was collected at baseline, post-test and follow-up at three months. The authors concluded that there was no treatment effect on quality of life, BMI, or the patient's ability

to walk, ascend or descend stairs and toe reaching. They did find positive effects at the post-test, on pain (moderate effect) and hip function (small effect). Small positive effects were also found at follow-up on pain, self-reported disability and the timed “Up & Go” test.

Although Tak et al (2005), concludes that this study provides evidence of the benefit of exercise in the management of OA the following points seem to indicate otherwise:

- The failure of sustainability of benefits such as decreased pain (was less at follow-up) and hip function (no treatment effect at follow-up).
- No treatment effect on quality of life or important functional abilities such as walking and stair climbing.

In a systematic review conducted by the Institute for International Health based at the University of Sydney, Australia, the authors Fransen et al (2002), investigated the possible advantage of people with OA of the hip or knee performing land based therapeutic exercises. The authors searched five databases for randomised controlled trials. The search yielded only two studies that might provide data on people with OA of the hip. In comparison they found fourteen studies investigating the benefit of exercises to patients with knee OA. The outcome measures assessed by the authors were the effects exercise had on pain levels and self-reported physical function. The authors concluded that land based therapeutic exercises showed some decrease in pain and improved function for people with OA of the knee. They could not however draw any conclusions on the effect of exercise on people with OA of the hip.

If the conservative approach fails then surgical management is indicated.
Patients need to be carefully evaluated to ascertain whether they are appropriate candidates for a THA. Patients who’s pain is so severe that they can’t perform activities of daily living, or require assistive devices to assist ambulation, or are bedridden because of their hip disorder are the most suitable candidates. This is provided that they are medically fit enough to be

operated upon (Moreland, 1993). In a study conducted by Aarons et al (1996), it was found that THA patients had attained significant pain relief by day seven post-THA and their function had improved significantly by day 50 post-operation.

2.2 Types of THA Prosthesis

The type of prosthesis used for THA has a direct bearing on the postoperative rehabilitation process. If one were to consider the two main types of prosthesis used these would be classified as either cemented or uncemented (Hall & Brody, 1999). In the cemented prosthesis, bone cement is used to secure the femoral and acetabular components to the prepared bone surfaces. Due to this type of prosthesis being inertly stable postoperatively, immediate weight bearing, albeit with crutches is allowed. The long term disadvantage of using cemented prosthesis is the failure of fixation with the elapse of time. In a study conducted by Mulroy & Harris (1990), it was found that there was an incidence of 3% femoral component loosening (a minimum 10 year follow-up of patients). With regard to acetabular component loosening the incidence was found to be 42% (mean of 11.2 years follow-up). (Russotti et al, 1988).

In uncemented prosthesis the stability of the implants are dependent upon the precision of bone surface preparation as the implant is press-fitted into the bone. Uncemented prosthesis was developed due to problems arising with bone resorption and loosening of cemented components (Hall & Brody, 1999). The stability of the implants is attained as bone grows into the prosthesis thus stabilising it. The disadvantage with this type of prosthesis is that it takes approximately six to twelve weeks for the prosthesis to become stable, thus requiring strict partial weight bearing status to be adhered to by the patient.

The concept of hybrid prostheses came about due to orthopaedic surgeons having good results with cemented femoral components and uncemented acetabular components. This gave rise to creating a prosthesis that utilised the best of both worlds by having cemented femoral components coupled with an uncemented acetabulum. (Hall & Brody,1999).

Weight bearing status:

Depending on whether the prosthesis is cemented or uncemented, the patient is advised on how much weight he/she is allowed to take through the operated limb (Moreland,1993). With cemented and hybrid prostheses, pain tolerated weight bearing is advocated for six weeks. With the uncemented prosthesis strict partial weight bearing is instructed for six-twelve weeks (Hall & Brody, 1999). In regards to the use of assistive devices, the patients need to use two crutches or a walker for the first six weeks, and then one crutch on the side of the non-operated limb.

2.3 Postoperative complication:

The incidence of postoperative complications after primary THA is relatively low (Mahomed et al, 2003). The specific complications that can occur will now be discussed.

2.3.1 Early complications

2.3.1.1 Thromboembolic disease

Thromboembolic disease refers to the presence of blood clot/s in the deep veins of the limbs (DVT) or in the lung fields (pulmonary embolism). Deep-vein thrombosis (DVT) is a frequent postoperative complication of THA and needs the medical and allied staff to be vigilant with regard to looking for clinical signs indicative of DVT (Hall & Brody, 1999). If a DVT is detected it needs to be treated as a medical emergency. Pulmonary embolism may be potentially fatal with a reported incidence of 0.9% (Mahomed et al, 2003). Preventative measures comprise use of anti-coagulation medications as well as mechanical methods for example elastic stockings (Jacobs, Galante & Sumner, 1993).

2.3.1.2 Dislocation

"Dislocation is a leading early complication of total hip arthroplasty." (Masonis & Bourne, 2002). The occurrence of dislocations is highest during the first few weeks after surgery. The reason for this is believed to be the insufficient amount of scar tissue formed around the prosthesis thus making it vulnerable to dislocation (Moreland, 1993). According to Moreland (1993) the main causes for dislocation are:

- Placing the operated limb into terminal range-of-motion positions during the vulnerable time period when there are still minimal amounts of scar tissue around the arthroplasty. To prevent anterior dislocation the movements that need to be avoided are external rotation in extension with adduction. Posterior dislocation may be caused by a combination of flexion with internal rotation and adduction.
- Poor surgical technique regarding the positioning and orientation of the prosthesis.
- Slack muscles – poor restoration of muscle tension during the operation.

"The incidence of dislocation is highest in the first year after arthroplasty and then continues at a relatively constant rate for the life of the arthroplasty." (Berry et al, 2004). Dislocation rates of 0.7% (Jacobs et al, 1993) to 3.1% (Mahomed et al, 2003) have been reported. Berry et al (2004) found that for first time dislocation, 1 % dislocated by one month, and1,9% at one year and this trend continued at a constant rate of 1% every five years, to 7% at twenty-five years post primary THA for patients who had survived without having had revision arthroplasty. The surgical approach used, also appears to have an effect on the rate of dislocations. Dislocations are more common when using the posterior approach (Woo & Morrey, 1982).

Positions of dislocations:

"Physical therapy and the patient's ability to comply with therapy recommendations are postoperative factors that also play a large role in

dislocation." (Mahoney & Pellicci, 2003). The two approaches used by the orthopaedic consultants at the Johannesburg Hospital are either the anterolateral or the posterior approach. With the anterolateral approach, the movements that can lead to hip dislocation are extension, adduction and lateral rotation. With the posterior approach, the movements of dislocation are flexion of more than 90 degrees, abduction and internal rotation. (Hall & Brody, 1999).

Functional movement precautions:

Restriction of activity until muscle strength has sufficiently recovered is a standard recommendation (Shih et al, 1994). Patients are given instructions as to what activities to avoid doing for the first six weeks after the operation. They are also advised as to when they may resume certain activities. Some of these precautions include not bending forward more than 90 degrees to dress the lower half of the body; avoiding sitting on low chairs; sleeping only on one's back; the use of long handled sponges, reachers and toilet seat raisers. (Brander, 2000; Hall & Brody, 1999).

2.3.1.3 Infection

The cause of infection may be via the wound at the time of the operation due to non-sterile technique or introduced later via haematogenous spread example via a urinary tract infection (Moreland, 1993). Mahomed et al (2003) found a 0.2% rate of wound infection in a period of ninety days after primary THA. As with DVT, the sooner the presence of infection is picked up the more likely the resolution of the infection. The presenting features of prosthetic infection are symptoms of pain and swelling coupled with a fever. The treatment options depend upon the time interval within which the presence of infection was found. Within two weeks postoperatively the treatment regime would consist of open debridement and synovectomy. This would be covered by a course of intravenous antibiotics. (Hall & Brody, 1999).

2.3.1.4 Heterotopic Ossification (H.O.)

There are widely varying reports regarding the incidence of heterotopic ossification. According to a study conducted by (Maloney et al, 1991), the incidence rate was found to be 13% in a group of patients who had hybrid THA's and 38% in a group of patients who had uncemented THA's. One should be suspicious of the presence of H.O. if there is a sudden deterioration of range of movement of the operated hip (Hall & Brody, 1999). Maloney et al (1991), also discovered in their study that no patients who had received hybrid THA's developed such severe limitation of movement that a second operation became indicated to remove heterotopic bone. In comparison 6% of patients in the group with the uncemented THA's had to undergo such an operation. There are certain subgroups of patients who are more susceptible to developing H.O. as a possible complication. Some examples of such patients are those who are diagnosed with hypertrophic arthritis or ankylosing spondylitis; as well as those patients who incurred H.O. after previous surgical procedures (Jacobs et al, 1993; Hall & Brody, 1999).

2.3.2 Late Complications

2.3.2.1 Loosening of Implants

The rate of loosening is dependent on various factors. According to Moreland (1999), these factors include the operative skills of the surgeon; the quality of the patients' bone stock at the time of the THA; as well the physical activity levels of the patient receiving the THA. In a study conducted by Schulte et al (1993), the following results were found after the subjects were followed up for a minimum of twenty years:

- Incidence of aseptic acetabular component loosening in the patients who survived the twenty year postoperative assessment and needed revision was 10%. Whilst the rate of acetabular loosening that required revision for the total subject population (including subjects that died before the twenty year postoperative period) was 6%.

- Incidence of aseptic femoral component loosening that required revision in those patients who survived the twenty year assessment was 3%. The rate of femoral loosening in the total subject population was 2%.

3. The postoperative physiotherapy management of THA patients:

The routine early postoperative physiotherapy management of the THA patient normally consists of three components: education, mobility regimens and exercises (Hall & Brody, 1999; Brander et al, 2000; Enloe et al, 1996). The benefit of the mobility regimen or the performance of exercises independently on the functional outcome, during the acute phase following THA, is not known (Jesudason & Stiller, 2002). The three components of the rehabilitation protocol will now be discussed.

3.1 Education of THA patients:

"Educating the patient and family is a key part of rehabilitation." (Brander et al, 2000). Patient education forms an important component of the rehabilitation process for patients undergoing total hip arthroplasty. Zavadek et al (1995) states education programmes as being one of the contributing factors to the variability that exists amongst patients attaining functional milestones postoperatively. Patient education also prevents serious complications from occurring viz. dislocation of the operated hip (Hall & Brody, 1999).

3.2 Mobility regimens and exercise therapy as part of the postoperative rehabilitation process

"The appropriate amount of rehabilitation necessary in the acute care setting following THA or TKA is unknown." (Zavadak et al, 1995). Brander et al (2000), after conducting an extensive review of available literature available on Medline from 1966 to 1999 regarding rehabilitation following THA, found "no prospective, randomized trials determining the most efficacious protocols." They found that postoperative protocols varied according to the

institution. According to Brander et al (2000) postoperative rehabilitation often focused on "restoring mobility, strength, and flexibility; teaching adherence to range-of-motion and weight-bearing precautions; patient and family education." In a survey conducted by Enloe et al (1996), the opinion of the panel which consisted of 18 clinicians (16 physiotherapists, one physician and one team of two nurses) considered to be specialists in treating THA patients, were gathered and put together, to form a protocol via consensus for the acute postoperative rehabilitation of the THA patient.

Mobility regimens:

A commonly used routine for mobilising a patient after primary THA as prescribed by a few authors is as follows (Jesudason & Stiller, 2002; Hall & Brody, 1999):

- The patient may be mobilised to a chair day one postoperatively.
- If the patient is able, the physiotherapist may assist the patient to walk using an assistive device such as a walker.
- Progression to crutches occurs when the patient is walking safely and effectively with the walker.
- Stair climbing is taught to the patient once the walking is being done effectively and safely.

In the survey conducted by Enloe et al (1996), there was a 100% consensus by the panel that 'transfer training' and 'gait training' should be part of the physiotherapy post-THA rehabilitation programme. 'Transfer training' would include supine to sit and sit to stand functions and was recommended to be initiated on day one/two post-operation. There was 89% consensus from the panel regarding the day of initiation. 'Gait training' would include ambulation "on level surfaces; on stairs; training of weight-bearing status; training of gait pattern; use of an assistive device." The survey results suggest beginning 'gait training' on day two/three post-operation for which there was 78% consensus from the panel. The authors chose a range for the day of initiation of training for both gait and transfers, as there was a variety of responses from the panel.

Exercise therapy:

In a survey conducted by Enloe et al (1996), there appears to be expert opinion consensus, on the types of exercises that should be included in post-THA exercise programmes. There wasn't 100% consensus regarding the type of exercises that should be included, but there was a majority consensus. The authors refer to two groups of exercises, namely 'bedside exercises' and 'exercises in physical therapy'. 'Bedside exercises' refer to those exercises commenced on day one/two postoperatively. The patient gets supervised only on the first visit and thereafter has to perform them independently. The purpose for conducting these exercises would be to primarily attempt to prevent complications such as venous stasis that could result in DVT's, as well as initiate muscle strengthening and regaining of the ROM of the operated hip. 'Exercises in physical therapy' refers to those exercises that the patient would continue with at home once discharged. The purpose of these exercises is the same as that for 'bed exercises', just that there is some progression in the level of difficulty of the exercises. These exercises are also commenced whilst the patients are in hospital, commencing on day two/three post-THA, most likely to reinforce what they should be doing once they are discharged from hospital.

The consensus on performing 'bedside exercises' and 'exercises in physical therapy' post-THA was the following:

- Consensus of 100% that these exercises should be performed during the acute post-operative phase.
- Consensus of 89% regarding the type of 'bedside exercises' that should be performed.
- Consensus of 72% regarding the type of 'exercises in physical therapy' that should be performed.
- The exercises that were selected had to have more than 50% of the clinicians in agreement in order to be included. 'Bed exercises' consisted of "quadriceps sets, gluteal sets, ankle pumps and active hip flexion".
- 'Exercises during physical therapy' consisted of all the exercises in the 'bedside exercises' group but also included terminal knee extension

and isometric and active hip abduction. If a trochanteric osteotomy was done during the THA, then isometric and active hip abduction were excluded.

The above exercises included in the 'bedside exercises' and 'exercises in physical therapy' aim at improving circulation, regaining mobility of the hip as well as strengthening key muscle groups around the operated hip joint.

According to Brander et al (2000), exercises prescribed need to take into consideration that whilst aiming to meet the desired objectives of the prescribed exercises, that no excessive forces that may cause dislocation or excessive wear on the prosthesis exists. This opinion is shared by Enloe et al (1996) who considered reports that alluded to certain exercises and functions that "cause higher contact pressures across the hip joint than others." Enloe et al (1996) therefore suggests careful selection of exercises for patients' post-THA. For example straight leg raises were excluded as 56% of the panel didn't believe it to be a necessary part of the post-THA exercise protocol.

The researcher has found after reviewing the current literature that the performance of bed exercises after primary THA, during the acute post-operative hospitalisation phase, has no evidence-based support for its use. There is actually very limited research available regarding the exercise component of physiotherapy rehabilitation, specifically during the acute hospitalisation phase following primary THA. During the researcher's survey of the available literature, the study conducted by Jesudason & Stiller (2002) was the only one found that directly addressed this issue.

The study conducted by Jesudason & Stiller (2002) aimed to ascertain whether patients performing bed exercises immediately post-THA held any further benefit as compared to a mobility regimen alone. Concealed, random allocation was utilised to allocate patients to either the control or experimental group. Patients in both groups were mobilised according to a standard postoperative protocol used at the authors' institution. The experimental group in addition had to perform daily bed exercises that were

supervised by the treating physiotherapist. Outcome measures were a functional assessment (ILOA Scale), pain at rest and range of active hip flexion and hip abduction. The outcome measures were assessed on the third/fourth and seventh/eighth postoperative days. It was concluded that there were significant improvements in the outcome measures from the third/fourth to the seventh/eight postoperative day. There was however no significant differences observed between control and experimental groups, with regard to any outcome measures, at either measurement time. This study found therefore that bed exercises did not add to the effectiveness of a mobility programme for patients following primary THA, during the initial postoperative period, with regard to function, pain, and range.

However there are studies that were conducted that advocate the benefit of perioperative exercise programmes as well as long term postoperative exercise programmes:

Wang et al (2002) tried to help establish whether a perioperative exercise programme would improve the early return of ambulatory function after THA. Twenty-eight subjects were randomly allocated to either a control group or experimental group. Subjects in the control group received the routine perioperative care. Subjects in the experimental group received a customized exercise programme. This involved subjects participating in two supervised clinic based sessions and two home based sessions per week, for eight weeks before scheduled THA. These subjects then recommenced this schedule at three weeks post surgery. This continued until week 12 post surgery, with subjects being given the option of continuing a supervised programme till week 24. The clinic sessions were of one hour duration and included hydrotherapy, stationary bike riding, and resistive training to increase strength in lower limb muscle groups. Ambulatory function was assessed using the 25 meter walk test, and endurance was assessed by the six-minute walk test. When the results of the experimental group were compared to the control group the former did significantly better at three weeks in regard to stride length and gait velocity; when compared at 12 and 24 weeks the experimental group outperformed the control group with regard to walking velocity and endurance.

Shih et al (1994) conducted a study to investigate the recovery of muscle strength post-THA. The authors' subject population included 20 female patients whose reason for having a THA was osteoarthritis and 20 male patients' whose reason for the THA was osteonecrosis. These patients's received identical postoperative rehabilitation which included mobilisation as well as bed exercises. Once the patient was considered ready for discharge home no further supervised rehabilitation took place. These patient's maximal isometric torque strengths were measured preoperatively and at six months and one year post-THA. A Cybex 340 dynamometer was used for this purpose. The results showed that in the female group there was no significant improvement of muscle strength at six months. At one year however there was significant improvement of 138 – 168%. In the male group there was significant improvement in muscle strength at both the six month and one year assessments. They also found that in both groups when the diseased hip strength was compared to the healthy hip even at one year post-THA, results of the operated hip were less. The authors' suggested the necessity for postoperative strengthening exercises as well as the need for it to be continued for at least one year if not longer.

Similar sentiments were expressed by Long et al (1993) in their study that investigated functional muscular recovery post-THA. Gait analysis that included electromyogram studies were conducted preoperatively, and then at three months, six months, one year and two years postoperatively. The results of the study were that gait parameters returned to normal two years postoperatively but weakness of operated limb hip musculature persisted even at two years post-THA. As a consequence of these results the authors recommend that THA patients don't participate in activities that cause jarring of the new hip joint like jogging. Also recommended was that these patients continue with a long term exercise programmes to encourage improvement in the strength of the hip musculature.

In a nonrandomised study conducted by Shashika et al (1996), the authors' aim was to determine if a six week home-based exercise programme could help improve various limitations in patients who had undergone THA six to

forty-eight months ago. The study had 23 subjects who were placed into three groups viz. group A, B and C. The patient's age, gender and postoperative periods were considered before he/she were placed into groups to prevent any bias. Patients in group A were prescribed "ROM exercises of hip flexion and isometric muscle strengthening exercises of low resistance." Patients in group B were prescribed the same exercises as group A, but in addition also had "eccentric muscle contractile exercises of hip abductors in the standing position on one leg." Group C was the control and had no home programme.

The patients were all assessed by physiotherapists at the first visit to the physiotherapy department. Various parameters such as hip ROM and muscle strength, walking velocity and so on were measured at the first visit as well as at the second and only other visit, which took place six weeks later. The physiotherapists gave the patients (group A and B) instructions that the exercises had to be done twice a day, with each session lasting for approximately 15-20 minutes. The patient's in groups A and B were provided with instructional handouts of the exercises that needed to be done. The only contact that these patients had with the physiotherapist from that point on was by a telephone call that the physiotherapist placed at two week intervals, to provide assistance if any difficulties had arisen or advice regarding progression of exercise performance was required. The results of this study showed that there was improvement in all three groups with regard to maximum isometric abduction strength. The difference was that group B also showed improvement of strength on the contralateral hip. Gait speed and cadence also improved significantly in groups A and B.
No improvement was noted with regard to ROM of hip in any of the groups. The authors' concluded therefore that there is benefit to patients performing exercise programmes six to forty-eight months post-THA, as patients show improvement in muscle strength and ambulation.

<u>Conclusion:</u>

The benefit of the components making up the post-THA rehabilitation process to the day of discharge from hospital, is what the researchers aims to demonstrate. The exercises that comprise the exercise program have various purposes. Some of the exercises like active hip flexion and extension, or hip abduction and adduction aim to improve ROM of the operated hip. Isometric quadriceps exercises hopes to achieve an improvement in muscle strength. Foot pumping exercises hope to prevent complications such as DVT's by improving blood circulation while the patient is in bed.

4. Outcome measures: evidence for use of chosen assessment tools used to evaluate outcome measures.

4.1 Visual Analogue Scale (VAS)

The visual analogue scale is a commonly used tool to aid in the assessment of patients pain levels (Myles & Urquhart, 2005; Huskisson, 1982). The scale simply comprises of a 10 cm line, with one end representing a pain-free state, and the opposite end representing excruciating pain. To administer the VAS, the patient is merely requested to place a mark, on the 10 cm line, corresponding to the amount of pain he/she is experiencing. The assessor then measures up to the mark made by the patient to get a reading of the patient's perceived pain levels. (Coll et al, 2004; Hall & Brody, 1999).

A systematic review conducted by Coll et al (2004) investigated the appropriateness of using the VAS to assess patients' pain levels after day surgery. These authors found: "Based on the established criteria, the VAS was found to be methodologically sound, conceptually simple, easy to administer and unobtrusive to the respondent." The authors concluded that the VAS was an appropriate tool to use for assessing patient pain levels post day surgery.

Myles & Urquhart (2005), in their study, aimed to evaluate the correlation of the subjects' perception of their own acute pain and how accurately this may

be expressed as a value using the visual analogue scale. They felt that since the VAS is commonly used to assess pain levels, it would be of value to establish this in subjects with acute pain. The researchers had 22 subjects indicate on the VAS their current pain level. They then were given analgesics and had to indicate their pain level again on the VAS. When the patients perceived their pain to be half of what it initially was, they had to indicate this on another VAS ($VAS_{0.5}$). When the patient felt agreeable relief of pain, they had to indicate that pain level on a third VAS (VAS_{final}). On analysing the data the authors concluded: "The VAS is a linear scale in subjects with severe acute pain." There was a strong correlation between pain levels experienced by the subjects to what the subjects indicated on their respective VAS's.

In a study conducted by Salo et al (2003), the reliability of the VAS was assessed with regard to the ability of patients to read the scale accurately as compared to physician-readers. It was concluded that 95% of patients' responses were within +/- 2mm of physician readings. This showed that patients are accurately able to read and understand the VAS, thus making it a suitable tool to assess pain.

Goddard et al (2004) conducted a study that aimed at assessing the reproducibility of normal individual's pain response to maximally tolerated mechanical pressure. The authors used healthy subjects and applied maximally tolerated pressure to marked spots on the subjects' masseter muscle. The subjects then had to record the intensity of pain experienced by recording it on a visual analogue scale. After the initial reading(T1), the following two readings were done at pre-determined time intervals of 6minutes(T2) and 30 minutes(T3). The same amount of mechanical pressure was applied. It was concluded that the VAS is an appropriate tool to measure pain response to mechanical pressure as the results of the subjects were highly reproducible.

4.2 Iowa Level of Assistance (ILOA) Scale

"The assessment of function using the Iowa Level of Assistance Scale is shown to be highly reliable, valid, and responsive in patients following total hip or knee replacements." (Shields et al, 1995). The ILOA Scale developed by Shields et al (1995), assesses the patient's ability to perform four functional tasks, these being:

- Supine to sitting on the edge of the bed.
- Sitting on the edge of the bed to standing.
- Walking 4.57 metres.
- Climbing up and down three stairs.

Walking speed over a 13.4 metre distance is measured and depending on the rate of ambulation allocated points that are ranked using an ordinal scale. Each task is graded according to the level of assistance provided and the assistive device required to perform that task (Except the first task where no assistive device can be used). When the assessor is evaluating the patient's performance of the tasks, the assessor must provide the least amount of assistance possible, to get a true reflection of the patient's ability to perform that particular task. Each task is then rated and given a score. The scores for all five tasks are then summated to give an overall total score.

Jesudason & Stiller (2002) used the ILOA Scale successfully in their study to assess post-THA function of their patients. These authors state that it is very appropriate to use the ILOA Scale as its key assessment criteria are the same criteria commonly used to determine if THA patients' are ready for discharge from hospital.

4.3 Goniometry as a tool for measuring hip range of motion

"Probably our most widely used evaluation procedure, goniometry, can be considered a fundamental part of the "basic science" of physical therapy." (Gajdosik & Bohannon, 2002). In an attempt to assess the reliability of goniometric measurements, Boone et al (1978), conducted a study to determine the intratester and intertester variability and reliability when using goniometry as a method of assessing joint range of movement. Four physiotherapists took goniometric measurements on upper and lower limb movements of normal male subjects. This was done on a once a week basis for four weeks. The results of the study were:

- Intratester measurements showed more reliability, for all movements when compared to intertester variation. The recommendation from this finding was that if investigators want to assess the presence of treatment effect on range of movement, then one assessor should be utilised in order to decrease intertester variations. When one assessor measures the same movement, an increase in joint range of motion of at least three to four degrees indicates an improvement for all movements.

In summary the important points of this review are:

- The primary aim of THA is the relief of pain, which as a surgical procedure, is successful in accomplishing. In doing so it allows these patients to improve their functional status and quality of life postoperatively.
- Physiotherapy rehabilitation post THA plays a key role in facilitating the successful outcome of the surgical procedure. The physiotherapy rehabilitation helps the patient to attain important functional milestones such as walking and climbing stairs prior to discharge. The physiotherapist also plays a key role in educating the patient about all the precautions the patient should observe to prevent the operated hip from dislocating.
- The benefit of performing bed exercises with patients following primary THA, in the acute postoperative phase, has no evidence to support its use. A randomised controlled study (Jesudason & Stiller, 2002) showed that there is no difference in outcome measures between

the group that received a mobility programme only, and the group that received the mobility programme and exercises.

- The tools being used in this study to assess patient function, resting levels of pain and ROM of operated hip are valid and reliable.