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The conservative treatment in anterior cruciate ligament injury among soccer male player

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Abstract

Injuries to the lower extremity occur most frequently in contact sports such as soccer. Soccer is one of the most popular sports in the world, is associated with a high injury risk and the knee joint is often affected. Both conservative and operative interventions are used in the treatment of Anterior Cruciate Ligament (ACL) injuries. While operative treatment of ACL lesions in athletes is widely performed, conservative treatment has been considered to have a good outcome in the general population. The purpose of this study was to assessment of conservative treatment in ACL injury among Soccer male player. At first selected 38 soccer male players with partial rupture in ACL that proven via magnetic resonance imaging (MRI) scan. The conservative treatment was carried out in four phase: Phase 1 (acute phase), Phase 2 (Sub-Acute/Strengthening Phase), Phase 3 (Limited Return to Activity Phase) and Phase 3 (Limited Return to Activity Phase). Our results indicate that all of participants have a good advantage from conservative treatment protocol. 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). The yearly incidence of anterior cruciate ligament injuries has been reported to be 3 per 10 000 inhabitants in Denmark, with a greater frequency among athletes (Nielsen *et al.*, 1991). In Sweden, ACL injuries comprise 43% of all soccer-related knee injuries. Elite players experience a greater risk for injury. [Roos *et al.*, 1995; Bjordal *et al.*, 1997]. Also a recent study showed, from 839 athlete among some sport activity included: soccer, volleyball, futsal, basketball, wrestling, ski and gymnastics, most number of injuries was related to soccer players (Kasbparast *et al.*, 2013). 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). Injuries to the lower extremity occur most frequently in contact sports such as soccer or American football (Fernandez *et al.*, 2007; Hawkins *et al.*, 1999; Hawkins *et al.*, 2001; Smidt *et al.*, 1985; Wong *et al.*, 2005). Soccer is one of the most popular sports in the world, with 265 million participants (Junge *et al.*, 2002; Renstorm *et al.*, 2008). Most injuries are either caused by direct impact or by twisting or pivoting maneuvers (Alentorn *et al.*, 2009; Griffin *et al.*, 2000; Griffin *et al.*, 2006; Hawkins *et al.*, 1998). Of all injuries, anterior cruciate ligament injuries account for 1.3% in male and 3.7% in female soccer players (Renstorm *et al.*, 2008). The risk factors most prominent for ACL injuries remain a subject of debate. The ACL is prone to torsional injuries: approximately 70% of ACL ruptures occur with the knee in or near full extension such as during landing maneuvers or pivoting on a plantigrade foot (Alentorn *et al.*, 2009; Gilchrist *et al.*, 2008). Cutting maneuvers combined with deceleration have also been associated with an increased risk of ACL injuries (Alentorn *et al.*, 2009; Griffin *et al.*, 2000). Evaluation of the ACL should be performed

immediately after an injury, if possible, but is often limited by swelling and pain. The evaluation should begin by observing the patient's gait, as well as the position of comfort he or she assumes on the examination table. The physician should note any asymmetry, including loss of the peripatellar groove indicating an effusion, hemarthrosis, or both. In a study of 132 athletes with acute knee injury and hemarthrosis, 77 percent had a partial or complete tear of the ACL (Hardaker *et al.*, 1990). A more subtle effusion can be detected by compressing the medial and superior aspects of the knee, then tapping the lateral aspect to create a fluid wave. The physician can also attempt to palpate the patella with suprapatellar compression, which will feel spongy if effusion is present. When hemarthrosis is present; the increased intraarticular volume produces considerable pain on range of motion. The result of this pain is extensive guarding and spasm of the hamstring muscle group, further limiting the knee's range of motion and making an accurate examination difficult. The patient may not be able to fully flex the knee, but the loss of hyperextension is more indicative of an ACL disruption. The torn ACL stump compressed between the tibia and femur, as well as the joint effusion, prevents full extension (Shelbourne *et al.*, 1994). Inability to achieve full extension also raises the possibility of a locked displaced meniscal tear. The discussion about the conservative treatment of an acute complete rupture of the anterior cruciate ligament 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). Some patients with ACL injuries may not be candidates for surgery because of serious comorbid medical conditions including serious cardiac, renal, or hepatic disease or because they no longer wish to participate in strenuous physical activities. For individuals who opt for conservative treatment, physical therapy with an experienced physical therapist or athletic trainer aimed at strengthening the muscles around the knee, especially the quadriceps femoris and hamstring muscles, is pursued. However, without surgical repair, the knee generally remains unstable and prone to further injury (Levy *et al.*, 2010). Long-term studies have shown that there is a significant increase in rates of damage to menisci and articular cartilage associated with delayed reconstruction (Levy *et al.*, 2010; Fithian *et al.*, 2005). The rate of healing for meniscal tears is faster when done at the same time as ACL reconstruction as opposed to being performed alone (Levy *et al.*, 2010). Generally, about one-third of patients who are selected as suitable for conservative treatment are able to complete the therapy regimen without the need for surgical intervention (Barrack *et al.*, 1990; Noyes *et al.*, 1989). However, patients with high level of sports activity show poor results after conservative treatment of ACL ruptures (Levy *et al.*, 2010; Barrack *et al.*, 1990; Scavenius *et al.*, 1999; Wittenberg *et al.*, 1998). Non-contact ACL injuries in soccer frequently occur during dribbling, cutting, or quick changes of direction while contact injuries are caused by knee hyperextension or a valgus motion (Ekstrand *et al.*, 1983; Fried *et al.*, 1992). For these reasons, the biomechanics of knee joint motion during activities such as landing, running and cutting maneuvers have been extensively examined in soccer (Besier *et al.*, 2003; Besier *et al.*, 2001; Sanna *et al.*, 2008). Although the above movements are common in various sports, the most important movement in soccer is the kick. In general, the side-foot kick is the most frequently used technique when a shorter and precise pass or shot is required, whereas the instep kick is used when a faster ball

speed must be generated (Myklebust *et al.*, 1998).

Materials and methods

For this study, we performed a post-injury screening to select 81 patients, but only 38 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 26 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 in some sport activity such as: soccer, volleyball, futsal, basketball, wrestling, ski and gymnastics. Because of persistent giving-way symptoms, 19 knees had to be operated in hospital after injury and 5 patients was lost to follow-up. Then only 38 soccer players were eligible for conventional treatments (46.9%). 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 38 conservatively treated patients, 26 reported good or very good subjective results (11 good, 15 very good), and 12 described a satisfactory result. Of the 26 patients with good and very good results, 19 person had never experienced giving-way symptoms after the end of conservative treatment; 7 patient had giving-way when participating in heavy exercise and wears an orthosis during sports activities. Twenty one play sports at the same level as before the treatment, eleven had to reduce their activity level slightly, and six patients participates in even more sports than before the ACL rupture. Twelve patients were able to perform high-risk pivoting sports (soccer), and all patients could participate in low-risk pivoting sports like jogging and mountain hiking. Seventeen of the 26 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 26 patients wanted an ACL reconstruction. The 12 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. Twenty-eight of the 38 conservatively treated patients never had pain in the concerned knee, 5 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. Twenty-nine 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 31 patients, the range of motion was equal to the unaffected knee; five patient 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 present study has contributed to the up to date understanding and knowledge in the conservative treatment in anterior cruciate ligament injury among soccer player. The most recent view indicate that neuromuscular fatigue is the most prominent cause of this injury in soccer and this idea also corroborated with the fact that the ACL injuries are mostly prevalent during non-contact situations of the game. ACL rupture is a common knee injury. In recent years ACL surgery has become very popular especially among surgeons treating sports injuries and it is becoming common practice for young and active people with ACL rupture to be treated operatively. On the other hand, several authors commented that there were higher osteoarthritis rates in knees after operative ACL reconstruction than in non-operated knees.(Daniel, 1992; Fink *et al.*, 1994; Fink *et al.*, 1996; Casteleyn, 1999). (Diekstall *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 (Diekstaal *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). We performed a post-injury 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. Soccer is particularly known as a sport with a reasonably high risk for ACL injuries (Arendt *et al.*, 1995; Bjordal *et al.*, 1997; Gwinn *et al.*, 2000; Powell *et al.*, 2000). Sustaining an ACL injury also predisposes an individual to the risk of significant long-term debilitation, such as in the case of osteoarthritis (Gillquist *et al.*, 1999). Regardless of how the ACL is torn, the physician will work with patient to determine a personalized course of treatment. People participating in soccer 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. Soccer players will not be able to return to their activity 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 soccer field 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? They may feel a psychological hindrance such as a fear of re-injury (Bjordal *et al.*, 1997). Seventy-eight percent of the patients continued non-operative treatment throughout the 1 year follow-up. 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 (Ardern *et al.*, 2011; Kvist *et al.*, 2005). 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

soccer games and/or physical activity. Performance-based functional tests showed symmetrical knee function, and the number of surgical procedures for new injuries was low (n=5, 9.5%). Whatever may be cause, ACL tear in soccer seriously affects players' career with short-term and long-term consequences and requires surgical treatments and keeps majority of soccer players out of competition at least four months every season that imposes significant economic consequences. Therefore, to prevent such health and economical consequences primary guidelines which have been mentioned in the study, should be taken under strict care and constant vigil by the soccer players, trainers or instructors and other health professionals to avoid the possibility of ACL injuries during the match as well as during the training sessions. this study therefore provides new knowledge on the growing challenge of ACL injuries in patients with partial ACL injury. Finally, It is suggested that the use of non surgical procedures have a less risk of side effect and economically more advantageous.

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