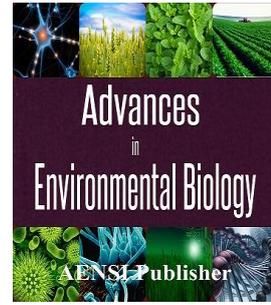




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Treatment Results of Arthroscopic Anterior Cruciate Ligament (ACL) Rupture, 5-Year Follow-Up

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ABSTRACT

There are turning and other impulses done during sportive activities are among the most seen factors of anterior cruciate ligament (ACL) injuries. It is also claimed that femur intercondylar notch sizes may have an impact on the etiological factors that cause ACL injuries and ACL is injured when it's on the lateral femoral condilin medial side and especially the narrowness of intercondylar notch increases the risk of injury. In order for diagnosis and treatment of ACL injuries, arthroscopy method is applied together with the physical examination. In our study we helped 62 amateur and professional athletes return to their sportive activities within 4.3 months by applying semitendinous and gracilis tendon arthroscopic ACL treatment with autograft. 5 patients experienced ACL rupture, 14 patients complained about anterior knee pain, 9 of the patients had tibial staple scratchiness while 7 patients had chronic pains around patellar tendon and near tibial tunnel.

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INTRODUCTION

Knee joints are one of the most vulnerable joints against trauma. The trauma is mostly caused by traffic accidents or sportive activities. As a result of knee injuries, the ligaments which keep the stability of this joint get damaged. ACL is the first one among these with a proportion of 48% [1, 2]. Anterior cruciate ligament (ACL) is an anatomic structure designed to stabilize different freedom degrees of the movement by knee joints [3, 4]. It means that the main duty of cruciate ligaments is to protect the robustness of knee while allowing a range of movements. Cruciate ligaments mostly prevent unexpected forward and backward movements while supporting lateral ligaments. Cruciate ligaments also support the lock mechanism in a full open knee and allow one to stay standing with a little amount of energy [5]. ACL prevents turning of tibia and its sliding to a more anterior position than femur. It stabilizes tibia by bringing it to an external rotation towards femur during the movement of knee from 30° flexion to the extension position [3, 4]. Anterior cruciate ligament links femur and tibia bones inside the knee and contributes to the stability of knee by preventing any frontward sliding of the leg bone. It means that ACL is the primary structure (%86) that prevents the frontward displacement of tibia [6]. Moreover, ACL is a secondary limiter for the varus and valgus within every phases of flexion that forms the center line of the knee. It also prevents internal rotation and hyperextension [7]. ACL, which has a low natural flexibility although it is highly strong, gets ruptured when it encounters with a burden that creates a stretching at a rate more than 5%. The possibility of a meniscus rupture in the knee after the injury of anterior cruciate ligament is between 45% and 68% [7].

ACL ruptures generally occurs as a result of either a hyperextension damage or valgus impact [4, 8-10] as well as an abrupt slowing, sprain of the knee after turning or moving, sprain as a result of improper landing after an act of jumping or some other direct impacts on the knee. It can also occur rarely as a result of some direct impacts from back to the front [10]. Moreover it is claimed that femur intercondylar notch sizes may have an impact on the etiological factors that cause ACL injuries and ACL is injured when it's on the lateral femoral condilin medial side and especially the narrowness of intercondylar notch increases the risk of injury [2].

After this rupture, a sense of space occurs and the patient has difficulty in standing on his/her knee. After that a swelling and pain occur in the knee. It is expected within the physiotherapy that the front drawer, lachman and pivot shift tests give positive results. The treatment method is determined according to the age, profession and sport activity of the patient [11, 4].

We may observe meniscus rupture and cartilage damage together with anterior cruciate ligament ruptures. If ACL is not treated on time, the rotational instability gets worse and degenerative changes develop more swiftly together with all damages mentioned above. It is important to determine the rehabilitation program related to the surgical treatment and post-treatment process of the patient experienced anterior cruciate ligament rupture [4].

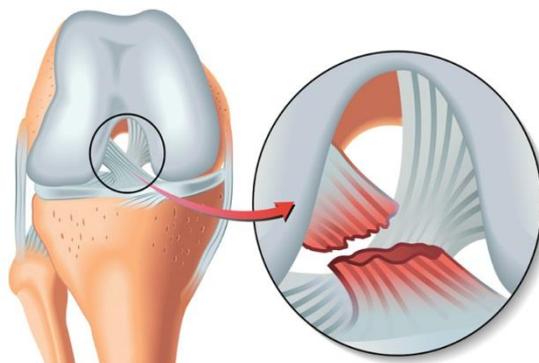


Fig. 1: Anterior Cruciate Ligament Injury [33].

We can divide the injury mechanisms of ACL in two parts as contact and non-contact. The first one of contact injuries is the one that occurs with the valgus impact during an external rotation of the knee. Frequently medial collateral ligament (MCL) and medial supportive structures get damage together with this mechanism. The second one is seen during knee hyperextension and includes meniscus ruptures at a rate of 30%. More severe contact hyperextension injuries may result in giving damage to neurovascular structures together with PCL and the posterior capsule. And the third one occurs due to a direct impact during the knee-flexion. Generally tibia cannot displace towards posterior on femur and PCL gets damaged too [12]. Noncontact injuries are mostly seen in the athletes who perform skiing. The first of these injuries occurs due to the interaction of valgus and external rotation impacts after the internal part of the ski is stuck in the snow [12]. The second one occurs with the combination of the abrupt and strong quadriceps contraction resulted from the movement of skier who loses the balance in order not to fall back and to keep his/her balance again and the passive front pull force created by the backside extension parts of high ski boots [13]. The third one is the ACL rupture caused by strong and abrupt quadriceps contraction. It occurs when basketball and football players turn their bodies to the direction they want to go during their feet are stable on the ground after the abrupt slowing down made in order to change direction. In this situation femur is forced to an external rotation on tibia [12]. The other ACL injury occurs when the athletes fall on the ground during the knee is in extension or landing on their feet jumping from a high platform [2, 14].

Patients mostly complain about the difficulty in running, making sport activities, dislocation of the knee after abrupt stopping or jumping and pain. Patients say that they mostly feel a rupture and hear a pop sound rather than feeling pain [10, 15]. They describe this feeling with sliding of two fists on each other (two fist sign) [7]. The patient applies to the clinic with the problem of hemarthrosis after the trauma in the knee. A giving-way occurs in the knee due to the forward translation of tibia during the acts of abrupt turning or changing direction simultaneously with performing a press on the extremity that already has a lack of ACL. No swelling and pain occur during these attacks. However, a secondary meniscus lesion or a cartilage lesion may occur in these attacks. These lesions may result in swelling and pain [7, 16].

The pain is resulted from the damage occurs in other structures of the knee joint. After this injury, one cannot further his/her activity [17]. In more severe situations the joint combination has instability due to a multiple ligament injury. The existence of hematoma under the skin shows that there is a severe injury together with the capsule rupture. There may also be a limitation of movement ability [8, 10].

The visualization in anterior cruciate ligament injuries is applied through direct radiographs, magnetic resonance imaging (MRI), ultrasonography (usg) and arthroscopy.

Treatment:

The recent orthopedic treatment methods recommend the reconstruction of ACL through a surgery for the patients who perform sports or physical activities intensely. As the ruptured ligaments are not sutured end to end, this method is called 'reconstruction' of the ligament and conducted in different ways [6]. However, the

inflammation should be decreased by treating any oedema and limitation of movement before the surgical operation [10, 18].

Reconstruction of ACL decreases the rate of meniscectomy and provides objective stability. Conservative treatment should primarily be applied for acute and partly isolated ACL injuries that have negative results from pivot-shift test. However, it must be considered that almost one third of these cases would further into surgery in a later period. The aims in ACL surgeries are; providing normal knee kinematics and stability, improving the functional capacity of the knee, preventing new injuries by preserving other anatomic structures, regaining the strength, range of motion and functionality again [7]. The best results in ACL reconstruction are obtained within the cases in which the stability of the knee is achieved before any incurable meniscus and cartilage injuries occur. The best time for the surgery is the one after the swelling and tenderness of the knee fade away and the normal range of motion is obtained.

Graft selection has a high significance in the success of the treatment for injured ACL. Graft selection depends on the surgical experience, the preferences, situation of tissues, the age of patients, the status about performed activities, accompanying diseases, the situation before surgical operation and the decision of patients [19-23]. Allografts for multiple ligament injured athletes or hamstring and patellar tendon grafts from the patient's body are used in order for this operation [32]. The most used autograft areas are; hamstring tendon graft from internal femur, bone-patellar tendon-bone grafts from the front part of knee and quadriceps tendon graft from the front part of femur [6]. We can categorize grafts under three groups as 1- Autografts, 2- Allografts, 3- Synthetic Grafts. The main ones of autografts are; bone- patellar tendon – bone (B-Pt-B) graft, hamstring tendons (semitendinosus and gracilis) and quadriceps tendon (QT) graft [7, 10, 18, 24-26].

Some tunnels are driven on femur and leg bones during the surgery, the prepared new tendon graft is placed in these tunnels and identified through some absorbable or metal instruments. Some instruments and imaging devices are put into the knee through the holes on different sides of patella for arthroscopy. Through this way the parts inside the knee can be monitored with the help of closed circuit camera system (cccs). Both diagnostic and therapeutic applications can be conducted [6].

General, spinal or epidural anesthesia types are applied for ACL reconstruction. The patient lies in supine position and the knee is supported with a lateral support. A tourniquet is wrapped around the femur and brought to proximal as much as possible. The flexion of knee is adjusted at least to 70°-90° and the arthroscopy process begins. The flexion of knee is adjusted to the minimum level and the arthroscopy process begins again. Within the arthroscopy, firstly the pathologies are taken out. Meniscectomy is applied and the stitchings are made but not knotted. ACL residuals are cleaned in tibial and femoral parts. In chronic cases, notchplasty may be applied in order to enlarge the narrowed intercondylar notch [8, 27, 28]. The periosteum that is 2cm medial to tibial tubercle is slide towards the medial. In order to obtain a convenient tunnel length, a guide wire is placed in the joint with a 55° angle between this part and the long tibia axis [10]. The intraarticular output point of guide wire should be in a few mm posterior to the adherence area ACL. This point anatomically is 7mm medial to the posterior margin of meniscus horn and 7mm in front of anterior cruciate ligament [8, 27]. After sending the guide wire properly, the tibial tunnel is made through a 10mm cannulated drill [10]. When the knee is in 90° flexion, the 7mm offset hooked guide reeved through the hole is placed in the posterior wall of intercondylar notch towards 11 o'clock and 1.22 o'clock for right and left parts of the knee respectively. Then the guide wire is driven forth until it goes out of femur anterior cortex. A femoral tunnel is driven through the wire with a 10mm cannulated drill. Because of a precedent use of 7mm offset, 2mm of cortex can be undamaged in femur posterior after using a 10mm one. The tunnel to be driven for B-T-B graft, should be 2mm longer than the bone block. [8, 10, 27, 28].

In order to provide the normal knee function, both of two bands of ACL are reconstructed. This method is called "dual band technique". Anteromedial and posterolateral adherence area traces in femur and tibia of ACL are showed up opening portals with an arthroscopic examination. The opened posterolateral femoral tunnel and femoral adherence area of ACL show differences with the position of knee. After placing the guide wire on posterolateral band adherence area, the knee is changed in flexion until 120° and a 25-30mm tunnel is driven with a 7mm drill. An almost 4cm incision is made from tubercle level of anteromedial of tibia for tibial tunnels. Firstly, the guide is adjusted to 55° and placed on tibial posterolateral adherence trace and the guide wire is sent. After that the guide is adjusted to 45° for anteromedial tibial tunnel. The starting point of this tunnel on tibia cortex is in more front and more proximal. Guide anteromedial [29] is placed on the adherence trace and the guide wire is sent. Tibial tunnels are driven by 7mm and 8mm drills. Lastly the femur anteromedial tunnel is driven transtibially [10, 30]. After driving these tunnels, the first thing to do is to determine the femoral edge of graft. This determination can be conducted through an interference screw, screw lamina combination, traverse nail, hook and button depending on the graft. For the tibial side this determination can be through an interference screw, staple, lamina-screw, screw-staple and suture post methods [31]. After these determinations, it is controlled whether the graft is stuck in intercondylar notch or not through applying flexion and extension to the knee. The internal side of the joined is washed and the meniscus stretching is knotted if there is. The stability is examined [10].

Methods and Symptoms:

62 athletes, who are diagnosed with acute and chronic ACL ruptures in different times, are included in our study. The average age of patients is 38.3. 46 of our patients are male. A radiographic examination and magnetic resonance imaging were applied for all patients after physical examination. After diagnosing a full-thickness ACL rupture, the preparations for a surgical operation was started.

General or spinal anesthesia was applied depending on the situation of patient. Sterilized tourniquets were applied to the related leg. A diagnostic arthroscopy was applied firstly and the diagnosis was confirmed and convenient treatment methods used for the other pathologies together with the rupture (such as: meniscus rupture) and ACL residuals were cleaned. Through a mini oblique incision from patellar tendon medial, semitendinous and gracilis grafts were taken out.

The graft was prepared and after the required measurements, tibial and femoral tunnels were prepared. Graft was implanted, movements of graft were controlled and the femoral and tibial sides were exposed to press fit determination with transfixation screw and bio absorbable screw respectively. The tibial determination was reinforced with a staple. The stability, being stuck etc. of the graft was controlled arthroscopically. The portals were closed with a drain and the incisions were closed too regularly. Tourniquet was loosened, bandaging was applied and the lower extremity brace was implanted in operating room. Drains of all patients were taken in the postop first day, they were made to walk and the active strengthening exercises were started. All patients were included in the physical therapy. Patients started to walk with full burdens in postop first day and the braces were taken out in the 3rd week. Follow-ups of the patients were conducted by the clinic.

In our study; we helped all of 62 amateur and professional athletes, to whom we applied a treatment for semitendinous and gracilis tendon autograft arthroscopic ACL rupture, to begin their active sport lives in only 4.3 months [Şekil2]. A traumatic ACL rupture developed in 5 patients, 14 patients complained about anterior knee pains, 9 patients had tibial staple scratchiness and 7 patients had chronic pains near the tibial tunnel, around patellar tendon.



Fig. 2: The post op graphy of the transfixation method we applied to a patient who has an ACL rupture.

Discussion:

Anterior Cruciate Ligament rupture is a widely seen injury and develops due to sport and daily activities. ACL is the primary structure to prevent tibia from any displacement toward the front (%86) [6]. This structure also prevents internal rotation and hyperextension [7]. ACL ruptures may generally be caused by a hyperextension injury or a valgus impact applied to knee [4, 8-10] an abrupt slowing down, sprain of the knee after turning or moving, sprain as a result of improper landing after an act of jumping or some other direct impacts on the knee. After this rupture, a sense of space occurs and the patient has difficulty in standing on his/her knee. After that a swelling and pain occur in the knee. It is expected within the physiotherapy that the front drawer, lachman and pivot shift tests give positive results. The treatment method is determined according to the age, profession and sport activity of the patient [4, 11]. The treatment is reproducing the ligament using different methods that is 'reconstruction' [6]. However, the inflammation should be decreased by treating any oedema and limitation of movement before the surgical operation [10, 18].

All the patients included in our study are active and young people. The patients with acute traumas were followed and treated until the acute tissue reaction and then the surgical operation was made. All our patients had some complaints about some severe problems affecting their lives. The fact that all our patients started over their daily activities shows the significance of ACL surgery. The press fit tibial determination has significance in allowing movements in an early time. It is highly noteworthy that no ruptures occurred in our patients except for

the ligament rupture related to traumas (seen in 5 patients). The staples of 9 patients who had staple scratchiness were taken off with local anesthesia. 14 patients who had anterior knee pains were treated with quadriceps strengthening exercises. The patients who had chronic pains around the patellar tendon were treated with local injections. The use of a monotype autograft is a disadvantage in our study. The 5-year follow-up is highly significant. There is a need for advanced studies with revisions. The fact that all our patients were athletes and all of them had strong muscles affected the study positively. The use of a monotype surgical method (transfixation and tibial screwing+staple) shows the limitation of our study.

Conclusion:

The ACL reconstruction surgery should be applied especially for the young active patients who have some complaints related to ACL ruptures. The success we obtained through our techniques and a 5-year follow-up is highly noteworthy. We believe that the use of autograft has an important effect on this success. We believe again that tibial and femoral determinations eased the patients to start over their daily activities. We think that all young patients should be supported with ACL surgery in order to improve the quality of their lives.

Contribution of Authors:

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