



## RESEARCH PAPER

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## The use of conservative treatment in partial anterior cruciate ligament (ACL) tears among male athlete

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### Abstract

In this study tried to using conservative treatment in partial anterior cruciate ligament (ACL) tear among male athlete. If an athlete is injured anterior cruciate ligament that he first recommended treatment is surgery. But surgery has complications and athlete will have a lot of problems later. So it is better to replace simple method instead surgical procedures. For this study, 57 patients were selected via magnetic resonance imaging (MRI) scan that should be performed exercises for 10 weeks. The mean time interval between the rupture and the diagnosis by an MRI was 2–14 days and the mean of subjects' age were 28 years old. Conservative treatment in this study divided into 4 phase included: 1. acute phase, 2. Sub-Acute/Strengthening Phase, 3. Limited Return to Activity Phase, and 4. Return to Activity/Sport Phase. Therapeutic Exercise during 4 phases that mentioned included: Increase and improve the range of motion, Patella mobilization (Medial/Lateral, Superior/Inferior) quadriceps, hamstring strengthening, Flexibility exercises, and Static lunge progressions, daily lower extremity stretching and sports specific drills, speed/agility program. In totally our results indicate that after 10 weeks conservative treatment protocol in partial ACL tear, 39 patients reported good or very good subjective results and 15 patients described a satisfactory result. 31persen had never experienced giving-way symptoms after 10 week, 8 patient had giving-way when participating in heavy exercise and wears an orthosis during sports activities. 26 athletes play sports at the same level as before the treatment. 11 patients were able to perform high-risk pivoting sports. And all patients could participate in low-risk pivoting sports like jogging and mountain hiking. As a general conclusion it can be said conservative treatment in Partial anterior cruciate ligament tear was effective.

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## Introduction

The anterior cruciate ligament (ACL) is one of the most commonly disrupted ligaments in the knee. Each year in the United States there are approximately 250,000 ACL injuries, or 1 in 3,000 in the general population (Hewett *et al.*, 1998). It averages 31-38 mm in length and 8-11 mm in width (Girgis *et al.*, 1975) and is not a single cord but a collection of fascicles that fan out over a broad flattened area, with a wider and stronger tibial than femoral attachment (Furman *et al.*, 1976). The injury of the ACL is a typical injury of the knee joint that occurs during sports activities (Arendt *et al.*, 1995; Bjordal *et al.*, 1997; Gray *et al.*, 1986). Assuming that at least one third of ACL-deficient patients require surgery, at about \$17,000 per reconstruction, the estimated annual cost is about \$1.5 billion (Kao *et al.*, 1995; Malek *et al.*, 1996). This total does not include the costs of initial evaluation and treatment of those injured the nonsurgical care of the remaining patients, or future medical treatment for those who develop post-traumatic arthritis. Because of this significant financial impact and the emotional toll this injury frequently takes on young athletes, developing non surgical strategies for this injury is essential. Injury to the ACL is a common and significant knee injury, potentially resulting in limitations in range-of-motion, degenerative changes of the knee joint and muscular atrophy (Elmqvist *et al.*, 1989). Muscular atrophy greater than 20% and strength loss exceeding 30% have been demonstrated strength persisting for several years after surgery (Feller *et al.*, 2003; Meighan *et al.*, 2003; Arangio *et al.*, 1997; Williams *et al.*, 2004). (Beynon *et al.*, 2005) emphasized use of caution with increasing the frequency and magnitude of quadriceps activity due to concern of increasing anterior knee laxity. Additionally, it has been demonstrated that when applied gradually and progressively, an eccentric (or negative-work) exercise training for the quadriceps is safe for these patients with ACL injury and can be tolerated without damage (LaStoya *et al.*, 2003; Gerber *et al.*, 2006; Gerber *et al.*, 2006). Eccentric knee extensor training was purported to be essential for restoration of the functional capacity of the ACL reconstructed knee due

to findings of significantly larger concentric and eccentric peak torque deficiencies in the knee extensors as compared to the knee flexors (Yoon *et al.*, 2000). An ACL partial tear is most often a sports-related injury. ACL partial tears can also occur during rough play, motor vehicle collisions, falls, and work-related injuries. About 80% of sports-related ACL partial tears are "non-contact" injuries. This means that the injury occurs without the contact of another athlete, such as a tackle in soccer. Most often ACL partial tears occur when pivoting or landing from a jump. The knee gives-out from under the athlete when the ACL is torn. Management after ACL injury may involve an operation to replace the torn ligament with a graft in an attempt to reduce excess anterior tibial movement in the sagittal plane. The main goal of reconstruction to restore knee function without any pain or degenerative changes correlated to the operation. Although the ACL reconstruction may not result in a normal knee, it may give the patient the chance to return to sporting activities, usually at a lower level than before (Ejerhed *et al.*, 2003). Not all patients with an ACL partial tear need to undergo surgery. The most common selection criteria are the patient's age, associated ligament and meniscal injuries, functional and sporting demands on the knee and the patient's ability and willingness to participate in postoperative rehabilitation. The rehabilitation process for knee ligament-injured patients has changed dramatically in the past several years. Previously, conservative rehabilitation with limitation of Range of Motion (ROM), delayed weight bearing with full weight bearing at 8-10 weeks and returning to sports after 9-12 months has been the norm. The trend today is accelerated protocols with immediate training of ROM and weight bearing and returning to sports within 4-6 months. In most studies, the rehabilitation programs are presented without motivation or references reported in articles. Some studies just mention that the rehabilitation program is constructed in order to give the graft normal mechanical stress and facilitate healing (Marcacci *et al.*, 2003; Barrett *et al.*, 2002). The discussion about the conservative treatment of an acute complete rupture of the ACL has been ongoing since the

introduction of operative treatment methods. J. Stark started using conservative treatment of the ACL in 1850, immobilizing patient's knees with plaster. M. Robson made the first primary suture of the ACL in 1895. In 1916 R. Jones criticized operative treatment because he found that sutures of the ligaments without immobilization ended in a persistent instability of the knee and only conservative treatment with "natural healing by scar tissue" would lead to reliable stability. Since that time, no other orthopedic malady has developed such a variety of different operative procedures (Eberhardt *et al.*, 1990). During the last 20 years the majority of published articles have agreed that operative reconstruction is the accepted method to treat the acute complete ACL rupture (Barrack *et al.*, 1990; Wittenberg *et al.*, 1998; Scavenius *et al.*, 1999; Hinterwimmer *et al.*, 2003).

### Materials and methods

For this study, we performed a postinjury screening to select 81 patients, but only 57 would be suitable for conservative treatment. The goal of our study is to analyze the course and results of these conservatively treated ACL injuries and to describe the applied treatment protocol. In all cases the ACL was partial ruptured, proven by a magnetic resonance imaging (MRI) scan. The mean time interval between the rupture and the diagnosis by an MRI was 2–14 days. The mean of subjects' age were 28 years old. The conservative treatment protocol consists of four stages which have been run for 10 weeks.

Phase 1 (acute phase): For Range of Motion (3-5 times a day): Patella mobilization (Medial/Lateral, Superior/Inferior) 2 Sets of 20 Repetitions Belt stretch (calf/hamstring) Hold 30 Seconds 3-5 Repetitions Heel slides 2 Sets of 20 Repetitions Prone quad stretch Hold 30 Seconds 3-5 Repetitions Cycle (minimal resistance) 10-15 Minutes Daily

To Strengthening (1 time a day): Quad sets 2-3 Sets of 20 Repetitions, Add sets 2-3 Sets of 20 Repetitions, SLR (no Lag) 2-3 Sets of 10-20 Repetitions, Hip Abd/Add/Ext/ER (against gravity) 2-3 Sets of 10-20

Repetitions, Body weight squats (partial range) 2-3 Sets of 10-20 Repetitions, Standing or prone hamstring curls 2-3 Sets of 10-20 Repetitions, Heel raises 2-3 Sets of 10-20 Repetitions.

Phase 2 (Sub-Acute/Strengthening Phase): ROM and mild flexibility exercises, (once a day) Open Chain hip and knee strength from phase 1 progress with ankle weights, Hamstring strengthening 2-3 Sets of 15-20 Repetitions, Leg press 2-3 Sets of 15-20 Repetitions, Step-up progressions 2-3 Sets of 15-20 Repetitions, Squat progression 2-3 Sets of 15-20 Repetitions, (3-5 times a week).

Phase 3 (Limited Return to Activity Phase): Continuing ROM and flexibility exercises as needed (daily). Progressing Phase 2 strengthening exercises, Step-up progressions (increase height of step) 2-3 Sets of 15-20 Repetitions, Single-limb dead lift 2-3 Sets of 15-20 Repetitions, Static lunge progressions (forward/backward/lateral) 2 Sets of 50 feet (3 times a week).

Phase 4 (Return to Activity/Sport Phase): daily lower extremity stretching (daily), strengthening program from phase 3 (increase load and decrease repetition, 3 times a week). The program progressed from static to dynamic lunges, sports specific drills, speed/agility program.

### Results

The patients who participated in this study were 81 persons, but only 57 patients are eligible for conventional treatments (70.4%). Because of persistent giving-way symptoms, 19 knees had to be operated in hospital after injury and 5 patients was lost to follow-up. No patients had to be operated on because of additional pathological findings, such as meniscus tears. The tears detected by an MRI at the time of the first presentation stayed asymptomatic, new tears did not occur. Our finding indicates that after 10 weeks conservative treatment protocol in partial ACL tear the patients reported about quality of themselves symptoms as follows: Of the 57 conservatively treated patients, 39 reported good or

very good subjective results (18 good, 21 very good), and 15 described a satisfactory result. Of the 39 patients with good and very good results, 31 persons had never experienced giving-way symptoms after the end of conservative treatment; 8 patients had giving-way when participating in heavy exercise and wears an orthosis during sports activities. Twenty-six play sports at the same level as before the treatment, nine had to reduce their activity level slightly, and four patients participate in even more sports than before the ACL rupture. Eleven patients were able to perform high-risk pivoting sports (football and handball), and all patients could participate in low-risk pivoting sports like jogging and mountain hiking. Twenty-eight of the 39 patients with good and very good results said that they were glad not to have had an operation—this was said spontaneously and without being asked. None of the 39 patients wanted an ACL reconstruction. The 15 patients who described a satisfactory result reported persistent giving-way episodes in everyday situations and during sports 2-3 years after the ACL rupture. They are considering surgical therapy as a necessity. Forty-five of the 57 conservatively treated patients never had pain in the concerned knee, 7 described mild pain when there was a change in the weather, 3 had intermittent medium pain without a special trigger, and 2 had slight pain while squatting. Fifty-one of the patients never had swelling, and one of the patients with giving-way symptoms still has knee swelling after participating in sports activities. No patient showed a limp or needed a walking aid. All were able to climb stairs without problems; one patient had difficulty carrying heavy weights while walking downstairs. In 52 patients, the range of motion was equal to the unaffected knee; five patients showed a slight reduction of flexion (10 degrees) with pain while squatting. In all other cases, squatting and kneeling was unlimited. In all cases, the walking distance was not limited by the concerned knee. None of the patients required further surgery in the follow-up period.

## Discussion

The discussion about the conservative treatment of an acute complete rupture of the anterior cruciate ligament (ACL) has been ongoing since the introduction of operative treatment methods. J. Stark started using conservative treatment of the ACL in 1850, immobilizing patient's knees with plaster. M. Robson made the first primary suture of the ACL in 1895. In 1916 R. Jones criticized operative treatment because he found that sutures of the ligaments without immobilization ended in a persistent instability of the knee and only conservative treatment with "natural healing by scar tissue" would lead to reliable stability. Since that time, no other orthopedic malady has developed such a variety of different operative procedures (Eberhardt *et al.*, 2002). During the last 20 years the majority of published articles have agreed that operative reconstruction is the accepted method to treat the acute complete ACL rupture. (Barrack *et al.*, 1990; Wittenberg *et al.*, 1998; Scavenius *et al.*, 1999; Hinterwimmer *et al.*, 2003). On the other hand, several authors commented that there were higher osteoarthritis rates in knees after operative ACL reconstruction than in nonoperated knees. (Daniel, 1992; Fink *et al.*, 1994; Fink *et al.*, 1996; Casteleyn, 1999). (Diekstatt *et al.*, 1999) showed significantly higher satisfaction levels and better results in subjective scores in conservatively treated patients. Another study showed equal satisfaction levels in all treatment regimens (Casteleyn, 1999). These unexpected findings led to a change in the therapeutic regimen in some hospitals (Diekstatt *et al.*, 1999) and to the recommendation of a delayed operative treatment only in cases with persistent instability under primary conservative treatment. (Wittenberg *et al.*, 1998). A randomized longitudinal cohort study with a large number of patients suitable for both operative and conservative treatment and who would be treated in one hospital would be desirable to evaluate the treatment options. At our institution, we performed a postinjury screening to select patients who would be suitable for conservative treatment. The goal of this study is to analyze the course and results of these conservatively treated ACL ruptures and to describe the applied treatment protocol.

Although guidelines for ACL rehabilitation have evolved, no single protocol will be universally successful for all patients. Factor such as age, sex, chronicity of injury, associated pathology, range of motion, patient activity level, attitude, and motivation must all be considered to develop the most appropriate rehabilitative program for each individual. Regardless of how the ACL is torn, the physician will work with patient to determine a personalized course of treatment. People participating in sports or work related activities that require a lot of pivoting, cutting, or jumping may decide to have surgery. Depending on lifestyle, however; conservative treatment may be the best option. In the case of an isolated ACL partial tear with no other ligamentous or cartilage involvement, the associated pain and dysfunction can be successfully treated with physical therapy. The initial course of treatment in physical therapy includes rest, anti-inflammatory measures and activity modification. After the swelling resolves and normal range of motion and strength is achieved, a decision to determine treatment options. If a non-surgical approach is chosen, it is imperative to maintain the strength, balance, and range of motion by physical therapy and physical exercise to avoid further injury. At this juncture, many people elect to use a sports brace and limit their participation in activities that require a lot of pivoting, cutting or jumping. If conservative measures are unsuccessful and recurrent buckling persists, may elect to have the ACL reconstructed. But if non-surgical methods such as physical exercise were helpful, must be carefully and with overload to achieve the desired result be continued. Recovering from a torn ACL is not an easy process. It can be a long and difficult recovery that requires a tremendous commitment to rehabilitation and the patient must be an active participant during this process, performing daily exercises to ensure the return of range of motion and strength. Athletes will not be able to return to their sport immediately and will have to avoid cutting, pivoting, and jumping. Return to sport is dependent on how progress in therapy and whether athlete continues to have episodes of knee buckling. Recovery is different for

every individual. Personal time table for return to activities and work will be addressed by physician and physical therapist throughout course of treatment. Do patients return because their knee feels normal or is it their ambition and sometimes money (in professional athletes) that makes them return to sports? If so, a return to sports is not necessarily an accurate indicator of knee function or successful treatment. Why do some patients not return to sports despite a good objective knee function? Many athletes may see the ACL injury as a good reason to stop with competitive sports and give more of their time to social and family life. Others may feel a psychological hindrance such as a fear of re-injury (Bjordal *et al.*, 1997). In the reviewed studies, only some reported the reasons why the patient did not return to their pre-injury activity level (Mikkelsen *et al.*, 2000; Bak *et al.*, 1999; Hamada *et al.*, 2000; Webb *et al.*, 1998). Only 36% (range 13–70%) of the patients, who reduced their activity level, did so because of knee problems. In two studies,[38-40] 77% and 21% of the patients, respectively, reported that they reduced their activity level due to social reasons and (Mikkelsen *et al.*, 2000) found that 7% of the patients reported fear of re-injury as an important reason. Seventy-eight per cent of the patients continued non-operative treatment throughout the 1 year follow-up. Performance-based functional tests showed symmetrical knee function, and the number of surgical procedures for new injuries was low (n=5, 9.5%). Eighty-three per cent of them maintained participation in pivoting sports and/or physical exercise throughout the follow-up period, although a significant number of individuals changed their main activity to low intensity. Knee function measured with patient-reported outcome measurements and single-legged hop tests remained unchanged with regard to changes of clinical relevance, while the knee extension and flexion muscle strength significantly improved over the course of the study. 91% of the ACL injured patients reported to be regularly participating in pivoting sports and/or physical activity. However, from the reports of *main* leisure time sport activity, we found a significantly reduced rate of level 1 activity at all follow-ups. The present study was not designed

to answer questions on why the patients reduced their participation in level 1 sport. Fear of reinjuries and other psychological factors have been shown to influence the rate of participation in pivoting sports after injury and reconstruction in adult ACL-injured individuals (Arderm *et al.*, 2011; Kvist *et al.*, 2005). Future studies should, thus, include reasons for why some patients seem to change their leisure time activity patterns after ACL injury. In total, this study therefore provides new knowledge on the growing challenge of ACL injuries in patients with partial ACL injury.

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