UNIVERSITY OF KWA ZULU- NATAL

THE EFFECTS OF A THREE VISIT SUPERVISED PHYSIOTHERAPY EXERCISE PROGRAMME VERSUS A SIX VISIT SUPERVISED PHYSIOTHERAPY EXERCISE PROGRAMME IN CHILDREN WITH SUPRACONDYLAR FRACTURES WITHOUT NEUROVASCULAR INJURIES

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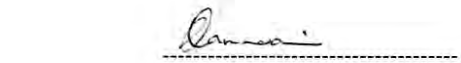
DECLARATION

I declare that this dissertation is my own work and that all sources that I have used or quoted have been indicated and acknowledged by means of complete references.



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LIST OF ACRONYMS

SCF	Supracondylar fracture
POP	Plaster of paris
ROM	Range of motion
WBFPRS	Wong Baker faces Pain Rating Scale
DASH	Disabilities of the Arm, Shoulder and Hand
ADL	Activities of Daily Living
QOL	Quality of life
FDAT	Functional Disability Assessment Tool
CDP	Centers for Disease and Prevention
KZN	Kwa- Zulu Natal
UKZN	University of Kwa -Zulu Natal
MGMH	Mahatma Gandhi Memorial Hospital
FOOSH	Fall on an outstretched hand

LIST OF OPERATIONAL DEFINITIONS

Supracondylar Elbow Fracture: A fracture of the distal end of the humerus or located above the condylar region at the elbow.

Neurovascular injury: An injury that occurs at the nerves e.g. Median, ulnar or radial nerve or the vessels namely: brachial/ radial artery may be compromised.

Physiotherapy Rehabilitation: To restore to good health or useful life, as through physiotherapy to reduce the level of disability, and education.

Activities of Daily Living: The things we normally do in daily living including any daily activity we perform for self-care such as feeding ourselves, bathing, dressing, grooming, work, homemaking, and leisure. The ability or inability to perform ADLs can be used as a very practical measure of ability/disability in many disorders.

Parent/caregiver/guardian: The adult who is responsible for the child for the period of the study

ABSTRACT

Background

From the literature that has been reviewed for this study it is evident that there is a lack of research conducted investigating the value of early mobilization and exercise treatment of supracondylar fractures (SCF) in children. There has been no documented research conducted in South Africa on the frequency of physiotherapy treatment in children with SCF of the elbow joint or compliance of the child and parent/caregiver/guardian to a physiotherapy upper limb home exercise programme. Currently there is no set physiotherapy treatment protocol for SCF. Therefore this study attempts to investigate the effects of a supervised physiotherapy exercise programme in children with SCF and the compliance of the child to the home exercise programme monitored and conducted by the parent/caregiver/guardian.

Aims and Objectives

The primary aim of this study was to compare the effects of an exercise programme supervised by the researcher fortnightly (three visits) over a six week period to those who attended physiotherapy once per week (six visits) over a six week period. The secondary aim was to determine the compliance of the child supervised by the parent/caregiver/guardian at home with a physiotherapy home exercise programme over the 6 week period when not attending formal physiotherapy sessions at the hospital.

The objectives used in the study was to determine pain, range of motion, activities of daily living and compliance of the physiotherapy exercise programme of flexion, extension supination and pronation movements at the elbow joint and soft tissue mobilization over three formal physiotherapy treatment sessions (3 visits) compared to six formal physiotherapy treatment sessions (6 visits) over the six week period.

Study Design

A randomised experimental design with a sample size of 50 children with SCF from three provincial hospitals in the eThekwini district was followed. The study population comprised of children between the ages of four to thirteen years presenting with SCF of the elbow joint in the participating hospitals. The children were randomly and equally assigned into two groups using a computer programme either into group A (intervention group) or group B

(control group). The researcher was blinded to the groupings. The researcher performed the physiotherapy treatment programme consisting of six basic elbow exercises namely: flexion, extension, pronation and supination movements of the elbow joint (Appendix VI). Each of the exercises was conducted 20 times. Soft tissue mobilization was the other technique conducted where the researcher performed a passive stretch at the biceps muscle of the affected arm on the children during the formal physiotherapy sessions (Appendix VII). The stretch was repeated five times. Functional activities such as washing your face, eating and combing the hair (extension and flexion) as well as keying and un-keying a door (supination and pronation) are some of the basic activities one requires in life. These activities are only possible if there is 90%-100% full range of motion at the elbow joint. Group A received the physiotherapy regimen three times over a period of six weeks (first, third and sixth week) whereas group B received the same physiotherapy regimen of basic elbow exercises six times (once per week) over a six week period. Group A and group B were taught and requested to continue with the same basic elbow exercises performed in the hospital as a home programme where each exercise was performed 20 times three times a day. The parent/caregiver/guardian was taught how to record the relevant information on the record sheet (Appendix VI). This information was used to assess the compliance of the child with the home exercise programme supervised by the parent/caregiver/guardian.

Data analysis

The completed questionnaires consisting of the demographic data that was coded and was entered into an excel spreadsheet and descriptive statistics were performed using the Statistical Package for Social Sciences IBM SPSS version 20. The significance was set at $p < 0.05$. Baseline characteristics were compared between the two randomised groups using Pearson's Chi Square Tests and the Fisher Exact Test. Data were described at each time point by group using non parametric descriptive statistics including median and interquartile range. Comparisons between groups were done at each time point using non parametric Mann-Whitney tests.

Results

The *p* value was identified to assess whether the effects of a) pain, b) range of motion, c) functional activities and d) compliance between the intervention group (three visit supervised physiotherapy exercise programme) and the control group (six visit supervised physiotherapy exercise programme) differed over time. A *p* value <0.05 was considered statistically significant. There was no evidence for a beneficial effect of the intervention group over the control group in terms of the differences in pain, range of motion and activities of daily living using the relevant assessment tools. In the intervention group there was a slight increase in flexion values at a non - significantly faster rate than those of the control group. There was however, significantly less compliance to the home exercise programme in the intervention group (three visits) compared to the control group (six visits).

Conclusion

The results of this study show that the condition of the children in the intervention group (three visit supervised physiotherapy exercise programme) improved with regards to pain, range of motion and function at the affected elbow at approximately the same rate as the children in the control group (six visit supervised physiotherapy exercise programme). Perhaps a more thorough illustration, demonstration and explanation of the purpose of the home exercises need to be communicated to the children and the caregivers in order to obtain a more positive response of the children to their compliance to the home exercise programme. Children presenting with supracondylar fractures without neurovascular injuries could possibly attend fewer formal physiotherapy sessions but comply with a home exercise programme which proved beneficial. Therefore children especially those from rural areas may spend less time attending formal physiotherapy sessions at public hospitals.

The overall results will also be beneficial to the parent/caregiver/guardian as they will possibly spend less time away from work and will probably cut travel time and costs to bring the child to hospital.

CHAPTER 1. INTRODUCTION

1.1 **Introduction**

Playgrounds are exciting and serve as a place for fun for children. Lukwago (2009) reported that according to the Centers for Disease and Prevention Control, each year in the United States more than 156,000 children under the age of fourteen are treated in hospital emergency rooms for injuries occurring on the public playgrounds. One of the most common injuries occurring on the playground are fractures mainly supracondylar fractures (Beaty and Kasser, 2012).

In South Africa supracondylar fractures (SCF) are the most common fractures occurring in children between the ages of four and fifteen years with an incidence of approximately 200 per year at Ngwelezana Hospital in KwaZulu- Natal (KZN) (Rollinson, 2004). Elbow pain, stiffness and decrease range of motion are the most common problems following injury to this joint. Elbow mobility for children is of major importance for activities of daily living (ADL). Treatment post injury or surgery may involve immediate gentle movement of the elbow (Harding et al., 2011). The purpose of physiotherapy rehabilitation following a SCF is to reduce pain and to restore full range of motion (ROM) such as flexion; extension; supination and pronation. Other goals are to restore full function to the elbow joint, such as to wash the face, comb the hair, bring food to the mouth (extension and flexion movements) as well as to key or unkey a door or to turn a knob to close or open a door (pronation and supination movements), prevent muscle contractures and to restore muscle strength. Exercise is one of the most common physiotherapy modalities implemented in patients with supracondylar fractures (Downie, 1993).

The researcher has found that many studies were conducted relating to medical and surgical treatment of supracondylar fractures in children and minimal literature found based on physiotherapy rehabilitation and the compliance of a home exercise programme of the children with SCF in South Africa.

The treatment approach of a supracondylar fracture in children is different compared to adults. This is due to the immature growth plates in children as compared to the adult elbow joint (Beaty and Kasser, 2012). Therefore this study targets children with SCF between the ages of four and thirteen years.

1.2 **Background**

The elbow plays an important role in any arm movement, such as reaching or lifting (Harding et al., 2011). An elbow fracture can result from a simple fall onto an outstretched hand with hyperextension of the elbow joint (Ĉekanauskas et al., 2003). SCF are the most common fractures occurring in the paediatric elbow, with a reported incidence of 75% (Noonan and Jones, 2001). Most supracondylar fractures are of extension type (McLauchlan et al., 1999) the distal fragments displaces posteriorly in more than 95% of fractures (Temple et al., 2006).

Well documented problems after an injury to the elbow are elbow pain, stiffness and loss of normal movement, and contractures if left unattended. After the initial treatment, which may involve surgery for the more serious elbow fractures, treatment may involve immediate gentle movement of the elbow (flexion, extension, supination and pronation), using a sling for support only, or it may involve a period of immobilization whilst in a sling or a cast. It is not clear as to which approach results in better movement and function of the elbow after a fracture has healed (Harding et al., 2011).

Elbow mobility for children is of major importance for ADL. The most frequent fractures in the children are on the upper extremities, and the incidence of fractures in the elbow area range from 7% - 9% (Vocke and Von Laer, 1998). Traumatism in the elbow region can lead to various degrees of limitation in mobility and function. This may have long-term consequences on the child's functional ability such as washing his face, combing his hair, bringing his hand to his mouth to eat and so forth (Slavica, 2007).

In practice, patients are usually only referred to physiotherapy for mobilization of the affected elbow joint once the plaster of paris (POP) has been removed. The purpose of physiotherapy rehabilitation following a SCF is to reduce pain and to restore full function to the elbow joint. The goals are to prevent muscle contractures, and to restore full range of motion and muscle

strength (Downie, 1993). In practice, these goals are often difficult to achieve when patients presenting with SCF have difficulty attending follow-up appointments.
The researcher also noted that children with SCF are generally not always referred immediately from the orthopaedic doctors for physiotherapy after the removal of the POP. This delay in referral could probably prolong the patient's recovery period and affect functional ability, resulting in poor quality of life (QOL). This is supported by Dias et al., (1987) who concluded in their study that early wrist mobilization following an uncomplicated unilateral Colles fracture resulted in rapid recovery of both movement and strength without causing increased discomfort and also hastened functional recovery.

A randomised study conducted by Kay et al., (2008) included fifty-six patients with distal radius fractures managed surgically with pins and conservatively with POP. The experimental group received a physiotherapist-directed programme of advice and exercises, while the control group did not receive any physiotherapy intervention. This study concluded that an advice and exercise programme provided some additional benefits over no physiotherapy intervention for adults following distal radius fractures.

Handoll (2006) conducted a review of fifteen randomised controlled trials that compared the outcomes of rehabilitation that began during the period of immobilisation, to outcomes of rehabilitation that began after the removal of POP. Rehabilitation interventions were defined as passive and active mobilisation exercises, and training for activities of daily living (ADL). The review involved 746 respondents, mainly female and older patients. His review concluded that there was insufficient evidence available to establish the effectiveness of interventions used in the rehabilitation of patients with distal radius fractures. This study shows that further research is therefore needed to establish effective interventions in the treatment of distal radius fractures.

A study conducted by Wakefield and McQueen (2000) showed that home exercises are adequate following uncomplicated distal radius fractures, and routine follow-up appointments for a course of physiotherapy treatment may not be necessary. In a study involving compliancy in breast cancer patients by Street and Voigt (1997) the researchers found that patients adhering to their rehabilitation programme reported a higher quality of life (QOL). In addition, they were better enabled to practice appropriate self-care. It was also noted that

patients who were generally treated with dignity; were well informed about their condition; and were given the freedom to participate in treatment decisions, were more likely to assume responsibility for complying with their treatment plans (A policy on quality in health care for South Africa National department of health, 2001).

1.3 **Motivation for the study**

A study conducted by Sheffer and Taggart (1993) found that self-management approaches result in fewer visits to the hospital and improvement in the functional ability and also noted that patients benefited from compliance from a self-care programme. The motivation for this study is if fewer physiotherapy treatments sessions for SCF prove to be beneficial, then children from rural areas need not attend regular physiotherapy sessions at a provincial hospital. Patients will have fewer visits and spend less time attending hospitals with fewer sessions to doctors and physiotherapy. Furthermore, if patients made good recovery in relation to pain, ROM and functional activities early after the period of immobilization, there may be less room for permanent disability of the elbow joint.

1.4 **Problem Statement**

There are no current literature and documented studies on the frequency of physiotherapy session on elbow exercises following SCF and compliance of children to a home exercise programme conducted in South Africa. However there are very few international studies that highlight the frequency of physiotherapy management of supracondylar fractures. This study focussed on determining whether fewer physiotherapy sessions of elbow exercises supervised by the researcher proved beneficial in relation to the pain, ROM and function in children with SCF. This study also focussed on determining whether compliance of the children to a physiotherapy home exercise programme prescribed to children with SCF will prove beneficial regarding the recovery and function of the elbow.

The high levels of unemployment and inequality considered by the government and most South Africans seem to be the most salient economic problems facing the country. The unemployment rate is very high, and the poor have limited access to economic opportunities and basic services. Poverty also remains a major problem. The citizens, especially those from

the lower income categories experience difficulty in accessing the bare necessities due to the cost of living.

Patients attending provincial hospitals in KwaZulu-Natal (KZN) are predominantly from low socio-economic background, often living in poverty. These individuals live in areas that often lack basic infrastructure and resources for medical and rehabilitation care. The purpose of a physiotherapist is to rehabilitate the patients optimally, but they often face the challenge of poor compliance to the physiotherapy rehabilitation programme. During her time as a physiotherapist at a government hospital from the year 2002-2010, the researcher noted that parents of children needing rehabilitation often complained about the associated transport cost. Those who worked expressed difficulty in requesting time off from their employers to accompany their children to hospital. Poor financial status and time constraints are probably the main factors that contribute to the poor turnout of patients for follow up physiotherapy sessions. This is supported by a survey conducted in South Africa in 1998 (Community Agency for Social Enquiry, 1999) where 17% of the sick people did not seek care when last ill. Of these, 66% could not afford to seek care and 23% reported that the medical services were unavailable. Lack of transport was also a problem, as this prevented 6% of people seeking healthcare (Community Agency for Social Enquiry, 1999).

1.5 **Research Questions**

a) Are three (3) formal physiotherapy sessions over a six week period as effective as six (6) formal physiotherapy sessions over a six week period for the complete rehabilitation of supracondylar fractures?
b) Does compliance to a home exercise programme enhance the recovery of an elbow fracture following physiotherapy sessions at the hospital?

1.6 **Aim**

The primary aim of this study is to determine whether three (3) formal physiotherapy sessions over a six week period is as effective as six (6) formal physiotherapy sessions over a six week period for the complete rehabilitation of supracondylar fractures and the secondary aim is to

establish whether the compliance to a home exercise programme enhances the recovery of an elbow fracture following physiotherapy sessions at the hospital.

1.7 **The objectives of the study are to compare:**

1. The levels of pain perceived in children fortnightly (3 visits) in the intervention group to the levels of pain perceived in children once a week (6 visits) in the control group over a six week period
2. The range of motion of children fortnightly (3 visits) in the intervention group to the range of motion of children once a week (6 visits) in the control group over a six week period
3. The level of function of the upper limb in children fortnightly (3 visits) in the intervention group to the level of function of the upper limb in children once a week (6 visits) in control group over a six week period
4. The level of compliance of children with a physiotherapy home exercise programme fortnightly (3 visits) in the intervention group to the level of compliance of children with a physiotherapy home exercise programme once a week (6 visits) in the control group over a six week period.

1.8 **Significance of the study**

A protocol for physiotherapy rehabilitation of supracondylar fractures in children may be adopted if the home exercise programme proves to be as effective as a course of routine physiotherapy. Children and their parent/caregivers/guardians in rural areas may not need to attend regular physiotherapy treatment for supracondylar fractures should the home treatment programme prove beneficial to them regarding improvement in the mobility and function of the affected elbow joint. Children will spend less time at hospital with visits to the physiotherapists. If patients make good recovery early after the period of immobilization, there will be a reduction in permanent disabilities encountered amongst children with SCF.

1.9 **Outline of the Chapters**

Chapter 1: Introduction

This chapter introduces the topic under investigation and outlines the purpose of the study. The flow of information in the thesis is clarified.

Chapter 2: Literature Review

Aspects of supracondylar fracture are presented here. The aim is to bring clarity and research related to the topic.

Chapter 3: Methodology

The methodology used to determine the effects of a supervised physiotherapy exercise programme for children with a supracondylar fracture in children without neurovascular injuries. This section includes the sampling technique, instrumentation used to collect data, the procedures employed used to analyse data.

Chapter 4: Results

The results of the study are presented in the form of graphs and tables. It includes the statistical analysis.

Chapter 5: Discussion

The results are discussed in this chapter and references made to studies which relate to this topic**.**

Chapter 6: Conclusion

Conclusions are drawn related to the study. Recommendations and limitations are presented. This section is followed by the related references used.

CHAPTER 2. LITERATURE REVIEW

2.1 **Introduction**

Literature was obtained from the following search engines: The Cochrane Database: systemic reviews 2011, CINAHL (Cumulative Index to Nursing and Allied Health), Pubmed, Medical and Allied journals, Encyclopedias, books, the internet and other related sources which addressed paediatric supracondylar humeral fractures. Studies from the year 1990-2013 were included in the search.

Keywords used in the search were: Supracondylar humeral fractures, diagnosis, physiotherapy treatment, paediatric management, elbow joint, classification, rehabilitation.

Included in this chapter is the demographic and incidence of SCF, definition, anatomy of the elbow joint, classification of the fractures and complications of supracondylar fractures as well as the validity and reliability of assessment tools used in the study. This is followed by physiotherapy protocol and rehabilitation for these fractures in children. This chapter also referenced articles that are for and against physiotherapy intervention.

2.2 **Demographics and incidence of supracondylar fractures**

According to many authors SCF are the most common fractures occurring in the paediatric elbow (Ĉekanauskas et al., 2003 and Temple et al., 2006). The reported incidence ranges between 60% -75% with the average incidence reaching a peak about the age of eight years (Houshian et al., 2001). However Almohrij (2000) and Garg et al., (2007) reported in their studies that SCF have a peak incidence between four to six years. These fractures may result in serious complications (Lee, 2000) especially neurovascular compromise if not treated appropriately (Ryan, 2009). Some of the complications that may occur are nerve injuries, compartment syndromes and angular deformities such as cubitus varus (Noonan and Jones, 2001).

SCF generally occur as a result of a fall on an out stretched hand (FOOSH). Most fractures in older children result from falls from a height from playground equipment e.g. monkey bars, swings (Ryan, 2009) with hyperextension load on the elbow (Almohrij, 2000). During the hyperextension process, the olecranon (elbow bone) process is forced against the weaker, immature metaphyseal bone of the distal humerus, producing the typical extension-type supracondylar fracture (Houshian et al., 2001). The distal fragment displaces posteriorly (Ĉekanauskas et al., 2003) making the extension type by far the most common occurring in 95% of the cases (Mangwani et al., 2006). Injuries such as these may results in long periods of immobilization (Downie, 1993).

Many studies (Garg et al., 2007, Temple et al., 2006 and Simic et al., 2012) have shown that more males than females between the ages of four and ten years presented with SCF at the elbow. Temple et al., (2006) reported in his study that boys under the age of seven are more frequently affected than girls. This may be due to the fact that the growth plates in the boys take longer to mature compared to the girls (Beaty and Kasser, 2012). Most injuries occur during the summer months (Temple et al., 2006). Ryan, (2009) and Simic et al., (2012) reported in their studies that the SCF are more likely to occur in the left elbow on the non-dominant extremity. Marchand and Dimegleo., (2001) speculated two theories for the predominance of the injury of the left upper extremity; one is that the right upper extremity is often being used actively during the injury, so the left assumes the role of protection and the second is the lack of muscular balance thus not allowing sufficient locking involving less resistance.

2.3 **Anatomy of Elbow Joint**

Figure 2.1 below illustrates the elbow joint which is made up of three bones namely the humerus, radius and the ulna. It acts like a constrained hinge joint by bending and straightening (Brubacher and Dodds, 2008). It is also important for rotation of the forearm; that is, the ability to turn our hands up or down (Klatt, 2011). The anatomy of the distal humerus is complex and may be thought of as a triangle. There is a very thin portion of bone in the middle of the triangle that is called the olecranon fossa (Hammond et al., 1998).

Figure 2.1: Osteology of the elbow joint (Tashjian, 2006)

The earliest ossification centres, shown in figure 2.2 of the distal humerus develops from five to twelve years of age. As the skeletal maturity approaches the capitulum, the lateral condyle and the trochlea fuse to become one common epiphyseal centre. Later this common centre fuses with the distal humeral metaphysis. This medial epicondyle remains separate until the late teens until it too, fuses with the distal metaphysis (Temple et al., 2006).

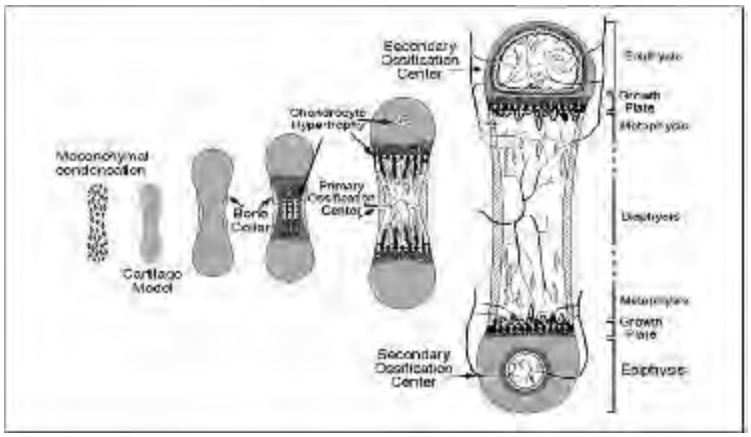

Figure 2.2: Ossification of the Distal Humerus (Brinker, 2003)

2.4 **Definition of a supracondylar fracture (SCF)**

The SCF is characterized by a break in the upper arm bone (humerus) just above the elbow joint (Klatt, 2011) as illustrated below in figure 2.3. The term SCF describes a fracture that occurs above or '*supra'* to the condyles (Hammond et al., 1998). During certain activities, such as a fall onto the outstretched hand, stress is placed on the humerus bone and

supracondylar region. When this stress is traumatic and beyond what the bone can withstand, a break in the humerus in the supracondylar region may occur. This condition is known as a SCF (Downie, 1993).

SCF occur at the level of the olecranon fossa, where the medial and lateral columns begin to flatten. When a child falls onto an outstretched arm with the elbow in hyperextension, the force of the fall is transmitted through the olecranon to the weak supracondylar region, causing a SCF. There are three major nerves that run in close relation to the elbow joint namely the median, radial and ulna and are at risk from both the fracture and surgical approach (Temple et al., 2006).

Figure 2.3: Radiographic image of a supracondylar fracture (Ryan, 2009)

2.5 **Classification and medical management of a supracondylar fracture**

Fractures are classified into two types namely; extension and flexion type fractures, depending upon the displacement of the distal fragment of bone (Clavier, 2000). *Extension type*: The most common type, accounting for 95% of all supracondylar fractures where the distal fragment is displaced posteriorly due to FOOSH (Mangwani et al., 2006). *Flexion type*: The least common variety (5%), where the distal fragment is displaced anteriorly (Garg et al., 2007) relative to the proximal segment due to a fall on the olecranon. *Displacements*: The displacements may present in one of a number of ways: posterior shift, posterior tilt, lateral or medial shift, proximal shift or internal rotation. Supracondylar fractures in children can be categorized by two commonly used classification systems namely: The Salter-Harris classification or the Gartland classification system.

1. The Salter-Harris classification was developed to categorize the different types of growth plate fractures in children where: Type I is a break through the bone at the growth plate, separating the bone end from the bone shaft and completely disrupting the growth plate.

Type II is a break through part of the bone at the growth plate and crack through the bone shaft, as well. This is the most common type of growth plate fracture. Type III occurs when there is a cross through a portion of the growth plate and break off a piece of the bone end. This type of fracture is more common in older children. Type IV is a break through the bone shaft, the growth plate, and the end of the bone and Type V occurs due to a crushing injury to the growth plate from a compression force. They are rare fractures (Salter and Harris, 1963).

2. Gartland classification: The most commonly used classification system is that of Gartland (Mangwani et al., 2006). Fractures are classified into three groups. For extension and flexion type supracondylar fractures the Gartland classification is based primarily on the degree of displacement divided into three types (Temple et al., 2006). *Type I* is undisplaced / minimally displaced fractures. *Type II* is displaced fractures with intact posterior cortex and some angulation. *Type III* is displaced fractures with complete disruption of the cortex. This may have implications on the likelihood of injury to the neurovascular structures. Type III fractures occur almost twice as frequently as the type II fractures (Temple et al., 2006). The management of supracondylar humerus fractures has evolved from a conservative approach to a more aggressive approach in recent years fractures (Lee, 2000). A study by Rijal and Pandey, (2006) concluded that closed reduction and K-wire pinning under anaesthetic is a safe and reliable method of treatment for supracondylar extension type III of humerus in children thereby reducing the chances of complications.

Many children from both urban and rural areas are assessed and managed at Addington Hospital. Children who reside in the catchment area are seen initially in trauma post injury and children who reside in rural areas are usually transferred to Addington Hospital for further investigations and management (surgical intervention) due to their complicated orthopaedic conditions. Children who are seen in trauma are either managed and sent home with a follow up appointment at the Addington orthopaedic clinic or are admitted at the hospital. This depends on the severity of the fracture.

Children who present with the Type 1 undisplaced or minimally displaced supracondylar fracture, based on the Gartland classification, are generally managed conservatively, with external devices such as Plaster of Paris (POP) above the elbow and or collar and cuff with the elbow flexed at 90 degrees (Cekanauskas et al., 2003). Thereafter they are reassessed at the clinic approximately three to four weeks post removal of POP. They are then referred to

physiotherapy for mobilization of the elbow. Children presenting with Type 11 or Type 111 displaced fractures are generally admitted immediately in hospital and are managed further (Cekanauskas et al., 2003). The management generally requires surgical intervention such as closed reduction and percutaneous pinning (Arora 2007, Garg et al., 2007). Upon discharge they are given a two week follow up appointment at the orthopaedic clinic at Addington Hospital for reassessment. If the bones are united in a satisfactory position, post check x-ray, they are then referred to Physiotherapy for mobilization of the elbow.

2.6 **Complications of a supracondylar fracture**

Some of the major complications that may occur following SCF are:

a. Loss of Range of Motion: According to Temple et al., (2006) temporary loss of motion is common following SCF. Joint stiffness is the most common complication of fractures, that may limit range of motion, and it's predisposed by:
    - Peri-articular adhesions: Injury to individual tissues, oedema and immobilization causes adhesion between muscle, ligaments, capsules and bone. As a vulnerable joint, the elbow may stiffen easily with permanent impairment.
    - Intra-articular adhesions: This occurs when the fracture involves the articular surface.
b. Muscle Complications: Torn muscle fibres are common with fractures and may adhere to other structures during the healing process. If the muscles are treated while the fracture is healing adhesions are reduced, and consequently the period of rehabilitation is shortened. This will directly impact on the on the range of motion at the joint (Downie, 1993).
c. Functional Limitations: The functional usefulness of the hand after a SCF is usually decreased. The joint will be re-educated in functional activity (Downie, 1993).

2.7 **Physiotherapy Protocol for Supracondylar fractures (SCF)**

Physiotherapy plays a very important role in fractures, with passive and particularly active exercises forming the most important item in fracture treatment (Morrey, 2000). This includes ordinary active movements as well as those in which the weight of the limb is supported by the hand of the operator or in a supporting medium (Cotton and Peterson, 2010). The general physiotherapy treatments for SCF are as follows: reduce pain, joint mobilization to improve range of motion such as flexion; extension; supination and pronation, soft tissue massage, electrotherapy, taping/bracing, exercises to improve strength and flexibility, education, activity modification, graduated return to activity plan is vital in all patients with a supracondylar fracture to hasten healing and ensure optimal outcome (Downie, 1993).

2.7.1 Physiotherapy Rehabilitation

General rehabilitation goals are to restore motion and strength for optimal function while protecting injured and repaired structures and preventing joint stiffness. The trend in rehabilitation has been toward early mobility with less immobilization. Range of Motion (ROM) is initiated as early as possible within safe parameters to prevent the development of stiffness (Morrey, 2000).

Morrey (2000) has outlined a list of guidelines for appropriate treatment to restore joint motion and function after elbow fractures, while avoiding damage to repaired and injured structures. The phases of wound healing are correlated to treatment so that techniques are used appropriately to augment healing and avoid inflammation (Annexure A). The treatment and rehabilitation at the elbow joint is the same irrespective of bone that is affected at the elbow joint. Gutierrez (1997) has also outlined guidelines on the physiotherapy management of radial head fractures (RHF) at the elbow joint. These include rehabilitation for non-operative and operative RHF.

2.7.1.1 Rehabilitation following conservative management of an elbow fracture

SCF managed conservatively by means of POP. This management consists of early passive motion phase (two to seven days post fracture) where it is important to control the pain and oedema, protect the fracture site, minimize deconditioning and maintain the range in the

joints around the affected region while preventing contractures of the muscles. At around three weeks post fracture the therapist will continue to control pain and oedema and try to minimize deconditioning and muscle atrophy. ROM will commence within pain limits. At six weeks the therapist will try to regain full range of motion and will work actively within the newly gained range of motion to increase strength. In the last phase (eight weeks) the therapist will educate patients on proper joint protection and therapeutic exercises. S/he will also strengthen the elbow flexor and extensors to gain full range of motion and increase stability at the elbow (Morrey, 2000)

2.7.1.2 Rehabilitation following surgical management of an elbow fracture

SCF managed surgically by means of pins and plates. This management consists of immobilization (three to five days post - op) where the therapist will try to control pain and oedema. We protect the fracture site with posterior splint or bandage, minimize cardiovascular deconditioning and prevent contractures. We maintain the range of the joints around the affected region (shoulders, wrist and fingers). At around seven days post - op to three weeks the therapist will continue to control pain and oedema while minimizing the deconditioning and atrophy of the muscles. We also try to regain range of motion in the elbow within the pain limits. At around four to six weeks the therapist will try to regain full range of motion and work actively within this newly gained range of motion to increase strength. At twelve weeks post - op the therapist will try to increase strength especially at the end ranges and educate the patient on proper joint protection and therapeutic exercises. The therapist will also try to gain strength in the forearm flexors and extensors to increase stability in the elbow and gain full range of motion and increase speed and control of limb movement (Morrey, 2000).

Table 2.1: Rehabilitation for conservative and surgical management of elbow fractures
The table below was adopted from Gutierrez (1997)

Conservative management		surgical management	
Early passive motion		Immobilization	
Phase I			
2-7 days post fracture	Gentle range of motion exercises of the shoulder, wrist, and fingers • Passive flexion/extension of the elbow • Passive pronation/supination of the elbow (Coleman and Strauch, 1999)	3-5 day Post-op	• Gentle range of motion exercises of the shoulder, wrist, and fingers • Passive flexion/extension of the elbow • Passive pronation/supination of the elbow
3-6 wks post fracture	Active assistive flexion/extension of the elbow • Active assistive pronation/supination of the elbow • Isometrics: flexion, extension, and pronation, supination • Active assistive hyper extension of elbow (at 6 weeks) • Gripping exercises (Bhandari and Adili, 2012)	7 days -3 wks Post-op	Active assistive flexion/extension with stick or pulleys • Active assistive pronation/supination with stick or pulleys • Increase mobility to tolerance, prevent stiffness
Phase II			
6-8 wks post fracture	Active flexion/extension of the elbow • Active pronation/supination of the elbow • Active flexion/extension in standing with wand • Pulleys with eccentric control of the elbow with flexion/extension (Ashwood et al., 2004)	4-6 wks Post-op	• Active flexion/extension of the elbow • Active pronation/supination of the elbow: pronation, supination, biceps • Active: flexion, extension, pronation, supination with a wand or pulleys • Pulleys with eccentric control during flexion/extension • Isometrics: flexion, extension, pronation, supination •Gentle stretching using inhibition/elongation techniques or joint mobilization to increase range of motion
Phase III			
8 wks post fracture	• Resistive exercises: standing with weights, theraband resisted (flexion, extension, pronation, supination) exercises: pronation, supination, biceps • Self-stretching: flexion/extension, pronation/supination, shoulder flexion/extension, and wrist flexion/extension, ulnar deviation/ radial deviation • Advance elbow extension with radial deviation and elbow flexion with ulnar deviation (Ikeda et al., 2005)	12 wks Post-op	• Resistive exercises: standing with weights, theraband resisted (flexion, extension, pronation, supination) exercises • Self-stretching: flexion/extension, pronation/supination, shoulder flexion/extension, and wrist flexion/extension, ulnar deviation / radial deviation • Advance elbow extension with radial deviation and elbow flexion with ulnar deviation • Higher speed and high intensity isotonic flexion/extension, pronation/supination while • standing or performing ADLs

2.7.1.3 Soft tissue post immobilization of the elbow joint

Soft tissue flexibility and strength are quickly lost with immobilization. It is therefore important that patients presenting with SCF should perform pain-free flexibility and strengthening exercises as part of their rehabilitation to ensure an optimal outcome. One of the most important components of rehabilitation following a SCF is that the patient rests sufficiently from any activity that increases their pain. Activities which place large amounts of stress through the humerus should also be avoided. Once the patient can perform these activities pain free, a gradual return to these activities is indicated provided there is no increase in symptoms (Downie, 1993).

Healing time of soft tissues vary from weeks to months. The outcome depends on the nature and location of the fracture. Fractures that involve a joint can leave residual pain, stiffness, or both and are poorly managed and diagnosed. Stiffness and loss of strength are natural consequences of immobilization. A joint of a fractured limb immobilized in a POP becomes progressively stiffer each week, eventually losing its ability to fully extend and flex in this case the arm muscles namely the biceps brachii and the bracialis muscles of the elbow. Wasting away of muscle (atrophy) also can be severe. When the POP is removed, the weakness resulting from muscle atrophy is very apparent (Hertling and Kessler, 2006).

In order for muscles to function properly, all of their fibers need to be aligned in the same direction. In an injured muscle the initial repair creates a “patch” of random scar tissue fibers. For an injured muscle to regain maximum strength and flexibility, the scar needs to become aligned and integrated with the muscle fibers. The inflammation process is the first stage of healing and by keeping the muscle short, the nervous system is trying to protect it from further harm, these reactions however, can continue well past the point of being productive whilst waiting for the scar tissue to heal completely and become aligned with the surrounding muscle tissue (Hertling and Kessler, 2006)

An experiment conducted by Kannus, (2000) concluded that muscles immobilized by the tenth day after trauma showed that the strength of the scar tissue becomes greater than the muscle tissue. Experimental data showed that beginning active mobilization after a short

period of immobilization enhances the penetration of muscle fibers through scar tissue, thereby limiting the size of the permanent scar and facilitating muscle tissue.

2.7.1.4 Treatment of soft tissue following removal of plaster of paris (POP*)* at the elbow joint

Soft tissue release (STR) is a hands' on deep tissue massage therapy for speeding up the healing process of muscle and tendon injuries. It's different from the other methods in that the muscle or tendon is pressed on at the same time the muscle is stretched. An injury involving the tearing of muscles or other tissues will result in scar tissue formation. It consists of collagen which may become adhesive if the soft tissue is not mobilized early (Hertling and Kessler, 2006).

The theory is that with the right stretching and strengthening rehabilitation programme the injured muscle or tendon will become stronger and more flexible. Even under the very best of circumstances when a full physical rehabilitation programme is administered one can still end up with muscles and or tendons that feel very tight, restricted, painful, and stubbornly resist the therapists' efforts because of excessive scar tissue. STR combines simultaneous pressure "massage" and stretching to get the maximum release effect. By using just the right amount of pressure and friction on the injured muscle or tendon and just the right amount of tension through the stretch the therapist can rapidly free up the restrictions caused by scar tissue. It can be done without being too aggressive and causing unnecessary pain or triggering the reflex action of stretching (Hertling and Kessler, 2006).

2.8 **Early mobilization of SCF**

It is physiotherapy recommendation that the patient with a post-traumatic immobilized elbow with impaired motion and/or strength be referred for outpatient physical therapy interventions as soon as possible after the immobilization period (Kovacs et al., 2007). It has been shown that patients who have been allowed early mobilization or referred to physiotherapy sooner have gone onto have, fewer complications, fewer residual symptoms, and faster gains in range of motion and strength than those who have delayed therapy (Nash et al., 2004, Keppler et al., 2005, and Dias et al., 1987). Similarly in a study conducted by Ćolović et al., (2008) they concluded that at the end of rehabilitation of SCF of the humerus, children from

group A with early rehabilitation, achieved significantly better results indicating better recovery of elbow function. In another study conducted by Gupta et al., (2006) the results also showed that at the end of three weeks the POP at the elbow was removed from the participants and active physiotherapy started. The average range of motion at the end of eight weeks was fifty two to hundred and twenty six degrees and all the patients had a full range of movement by the twelfth week.

However in a randomised control trial conducted by Harding et al., (2011) it was concluded that there were no important differences between early and delayed mobilization in the number of participants with regards to pain or to limitations in their range of elbow motion. All the patients reported as being able to use their arms for full ADL. In many studies researchers (Temple et al., 2006, Zionts et al., 2007, Ling et al., 2009) also reported that physiotherapy intervention in supracondylar fractures is unnecessary and should be discouraged as these studies showed an improvement in ROM from 72% in week six to 98% in week fifty two.

Early mobilization and range of motion exercises are particularly important in the rehabilitation of the elbow as without them, a fractured elbow can easily become stiff and lose important range of movement (Nandi et al., 2009). Regaining the ability to bend your elbow and rotate your forearm is crucial in order to be able to do simple daily activities such as bringing food to your mouth or holding change in your hand. Regaining elbow extension, while also important, is not as crucial to the activities of daily living in comparison to elbow flexion (Bryce and Armstrong, 2008). In other words, losing some extension of the elbow due to stiffness following an elbow fracture will not affect your everyday function as much as the loss of elbow flexion. Therefore for those participating in sport, loss of any elbow extension can be extremely detrimental to the functioning of their upper limb and can severely limit them in the participation of their sport. For this reason, the return of full elbow range of motion, in any situation, is one of the goals (Nandi et al., 2009).

2.9 **Outcome Measures**

2.9.1 Questionnaire

A questionnaire (Appendix II) consisting of close-ended questions was developed to obtain biographical data about the child's present medical history, past medical history and health status. All the children were required to answer these questions at the initial visit before any physiotherapy intervention occurred. A translator was present when the questionnaire was administered for those patients who experienced difficulty in communicating in English and required a back and forth translation of the questionnaire in isiZulu.

2.9.1.1 Reliability and Validity of the Questionnaire

A pilot study was administered at Mahatma Gandhi Memorial Hospital (MGMH). It was found that some of the questions were ambiguous and not very clear to the children and the parent/caregiver/guardian. The researcher therefore, corrected, adjusted and re-administered the questionnaire to ensure validity. An observer was allocated at the institution to ensure that the senior therapist appointed at MGMH administers the questionnaire appropriately thereby ensuring reliability.

2.9.2 Pain and The Wong-Baker Faces Pain Rating Scale (WBFPRS)

The Faces Pain Scale was developed by Wong and Baker and is recommended for children ages three and older (Wong and Baker, 1988). The scale requires health care professionals to point to each face and describe the pain intensity associated with it, and then ask the child to choose the face that most accurately describes his or her pain level (Wong and Baker, 1988). Most pain rating scales using faces that portray degrees of distress are divided into two categories: those starting with neutral face as the "no pain" indicator and those with a smiling face. Results showed that children exposed to smiling scale had considerably higher pain scores in the no pain categories and lower scores for positive pain than children who used the neutral faces scale (Wong and Baker, 1988).

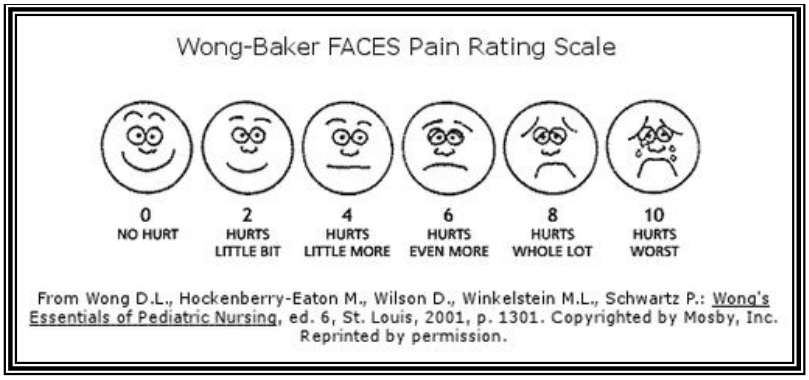

Figure 2.4: Wong-Baker Faces Pain Rating Scale (Wong et al., 1988)

Accurate pain measurements in children are difficult to achieve and according to the International Association for the Study of Pain (pages 1-11), pain is an unpleasant sensory and emotional experience associated with actual or potential tissue damage." Although the principles of pain evaluation and management apply across the human lifespan, infants and children present unique challenges that necessitate consideration of the child's age, developmental level, cognitive and communication skills, previous pain experiences, and associated beliefs (Srouji, et al., 2010). The WBFPRS (Appendix III) was used to measure the child's pain at every session at physiotherapy.

2.9.2.1 Reliability and Validity of the Wong Baker Faces Pain Rating Scale

The Wong Baker Faces Pain Rating Scale (WBFPRS) was selected by the researcher because it was the most preferred scale for all age groups (Wong and Baker, 1988). A study conducted by Newman et al., (2005) compared three commonly used pain scales namely Visual Analog Scale (VAS), WFPRS and Faces pain rating scale –Revise (FPRS-R) in their study amongst Thai children. It was found that on analysis by age, there was moderate to good correlation (r=0.64–0.84) of all scores in the younger (4–7) and older (8–11) age groups. Correlation between the VAS and WBFPS was weak in 4 year old children (r=0.38, p=0.07). The highest coefficients in all subgroups were those correlating the two face pain scales. Another study conducted by Garra et al., (2005) showed an agreement between the WBFPRS and VAS was excellent (q = 0.90; 95% confidence interval [CI] = 0.86 to 0.93). Tomlinson et al., (2010) concluded in his study that the adequate test-retest reliability (r > 0.5) and correlation between self-reports (WBFPRS) and global observational estimates of pain intensity (r > 0.4). They also reported that Test-retest reliability was assessed in a few

studies but must be considered with caution, because acute and recurrent pain is assumed to change over time rather than to remain stable.

2.9.3 Range of motion and the Goniometer

A 30cm international standard, transparent plastic goniometer was used to measure the range of motion (flexion, extension, pronation and supination) at the elbow joint.

Figure 2.5: The Standard Goniometer -Norkin and White, (2003)

A goniometer is an instrument that either measures an angle or allows an object to be rotated to a precise angular position. The term goniometry is derived from two Greek words *gonia*, meaning angle and *metron,* meaning measure. It is used to measure the ROM at the joints. In this study the goniometer was used to measure ROM (flexion, extension, pronation and supination) at the elbow joint.

Limited range of motion (ROM) refers to a joint that has a reduction in its ability to move. The reduced motion may be a mechanical problem with the specific joint or it may be caused by injury or diseases. Pain, swelling, and stiffness associated with orthopaedic conditions can limit the range of motion of a particular joint and impair function and the ability to perform usual daily activities. In the biomedical and weightlifting communities, ROM refers to the distance and direction a joint can move between the flexed position and the extended position. Limited ROM refers to a joint that has a reduction in its ability to move. The reduced motion may be a mechanical problem with the specific joint or it may be caused by injury or diseases (Luttgens and Hamilton, 1997).

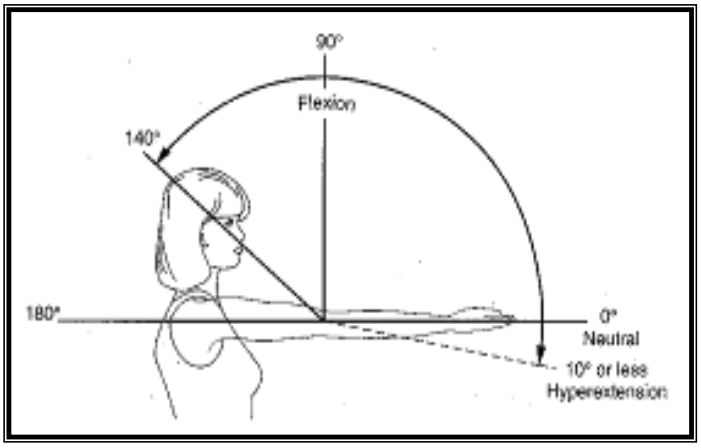

Figure 2.6: Elbow Joint Motions (Luttgens and Hamilton, 1997).

Physiotherapy can help to improve joint function by focusing on range of motion exercises. The goal of these exercises is to gently increase range of motion while decreasing pain, swelling, and stiffness. Table 2.2 illustrates the normal range of motion of elbow extension, flexion, pronation and supination.

Table 2.2: Normal ROM at the elbow joint (Luttgens and Hamilton, 1997)

Joint/Segment	Movement	Range
Elbow	Flexion	0° -140°-145°
	Extension	145°-140°- 0°
Forearm	Pronation	0°- 90°
	Supination	0°- 90°

2.9.3.1 Reliability and Validity of the Goniometer

It is a reliable and valid instrument used to measure ROM. A 30cm international standard, transparent plastic goniometer was used to measure the range of motion (flexion, extension, pronation and supination) at the elbow joint. An inch and centimeter linear measurements are marked on the goniometer which reads 0^0 -90^0, 0^0-180^0, 0^0-360^0 in 1^0 increments. The goniometer has an opaque white background behind the degree markings for easy, accurate readings. Riddel et al., (1987) reported an $ICC_{1.1}$=0.91-0.98 for intrarater reliability of goniometric range of motion measurements. Boone, et al., (1978) reported that an increase in

goniometric range of motion $\geq 3^0$- 4^0 could be considered indicative of improvement when measured by the same tester (DeSantis and Hasson, 2006). Measurement will be taken three times and the mean which will be calculated by the tester, to ensure validity and reliability (DeSantis and Hasson, 2006).

2.9.4 Activities of Daily Living (ADL) and Disabilities of the Arm, Shoulder and Hand (DASH) assessment tool

Activities of Daily Living (ADL) is used in rehabilitation as an umbrella term relating to self-care, comprising those activities or tasks that people undertake routinely in their everyday life. The activities can be subdivided into personal care or Basic ADL (BADL) and domestic and community activities-Instrumental ADL (IADL) (Fricke, 1993). Specifically, James, (2008) suggests that BADL is typically restricted to activities involving functional mobility (ambulation, wheelchair mobility, bed mobility and transfers) and personal care (feeding, hygiene, toileting, bathing and dressing). A typical rehabilitation team aims to achieve maximal increase in function and participation in everyday life for the patient or client. Functional assessment is the method used to document these outcomes, with activities of daily living scales being the most frequently used tools (Fricke, 1993).

The DASH assessment tool (Annexure C) was developed to evaluate symptoms and upper extremity functional status and to determine the relative impact of disorders. The DASH is a 30-item questionnaire with a five-item response option for each item. The test has a maximum score of 100, where higher scores reflect greater disability. It can be used as either a one-time measure or to determine change over time (Beaton, et al., 2001).

2.9.4.1 Reliability and Validity of the DASH Tool and the Functional Disability Assessment Tool (FDAT)

The DASH has been demonstrated to be a valid and reliable tool for both proximal and distal disorders of the upper extremity in adults and children, therefore confirming its usefulness for multiple joints of the entire upper extremity (Beaton et al., 2001). A study was conducted by Raven et al., (2008) to validate and discover the reliability of the DASH scale in patients with Rhematoid Arthritis. The results of his study showed that the reliability of the DASH was excellent (intraclass correlation coefficient 0.97). Internal consistency was strong

(Cronbach's alpha 0.97). Validity was proven with excellent results for Pearson correlation with the relevant domains of the questionnaires: HAQ, r = 0.88; SF-36, r = 0.70; and AIMS2, r = 0.85. The clinical scores had a relatively low correlation with the DASH (DAS28, r = 0.42; and grip strength, r = 0.41–0.48), except for the VAS (r = 0.60–0.65).

The DASH assessment tool was piloted at MGMH. It was found that the children were becoming restless and uncooperative because there were too many questions involving functional ability. The researcher therefore extracted, (three common functional activities relating to the elbow joint) modified and designed a Functional Disability Assessment Tool (FDAT) (Appendix V) to suit the age group of children in this study. This revised tool was piloted at MGMH to ensure validity. It was found that children were much more cooperative and responsive to the modified functional tool. An observer was allocated at the institution to ensure the appointed senior therapist administers the modified functional tool appropriately to ensure reliability.

2.10 Summary

From the literature that has been reviewed for this study, it is evident that there is a lack of research conducted in investigating the value of early mobilization in the treatment of SCF particularly in children. It was also found that there is more research done on the surgical intervention of SCF in children rather than the rehabilitation of SCF. There has been no or minimal research done in South Africa on specific electrotherapy modalities such as ultrasound, interferential, Transcutaneous electro neuro-stimulator (TENS) for this condition, nor studies on the compliance of the child and parent to a physiotherapy home exercise programme. Currently there is no set treatment protocol for SCF. Therefore this study attempts to investigate the effects of the frequency of an exercise programme supervised by the physiotherapist as well as to investigate the compliance of child to the home exercise programme supervised by their parent.

CHAPTER 3. METHODOLOGY

3.1 Introduction

This chapter describes the methodology used to conduct this study. It explains the design, population and sample of the study. The data collection tools, data management, data analysis. Ethical consideration and confidentiality are reflected. The study was conducted from January 2011 to September 2012

3.2 Study Design

A single blinded (assessor blinded) randomised experimental design was used. Children with SCF from three provincial hospitals in the eThekwini district were identified. The children were randomly and equally assigned into two groups using a computer programme either to the intervention group (A) or Control group (B).

3.3 Study setting

Three provincial hospitals serving a large proportion of the urban and semi-urban population in the eThekwini District were identified namely; Addington, King Edward VIII and R.K. Khan Hospitals. These hospitals serve a large population presenting with orthopaedic conditions where surgery and rehabilitation are performed generally. The patients attending these hospitals come from similar socio-economic and cultural backgrounds. Patients attending these hospitals rely on the public health service for care, and are unable to afford private practitioners. They attend these hospitals after being referred by their local primary health care clinic staff, which means that parents may already have taken time off from work and incurred costs to take their children to other health facilities before seeking assistance at the larger provincial hospitals.

3.4 Study population and sampling

The study population comprised of 60 children after using the inclusion and exclusion criteria, there were twenty- seven children from Addington Hospital, twenty- five from King

Edward VIII Hospital and eight from R.K. Khan Hospital. However the researcher eventually managed to get a sample size comprising of 50 children between the ages of four and thirteen years, presenting with supracondylar fractures at the elbow joint in the relevant hospitals. This was due to dropouts and non-compliance of the children and their parents/caregiver/guardian to the study. The statistician used the (PASS version 12) to calculate the sample size for the four outcomes using the non -parametric assumption.

The calculations showed that the sample size of 50 and the number of 25 in each group were sufficiently powered (above 80%) for the comparison of the four outcomes namely: pain, extension and flexion (ROM) and functional ability (Annexure B).

3.5 **Inclusion and Exclusion Criteria**

3.5.1 Inclusion criteria :

- Children presenting with supracondylar fractures three to six weeks post -surgical intervention and post removal of POP.
- Ages between four and thirteen years irrespective of race, gender or ethnic group
- Physiotherapy intervention commenced immediately post removal of POP at Outpatient Orthopaedic Department once the x rays showed union of the bones at the fracture site.
- Parents who were able to read and write in either English and /isiZulu and were able to comprehend and follow instructions.

3.5.2 Exclusion criteria :

- Children presenting with contractures of the upper limb
- Children with previous upper limb fractures; open infected wounds and neurological deficits
- Children presenting with neurovascular injuries
- Children presenting with non- union bones

3.6. **Data collection instruments**

A questionnaire was designed by the researcher to gather information related to the demographics, health status and hobbies of the child and the parent/caregiver/guardian. The

researcher also used three assessment tools for physiotherapy diagnosis and treatment in this study. The goniometer was used to measure the range of motion at the elbow joint at each visit to physiotherapy. The Wong Baker faces pain rating scale was used to determine the severity of pain the child experienced before and after treatment at each physiotherapy session. The Functional Disability Assessment Tool designed by the researcher was used to determine the level of function of the upper limb.

The following instruments were used:

3.6.1 Questionnaire

A questionnaire (Appendix II) consisting of close-ended questions was developed to obtain biographical data about the child's present medical history, past medical history and health status. All the children were required to answer these questions at the initial visit before any physiotherapy intervention occurred. A translator was present when the questionnaire was administered for those patients who experienced difficulty in communicating in English. A back and forward translation of the questionnaire was administered in isiZulu.
The questionnaire was valid and reliable (see 2.9.1.1) as it was piloted and an observer was allocated in the relevant hospitals to observe the manner in which the questionnaire was administered by the appointed senior physiotherapist at these hospitals.

3.6.2 The Wong-Baker Faces Pain Rating Scale (WBFPRS)

The Faces Pain Scale was developed by Wong and Baker and is recommended for children ages three and older (Wong and Baker, 1988). The child's outcome measure for pain was administered by the senior physiotherapist appointed at the relevant hospital. She/he pointed to each face and described the pain intensity associated with it, and then asked the child to choose the face that most accurately describes his or her pain level (Wong and Baker, 1988). An observer was present to ensure reliability of the tool.

3.6.3 Goniometer

In this study the goniometer was used to measure ROM (flexion, extension, pronation and supination) at the elbow joint. It was administered by the senior physiotherapist. The measurement at the elbow was taken three times and an average was obtained in order to ensure reliability of the goniometer readings.

3.6.4 Disabilities of the Arm, Shoulder and Hand and Functional disability assessment tool

The Disabilities of the Arm, Shoulder and Hand (DASH) assessment tool (Annexure C) was developed to evaluate symptoms and upper extremity functional status and to determine the relative impact of disorders. The DASH is a 30-item questionnaire with a five-item response option for each item. The test has a maximum score of 100, where higher scores reflect greater disability. It can be used as either a one-time measure or to determine change over time (Beaton, et al., 2001).

The researcher designed a Functional Disability Assessment Tool (Appendix V) where she extracted and adjusted three functional activities from the DASH assessment tool to make it easier and suitable for the age group of the children in this study. The researcher chose three functional activities to determine the level of function at the elbow over the period of six weeks (Appendix V). The child was scored according to his /her ability of performing the activity where: score 1 was no difficulty and score 5 was unable to perform the activity (Appendix V).

Functional ability of the elbow joint:

Participants were requested to demonstrate activities that were related to the function of their forearm which was:

- Activity 1 - Turn a key to the right and then to the left using their affected arm (pronation and supination)
- Activity 2 – using both their hands to wash their face by moving their hands from an extension to a flexion position at the elbow joint.

These functional activities were measured and recorded by the senior physiotherapist on every visit to physiotherapy over the six week period.

The functional tool designed by the researcher was validated as it was piloted at MGMH. An observer was allocated at the relevant hospitals to ensure that the functional tool was standardized by the senior physiotherapist to ensure reliability.

3.6.5 Home programme information booklet

An information booklet (Appendix VIa) was handed to all the participants, in both groups. This booklet consisted of:

- A list of basic elbow exercises and contraindications thereof with the instructions to record the compliance of the home exercise programme.
- A sheet where the parent/caregiver/guardian recorded information as to whether the child performed the exercises and the number of repetitions done per exercise. The parent/caregiver was required to complete the information after the child performed each of the exercises at the relevant times in the day being morning, afternoon and evenings and were given a sheet a week over six weeks and were required to hand in the completed document to the researcher on their next visit. The researcher also advised the parent/caregiver/guardian to make general comments on the home exercises when performed by the children.

3.7 **Pilot study**

A questionnaire with closed ended questions was used in a pilot study involving fifteen children presenting with SCF without neurovascular injuries initially. However ten of the participants met the inclusion criteria at Mahatma Gandhi Hospital. It was found that some of the questions were ambiguous and not very clear to the children and the parent/caregiver/guardian. The researcher therefore, corrected, adjusted and re-administered the questionnaire to ensure validity.

The DASH assessment tool was also piloted to observe the reaction and behaviour of the children. At the end of the pilot study the researcher decided to reduce the number of activities that the children were asked to perform as they seemed to be losing concentration when the 30 question DASH tool was administered. The researcher designed a Functional Disability Assessment Tool by extracting and adjusting three functional activities from the DASH tool. She piloted this tool at MGMH to ensure validity.

3.8. **Procedure**

3.8.1 Ethical procedure

Ethical clearance was obtained from the Research Ethics Committee of the University of KwaZulu-Natal to conduct the study (Appendix IX).

Permission was granted by the Department of Health as well as the relevant Hospital Managers to conduct the study in the relevant hospital that were identified for fieldwork (Appendices X XI, XII, XIII).

- Informed consent was also obtained from the parent/caregiver/guardian for the participants who satisfied the requirements of the inclusion criteria of the study. The researcher assistant (senior physiotherapist) administered the questionnaire (Appendix II) and captured the relevant data from all the participants. Their pain (Appendix III), range of motion (Appendix IV) and functional ability (Appendix V) was recorded at the relevant hospitals, using the relevant assessment tools on each visit to physiotherapy. The child and the parent/caregiver/guardian were informed that all information was to be kept confidential and their participation in the study was voluntary and the child was free to withdraw from the study at any time. The names of the participants were written on the consent form only and were kept separately from the completed questionnaires. Their responses were coded and grouped so that hospitals and participants could not be identified and the results were to be based on the study as a whole. The completed questionnaires would be stored in a locked cupboard at the university and will be discarded after five years.
- The benefits and risks of participation and treatment were explained to the child and the parent/caregiver/guardian on their initial visit to physiotherapy. It was also outlined on the information sheet (Appendix Ia).
- The written dissertation as well as an electronic copy will be submitted to the relevant hospital managers in which the study was conducted as well as to the Department of Health. The dissertation and its contents may also form part of peer review journals or presentations at local, national or international conferences.

3.8.2 Study Procedure

Once permission was obtained from the parents/caregivers/guardians for the participation of the children in this study, they were randomly assigned into two equal groups. Group A (intervention) and group B (control) using a computer programme. The researcher was blinded to the groupings. Those participants who attended three formal physiotherapy sessions (3 visits) within a six week period were placed in the intervention group whereas those children who attended six formal physiotherapy sessions (6 visits) within a six week period were assigned to the control group. A senior physiotherapist independent of the study was blinded to the groupings in order to eliminate researcher bias. He/she was allocated at the relevant hospitals to assess the following on each child participated in the study on every visit to physiotherapy for the duration of the data collection:

1. Administered the questionnaire
2. The level of pain at the affected elbow using the Wong-Baker face pain rating scale.
3. The range of motion (flexion, extension, supination and pronation) at the affected elbow joint using the goniometer.
4. The functional ability at the affected elbow (washing the face, key and unkey a door) using the Functional Disability Assessment Tool designed by the researcher.

The assessment and treatment regime were conducted in a well - ventilated cubicle that was screened to ensure privacy and confidentiality of each participant. The assessments and data were recorded by the senior physiotherapist before and after every treatment session on the initial and on subsequent physiotherapy sessions at the relevant hospitals. The starting position of the patient was in supine lying on the plinth and the starting position of the therapist was sitting on a chair at 90° to the plinth. The researcher conducted a 20 minute supervised treatment regime with each of the patients participating in the study at the relevant hospitals. The active physiological elbow exercises and the auto-assisted physiological elbow exercises were performed by the participants in sitting position at a table. The researchers starting position whilst supervising the exercises was standing at 90° beside the participant.

The researcher conducted a physiotherapy programme of basic physiological elbow exercises (Appendix VIa) and performed soft tissue mobilization (STM) (Appendix VII) on the participants in the relevant hospitals. There were 6 basic elbow exercises conducted and supervised by the researcher on the children. These exercises included flexion, extension,

pronation and supination movements at the affected elbow joint. The children were taught only those exercises that incorporated the movements that they experienced difficulty with in terms of range of motion. The children performed the exercises whilst sitting at a table with their affected elbow over a pillow with the researcher standing beside the child. Each of the exercises was performed twenty times by the children supervised by the researcher at the hospital. STM was the other technique performed by the researcher where she placed her thumbs adjacent to each other midway of the biceps muscle of the child above the affected elbow joint. A moderate amount of pressure within pain free range was placed on the muscle in the direction of the humeral bone. Thereafter the researcher gently glided her thumbs in opposite directions simultaneously, one towards the elbow and the other towards the shoulder still maintaining the pressure. This stretch was held for two seconds. This stretch was repeated five times by the researcher after the elbow exercises were conducted. The exercises performed by the participant and the STM performed by the researcher were conducted on every visit to physiotherapy by all the children. The difference between the two groups was the frequency in which each group received the physiotherapy treatment. The children in the intervention group received physiotherapy treatment three times in the six week period whereas the children in the control group received the physiotherapy treatment six times in the six week period (Appendix VIa and VII).

The children from group A and B were taught and requested to continue with the basic elbow exercises (Appendix VIa) as a home programme. The parent/caregiver/guardian was requested to observe and thereafter demonstrate the exercises with the child and corrected by the researcher at the hospital before continuing with it at home. The children were requested to perform each of the exercises 20 times, 3 times a day (in the morning, afternoon and evening). The parent/caregiver/guardian was briefed on how to record the information in the record sheet (Appendix VIa). The researcher interpreted the compliance of the participants based on the information documented where the parent/caregiver/guardian recorded whether the exercises were done, the number of times performed in the morning, afternoon and evening alongside the allocated exercises. The parent/caregiver/guardian was also encouraged to make general comments on the home exercises performed by the children. In order to avoid complications such as Myositis Ossificans the parents were informed about the contraindications (Appendix VIa) and the steps that need to be taken should these symptoms occur.

3.9 **Data Management**

During the research process, only the senior therapists identified in the relevant hospitals administered the questionnaire with the participants to ensure consistency and confidentiality to eliminate biasness. All the information gathered and recorded on the questionnaire were stored in a locked up cupboard, in an office, to which the researcher had access to only. The digital data was stored on a password protected computer, and only the researcher, the supervisor and the statistician had access to the data.

3.10 **Data Analysis**

The completed questionnaires consisting of the demographic data that was coded and was entered into an excel spreadsheet and descriptive statistics were performed using the Statistical Package for Social Sciences IBM SPSS version 20. The significance was set at $p < 0.05$. Baseline characteristics were compared between the two randomised groups using Pearson's Chi Square Tests and the Fisher Exact Test. Data were described at each time point by group using non parametric descriptive statistics including median and interquartile range. Comparisons between groups were done at each time point using non parametric Mann-Whitney tests.

CHAPTER 4. RESULTS

4.1 **Introduction**

This chapter presents the results of the study with respect to the study objectives and the tools used. The study population comprised of 60 children after using the inclusion and exclusion criteria, there were twenty- seven children from Addington Hospital, twenty- five from King Edward VIII Hospital and eight from R.K. Khan Hospital. Fifty participants completed the six week period resulting in a response rate of 83%. There were 25 children allocated in each group.

4.2. **Socio - demographic characteristics**

In table 4.1 it shows the demographics of the children documented according to age, gender and ethnic groups. The Pearson's Chi Square Test was used to determine whether there was any association between group A and B with regards to age where the probability value (p=0.534). This shows that there was no significant difference between the two groups. This holds true for gender and the race/ethnic group where the p - values are 0.747 and 0.180 respectively.

Table 4.1 Demographics of the children

		Group (n=25) per group				p value
		Intervention group - 3 visits		Control group - 6 visits		
		Count	Column N %	Count	Column N %	
Age group	4-6	15	60.0%	13	52.0%	0.534
	7-9	7	28.0%	6	24.0%	
	10-13	3	12.0%	6	24.0%	
Gender	Male	18	72.0%	19	76.0%	0.747
	Female	7	28.0%	6	24.0%	
Ethnic group	African	23	92.0%	21	84.0%	0.180
	Asian	2	8.0%	1	4.0%	
	Coloured	0	0.0%	3	12.0%	

Table 4.2 shows that 87.5% of the children in the intervention group live with their parents compared to 84% in the control group whereas 12.5% of the children reside with others namely: caregivers or guardians in the intervention group compared to 16% in the control group. The p value is 1.000 (Fisher's Exact Test) therefore illustrating no significance between the two groups.

This table also shows that 76% of the children reside in the urban area in the intervention group compared to 75% of the children in the control group whereas 24% of the children reside in the rural area in the intervention group compared to 25% in the control group. The p value is 0.944 therefore there is no significance between the two groups.

Table 4.2: Socio-economic residential background of the children.

		Group (n= 25 /group)				p value
		Intervention group – 3 visits		Control group - 6 visits		
		Count	Column N %	Count	Column N %	
lives with	parents	21	87.5%	20	84.0%	1.000
	other	4	12.5%	5	16.0%	
Area reside	urban	19	76.0%	18	75.0%	0.944
	rural	6	24.0%	7	25.0%	

Table 4.3 illustrates that 92% of the parents/caregivers/guardian received formal education in the intervention group compared to 94% of the parents/caregivers/guardian in the control group. Eight percent of the parents/caregivers/guardian in the intervention did not receive formal education compared to 4% of the parents/caregivers/guardian in the control group. The p value is 1.000 (Fisher's Exact Test) therefore no significance between the two groups.

The table below also illustrates that 40% of the children were in grade 00-0 in the intervention group compared to 30.4% of the children in the control group, 52% of the children were in grade one to four in the intervention group compared to 43.5% of the children in the control group, and 8% of the children were in grade 5-8 in the control group compared to 26.1% of the children in the control group. The p value is 0.241 therefore no significance noted between the two groups.

Table 4.3: Formal Education of the child and parent

		Group				p value
		Intervention group – 3 visits n=25		Control group – 6 visits n=25		
		Count	Column N %	Count	Column N %	
Parents educated	Yes	23	92.0%	24	96.0%	1.000
	No	2	8.0%	1	4.0%	
Child's grade	00-0	10	40.0%	7	30.4%	0.241
	1-4	13	52.0%	10	43.5%	
	5-8	2	8.0%	6	26.1%	

Table 4.4 illustrates that 92% of the children in the intervention group compared to 96% of the children in the control group reported having no other medical conditions whereas 8% of the children in the intervention group compared to 4% of children in the control group reported having other medical conditions. The p value is 1.000 (Fisher's Exact Test) therefore there is no significance between the two groups. In both the groups there were no reports of previous elbow injuries therefore no p value obtained.

Table 4.4: Present and past health status

		Group				p value
		Intervention group - 3 visits n=25		Control group - 6 visits n=25		
		Count	Column N %	Count	Column N %	
medical condition	yes	2	8.0%	1	4.0%	1.000
	No	23	92.0%	24	96.0%	
previous elbow injuries	yes	0	0.0%	0	0.0%	constant
	No	25	100.0%	25	100.0%	

*Constant- no variation

Figure 4.1 shows that 96% of the children in both the intervention and control groups were right hand dominant whereas only 4% of the children in both the groups were left hand dominant. There was no significance between the groups as the p value = 1.000 (Fisher Exact Test).

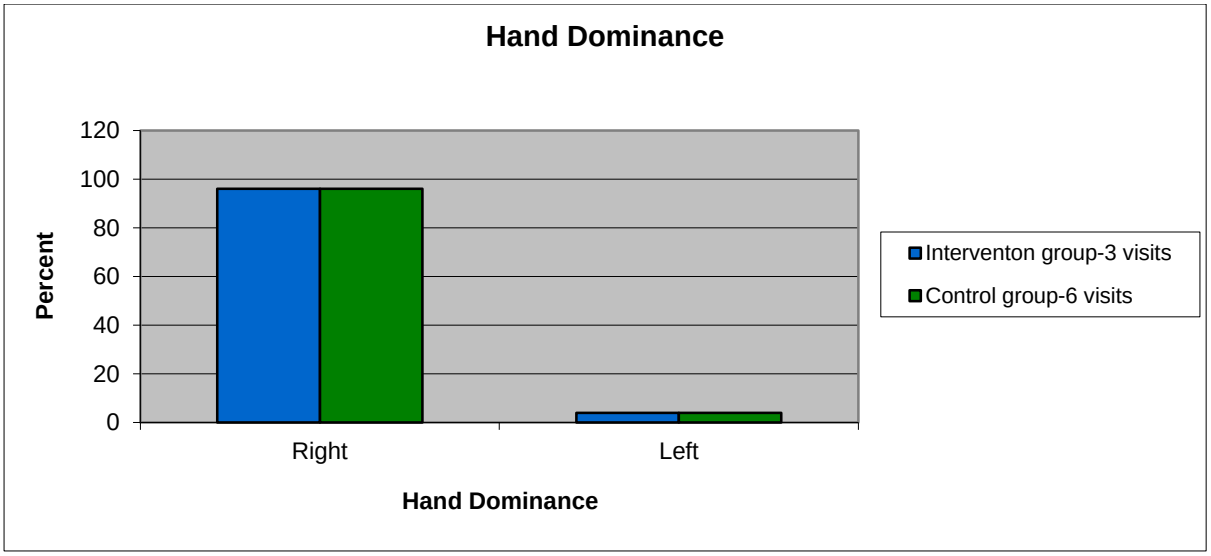

Figure 4.1: Child's hand dominance

Figure 4.2 shows that 80% of the children presented with left sided elbow fracture in the intervention group compared to 72% in the control group. Twenty percent of the children presented with right sided elbow fracture in the intervention group compared to 28% in the control group. There was no significant difference between the intervention and control groups as the p value was 0.741 (Fisher's Exact Test).

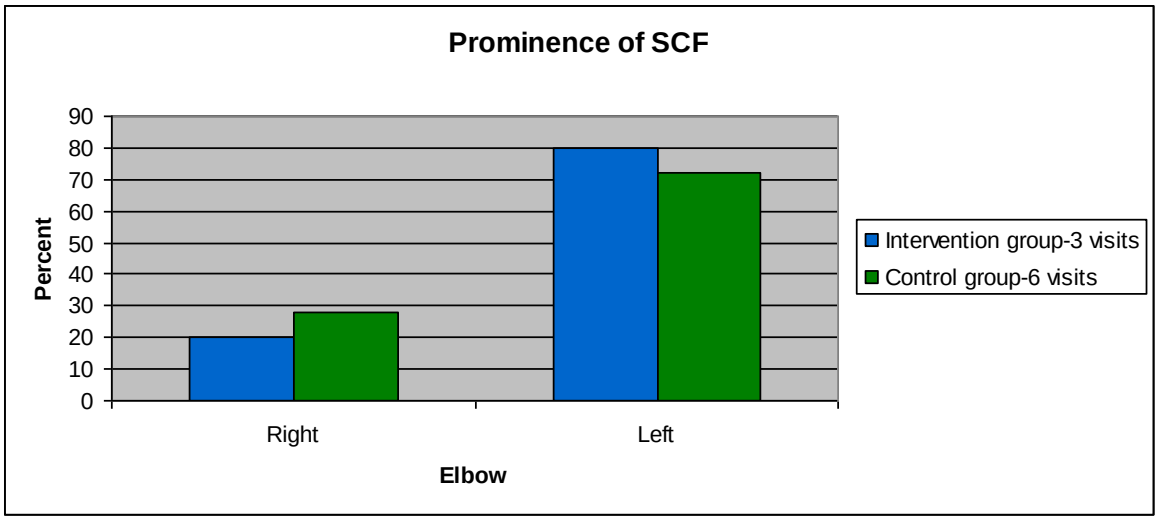

Figure 4.2: Prominent side of SCF

Figure 4.3 shows that 88% of the children in the intervention group had their POP removed at three weeks post operation compared to 68% in control group whereas 12% of the children in intervention group had their POP removed at six weeks post- operation compared to 32% in

the control group. There was no significance between the intervention and the control groups as the p value = 0.171 (Fisher Exact Test).

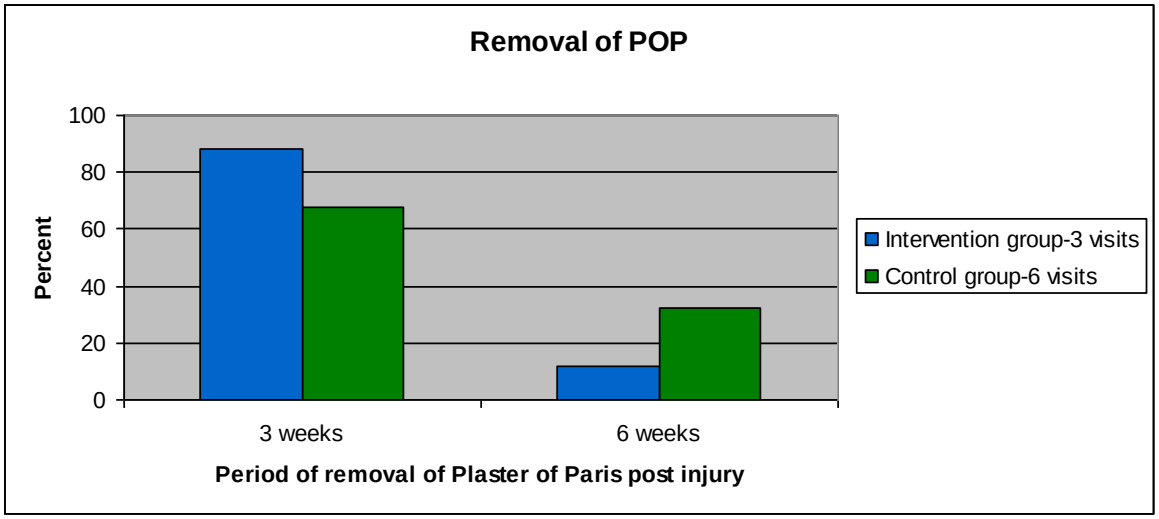

Figure 4.3: Removal of Plaster of Paris post injury

Figure 4.4 shows the different hobbies that the children enjoyed. The majority of the children (60%) in the intervention group verbalized that they did not play any sport as a hobby compared to 41% in the control group. Thirty two percent of the children in the intervention group reported playing soccer as a hobby compared to 37% in the control group, 8% enjoyed playing football in the intervention group compared to 16.7% in the control group and only 4.2% of the children in the control group enjoyed playing netball as a hobby. There was no significance between the two groups in terms of the hobbies as the p value = 0.439 (Pearson's Chi square Test)

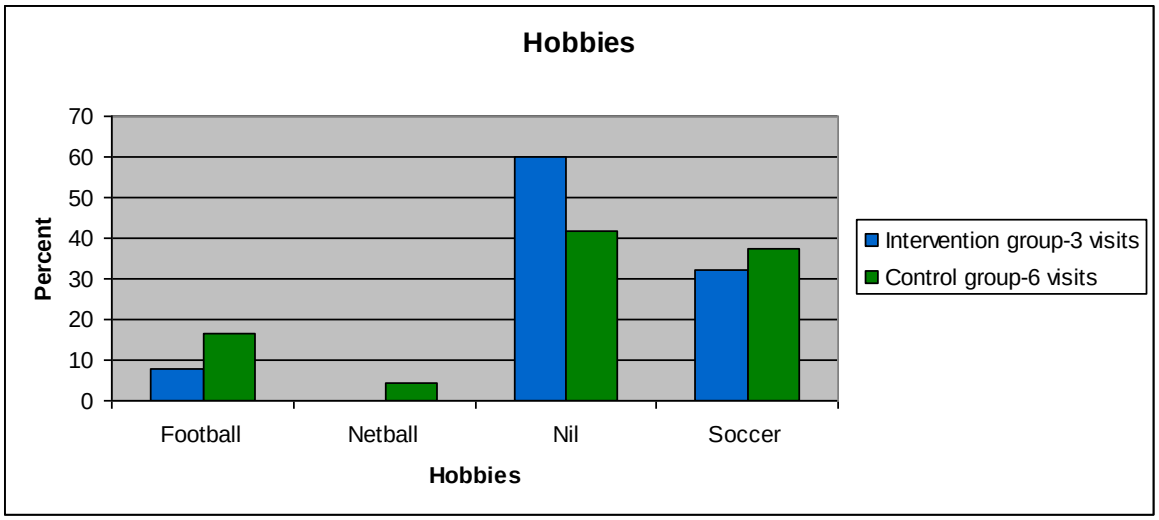

Figure 4.4: Hobbies

4.3 **Pain at the elbow joint**

Objective 1: To compare the levels of pain perceived in children fortnightly (3 visits) in the intervention group to the levels of pain perceived in children once a week (6 visits) in the control group over a six week period

Figure 4.5 shows that the children in the control group experienced more pain (6) (WBFPRS) compared to the children in the intervention group (4) on the first visit. On the third visit the children in both the groups show that they experienced the same level of pain (4). On the sixth visit the children in both groups experienced no pain (0). There was no significant difference between the medians of the two groups at any of the time points. The p values were 0.238; 0.481; 0.514 in the first, third and sixth visits respectively.

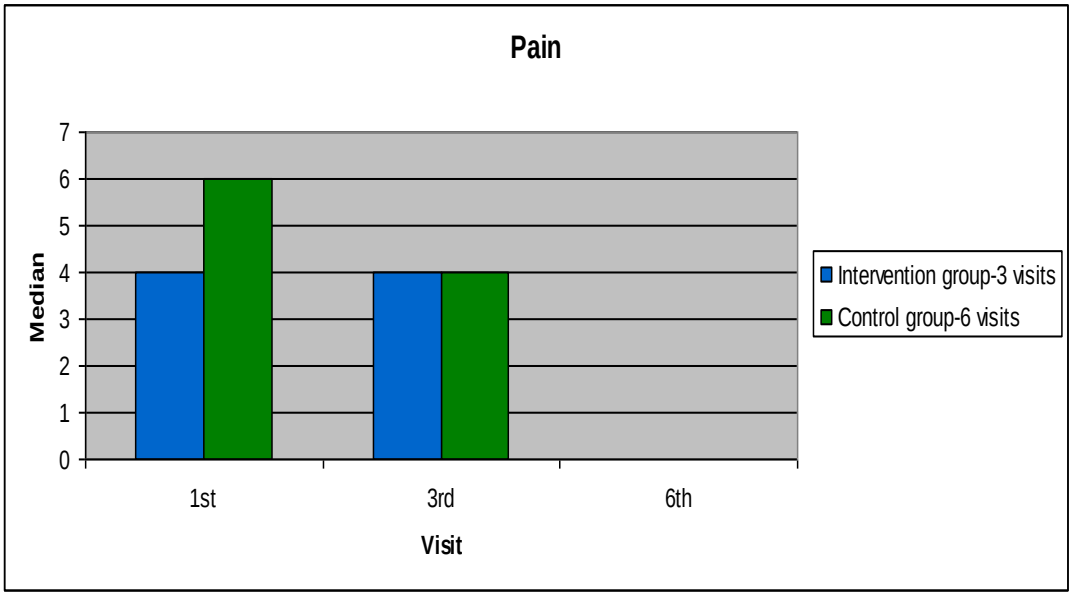

Figure 4.5: Median pain post intervention

4.4 **Range of motion at the elbow joint**

Objective 2: To compare the range of motion of children fortnightly (3 visits) in the intervention group to the range of motion of children once a week (6 visits) in the control group over a six week period

Extension

The graph shows that extension in the intervention group was 50° compared to 36° in the control group on the first visit. On the third visit both the groups on the graph show extension is the same (15°) and on the sixth visit both the groups had full range of extension (0°). There was a no significant difference between the median of the two groups at any of the time points as the p values were 0.126; 0.875; 0.984 in the first, third and sixth visits respectively.

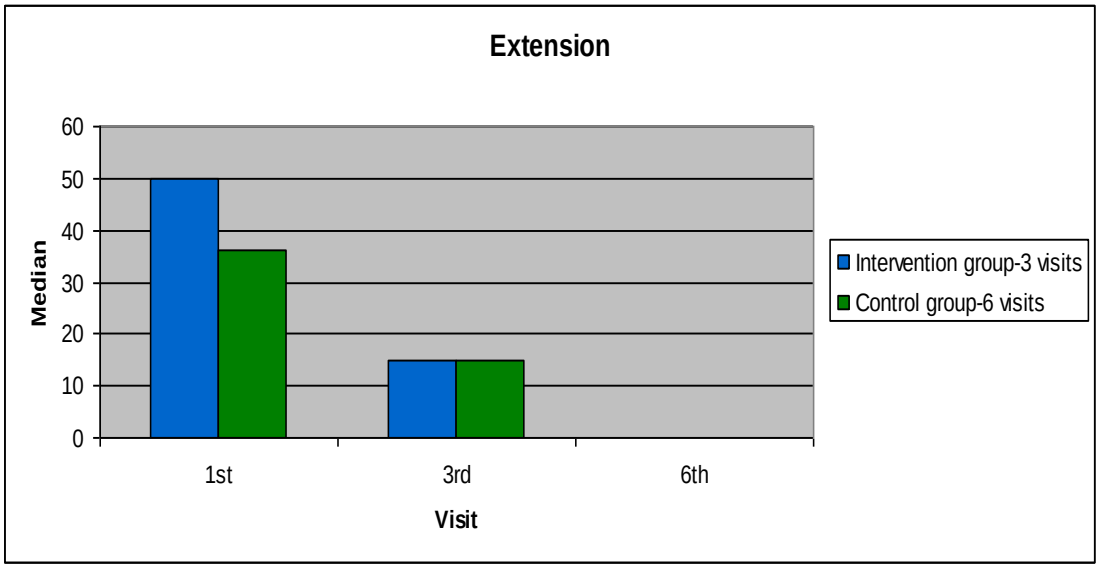

Figure 4.6: Median extension post intervention

Flexion

Figure 4.7 shows that flexion in the intervention group was 118° compared to 100° in the control group on the first visit. Flexion on the third visit in the intervention group was 133° to 120° in the control group and on the sixth visit full range of flexion (140°) was obtained in both groups. There was a significant difference between the median of the two groups at all three time points as the p values were 0.016; 0.004 and 0.047 on the first, third and sixth visits respectively.

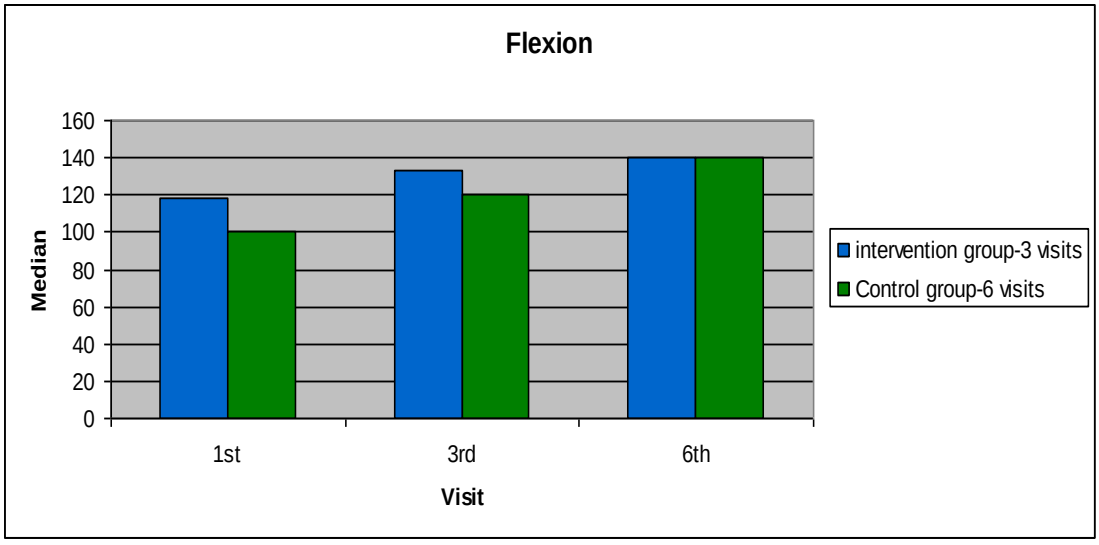

Figure 4.7: Median flexion post intervention

The results from this study show that there has been an increase in the range of motion from extension to flexion in both the intervention and control groups over time as shown below in table 4.5

Table 4.5: Comparison of ROM from extension to flexion between intervention and control groups

	Groups (n=25/group) Median values from extension to flexion in degrees (°)	
Visits	Intervention	Control
1st	70°	71.32°
3rd	116.48°	108.8°
6th	140.6°	137.12°

Supination and pronation

Table 4.6 shows that 100% of the children in the intervention and control groups presented with full range of supination whereas 92% of the children presented with full range of pronation on the first visit in both the intervention and the control groups. On the subsequent visits that being the third visit the graph below shows that 100% of the children presented with full range of supination and pronation. There was no significant difference between the intervention and the control groups for supination and pronation as the p value was 0.489.

Table 4.6: Supination and Pronation movements of the children

Visit	Intervention group (n=25)– 3 visits				Control group (n=25) - 6 visits				p value
	Full range of supination		Full range of pronation		Full range of supination		Full range of pronation		
	Count	Column N%	Count	Column N%	Count	Column N%	Count	Column N%	
1	25	(100%)	23	(92%)	25	(100%)	23	(92%)	0.489
3	25	(100%)	25	(100%)	25	(100%)	25	(100%)	
6	25	(100%)	25	(100%)	25	(100%)	25	(100%)	

4.5 **Activities of daily living**

Objective 3: To compare the level of function of the upper limb in children fortnightly (3 visits) in the intervention group to the level of function of the upper limb in children once a week (6 visits) in control group over a six week period

Figure 4.8 shows that, in the intervention group, the median functional disability was three compared to four in the control group on the first visit. On the third visit the median score was two in both groups; and one in both groups in the sixth visit. Both the intervention and the control groups experienced decrease in functional disability over time at approximately the same rate. There was no significant difference in the between the two groups at any of the time points as the p values were 0.145; 0.253; and 0.153 on the first, third and sixth visits respectively.

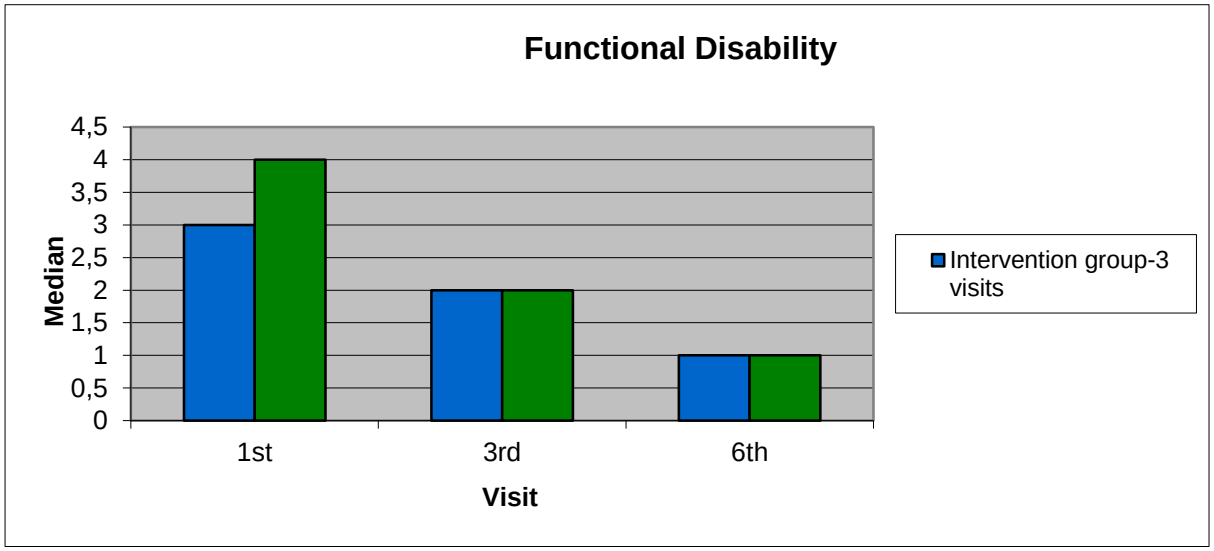

Figure 4.8: Median functional disability post intervention

4.6 **Compliance of the children to a home exercise programme**

Objective 4: To compare the level of compliance of children with a physiotherapy home exercise programme fortnightly (3 visits) in the intervention group to the level of compliance of children with a physiotherapy home exercise programme once a week (6 visits) in the control group over a six week period.

Table 4.7 shows that 68% of the children were compliant and 32% non- compliant to the home exercise programme in the intervention group compared to 92% compliant and 8% non- compliant in the in the control group over the six week period. There was a significant difference in compliance between the two groups (p=0.034). The control group had a higher proportion of compliance than the intervention group.

Table: 4.7 Compliance of the home exercise programme

		Group (n=25/group)				p values
		Intervention group - 3 visits		Control group - 6 visits		
		Count	Column N %	Count	Column N %	
Compliance	yes	17	68.0%	23	92.0%	0.034
	no	8	32.0%	2	8.0%	

Under the comments column on the record sheet (Appendix Via) the general comments made by the parents were, the children were “good”, “doing well”, This showed 80% positive response from the children to the home exercise programme. For the first 3 weeks some of the comments were “pain when exercising” but later on “no pain was felt with the exercises”. Some of the remarks were, the child was “not committed to doing the exercises” as per the instructions or the parents also verbalized that they were unable to monitor the child with the home exercise programme due to being at work. This accounted for 20% of a negative response to the compliance to the home exercise programme.

4.7 **Summary**

With the p value < 0.05 there was no evidence for a beneficial effect of intervention group over the control in terms of the differences in pain, range of motion and activities of daily living using the relevant assessment tools. In the intervention group there was a slight increase in flexion values at a non - significantly faster rate than those of group B. There was however, significantly less compliance to the home exercise programme in the intervention group compared to the control group.

CHAPTER 5. DISCUSSION

5.1 **Introduction**

Supracondylar fractures is one of the most common fractures in children with an incidence of 156 000 per year in the United States of America (Luwango, 2009). Physiotherapy intervention for fractures requires frequent visits to the hospital for rehabilitation. Parents report the financial constraints they are faced with in order to accompany their children to the state hospitals for physiotherapy intervention. The primary aim of this study was to determine the effects of a physiotherapy intervention fortnightly (3 visits) compared to those attending physiotherapy once a week (6 visits) over a six week period and to establish the compliance of the child and parent/caregiver/guardian with a physiotherapy home exercise programme over this period. The results are discussed in detail in relation to its objectives and to other studies conducted internationally.

5.2 **Socio-Demographic characteristics**

This study shows that there is no significant difference between the intervention and the control group with regards to age, male and race group. There were more children between the ages of four to six years who presented with supracondylar fractures in this study. This is similar to the study conducted by Almorij (2000) and Garg et al., (2007) where they also found that SCF have a peak incidence between four to six years. This could be due to the fact that children at this age are more active and playful on the playground engaging in activities such as playing on the jungle gym, hanging on monkey bars etc. There were more boys than girls presenting with supracondylar fractures in this study. This is in keeping with the study by conducted by Garg et al., (2007); Temple et al., (2006) and Simic et al., (2012) where they found that there were more boys than girls under the age of seven years that presented with SCF. This is probably due to the boys being more playful and active than girls around this age. The researcher found in her study that there were more children from the African race group compared to the other races. Taking into consideration that this study was conducted in KZN this is perhaps the reason for this outcome owing to the fact that there is a majority of Africans compared to the other race groups in this province. The population distribution figures in KwaZulu-Natal show that KZN has the majority of blacks who make up 79% of the

population (Statistics South Africa, 2012). There was no significant difference found with whom the children resided with, nor the area in which they resided between the two groups. This study found that the majority of the children resided with their parents in the urban area. According to the 2012 South African National Census, 67% of the population reside the urban areas (Statistics South Africa, 2012). The study shows that there were no significant difference between the levels of formal education of the parents/caregivers/guardian nor any significant difference between the formal education of the children as this study shows that the majority of them received (parents) and are still receiving (children) formal education. This statistics shows that both the parents/caregivers/guardian and the children were able to comprehend, understand and follow the instructions of the physiotherapy regime and home exercise programme explained and demonstrated to them by the researcher.

There was no significant difference found with the medical condition between the two groups the majority of the children reported presenting with no other medical condition where a percentage (12%) of the children in the study verbalized presenting with other medical conditions such as asthma and were immuno-compromised. These children were on treatment for these conditions. This however did not affect the recovery rate of their fracture of the elbow.

This study also showed that there were no significance between the two groups with regards to hand dominance and affected elbow. The majority of the children were right hand dominant and presented with a left elbow fracture. This is in keeping with a study conducted by Ryan, (2009) and Simic et al., (2012) where they state that the SCF are more likely to occur in the left elbow on the non-dominant extremity.

This study found that there was no significant difference found in the removal of POP between the two groups. The majority of the children had their POP removed at three weeks once the union of the bones and callus formation was confirmed on x- rays. A small percent of the children had their POP removed at six weeks. This was due to the POP being too tight or due to the non- union of the bones. The POP was therefore reapplied for a further three weeks. This however did not affect the recovery of the elbow in terms of ROM and the level of function. There was no significant difference in the hobbies between the two groups. This study shows that the majority of the children reported that they did not have any hobbies in terms of sporting activities. The majority of the children were between the age group of four years to six years. These children probably engaged in casual play on the playground (Ryan,

2009) or at home rather than a structured and organised sport as would the older children. This may have led to their elbow injury.

5.3 **Pain at the elbow joint**

Objective 1: To compare the levels of pain perceived in children fortnightly (3 visits) in the intervention group to the levels of pain perceived in children once a week (6 visits) in the control group over a six week period

This study has found that the results on the levels of pain show that there was no significant difference between the two groups. However the children did experience a decrease in their level pain from the first visit to the sixth visits where there was no pain on the affected elbow post physiotherapy intervention and a home exercise programme. This is in keeping with a study conducted by Nash et al., (2004) and Keppler et al., (2005) where they reported that there was a decrease in pain (one of the clinical outcomes) post physiotherapy intervention.

5.4 **Range of motion at the elbow joint**

Objective 2: To compare the range of motion of children fortnightly (3 visits) in the intervention group to the range of motion of children once a week (6 visits) in the control group over a six week period

This study has found that there was no significant difference with extension between the two groups. However there has been a decrease in extension from the first visit to a median of 0° (full range of extension) in both the groups on the sixth visit post physiotherapy intervention and a home exercise programme. There has been a significant difference found in flexion between the two groups, at all three time points. This implies that more children in the intervention group presented with a degree of flexion compared to the control group on the first and third visit. However the study also shows that on the sixth visit the children from both groups presented with a median of 140° (full range of flexion) post physiotherapy and a home exercise programme. This study is in agreement with the studies conducted by Keppler et al., (2005) and Simic et al., (2009) where the researchers reported that statistically significant results were seen at earlier endpoints where patients who received physical therapy had a better range of motion.

However many authors (Temple et al., 2006, Zionts et al., 2007, Ling et al., 2009) disagree with these studies as they concluded from their studies that physiotherapy intervention in supracondylar fractures is unnecessary and should be discouraged as these studies showed an improvement in ROM from 72% in week six to 98% in week fifty two.

In this study the researcher found that there was no significant difference in supination and pronation between the two groups. The majority (96%) of the patients presented with full range of supination and pronation at the elbow joint on the first visit. On the subsequent visit (third) the 8%, that presented restricted movements initially, gained full range of supination and pronation at affected the elbow joint. Similarly the results in a study conducted by Ling et al., (2009) showed that the movements of extension, flexion took longer to achieve full range of motion compared to supination and pronation. The researcher also found that a small percentage of the children with supracondylar fractures presented with restriction in supination and pronation movements.

5.5 **Activities of daily living**

Objective 3: To compare the level of function of the upper limb in children fortnightly (3 visits) in the intervention group to the level of function of the upper limb in children once a week (6 visits) in control group over a six week period

The researcher has found in her study that there was no significant difference in the activities from the functional disability assessment tool between the two groups. However the results scoring showed that there was a decrease in the level of disability of the upper limb from the initial visit to a median score of 0. This is therefore implies that there was an increase in the level of function of the children (ADL) post physiotherapy intervention and home exercise programme. This research is in agreement with a study conducted by Ćolović et al., (2008) where they found that the DASH score correlates with objective parameters of final status of elbow after SCF in children and it is applicable to small series of patients. A positive effect of early rehabilitation of children with SCF was found.

Physiotherapists generally design gentle range of motion (stretching) exercises to restore movement and strength to your joint and to promote blood flow for healing (Cotton and Peterson, 2010). Fractures that involve a joint may lead to residual pain, stiffness, decrease in range of motion or both if not managed early (Hertling and Kessler, 2006). The results in this study show that there was an improvement in pain, range of motion and ADL post physiotherapy intervention which shows that there was good blood flow to the fractured elbow (good healing). This study agrees with a study conducted by Nash et al., 2004 where they reported a delay in early mobilization of an injured elbow may delay recovery of the healing process.

5.6 **Compliance of the children to a home exercise programme**

Objective 4: To compare the level of compliance of children with a physiotherapy home exercise programme fortnightly (3 visits) in the intervention group to the level of compliance of children with a physiotherapy home exercise programme once a week (6 visits) in the control group over a six week period.

In this study the researcher found that there was a significant difference between the two groups with regards to the level of compliance of the children. It has been shown that the control group was more compliant with the home exercise programme compared to the intervention group. In a study conducted by Wakefield and McQueen (2000) where they carried out a randomised controlled trial on 96 patients, comparing conventional physiotherapy with a regime of home exercises. The upper limb function was assessed. There was no significant difference with the level of functional ability between the two groups at six months after injury. They concluded that home exercises are adequate rehabilitation after uncomplicated fractures of the upper limb, and routine referral for a course of physiotherapy should be discouraged.

This study showed that 80% of the children were compliant where the parents commented positively with regards to the adherence of the child to the home exercise programme and 20% were non- compliant where the parents indicated a negative response to the adherence of the child and commitment of the parent in monitoring the home exercise programme.

This study is in agreement with the research conducted by Escolar et al., (2010) who highlighted in their study that adherence to treatment was poor when exercises were time consuming or when the programme interrupted the participant's daily routine. Additional issues which contributed to poor adherence were identified, such as time consumption, complexity and adverse effects of exercises, and some care provider's styles. Other important factors which can affect adherence to treatment are: the way in which the prescribed exercises are designed, the degree of difficulty of the exercises, and how the programme is delivered by the health care provider. These findings provide additional information to health care providers, by showing which issues should be considered when delivering health care to patients.

However this result should be taken with caution as the compliance to the home exercise programme could only be analysed by the researcher based purely on the returns of the record sheet. Parents (on behalf of the younger children) or the older children who did not complete entering the number of exercises performed on different times of the day (morning, afternoon, evening) or complete the record sheet was taken as non- compliant. Children or parents/caregivers/guardians who did not hand in all the record sheets for the six weeks were regarded as being non- compliant as well.

The researcher has shown in her study that there was an improvement in pain, range of motion and functional ability at the fractured elbow post physiotherapy intervention and home exercise programme in intervention and control groups. She therefore concludes that a physiotherapy intervention and a home exercise programme is adequate for children with supracondylar fractures, however, if they are to attend fewer physiotherapy sessions rather than routine weekly visits they may be able to save on money and time.

CHAPTER 6. CONCLUSION

6.1 **Overview**

Healthcare is one of the bare essentials that have become difficult to access. Patients complain about accessing the state hospitals due to the associated cost of transport to and from the hospitals.

As a clinical physiotherapist at a government hospital in KZN South Africa the researcher noted that parents of children needing rehabilitation complained about the associated transport cost. Those who worked express difficulty in requesting time off from their employers to accompany their children to hospital frequently. Physiotherapists are often faced with the challenge of patients with poor compliance to the physiotherapy rehabilitation programme.

The results of this study show that the condition of the children in the intervention group (three visit supervised physiotherapy exercise programme) improved with regards to pain, range of motion and function at the affected elbow at approximately the same rate as the children in the control group (six visit supervised physiotherapy exercise programme). Perhaps a more thorough illustration, demonstration and explanation of the purpose of the home exercises need to be communicated to the children and the caregivers in order to obtain a more positive response of the children to their compliance to the home exercise programme.

It therefore can be concluded from the data of this study that the current protocol for children presenting with supracondylar fractures without neurovascular injuries may be revised where the children could possibly attend fewer supervised physiotherapy sessions. Therefore children especially those from rural areas need not necessarily attend regular treatment at a large provincial hospital. Their affected elbow may improve in function by complying with a home exercise programme. Children will spend less time attending formal physiotherapy sessions and the parent/caregiver need not stress about the financial implications relating to the regular cost of transport to and from the hospital as well as being absent from work often.

Physiotherapists need to emphasize the importance of educating and providing awareness to patients for being responsible for their own health. Patients should be encouraged to heed to the physiotherapists advice with regards to continuing with their exercises as a home programme as this will improve pain, range of motion and activities of daily living thereby improving their quality of life. They will also find that this will also reduce their visits to physiotherapy and indirectly saving them time and money.

6.2 **Limitations of the study**

Some parents/caregivers/guardians expressed difficulty at keeping to the physiotherapy appointment dates and times as they experienced difficulty taking time off work accompany their children to the hospital.

Some children also did not attend follow up physiotherapy sessions at times when they were on school vacation because many had to go back to the rural area thereby affecting the sample size.

Compliance was measured purely on the record cards being completed and handed in by the parent/caregiver/guardian. Compliance may be compromised due to the fact that some of the parents/caregivers/guardians did not hand in nor complete recording the appropriate information on the record cards. Some of the parents/caregivers/guardians verbalized that they forgot to bring the record sheet on their visit to physiotherapy whilst others confessed they lost the record sheet or they were not clear as to what to fill out on the sheet therefore leaving it incomplete.

6.3 **Recommendations**

The following recommendations are suggested based on the findings of the study:

A larger number of hospitals from more districts should be included in future studies. Considering that urban hospitals were used, it is recommended that supracondylar fractures in children in rural hospitals be investigated so further comparison on the outcome can be analyzed between the children in urban hospital compared to those in rural hospitals.

Further insight into the employment of parents/caregivers/guardians should be taken into account and how much is spent on their transport to and from work.

An easier, user friendly record sheet should be devised to encourage the child and parent/caregiver to record the number of exercises that were performed at home and how often in the day they were done to ensure a more accurate outcome in terms of their compliancy.

An easier, user friendly functional tool should be designed to measure the functional ability of children.

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Appendix Ia

Information Document (English)

Introduction

I am Reshma Ramnarain and I am a physiotherapist doing my masters at the University of KwaZulu Natal. I am presently doing **A STUDY TO DETERMINE "THE EFFECTS OF A SUPERVISED PHYSIOTHERAPY PROGRAMME IN CHILDREN WITH SUPRACONDYLAR ELBOW FRACTURES".**

The purpose of this study is to investigate the effects of a three visit supervised physiotherapy programme compared to a six visit supervised physiotherapy programme in children with supracondylar elbow fractures without neurovascular injuries over a six week period.

Invitation to participation: I am inviting you to take part in this research project.

What does the study involve?

When your hard plaster is removed, the orthopaedic doctor will refer you to physiotherapy for rehabilitation. On your initial visit to the physiotherapy department the researcher will explain the study to you and request your signed consent via this form. You will be interviewed by the researcher for about 15 minutes. Initial questions will be on details like your age, gender, area you live in, the level of education and if you have any other medical problems. Thereafter questions based on your child's level of pain and function at the elbow will be determined using specific tools. You will be given an exercise booklet to take home where the child will be required to continue with these exercises under your supervision. You will be required to complete the record sheet (briefed by the researcher) to determine the compliance of the child to the exercises.

The study will be conducted in 2 parts. The first part will take about 15 minutes. It will consist of the researcher assistant interviewing you and thereafter asking you about the level of your pain in the elbow region and how much of movement you have in your arm.

The second part of the research will be the treatment. This will take about 20 minutes conducted by the researcher.

Are there any inherent risks involved in the study?

Yes. Patients may experience some pain or discomfort during the physiotherapy treatment. They may also develop Myositis Ossificans if they perform the exercises in an aggressive manner.

Benefits of being in the study

The results of the study will be available to you once the study has been completed

Participation is voluntary

Your participation in the study is voluntary and you may stop at any time. This would not prevent you from obtaining any services at the hospital and you would not be treated unfairly in any way.

Confidentiality

All the data from this study will be grouped together and presented. Your name and other personal details will be kept confidential. Please be informed that all your information will not be disclosed to anyone else and that you will have access to information that concerns you.

Contact details:

Researcher	Supervisor
Ms Reshma Ramnarain	Dr S.S. Maharaj
Contact no:	contact no:
Cell no. 0837890651	031 2607938

Research Office

Biomedical Research Ethics Administration

Westville Campus, Govan Mbeki Building

Private bag X54001

Durban 4000

Kwa Zulu – Natal, South Africa

Tel : (031) 260 4769 Fax (031) 2604609

Consent form

My name is Reshma Ramnarain and I am doing a study to determine: The effects of a supervised physiotherapy programme in children with supracondylar fractures

Declaration

I ---------- hereby give permission on behalf of ---------- (child) on ----- (date) at ---------- (place) to take part in the study entitled ---------- ---------- and consent to participate in the study

I understand that the study is being carried out by Ms R. Ramnarain, a student at the University of Kwazulu- Natal for the requirements of Masters in Physiotherapy Degree.

I am aware that my participation is voluntary and that I may stop at any time. I understand that my stopping participation would not prevent me from obtaining any services at the hospital and I would not be treated unfairly in any way. I am fully informed that all information will not be disclosed to anyone else and that I will have access to information that concerns me. I agree that information obtained from this study may be published so that the findings may be of benefit to others.

The study has been explained to me and that I will receive any payment from this study.

---------- ----------

Participant name and signature Researcher name and signature

Contact details:

Researcher	Supervisor
Ms Reshma Ramnarain	Dr S.S. Maharaj
Contact no: Cell no. 0837890651	Contact no: 031 2607817

Appendix Ib

Incwajana Yolwazi(Information Document isiZulu)

Isingeniso

Sanibona, igama lami ngingu Reshma Ramnarain ngiyi- Physiotherapist (umjimisi wamathambo) futhi ngibuye ngibe umfundi e university of Kwa Zulu Natal. Okwamanje ngibhalisele izifundo ze Masters in Physiotherapy degree. Ukuze ngikwazi ukuqeda le degree, kumele ngihambise lomsebenzi enginikiwe ukuba ngiwenze.

Lolulwazi olukulelipheshana liphathelene nalo msebenzi okufanele ngiwenze.

Isihloko salomsebenzi wami sithi A Comparative Study investigating the effectiveness of a standardized exercise programme in children with supracondylar fractures post immobilization, that is (removal of plaster of Paris (okusho ukuthi ukususwa kukakhonkolo)

Injongo yalolucwaningo ukuthola the effectiveness of standized exercise programme olwenzelwe abantwana abanalenkinga okuthiwa supracondylar fractures oluzophathwa abazali babantwana noma ababagadayo ekhaya, kunokuqhathanisa nohlelo lokuzivocavoca oluphethwe i physiotherapist elibona abagulayo abaphuma ngaphandle kwesibhedlela beze lapha kujimelwa khona.

Isimemo sokuzimbandakanya

Ngiyanimema ukuba nibe khona kulomsebenzi wokucwaninga

Lokukufunda kuphathelene nani?

Uma ukhonkolo wakho usususiwe udokotela wamathambo uzokusa ku Physiotherapist ukuze ukwazi ukujimiswa. Uma ufika e physiotherapy, umcwaningi uzochaza ngalokhu okufunwa kuwe. bese ecela ukuba usayine iphepha elibizwa ngokuthi i consent.

Uzobuzwa umcwaningi isikhathi esingamami- nithi awu 15 njengemibuzo efana neminyaka yakho, ukuthi ungowesifazane noma ungowesilisa nokuthi uhlala kuphi, nokuthi ugcine kubani esikoleni nokuthi unayo yini enye inkinga emzimbeni wakho. Emva kwalokho imibuzo ejulile izobe isiyobuzwa ngobuhlungu endololwaneni nokuthi uyakwazi yini ukunyakazisa ingalo yakho.

Uzobe-ke usunikwa uhlelo lokuzivocavoca ozokhonjiswa lona ukuthi wenzenjani kanye nencwajana ozonikwa yona ukuba uhambe nayo uye ekhaya ukuze uqhubeke nokujima.

Lezifundo –ke zizohlukaiswa kabili. Olokuqala lizothatha amaminithi awu 15 lizobe linemibuzo ebuzwa umcwaningi ebuzwa wena ebese ekubuza nobuhlungu ukuthi bungakanani nokuthi ukwazi kangakanani ukunyakazisa ingalo yakho.

Ucwaningo lwesibili luzoba ukulashwa oluzothatha amaminithi awu 20.

Ayikho yini inkinga uma ufunda.

Ayikho inkinga engabakhona.

Yebo, ingaba khona inkinga. Iziguli zingaba nezinhlungu noma zizwe zingakhululekile ngesikhathi zilashwa e physiotherapy,futhi bangazithola sebenesifo okuthiwa I Myositis Ossifican uma bejima ngendluzula.

Ongakuzuza uma ufunda

Imiphumela yokufunda uzonikwa uma usuqedile ukufunda.

Ukuzimbandakanya ngokuzikhethela

Ukuba khona kwakho kulokukufunda ngokuzi khethela futhi ungayeka noma inini uma ufuna. Lokho angeke kukuvimbele ukuthi uthole ukwelashwa lapha esibhe dlela futhi ngeke uthole ukuphatheka kabi.

Imfihlo

Yonke imibhalo ekulokhu kufunda izohla nganiswa ndawonye itshewe umphakathi. Igama lakho nokunye kwakho kizogcinwa kufihliwe. Sicela wazi ukuthi yonke imininingwano yakho angeke itshelwe noma ubani futhi nawe ungayithola uma uyidinga.

Lapho singathintana khona

Umcwaningi	Umphathi	Research Office: Biomedical Research Ethics Administration
Ms Reshma Ramnarain	Dr S.S. Maharaj	Westville Campus, Govan Mbeki Building, Private bag X54001,
Contact no: 0837890651	contact no:031 2607938	Durban 4000, Kwa Zulu – Natal, South Africa
		Tel : (031) 260 4769 Fax (031) 2604609

Ifomu Yokugcwaliswa

Sanibona igama lami ngingu reshma Ramnarain, ngenza izifundo zokuhlolisisa ngomthelela wohlelo standardize wokuzivoca voca kubantwana abanokuphuka okubizwa ngokuthi isupracondylar fractures post immobilization, njengokususwa kukakhonkolo.

Isivumelwano

Mina ---------- ngivumele ukuthi(ngomhlaka) ---------- usuku ---------- indawo ukuze ngizihlanganise ukuba ngithathe lezifundo ezibekiwe ukuba ngizifunde.

Ngiyazi ukuthi izifundo ziphethwe u Miss Ramnarain, isistudeni sase University of kwazulu Natal ukuze athole izifundo Ze Masters in Physiotherapy Degree.

Ngiyazi ukuthi ukuzixhumaisa kwami ingoba ngizithandela mina, kodwa futhi ngingayeka noma inini futhi lokho ngeke kungivimbele ukuthi ngithole noma iluphi usizo esibhedlela kanti futhi angeke ngilashwe ngokungathembekile noma okungalungile. Ngitsheliwe ukuthi futhi lonke ulwazi angeke ngilitshele noma ubani nokuthi lololwazi luyangithinta nami.

Ngiyavuma ukuthi ulwazi engilitholile kulokukufunda lizokwaziswa nabanye ukuze konke okutholakele kuzosiza nabanye.

Izifundo lezi zichaziwe kimi nokuthi angizukukhokhelwamali.

Ngiyaqonda ukuthi ulwazi olukulencwajana nesimo sokuhlola lomsebenzi, nokuthi ngiyavuma ukuba ngizimbandakanye kulokukufunda.

----------	----------
Igama lozimbandakanyayo	Igama lomcwvaningi
Kanye nokusayina	kanye nokusayina
Umcwvaningi – Miss Reshma Ramnarain	Umphathi Dr S.S. Maharaj
Cell no. 083 789 0651	contact no: 031 2607817

Appendix II

Demographic questionnaire

The questionnaire will be administered by the researcher

All questions must be answered

Tick in the appropriate box

1. Reference number :----------

2. Age: ☐

3 Gender: Male ☐ Female ☐

4. Race: Asian ☐ African ☐ Coloured ☐ White ☐

5. Whom do you live with? Parents ☐ Guardian ☐ Others ☐

If others state ----------

6. What is the highest level of education of the parent Grade ☐ None ☐

7. Area in which you live Urban ☐ Rural ☐ Informal settlement ☐

8. Are you at school Yes ☐ No ☐

If yes, what Grade are you in ----------

9. Are you Right ☐ Left ☐ Hand dominant?

10. Do you have any known medical conditions Yes ☐ No ☐

If yes state your condition/s ----------

---

11. Are you on any medication Yes ☐ No ☐

If yes, name the medication and for what condition ----------

---

12. Did you have previous injuries to the elbow Yes ☐ No ☐

If yes: what injury ----------

When did it occur (date) ----------

13. If POP was applied, when was it removed at: 3 weeks ☐ 6 weeks ☐ 9 weeks ☐ other ☐

14. Do you play any sport Yes ☐ No ☐

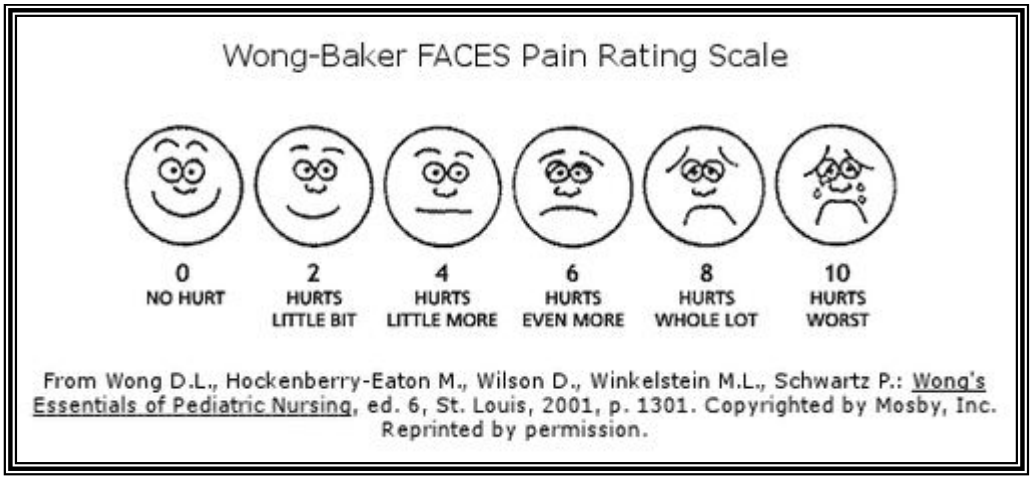
If yes, name the sport - ----------

Appendix III

Wong Baker Pain Rating Scale

Recording of pain

Reference number: Date:



Tick (✓) the appropriate emotion. Key: b/t = before treatment a/t = after treatment

	0 No hurt b/t a/t		2 Hurts a little bit b/t a/t		4 Hurts little more b/t a/t		6 Hurts even more b/t a/t		8 Hurts whole lot b/t a/t		10 Hurts worst b/t a/t	
Week 1												
Week 2												
Week 3												
Week 4												
Week 5												
Week 6												

Appendix IV

Record sheet for Range of Motion

Reference number Date : Visit/week

AFFECTED ELBOW : right left						UNAFFECTED ELBOW	
	ACTIVE				PASSIVE	ACTIVE	PASSIVE
	R1	R2	R3	M (E-F)			
EXTENSION-FLEXION							
SUPINATION							
PRONATION							

	EXTENSION FLEXION		SUPINATION		PRONATION	
	A	P	A	P	A	P
Week 1						
Week 2						
Week 3						
Week 4						
Week 5						
Week 6						

Appendix V

Functional disability assessment tool

Functional Activities	No difficulty (1)	Mild difficulty (2)	Moderate difficulty (3)	Severe difficulty (4)	Unable (5)
a) Turn the key to the right					
b) Turn the key to the left					
c) Wash your face					

Activity	Week 1	Week 2	Week 3	Week4	Week 5	Week 6
A						
B						
C						

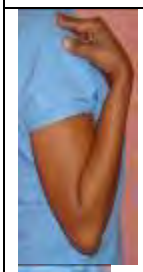
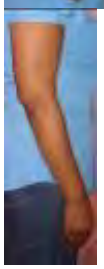
Table 2: Functional ability

Key :

1. **N = No difficulty,**
2. **Mild = Mild difficulty**
3. **Moderate = Moderate difficulty**
4. **S = Severe difficulty**
5. **U = Unable**

Appendix VIa (English)

Information booklet of a home programme

20 times per exercise	Days	Morning		Afternoon		Evening		Comment
		Tick ✓ if done × if not done	Number of times done	Tick ✓ if done × if not done	Number of times done	Tick ✓ if done × if not done	Number of times done	
  Exercise – 1 a)Lift the hand to touch the shoulder b) Straighten the arm to face the ground	1							
	2							
	3							
	4							
	5							
	6							
	7							
 Exercise - 2 Turn hand to face palm to a.) ceiling b.) ground	1							
	2							
	3							
	4							
	5							
	6							
	7							
 Exercise -3 Straighten elbow with help of the other hand	1							
	2							
	3							
	4							
	5							
	6							
	7							

20 times per exercise	Days	Morning		Afternoon		Evening		Comment
		Tick ✓ if done × if not done	Number of times done	Tick ✓ if done × if not done	Number of times done	Tick ✓ if done × if not done	Number of times done	
 Exercise – 4 Bend elbow with help of the other hand	1							
	2							
	3							
	4							
	5							
	6							
	7							
 Exercise – 5 Turn hand to face palm to ceiling with the help of the other hand	1							
	2							
	3							
	4							
	5							
	6							
	7							
 Exercise – 6 Turn hand to face the ground with the help of the other hand	1							
	2							
	3							
	4							
	5							
	6							
	7							

<u>Complications of Supracondylar Fractures</u> (English)

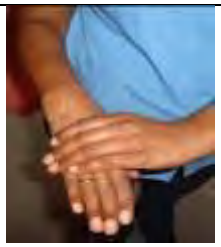
Parents/Guardians - BE AWARE!!!

If your child is presenting with the **following symptoms after the initial physiotherapy** session then **PLEASE BRING THEM TO HOSPITAL/PHYSIOTHERAPY DEPARTMENT AS SOON AS POSSIBLE:**

- Break in the skin resulting in bleeding at the affected elbow
- Infected/ septic wound – if there is a bad odour at the affected elbow
- Decrease in the range of motion at the affected elbow joint where the joint is getting stiffer.
- The child is complaining of increased pain, increased swelling, muscle weakness and sensitive to touch at the affected elbow.

Appendix VIb (isiZulu)

20 times per exercise	Izinsuku	Ekuseni		Ntambama		Ebusuku		Umbono
		Tick ✓ if done × if not done	Number of times done	Tick ✓ if done × if not done	Number of times done	Tick ✓ if done × if not done	Number of times done	
 Ukujima - 1 Gobisa Bese Uqondisa indololwano	1							
	2							
	3							
	4							
	5							
	6							
	7							
 Ukujima -2 Phendula isandla sibe ngase mpaneni a). Sibheke phezulu b.) Sibheke phansi	1							
	2							
	3							
	4							
	5							
	6							
	7							
 Ukujima - 3 Qondisa indolowano sisizwa esinye	1							
	2							
	3							
	4							
	5							
	6							
	7							

20 times per exercise	Izinsuku	Ekuseni		Ntambama		Ebusuku		Umbono
		Tick ✓ if done × if not done	Number of times done	Tick ✓ if done × if not done	Number of times done	Tick ✓ if done × if not done	Number of times done	
 Ukujima - 4 Gobisa indololwano sisizwa esinye isandla	1							
	2							
	3							
	4							
	5							
	6							
	7 21							
 Ukujima -5 Phendula isandla sibheka phezulu ngasempa meni sisizwa esinye isandla	1							
	2							
	3							
	4							
	5							
	6							
	7							
 Ukujima – 6 Phendula isandla sibheke phansi sisizwa esinye isandla	1							
	2							
	3							
	4							
	5							
	6							
	7							

Izinkinga Zokuphuka Endololwaneni (Zulu)
Abazali/ Ababekhi/Abanakekeli – Abagaphele!!!

Uma ingane yakho ikhombisa izibonakaliso zokugula ezilandelayo, emuva kokubonwa i-physiotherapy, sicela nimbuyise futhi esibhedlela noma kuma-physiotherapy department ngokushesha.

- Ukuvuleka kwesikhumba kwenza igasi liphume ligeleze endololwani.
- Isilonda esesonakele – Uma kunephu nga elibi eliphuma endololwani elimele futhi evundile.
- Ukwehla kwezinga lokulula indololwano lapho inenkinga khona futhi nokuqina kuyangokughu beka.
- Ingane ikhala ngobuhlungu obuya bughubeka nokuvuvukala kanye nokuba buthakathaka kwemisipha kanye futhi nemizwa iyaghubeka kuleyondawo enenkinga endololwaneni.

Appendix VII

Soft tissue mobilization

a) STARTING POSITION OF THE RELEASE

b) POSITION OF THE SOFT TISSUE RELEASE

Instructions

NB: This technique will only be performed by the physiotherapist on the participants

- Place both your thumbs next to each other over the biceps muscle on the affected elbow (as in picture a).
- Apply some pressure with both hands towards the bone within pain free range.
- Use a lubricant example: oil or lotion in your hands
- Glide both your hands simultaneously with one towards the elbow joint and the other towards the shoulder joint (as in picture b).
- Hold this stretch for two seconds.
- Repeat this stretch 5 times.

Appendix VIII

Addington / King Edward VIII/ R.K. Khans Hospital

Attention: Hospital Medical Manager

RE: RESEARCH FOR MASTER'S IN PHYSIOTHERAPY

My name is Reshma Ramnarain. I am currently registered for my Masters' degree in Physiotherapy at the University of KwaZulu - Natal. I hereby request permission and assistance to undertake my research at your institution.

It is evident from the literature that there have been many studies conducted investigation the prevalence, surgical and physiotherapy management of supracondylar fractures in children, however there is contradictory information regarding the effectiveness of early physiotherapy rehabilitation and home exercise regimen following immobilization of supracondylar fractures in children as compared to the many studies conducted investigating rehabilitation of the upper limb fractures in adults following immobilization.

The primary aim of this study is to compare the effects of a physiotherapy intervention once per week (six visits) to those attending physiotherapy fortnightly (three visits) over a six week period. The secondary aim is to determine the compliance of the child and parent with a physiotherapy home programme over this period.

The research sample will consist of children between the ages of 5 years and 12 years presenting with uncomplicated supracondylar fractures. Once ethical clearance is obtained and permission to collect data at the relevant institution is granted, the participants will be requested to sign a consent form with the approval of their parents/caregivers. Each participant will thereafter be asked a few questions about their health status and hobbies. An assessment will be conducted where the participants' pain, ROM and functional ability will be measured and recorded. The participants will be randomly divided into two groups; group A and Group B where in:

In the **Intervention Group** the physiotherapist will apply soft tissue mobilization (STM) (Appendix VII) and a physiotherapy programme of basic elbow exercises (Appendix VI). This will be conducted three times over a period of six weeks (first, third and sixth week).

In the Control group the physiotherapist will apply soft tissue mobilization (STM) (Appendix VII) and a physiotherapy programme of basic elbow exercises (Appendix VI). However this will be conducted six times (once per week) over a period of six weeks.

Both groups will be taught basic elbow exercises (Appendix VI) as a home programme. They will also be taught how to record information in Appendix VI. The researcher will be able to interpret the compliance of the participants from the information documented. In order to avoid complications such as Myositis Ossificans the parents will be informed about the contraindications (Appendix VII) and the steps that need to be taken should these symptoms occur.

All personal details of the participants will be kept confidential and a summary of all data will be collaborated into a thesis. This will be available for you to review once the study has been completed.

Eagerly awaiting your response
Yours sincerely
Reshma Ramnarain
Physiotherapist

Appendix IX

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

10 July 2014

Ms. R Ramnarain
Department of Physiotherapy
Westville Campus
University of KwaZulu-Natal

Dear Ms Ramnarain

PROTOCOL: The effects of a supervised Physiotherapy Programme in children with Supracondylar Fractures without Neurovascular Involvement. REF: BE155/11

EXPEDITED APPLICATION

A sub-committee of the Biomedical Research Ethics Committee has considered and noted your application received on 23 August 2011.

The study was provisionally approved pending appropriate responses to queries raised. Your correspondence dated 26 May 2014 (received on 09 July 2014) to queries raised on 26 January 2012 has been noted by a sub-committee of the Biomedical Research Ethics Committee. The conditions have now been met and the study is given full ethics approval effective from 23 May 2012.

To ensure uninterrupted approval of this study beyond the approval expiry date, an application for recertification must be submitted to BREC on the appropriate BREC form 2-3 months before the expiry date.

Any amendments to this study, unless urgently required to ensure safety of participants, must be approved by BREC prior to implementation.

Your acceptance of this approval denotes your compliance with South African National Research Ethics Guidelines (2004), South African National Good Clinical Practice Guidelines (2006) (if applicable) and with UKZN BREC ethics requirements as contained in the UKZN BREC Terms of Reference and Standard Operating Procedures, all available at http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx.

BREC is registered with the South African National Health Research Ethics Council (REC-290408-009). BREC has US Office for Human Research Protections (OHRP) Federal-wide Assurance (FWA 678).

The sub-committee's decision will be **RATIFIED** by a full Committee at its meeting taking place on **12 August 2014.**

We wish you well with this study. We would appreciate receiving copies of all publications arising out of this study.

Yours sincerely

Professor D.R Wassenaar
Chair: Biomedical Research Ethics Committee

Professor D Wassenaar (Chair)
Biomedical Research Ethics Committee
Westville Campus, Govan Mbeki Building
Postal Address: Private Bag X54001, Durban, 4000, South Africa
Telephone: +27 (0)31 260 2384 **Facsimile:** +27 (0)31 260 4609 **Email:** brec@ukzn.ac.za
Website: http://research.ukzn.ac.za/Research-Ethics/Biomedical-Research-Ethics.aspx
Founding Campuses: Edgewood Howard College Medical School Pietermaritzburg Westville

Appendix X

09 May 2012
Mr Xaba Xolani
Research Department
Department Of Health

Re: Permission to conduct research at Addington, King Edward VIII and R.K.Khan Hospital

I would like to request permission to conduct fieldwork for my research at the above mentioned hospitals. I have received provisional ethical clearance from the ethics board and provisional permission to conduct my fieldwork at the above mentioned hospitals.

I have attached copies of the permission letters received and the approval for ethical clearance. I have also attached a copy of my research proposal.

I am eagerly awaiting a response.

Thank You

Reshma Ramnarain

Appendix XI

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

Health Research & Knowledge Management sub-component
10 – 103 Natalia Building, 330 Langalibalele Street
Private Bag x9051
Pietermaritzburg
3200
Tel.: 033 – 3953189
Fax.: 033 – 394 3782
Email.: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

Reference : HRKM 63/12
Enquiries : Mr X Xaba
Tel : 033 – 395 2805

Dear Ms R. Ramnarain

Subject: Approval of a Research Proposal

1. The research proposal titled "**The effects of a supervised physiotherapy programme with supracondylar fractures (SCF) without neurovascular injuries**" was reviewed by the KwaZulu-Natal Department of Health.

   The proposal is hereby **approved** for research to be undertaken at **Addington, King Edward VIII and RK Khan Hospitals.**

2. You are requested to take note of the following:
   a. Make the necessary arrangement with the identified facility before commencing with your research project.
   b. Provide an interim progress report and final report (electronic and hard copies) when your research is complete.

3. Your final report must be posted to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za

For any additional information please contact Mr X. Xaba on 033-395 2805.

Yours Sincerely

Dr E Lutge
Chairperson, Provincial Health Research Committee
Date: 22/05/2012

Appendix XII

health
Department:
Health
PROVINCE OF KWAZULU-NATAL

OFFICE OF THE HOSPITAL CEO
KING EDWARD VIII REGIONAL HOSPITAL
Private Bag X02, CONGELLA, 4013
Corner of Rick Turner & Sydney Road
Tel.031-3603853/3015; Fax.031-2061457:
Email.rejoice.khuzwayo@kznhealth.gov.za:
www.kznhealth.gov.za

Ref.: KE 2/7/1/ (09/2012)
Enq.: Mrs. R. Sibiya
Research Programming

27 March 2012

Ms. R. Ramnarain
Department of Physiotherapy
Westville Campus
UNIVERSITY OF KWAZULU-NATAL

Dear Ms. Ramnarain

Protocol : " The effect s of a supervised Physiotherapy Programme in children with Supracondylar Fractures without Neurovascular involvement" Ref. No. BE155/

Permission to conduct research at King Edward VIII Hospital is provisionally granted, pending approval by the Provincial Health Research Committee, KZN Department of Health.

Kindly note the following:-

- The research will only commence once confirmation from the Provincial Health Research Committee in the KZN Department of Health has been received.
- Signing of an indemnity form at Room 8, CEO Complex before commencement with your study.
- King Edward VIII Hospital received full acknowledgment in the study on all Publications and reports and also kindly present a copy of the publication or report on completion.

The Management of King Edward VIII Hospital reserves the right to terminate the permission for the study should circumstances so dictate.

Yours faithfully

SUPPORTED/~~NOT SUPPORTED~~

DR. O.S.B. BALOYI
ACTING CEO & SENIOR MEDICAL MANAGER

28/03/2012
DATE

Appendix XIII

HEALTH
KwaZulu-Natal

ADDINGTON HOSPITAL
OFFICE OF THE HOSPITAL MANAGER
Postal Address: P.O. Box 977, DURBAN, 4000
Physical Address: 16 Erskine Terrace, South Beach
Tel.: (031) 327-2970, Fax.:(031) 368-3300
Email.: addington.management@kznhealth.gov.za
www.kznhealth.gov.za

AD/9/2/3/R

Enquiries: Dr E.R Masilela
Extension: 2970/2568

8th May 2012

Principal Investigator:
- **Ms R. Ramnarain**

PERMISSION TO CONDUCT RESEARCH AT ADDINGTON HOSPITAL: "THE EFFECTS OF A SUPERVISED PHYSIOTHERAPY PROGRAMME IN CHILDREN WITH SUPRACONDYLAR FRACTURES WITHOUT NEUROVASCULAR INVOLVEMENT. REF: BE155/11 "

I have pleasure in informing you that permission has been granted to you by Addington Management to conduct research on "The effects of a supervised Physiotherapy Programme in children with Supracondylar Fractures without Neurovascular involvement. REF: BE155/11"

Please note the following:

1. Please ensure that you adhere to all the policies, procedures, protocols and guidelines of the Department of Health with regards to this research.
2. This research will only commence once this office has received confirmation from the Provincial Health Research Committee in the KZN Department of Health.
3. Please ensure this office is informed before you commence your research.
4. Addington Hospital will not provide any resources for this research.
5. Your will be expected to provide feedback on your findings to Addington Hospital.

MEDICAL MANAGER/ACTING CEO
DR E.R. MASILELA
ADDINGTON HOSPITAL

Appendix XIV

HEALTH
KwaZulu-Natal

R.K. Khan Hospital
Private Bag X004,
CHATSWORTH, 4030
Tel.: 031 4596001, Fax.: 031 4011247
Email.:reena.ramcharan@.kznhealth.gov.za
www.kznhealth.co.za

ENQUIRIES: DR M. NDLANGISA

26 APRIL 2012

Reshma Ramnarain
Chief Physiotherapist
ADDINGTON HOSPITAL

Dear Madam

PERMISSION TO CONDUCT RESEARCH : THE EFFECTS OF A SUPERVISED PHYSIOTHERAPY PROGRAMME IN CHILDREN WITH SUPRACONDYLAR FRACTURES WITHOUT NEUROVASCULAR INJURIES

Permission is granted to conduct your research at this institution.

Please note the following:

1. Please ensure that you adhere to all the policies, procedures, protocols and guidelines of the Institution with regards to this research.
2. This research will only commence once this office has received confirmation from the Provincial Health Research Committee in the KZN Department of Health.
3. Please ensure this office is informed before you commence your research.
4. The District Office/Facility will not provide any resources for this research.
5. You will be expected to provide feedback on your findings to this institution.

Yours faithfully

DR M. NDLANGISA
SENIOR MANAGER : MEDICAL SERVICES

Annexure A

Physiotherapy protocol for elbow fractures

Postoperative Phase I: Inflammation/Protection (Weeks 0 to 2)

GOALS

- Protective immobilization
- Edema and pain control
- Full ROM in uninvolved joints
- A/AAROM of elbow within safe parameters
- Awareness and understanding of repair process and precautions
- Independence in HEP

PRECAUTIONS

- Exercise only within safe prescribed arc
- Monitor pressure areas over posterior aspect of elbow from prolonged splinting
- No passive manipulation or stretching
- No aggressive motion, which can cause inflammation and pain
- Avoid neurovascular compromise

TREATMENT STRATEGIES

Protection Options

- Custom thermoplastic splint
  - Adequate padding over the olecranon, medial/lateral epicondyles, and ulnar styloid

Pin and Wound Care for ORIF/CREF

- Solution of 50% hydrogen peroxide and sterile water daily to pin sites
- Standard sterile wound care procedures to ORIF
- Use of nonadherent dressing with minimal bulk to allow for early motion

Edema/Pain Management

- Elevation, correct positioning, cryotherapy, light compression wrap (Ace bandage), safe early active ROM

Uninvolved Joint ROM

- Hand: tendon gliding (full composite flexion to DPC), thumb all planes
- Wrist: MD approval required, gravity eliminated flexion, extension, deviation
- Shoulder: in supine, wearing splint, AAROM exercises—all planes
- Avoid use of sling or posturing in the sling position

Elbow ROM

Only appropriate for* stable *fractures/dislocations and within limits of repaired structures

- Removal of splint to allow early active-assisted ROM exercises
- Exercise only in safe prescribed arc, in gravity-eliminated or gravity-assisted positions
- Forearm pronation/supination if permitted

CRITERIA FOR ADVANCEMENT

- Clinical union at fracture site or stability via surgical fixation
- Joint stability throughout full arc of motion at ulna/humeral and radio-ulnar joints

Postoperative Phase II: Fibroblastic/Fracture Stability (Weeks 2 to 8)

GOALS

- Maximize active/passive ROM of the elbow and forearm in a pain-free range
- Control of edema and inflammation
- Decrease scar adherence
- Increase distal strength and proximal stabilization strength
- Improved muscle-tendon unit length
- Return to light, functional tasks with use of involved extremity

PRECAUTIONS

- Full arc active/passive ROM with MD approval
- Monitor response to ROM: avoid inflammatory episodes and/or exacerbation of pain
- No dynamic elbow splinting
- Monitor for early forearm and/or elbow joint contractures
- No grade III or IV joint mobilization
- No resistive exercises or activities

TREATMENT STRATEGIES

Protection

- Use thermoplastic splint for travel, sleep, or at-risk activities
- D/C sling, avoid posturing in "sling" position

ROM Program

- Active, active-assisted, and gentle passive ROM exercises, against gravity
- Emphasize total end range time (TERT) over several repetitions
- Gentle distraction, grades I & II joint mobilizations only
- Use of moist heat before exercising, heat on stretch
- Contract/relax exercises
- Biofeedback and/or NMES

Edema Control

- Cold pack, retrograde massage, moist heat before retrograde massage, light compression wrapping or sleeve, overhead ROM exercises

Scar Management

- Scar massage and silicone gel sheeting following removal of sutures/staples and complete closure of the wound
- Decrease scar adherence with cross-friction massage at scar interface
- Deep muscle massage to flexor/extensor muscle groups
- Compression sleeves (Tubigrip) to minimize hypertrophic scarring

Light, Functional Activities

- Restoration of normal movement patterns and encouraged use of extremity for light ADL
- Encourage functional splinting (holding phone to increase flexion, swinging arm while walking, and/or using keyboard)
- PNF patterns encouraged

CRITERIA FOR ADVANCEMENT

- Evidence of radiographic union or confirmation by MD of fracture, joint, and repaired structures to withstand resistance/stress

Postoperative Treatment Phase III: Scar Maturation and Fracture Consolidation (Week 8 to Month 6)

GOALS

- Full functional ROM
- Full functional strength and endurance
- Full participation in all functional activities, work, and leisure

PRECAUTIONS

- Hard end feel indicating a bony or hardware block; notify MD
- Failure of hardware, joint incongruity
- Nonunion or malunion
- PRE is contraindicated if patient is unable to isolate specific muscle group

TREATMENT STRATEGIES

ROM Program

- Focus on end range parameters and quality of motion
- Continue previous exercises; goal: passive ROM = active ROM

Strength and Endurance

- PRE to all muscle groups
- Free weights, wall pulleys, Thera-Band, weight well, MULE, BTE, PNF patterns with resistance

Splinting Program

- Continue splinting program overnight and intermittently during the day
- Upgrade splint parameters to passive end range position
- Continue functional splinting throughout the day

Return to Function

- Encourage return to ADL, work, and leisure activities
- Activity analysis
- BTE

CRITERIA FOR DISCHARGE

- Achieved full or functional ROM and strength
- Returned to previous level of function
- Independence in home exercise program and splinting program
- Progress has plateaued, and status has not changed over 6 weeks

Annexure B

a). Statistical data and b) calculation of the sample size:

Pain

	Group						P value
	Intervention group - 3 visits			Control group - 6 visits			
	Median	Percentile 25	Percentile 75	Median	Percentile 25	Percentile 75	
Pain1	4	4	6	6	4	6	0.238
pain3	4	2	4	4	2	4	0.481
pain6	0	0	2	0	0	2	0.514

There was no significant difference between the medians of the 2 groups at any of the time points.

Flexion

	Group						P value
	Intervention group - 3 visits			Control group - 6 visits			
	Median	Percentile 25	Percentile 75	Median	Percentile 25	Percentile 75	
ext1	118	110	125	100	96	115	0.016
ext3	133	130	135	120	120	130	0.004
ext6	140	140	145	140	140	140	0.047

There was a significant difference between the two groups at all 3 time points.

Extension

	Group						P value
	Intervention group - 3 visits			Control group - 6 visits			
	Median	Percentile 25	Percentile 75	Median	Percentile 25	Percentile 75	
Flex1	50	25	60	36	20	40	0.126
flex3	15	10	20	15	0	25	0.875
flex6	0	0	0	0	0	0	0.984

No significant differences between the groups at any of the time points.

Functional score

	Group						P value
	Intervention group - 3 visits			Control group - 6 visits			
	Median	Percentile 25	Percentile 75	Median	Percentile 25	Percentile 75	
Functional1	3	3	4	4	3	4	0.145
Functional3	2	2	3	2	2	3	0.253
Functional6	1	1	1	1	1	1	0.153

No significant difference between the groups at any of the time points

		Group				P values
		Intervention group - 3 visits		Control group - 6 visits		
		Count	Column N %	Count	Column N %	
compliance	yes	17	68.0%	23	92.0%	0.034
	no	8	32.0%	2	8.0%	

Sample size calculations:

b). Sample size calculations for the 4 outcomes using non parametric assumption (PASS version 12, Hintze, J. (2013). PASS 12. NCSS, LLC. Kaysville, Utah, USA. www.ncss.com.)

Functional score

Group sample sizes of 16 and 16 achieve 81.107% power to reject the null hypothesis of equal means when the population mean difference is $\mu1 - \mu2 = 1.0 - 0.1 = 0.9$ with standard deviations of 1.1 for group 1 and 0.4 for group 2, and with a significance level (alpha) of 0.050 using a two-sided two-sample unequal-variance t-test. . To allow for loss of power for non parametric testing, a 15% increase in sample size is a useful rule of thumb, thus the required sample size would be 18 per group. This study used 25 per group and thus was sufficiently powered for this comparison.

Pain

Group sample sizes of 11 and 11 achieve 82.869% power to reject the null hypothesis of equal means when the population mean difference is $\mu 1 - \mu 2 = 0.2 - 0.6 = -0.4$ with standard deviations of 0.1 for group 1 and 0.4 for group 2, and with a significance level (alpha) of 0.050 using a two-sided two-sample unequal-variance t-test. To allow for loss of power for non- parametric testing, a 15% increase in sample size is a useful rule of thumb, thus the required sample size would be 13 per group. This study used 25 per group and thus was sufficiently powered for this comparison.

Extension

Group sample sizes of 25 and 25 achieve 81.417% power to reject the null hypothesis of equal means when the population mean difference is $\mu 1 - \mu 2 = 1.0 - 4.1 = -3.1$ with standard deviations of 1.2 for group 1 and 5.1 for group 2, and with a significance level (alpha) of 0.050 using a two-sided two-sample unequal-variance t-test. To allow for loss of power for non- parametric testing, a 15% increase in sample size is a useful rule of thumb, thus the required sample size would be 29 per group. This study used 25 per group and thus was slightly under-powered for this comparison.

Flexion

Group sample sizes of 10 and 10 achieve 80.824% power to reject the null hypothesis of equal means when the population mean difference is $\mu 1 - \mu 2 = 141.6 - 2.4 = 139.2$ with standard deviations of 138.1 for group 1 and 9.8 for group 2, and with a significance level (alpha) of 0.050 using a two-sided two-sample unequal-variance t-test. To allow for loss of power for non- parametric testing, a 15% increase in sample size is a useful rule of thumb, thus the required sample size would be 12 per group. This study used 25 per group and thus was sufficiently powered for this comparison.

Annexure C

Disability of the Arm, Shoulder and Hand

Please rate your ability to do the following activities in the last week by circling the number below the appropriate response.

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. Open a tight or new jar.	**1**	**2**	**3**	**4**	**5**
2. Write.	**1**	**2**	**3**	**4**	**5**
3. Turn a key.	**1**	**2**	**3**	**4**	**5**
4. Prepare a meal.	**1**	**2**	**3**	**4**	**5**
5. Push open a heavy door.	**1**	**2**	**3**	**4**	**5**
6. Place an object on a shelf above your head.	**1**	**2**	**3**	**4**	**5**
7. Do heavy household chores (e.g., wash walls, wash floors).	**1**	**2**	**3**	**4**	**5**
8. Garden or do yard work.	**1**	**2**	**3**	**4**	**5**
9. Make a bed.	**1**	**2**	**3**	**4**	**5**
10. Carry a shopping bag or briefcase.	**1**	**2**	**3**	**4**	**5**
11. Carry a heavy object (over 10 lbs).	**1**	**2**	**3**	**4**	**5**

12.	Change a lightbulb overhead.	**1**	**2**	**3**	**4**	**5**
13.	Wash or blow dry your hair.	**1**	**2**	**3**	**4**	**5**
14.	Wash your back.	**1**	**2**	**3**	**4**	**5**
15.	Put on a pullover sweater.	**1**	**2**	**3**	**4**	**5**
16.	Use a knife to cut food.	**1**	**2**	**3**	**4**	**5**
17.	Recreational activities which require little effort (e.g., cardplaying, knitting, etc.).	**1**	**2**	**3**	**4**	**5**
18.	Recreational activities in which you take some force or impact through your arm, shoulder or hand (e.g., golf, hammering, tennis, etc.).	**1**	**2**	**3**	**4**	**5**
19.	Recreational activities in which you move your arm freely (e.g., playing frisbee, badminton, etc.).	**1**	**2**	**3**	**4**	**5**
20.	Manage transportation needs (getting from one place to another).	**1**	**2**	**3**	**4**	**5**
21.	Sexual activities.	**1**	**2**	**3**	**4**	**5**

	NOT AT ALL	SLIGHTLY	MODERATELY	QUITE A BIT	EXTREMELY
22. During the past week, ***to what extent*** has your arm, shoulder or hand problem interfered with your normal social activities with family, friends, neighbours or groups? ***(circle number)***	**1**	**2**	**3**	**4**	**5**

	NOT LIMITED AT ALL	SLIGHTLY LIMITED	MODERATELY LIMITED	VERY LIMITED	UNABLE
23. During the past week, were you limited in your work or other regular daily activities as a result of your arm, shoulder or hand problem? ***(circle number)***	**1**	**2**	**3**	**4**	**5**

Please rate the severity of the following symptoms in the last week. ***(circle number)***

	NONE	MILD	MODERATE	SEVERE	EXTREME
24. Arm, shoulder or hand pain.	**1**	**2**	**3**	**4**	**5**
25. Arm, shoulder or hand pain when you performed any specific activity.	**1**	**2**	**3**	**4**	**5**
26. Tingling (pins and needles) in your arm, shoulder or hand.	**1**	**2**	**3**	**4**	**5**

27. Weakness in your arm, shoulder or hand.	**1**	**2**	**3**	**4**	**5**
28. Stiffness in your arm, shoulder or hand.	**1**	**2**	**3**	**4**	**5**

	NO DIFFICULTY	**MILD DIFFICULTY**	**MODERATE DIFFICULTY**	**SEVERE DIFFICULTY**	**SO MUCH DIFFICULTY THAT I CAN'T SLEEP**
29. During the past week, how much difficulty have you had sleeping because of the pain in your arm, shoulder or hand? ***(circle number)***	**1**	**2**	**3**	**4**	**5**

	STRONGLY DISAGREE	**DISAGREE**	**NEITHER AGREE NOR DISAGREE**	**AGREE**	**STRONGLY AGREE**
30. I feel less capable, less confident or less useful because of my arm, shoulder or hand problem. ***(circle number)***	**1**	**2**	**3**	**4**	**5**

WORK MODULE (OPTIONAL)

The following questions ask about the impact of your arm, shoulder or hand problem on your ability to work (including home-making if that is your main work role).

Please indicate what your job/work is: _

❒ I do not work. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week. Did you have any difficulty:

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. using your usual technique for your work?	1	2	3	4	5
2. doing your usual work because of arm, shoulder or hand pain?	1	2	3	4	5
3. doing your work as well as you would like?	1	2	3	4	5
4. spending your usual amount of time doing your work?	1	2	3	4	5

SPORTS/PERFORMING ARTS MODULE (OPTIONAL)

The following questions relate to the impact of your arm, shoulder or hand problem on playing ***your musical instrument or sport or both***. If you play more than one sport or instrument (or play both), please answer with respect to that activity which is most important to you.

Please indicate the sport or instrument which is most important to you: _

❑ I do not play a sport or an instrument. (You may skip this section.)

Please circle the number that best describes your physical ability in the past week. Did you have any difficulty:

	NO DIFFICULTY	MILD DIFFICULTY	MODERATE DIFFICULTY	SEVERE DIFFICULTY	UNABLE
1. using your usual technique for playing your instrument or sport?	**1**	**2**	**3**	**4**	**5**
2. playing your musical instrument or sport because of arm, shoulder or hand pain?	**1**	**2**	**3**	**4**	**5**
3. playing your musical instrument or sport as well as you would like?	**1**	**2**	**3**	**4**	**5**
4. spending your usual amount of time practising or playing your instrument or sport?	**1**	**2**	**3**	**4**	**5**