

DEVELOPMENT AND VALIDATION OF AN EVIDENCE-BASED EDUCATIONAL PROGRAM FOR ADULTS UNDERGOING ANTERIOR CRUCIATE LIGAMENT RECONSTRUCTION SURGERY IN THE UNITED ARAB EMIRATES

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March 2010

Declaration

By submitting this thesis electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the owner of the copyright thereof (unless to the extent explicitly otherwise stated) and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

March 2010

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ABSTRACT

BACKGROUND: Patients' knowledge about the effectiveness of interventions is now recognized as an important facilitator of the implementation of evidence in practice. Evidence-based, patient education programs aim to impart knowledge about the efficacy and effectiveness about interventions to individuals. However, there is currently a lack of structured evidence-based educational programs to educate patients about the evidence-base for interventions prescribed by the health professionals in the field of orthopaedics.

OBJECTIVE: The main objective of this study was to develop and validate an Arabic version of an evidence-based educational program for patients who are scheduled to undergo ACL reconstruction surgery in UAE, based on available evidence collated through a systematic review process.

METHODS: A systematic review was conducted to generate clinical recommendations which were used to develop the evidence-based educational program. The evidence-based information was derived from secondary research to determine which rehabilitation strategies were most effective in improving outcome measurements following ACL reconstruction surgery. A pre-final draft of the evidence-based educational program was prepared and forward and back translated from English into the Arabic language. Feedback groups of ACL patients and physiotherapists were used to determine the content and face validity of the program. The final draft was validated in a group of 40 ACL patients waiting to undergo ACL reconstruction surgery at Zayed Military hospital and Abu Dhabi Knee and Sports Medicine Centre in the UAE, using checklists.

RESULTS: A total of 40 patients undergoing ACL reconstruction surgery consented to participate in this study. All the subjects were male. The age range was between 18 to 38 years old with mean age of 28.5 years (SD 5.75). Most of the patients (65%) underwent ACL reconstruction surgery to the right knee. Of the total sample (n=40), the majority of the subjects who participated in this study (90 %), had ACL surgery for the first time. Most of the responses to the evidence-based educational program checklist were positive.

CONCLUSION: It can be recommended that the newly-developed evidence-based educational program is a valid tool which can be given to ACL patients prior to ACL reconstruction to prepare them for the rehabilitation postoperatively. By informing patients of their condition, the expected outcomes of their condition and the effect of doing exercises to improve their condition, the patients will be more encouraged to partake in rehabilitation, as they know it is for their own good. This will ultimately improve overall patient care and improve management of ACL patients.

Key words: *Anterior cruciate ligament, educational program, evidence-based, validity*

DEDICATION

This thesis is dedicated to my family.

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GLOSSARY

ABBREVIATIONS

- ACL:** Anterior Cruciate Ligament
UAE: United Arab Emirates
ZMH: Zayed Military Hospital
ADKSMC: Abu Dhabi Knee and Sport Medicine Centre
FGFS: Focus Group Feedback Session

DEFINITIONS

Content validity

Content validity is the degree to which the items in a measurement instrument adequately reflects the content domain being measured (Portney et al 2000).

Face validity

The assumption that the validity of an instrument is a reasonable measure of a given variable based on its appearance (Portney et al 2000)

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CHAPTER 1

Introduction

The role of the anterior cruciate ligament (ACL) in knee joint stability is critical (Zantop et al 2006). The ACL controls movement of the tibia relative to the femur and guides knee extension (Trees et al 2009). The ACL's primary function is to prevent anterior translation and rotation of the tibia relative to the femur (Trees et al 2009). It also guides the screw-home mechanism associated with knee extension; prevents hyperextension and assists in prevention of varus and valgus movement, especially in the extended knee (Trees et al 2007). The multi-dimensional stability offered by the ACL, therefore contributes significantly to optimal knee function.

The ACL's multi-dimensional knee stability function is possible due to the structural arrangement of the ACL's functional fiber bundles (Zantop et al 2006). Due to this fiber arrangement, the ACL is arguably one of the most complex ligaments in the human body (Zantop et al 2006). Injury to any of the functional fiber bundles leads to catastrophic functional implications for the lower limb, which necessitates surgical intervention (Zantop et al 2006). The aim of ACL surgical reconstruction techniques is to restore the static and dynamic joint stability of the injured knee comparable to that of the intact knee (Zantop et al 2006). It has been demonstrated that reconstruction of the ACL is successful in limiting anterior tibial translation (Zantop et al 2006). However, rotational stability of the surgical grafts is insufficient (Zantop et al 2006). Consequently, individuals who have undergone ACL reconstruction may still experience functional knee instability (Zantop et al 2006). Therefore, exercise rehabilitation strategies are crucial to address redundant knee functional instability post-surgery (McDonald et al 2007). Evidence-based exercise strategies to manage ACL injuries are therefore required to optimize knee function post-surgery and prevent the development of secondary osteoarthritic changes.

Rehabilitation following ACL reconstruction typically commences during the acute in-patient period (McDonald et al 2007). The goals of post-operative ACL rehabilitation include controlling pain and swelling, restoration of knee range of motion, muscle strength and neuromuscular control to enable optimal function (McDonald et al 2007). The efficacy of a range of exercise strategies and approaches including land- and water based exercises, supervised and home-based exercise programs, open- and closed kinetic chain

exercises, weight-bearing exercises, neuromuscular and isokinetic strength training exercises has been established in randomized controlled trials (Trees et al 2009). However, the application of evidence-based rehabilitation strategies in clinical practice continues to be hampered by a lack of knowledge regarding the evidence for interventions by patients, as well as patient compliance to exercise programs during the post-operative stage.

The role of patient education in the translation of research evidence into clinical practice has recently been highlighted. Patients' knowledge about the effectiveness of interventions is now recognized as an important facilitator of the implementation of evidence in practice (Straus et al 2008). Evidence-based, patient education programs aim to impart knowledge about the efficacy and effectiveness about interventions to individuals. The health care recipient is thus empowered to play an active role in promoting the application of evidence-based health care in clinical practice (Osborne et al 2006). However, there is currently a lack of structured evidence-based educational programs to educate patients about the evidence-base for interventions prescribed by the health professionals in the field of orthopaedics. This study reports on the development and validation of the first evidence-based educational program to inform patients undergoing ACL reconstruction about the *evidence* of the most common post-ACL reconstruction rehabilitation *interventions to be delivered by the health professional*.

The organization of the thesis chapters is illustrated in the flow chart (Figure 1.1).

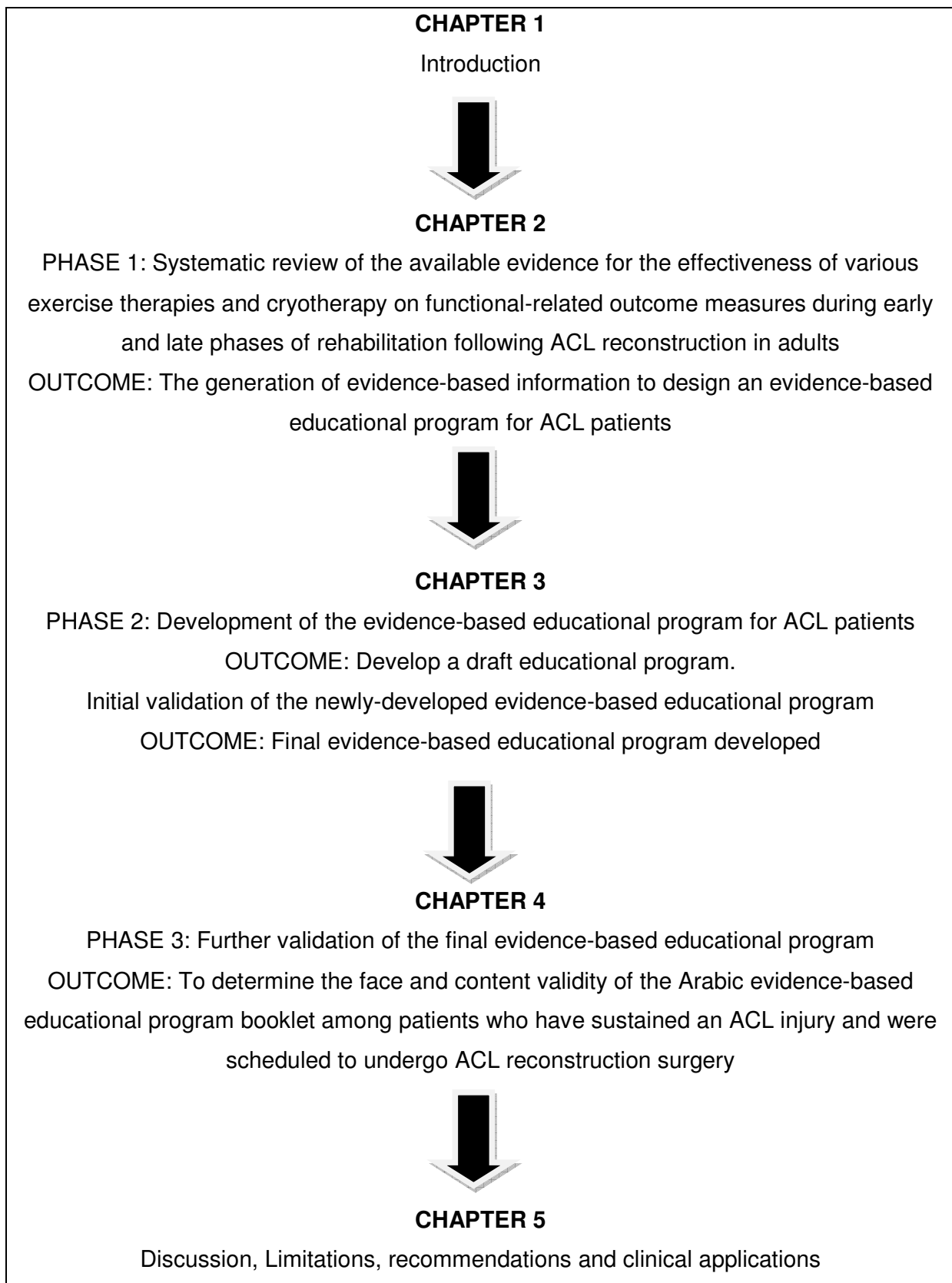


Figure 1.1 Flow chart depicting project outline

CHAPTER 2

Phase 1: Systematic review of the efficacy of various exercise therapies and cryotherapy on functional-related outcome measures during early and late phases of rehabilitation following anterior cruciate ligament reconstruction in adults.

2.1 BACKGROUND AND RATIONALE FOR ASSESSMENT

Anterior Cruciate Ligament (ACL) tears are one of the most common and most serious knee ligament injuries (Demirag et al 2004), causing severe functional problems (Risberg et al 2007). More than 100,000 new ACL tears occur in the United States of America (USA) annually (Trees et al 2007) with the majority of cases reported in the young athlete population due to non-contact sports (Trees et al 2007). Following injury to the ACL, pain and inflammation may lead to muscle inhibition and the ability to fully activate the thigh muscles, may further result in muscle atrophy and consequently joint instability (Trees et al 2007). The management of ACL tears may be conservative, but most often requires reconstructive surgery (Trees et al 2007) of which the success rate ranges from 75% to 95% (Madhavan 2007). Despite treatment and technique advances, many patients still develop unsatisfactory post-operative outcomes, therefore warranting post-ACL reconstruction rehabilitation to assist the athlete in his return to pre-injury status (Trees et al 2007; Madhavan 2007, unpublished thesis). Rehabilitation programs are an important component of ACL post-surgical reconstruction, as successful return to full knee function may limit future degenerative changes to the knee joint (Trees et al 2007).

The goals of post-operative ACL rehabilitation include controlling pain and swelling, restoration of knee range of motion (ROM), development of sufficient muscle strength for normal gait and restoring a good level of independence in performing the activities of daily living (ADL) (McDonald et al 2007). Rehabilitation may consist of exercise therapy (i.e. land- and water based exercises, supervised and home-based exercise, open- and closed kinetic chain exercises, weight-bearing exercises and neuromuscular and isokinetic strength training exercises, and other exercise) and cryotherapy (McDonald et al 2007; Trees et al 2007). These rehabilitation strategies typically commence during the acute in-patient period following ACL reconstruction surgery (McDonald et al 2007) and may later include prevention strategies for future ACL injuries. To date, no clinical

guideline exists reporting the superiority of one intervention over another (McDonald et al 2007, Trees et al 2007). An evidence-based clinical guideline explaining the management following ACL reconstruction surgery is therefore warranted.

The purpose of this review was to systematically review the efficacy of various exercise therapies (i.e. land- and water based exercises, supervised and home-based exercise, open- and closed kinetic chain exercises, weight-bearing exercises, early quadriceps exercises and neuromuscular and isokinetic strength training exercises, and other exercises) and cryotherapy in decreasing pain and swelling, as well as improving knee function, knee ROM, and muscle strength in adults during the early and late phases of rehabilitation following ACL reconstruction surgery. The information obtained from this review was derived from systematic reviews (secondary research) to determine which rehabilitation strategies are most effective in improving outcome measurements (namely decreasing pain and swelling, as well as improving knee function, knee ROM, and muscle strength ROM, reduce swelling, improving muscle strength and functional activity) following ACL reconstruction surgery. The outcome of this review could possibly initiate a management guideline for post-ACL reconstruction in early and late phases of rehabilitation.

2.2 PROJECT AIM

The primary aim of this review was to systematically assess the literature and present the best evidence available for the efficacy of various exercise therapies (i.e. land- and water based exercises, supervised and home-based exercise, open- and closed kinetic chain exercises, weight-bearing exercises, early quadriceps exercises and neuromuscular and isokinetic strength training exercises, and other exercises) and cryotherapy in decreasing pain and swelling, as well as improving knee function, knee ROM, and muscle strength in adults during the early and late phases of rehabilitation following ACL reconstruction surgery. This review also aimed at developing clinical recommendations for each of the included interventions.

2.3 RESEARCH QUESTIONS

1. What is the efficacy of various exercise therapies (i.e. land- and water based exercises, supervised and home-based exercise, open- and closed kinetic chain exercises, weight-bearing exercises, early quadriceps exercises, and neuromuscular and isokinetic strength training exercises, and other exercises) and

cryotherapy in decreasing pain and swelling, as well as improving knee function, knee ROM, and muscle strength in adults during the early and late phases of rehabilitation following ACL reconstruction surgery?

2. Which clinical recommendations can be made from the reviewed interventions (i.e. land- and water based exercises, supervised and home-based exercise, open- and closed kinetic chain exercises, weight-bearing exercises, early quadriceps exercises and neuromuscular and isokinetic strength training exercises, and other exercises and cryotherapy)?

2.4 OBJECTIVES

The specific objectives of this review were to:

- Determine the efficacy of land - and water-based exercises on improving knee ROM, knee function, reducing swelling, and increasing muscle strength during the early and late phases of rehabilitation following ACL reconstruction surgery in adults.
- Determine the efficacy of supervised and home-based exercises on improving knee ROM, knee function, reducing swelling, and increasing muscle strength during the early and late phases of rehabilitation following ACL reconstruction surgery in adults.
- Determine the efficacy of open- and closed- kinematic chain exercises on improving knee ROM, knee function, reducing swelling, and increasing muscle strength during the early and late phases of rehabilitation following ACL reconstruction surgery in adults.
- Determine the efficacy of immediate and late weight-bearing exercises on improving knee ROM, knee function, reducing swelling, and increasing muscle strength during the early and late phases of rehabilitation following ACL reconstruction surgery in adults.
- Determine the efficacy of neuromuscular and isokinetic muscle strength training on improving knee ROM, knee function, reducing swelling, and increasing muscle strength during the early and late phases of rehabilitation following ACL reconstruction surgery in adults.
- Determine the efficacy of early quadriceps exercises muscle strength training on improving knee ROM, knee function, reducing swelling, and increasing muscle strength during the early and late phases of rehabilitation following ACL reconstruction surgery in adults.

- Determine the efficacy of specific exercises (such as lateral slide exercises, cycling, isokinetic muscle training, stair climbing and standard training) on improving knee ROM, knee function, reducing swelling, and increasing muscle strength during the early and late phases of rehabilitation following ACL reconstruction surgery in adults.
- Determine the efficacy of cryotherapy on improving knee ROM, knee function, reducing swelling, and increasing muscle strength during the early and late phases of rehabilitation following ACL reconstruction surgery in adults.
- Determine the efficacy of rehabilitation strategies namely neuromuscular training (plyometric power, biomechanics and techniques, strength, balance and core stability training) for decreasing the biomechanical risk factors for ACL injury, thereby preventing future injuries following ACL reconstruction surgery.
- Develop specific clinical recommendations for each of the reviewed interventions with a view to include them in an evidence-based educational program for adults who will undergo ACL reconstruction surgery.

2.5 DEFINITIONS

ACL reconstruction: The anterior cruciate ligament (ACL) is one of a pair of ligaments in the center of the knee joint that form a 'cross', and this is where the name "cruciate" comes from. There is both an anterior and a posterior cruciate ligament (PCL). Both of these ligaments function to stabilize the knee from anterior to posterior. In medical terms, the ACL is the primary restraint to anterior displacement of the tibia on the femur. This means that when the ACL is injured, the tibia can slide forward on the femur, causing the knee to "give way" (Triston et al 2005).

Adult: one who has reached maturity, an individual aged 18 years and older (<http://dict.die.net/adult/>)

2.6 METHODS OF REVIEW

2.6.1 Criteria for considering studies

2.6.1.1 Types of studies

All published systematic reviews that investigated the effectiveness or efficacy of exercise therapies (i.e. land- and water based exercises, supervised and home-based exercise, open- and closed kinetic chain exercises, weight-bearing exercises and neuromuscular and isokinetic strength training exercises, quadriceps exercises and other exercises) and

cryotherapy in decreasing pain and swelling, as well as improving knee function, knee ROM, and muscle strength in adults during the early and late phases of rehabilitation following ACL reconstruction surgery were selected for this review. In addition, systematic reviews reporting on prevention strategies for preventing future ACL injuries following ACL reconstruction rehabilitation were sought. Other research designs, such as, observational studies and case studies, were excluded. Only systematic reviews published in the English and Arabic languages were sought for this review. Systematic reviews published after 2000 were included.

2.6.1.2 Type of Participants

Systematic reviews that included male and female adults over eighteen years of age who had undergone ACL reconstruction surgery were included in the review.

2.6.1.3 Type of Interventions

Systematic reviews that included exercise therapies (i.e. land- and water based exercises, supervised and home-based exercise, open- and closed kinetic chain exercises, weight-bearing exercises and neuromuscular and isokinetic strength training exercises, quadriceps exercises, and other exercises) and cryotherapy in decreasing pain and swelling, as well as improving knee function, knee ROM, and muscle strength in adults during the early and late phases of rehabilitation following ACL reconstruction surgery were considered eligible. Interventions had to be administered by a physiotherapist or physical therapist. Systematic reviews reporting on prevention strategies for preventing future ACL injuries following ACL reconstruction rehabilitation were also sought.

2.6.1.4. Type of Comparisons

Systematic reviews that compared land- to water based exercises, supervised to home-based exercise, open-to closed kinetic chain exercises, immediate and late weight-bearing exercises and neuromuscular to isokinetic strength training exercises, early quadriceps exercises to not allowing early quadriceps exercises, and other exercises) were sought. In addition, systematic reviews comparing cryotherapy to no intervention or another physiotherapeutic intervention were also included.

2.6.1.5 Types of Outcome measures

Studies that incorporated the following outcomes were included:

1. Pain as measured with a Visual analog scale (VAS).

2. Knee range of motion as measured with a goniometer.
3. Knee swelling measured with a tape measure.
4. Muscle strength of quadriceps and hamstring muscles as measured with isokinetic equipments.
5. Knee function as measured with a disability outcome measurement tool i.e. activity VMO, Tegner Activity Scale, Cincinnati Knee Rating system, KT1000, and standard pre-participation physical examination and Knee injury and Osteoarthritis Outcome Score (KOOS).

2.6.2 Search strategy for identification of studies

Prior to commencing this review, PubMed/Medline, PEDro, Cochrane library and CINAHL were searched to determine if a similar review has ever been published. No similar reviews were found prior August 2007. An extensive search of the databases was conducted using the following keywords and combinations. This search strategy was designed for PubMed/Medline and CINAHL, and was adapted for each database. The databases included: PEDro, Cochrane Library, Sports Discus, Web of Science, Science Direct, Google Scholar, EbscoHost, ProQuest, PsycInfo, BMJ.com, Scirus, and NLM Central Gateway. These databases can be accessed via the library Website of Stellenbosch University. The searches were updated during March 2009 prior to publication. PubMed and CINAHL were searched using their MeSH functions. The MeSH function condenses the keywords to build the most appropriate search strategies. PubMed and CINAHL functions allow terms to be combined using Boolean terms such as 'AND' and 'OR'. This benefits the outcome of the search strategy by being more precise while saving time. As each database has its own indexing terms and search functions, and search strategies were adapted to suit each database individually. The following keywords were used as combinations during each search: *Anterior cruciate ligament, anterior cruciate ligament reconstruction, physiotherapy, and physical therapy, exercise, exercises, therapy exercises, hydrotherapy, water therapy, cryotherapy, cold and cool therapies.*

The following is a basic search strategy using the indicated search terms and was adapted for each database (the individual search strategies for each database can be found in the appendix (addendum A))

1. anterior cruciate ligament (MeSH)
2. #1 AND reconstruction
3. #2 AND physiotherapy
4. #2 AND physical therapy
5. #2 and physi*
6. #2 AND exercise

7. #2 AND exercises
8. #2 AND exercise therapy
9. #2 AND hydrotherapy
10. #2 AND water therapy
11. #2 AND cryotherapy
12. #2 AND cold therapy
13. #2 AND cool therapy
14. #1 AND injury prevention
15. #1 AND prevention AND injuries

The following limits were applied in the databases: Systematic reviews that were reported in English and Arabic, Humans; female and male adult 18+ years. Dates of publications of systematic reviews were limited from the year 2000 to present.

Secondary methods of searching included:

- **Pearling** The references lists of all publications of included and excluded systematic reviews were searched for additional systematic reviews.
- **Content experts** Content experts were not contacted due to time constraints.

2.6.3 Level of evidence allocation

The hierarchical system of evidence as described by JBI was used to determine the level of evidence of the eligible systematic reviews (Table 2.1). The level of evidence is a reflection of the degree to which bias has been considered within the study design. The studies sought in this review were all systematic reviews of randomized control trials, and should therefore denote Level 1 evidence in this hierarchy of evidence. The JBI hierarchy is illustrated in Table 2.1.

Table 2.1 JBI scale for level of evidence

Level 1	Evidence obtained from a systematic review of all relevant randomized controlled trials (RCTs).
Level 2	Evidence obtained from at least one properly designed RCT.
Level 3.1	Evidence obtained from well-designed controlled trials without randomization.
Level 3.2	Evidence obtained from well-designed cohort case control analytical studies.
Level 3.3	Evidence obtained from multiple time series with/without an intervention Dramatic results in uncontrolled experiments.
Level 4	Opinion of respected authorities based on clinical experience, descriptive studies or reports of expert committees.

2.6.4 Assessment of methodological quality

Two reviewers independently critically appraised the included systematic reviews. A third reviewer was consulted if there was any disagreement between the reviewers. The critical appraisal tool of Greenhalgh (1997) appraises the methodology of systematic reviews (Addendum A). The Greenhalgh critical appraisal tool consists of five questions, each requiring a yes/no response, with a 'yes' response being allocated one point, and a

'no/unclear' allocated zero point. Studies scoring 3 out of 5 and above, on the Greenhalgh critical appraisal tool were included in the review.

2.6.5 Data storage

For tracking purposes, all systematic reviews obtained for this review were recorded on a data storage form. This provided details about the article's authors, title and source, which database the article was retrieved from and the location where the article is being stored.

2.6.6 Data extraction

Data from included studies was placed into data extraction sheets to systematically catalogue the following information: year, country, author, title, objective, inclusion criteria (study), inclusion criteria (sample), inclusion criteria (language and search year), databases, methodological appraisal (which tool), method of review, outcome measurement, intervention (type of treatment), intervention (Dosage, frequency, and treatment period), control (type of treatment), control (Dosage, frequency, and treatment period), number of studies, data analysis, presentation of statistics, meta-analysis, main finding, clinical application, heterogeneity of discussion.

2.6.7 Data synthesis

The heterogeneous nature of the systematic reviews prevented the results to being pooled in meta-analysis. Consequently the results were presented in a narrative summary.

2.7 RESULTS

2.7.1 Search results

The search for published secondary research into the efficacy of exercise therapies (i.e. land- and water based exercises, supervised and home-based exercise, open- and closed kinetic chain exercises, weight-bearing exercises and neuromuscular and isokinetic strength training exercises, early quadriceps exercises to not allowing early quadriceps exercises and other exercises) and cryotherapy in decreasing pain and swelling, as well as improving knee function, knee ROM, and muscle strength in adults during the early and late phases of rehabilitation following ACL reconstruction surgery, including preventative strategies, yielded 388 hits. Of this total, 275 hits were excluded after reviewing the title, as they clearly did not conform to the inclusion criteria. The abstracts of the remaining 113 were retrieved, and 85 articles were further excluded as they did not meet the inclusion criteria. This left the reviewer with 31 potentially eligible studies, of which the full-text was

retrieved. Ten of these were duplications, and were excluded. A further 12 were excluded after reviewing the full-text, as they did not completely meet the inclusion criteria. Consequently, eight systematic reviews were included in this review (Trees et al 2007, Risberg et al 2004, Raynor et al 2005, Permall et al 2008, Wright et al 2008 (a and b), Owen et al 2006 and Hewett et al 2005). Figure 2.1 depicts the results of the search.

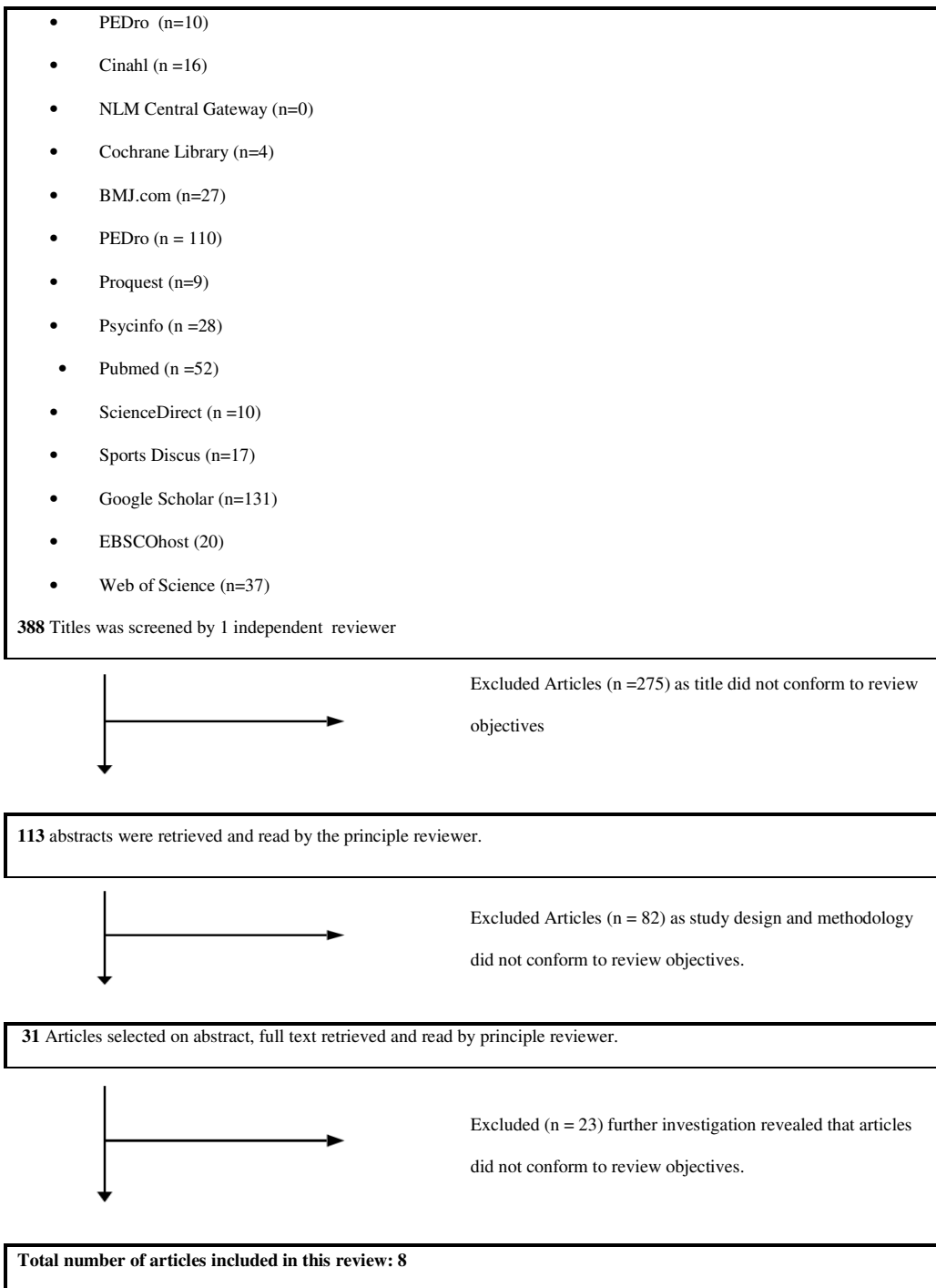


Figure 2.1: Database search results

2.7.2 Level of evidence

The evidence levels of the systematic reviews were allocated using the JBI scale of level of evidence (Table 2.2). The majority of the included systematic reviews denoted Level 1 evidence on the JBI scale of evidence as they included RCTs. Only one systematic review however included six studies: four of which denoted level I evidence and the other three denoted level 3.2 evidence. The results of the allocation of evidence levels of the eight systematic reviews are illustrated in (Table 2.2). In addition, to develop clinical recommendation for the included interventions, the NHMRC guidelines for developing clinical guidelines will be used.

Table 2.2 Level of evidence results using JBI level of evidence scale.

No.	Author	Nr of studies / RCTs	Type of studies	Level of evidence
1.	Risberg et al 2004	33	RCTs	Level 1
2.	Raynor et al 2005	7	RCTs	Level 1
3.	Hewett et al 2005	6	3 RCTs and 3 prospective cohort studies	Level 1 Level 3.2
4.	Owen et al 2006	4	Prospective randomized intervention study, prospective controlled study, and systematic review.	Level 1
5.	Trees et al 2007	9	RCTs	Level 1
6.	Wright et al 2008a	54	RCTs and clinical trials	Level 1
7.	Wright et al 2008b	54	RCTs and clinical trials	Level 1
8.	Permall et al 2008	3	RCTs	Level 1

2.7.3 Methodological appraisal

Five of the eight included systematic reviews scored 5/5 on Greenhalgh's critical appraisal tool (Risberg et al 2004, Trees et al 2007, Permall et al 2008 and Wright et al 2008 (a and b)). One systematic review scored 4/5 (Raynor et al 2005). The remaining 2 systematic reviews scored 3/5 on the critical appraisal tool (Owen et al 2006 and Hewett et al 2005). Two studies did not perform a thorough search (Owen et al 2006 and Hewett et al 2005) and three studies did not appraise the methodological quality of the trials that they had included (Raynor et al 2005, Owen et al 2006 and Hewett et al 2005.). The results of the scoring of the eight systematic reviews are illustrated in table 2.3.

Table 2.3: Methodological quality result of included systematic reviews using Greenhalgh critical appraisal tool:

Criteria	Risberg et al 2004	Hewett et al 2005	Raynor et al 2005	Owen et al 2006	Trees et al 2007	Wright et al 2008a	Wright et al 2008b	Permall et al 2008
1. Can you find an important clinical question which the review addressed?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Was a thorough search done of the appropriate databases and were other potentially important sources explored?	Yes	No	Yes	No	Yes	Yes	Yes	Yes
3. Was methodological quality assessed and the trials weighted?	Yes	No	No	No	Yes	Yes	Yes	Yes
4. How sensitive are the results to the review which has been done?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
5. Have the numerical results been interpreted with common sense and due regard to the broader aspects of the problem?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Total score	5/5	3/5	4/5	3/5	5/5	5/5	5/5	5/5

2.7.4 General description of reviews

All of the included eight systematic reviews were fully reported from medical journals indexed in the electronic databases. All included reviews were published in the English language and their publication dates span across four years (2004-2008). The systematic reviews were conducted in six countries, UK (one review), USA (three reviews*), Canada (one review), Switzerland (one review), South Africa (one review) and Norway/ USA (one review*) (Table 2.4)

Six systematic reviews evaluated rehabilitation following ACL reconstruction (Trees et al 2007, Risberg et al 2004, Raynor et al 2005, Permall et al 2008 and Wright et al 2008 (a and b)). Two systematic reviews evaluated the possibility of ACL injury prevention among athletes following ACL reconstruction (Hewett et al 2005 and Owen et al 2006). The total sample size for the eight included systematic reviews was n=14709. All populations were adult and varied between the ages of 18 to 48 years. The majority of the included systematic reviews included male and female participants except one systematic review which included only female participants (Hewett et al 2005). Patient populations, age range, gender, type and number of studies were described in all systematic reviews (Table 4). The recall periods referring to follow-up periods of ACL reconstruction postoperative

rehabilitation varied from 0-24 month's life-time follow up. The recall periods for ACL injuries prevention training programs varied from 4 weeks to 2 years life-time follow up.

All eight systematic reviews provided a definition for ACL reconstruction and for the rehabilitation training technique used. The definitions reported in the systematic reviews are listed in Table 2.4 below.

Table 2.4: General description of included studies

Author	Year	Country	Intervention	Definition	Age	Gender	Sample size	Type of studies	Nr of studies
Risberg et al	2004	USA /Norway	Exercise therapy, Hydrotherapy	Neuromuscular training, weight bearing , Strength, OKC, CKC exercises and exercises in water	14-48	M-F	1244	RCTs	33
Raynor et al	2005	Switzerland	Cryotherapy	Common treatment modality after surgery procedures and several cryotherapy devices (ice packs, gel packs, braces with circulating ice water) are commonly used.	25-34	M-F	172	RCTs	7
Hewett et al	2005	USA	Prevention injuries by neuromuscular training	polymeric power, biomechanics and technique, strength, balance and core stability training	14-20	F	9909	RCTs or prospective cohort study	6
Owen et al	2006	Canada	Prevention of ACL injury without previous ACL pathology by proprioception balance training.	proprioception balance training	16-20	M-F	932	Prospective randomized intervention study, prospective controlled study, and systematic review.	4
Trees et al	2007	UK	Exercise therapy, hydrotherapy	Strength, OKC,CKC , weight bearing exercises, and exercises in water	15-48	M-F	391	RCTs	9
Wright et al a	2008	USA	Exercise therapy,	Early weight bearing and home-based rehabilitation	Age>15	M-F	819	RCTs	54
Wright et al b	2008	USA	Exercise therapy, acceleration rehabilitation and miscellaneous topics	OKC versus CKC exercises, accelerated rehabilitation and miscellaneous topics	Age>15	M-F	1057	RCTs	54
Permall et al	2008	SA	the effect and safety of early postoperative quadriceps exercise	early postoperative quadriceps exercise via a rehabilitation program not allowing early quadriceps exercises or restricting quadriceps exercise training to only isometric quadriceps contractions in postoperative adult ACL reconstruction patients		M-F	185	RCTs	3

2.7.5 Outcomes measured in included systematic reviews

All of the authors used different outcome measures and scales to measure the effectiveness of their interventions. Outcome measurement and scales encountered after ACL reconstruction in adults are listed in table 2.5 below. The most commonly measured outcomes were range of motion (Risberg et al 2004, Raynor et al 2005, Trees et al 2007, Permall et al 2008, and Wright et al 2008a and b) and muscle strength (Risberg et al 2004, Trees et al 2007, Owen et al 2006 and Wright et al 2008a and b). Pain was reported in five systematic reviews (Raynor et al 2005, Trees et al 2007, Permall et al 2008 and Wright et al 2008 (a and b)). All systematic reviews in this review used different outcome measures and different instruments measuring the outcomes, resulting in difficulty when attempting to combine the results from the systematic reviews. The measurement of the outcomes for the systematic reviews varied between immediate postoperative and a 2- year follow-up.

Table 2.5: Outcomes measured in included systematic reviews

Outcomes	Outcome measurement tool	Risberg et al 2004	Raynor et al 2005	Hewett et al 2005	Owen et al 2006	Trees et al 2007	Wright et al 2008a	Wright et al 2008b	Permall et al 2008
ROM	Goniometer	X	X			X	X	X	X
Muscle strength	EMG	X			X	X	X	X	X
	Lysholm score	X					X	X	X
	EMG activity VMO	X					X	X	
	Leg girth	X						X	
Reflex	reflex hamstring contraction latency (RHCL)	X							
Knee laxity	KT1000	X					X	X	X
Postoperative drainage	hemoVac output		X						
Pain	Visual Analogue Scale (V.A.S).		X			X	X	X	X
Activity	Tegner Activity scale					X	X	X	X
	Cincinnati knee Rating system					X			
	Functional hop tests	X					X	X	X
	Average isokinetic torque	X						X	
Muscle activation	EMG					X	X	X	X
	Flexibility				X				
	Plyometrics				X				
	sport specific agility drills				X				
	speed enhancement				X				
	athlete education				X				
Static measures of joint stability	Standard pre-participation physical examinations			X					

2.7.6 Interventions

All patients received a postoperative rehabilitation program immediately after surgery (Trees et al 2007, Risberg et al 2004, Permall et al 2008, Wright et al 2008 (a and b) and Raynor et al 2005). There were several postoperative interventions utilized and the following sections will provide a summary of the postoperative management utilized by each systematic review.

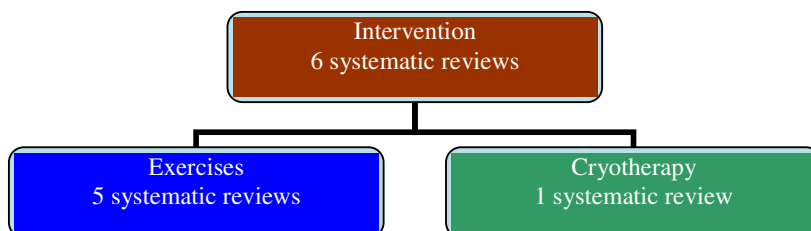


Figure 2.2 Summary of post-ACL reconstruction rehabilitation interventions

2.7.6.1 Exercise Therapies following ACL reconstruction surgery

The following section will describe the various exercise therapies reported in the included systematic reviews. In addition, appropriate clinical recommendations for each intervention were developed using the NHMRC guidelines for clinical guidelines, namely the level, quality, relevance and strength of each intervention was determined.

2.7.6.1.1 Land-based versus water-based rehabilitation

Three of the eight included systematic reviews (Risberg et al 2004, Trees et al 2007, and Wright et al 2008b) reported on one study (Tovin et al 1994) which compared the effect of land-based exercises on improving muscle strength (Risberg et al 2004, Trees et al 2007, and Wright et al 2008b), decreasing joint effusion (Risberg et al 2004, Wright et al 2008b) and increasing knee ROM (Wright et al 2008b) to water-based exercises (See table 2.6).

- **Level of evidence:** Tovin et al (1994) was the only study reviewed in all of the three systematic review, therefore denoting level 2 evidence for land-based and water-based exercises in the rehabilitation following ACL reconstruction surgery.
- **Quality of evidence:** The three systematic reviews which reported on the effect of land-and water-based exercises following ACL reconstruction each scored 5 out of 5 on the Greenhalgh critical appraisal tool, indicating high methodological quality.
- **Relevance of evidence:** Clinical outcomes, namely knee ROM, muscle strength, joint effusion were measured by Tovin et al (1994), which indicates that the

information retrieved from the trial was clinically relevant to patients post ACL reconstruction surgery.

- **Strength of evidence:** The results from the three reviews stated that water-based exercises were significantly better at decreasing joint effusion (Risberg et al 2004) and improving muscle strength; in Trees et al 2007 it was reported as a weighted mean difference of 9.80 95% CI 1.29 to 18.31 on the Lysholm scale; in Wright et al 2008b it was reported that the water-based exercise group did significantly better with a p=0.03. In Risberg et al (2004), no numerical data was given for outcome measurements. Trees et al (2007) reported a wide 95% CI range which indicates weak evidence.

Table 2.6: Land-based versus water-based exercises

Author	Intervention group (1)	Intervention Dosage	Control group (2)	Control Dosage	Outcome measure	Finding /stats
Tovin et al 1994	water based rehabilitation including exercises in water and home exercises	8 Wks	land based rehabilitation including exercises and home exercises	8 Wks	Lysholm score	WMD 9.80: 95% CI: 1.29 to 18.31 Higher Lysholm score in group 1
Tovin et al 1994	water based rehabilitation	8 Wks	land based rehabilitation	8 Wks	Peak isokinetic muscle torque (8 weeks)	WMD-14.70: 95% CI:-25.89 to -3.51 (this seems to be ineffective)

Key: wks = weeks

Clinical recommendation

The evidence available for the effect of water- and land-based exercises in the rehabilitation of ACL reconstruction is inconclusive. Therefore, no recommendation as to which exercise should rather be used, or as to which exercise is better than the other can be made. At this point, both exercises are equally suitable to be used during post-ACL reconstruction rehabilitation.

2.7.6.1.2 Supervised and home-based rehabilitation programs.

Three systematic reviews (Trees et al 2007; Risberg et al 2004 and Wright et al 2008a) described the effect of supervised rehabilitation programs on increasing knee ROM, muscle strength, and decreasing laxity compared to home-based rehabilitation programs. The supervised programs were directly monitored by physiotherapists, whereas the home-based programs were not. Patients in the home-based program group had to report back to the physiotherapist. Trees et al (2007) reported on two studies (Beard 1998; Fischer 1998) comparing the effect of supervised and home-based rehabilitation programs on

increasing knee ROM. Trees et al (2007) and Wright et al (2008b) reported the effect of supervised and home-based rehabilitation programs on increasing knee ROM (Fischer 1998; Grant et al 2005). The effect of supervised and home-based rehabilitation programs on improving muscle strength, and decreasing knee laxity was reported in Risberg et al (2004), Trees et al (2007) and Wright et al (2008a). (See table 2.7)

- **Level of evidence:** In total, four RCTs were included in the three systematic reviews which reported on the effect of supervised programs compared to home-based programs in increasing knee ROM, muscle strength, and decreasing laxity. There is level 1 evidence for the effect of supervised and home-based rehabilitation programs following ACL reconstruction surgery.
- **Quality of evidence:** The three systematic reviews which reported on the effect of supervised rehabilitation program compared to home-based programs following ACL reconstruction each scored 5 out of 5 on the Greenhalgh critical appraisal tool, indicating high methodological quality.
- **Relevance of evidence:** Clinical outcomes, namely knee ROM, muscle strength, and decreasing knee laxity were reported by the three systematic reviews (Trees et al 2007; Risberg et al 2004 and Wright et al 2008a) which indicate that the information retrieved from the trials was clinically relevant to patients post ACL reconstruction surgery.
- **Strength of evidence:** Fischer (1998) found that there was significant difference (in favour of the home-based rehabilitation program group) between the groups in the ROM, the weighted mean difference on 18 weeks was -6.00 (95% CI -11.76 to -0.24) and after 24 weeks was -8.00 (95% CI -12.92 to -3.08) in increasing knee ROM. Fischer (1998) reported that home-based rehabilitation programs were understandable, convenient, and reliable and could be used for many patients undergoing ACL reconstruction (Trees et al 2007 and Wright et al 2008b). Beard (1998), however, found that there was no significant difference between the groups in improving muscle strength. The weighted mean difference on 6 months was 9.00 (95% CI -2.41 to 20.41) (Risberg et al 2004, Trees et al 2007 and Wright et al 2008a). Beard (1998) also found that there was no significant difference between the groups in the Lysholm scores. The weighted mean difference on 6 months was 2.00 (95% CI -4.53 to 8.53). Tegner scores were used to evaluate the level of activity at 6 months after surgery. There was no significant difference found between the groups. The weighted mean difference was 6.00 (95% CI -6.71 to

18.71). Beard (1998) found that there was no significant difference between the groups in knee laxity. The weighted mean difference on 6 months was - 2.50 (95% CI -5.41 to 0.4) (Risberg et al 2004, Trees et al 2007 and Wright et al 2008a). Two systematic reviews (Risberg et al 2004 and Wright et al 2008a) found that there was a significant difference between the groups in the number of visits required ($P < .05$) and weighted mean difference of 11.35 (95%CI 14.2 to 2.85) (Schenck et al 1997). Wright et al (2008a) reported that Grant et al (2005) found a significant difference in knee flexion and extension ROM. The home-based group had an acceptable rate of 96.8% for extension versus 83.3% for the physical therapy-based group ($P = .02$). The home-based group had an acceptable flexion rate of 66.7% versus 47% for the physical therapy therapy-based group ($P = .03$). No significant differences in knee laxity and strength between the two groups were found.

Clinical recommendation

From the evidence available, it can be recommended that home-based rehabilitation may be more effective at increasing knee ROM than supervised rehabilitation programs. No significant difference was reported between the supervised and home-based rehabilitation programs in improving muscle strength, decreasing knee laxity and Tegner scores.

Table 2.7: Supervised versus home-based exercises

Author	Intervention group (1)	Intervention Dosage	Control group (2)	Control Dosage	Outcome measure	Findings/ statistics
Schenck 1997	Home-based (6 PT visits)	0-6 visits	Clinical-based (24 PT visits)	6-40 visits	Lysholm (12 and 24 weeks)	no significant finding
Schenck 1997	Home-based (6 PT visits)	0-6 visits	Clinical-based (24 PT visits)	6-40 visits	Knee ROM (18 weeks)	(P<.05) and weighted mean difference of 11.35 95%CI 14.2 to 2.85.
Schenck 1997	Home-based (6 PT visits)	0-6 visits	Clinical-based (24 PT visits)	6-40 visits	Pain visual analogue scale, 1-leg hop, instrument laxity, sickness profile	no significant finding
Fischer et al 1998	Home-based (6 PT visits)	6 visits/ 6month	Clinical-based (24 PT visits)	24 visits/6 month	Lysholm (12 and 24 weeks)	WMD1.46, 95% CI -3.19 to 6.10
Beard and Dodd 1998	Supervised (knee class twice a week)+ home-based program	12 wks	Home-based program	12 wks	Knee ROM (18 weeks)	WMD -6.00, 95% CI -11.76 to -0.24
Beard and Dodd 1998	Supervised (knee class twice a week) +home-based program	12 wks	Home-based program	12 wks	VAS	WMD - 8.00, 95% CI -12.92 to -3.08
Grant et al 2005	Minimally supervised home-based	4 sessions 6-12 wks	Traditional Supervised protocol (PT)	17 sessions 6-12wks	instrument laxity and strength	no significant finding
Grant et al 2005	Minimally supervised home-based	4 sessions 6-12 wks	Traditional Supervised protocol (PT)	17 sessions 6-12 wks	ROM	Group 1 extension (P=.02) Flexion (P=.03)

2.7.6.1.3 Open kinetic chain (OKC) or closed kinetic chain (CKC) exercises

Three systematic reviews (Trees et al 2007, Risberg et al 2004 and Wright et al 2008b) reported on the effectiveness of CKC and OKC exercises on improving knee function, increasing knee ROM, decreasing patellofemoral pain and decreasing knee laxity following ACL reconstruction rehabilitation (Beynon et al 1998, Bynum et al 1995, Hooper et al 2001, Mikkelsen et al 2000, Morrissey et al 2000, and Morrissey et al 2002). (See table 2.8)

- **Level of evidence:** In total, six RCT were included in the three systematic reviews. Therefore the level of evidence for the effect of CKC and OKC exercises denotes level 1 evidence following ACL reconstruction surgery.
- **Quality of evidence:** The three systematic reviews which reported on the effect of CKC and OKC exercises following ACL reconstruction each scored 5 out of 5 on the Greenhalgh critical appraisal tool, indicating high methodological quality, or quality of evidence.
- **Relevance of evidence:** Clinical outcomes, namely knee function, ROM, patellofemoral pain and knee laxity were reported by the three systematic reviews (Trees et al 2007; Risberg et al 2004 and Wright et al 2008a) which indicates that the information retrieved from the trials was clinically relevant to patients post ACL reconstruction surgery.
- **Strength of evidence:** Bynum et al (1995) found that there was significant difference noted in KT-1000 maximum values at 24 weeks with the CKC group reporting 1.6 mm and the OKC group reporting 3.3 mm ($p=.02$) (Wright et al 2008b). Patellofemoral pain was severe enough to restrict activity at one year. In Trees et al (2007) a Relative Risk 1.34, 95% CI .59 to 3.07 was reported and in Wright et al (2008b) it was reported that at 9 months evaluation, patellofemoral pain was noted in 15% of the CKC group versus 38% in the OKC group ($p=.046$). Subjective patient assessments, Lysholm and Tegner scores were equivalent in both groups. 21 of the 50 subjects in CKC group felt that they had returned to normal activities of daily living sooner than expected versus 10 of the 46 subjects in the OKC group ($p=.007$) (Wright et al 2008b). Negative Lachman test measurements at one year was reported as a Relative Risk of 0.93, 95% CI 0.80 to 1.09 (Trees et al 2007).
*Hooper et al (2001) found that there was no significant difference between the groups in knee function (Houghston knee functional score). The weighted mean difference at 6 weeks was 0.00 (95% CI -9.34 to 9.34) (Trees et al 2007 and Wright

et al 2008b). *Mikkelsen et al (2000) found that there were significant differences in CKC and OKC rehabilitation program compared to the CKC only programs on return to pre-injury level of sport by 31 months after ACL reconstruction surgery, reported as a Relative Risk 0.42,95% CI .18 to .98 (Trees et al 2007) and with $p < 0.05$ in Wright et al (2008b). Morrissey et al 2000 assessed knee laxity using the Knee Signature System at 2 and 6 weeks. The OKC group was determined to be 9% more lax, with the 95% confidence interval ranging from -8% to +29% (Wright et al 2008b). Morrissey et al (2002) evaluated pain, isokinetic and isometric testing performed at 2 and 6 weeks, and 3 questions from Houghston clinical score were assessed. The result with was that there no difference in the pain scores. Beynnon et al (1998) found that in order to minimize the strain on ACL during quadriceps muscle strength training, the knee should be maintained in less than 60 degrees during CKC exercises with knee angles greater than 40 of flexion.

Clinical recommendation

From the available evidence, it can be recommended that a combination of OKC and CKC exercises should be incorporated into the rehabilitation program following ACL reconstruction surgery.

Table 2.8: Open kinetic chain (OKC) versus closed kinetic chain (CKC) exercises

Author	group (1)	Group (1) Dosage	Group (2)	Group(2) Dosage	Outcome measure	Finding/ stats
Hooper 2001	CKC rehabilitation	4 wks	OKC rehabilitation	4wks	Houghston Clinic Functional score at 6 weeks post surgery	WMD 0.00, 95% CI - 9.34 to 9.34
Bynum 1995	CKC rehabilitation	24 wks	OKC rehabilitation	24 wks	Patellofemoral pain sever at one year	RR 1.34, 95% CI 0.59 to 3.07
Bynum 1995	CKC rehabilitation	24 wks	OKC rehabilitation	24 wks	Negative Lachman test at one year	RR 0.93, 95% CI 0.80 to 1.09
Mikkelsen 2000	CKC rehabilitation	24 wks	OKC and CKC rehabilitation	24 wks	Return to pre-injury level of sport by 31 months after surgery	RR 0.42, 95% CI 0.18 to 0.98
Mikkelsen et al 2000	CKC rehabilitation	12wks	OKC rehabilitation	6wks	Instrument laxity (KT-1000) at 6 month	no significant difference in knee laxity
Mikkelsen 2000	CKC rehabilitation	12 wks	OKC rehabilitation	6 wks	Isokinetic strength testing) at 6 month	no statistics were cited
Mikkelsen 2000	CKC rehabilitation	12 wks	OKC rehabilitation	6 wks	Patient satisfaction at an average of 31 months	(P<.05) higher rate of patients in OKC return to sports at the same level than in CKC group
Morrissey 2000	CKC rehabilitation	3-6 wks	OKC rehabilitation	2-6 wks	Instrument laxity (Knee Significant System) at 2-6wks	OKC group determined to 9% looser, 95% CI-8% to +29%

Key:

2.7.6.1.4 Immediate versus late weight bearing (WB) exercise.

Two of the eight included systematic reviews (Risberg et al 2004, and Wright et al 2008b) reported on the effect of immediate versus late WB exercises on improving ROM, stability of knee, knee function, vastus medialis oblique strength and anterior knee pain (Risberg et al 2004 and Wright et al 2008b) (See table 2.9).

- **Level of evidence:** In total, one RCT was included in the two systematic reviews which reported on the effect of immediate versus late WB exercises in improving ROM, stability of knee, knee function, vastus medialis oblique strength and anterior knee pain following ACL reconstruction surgery, denoting level 2 evidence.
- **Quality of evidence:** The two systematic reviews which reported on the effect of immediate versus late WB exercises following ACL reconstruction each scored 5

out of 5 on the Greenhalgh critical appraisal tool, indicating high methodological quality, or quality of evidence.

- **Relevance of evidence:** Clinical outcomes, namely ROM, stability of knee, knee function, vastus medialis oblique strength and anterior knee pain were reported by the two systematic reviews (Risberg et al 2004 and Wright et al 2008b) which indicate that the information retrieved from the trial was clinically relevant to patients post ACL reconstruction surgery.
- **Strength of evidence:** The results from the two reviews stated that in Tyler et al (1998) the effect of immediate WB were significantly better at improving Vastus medialis oblique activity at 2 weeks with $p=.02$ (Risberg et al 2004 and Wright et al 2008b). Lysholm scores demonstrated a significantly greater improvement preoperatively in the immediate WB group ($p=0.03$) (Tyler et al 1998). Anterior knee pain was evaluated (Tyler et al 1998) using questions from the Lysholm scale reported pain to be significantly decreased in the immediate WB group ($p=.03$) (Risberg et al 2004, and Wright et al 2008b). No statistical different was noted at 2 weeks or 14 months for knee ROM (Risberg et al 2004, and Wright et al 2008b).

Clinical Recommendation

It is recommended that immediate WB exercises be incorporated into ACL reconstruction rehabilitation to improve muscle strength, knee function and decrease knee pain.

Table 2.9: Immediate versus late weight bearing (WB) exercise.

Author	Group(1)	Group(1) Dosage	Group (2)	Group(2) Dosage	Outcome measure	Finding/stats
Tyler et al 1998	Immediate weight bear as tolerated	2 wks	WB after 2 weeks of surgery	2wks	EMG activity VMO	There was no effect of WB on ROM, VMO knee stability, EMG activity, Lysholm score and anterior knee pain

2.7.6.1.5 Quadriceps exercise

One systematic review described the effect and safety of early postoperative quadriceps exercises on increasing knee ROM, lower limb function, decreasing pain, and laxity compared to a rehabilitation program not allowing early quadriceps exercises or restricting quadriceps exercise training to only isometric quadriceps contractions in postoperative adult ACL reconstruction patients (Permall et al 2008). Permall et al (2008) reported on three studies (Shaw et al 2005, Isberg et al 2006, and Friemert et al 2006) See table 2.10).

- **Level of evidence:** In total, three RCTs were included in the one systematic review which reported on the effect and safety of early postoperative quadriceps exercise on increasing knee ROM, lower limb function, decreasing pain, and laxity compared to a rehabilitation program not allowing early quadriceps exercises or restricting quadriceps exercise training to only isometric quadriceps contractions in postoperative adult ACL reconstruction patients, denoting level 2 evidence.
- **Quality of evidence:** The systematic review which reported on the effect and safety of early postoperative quadriceps exercise following ACL reconstruction scored 5 out of 5 on the Greenhalgh critical appraisal tool, indicating high methodological quality.
- **Relevance of evidence:** Clinical outcomes namely knee ROM, lower limb function, pain, and knee laxity were reported by the systematic review (Permall et al 2008) which indicates that the information retrieved from the trial was clinically relevant to patients post ACL reconstruction surgery.
- **Strength of evidence:** Shaw et al (2005) found that there was significant difference between the groups only in active knee flexion which was 5.9 (95% CI 0.1 to 11.7) and extension 2.7 (0.1 to 5.3), no significant difference found in passive knee extension 1.2 (-0.8 to 3.2) on one month postoperatively. ROM measured over 6-month follow-up period (pre-operative, day 1, week 2, 1 month, 3 months and 6 month post-operatively) (Permall et al 2008). Friemert et al (2006) reported that on 7 days postoperatively the effect size for active knee flexion in the study was 0.15 (small effect). Isberg et al (2006) measured ROM from 6-months to 2 years follow up. There were no values given in Isberg et al (2006) in active knee flexion in the study, and they mentioned that there was no significant difference between the groups in active knee flexion extension when comparing the intact and reconstructed knee for each individual patient (Isberg et al 2006).

Shaw et al (2005) evaluated function by means of hop tests (single-leg-hope and triple-leg-hope tests). No significant differences were reported between the reconstructed leg strength relative to the non-operative leg at 6 month. The weighted mean difference on single-leg-hop test was 2.1 (95% CI -2.8 to 7) and triple-leg-hop test was 1.9 (95% CI -3.5 to 7.3). Isberg et al 2006 found that there was no significant difference found between the groups measured by single-leg-hop test at 6 month postoperatively and at 2 years follow up. The median range was 97 (86-100) in intervention group and 96 (85-100) in control group (Isberg et al 2006). Subjective assessment of function was used by Shaw et al (2005) which was Cincinnati Knee Rating System (CKRS). Measurement was taken at 1, 3 and 6 months postoperatively. No significant differences between the groups were found. The weighted mean difference between the groups at 6 months was 4.8 (95% CI -1.4 to 11) (Shaw et al 2005).

Shaw et al (2005) found that there was no significant difference between the groups in decreasing pain measured by VAS at day 1 week 2, 1 month, 3 months and 6 month postoperatively follow up. The weighted mean difference on 6 months for pain at rest was 0.00 (95% CI -0.3 to 0.3) and -0.1(95%CI -0.9 to 0.7) for performing exercise (Shaw et al 2005). CKRS evaluation system was also used to evaluate pain in Shaw et al (2005) study. Significant difference on 6 month postoperatively was reported between the groups and the intervention group reported higher results for pain. The weighted mean difference was 4.8.00 (95% CI -1.4 to 11.00).

Shaw et al (2005) found that there was no significant difference between the groups in knee laxity measured by KT-1000 at 3 and 6 month post-operatively ($p=0.99$). Isberg et al (2006) used the KT-1000 and radiostereometric analysis (RSA) to evaluate anterior posterior laxity preoperatively, 6 months postoperatively and 2 years follow up. There was no significant difference between the groups in knee laxity (Table 12) (Isberg et al 2006).

Table 2.10: A-P laxity preoperatively, at 6 months and 24 months follow up (Isberg et al 2006) (Permall et al 2008).

	RSA Intervention median (range) in mm	RSA Control median (range)in mm	KT-1000 intervention median (range) in mm	KT-1000 Control median (range)in mm
Preoperative	8.6 (2.3-15.4)	7.2(2.2-17.4)	2.0(0-8.0)	4.0(0-10.10)
6 months	3.4(0.6-11.5)	3.4(-3.3 to 7.8)	0 (-3.0 to 1.5)	1.5 (0.5 to 4.5)
24 month	2.7 (0-10.7)	2.8 (-1.8 to 9.5)	1.0 (-1.5 to 3.5)	0.5 (-1.0 to 4.0)
Pre-op v.24 months	<i>P=0.005</i>	<i>P=0.005</i>	<i>P=0.0096</i>	<i>P=0.004</i>

A-P laxity: an anterior posterior side to side difference of greater than 3 mm or greater than 5 mm on testing with the KT-1000 arthrometer.

Clinical recommendation

From the evidence available, it can be recommended that early quadriceps exercises can be performed safely in the first 2 postoperatively weeks. But clinically, no significant difference was reported between the intervention and control groups using quadriceps exercises in improving ROM, functional performance, decreasing knee laxity and pain.

2.7.6.1.6 Neuromuscular versus strength training

Two of the eight included systematic reviews (Risberg et al 2004, and Wright et al 2008b) reported on one study (Liu-Ambrose et al 2003) which assessed the effects of strength training programs and neuromuscular/proprioception training programs on improving the functional activity using the Lysholm and Tegner scores, average isokinetic torque, and functional hop tests to assess compliance and hamstring peak torque time (Risberg et al 2004 and Wright et al 2008b) (See table 2.11).

- **Level of evidence:** Liu-Ambrose et al (2003) was the only study reviewed in the two systematic reviews, therefore denoting level 2 evidence for neuromuscular and strength training exercises in the rehabilitation for ACL reconstruction surgery.
- **Quality of evidence:** The two systematic reviews which reported on the effect of neuromuscular and strength training programs following ACL reconstruction each scored 5 out of 5 on the Greenhalgh critical appraisal tool, indicating high methodological quality, or quality of evidence.
- **Relevance of evidence:** Clinical outcomes, namely improving the functional activity, compliance and hamstring peak torque time were reported by Risberg et al (2004) and Wright et al (2008b) indicates that the information retrieved from the trial was clinically relevant to patients post ACL reconstruction surgery.

- **Strength of evidence:** The results from the two reviews stated that the Lysholm and Tegner scores increased significantly in both groups (Risberg et al 2004 and Wright et al 2008b). The neuromuscular group demonstrated a greater change in isokinetic torque compared to the strength group after 12 weeks of training (hamstring: $p=.04$, quadriceps $p=.005$). Both groups showed statistically significant increases in their functional hop tests, but there were no significant differences between groups. Peak torque time decreased in the neuromuscular group at 6 weeks and then returned to baseline at 12 weeks (Risberg et al 2004 and Wright et al 2008b).

Clinical recommendation

The evidence available for the effect of strength training programs and neuromuscular training programs in the rehabilitation of ACL reconstruction is limited and inconclusive. Although the neuromuscular group demonstrated a greater change in isokinetic torque compared with the strength group, it cannot be recommended that the one training program be used instead of the other. Both training programs can therefore be used in the rehabilitation phase following ACL reconstruction.

Table 2.11: Neuromuscular versus strength training

Author	Group (1)	Group (1) Dosage	Group (2)	Group (3) Dosage	Outcome measure	Finding/stats
Liu-Ambrose et al 2003	Proprioceptive training	12 wks	Isotonic strength training	12wks	Peak torque time	Both training protocols influenced
Liu-Ambrose et al 2003	Proprioceptive training	12 wks	Isotonic strength training	12wks	Hamstring Concentric and eccentric	Peak TT
Liu-Ambrose et al 2003	Proprioceptive training	12 wks	Isotonic strength training	12wks	Hamstring and quadriceps torque	Proprioceptive training Alone can induce isokinetic strength gains
Liu-Ambrose et al 2003	Proprioceptive training	12 wks	Isotonic strength training	12wks	One leg hope	Proprioceptive training Alone can induce isokinetic strength gains
Liu-Ambrose et al 2003	Proprioceptive training	12wks	Isotonic strength training	12wks	Lysholm score	Proprioceptive training Alone can induce isokinetic strength gains

2.7.6.1.7 Other specific exercises

Two systematic reviews (Risberg et al 2004 and Wright et al 2008b) reported 7 RCTs, which had addressed more discrete issues in single studies regarding ACL reconstruction rehabilitation (Blanpied et al 2000, Cupal and Brewer 2001, Decker et al 2004, Draper 1990, Shaw et al 2005, Meyers et al 2002, Hehl et al 1995) (See table 2.12).

- **Level of evidence:** In total, seven RCTs were included in the two systematic reviews, which reported on specific exercise; therefore the level of evidence for specific exercises following ACL reconstruction surgery denotes level 1 evidence.
- **Quality of evidence:** The two systematic reviews which reported on the effect of other specific exercises following ACL reconstruction each scored 5 out of 5 on the Greenhalgh critical appraisal tool, indicating high methodological quality or quality of evidence.
- **Relevance of evidence:** Clinical outcomes, namely peak flexion, isokinetic muscle strength, quadriceps and hamstrings strength, gastrocnemius circumferences, knee joint laxity, recovery of the quadriceps muscles following ACL reconstruction, and gait retraining were reported by the three systematic reviews (Risberg et al 2004 and Wright et al 2008b) which indicates that the information retrieved from the trials were clinically relevant to patients post ACL reconstruction surgery.
- **Strength of evidence:** Blanpied et al (2000) assessed the effectiveness of adding a slide-board home exercise program twice per week to a standard physical therapy regime (Risberg et al 2004 and Wright et al 2008b). Isometric peak extension and flexion torque, maximum lateral step height and lateral step-up repetitions to fatigue were assessed. The slide-board group demonstrated a 38% increase in knee peak isometric extension torque from pre-test values. A 2-way repeated measure ANOVA (group by test session), and posthoc testing revealed significant improvements in the slide group for quadriceps strength (101.9 +/- 31.3 N m to 140.5 +/- 31.3 N m of torque), while the control group showed no significant increase (125.1 +/- 61.7 N m to 125.8 +/- 45.1 N m of torque). Lateral step height increased significantly in the slide group from pre-test to post-test, from 22.9 +/- 5.3 cm to 28.7 +/- 5.6 cm, while the control group showed no increase (20.0 +/- 4.5 cm to 20.7 +/- 3.4 cm).
Meyers et al (2002) compared stair-climbing to cycle ergometry in ACL reconstruction rehabilitation at 4 week post-operatively (Risberg et al 2004 and Wright et al 2008b). Leg girth, KT-1000 testing, isokinetic strength testing was

conducted at 4 and 12 weeks and subject evaluations were assessed. Meyers et al (2002) found increased gastrocnemius circumferences in the stair-climbing group the p values was $p=0.02$ (Risberg et al 2004 and Wright et al 2008b). Hehl et al (1995) examined the effects of adding isokinetic strength training (7 to 9 weeks) versus standard training after ACL reconstruction or augmented repair (Risberg et al 2004). Hehl et al (1995) assessed isokinetic muscle, quadriceps and hamstrings strength and knee joint laxity between the intervention group (isokinetic muscle training and standard training) to control group (standard training only). Significant improvement was found in the isokinetic muscle strength training group, the flexion/extension ratio of the operated leg at 60 degrees/s came to 100% in the training group compared to 135% in the control group. This difference was even more apparent at 180 degrees with 100% in the isokinetic group compared to 160% in the control group and at 240 degrees with 110% compared to 200% respectively. The average maximum torque was 10 to 15% better with the training group as with the control group though there was no training of maximum force done explicitly. There was no effect on the postoperative anterior stability of the knee at 6 month after ACL reconstruction surgery (Risberg et al 2004). Draper (1990) assessed the effect of EMG biofeedback on recovery of the quadriceps muscles following ACL reconstruction. 22 patients were randomly assigned either to routine protocol or routine protocol plus biofeedback performed during straight-leg raises and quadriceps sets for the first weeks of rehabilitation. For quadriceps isometric strength return a significant treatment effect was noted in biofeedback group ($p<.01$). Time to obtain full extension was 63 days in the biofeedback group versus 78 days in the routine group extension, this difference was significant ($p=.033$). (Wright et al 2008b). Cupal and Brewer (2001) examined the effects of relaxation and guided imagery on the strength, re-injury anxiety and pain following ACL reconstruction (Wright et al 2008b). Thirty patients were randomly assigned to three groups (treatment, placebo and control). Parameters assessed included isokinetic knee strength testing, 0 to 10 re-injury anxiety score and pain score at 24 weeks. Significant increases in isokinetic strength at 24 weeks ($p<.05$) in treatment group was found (Wright et al 2008b). Re-injured anxiety and pain decreased more significantly in the treatment group ($p<.05$) (Wright et al 2008b). Compliance with daily audiotape listening averaged 4.4 times per week (Wright et al 2008b). Cupal and Brewer (2001) recommended that a relaxation-based and imagery-based psychological intervention program may facilitate recovery from ACL reconstruction

(Wright et al 2008b). Decker et al (2004) evaluated gait retraining following patellar tendon ACL reconstruction at 6 and 12 weeks. Group 1 began a walking program with the aid of a metronome set at a stride frequency modified force driven harmonic oscillator. Group 2 began a walking program at a preferred stride frequency without using a metronome. Both groups walked 3 times /week for 20 to 30 min. Both groups showed decreased stride frequency and velocity at 6 weeks. At 12 weeks the metronome group had an improved mid-stance knee range of motion and improved extension at group contact $p < .05$ (Wright et al 2008b).

Clinical recommendation

It can be recommended that other specific exercises such as slide-board home exercises, stair climbing, isokinetic strength training, EMG biofeedback, relaxation and guided imagery exercises, and gait training be included in the post-ACL reconstruction rehabilitation program.

Table 2.12: Other specific exercises

Author	group (1)	Group(1) Dosage	Group(2)	Group(2) Dosage	Outcome measure	Finding/stats
Blanpied et al 2000	Standard program	8-14 wks post-op	lateral slide exercise and Standard program	8-14 wks post-op	Isometric knee extension torque	Significant improvements in slide group for quadriceps strength
Blanpied et al 2000	Standard program	8-14 wks post-op	lateral slide exercise and Standard program	8-14 wks post-op	Isometric knee flexion torque	Significant improvements in slide group for quadriceps strength
Blanpied et al 2000	Standard program	8-14 wks post-op	lateral slide exercise and Standard program	8-14 wks post-op	Maximum lateral step up height Lateral step up fatigue	Lateral step height also improved in the slide group compared to the control group
Meyers et al 2002	Stair climbing	4- 12 WKS	Cycling	4- 12 WKS	Isokinetic quadriceps strength	No deleterious effect of stair climbing on knee isokinetic performance or limb girth measurements, and confirms the use of stair climbing as a viable adjunct/ alternative to cycle ergometry
Hehl et al 1995	Isokinetic muscle training+ standard training	12 WKS (pre training program(7 Wks), 6,12,18 months	Standard training	12 WKS (pre training program(7W Ks), 6,12,18 months	Isokinetic quadriceps and hamstrings strength	By 18 WKS, evidence of a better recovery of muscle strength
Hehl et al 1995	Isokinetic muscle training+ standard training	12 WKS (pre training program(7 Wks), 6,12,18 months	Standard training	12 WKS (pre training program(7W Ks), 6,12,18 months	Not stated	No significant difference in knee laxity at 6 months

2.7.6.2 Cryotherapy

One meta-analysis (Raynor et al 2005) reported on the effect of cryotherapy for post-ACL reconstruction compared to a placebo group on controlling pain, improving ROM or post-operative knee drainage. Three RCTs measuring pain using the VAS (Dervin et al 1998, Edwards et al 1996, Ohkoshi et al 1999), three studies measuring ROM of knee joint (Dervin et al 1998, Edwards et al 1996 and Ohkoshi et al 1999) and two studies measuring postoperative drainage (Dervin et al 1998 and Konrath et al 1996) were included in the meta-analysis. (See table 2.13)

- **Level of evidence:** the level of evidence for the effect of cryotherapy on knee pain, knee ROM and post-operative knee drainage denoted level 1 evidence.
- **Quality of evidence:** One meta-analysis reported on the effect of cryotherapy following ACL reconstruction and scored 4 out of 5 on the Greenhalgh critical appraisal tool, indicating good methodological quality, or quality of evidence.
- **Relevance of evidence:** Clinical outcomes, namely pain, ROM or post-operative knee drainage were reported by the Raynor et al (2005) meta-analysis, indicating that the information retrieved from the trial was clinically relevant to patients post ACL reconstruction surgery.
- **Strength of evidence:** One RCT showed a significant pain reduction in the cryotherapy group (Ohkoshi et al 1999). Raynor et al 2005 reported that cryotherapy has a significant benefit in post-operative pain control ($P=.02$) especially in the early phase following arthroscopy- assisted ACL reconstruction (24-48 hours post-operatively) (Ohkoshi et al 1999). Two studies (Dervin et al 1998 and Edwards et al 1996) produced a marginally significant improvement in pain for the treatment group (cryotherapy group) compared to placebo group with $p=.075$ (Raynor et al 2005). For postoperative drainage ($p=.23$) (Dervin et al 1998 and Konrath et al 1996) and knee ROM ($p=.25$) (Dervin et al 1998, Edwards et al 1996 and Ohkoshi et al 1999) were not significantly different between the cryotherapy and control groups.

Clinical recommendation

From the available evidence it can be recommended that cryotherapy be used post-ACL reconstruction surgery for the relief of pain, especially in the early phase following arthroscopy- assisted ACL reconstruction (Table 11).

Table 2.13: Cryotherapy

Author	Intervention group(1)	Group(1) Dosage	Control group(2)	Group(1) Dosage	Outcome measure	Finding/stats
Ohkoshi et al 1999	Patient treated by icing system set at 10 C	(24-48 hours) post-operatively	Placebo (room-temperature water)	(24-48 hours) post-operatively	postoperative drainage	P=.23
Ohkoshi et al 1999	Patient treated by icing system set at 10 C (24-48 hours) post-operatively	(24-48 hours) post-operatively	Placebo(room-temperature water)	24-48 hours) post-operatively	ROM	P=.25
Ohkoshi et al 1999	Patient treated by icing system set at 10 C	(24-48 hours) post-operatively	Placebo(room-temperature water)	24-48 hours) post-operatively	postoperative pain	P=.02*

2.7.6.3 Prevention of ACL injury

Two of the eight included systematic reviews described the reduction and prevention of ACL injuries among athletes (Hewett et al 2005 and Owen et al 2006). A systematic review by Hewett et al (2005) and Owen et al (2006) reported on six studies on the effectiveness of neuromuscular training exercises on improving plyometric power, biomechanics and technique, strength, balance and core stability training on decreasing the potential biomechanical risk factors for decreasing and preventing ACL injuries in female athletes (Hewett et al 1999, Wedder et al 1999, Heidt et al 2000, Soderman et al 2000, Myklebust et al 2003 and Caraffa et al (1996) (See table 2.14).

- **Level of evidence:** In total, six studies were included in the two systematic reviews. Therefore the level of evidence for the described the reduction and prevention of ACL injuries among athletes in Hewett et al 2005 denotes level 1 evidence and level 3.2 in Owen et al (2006).
- **Quality of evidence:** The two systematic reviews which reported on the effect of neuromuscular training exercises among athletes to prevent the ACL injuries, both of Hewett et al (2005)and Owen et al (2006) scored 3 out of 5 on the Greenhalgh critical appraisal tool, indicating medium methodological quality.
- **Relevance of evidence:** Clinical outcomes, namely plyometric power, biomechanics and technique, strength, balance and core stability training on decreasing the potential biomechanical risk factors for decreasing and preventing ACL injuries in female athletes were reported by the two systematic reviews (Hewett et al 2005 and Owen et al 2006), which indicates that the information retrieved from the trials was clinically relevant to decreasing and preventing ACL injuries.

• **Strength of evidence:** Hewett et al (1999) compared a neuromuscular training intervention group consisting of 15 trained female teams to 15 female and 13 male untrained teams (control group) for 6 weeks prior to the competitive session (3 times/week 60 to 90 min per session). The trained female athletes (neuromuscular training group) had statistically fewer serious knee injuries $p = .05$, non-contact injuries $p = .01$ and non-contact ACL injuries $p = .05$. The serious knee injury incidence per 1000 player exposures was 0.43 in untrained females compared to 0.12 in the trained group and 0.09 in the male group (Hewett et al 2005). Training interventions included jump training, weight training, and flexibility training. Wedder et al (1999) compared 11 teams of female handball players which comprised the intervention group ($n = 111$) to teams of European handball players comprised control group ($n = 126$). Intervention group training consisted of ankle disk training and full body warm up for 10 to 15 min/session. Overall injury rates were significantly less in the intervention group during practices ($p < .05$) and games ($p < .01$) compared to the control group (Hewett et al 2005). Heidt et al (2000) compared a neuromuscular training intervention group ($n = 42$) of high school female soccer players for 7 weeks prior to competitive session to an untrained control group (258). Neuromuscular training intervention consisted of 13 treadmill speed training sessions (2 times/week) and seven sessions of foot agility exercises (line jumps that progress from unidirectional to multidirectional to 2-inch incremented barrier hops). Overall injury rates were significantly less in the intervention group (14%) than the control group (33.7%, $p < .01$). Rupture of the ACL occurred in 2.4% of the trained group compared to 3.1% of control group (Hewett et al 2005). Soderman et al (2000) compared an intervention group ($n = 62$) consisting of 7 female teams and a control group ($n = 78$) consisting of 6 female teams. The intervention training included specialized balance board training on a single leg for 10 to 15 minutes. Any player sustaining a major injury was evaluated by an orthopedic surgeon. No significant differences for traumatic injuries between the groups were found. The intervention group had 4.4 injuries per 1000 hours of practices and games compared to 3.83 in the control group. Eight major injuries were sustained in the intervention group which was significantly more than the one major injury sustained in the control group ($p = .02$) (Hewett et al 2005 and Owen et al 2006). *Myklebust et al (2003) monitored ACL injury incidence among a female handball team for three consecutive seasons of the elite, second, and third divisions in the handball federation. 29 ACL injuries occurred in the initial control season

compared to 23 and 17 in the next two intervention seasons ($p=.62$ and $.15$, respectively). There was a significant reduction in the number of non-contact injuries from the control season to the second intervention year (18 in the control year versus 7 in the intervention year2, $p=.04$) (Hewett et al 2005). Caraffa et al (1996) examined the effect of proprioception or balance training in prevention of ACL injuries over 3 years period. Caraffa et al (1996) divided the players into groups, one which received the proprioception training program (20 min/day/ 3 times/week) and one which followed their normal training. The incidence of ACL injury was 1.15 injuries per team per season in the control group and 0.15 in the intervention group. Proprioception training seems to reduce the number of ACL injuries in soccer (Owen et al 2006).

Clinical recommendation

Neuromuscular training can be recommended for female athletes to reduce and prevent ACL injuries. The evidence is however only applicable for female athletes.

Table 2.14: Prevention of ACL injury

Author	Intervention group (1)	Group (1) Dosage	Control group (2)	Group (1) Dosage	Outcome measure	Finding /stats
Hewett et al 1999	Trained Basketball, soccer, volleyball Jump training, weight training and flexibility	6 Wks	Untrained	6 Wks	Videotape and manual	$P=.05$
Wedder et al 1999	Trained handball	10-15 min/session	Untrained	- Not stated	Knee sprain	$P<.05$ practices $P<.01$ games
Heidt et al 2000	Trained soccer	20 session for 7 Wks	Untrained	20 session for 7 Wks	Ligament sprain and tear	$P<.01$
Soderman et al 2000	Trained soccer	10- 15 min for 30 days then continue 3 times per week	Untrained	Not stated	Orthopedic surgeon	$P= .02$
Myklebust et al 2003	Trained handball	5-7 Wks	Untrained	5-7 Wks	Coaches and physiotherapist	$P= .04$
Mandelbaum et al	Trained soccer	Over 2-years	Untrained	Over 2-years	Physical examination by: physician, magnetic resonance imaging or arthroscopy	First year $P<.001$ Second year $P<.01$

2.8 SUMMARY POINTS OF CHAPTER:

- Eight systematic reviews were included in this review
- The majority of the included systematic reviews denoted Level 1 evidence on the JBI scale of evidence as they included RCTs.
- The evidence available for the effect of water- and land-based exercises in the rehabilitation of ACL reconstruction is inconclusive. Therefore, no recommendation as to which exercise should rather be used, or as to which exercise is better than the other can be made. At this point, both exercises are equally suitable to be used during post-ACL reconstruction rehabilitation.
- It can be recommended that home-based rehabilitation may be more effective at increasing knee ROM than supervised rehabilitation programs. No significant difference was reported between the supervised and home-based rehabilitation programs in improving muscle strength, decreasing knee laxity and Tegner score.
- From the available evidence, it can be recommended that a combination of OKC and CKC exercises should be incorporated into the rehabilitation program following ACL reconstruction surgery.
- It is recommended that immediate weight-bearing exercises be incorporated into ACL reconstruction rehabilitation to improve muscle strength, knee function and decrease knee pain.
- It can be recommended that early quadriceps exercises can be performed safely in first 2 postoperatively weeks. But clinically, no significant difference was reported between the intervention and control groups using quadriceps exercises in improving ROM, functional performance, decreasing knee laxity and pain.
- The evidence available for the effect of strength training programs and neuromuscular training programs in the rehabilitation of ACL reconstruction is limited and inconclusive. Although the neuromuscular group demonstrated a greater change in isokinetic torque compared with the strength group, it cannot be recommended that the one training program be used instead of the other. Both training programs can therefore be used in the rehabilitation phase following ACL reconstruction.
- It can be recommended that other specific exercises such as slide-board home exercises, stair climbing, isokinetic strength training, EMG biofeedback, relaxation and guided imagery exercises, and gait training be included in the post-ACL reconstruction rehabilitation program.

- From the available evidence it can be recommended that cryotherapy be used post-ACL reconstruction surgery for the relief of pain, especially in the early phase following arthroscopy- assisted ACL reconstruction.
- Neuromuscular training can be recommended for female athletes to reduce and prevent ACL injuries. The evidence is however only applicable for female athletes.

ADDENDUM 2.A

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1. Anterior cruciate ligament reconstruction AND systematic review
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Limiters - Publication Type: Systematic Review; Age Groups: All Adult
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ADDENDUM 2.B

Greenhalgh's critical appraisal tool (Greenhalgh et al 1997)

Questions

1. Can you find an important clinical question which the review addressed?
2. Was a thorough search done of the appropriate databases and were other potentially important sources explored?
3. Was ethodological quality assessed and the trials weighted?
4. How sensitive are the results to the review which has been done?
5. Have the numerical results been interpreted with common sense and due regard to the broader aspects of the problem?

Total score: 5

CHAPTER 3

Phase 2: Development and validation of the Evidence-based Educational Program

3.1 INTRODUCTION

The development of the evidence-based educational program for patients who have undergone ACL reconstruction surgery in UAE was a core component of this research project which included the generation of evidence-based program contents (See Chapter 2). This chapter presents: a) the development process of the evidence-based educational program (this includes the translation process, development of the figures, designing and printing of the pre-final newly-developed educational program booklet), and b) content and face validation of the evidence-based educational program. The final version of the evidenced-based educational program was used in the main validation study (see Chapter 4).

3.2 STUDY AIM

The aim of this study was to develop and validate an evidence-based educational program for patients who have undergone ACL reconstruction surgery in United Arab Emirates (UAE) to inform them about the available evidence of post-surgical rehabilitation strategies.

3.3 STUDY OBJECTIVES

The objectives of this section of the study were to:

- Develop an evidence-based educational program for patients who have undergone ACL reconstruction surgery in UAE, based on available evidence collated through a systematic review process.
- To undertake forward and back translation of the evidence-based educational program from the English language to the Arabic language.
- Determine the content and face validity of the evidence-based education program through a focus group feedback process
- Determine the required changes for the evidence-based educational program through a focus group feedback process, to produce the final

version of the evidence-based educational program booklet which will be used in the main validation study.

3.4 METHODS

3.4.1 Development of the Evidence-based Educational Program

The development of an evidence-based educational program for patients who have undergone ACL reconstruction surgery included the following processes:

3.4.1.1 Generation of the educational program evidence-based content

A systematic review was conducted to generate content and information that are evidence-based (See Chapter 2). The clinical recommendations that had been extracted from the review were used to develop an evidence-based educational program which would provide patients with updated evidence-based information regarding the anticipated rehabilitation program he/she may undergo following an ACL reconstruction surgery (see the details in Chapter 2).

3.4.1.2 Translation process

The translation process was conducted to translate the content of the evidence-based educational program from the source language (English, where it was developed) to the target language (Arabic, where it is going to be used in the UAE). The target language is the 'mother tongue' language of the adult patients who have had ACL reconstruction surgery in the UAE. The translation process consisted of two steps: forward and back translation. The forward translation process was carried out by two bilingual translators from Zayed military hospital (ZMH). The two bilingual translators independently translated the evidence-based educational program from English to Arabic language, and then followed independent back translation. The two bilingual translators met, they compared their independent translations and discussed the ambiguous wording in the source (where it was developed) and discrepancies in the translation. The Arabic version of the evidence-based education program was used in the content and face validity study.

3.4.1.3 The educational program development

The principle researcher selected the relevant materials, namely the exercise pictures and other anatomical diagrams from the systematic review and formulated the content of the evidence-based educational program booklet (see Chapter 2). She organized the selected materials to illustrate the proper stages of the rehabilitation program that the client may undergo following the surgery, and produced the 1st draft of the evidence-based education program. The research supervisors were consulted on the 1st draft and advised by the researcher to reduce the number of the exercises that were included as it was unnecessarily detailed information and exercises. This may have lead to the client thinking that he can manage the rehabilitation program independently which was not the goal of evidence-based educational program. The principal researcher changed the content accordingly and consulted the research supervisors who approved the changes. The pre-final version of the evidence-based education program was produced by the principal researcher. The principle researcher sent the pictures and the diagrams to an artist in South Africa via e-mail. The artist designed, developed and produced attractive pictures and diagrams and sent them back to the principle researcher via e-mail at the beginning of July 2009. The principle researcher placed the pictures and diagrams into the relevant areas of the educational program booklet and produced the pre-final evidence-based educational program booklet draft.

3.4.1.4 Designing the educational program booklet

The principal researcher sent the produced pre-final evidence-based educational program booklet draft to a computer programmer in Abu Dhabi, UAE. The computer programmer designed the graphical layout of the booklet and produced a pre-final printable evidence-based educational program booklet and sent it back to the principle researcher via e-mail. The principle researcher sent an electronic pre-final version of the printable evidence-based educational program booklet to the research supervisors for final feedback before printing. The final feedback from the supervisors to the researcher was to go ahead and send it for printing. The principle researcher took an electronic copy of the evidence-based educational program booklet on a flash

disk to a printing company in Abu Dhabi to print twenty copies which were used in the content and face validity study (see Appendix 7) .

3.4.1.5 Printing the educational program booklet

The principal researcher collected the twenty printed copies from the printing company that were used in the content and face validity study.

Below is a flowchart depicting the development and validation procedure:

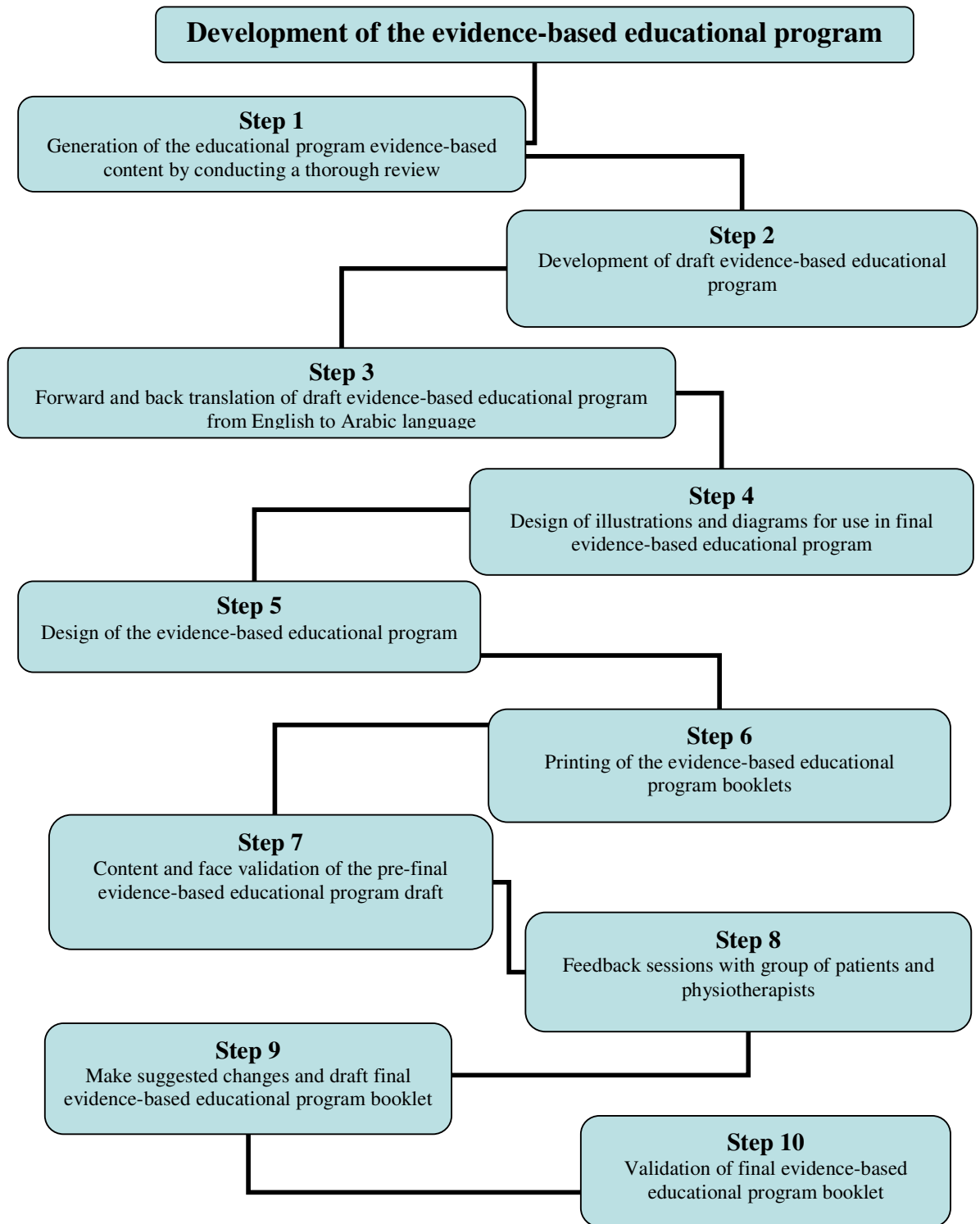


Figure 3.1: Flowchart depicting the development and validation procedure

3.4.2 Content and face validation of a pre-final evidence-based educational program booklet

The determination of the content and face validity of the pre-final evidence-based educational program booklet among patients (who had undergone ACL reconstruction surgery) and physiotherapists (experienced in working with ACL injuries and reconstructions in UAE) to develop the final version. This part of the study included an interview with: (A) a focus group of five physiotherapists and; (B) a focus group of three patients. The final version of the educational program was used in the main validation study of the project (Chapter 4).

3.4.2.1 A: Validation process among physiotherapists (Descriptive Study).

This study took place between July and August 2009.

3.4.2.1.1 Study Aim

The aim of this phase of the study was to conduct content and face validity of a evidence-based educational program (which would inform the adult patients who had undergone ACL reconstruction surgery about the rehabilitation process following the ACL reconstruction surgery), among UAE physiotherapists experienced in working with ACL injuries and reconstructions.

3.4.2.1.2 Study Objectives

The objectives of this phase of the study are to:

- Determine the content and face validity of a newly-developed evidence-based educational program, (which would inform the adult patients who had undergone ACL reconstruction surgery about the rehabilitation process following the ACL reconstruction surgery) among UAE physiotherapists experienced in working with ACL injuries and reconstructions.

3.4.2.1.3 Study design

A descriptive study using focus groups consisting of physiotherapists experienced in working with ACL injuries and reconstructions to validate a newly-developed evidence-based educational program.

3.4.2.1.4 Study setting

The study was conducted in the physical therapy departments situated at ZMH and Abu Dhabi Knee and Sports Medicine Centre (ADKSMC) (both institutions are located in Abu Dhabi, UAE). ZMH was established thirty five years ago. It is the biggest hospital in the U.A.E and about twenty ACL reconstruction surgeries are conducted there monthly. ADKSMC was established five years ago and is the largest medical sports centre in Abu Dhabi. About forty ACL reconstruction surgeries are conducted monthly at this institution. The surgeons, Dr Charles H. Brown and Dr Nader Darwich, perform the surgery at both institutions. The two surgeons have similar techniques as Dr Darwich was trained by Dr Brown. These hospitals were also selected since the principle researcher is employed by these institutions and had obtained permission from the surgeons and the ZMH commander (Appendix 2).

3.4.2.1.5 Sample description

Inclusion criteria

The physiotherapists were recruited to be part of the focus groups using the following inclusion criteria:

- Be permanently employed by either ZMH or ADKSMC.
- Be experienced in working with ACL patients, both pre- and post-operatively, for no less than five years.
- Be able to speak and read the Arabic and English language.
- Male and/or female physiotherapists.

The *exclusion criteria* were:

- Physiotherapists who were unable to attend interviews at ZMH and ADKSMC.

- Physiotherapists who had less than five years of experienced working with ACL patients, both pre- and post-operatively.

-

3.4.2.1.6 Sampling procedure and sample size

The principle researcher visited the ZMH and ADKSMC institutions and invited the eligible physiotherapists to participate in this study. The study procedures and requirements were thoroughly explained to each physiotherapist. When the eligible physiotherapist agreed to participate in this study, oral informed consent was required from the physiotherapists. Five physiotherapists who had working experience in treating ACL patients pre- and post-operatively and were proficient in the English and Arabic language were recruited from the two major hospitals in Abu Dhabi, UAE (Two physiotherapists were recruited from ZMH, and three physiotherapists were recruited from ADKSMC.). The five physiotherapists met the inclusion and exclusion criteria.

3.4.2.1.7 Interview guide design and procedure

- Interview guide design

An interview guide was developed in English by the principal researcher in March 2009. The study supervisors were consulted in developing the physiotherapists' focus group interview guide. A draft of focus group interview guide was developed with a view to ascertain information of the evidence-based educational program format. The interview guide included nine questions for the focus groups of physiotherapists (see table 3.1). The interview guide were designed to allow the interviewees free independent input to answer by 'yes' or 'no' and patients were encouraged to explain their responses. This also facilitated the data collection procedure and saved the interviewees and researcher time during the data collection time.

Table 3.1 Interview guide for focus groups of physiotherapists and patients

No.	Questions	Yes	No
1.	Is the structural format of the evidence-based educational program easy to follow? Please explain.		
2.	Is the presentation of the evidence-based educational program interesting? Please explain.		
3.	Is the aim of the evidence-based booklet clear? Please explain		
4.	Does the structure of the evidence-based educational program follow a logical layout? Please explain		
5.	Are the sentences in the evidence-based educational program clear and easy to understand? Please explain		
6.	Do you think the evidence-based booklet is the best way of delivering this information? Please explain		
7.	Do you think the evidence-based booklet covers all necessary information? Please explain		
8.	Do any of the evidence-based educational program content infringe on the correspondent's privacy? Please explain		
9.	Do you have any other comments about the ACL evidence-based educational program? Please explain		

3.4.2.1.8 Study procedure

The newly-developed evidence-based educational program was sent via e-mail to eligible physiotherapists who had experience in treating ACL patients, both pre- and post-operatively. The eligible physiotherapists were allowed one week to review the evidence-based educational program. While reviewing the evidence-based educational program, it was expected that the physiotherapists pay special attention to the previous aspects of the evidence-based educational program mentioned above (see Table 3.1).

The principle researcher contacted the eligible physiotherapists telephonically to arrange a feedback session to discuss the evidence-based educational program after a week of receiving the evidence-based education program. The feedback sessions were held separately at each hospital, but followed exactly the same procedure. The physiotherapists were informed that the meeting would be digitally recorded on a voice recorder and hand-written. During the feedback session, the physiotherapists were asked the interview questions.

3.4.2.1.9 Data collection

- Meeting room

The interviews were conducted in the meeting rooms at ZMH or ADKSMC institutions, at a convenient time for all the focus group participants. The use of the digital voice recorder ensured that attention could be given unreservedly to the physiotherapists, and allowed the principal researcher to return to the raw data later for confirmation. Each interview lasted for (5 to 12) minutes. A total of two interviews were held, one at each hospital.

- Process

Five folders were prepared for each of the two interviews consisting of a draft of the newly-developed evidence-based educational program, and observer note forms for interview questions. A demographic data capturing sheet was completed by the participating physiotherapists before starting the interview. The objectives were explained to the interviewees.

- Research team (functions and duties)

The interviews were conducted face-to-face by the principle researcher with the focus group of physiotherapists in English. The feedback sessions were held separately at each hospital, but followed exactly the same procedure. The principle researcher has been working as a physiotherapist with outpatients for the past five years. The researcher is a physiotherapist at the physiotherapy department and as a staff member of ZMH could have influenced the responses from the two physiotherapists who were participating in interview. This was limited by creating an environment of comfort and trust, emphasizing that the researcher wanted to listen and learn from the interviewees, and to prove the trustworthiness of data collection.

- Responsibilities of the research

The principle researcher arranged the room, and conducted the interviews. There was an independent writer who documented the meeting conversation, and was present at all interviews to enable validity checks between writer notes and interview transcripts.

3.4.2.1.10 Data transcription

The principle researcher downloaded the recorded interviews from the digital voice recorder to a computer CD-drive. The interview data was transcribed for analysis (see Table 3.2 and Appendix 8).

3.4.2.1.11 Data validation

The principle researcher compared the written notes of the Focus Group Feedback Session (FGFS) with information obtained from the digital voice recorder. The project supervisors validated the newly-developed evidence-based educational program by checking the transcript.

3.4.2.1.12 Data analysis

Data analysis was performed using the transcribed data obtained during the two interviews with the focus groups at each institution. After reviewing the CD of the FGFS on the evidence-based educational program booklet, all the comments were transcribed, collated, scrutinized and analyzed into descriptive information.

3.4.2.1.13 Results

The following table summarizes the results of FGFS for both the interviews held at ZMH and ADKMSC.

Table 3.2 The results of Interview questions for focus group of physiotherapists in both of ZMH and ADKMSC

No.	Questions	PT1	PT2	PT3	PT4	PT5
		ZMH	ZMH	ADKMSC	ADKMSC	ADKMSC
1.	Is the structural format of the educational program easy to follow? Please explain	Yes	Yes	Yes	Yes	Yes
2.	Is the presentation of the educational program interesting? Please explain	Yes	Yes	Yes	Yes	Yes
3.	Is the aim of the booklet clear? Please explain	Yes	Yes	Yes	Yes	Yes
4.	Does the structure of the educational program follow a logical layout? Please explain	Yes	Yes	Yes	Yes	Yes
5.	Are the sentences in the educational program clear and easy to understand? Please explain	Yes	Yes	Yes	Yes	Yes
6.	Do you think the booklet is the best way of delivering this information? Please explain	Yes	Yes	Yes	Yes	Yes
7.	Do you think the booklet covers all necessary information? Please explain	Yes	Yes	Yes	Yes	Yes
8.	Do any of the educational program content infringe on the correspondent's privacy? Please explain	No	No	No	No	No
9.	Do you have any other comments about the ACL Educational program? Please explain	No	Yes	No	No	No

Key: PT: Physiotherapists, ZMH: Zayed Military Hospital, ADKMSC: Abu Dhabi Knee and Sports Medicine Centre

- Interviewees' comments

The following table includes the comments of the focus groups of physiotherapists from ZMH and ADKMSC (table 3.3).

Table 3.3 Comments of Focus group of physiotherapist

PTs no.	Hospitals	Comments
PT1	ZMH	1. The sentences in the evidence-based educational program clear and easy to understand for every body.
PT2	ZMH	2. The evidence-based booklet covers all necessary information and they are ready to provided to patients
PT3	ADKMSC	3. The evidence-based educational program pictures ,and protocol list is well arranged and interesting
PT4	ADKMSC	1. The evidence-based educational program is visually clear and pictures are nice to look at. 2. If there is CD with the evidence-based booklet it will be much better for delivering this information. 3. If patient need more details information it can be taken from other sources 4. The evidence-based educational program covers all necessary information and it will be easy for patients.
PT5	ADKMSC	1. Advice using colour pictured for patients. 2. Adding the ADKMSC web site as a references for patients to know more details about the ACL reconstruction 3. more exercises should be added the injury prevention phase (Last phase)

Key: PT: Physiotherapists, ZMH: Zayed Military Hospital, ADKMSC: Abu Dhabi Knee and Sports Medicine Centre

- Demographic information

All of the five physiotherapists, who were invited, agreed to participate in this interview. The mean age was 34,6 years old (SD= 11.45862) and the mean years of working experience was 10.2 years (SD= 8.348653) The demographic information of the focus groups of physiotherapists in ZMH and ADKMSC is presented in table 3.4.

Table 3.4 Demographic information of the Focus group of physiotherapists

PTs no.	PT1	PT2	PT3	PT4	PT5
Hospital	ZMH	ZMH	ADKMSC	ADKMSC	ADKMSC
Age	55	30	29	28	31
Gender	F	M	F	M	M
Experience	25Y	7 Y	5 Y	6 Y	8 Y
Qualifications	BSc.PT	BSc.PT	BSc.PT	BSc.PT	BSc.PT, Msc.PT

Key: PT: Physiotherapists, ZMH: Zayed Military Hospital, ADKMSC: Abu Dhabi Knee and Sports Medicine Centre, F: Female, M: Male, BSc: Bachelor, MSc: Master of Science, Y: Year.

3.4.2.1.14 Changes made from the feedbacks of physiotherapists on the evidence-based Educational program (Arabic version)

This section presents and explains the changes made to the newly developed evidence-based educational program in accordance with the feedback from the focus groups that were relevant and within the aim of the study. There were no changes recommended from the physiotherapists in FGFS to be made to the content of the evidence-based educational program. The majority of the comments supported the content of the evidence-based educational program. PT4 suggested a CD with the evidence-based educational program which was not within the aim of this study, but could be considered in future research. PT5 suggested color pictures and this was considered in the final version. The results of physiotherapists' feedback sessions at ZMH and ADKMSC are presented in Table 3.2 and Table 3.3.

3.4.2.2 B: Validation process among patients (Descriptive Study).

This study took place during the first two weeks of August 2009.

3.4.2.2.1 Study Aim

The aim of this phase of the study was to conduct content and face validity of a newly-developed evidence-based educational program, (which would inform the adult patients undergoing ACL reconstruction surgery about the rehabilitation process following ACL reconstruction surgery) among UAE ACL patients.

3.4.2.2.2 Study Objectives

The objectives of this phase of the study are to:

- Determine the content and face validity of a newly-developed evidence-based educational program (which would inform the adult patients undergoing ACL reconstruction surgery about the rehabilitation process following ACL reconstruction surgery) among UAE ACL patients.

3.4.2.2.3 Study design

A descriptive study approach using a focus group consisting of adult ACL reconstruction surgery patients to validate a newly-developed evidence-based educational program, which would inform adult ACL reconstruction surgery patients about the rehabilitation process following ACL reconstruction surgery, was used in this study.

3.4.2.2.4 Study setting

The study was conducted in the physical therapy department situated at ZMH (which is located in Abu Dhabi, UAE). This hospital was also selected since the principle researcher is employed by this institution and had obtained permission from the surgeons and the ZMH commander (Appendix 2).

3.4.2.2.5 Sample description

The *inclusion criteria* were:

- Patients who were admitted by either ZMH or ADKSMC.
- Patients who were able to speak and read Arabic language.
- Patients who were undergoing ACL reconstruction surgery.

The *exclusion criteria* were:

- Patients who were unable to attend interviews at ZMH and /or ADKSMC.
- Patients who were able to speak and/ or read English language.

3.4.2.2.6 Sampling procedure and sample size

The researcher visited the ZMH and recruited three eligible patients to participate in this study and be part of the focus group. The researcher gave one evidence-based educational program booklet to each of the three patients that would undergo ACL reconstruction surgery pre-operatively and introduced the evidence-based educational program to them. The researcher informed them that she would contact them after a week for a feedback session about their experience with the evidence-based educational program.

3.4.2.2.7 Interview guide design and procedure

- Interview guide design

An interview guide was developed in Arabic and English by the principal researcher in March 2009. The interview guide included nine questions for focus groups of patients (see table 3.1). The interview questions were designed to allow the interviewees freedom to give independent input by answering 'yes' or 'no' and giving additional comments. This also facilitated the data collection procedure and saved the interviewees and researcher time during the data collection time.

3.4.2.2.8 Study procedure

The principle researcher visited the ZMH and invited the eligible patients who were undergoing ACL reconstruction surgery to participate in the patient focus group interviews. Evidence-based educational program booklets were handed to the patients undergoing ACL reconstruction surgery pre-operatively. Written inform consent was obtained from the individual patients to participate in this descriptive study. After a week the patient focus group was invited for a feedback session about their experience with the evidence-based educational program by using a questionnaire for ACL reconstruction patients. This feedback interview was transcribed by the principle researcher after information was obtained from the digital voice recorder. The patients were informed that the meeting would be digitally recorded on a recorder and hand-written. During the feedback session, the patients were asked the interview questions. This procedure was to determine if further changes were needed for the evidence-based educational program (see table 3.1).

3.4.2.2.9 Data collection

- Meeting room

The focus group interviews were conducted in the meeting room at ZMH, at a convenient time. The use of digital voice recorder ensured that attention could be given unreservedly to the patients, and allowed the principal researcher to return to the raw data later for confirmation. The interviews lasted for five minutes. (Only one interview for the three patients was conducted) .

- Process

Three folders were prepared for the interview consisting of a draft of the newly developed evidence-based educational program, a questionnaire for ACL reconstruction patients and observer note forms for interview questions. The objectives were explained to the interviewees. Questionnaires for ACL reconstruction patients were completed by the patients before the interview.

- Research team (functions and duties)

The interviews were conducted face-to-face by the principle researcher with the focus group of patients in Arabic language.

- Responsibilities of the principle researcher

The principle researcher arranged the room, and conducted the interview. An independent writer documented the meeting conversation, and was present at the interview to enable validity checks between writer notes and interview transcripts.

3.4.2.2.10 Data transcription

The principle researcher downloaded the recorded interview from the digital voice recorder to a computer CD-drive. The interview data was transcribed for analysis (see Table 3.5 and 3.6).

3.4.2.2.11 Data validation

The principle researcher compared the written notes of patients FGFS with information obtained from the digital voice recorder. A physiotherapist working as an officer examiner in Health authority in Abu Dhabi validated the newly-developed evidence-based educational program by re-reading the transcripts.

3.4.2.2.12 Data analysis

Data analysis was performed using recorded information obtained while getting the feedback from patients through the feedback sessions. After reviewing the CD of FGFS on the evidence-based educational program booklet, all the comments were transcribed, collated, scrutinized and analyzed.

3.4.2.1.13 Results

The following table summarizes the results of FGFS in ZMH.

Table 3.5 The results of Interview questions for focus group of patients in ZMH.

No.	Questions	Pt1	Pt2	Pt3
		ZMH	ZMH	ZMH
1.	Is the structural format of the evidence-based educational program easy to follow? Please explain	Yes	Yes	Yes
2.	Is the presentation of the evidence-based educational program interesting? Please explain	Yes	Yes	Yes
3.	Is the aim of the evidence-based booklet clear? Please explain	Yes	Yes	Yes
4.	Does the structure of the evidence-based educational program follow a logical layout? Please explain	Yes	Yes	Yes
5.	Are the sentences in the evidence-based educational program clear and easy to understand? Please explain	Yes	Yes	Yes
6.	Do you think the evidence-based booklet is the best way of delivering this information? Please explain	Yes	Yes	Yes
7.	Do you think the evidence-based booklet covers all necessary information? If not, what other factors should be added? Please explain	Yes	Yes	Yes
8.	Do any of the evidence-based educational program content infringe on the correspondent's privacy? Please explain	No	No	No
9.	Do you have any other comments about the ACL evidence-based Educational program? Please explain	No	No	Yes

Key: Pt: Patients, ZMH: Zayed Military Hospital.

- Interviewees' comments

The following table includes the comments of the focus group of patients in ZMH is presented in table 3.6.

Table 3.6 Comments of Focus group of patients

Pts no.	Hospitals	Comments
PT1	ZMH	No
PT2	ZMH	1. If there is CD with the evidence-based booklet it will be much better for delivering this information. 2. The injury prevention phase (Last phase) is very interesting and supportive.
PT3	ZMH	3. The evidence-based educational program pictures ,and protocol is interesting 4. If there is CD with the evidence-based booklet it will be much better for delivering this information

Key: Pt: patients, ZMH: Zayed Military Hospital

- Demographic information

All of the three patients who were invited to participate in this interview, agreed. The mean age was 35.3 years old (SD= 11.67619). The demographic information of the focus group of physiotherapists in ZMH and ADKSMC is presented in table 3.7.

Table 3.7 Demographic information of the Focus group of patients

PTs no.	Pt1	Pt2	P33
Hospital	ZMH	ZMH	ZMH
Age	48	33	25
Gender	M	M	M
Operated knee	Rt	Rt	Lt

Key: Pt: patients, ZMH: Zayed Military Hospital, M: Male, Rt: right , Lt: left.

3.4.2.2.14 Changes made from patients' feedbacks on the evidence-based Educational program (Arabic version)

This section explains the changes made to the newly developed evidence-based educational program which was generated from the results of a systematic review (Chapter 2). There were no recommended changes to be made to the evidence-based educational program from the patients in FGFS. All the comments supported the content and face validity of the evidence-based educational program. Pt (1) suggested a CD with the evidence-based educational program which can be done in future research.

3.4.3 Pre-testing the pre-final newly-developed evidence-based educational program booklet (Pilot Study):

3.4.3.1 Aim Study

The aim of this study was to pilot the pre-final newly-developed evidence-based educational program in a group of five eligible subjects who had sustained an ACL injury and would undergo ACL reconstruction surgery.

3.4.3.2 Objectives

The objectives of this pilot study were to ascertain if there were any difficulties in understanding the evidence-based educational program, any unclear items, ease of reading, format, content or any additional comments related to the newly-developed evidence-based educational program booklet.

3.4.3.3 Study setting

The pilot study was conducted at the physiotherapy department, in ADKSMC and ZMH, Abu Dhabi-UAE.

3.4.3.4 Sampling procedure and size

Convenience sampling of five patients was applied to collect data from adults between the ages 18 and 45 years, who have sustained an ACL injury and would undergo ACL reconstruction surgery.

3.4.3.5 Sample description

Inclusion criteria

The following inclusion criteria were applied to the sample population:

- Male and/or female patients aged between 18-45 years old
- Military or civilian adult patients scheduled to undergo ACL reconstruction surgery during the third and fourth weeks of August 2009.
- Patients who were able to read and write in the Arabic language.

Exclusion criteria

The following exclusion criteria were applied to the sample population:

- Patients who were unable to attend outpatient follow-up physiotherapy sessions at ZMH and ADKSMC.

- Patients with ACL who were older than 45 years or younger than 18 years since the structural and biomechanical differences in the function of the neuromusculoskeletal system in both young and old patients may influence knee function.

3.4.3.6 Study procedure

The principle researcher visited the ADKSMC and ZMH to screen the orthopedic ward for five eligible subjects who had sustained an ACL injury and would undergo ACL reconstruction surgery to participate in the pilot study. There were three patients from ADKSMC and two patients from ZMH. The subjects were invited to participate and the study aim, procedure and requirements were thoroughly explained to each subject by the researcher. Once the eligible subject had agreed to participate in this study, he/she was required to read and sign an Arabic informed consent form. The study took place during the last two weeks of August 2009.

The researcher gave each eligible ACL injury patient the revised newly-developed evidence-based education program booklet one day pre-operatively. The researcher asked the patient to read the booklet and explained that she would return after 15 minutes. After 15 minutes, the researcher asked the subject if he/she had any questions regarding the evidence-based educational program booklet. The researcher informed the subject that he/she was required to come back to the hospital one week after being discharged from the hospital following the ACL reconstruction surgery for a feedback session. It was explained to the subject that at this feedback session a previously-designed checklist would be given to him/her to complete (Table 3.8). The results regarding any changes suggested by the patients were considered based on a minimum of three patients reporting difficulty of understanding any section of the newly-developed evidence-based education program booklet.

3.4.3.7 Feedback session

One week after being discharged following ACL reconstruction surgery, the subject returned to the physiotherapy department at either ZMH or ADKSMC for a feedback session regarding the evidence-based educational program. At the feedback session, the subject was interviewed individually and a checklist was administered to him/her. The checklist provided feedback on any unclear items, ease of reading, format, content or any additional comments related to the evidence-based educational program booklet. The

subject was allowed 15 minutes within which to complete the checklist. The checklist was collected from the subject by the principle researcher and filed in a subject-specific folder.

Table 3.8 Checklist questions

No.	Questions
1.	Did you <u>use this evidence-based booklet</u> last week?
2.	Is the structural format of the evidence-based education program <u>easy to follow</u> ? If not please indicate which aspect is not clear
3.	Is the presentation of the evidence-based <u>educational program interesting</u> ? If not, please explain.
4.	Is the <u>aim of this evidence-based educational program clear</u> ? If not, please make suggestions for improvement.
5.	Are the <u>sentences in the evidence-based educational program clear</u> ? If no, which sentences are ambiguous?
6.	Did you <u>understand the early phase</u> (advice) of the evidence-based educational program?
7.	Did you <u>understand the mid – phase</u> (advice) of the evidence-based educational program?
8.	Did you <u>understand the late phase</u> (advice) of the evidence-based educational program? If not, what you did not understand?
9.	Is the evidence-based <u>booklet encouraging</u> you to do the exercises? Explain your answer.
10.	Do you think you have <u>benefited from the evidence-based educational program</u> ? Please explain your answer.

3. 4.3.8 Results

The following is the analysis of each question answered in the pilot study:

- **Did you use this evidence-based booklet last week?**

The evidence-based educational program for patients with ACL reconstruction surgery was used during one week after being discharged by four patients in pilot study. One patient mentioned that he did not use the evidence-based educational program (see table 3.9).

- **Is the structural format of the evidence-based education program easy to follow?**

All patients with ACL reconstruction surgery in the pilot study found that the structural format of the evidence-based education program easy to follow (see table 3.9).

- **Is the presentation of the evidence-based educational program interesting?**

The presentation of the evidence-based educational program was interesting for all of the five patients with ACL reconstruction surgery (see table 3.9). Even though there

was one patient who did not use the booklet; he said that after he had read the booklet he found that it was interesting.

- **Is the aim of this evidence-based educational program clear?**

The aim of the evidence-based educational program was clear enough for patients with ACL reconstruction surgery in the pilot study (see table 3.9).

- **Are the sentences in the evidence-based educational program clear?**

None of the patients with ACL reconstruction surgery in the pilot study had any difficulty understanding the sentences of the evidence-based educational program and it were clear enough (see table 3.9).

- **Did you understand the early phase, the mid-phase and the late phase (advice) of the evidence-based educational program?**

All of the five patients with ACL reconstruction surgery in the pilot study understood the three phases of the evidence-based educational program (the early phase, the mid-phase and the late phase (advice) (see table 3.9).

- **Is the evidence-based booklet encouraging you to do the exercises?**

The evidence-based educational program booklet encouraged the pilot study patients to do the exercises (see table 3.9).

- **Do you think you have benefited from the evidence-based educational program?**

All patients with ACL reconstruction surgery in the pilot study benefited from the evidence-based education program (see table 3.9).

Table: 3. 9 Patients' responses

No.	Questions	Patient 1	Patient 2	Patient 3	Patient 4	Patient 5
1.	Did you use this evidence-based booklet last week?	YES	YES	NO	YES	YES
2.	Is the structural format of the evidence-based education program easy to follow? If not please indicate which aspect is not clear	YES	YES	YES	YES	YES
3.	Is the presentation of the evidence-based educational program interesting? If not, please explain.	YES	YES	YES	YES	YES
4.	Is the aim of this evidence-based educational program clear? If not, please make suggestions for improvement.	YES	YES	YES	YES	YES
5.	Are the sentences in the evidence-based educational program clear? If no, which sentences are ambiguous?	YES	YES	YES	YES	YES
6.	Did you understand the early -phase (advice) of the evidence-based educational program?	YES	YES	YES	YES	YES
7.	Did you understand the mid - phase (advice) of the evidence-based educational program?	YES	YES	YES	YES	YES
8.	Did you understand the late- phase (advice) of the evidence-based educational program? If not, what you did not understand?	YES	YES	YES	YES	YES
9.	Is the evidence-based booklet encouraging you to do the exercises? Explain your answer.	YES	YES	YES	YES	YES
10.	Do you think you have benefited from the educational program? Please explain your answer.	YES	YES	YES	YES	YES

3. 4.3.9 Outcomes of pilot study

The newly-developed evidence-based educational program reflected areas that were important to inform adult ACL reconstruction surgery patients of the rehabilitation process following ACL reconstruction surgery, among patients who had sustained an ACL injury and would undergo ACL reconstruction surgery (see table 3.9). The pilot study results ascertained the time taken to conduct data collection for each recruited subject which was 15 minutes.

The highest score in the pilot study was ten out of ten, and the lowest score was nine out of ten. The lower score was nine out of ten for patient 3 because he mentioned that he did not use the evidence-based educational program during one week after being discharged from hospital (see table 3.10).

Table 3.10 Pilot study scoring results

Patients code numbers	Higher score	lower score	Total = 10
Patient 1	X		10
Patient 2	X		10
Patient 3		X	9
Patient 4	X		10
Patient 5	X		10

3.5 SUMMARY POINTS OF CHAPTER

- Both the physiotherapists' and patients' FGFS were satisfied about the content and face validity of the evidence-based educational program booklet.
- One physiotherapist and one patient suggested a CD with the evidence-based educational program which can be done in future research.
- All the physiotherapists found that the evidence-based educational program covered all necessary information.
- The physiotherapists felt that it would be easy for these patients to use the evidence-based educational program.
- The pilot study results were to ascertain that there were no difficulties in understanding the evidence-based educational program, on any unclear items, ease of reading, format, content or any additional comments.
- The pilot study indicated that the newly-developed evidence-based educational program booklet among patients who had sustained an ACL injury and would undergo ACL reconstruction surgery, was well understood by a sample of five patients.

CHAPTER 4

Phase 3: Validation of the final version of an evidence-based educational program booklet among ACL reconstruction patients

4.1 INTRODUCTION

This chapter reports on a descriptive study to validate the final version of the Arabic version of an evidence-based educational program booklet (Appendix 7) for patients who have undergone ACL reconstruction surgery in UAE.

4.2 RESEARCH QUESTION

Is the final version of the Arabic evidence-based educational program booklet valid for adult patients who have had ACL reconstruction surgery in the UAE?

4.3 STUDY OBJECTIVES

The objective of this phase of the study was to determine the face and content validity of the Arabic evidence-based educational program booklet among patients who have sustained an ACL injury and were scheduled to undergo ACL reconstruction surgery.

4.4 METHODS

4.4.1 *Study design*

A descriptive study was conducted to address the research question.

4.4.2 *Study setting*

The validation study was conducted at ADKSMC and ZMH in Abu Dhabi-UAE. ZMH was established 35 years ago and it is the biggest hospital in the U.A.E. About 20 ACL reconstruction surgeries are conducted monthly at this institution. ADKSMC was established 5 years ago and is the largest medical sports centre in Abu Dhabi and about 40 ACL reconstruction surgeries are conducted monthly at this hospital. The surgeons, Dr Charles H. Brown and Dr Nader Darwich, perform the surgeries at both institutions. The two surgeons have similar ACL reconstruction techniques as Dr Darwich was trained by Dr Brown and either use a hamstring semitendinosus or semimembranosus muscle graft or quadriceps muscle graft technique. These hospitals were also selected because the principle researcher is employed by these institutions and has obtained permission from

the surgeons and the ZMH commander. This study was conducted between August and September 2009.

4.4.3 Sampling procedure and sample size

Consecutive sampling of 40 patients, who have sustained an ACL injury and were scheduled to undergo ACL reconstruction surgery, was conducted at the ZMH and ADKSMC, was conducted.

4.4.4 Sample description

Inclusion criteria:

The following inclusion criteria were applied to the sample population:

- Male and/or female patients aged between 18-45 years old
- Military or civilian adult patients scheduled to undergo ACL reconstruction surgery during August 2009 and September 2009.
- Patients who were proficient in the Arabic language.

Exclusion criteria:

- Patients who were unable to attend outpatient follow-up physiotherapy sessions at ZMH and ADKSMC following the ACL reconstruction surgery
- Patients with ACL injuries who were older or younger than 18-45 years old, since the structural and biomechanical differences in the function of the neuromusculoskeletal system in both young and old patients may influence knee function.

4.4.5 Final version of an evidenced-based educational program booklet

The development of the final version of Arabic evidence-based educational program booklet (Appendix 7) was presented in Chapter 3. The final version of the evidence-based educational program booklet was given to each eligible patient one day pre-operatively. The patients were required to return for a follow-up hospital visit one week after being discharged from the hospital following the ACL reconstruction surgery for a feedback session using a checklist that was used in the pilot study (Chapter 3).

4.4.6 Measurement tool

4.4.6.1 Development of the checklist to validate the program

A checklist was deemed the most feasible method to establish content and face validity in a relatively large group of patients who underwent ACL surgery. The specific ease of reading, format, content or any additional comments related to the Arabic evidence-based educational booklet was sought. The checklist was developed by the principal researcher in consultation with the study supervisors (checklist Table 3.8). The development of the checklist pilot was based on information obtained from the pilot study (Chapter 3). The checklist consisted of nine dichotomous questions. However, the checklist also made provision for patients to provide descriptive feedback. The checklist was provided to the subjects pre-operatively and they were instructed to provide feedback post-operatively.

4.4.7 Researcher's responsibilities

The principle researcher visited ADKSMC and ZMH to screen the orthopedic ward for eligible subjects. She also obtained consent and provided the Arabic version of the evidence-based educational booklet to patients who provided consent. She also administered the checklist. The researcher replaced patients name with a subject identity to maintain anonymity of the patient's personal details.

4.4.8 Clinicians' responsibilities

The responsibilities of the physiotherapists in each hospital were to identify eligible patients in the orthopedic ward and to inform the principle researcher about the out-patients appointment for each eligible patient one week after being discharged from the hospital following the ACL reconstruction surgery for a feedback session after the physiotherapy session in physiotherapy department.

4.4.9 The data collection procedures

The principle researcher visited the ADKSMC and ZMH to screen the orthopedic ward for 40 eligible subjects who had sustained an ACL injury and were scheduled to undergo ACL reconstruction surgery. The subjects were invited to participate and the study aim, procedure and requirements were thoroughly explained to each subject by the researcher. Once the eligible subject had agreed to participate in this study, he/she was required to read and sign an Arabic informed consent form (Appendix 3).

Each patient then received a copy of the Arabic version of the ACL evidence- based educational booklet one day pre-operatively. The researcher requested the patient to read the booklet and the principle researcher returned after 30 minutes to address any questions relating to the booklet. The aim, construction and content of the booklet were also explained. The researcher informed the subjects that they would attend a follow-up session one week after being discharged from the hospital following the ACL reconstruction surgery. During this follow-up session they will be required to provide written feedback about the booklet by completing a checklist.

4.4.10 Feedback session

At the feedback session, the subjects were interviewed individually and a checklist was administered to him/her. The checklist provided feedback on any unclear items, ease of reading, format, content or any additional comments relating to the educational program booklet. Subjects took about 15 minutes to complete the checklist. Patients were required to submit the completed checklist into a sealed box which was only opened once all data collection sheets were completed.

4.5 Ethical considerations

Approval for this study was obtained from the Committee for Human Research of Stellenbosch University. Permission to conduct the study was obtained from the commander of ZMH (Appendix 2.A) and the director of ADKSMC of (Appendix 2.B). The study was conducted according to the international accepted ethical standards and guidelines. Written Arabic consent was obtained from each patient prior participating in the study (Appendix 3). Each patient had the right to withdraw from the study at any time by notifying the participating physiotherapist.

4.6 Data analysis

All analyses were conducted in Microsoft Excel Version 2003. Descriptive statistics was used to analyse the data.

4.7 RESULTS

4.7.1 Demographics

Thirty patients from ADKSMC and ten patients from ZMH participated. All 40 patients were male. The age range was between 18 years to 38 years old with a mean age of 28.5 years (SD 5.75).

- **Affected knee (ACL injured)**

Most of the patients (65%) had undergone ACL reconstruction surgery to the right knee (see figure 4.1).

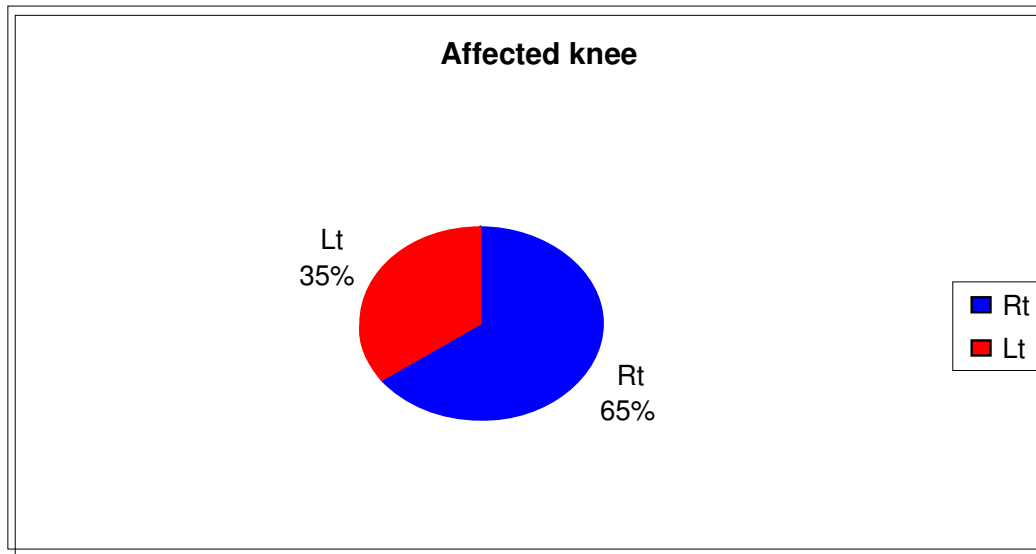


Figure 4.1: Distribution of affected knee amongst subjects (Key: RT=right knee, Lt=left knee)

- **First or second ACL reconstruction surgery**

Of the total sample (n=40), the majority of the subjects who participated in this study (90 %), had ACL surgery for the first time (see figure 4.2).

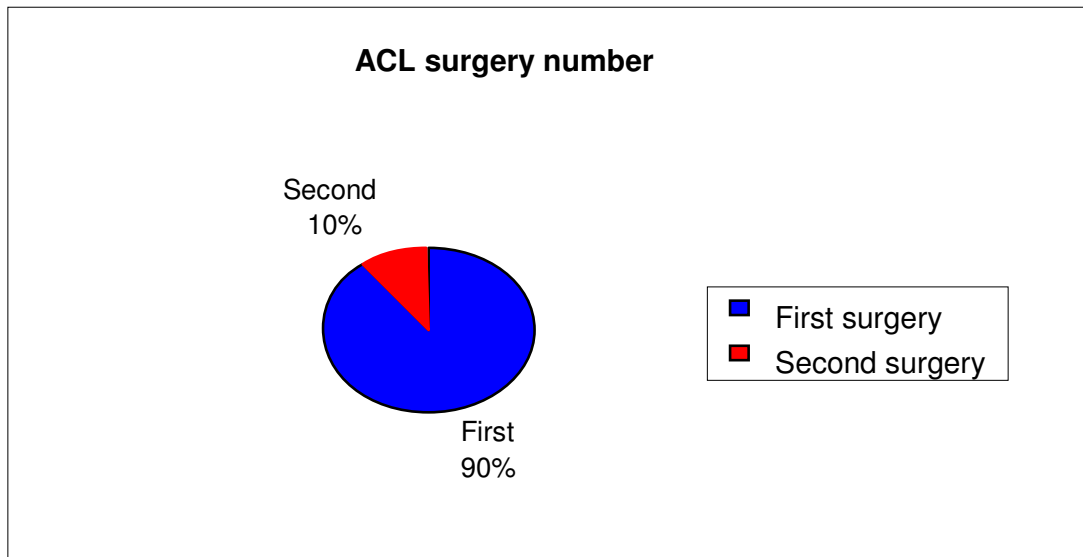


Figure 4.2: Distribution of total number of ACL surgeries per subject

4.7.2 Findings relating to the Checklist questions

4.7.2.1 Dichotomous data

The graph (Figure 4.3) illustrates that the majority of the responses to the checklist received from the patients were positive. Questions 4, 5, 7 and 10 received 100% positive responses. Questions 2, 3, 8 and 9 received 97.5% positive responses. Questions 1 and 6 received 95% positive responses.

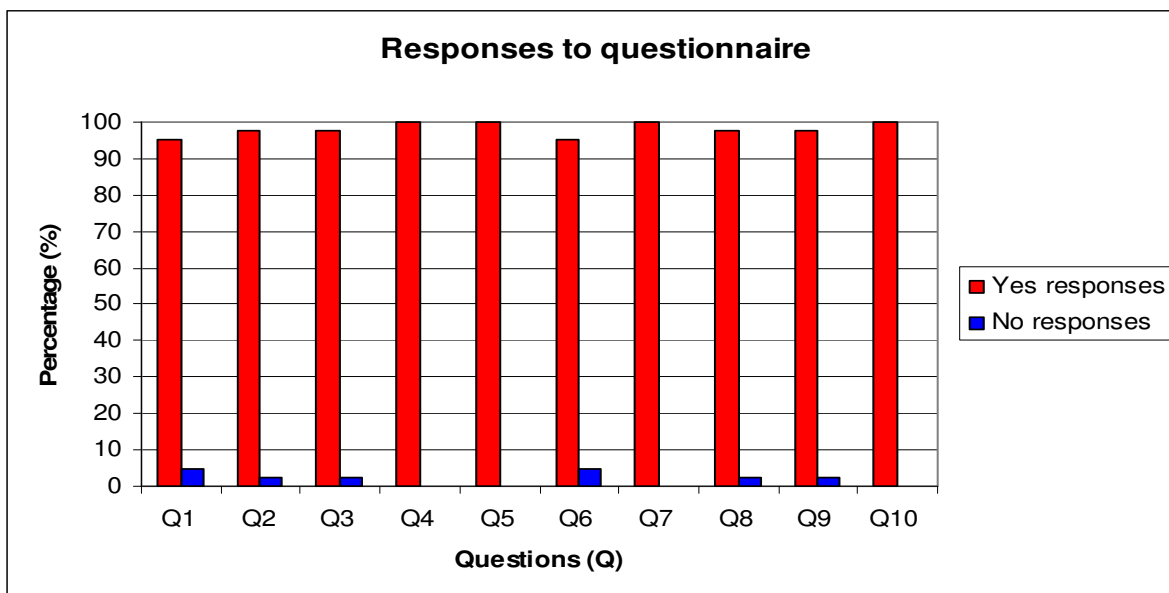


Figure 4.3 Percentages of positive and negative responses to checklist questions

Key: Q=question

4.7.2.2 Descriptive comments

Table 4.1 summarizes the descriptive information obtained from the subjects.

Table 4.1: Summary of comments made by subjects

Comments collected from subjects
1. The booklet encourages the patient to apply the program and make them more psychological satisfied.
2. Distribute this booklet for all patients who will go under ACL reconstruction.
3. Rehabilitation before the surgery is very important for the affected leg.
4. The booklet encouraged the patients to continue doing the exercises even after the rehabilitation.
5. Consider using a CD to deliver this educational program.
6. Good idea to place the three rehabilitation phases in the booklet to be easily accessible for patient.
7. One patient asks for more explanation for the type of surgeries for ACL reconstruction.

4.8 SUMMARY POINTS OF CHAPTER

- A total of 40 patients with ACL reconstruction surgery consented to participate in this study
- All the subjects were male
- The age range was between 18 years to 38 years old with mean age of 28.5 years (SD 5.75).
- Most of the patients (65%) underwent ACL reconstruction surgery to the right knee.
- Of the total sample (n=40), the majority of the subjects who participated in this study (90 %), had ACL surgery for the first time.
- Most of the responses to the evidence-based educational program checklist were positive.

CHAPTER 5

Discussion, limitations, recommendations and conclusion

5.1 DISCUSSION

The thesis reports on the development and validation of an Arabic evidence-based educational program booklet for patients who have undergone Anterior Cruciate Ligament (ACL) reconstruction surgery in United Arab Emirates (UAE). The evidence-based educational program is intended to be given to ACL patients prior to reconstruction surgery for post-reconstruction rehabilitation. The overall objectives of this project were to: 1) develop an evidence-based educational program for patients who have undergone ACL reconstruction surgery in UAE, based on available evidence collated through a systematic review process; 2) forward and back translate the draft generated into Arabic language from the English language; 3) determine the content and face validity of the newly developed evidence-based education program through a focus group feedback process as well as making the required changes for the newly developed evidence-based educational program through a focus group feedback process, to produce the final version of the evidence-based educational program booklet which was used in the main validation study; and 4) validate the final evidence-based educational program booklet.

Patient education programs aim to impart knowledge and skills to individuals so that they may be able to better manage their condition (Osborne et al 2006). If patients are educated about their condition, the prognosis for the disorder, and its long-term management is associated with higher patient satisfaction and better short term outcomes (Burton et al 2004). Education and advice is therefore an important component in the management of orthopaedic patients especially in surgical conditions (McDonald et al 2007). It has been found that educational programs are associated with increased motivation and change the behaviour of patients towards self-management in diabetes (Vatankhah et al 2009). Previous research has shown that 'the Back book', a novel education booklet, had a positive impact on patients with low back pain' beliefs and clinical outcomes (Deberey et al 2009). Effing et al (2007) also reported that educational programs could lead to a decrease in hospital stay in chronic obstructive pulmonary disease (Effing et al 2007).

ACL reconstruction surgery is a common procedure following ACL injuries. However, to date, no clinical guideline or evidence-based educational program exists indicating the most appropriate management prior to and following ACL surgery. Furthermore, while there is evidence that preoperative education may have a modest beneficial effect on preoperative anxiety (McDonald et al 2007) and post-operative recovery, no pre-operative educational program exists for ACL reconstruction patients. The results of a recent study showed that 100% of the patients and 99 % of therapists view preoperative education to be an important component for radiculopathy lumbar surgery (Louw et al 2009). This concurs with studies in other medical disciplines that indicate the importance of preoperative education for patients (Vatankhah et al 2009). It may therefore be beneficial to include an evidence-based educational program in the rehabilitation process of an ACL reconstruction patient pre-operatively, to encourage the patient to continue the rehabilitation following surgery.

In countries like the UAE, where ACL injuries are prevalent (Demirag et al 2004), education about short- and long-term benefits of rehabilitation should be staple outcomes for each patient undergoing ACL reconstruction. The lack of published studies supporting the use of evidence-based educational programs in ACL populations plays a big role in the fact that no such evidence-based educational programs have been implemented. There is also a lack of physiotherapists specializing in ACL rehabilitation in UAE, and this further warrant the need for patients to be self-informed and motivated to continue rehabilitation on their own. Furthermore, the reason for the surgery may emerge as most important to patients, because the patient wants to know how their underlying pathological or structural abnormalities will be addressed by the surgical procedures (Tyonne et al 2005). Patients have also previously rated 'understanding the reason for surgery' as the most important aspect of the pre-operative education. Pre-operative information about how surgery may impact symptoms may be particularly important for patients (Louw et al 2009). Patients need to develop realistic goals associated with the outcome of the surgery to alleviate the pain (Tyonne et al 2005). It is therefore important that pre-operative evidence-based educational programs are incorporated into the rehabilitation of ACL patients. The pre-operative education program should address how surgery may negatively impact a patient's physical ability, social interaction and being able to take care of themselves and their families (Gross et al 2006). Addressing limitations may help patients set realistic goals and expectations for recovery and return to function (Louw et al 2009). This may consequently provide patients with an increased understanding for how ACL

reconstruction surgery will impact their function. This project presents the first attempt at delivering a preoperative evidence-based educational program for patients undergoing ACL reconstruction in the United Arab Emirates.

The clinical recommendations generated from the results of the systematic review (Chapter 2) were used to develop the evidence-based educational program which would provide patients with updated evidence-based information regarding the anticipated rehabilitation program he/she may undergo following an ACL reconstruction surgery. The evidence-based information reported in this review was derived from secondary research to determine which rehabilitation strategies were most effective in improving outcome measurements (namely decreasing pain and swelling, as well as improving knee function, knee ROM, and muscle strength ROM, reduce swelling, improving muscle strength and functional activity) following ACL reconstruction surgery. Although there are various ways in which educational programs can be delivered (Lysack et al 2005), the traditional methods of educational program delivery consists of demonstrations, verbal feedback, and written materials. For the purposes of this project it was decided that an evidence-based booklet would be the most appropriate way to deliver the newly-developed evidence-based educational program.

The development of the evidence-based educational program booklet for ACL patients was successful and resulted in a descriptive and informative educational program. It is simple and clear, and therefore easy to understand, which is important for relating information to patients and also the physiotherapist. It is also interesting since research findings were included, but not made the centre of attention, but just as add-ons to the information. It is appropriate as it included descriptive information for all rehabilitation phases, namely early-, mid- and the late-phase of the ACL rehabilitation program. The illustrations of the exercises were bright and colorful, and were believed to possibly motivate patients and capture their attention. The use of the question headings also facilitated easier reading and understanding for the patient. Furthermore, the evidence-based educational program was developed using groups of patients and physiotherapists to review and comment on the content of the evidence-based education program. This is of importance as patients should feel at ease knowing that the evidence-based educational program was developed by other patients with a similar condition. The involvement of patients and physiotherapists make the evidence-based educational program user-friendly to the specifically targeted ACL patient population. Since both the

patient and physiotherapist were allowed to give their ideas about the content of the evidence-based educational program, the views of both patient and clinician were captured. This resulted in an evidence-based educational program which was applicable to both an ACL patient and a physiotherapist working with ACL patients.

The most important aspect of the newly-developed educational program is that it is evidence-based. Evidence-based practice is important to inform health professionals of the most appropriate management pathways for optimal patient care. Although it is important to publish evidence-based guidelines and keep them up-to-date and relevant for the different disciplines, disseminating the knowledge to clinicians and patients is also very important to ensure good clinical practice (Finestone et al 2009). Making research findings interpretable is a goal of evidence-based practice (Fritz et al 2009). The pre-operative evidence-based educational program developed in this study was derived from evidence-based information. It was however designed in such a way that it could be related to patients easily. The referencing to the evidence was included, but did not overpower the main aim of the evidence-based booklet and make the information difficult to understand. Attention was placed on strategically adding the research findings in the evidence-based booklet, and highlighting the specific aspects for which evidence was available. This ensured that patients would be able to identify the exact evidence-based information pertaining to their rehabilitation. The reference list was included in the back of the evidence-based booklet to support the evidence-based knowledge presented in the booklet.

The inclusion of instructions to manage pain in the evidence-based booklet was pertinent to address pain education in the ACL patient population. A study by Louw et al (2009) indicated that pain and the desire to know about pain was the main reasons for wanting pre-operative education regarding surgery. It was therefore important to include a section pertaining to pain for the ACL patients. Patients are interested in pain as well as the degree of post-operative pain. Patients should therefore be educated more about pain and more precisely about the science of pain (Moseley, 2003). Studies have shown that patients are capable of understanding the neurophysiology of pain, but health professionals underestimate patients' ability to understand the complex issue related to pain (Moseley, 2003). Improved understanding of pain science may lead to a decrease in the fear and anxiety associated with ACL reconstruction surgery and could potentially result in better outcomes related to decreased pain and improved function (Moseley 2003).

However, the level at which patients should be educated and whether the education is appropriate for the specific population should be decided upon. At this point it was deemed important that the ACL patients need only know the basics of pain and not be bombarded with pain science information.

The patients included in the survey were asked to comment on the evidence-based educational program. This assisted the principle researcher in attending to any shortcomings presenting in the evidence-based educational program. The patient had the freedom to express his/her ideas and to make suggestion on how the evidence-based educational program could be improved. The comments suggested by the group of patients were considered. It is suggested that these shortcomings or ideas are implemented in future evidence-based educational programs. One of these suggestions was to possibly place the evidence-based educational program on a CD. Since technology has become common place in most societies, this suggestion of using a CD could be more ideal for some patients. However, patients should have the opportunity to decide on which method of delivery they would prefer. As mentioned earlier, the evidence-based booklet format is a traditional way of delivering educational programs, and was therefore used instead of other methods or technologies, since it was believed to be the most reliable way of delivering the evidence-based educational program at the time of the study.

The majority of the subjects responded positively to the evidence-based educational program presented to them prior to their ACL reconstruction surgery. All the subjects felt that evidence-based educational program was clear, that the sentences were constructed in a non-ambiguous manner, that they understood the mid-phase advice and that they benefitted from the evidence-based educational program. The majority of the subjects felt that the evidence-based educational program was easy to follow, interesting, could understand the early and late-phase advice, and that the evidence-based educational program was encouraging. It is also notable, that all the subjects were satisfied with the inclusion of the late-phase advice as it pertained to injury prevention. The positive responses could have been due to the fact that the subjects were satisfied with the knowledge conveyed through the evidence-based educational program and that the evidence-based educational program eased their anxiety toward the upcoming surgery. It could also have been that the evidence-based educational program may have answered specific questions that they may not have felt at ease to ask the health professional. Furthermore, since the evidence-based educational program was in a language that they

understood, at a level appropriate for them, and compiled by patients for patients, it may have been more acceptable. However, it may have been interesting to possibly determine if a specific population may be more willing to accept such an evidence-based educational program, than another population. In the Arabic community, it is common place to accept and comply with what is proposed as beneficial to the health of an individual. It is therefore not seen as good manners to refuse a gesture of good will. Furthermore, freedom of willingness to participate in this study was clear and no subject was forced or coerced into participating in this study.

Other comments suggested by one patient during the validation of the evidence-based educational program felt that more information was required regarding the different type of surgery for ACL reconstruction. However, this suggestion may not be feasible as the detailed inclusion of surgery procedures may confuse the patient and be too much information to absorb. The inclusion of just enough explanation of the ACL reconstruction is deemed as sufficient in this evidence-based educational program. It kept the evidence-based educational program simple and easy to understand. Furthermore, if the patient required more information after reading the evidence-based educational program; he/she was free to ask the physiotherapist who would answer to his/her best ability. If a patient still however, wants more information regarding the surgery procedures, he/she can either do further investigations on the internet or ask the surgeon, who would be the best person to approach.

5.2 LIMITATIONS OF THIS STUDY

This study reports on initial steps in the validation of a newly-developed evidence-based educational program. The number of individuals who participated in the focus groups interviews may have been too small and future studies should incorporate larger focus groups with a multidisciplinary panel. Furthermore, the focus groups used in the preliminary studies (Chapter 3) only consisted of patients and physiotherapists. It may have been better to include ACL surgeons. The interview guide questions were primarily closed-ended although the researcher encouraged the patients and physiotherapists to explain their responses. This limited the qualitative information and readdressed in future studies.

Another aspect that could have presented as a limitation was the fact that all the subjects included in this study were male. This may however have been due to the fact that ACL

injuries are more common among males and the inclusion of females was not possible at the time of data collection.

Another possible limitation could have been the fact that the principle researcher was female. In the Arabic culture, it is regarded as strange for one female to be amongst a group of males. The males seemed to shy away from the principle researcher, regardless of the fact that she was a medical professional.

5.3 RECOMMENDATIONS

From the results of this study it can be recommended that the evidence-based educational program is a valid tool which can be given to ACL patients prior to ACL reconstruction to prepare them for the rehabilitation postoperatively. The positive feedback regarding the evidence-based educational program indicates that the evidence-based educational program will be acceptable to include in the management of ACL patients. Although this study was conducted in UAE, the results can be extrapolated and can influence similar studies to be conducted in other countries where ACL reconstruction surgeries are common. This study was a validation study and future research should focus on investigating the effect of the evidence-based educational program in an ACL population. The empirical evidence would further support the introduction of the evidence-based educational program into ACL wards.

5.4 CLINICAL APPLICATIONS

As mentioned before the evidence-based educational program could be of benefit if given to ACL patients prior to ACL reconstruction to prepare them for the rehabilitation postoperatively. It could lead to ACL patients not being as anxious about the surgery or the post-operative complications. 'Knowledge is power', and although a cliché, is very applicable in patient care. If a patient is informed of his condition, the expected outcomes of his condition and the effect of doing exercises to improve his condition, the patient will be more encouraged to partake in rehabilitation, as he/she knows it is for his/her own good. This will influence functional and clinical outcomes of ACL patients. Physiotherapists can use the evidence-based educational program to encourage patients and to make the rehabilitation process as easy as possible for both patient and clinician. The easy access information also makes the evidence-based educational program a quick reference guide for clinicians. Furthermore, pertaining to the ACL surgeon, the evidence-based educational program may contribute to the success rate of the surgery.

5.5 CONCLUSION

It can be recommended that the newly-developed evidence-based educational program is a valid tool which can be given to ACL patients prior to ACL reconstruction to prepare them for the rehabilitation postoperatively. The positive feedback regarding the evidence-based educational program indicates that the educational program will be acceptable to include in the management of ACL patients. The evidence-based educational program booklet provides a quick reference for patients and clinicians, and is deemed clear and easy to understand. By informing patients of their condition, the expected outcomes of their condition and the effect of doing exercises to improve their condition, the patients will be more encouraged to partake in rehabilitation, as they know it is for their own good. This will ultimately improve overall patient care and improve management of ACL patients.

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APPENDICES

Appendix 1: Letter to Zayed Military Hospital and
Abu Dhabi Knee and Sport Medicine Center

Appendix 2: Letter from - A. Zayed Military Hospital
B. Abu Dhabi knee and sport medicine centre

Appendix 3: Patient Informed consent form
(English and Arabic language)

Appendix 4: Interview questions for focus group of physiotherapist

Appendix 5: Checklist for ACL reconstruction patients (checklist in English and Arabic)

Appendix 6: An evidence-based educational program booklet among ACL
reconstruction patients (English and Arabic version)

Appendix 1

A. Letter to Bayed Military Hospital Commander and to Abu Dhabi Knee and Sport Medicine Centre.

Dear Sir,

The effectiveness of an educational program on adults patients with hamstring reconstruction for ACL injury in UAE.

The above research project is part of the MSc course in physiotherapy, at the Stellenbosch University in Cape Town, South Africa. The aim of this study is to contribute towards an understanding of pre- and post-operative education for adult patients with a hamstring graft reconstruction for ACL injury.

ACL rupture is one of the most common debilitating knee injuries that can result in significant functional impairment. The incidence of isolated ACL tears is estimated to be 30 per 100,000 of USA population per year. There is little evidence into effectiveness of rehabilitation education programs, pre-and post-operative of ACL. Increased understanding of patients' pre- and post-operative educational needs can impact patient care and outcomes in the field of ACL surgery. Once educational needs have been identified, further studies can be performed to determine if pre- and post-operative programs, initially based on the patients needs, have superior outcomes and decrease disability. Superior outcomes would provide significant benefit to all medical personnel caring for the ACL reconstruction patient, including physical therapy in general and the role of the physical therapist in pre-and-post operative care for the ACL reconstruction patient.

We are hereby seeking permission to conduct the study at your hospital. The study has the potential to improve the rehabilitation program and outcomes of ACL patients who have received the hamstring reconstruction.

Thank you for your time and participation

Hana Al Zaabi
BSc physio (UAE)

Prof. Quinette Louw

Mrs. Lynette Crous
HOD Physiotherapy (US)

Appendix 2

Letter from : A. Zayed Military Hospital hospital

*GHQ Armed Forces
Logistic Staff
Directorate Of Medical Services
Zayed Military Hospital*



القيادة العامة للقوات المسلحة
هيئة الإسعاف
مديرية الخدمات الطبية
مستشفى زايد العسكري

April 18, 2007

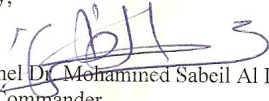
Stellenbosch University
Cape Town
South Africa

To Whom It May Concern

Re: The effectiveness of an educational program on adults patients with hamstring reconstruction for ACL injury

This is to inform you that we have approved the above mentioned research project to be carried out at Zayed Military Hospital, Physiotherapy Department, under the supervision of Mrs. Hana Al Zaabi, Mrs. Lynette Crous and Prof. Qunite Louw.

Sincerely,


Lt. Colonel Dr. Mohammed Sabeil Al Dhanhani
Deputy Commander
Zayed Military Hospital



B. Abu Dhabi knee and sport medicine center



مركز أبوظبي لجراحة الركبة و الطب الرياضي
Abu Dhabi Knee & Sports Medicine Centre

May 10, 2007

To whom it may concern,

This is to certify, Ms. Hana Al Zaabi, a master degree student of Stellenbosch University in Cape Town, South Africa, has performed her research in Abu Dhabi Knee & Sports Medicine Centre regarding the effectiveness of an Educational Program on adult patients with ACL hamstring reconstruction injury in United Arab Emirates.

Dr. Charles Brown
ADKSMC Medical Director

Appendix 3

Informed Consent forms for patients PARTICIPANT INFORMATION LEAFLET & CONSENT FORM

TITLE OF THE RESEARCH PROJECT:

Validation of final version of a newly-developed educational program booklet among anterior cruciate ligament reconstruction patients.

REFERENCE NUMBER:

PRINCIPAL INVESTIGATOR: Miss Hana Al Zaabi

ADDRESS: P.O.Box:35272
Abu Dhabi
U.A.E

CONTACT NUMBERS: (971) 506119178 or (971) 507100323

You are hereby being invited to take part in a research project. Please take some time to read the information presented, which will explain the details of this project. Please ask the study staff any questions about any part of this project that you do not fully understand. It is very important that you are fully satisfied and that you clearly understand what this research entails and how you could be involved. Also, your participation is **entirely voluntary** and you are free to decline to participate. If you say no, this will not affect you negatively in any way whatsoever. You are also free to withdraw from the study at any point, even if you do agree to take part.

This study has been approved by the **Committee for Human Research at Stellenbosch University** and will be conducted according to the ethical guidelines and principles of the International Declaration of Helsinki, common rule.

What is this research study all about?

- *This research is about evaluating the importance of patient education for patients who will receive surgery for their anterior cruciate ligament (ACL) injury. The ACL is the most commonly injured ligament in the body and is important in the function of the knee joint.*
- *Patient education is about informing the patient about the surgery as well as self management skills which can help to improve the function of your knee after the surgery.*
- *The research will involve a group of 40 patients. The principle researcher will deliver an educational program specifically designed for patients with ACL injuries to patients assigned to the intervention group.*

Why have you been invited to participate?

- *A group of about 40 patients who are scheduled to undergo ACL reconstruction surgery at Zayed Military Hospital or Abu Dhabi Knee and Sport Medicine Centre at the time of this study, have been asked to participate in this study.*

What will your responsibilities be?

- *By agreeing to participate in this study, you will be asked to allow the physiotherapist to present the ACL injury to you before and again after your knee operation.*

Will you benefit from taking part in this research?

- *There are no personal benefits by participating in this study. The aim of this study is to improve the physiotherapy management and particularly education to patient receiving knee surgery for an ACL injury.*

Who will have access to your personal records?

- *No personal data will be recorded for this study.*

Will you be paid to take part in this study and are there any costs involved?

- *No you will not be paid to take part in the study. There will be no costs involved for you, if you do take part.*

Is there anything else that you should know or do?

- *You can contact the Committee for Human Research, Stellenbosch University, Cape Town, South Africa, at 011-2721-938 9207 if you have any concerns or complaints that have not been adequately addressed by your study doctor.*

You will receive a copy of this information and consent form for your own records.

Declaration by participant

By signing below, I agree to take part in a research study entitled. Validation of final version of a newly-developed educational program booklet among ACL reconstruction patients

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is **voluntary** and I have not been pressurized to take part.
- I may choose to leave the study at any time and will not be penalized or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the study doctor or researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.

Signed at (*place*) on (*date*) 2009.

.....
Signature of participant

.....
Signature of witness

Declaration by investigator

I (*name*) declare that:

- I explained the information in this document to
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above
- I did/did not use a translator. (*If a translator is used then the translator must sign the declaration below.*)

Signed at (*place*) on (*date*) 2009.

.....
Signature of investigator

.....
Signature of witness

Patient Inform Consent form in Arabic Language

إبلاغ للموافقة من المرضى
وثيقة معلومات للمشاركين ونموذج تبليغ

اسم مشروع البحث: توثيق وتأثير وفعالية البرنامج التثقيفي على المرضى البالغين المصابين بإصابة الرباط الصليبي الأمامي (ACL Reconstruction) في دولة الإمارات العربية المتحدة.

العنوان: صندوق البريد رقم 35272

أبو ظبي - دولة الإمارات العربية المتحدة.

تلفونات الاتصال: 506119178 (971) أو 507100323 (971)

يسرنا أن ندعوكم للمشاركة في هذا البحث العلمي. يرجى أخذ بعض الوقت لقراءة المعلومات المذكورة هنا، والتي تشرح تفصيلاً هذا البحث. كذلك يرجى الاستفسار من العاملين على هذا البحث عن أي شيء لا تفهموه في هذا المشروع. يهمننا جداً أن تكونوا مقتنعين تماماً بأنكم تفهمون ما يتطلبه هذا البحث وكيف يمكنكم التفاعل معه. كذلك، يرجى العلم أن مشاركتكم هي طوعية تماماً وبرغبتكم الخالصة ولكم كامل الحرية بعدم المشاركة. وإذا اخترتم عدم المشاركة فلن يؤثر هذا سلباً عليكم بأي حال من الأحوال. كذلك يمكنكم الانسحاب من هذه الدراسة في أي وقت تشاؤون حتى لو وافقتم في البداية على ذلك.

هذه الدراسة مصادق عليها من قبل (The Committee for Human Research at Stellenbosch University)، وسيتم تنفيذها حسب التوجيهات الأخلاقية ومبادئ القاعدة العامة لاتفاقية هلسنكي الدولية.

ما أهمية هذا البحث العلمي وعن ماذا يبحث؟

- يدور هذا البحث العلمي حول تقييم أهمية تثقيف المرضى الذين ستجرى لهم عمليات جراحية والمصابين بتمزق الرباط الصليبي (Anterior Cruciate Ligament)، لأن هذه الإصابة هي أكثر الإصابات شيوعاً في الجسم وهي هامة جداً لعمل مفصل الركبة.
- عملية تثقيف المصابين هو القيام بإبلاغهم عن العملية الجراحية بالإضافة إلى تعليمهم مهارات العناية بأنفسهم التي قد تساعدهم لتحسين عمل ركبهم بعد العملية الجراحية.
- سيجري هذا البحث العلمي على مجموعة تتكون من (45) مريضاً، وسيتم تقسيم هذه العينة تسلسلياً ستقوم أخصائية العلاج الفيزيائية بتقديم البرنامج التثقيفي/التعليمي المصمم خصيصاً للمصابين بإصابة في (Anterior Cruciate Ligament) وهم الذين سيتم تعيينهم في البحث. في هذه المرحلة لن يكون للبرنامج التثقيفي أي فعالية أو تأثير واضح، ولذلك لن يكون هنالك أي إثبات بأنه أفضل من المعالجة الفيزيائية المعتادة.

لماذا ندعوكم للمشاركة؟

- لقد تقرر دعوة مجموعة تقدر بحوالي (45) شخصاً من المصابين الذين تقرر لهم طيباً القيام بـ (ACL reconstruction) في مستشفى زايد العسكري أو في مركز أبو ظبي لمعالجة الركبة والإصابات الرياضية للمشاركة في هذا البحث لتوثيق الفوائد العائدة من هذا البحث وإمكانية استخدامه مستقبلاً بشكل أوسع في كافة مستشفيات الدولة؟

ما هو المطلوب من المشاركين وما هي مسؤولياتهم؟

- بموافقتكم على المشاركة في هذا البحث تسمحون لاختصاصي العلاج الطبيعي الفيزيائي أن يشرح لكم الإصابة (anterior cruciate ligament) قبل عملية الركبة وبعدها.

ما هي الفائدة التي ستجنيونها من هذا البحث؟

- لا يوجد أية مكاسب شخصية يجنيها المشاركون في هذا البحث، حيث أن الهدف منه هو تحسين إدارة المعالجة الفيزيائية وخاصة تعليم المرضى الذين تتم معالجتهم بعملية الركبة لإصابة (anterior cruciate ligament).

من الذين سيسمح لهم بالإطلاع على سجلاتكم الشخصية؟

➤ لن يتم تسجيل أية معلومات شخصية عنكم في هذا البحث.

هل سيدفع لكم أية نقود مقابل المشاركة في هذا البحث وهل هنالك أية تكاليف ترافقه؟

➤ لن يدفع للمشاركين أية مبالغ مالية مقابل المشاركة في هذا البحث، ولن يطلب من المشاركين أن يتكفوا أية نفقات للمشاركة فيه.

هل هنالك أي شيء آخر يجب أن تعرفه أو تعمله لمصلحة هذا البحث؟

➤ يمكنك الاتصال بلجنة الأبحاث الإنسانية في جامعة (*Stellenbosch University, Cape Town, South Africa*) 9207 9207-011 (Africa) إذا كان لديكم أية شكوك حول هذا البحث أو إذا شعرت بأنكم لم تحصلوا على المعاملة الصحيحة من قبل الطبيب المعالج.

➤ سيكون لدى كل مشارك نسخة للاحتفاظ بها لديه/لديها من هذه الدعوة للرجوع إليها عند الحاجة.

تعهد وإقرار من قبل المشارك

أتعهد أنا الموقع أدناه بالمشاركة في هذا البحث العلمي تحت عنوان أثار البرنامج التنقيفي/التعليمي على المرضى البالغين الذين يعالجون من إصابة في (reconstruction for ACL injury) في دولة الإمارات العربية المتحدة. وبناء على ذلك أقر بما يلي:

- قرأت / قرأت لي هذه المعلومات ونموذج التعهد للمشاركة في هذا البحث العلمي وقد كتب بلغة مريحة أفهمها وأجيدها جدا.
- أعطيت لي الفرصة للاستفسار وطرح الأسئلة وتلقيت إجابات شافية على كافة استفساراتي.
- أفهم أن مشاركتي في هذا البحث العلمي هي طوعية تماما وبرغبتي ولم تمارس ضدي أية ضغوط للمشاركة.
- يمكنني أن أقرر التوقف عن المشاركة في هذا البحث في أي وقت أشاء ولن يتم تغريمي أية مبالغ مالية أو تغيير معاملي بعد ذلك أو التمييز ضدي نتيجة ذلك.
- من المحتمل أن يطلب مني عدم المضي في المشاركة قبل انتهائها، إذا شعر الطبيب أو المعالج أنه من الأفضل لي عدم المشاركة. وبناء على ما تقدم أوقع بأدناه.

تم التوقيع في (المكان): التاريخ:

.....
توقيع المشارك
توقيع الشاهد

تعهد وإقرار من قبل الباحث

أتعهد أنا (اسم الباحث)..... بأنني:

- قمت بشرح كافة المعلومات المبينة بهذه الوثيقة إلى.....
- شجعت/شجعته على طرح الأسئلة والاستفسارات وأخذ الوقت المناسب للإجابة عليها.
- أنني مقتنع تماما أنه/أنها تفهم كافة جوانب هذا البحث وتمت مناقشتها كما في أعلاه.
- قمت/لم أقم باستخدام مترجم. (إذا تم استخدام مترجم يجب أن يقوم المترجم بالتوقيع على هذا التعهد).

تم التوقيع في (المكان): في (تاريخ):

.....
توقيع الباحث
توقيع الشاهد

Appendix 4

Interview guide

for focus group of physiotherapist and patients

Please answer the following Questionnaires with Yes or No and explain where appropriate.

No.	Questions	Yes	No
1.	Is the structural format of the educational program easy to follow? Please explain.		
2.	Is the presentation of the educational program interesting? Please explain		
3.	Is the aim of the booklet clear? Please explain		
4.	Does the structure of the educational program follow a logical layout? Please explain		
5.	Are the sentences in the educational program clear and easy to understand? Please explain		
6.	Do you think the booklet is the best way of delivering this information? Please explain		
7.	Do you think the booklet covers all necessary information? Please explain		
8.	Do any of the educational program content infringe on the correspondent's privacy? Please explain		
9.	Do you have any other comments about the ACL Educational program? Please explain		

Extra Comments: (If you have any additional comments please write the here)

1.

2.

3.

4. Signature: -----

Appendix 5

Checklist for ACL reconstruction patients

(To be completed 1 week after discharge)

Name: Age:

Gender: F or M: Hospital: first or second ACL surgery

Please read the following question and put x where appropriate under the columns yes or no.

No.	Questions	YES	NO
1.	Did you use this evidence-based booklet last week?		
2.	Is the structural format of the evidence-based education program easy to follow? If not please indicate which aspect is not clear		
3.	Is the presentation of the evidence-based educational program interesting? If not, please explain.		
4.	Is the aim of this evidence-based educational program clear? If not, please make suggestions for improvement.		
5.	Are the sentences in the evidence-based educational program clear? If no, which sentences are ambiguous?		
6.	Did you understand the early -phase (advice) of the evidence-based educational program?		
7.	Did you understand the mid - phase (advice) of the evidence-based educational program?		
8.	Did you understand the late- phase (advice) of the evidence-based educational program? If not, what you did not understand?		
9.	Is the evidence-based booklet encouraging you to do the exercises? Explain your answer.		
10.	Do you think you have benefited from the educational program? Please explain your answer.		

Additional Comments. (If you have any additional comments please write them here).

1.

2.

3.

Signature:

مجموعة أسئلة

لمرضى إعادة بناء الرباط الصليبي

(للتعبئه بعد أسبوع واحد من الخروج من المستشفى)

الإسم: العمر: الجنس: ذكر أم أنثى:

المستشفى: الركبه: اليمني ام اليسري .

هل عملية الرباط الصليبي هذه الأولى أم الثانية.

الرجاء قراءة الأسئلة التالية ووضع إشارة (×) في المكان المناسب في العمودين (نعم أم لا).

ت	السؤال	نعم	لا
(أ)	(ب)	(ج)	(د)
1.	هل استخدمت هذا الكتيب في الأسبوع الماضي؟		
2.	هل وجدت نموذج البرنامج التعليمي سهل الاستخدام؟		
3.	هل كانت طريقة تقديم البرنامج التعليمي مشوقة؟ إذا كان الجواب لا ، أرجو التوضيح.		
4.	هل وجدت أن الهدف من هذا البرنامج التعليمي واضحاً؟ إذا كان جوابك لا , أرجو وضع اقتراحاتك للتطوير أو التحسين.		
5.	هل جمل البرنامج التعليمي واضحة؟ إذا كان جوابك لا، أي الجمل غير الواضحة؟		
6.	هل فهمت المرحلة المبكرة (النصيحة) من البرنامج التعليمي؟		
7.	هل فهمت المرحلة الوسطى (النصيحة) من البرنامج التعليمي؟		
8.	هل فهمت المرحلة الأخيرة (النصيحة) من البرنامج التعليمي؟ إذا كان الجواب لا، ما هي الأمور التي لم تتمكن من فهمها؟		
9.	هل رأيت الكتيب مشجعا للقيام بالتمرين؟ الرجاء توضيح جوابك.		
10.	هل تشعر أنك استفدت من البرنامج التعليمي؟ الرجاء توضيح جوابك.		

الملاحظات الإضافية:

1.

2.

3.

4.

5.

التوقيع.....



All Copyright Reserved



**POST-ACL
RECONSTRUCTION
EDUCATIONAL
PROGRAM**

Hana Alzaabi

**MSc Physiotherapy candidate
Stellenbosch University
Tygerberg
Republic of South Africa**

**Supervisors
Prof. Quinette Louw
Mrs Lynette Crous**



POST-ACL RECONSTRUCTION EDUCATIONAL PROGRAM

► What is the aim of this educational program and who is it intended for?

This aim of this educational program is to assist you in regaining full function of your knee after you have had surgery. The content of this booklet is intended for all adults who have sustained an anterior cruciate ligament (ACL) tear and will have to undergo ACL reconstruction surgery. This educational program has been designed using information from study findings about the usefulness of doing specific exercises and activities after you have had the surgery.

The booklet contains information about:

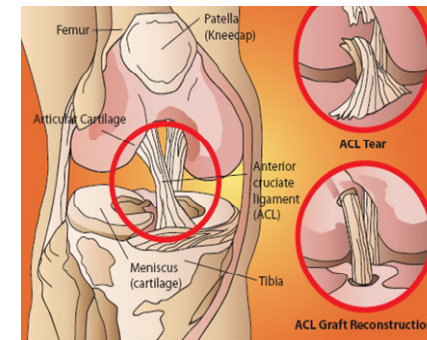
- The ACL reconstruction surgery,
- Your role in the rehabilitation after surgery, and
- How and why you have to do exercises and functional activities to help your knee regain normal function.

► What is the ACL?

Inside your knee joint you have ligaments, tendons, and muscles which are specific structures that give your knee stability and strength (Graaff 2001). The ACL is one of four major ligaments that stabilize the knee joint (Risberg et al 2004) and it prevents the lower leg bone from sliding forward too much.

► How is the ACL injured?

ACL injuries are one of the most common knee ligament injuries. The injuries of the ACL ligament can consist of partial or total tears in the ligament itself or where it attaches to bone (Kisner et al 1996). Tears can cause pain and swelling, as well as instability, which can make your knee 'give way' and result in significant functional impairment (Risberg et al 2007).



► How is the ACL repaired?

A torn ACL will not heal by itself and must be reconstructed by using ligaments or tendons from another part of the body to replace the torn ACL with healthy strong tissue (namely, a graft) (Brown et al 2004, Brown and Nader 2005, Ergen 2004). The graft is most often taken from the tendon just below the knee cap (Brown et al 2004, Brown and Nader 2005, Ergen 2004).

► What happens after I have had the ACL reconstruction surgery?

After surgery you will have restriction of your knee movement. Gradually the muscles around the knee will weaken and your knee may feel unstable when you try to walk. For these reasons you will need specific ACL rehabilitation.

A physiotherapist-led rehabilitation program will help you regain knee function after the surgery (Risberg et al 2004, Trees et al 2007, and Wright et al 2008b).

If you follow and participate actively in the rehabilitation program after your surgery, it will help you to:

- control the pain and swelling around your knee
- restore your normal active knee movement
- develop sufficient muscle strength for normal walking
- perform your activities of daily living independently
- regain good balance and stability
- prevent further injury to your knee.

► Will early movement of the knee cause harm?

You will experience pain at your knee after surgery, but this should not stop you from starting to move your knee gradually. The early movement of your knee will help in reducing your knee pain and prevent knee stiffness.

Early joint motion is beneficial to reduce pain and prevent knee stiffness (Trees et al 2007).



► Should I start knee exercises shortly after surgery, even though I have the pain?

One of the first exercises the physiotherapist may teach you, is how to contract the front thigh muscles, called the quadriceps muscle. When performing this exercise, you can exercise within limits of your pain.

Performing the quadriceps exercises when pain can be tolerated is as effective as when the patient is taught to exercise through pain. Within the first few days, it is thus advisable that these exercises can be done within limits of pain (Beynon and Johnson 1996).

► What does the rehabilitation program consist of?

The rehabilitation program will consist of 3 phases (early phase, mid phase and late phase). The duration (in days and weeks) of the rehabilitation phases are as follows:

The early phase, including hospital stay (day 1 to 2 weeks)

The mid phase (2 to 8 weeks)

The late phase (after 8 weeks)

During each phase the following activities can be started:

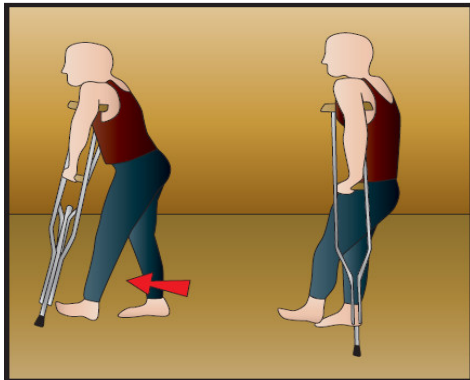


THE EARLY PHASE (DAY 1 TO WEEK 2)

Walking

As your pain improves and becomes tolerable, you can start walking around using crutches. The physiotherapist will teach you how to use the crutches and will advise you on the weight-bearing exercises that you may practice. It is advisable to gradually increase the time of walking and the amount of weight-bearing you can tolerate on your operated leg from the first day post-surgery.

Early weight bearing exercises will help you to restore and improve your normal walking, muscle strength and decrease knee pain (Risberg et al 2004, Wright et al 2008).



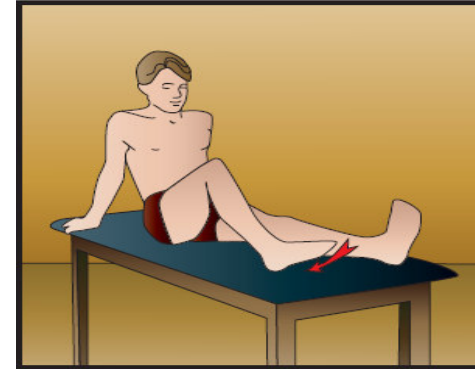
Crutch walking

5



Exercises

The physiotherapist will teach you how to do strengthening exercises to the muscles at the back of the thigh (called the hamstring muscles).



Hamstring strengthening

With your foot straight, tighten the muscles on the back of your thigh by pushing your heel down into the bed or table: Hold for 6 seconds, repeat 10 times per set, do 3 sets per session x 3 sessions a day.

Strengthening exercise for the hamstring muscles is useful in restoring knee function after surgery (Risberg et al 2004, Trees et al 2007, and Wright et al 2008b).

► When can I walk without crutches?

Continue to use the crutches for walking until you can tolerate full weight on your involved leg and walk normally without limping. You can gradually wean yourself off the crutches and your physiotherapist will give you advice regarding this.

6



► When will I leave the hospital and what do I have to do after leaving the hospital?

- You will be discharged from hospital on the third or the fourth day after surgery.
- Following discharge you can apply the ice on your knee at home to reduce the pain and swelling (Raynor et al 2005).

The exercises you will do during physiotherapy follow-up sessions are not enough to improve your knee function and gain the maximum benefits of your exercises; it is therefore important to practice them regularly on a daily basis at home. Continuing your exercises regularly at home are as important as the exercises you do in the physiotherapy follow-up sessions to build up your muscle strength and improve your knee movements.

It is important to continue your exercises at home regularly in addition to the exercises you do during your physiotherapy follow up sessions in order to ensure that your knee will optimally improve (Trees et al 2007; Risberg et al 2004 and Wright et al 2008).



► Will early discharge from the hospital affect my knee improvement?

Early discharge from the hospital will not affect your knee improvement. Before discharge your physiotherapist will provide you with a home exercise program to continue regularly at home and you will be referred as an outpatient for physiotherapy follow-up sessions. The evidence shows that home exercise program is as effective as the exercises which are directly supervised by your physiotherapist in improving muscle strength, decreasing knee laxity and improving knee function

There is some evidence that home-based rehabilitation programs are actually just as effective as exercises which are directly supervised by your physiotherapist in improving muscle strength, decreasing knee laxity and improving knee function (Trees et al 2007; Risberg et al 2004 and Wright et al 2008a).



DURING THE MID PHASE (2 TO 8 WEEKS FOLLOWING YOUR ACL SURGERY)

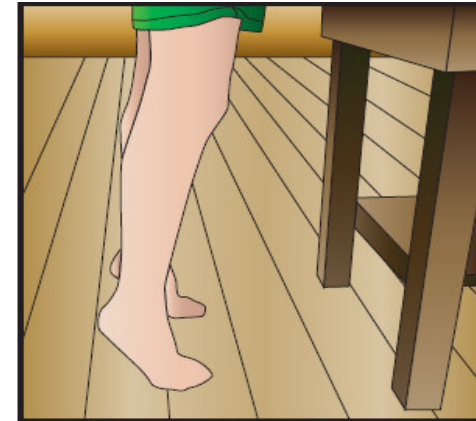
In addition to the exercises described above in the early phase, the physiotherapist may progress your program with the following exercises to further improve the movement of your knee to reach 90 to 100 degrees of bending and the strength of the muscles of the involved leg.

Some of the useful exercises that the physiotherapist may instruct you to do are:



Partial squat

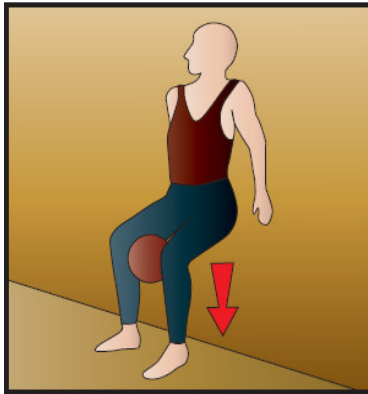
Stand with feet at shoulder width in a slightly externally rotated position. Use a table for stability, and gently lower the buttocks backward and downward. Hold for 6 seconds, repeat 10 times per set, do 3 sets per session x 3 session per day.



Heel raises

While standing, place hands on a flat surface such as a table for stabilization and gently raise the heel off the floor and balance on the ball of the feet. Hold for 6 seconds and ease slowly back down. Do 3 sets of 10 repetitions each day.

After your hamstrings have become stronger and you feel your leg is more stable, you can continue with strengthening the quadriceps muscle (a large muscle in front of the thigh). A good way to do this is to do a wall squat with a ball:



Wall squat with a ball

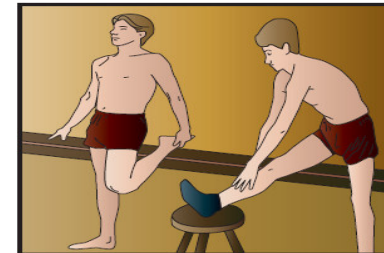
Stand with your back, shoulders, and head against a wall and look straight ahead. Keep your shoulders relaxed and your feet one foot away from the wall and a shoulder-width apart. Place a rolled up pillow or a Nerf ball between your thighs. Keeping your head while squeezing the pillow or ball at the same time. Squat down until your thighs are parallel to floor. Hold the position for 10 seconds. Slowly stand up. Make sure you keep squeezing the pillow or ball throughout this exercise. Do 2 sets of 10 repetitions each day against the wall, slowly squat

DURING THE LATE PHASE (AFTER 8 WEEKS).

► How can I prevent further injury to my knee when I return to sport?

To minimize further injury to your knee, you should:

- Practice warm up and cool down exercises before sports activities and exercises.
- Balancing exercises that can help to prevent further injury to your knee.
- Emphasize functional activities in addition to specific strengthening exercises.



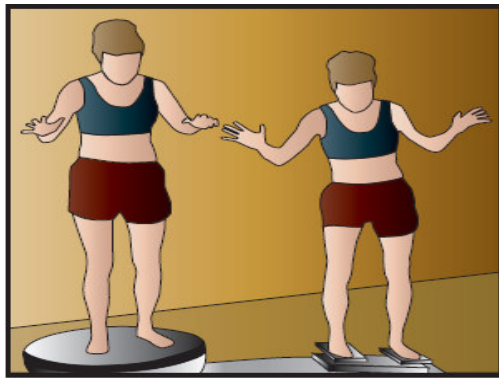
Example stretching exercises

For a front thigh stretch pull your heel slowly toward you buttock until a stretch is felt in the front of your thigh, hold for 8 seconds, repeat 5 times.

For a back of thigh stretch place foot on stool, slowly lean forward reaching down to your shin until a stretch is felt in back of you thigh, hold for 8 seconds, repeat 5 times

To prevent further injuries to your knee it is important to warm up before sports activities and cool down after sports activities exercises (Risberg et al 2004, and Wright et al 2008b).

One of the useful balancing exercises the physiotherapist may teach you is how to maintain your balance on the wobble board and sliding board with your eyes open and progress with your eyes closed as illustrated in the picture below



Wobble board

b. sliding board

Progression of exercise: Stand on the board, try to balance yourself and close your eyes. Try to move your body in different directions and maintain your balance (close your eyes). Maintain your balance for 1 minute, repeat 5 times per set, twice a day.

To prevent further injury to your knee ligaments, you have to practice regular balancing exercises (Hewett et al 2005 and Owen et al 2006).

Walking is an efficient functional exercises for you to practice regularly to improve the endurance of your legs muscles and helps in minimizing further injury to your knee.

C. Walk on the treadmill gradually with a comfortable walking speed to improve your gait pattern 3 times a week for 10-15 minutes twice a day.

Practicing functional exercises regularly is important to minimize further injury to your knee (Hewett et al 2005 and Owen et al 2006).

► Are there any exercises that are better than other exercises?

Your physiotherapist will prescribe all the exercises that you will follow in your rehabilitation program. Currently there is no real evidence to support one exercise over another in the rehabilitation program, but the evidence highlights the importance of performing the exercises since without performing the exercises you will not be able to restore your knee function.

At present there is no real evidence to support one exercise over others but the evidence does highlight the importance of performing the exercises to restore function and normal movement of your knee (Trees et al 2007).

Are exercises in water better than exercises on land for my knee?

There are two physiotherapy exercise approaches, one is to perform the exercises in water, and the other is to perform the exercises on land. Both water - and land-based exercise approaches are equally suitable to be used for you after surgery.

Both water- and land-based exercises are equally suitable to be used after surgery (Risberg et al 2004, Trees et al 2007, and Wright et al 2008b) .

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حقوق الطبع محفوظة

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البرنامج التعليمي بعد إعادة بناء الرباط الصليبي



البرنامج التعليمي بعد إعادة بناء الرباط الصليبي

1. ما هو الهدف من هذا البرنامج التعليمي ومن هم المقصودين به؟

الهدف من هذا البرنامج التعليمي هو مساعدتكم في استعادة العمل الكامل لركبتكم بعد إجراء عملية بها. إن محتويات هذا الكتيب/النشرة تتعلق بجميع البالغين الذين تعرضوا لتمزق في الرباط الصليبي وسيخضعون إلى عملية جراحية لإعادة بناء الرباط الصليبي. لقد تم تصميم هذا البرنامج التعليمي/التثقيفي باستخدام معلومات تم الحصول عليها من نتائج الأبحاث التي أجريت عن تأثير إجراء نشاطات محددة وتمارين معينة بعد إجراء العملية. يتضمن الكتيب معلومات عما يلي:

أ. عملية إعادة بناء الرباط الصليبي.

ب. دورك أو واجبك في إعادة التأهيل بعد العملية.

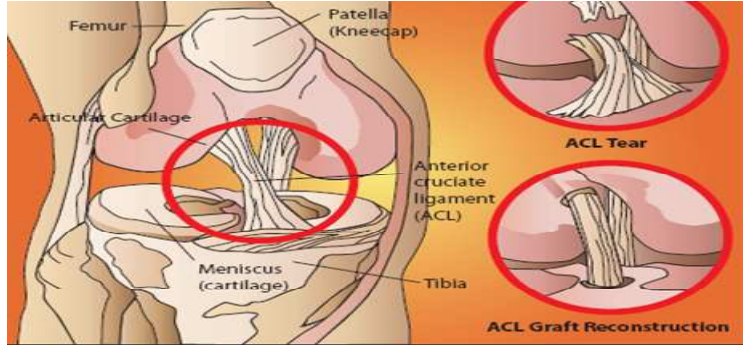
ج. لماذا وكيف تقوم بالتمارين ونشاطات العمل لمساعدة ركبك في العودة إلى العمل الطبيعي.

2. ما هو الرباط الصليبي؟

بداخل ركبك يوجد لديك (ligaments, tendons, and muscles) وهي عبارة عن أبنية محددة تمنح ركبك التوازن والقوة (4). الرباط الصليبي هو أحد من أربعة أربطة رئيسية أذ تقوم بتوازن مفصل الركبة (10) وتمنع عظمة الساق السفلى من الانزلاق بدرجة كبيرة إلى الأمام.

3. كيف يصاب الرباط الصليبي؟

إن إصابات الرباط الصليبي هي أكثر إصابات أربطة الركبة شيوعا. قد تكون إصابات الرباط الصليبي علي شكل تمزق جزئي أو كلي للرباط نفسه أو مكان اتصاله بالعظمة (6). هذه التمزقات قد تسبب الألم والتورم، بالإضافة إلى عدم الاتزان أو التوازن الذي قد يجعل الركبة تستسلم أو تضعف إلى درجة كبيرة جدا وبالتالي ضعف كبير في الأداء (10).



الشكل (1) إصابة الرباط الصليبي

إن أكثر حالات التمزق في الرباط الصليبي شيوعا عندما يقوم الشخص بالوقوف السريع أو الفجائي والحركة الإلتوائية أثناء الرياضة (6). بهذا النوع من الحركة، يتمزق الرباط الصليبي وغالبا يحتاج إلى عملية جراحية لإصلاحه (3).

4. كيف يتم إصلاح الرباط الصليبي؟

لن يشفى أو يلتئم الرباط الصليبي الممزق تلقائيا ويجب إعادة بنائه باستخدام أربطة أو أوتار من جزء آخر من الجسم لاستبدال الرباط الصليبي الممزق بأنسجة صحية قوية (تسمى Graft) (1، 2، 3).

5. ماذا يحصل بعد أن تُجرى لي عملية إعادة بناء الرباط الصليبي؟

بعد العملية سيكون هنالك تقييد على حركة الركبة، بالتدريج تبدأ تضعف العضلات المحيطة بالركبة وقد تشعر أن تصبح الركبة أصبحت غير متوازنة عند محاولة المشي. لهذه الأسباب ستحتاج إلى إعادة تأهيل خاص بالرباط الصليبي.

نتائج الأبحاث: أظهرت نتائج الأبحاث أن تنفيذ برنامج إعادة تأهيل بعد الجراحة بقيادة اختصاصي العلاج الطبيعي/الفيزيائي سيساعدك في استعادة عمل الركبة

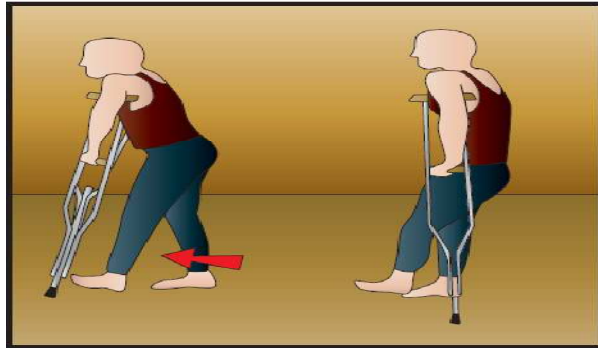
الطبيعي 10، 11، 13.

المرحلة الأولى (من اليوم الأول ولمدة أسبوعين)

المشي / السير

عندما تبدأ الآلام والتورمات بالتناقص، يمكنك البدء بالمشي مع استخدام العكازان. سيقوم إختصاصي العلاج الطبيعي/الفيزيائي بتعليمك كيفية استخدام العكازان وسينصحك حول تمارين تحميل الوزن التي يمكنك إجراؤها. ينصح بزيادة وقت المشي تدريجيا ومقدار تمارين تحميل الوزن التي يمكنك تحملها على ساقك التي أجريت بها العملية منذ اليوم الأول بعد العملية.

نتائج الأبحاث: تمارين تحميل الوزن ستساعدك في استعادة وتحسين مشيتك الطبيعية، وقوة العضلات وتخفيف آلام الركبة (10، 13).



الشكل (2) المشي بمساعدة العكازات

إذا اتبعت وشاركت بنشاط في برنامج إعادة التأهيل بعد الجراحة، هذا سيساعدك في ما يلي:

- السيطرة على الألم والتورم حول ركبتك.
- استعادة الحركة الطبيعية النشيطة لركبتك.
- تطوير قوة عضلات كافية للسير بصورة طبيعية.
- مزاوله نشاطاتك اليومية لوحدك وبدون الاعتماد على أحد.
- استعادة توازن واتزان جديدين.
- منع زيادة الإصابة في ركبتك سوءا.

6. هل سيؤدي تحريك الركبة مبكرا إلى التسبب بالألم؟

ستشعر بالألم بعد الجراحة، لكن هذا الألم يجب أن لا يمنعك من البدء بتحريك ركبتك ببطء تدريجيا.

نتائج الأبحاث: أفادت نتائج الأبحاث أن تحريك المفصل مبكرا يفيد في تخفيف الألم ومنع تصلب الركبة 11.

7. هل علي أن أبدأ بتمارين للركبة مع الألم بعد الجراحة بوقت قصير؟

أحد التمارين الأولى التي قد يقوم المعالج الفيزيائي بتعليمك إياه هو كيف تقوم بسحب عضلات الفخذ الأمامية التي تسمى العضلات الرباعية. عند القيام بهذا التمرين، يمكنك مزاوله التمرين ضمن حدود الألم.

8. مما يتكون برنامج التأهيل؟

سينتكون برنامج التأهيل من ثلاثة مراحل (المرحلة المبكرة، المرحلة الوسطى والمرحلة الأخيرة). ستكون مدة (بالأسابيع والأيام) مراحل التأهيل كما يلي:

- المرحلة الأولى بما في ذلك فترة البقاء في المستشفى (من اليوم الأول وحتى أسبوعين).
 - المرحلة الوسطى (2 - 8 أسابيع).
 - المرحلة الأخيرة (بعد 8 أسابيع).
- خلال كل مرحلة يمكن البدء بالقيام بالنشاطات التي سيتم عرضها فيما يلي:

التمارين

سيقوم اختصاصي العلاج الطبيعي/الفيزيائي بتعليمك كيفية ممارسة تمارين تقوية العضلات في مؤخرة الفخذ والتي تسمى عضلات الأوتار.



الشكل (3) مجموعات أوتار الركبة

مبقيا على القدم مستقيمة، قم بشد العضلات الموجودة في مؤخرة الفخذ (الجهة الخلفية من الفخذ) من خلال دفع قدمك للأسفل نحو السرير أو الطاولة: إبقائها لمدة 6 ثوان، تكرر أو إعادة ذلك 10 مرات في كل مجموعة، وقم بعمل 3 مجموعات في كل جلسة يوميا.

نتائج الأبحاث: أظهرت نتائج الأبحاث أن تمارين التقوية للعرقوب تفيد في استعادة عمل الركبة بعد العملية (10، 11، 13).

9. متى أستطيع السير بدون عكازات؟

يجب أن تداوم على استخدام العكازات للمشي حتى تتمكن من تحمل وزنك كاملا على الساق المعنية وتسير بصورة طبيعية بدون أن تعرج. يمكنك تدريجيا منع نفسك من استخدام العكازات وسيقوم اختصاصي العلاج الطبيعي/الفيزيائي الذي يعالجك بإعطائك النصح والإرشاد بهذا الخصوص.

10. متى سأغادر المستشفى وماذا علي أن أفعل بعد ذلك؟

• ستخرج من المستشفى في اليوم الثالث أو الرابع بعد العملية.
• بعد خروجك من المستشفى يمكنك وضع الثلج على ركبتك في البيت لتخفيف الألم (9).
التمارين التي ستجريها خلال جلسات المتابعة ليست كافية لتحسين أداء ركبتك والاستفادة القصوى من التمارين. من الضروري ممارسة هذه التمارين بانتظام يوميا في المنزل.
الاستمرار بممارسة التمارين بانتظام في المنزل بنفس أهمية التمارين التي تجريها في جلسات المعالجة الفيزيائية لبناء قوة العضلات وتحسين حركة ركبتك.

نتائج الأبحاث: أظهرت نتائج الأبحاث أنه من الأهمية بمكان الاستمرار بعمل تمارينك في المنزل بانتظام بالإضافة إلى التمارين التي تجريها خلال جلسات المتابعة الفيزيائية للتأكد أن ركبتك ستتحسن بالطريقة المثالية (10، 11، 12).

11. هل سيؤثر الخروج المبكر من المستشفى على تحسن

ركبتي؟

الخروج المبكر من المستشفى لن يؤثر على التحسن في ركبتك. قبل الخروج سيقوم اختصاصي العلاج الطبيعي/الفيزيائي الذي يعالجك بإعطائك برنامج التمارين المنزلية لتتمكن من الاستمرار على التمرن في المنزل بانتظام وسيتم تحويلك كمريض من خارج المستشفى لجلسات متابعة معالجة فيزيائية. أظهرت البراهين أن برنامج التمارين المنزلية له نفس تأثير التمارين التي يتم الإشراف عليها مباشرة من قبل اختصاصي العلاج الطبيعي / الفيزيائي الخاص بك في تحسين قوة العضلات، تخفيض ارتخاء الركبة وتحسين أداء الركبة.

نتائج الأبحاث: هنالك بعض الدلائل التي تشير إلى أن برامج إعادة التأهيل المنزلية التي تكون تحت إشراف اختصاصي العلاج الطبيعي/الفيزيائي في الحقيقة لها نفس تأثير التمارين التي يشرف عليها مباشرة اختصاصي العلاج الطبيعي / الفيزيائي في تحسين قوة العضلات، تقليل ارتخاء الركبة وتحسين أداء الركبة (10، 11، 12).

المرحلة المتوسطة

2 - 8 أسابيع بعد إجراء عملية الرباط الصليبي

بالإضافة إلى التمارين المذكورة أعلاه في المرحلة الأولى (المبكرة)، قد يقوم اختصاصي العلاج الطبيعي / الفيزيائي بتعديل برنامجك بالتمارين التالية لإضافة تحسين إلى:

- حركة ركبتك لتصل (90 - 100) درجة من الانحناء.
- قوة عضلات الساق المعنية. بعض هذه التمارين المفيدة التي قد يطلب منك اختصاصي العلاج الطبيعي / الفيزيائي بإجرائها هي:

(أ) قرفصاء جزئية.



الشكل (4) قرفصاء جزئية

الوقوف بحيث يكون القدمين بنفس عرض الكتفين في وضعية التفاف خارجي قليلا. استخدام طاولة للتوازن، وبلطف تنزّل الأرداف إلى الخلف والأسفل. الثبات لمدة (6) ثوان، إعادة ذلك (10) مرات في كل مجموعة، بحيث تقوم بثلاث مجموعات في كل جلسة وثلاثة جلسات يوميا.

(ب) رفع الكعبين



الشكل (5) رفع الكعبين

• أثناء الوقوف، ضع اليدين على سطح مستو كطاولة للتوازن وبلطف ارفع الكعبين عن الأرض واجعل لتوازن على كرة القدمين

• الثبات لمدة (6) ثوان ومن ثم الارتخاء للخلف والأسفل ببطء تدريجيا.

• قم بتنفيذ (3) مجموعات مع إعادة (10) مرات يوميا.

• بعد أن تصبح أوتار ركبتك أقوى وتشعر أن ساقك أكثر توازنا، يمكنك الاستمرار بتقوية العضلة الرباعية (وهي عضلة كبيرة في الجهة الأمامية للفخذ). الطريقة المثلى للقيام بذلك هي القيام بقرفصاء الجدار باستخدام الطابوقة/الكرة.

المرحلة الأخيرة (بعد 8 أسابيع)

12. كيف يمكنني منع زيادة الإصابة لركبتي؟

لتقليل فرصة زيادة الإصابة لركبتك، عليك القيام بما يلي:

- ممارسة تمارين الإحماء والاسترخاء قبل النشاطات والتمارين الرياضية.
- تمارين التوازن التي تستطيع المساعدة في منع زيادة الإصابة في ركبتيك.
- التأكيد على نشاطات الأداء بالإضافة إلى تمارين تقوية محددة:

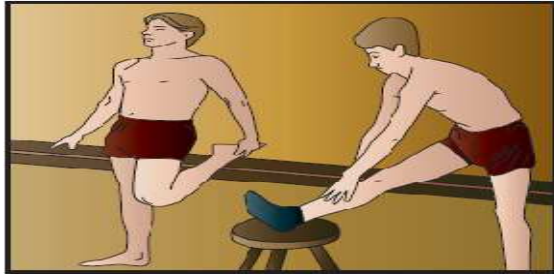
(أ) أحد تمارين التحمية والاسترخاء الذي قد يعلمك إياه اختصاصي المعالجة الفيزيائية هو كيفية تمديد العضلات في مقدمة ومؤخرة الفخذين كما هو ظاهر في الصورة أدناه في الشكل (7).

✓ لتمديد الجزء الأمامي من الفخذ اسحب كعبك ببطء باتجاه أردافك حتى تشعر بالتمدد (الشد) في الجزء الأمامي من فخذك، ثبت هذه الوضعية لمدة (8) ثوان، وكررها (5) مرات.

✓ لتمديد الجزء الخلفي من الفخذ ضع قدمك على كرسي مرتفع ثم أمل بجسمك إلى الأمام ببطء وحاول ملامسة ذقنك حتى تشعر بالتمدد (الشد) في الجزء الخلفي من فخذك، ثبت هذه الوضعية لمدة (8) ثوان، وكررها (5) مرات.

نتائج الأبحاث: لمنع زيادة الإصابة سوءاً في ركبتيك من الضروري إجراء التحمية قبل النشاطات الرياضية والإرتخاء بعد تمارين النشاطات الرياضية (10، 13).

تمديد مؤخره الفخذ



الشكل (7) تمارين التمديد

تمديد مقدمة الفخذ

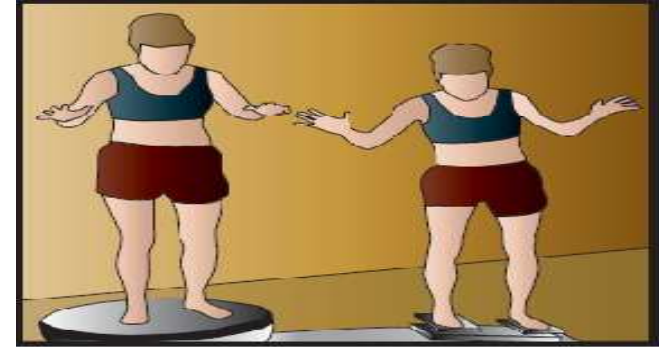
ج. قرفصاء الجدار بالطابة/بالكرة.



الشكل (6) قرفصاء الجدار بالطابة/الكرة

الوقوف بحيث يكون ظهرك، كتفيك، ورأسك على الحائط أو الجدار والنظر باستقامة إلى الأمام. حافظ على ارتخاء كتفيك وقدميك على بعد قدم واحد من الجدار ومفتوحتين بعرض الكتف. ضع وسادة ملفوفة أو كرة نيرف بين فخذيك. تدريجياً حاول القرفصاء أثناء الضغط على الوسادة أو الكرة، وبنفس الوقت حافظ على رأسك على الجدار. انزل بالقرفصاء للأسفل حتى تصبح فخذيك على موازاة الأرض. حافظ على هذه الوضعية لمدة (10) ثوان. حاول الوقوف ببطء. تأكد من البقاء بالضغط على الوسادة أو الطابة طيلة مدة هذا التمرين. كرر هذا (10) مرات في كل مجموعة، قم بعمل (3) مجموعات في كل جلسة، بحيث تنفذ (3) جلسات يومياً.

(ب). أحد تمارين التوازن التي قد يعلمك إياها اختصاصي العلاج الطبيعي / الفيزيائي هو كيفية المحافظة على توازنك على اللوحة المرنة واللوحة المنزلقة وعينيك مفتوحتان والتقدم وعينك مغلقتان كما هو موضح في الصورة بأدناه.



الشكل (8)

قف على اللوحة، حاول توازن نفسك ثم أغمض عينك. حاول تحريك جسمك في عدة اتجاهات مع المحافظة على توازنك (أغمض عينيك).
حافظ على توازنك لمدة دقيقة، كرر ذلك (5) مرات في كل مجموعة، مرتين يوميا.

نتائج الأبحاث: لمنع المزيد من الإصابات لركبتك، من الضروري إجراء التحمية قبل النشاطات الرياضية والارتخاء بعد تمارين النشاطات الرياضية (10، 13).

المشي هو أحد تمارين الأداء الفعالة الذي يمكنك ممارسته بانتظام لتحسين قوة تحمل عضلات ساقيك ومساعدتك في تقليل فرصة إصابات أخرى لركبتك.

نتائج الأبحاث: لمنع المزيد من الإصابات للرباط الصليبي في ركبتيك، عليك ممارسة تمارين توازن منتظمة (5، 7).

13. هل هناك أية تمارين أفضل من تمارين أخرى؟

التمارين مجموعات مختلفة. مجموعات لتحسين قوة عضلات الركبة ومرونتها، ومجموعات لتحسين حركة ركبتيك، ومجموعات أخرى لاستعادة عمل ركبتيك. بين كل مجموعة لا يوجد أي دليل حقيقي يفضل تمرين على الآخر، ولكن الدليل يوضح بأن القيام بالتمارين ضروري لاستعادة الحركة والوظيفة الطبيعية لركبتك.

نتائج الأبحاث: في الوقت الحالي لا يوجد أي دليل حقيقي يدعم أو يفضل تمرين على التمارين الأخرى لكن الدليل يوضح أهمية وضرورة القيام بالتمارين لاستعادة الأداء والحركة الطبيعية لركبتك (11).

14. هل التمرن في الماء أفضل من التمرن على اليابسة لركبتي؟

هنالك أسلوبين لممارسة تمارين العلاج الطبيعي/الفيزيائي. الأول هو ممارسة التمارين في الماء، والآخر هو ممارسة التمارين على اليابسة. كلا التقريين للتمارين في الماء وعلى اليابسة مناسبين بنفس المقدار لاستخدامهما بعد الجراحة.

نتائج الأبحاث: كلا التمرينين في الماء وعلى اليابسة مؤثرين بنفس المقدار لاستعادة عمل الركبة (10، 11، 13). 00.

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