An Updated Insight about ALC Reconstruction Techniques

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Abstract: Disruption of the anterior cruciate ligament (ACL) can lead to early joint deterioration, meniscal lesions, and dysfunction, making it a crucial ligament for good knee function. The purpose of this extensive study was to examine the various methods employed for ACL reconstruction. To replace native ligaments, modern ACL repair techniques use a variety of autograft and allograft varieties. For ACL restoration, the ideal graft would be one that mimics the natural ligament biomechanically, is easy to harvest, has minimal harvest site morbidity, and integrates well with the bone. To address possible issues with the interference screw and button fixation method, a new approach called cross-fixing of the hamstrings has been developed for ACL restoration. In terms of restoring anterior and rotational stability, prior clinical findings suggested that double-bundle ACL restoration was on par with or even better than single-bundle ACL reconstruction.

Keywords: ACL reconstruction techniques

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Introduction

When it comes to stabilizing the knee and keeping it in a state of dynamic-static stability, the anterior cruciate ligament is among the most crucial.[1] The anterior cruciate ligament's primary role is to stop the tibia from moving forward in the femur.Deterioration or injury to the anterior cruciate ligament (ACL) can cause early joint degeneration and functional impairment in the knee, which is why it is so crucial to the knee's regular functioning [2].the third ACL tears are common among athletes and other physically active people. Sudden deceleration or hyperextension are potential causes of these injuries, which are more common as athletic activity rises.[4] After an injury, the majority of patients go through phases of discomfort, loss, instability, and diminished function.[5] Because of the associated costs and loss of production, ACL injuries have far-reaching consequences for both individuals and society as a whole.[6] There is now universal agreement that ACL remodeling is the best method for restoring stability and function. It has a low recurrence rate, a high rate of return to preoperative activity, and it delays the onset of osteoarthritis and meniscus deterioration.Tendon grafting is a common surgical procedure for ACL restoration [7,8]. However, the structure and composition of tendons varies from the ligaments, with tendons having a larger proteoglycan quantity and a different distribution of collagen.The ACL graft needs to remodel (ligamentize) after surgery so it can mimic the native ACL more closely in terms of

structure and biochemistry.[10] The literature reports that ACL reconstruction has made use of a wide variety of procedures from a variety of sources. Some unwanted consequences may occur if you use any of these approaches. In order to identify the optimal treatment, it is helpful for the treating physician and patient to evaluate the prevalence of these consequences. In order to better understand how to repair a torn ACL, this study compared various methods. We postulated that there would be a wide range of advantages and disadvantages to each method.

Arthroscopic ACL reconstruction techniques

In various medical settings, the surgeon may employ a variety of approaches.[11] Placing a bone tunnel, selecting and harvesting grafts, fixing grafts, and postoperative therapy are the fundamental elements of ACL restoration. Clinical outcomes following ACL reconstruction may be impacted by each of these.Those numbers are [12,13,14, 15]. It The most common approach to repairing an ACL is using an autograft from the hamstrings (specifically, the semitendinosus and gracilis tendon).references [16,17, 18] Potential advantages of hamstring grafts over patellar tendon autografts include less extensor mechanism problems and better biomechanical qualities. After repairing the ACL using hamstring tendons, graft attachment is seen as the weak spot. Optimization elements are necessary to meet the demand for quicker recovery following ACL surgery.The year 19

A reciprocal stabilizer, button, or interference screw can be used to secure soft tissue to bone. When it comes to quadruple hamstring grafts, interference screw fixation might not provide the strength necessary for a comprehensive rehabilitation program.Anteromedial portal, transtibial, and outside-in techniques are the three main categories into which ACL arthroscopic restoration approaches fall [20].[21] Due to the transtibial method's graft direction being more vertical than the position of the upper femoral tunnel entrance, some patients were not observed in terms of rotational control following surgery.In order to create oblique femoral tunnels with fewer incisions, a novel technique called the modified transtibial method has been created from the regular transtibial method [22].[23]

Nevertheless, there is a lack of data about the use of cross pins, a novel approach to graft stabilization. Graft fixation to the bone tunnel is the main issue that limits early intensive rehabilitation during the early postoperative phase. Metal interference screws provide the best initial fixed strength of any treatment for patellar bone tendon ligaments, according to multiple studies.referenced as [24,25,26] Metal interference screws have a strong binding, however these implants come with a lot of drawbacks such MRI distortion, joint rupture risk, and hardware removal.referenced as [24,25,26] Compared to metal screws, bio-absorbable interference screws might be better.the eleventh

Regional anesthetic has been extensively utilized to provide the necessary postoperative analgesia for ACL reconstruction in outpatient settings, as this orthopedic treatment is commonly done on an outpatient basis. A number of studies have compared the efficacy of various regional anesthetic techniques in arthroscopic ACL restoration with respect to postoperative pain reduction and functional outcomes.27 and 28 An thorough investigation revealed that femoral nerve block, while commonly used to alleviate postoperative pain in ACL reconstruction patients, is linked to several

negative effects, including quadriceps weakness, antalgic walking, and an increased risk of falls. In the early postoperative time after ACL repair, they found that adductor canal block can be used instead of femoral nerve block to provide the same amount of analgesia while protecting the motor nerve. This allowed the quadriceps to continue to work.[27]

Graft choices

Autografts (bone patellar tendon, hamstring), allografts, and synthetic grafts are among the options for ACL reconstruction. For an anterior cruciate ligament (ACL) repair to be successful, the chosen graft must match the native ligament biomechanically, be easy to harvest, cause minimal harm at the harvest site, and integrate properly with the bone.[29] There is currently no perfect graft for ACL restoration because each graft has its own set of benefits and drawbacks.[30] When compared to other forms of transplants, autografts are far more prevalent. The three most frequent types of autografts are hamstring, bone patellar tendon bone (BPTB), and bone quadriceps tendon grafts.[31] in For a long time, BPTB was thought to be the best option for ACL repair. Excellent clinical outcomes and high levels of patient satisfaction make the BPTB autograft a popular choice.[32] One of the most popular grafts used for ACL restoration is the hamstring tendon graft. If the gracilis tendon is not present, the semitendinosus tendon can still be taken from the ipsilateral leg.Although there is little donor site morbidity with hamstring grafts, there are issues with the healing and elongation of bone tendon junctions [33]. Despite its potential utility in revision or cases involving multiple ligamentous injuries, allograft has subpar results when it comes to immunity and re-rupture rates. Overall, there isn't a perfect synthetic graft accessible, and they're continually evolving.[29]

Options for incision size: one or two Arthroscopy with a patellar or hamstring tendon graft is a common method for reconstructive surgery to treat major knee injuries, such as double- or single-bundle ACL ruptures. In order to determine if one or two incisions should be made, Rezende et al.[4] analyzed the evidence of choice of ACL reconstruction approach with arthroscopy. It is not straightforward to select a strategy for ACL reconstruction. There is a problem with the method of creating the tunnel in the femur. The conventional technique involves penetrating the femoral tunnel from the outside into the knee joint and then making an incision from the outside of the thigh to access the bone.Here, the bond is externally fastened to the femur into the joint using an interference screw while the tunnel is directly visible through the thigh incision [34].[4] By excavating the femoral tunnel from within the knee joint using arthroscopic imaging, the incision and dissection of the quadriceps are minimized in the arthroscopic procedure of one incision.[35] in The graft is secured to the femur using an interference screw after being guided within the joint via arthroscopy. This means that, similar to the two-incision approach, the only incision needed is an anterior incision just below the knee to bore a tunnel into the tibia. The inadequacy of the information available to guide this essential comparison should be noted when establishing priorities for high-quality randomized trials on procedures for ACL repair, as stated by Rezende et al. [4].

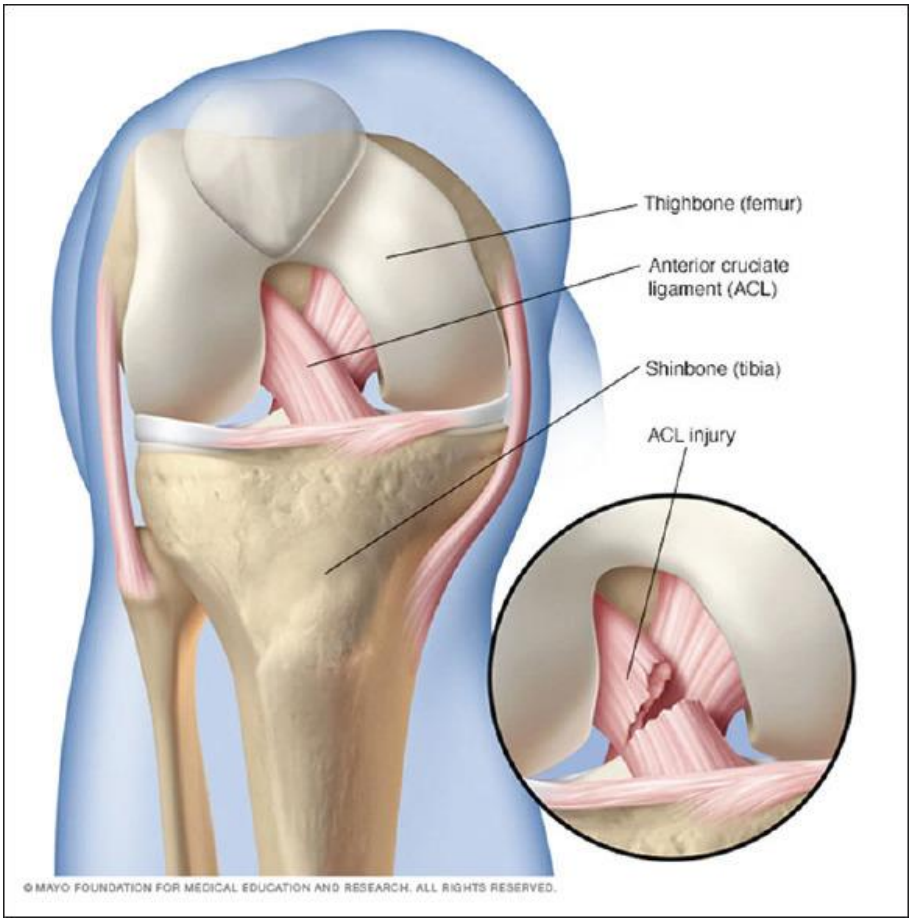

Figure 1 ACL injury (MAYO foundation for medical education and research)

According to several studies, anterior (front-to-back) stability is usually adequately achieved with a single bundle of screws. However, it falls short when it comes to knee rotational stability.[36] Surgical treatments in "double bundles" have been adjusted to repair both the anteromedial and posterolateral bundles, which improves rotational stability.[37] As a result, the anteromedial and posterolateral bundles of the ACL were reconstructed utilizing the double-bundle approach. Rotational stability is better with double-bundle reconstruction than with single-bundle, according to previous research.In a cadaveric model, anatomic double-bundle restoration is superior to a single-bundle technique for restoring normal knee kinematics [38].in the text. Kurosaka et al.[40] found that double bundles provided greater progressive stability than single bundles when they looked at the clinical outcomes of 54 patients who had reconstructive surgery and had at least two years of follow-up. Due to the increased contact areas, the scientists discovered that twin bundles could enhance tendon-bone junction repair. Compared to single-bundle surgery, double-bundle procedures demonstrated superior anterior-posterior stability and rotation, according to certain clinical data obtained through computer guidance.Other research has failed to find any significant difference between single and double bundles [41].Most surgeons choose the single bundle for ACL reconstruction, likely because to the difficulty of the double bundle.On the other hand, the intricacy of the surgical process suggests that this choice may be based on deeper anatomical and biomechanical considerations [43].[44] Compared to single-bundle anterior cruciate ligament replacement, double-bundle reconstruction significantly improves anterior and rotational stability,

according to biomechanical studies. Compared to a single-bundle ACL repair, the extra reconstruction of the posterolateral bundle greatly improved rotational stability. If you want to regain anterior and rotational stability after a knee injury, a double-bundle ACL restoration is the way to go, according to previous clinical outcomes.[45]

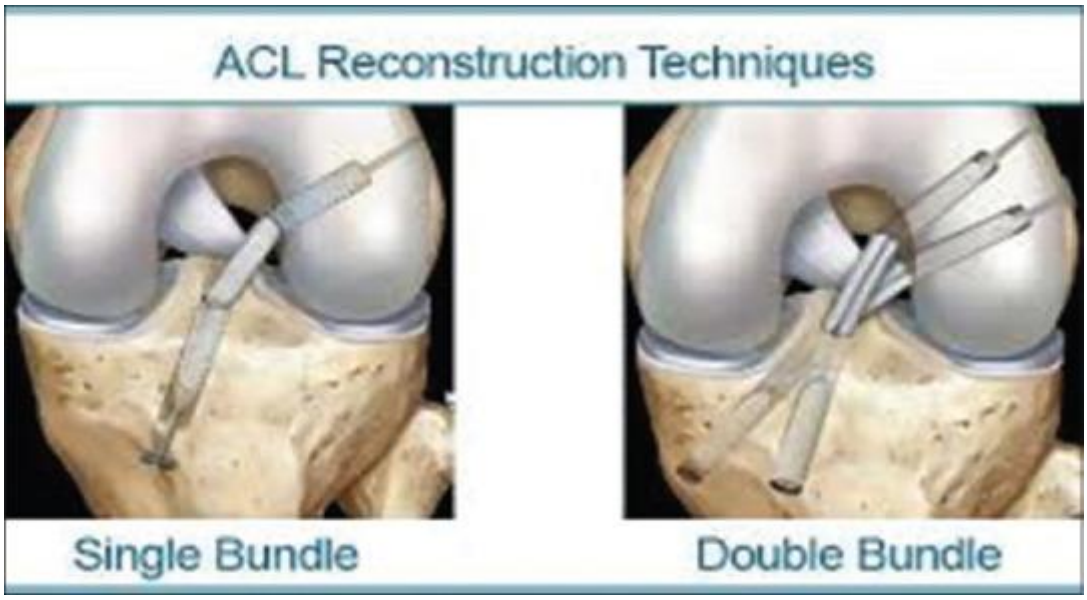

Figure 2: Single vs. double bundle technique

All-inside ACL reconstruction

ACL surgery has advanced with the advent of the all-inside ACL reconstruction technique. More than two decades have passed since this technique was first detailed[46]; Lubowitz et al.[47] Among the many advantages of this technique are its reduced bone removal, preservation of the gracilis, greater cosmesis, smaller skin incisions, closed-socket tunnels, and less postoperative pain. There may be a correlation between the all-inside ACL and reduced post-operative pain, and the results seem to be comparable to those of conventional ACL procedures. Nevertheless, the all-inside ACL raises concerns about a potential increased graft failure rate.[46] An ACL repair using a BPTB or an autograft from the semitendinosus and gravis tendon is the gold standard. On the other hand, a triple or quadruple semitendinosus tendon autograft is typically used in the all-inside ACL method.[47] Because the all-inside ACL operation uses closed sockets of the femur and tibia instead of entire tunnels, the graft length must be reduced. Restoring the tibia's anterior translation at 1.3 mm from the native ACL and achieving comparable rotational and torque properties were demonstrated in a biomechanical investigation that utilized a hamstring tendon for restoration.There was no statistically significant difference in pain, Lysholm, or Tegner scores between the two groups at two years of follow-up in a study that compared an all-inside ACL technique using a double or triple semitendinosus tendon graft with a conventional ACL technique using a semitendinosus-gracilis hamstring tendon autograft [48].[47] Prior research has shown that the all-inside ACL technique, which just requires a single hamstring tendon transplant, can achieve knee stability that is comparable to that of a native ACL.[46]

Conclusion

There are a variety of grafts that can be used for ACL restoration, including synthetic grafts, allografts, and autografts (such as BPTB, hamstring, and bone quadriceps tendon). For an anterior cruciate ligament (ACL) repair to be successful, the chosen graft must match the native ligament biomechanically, be easy to harvest, cause minimal harm at the harvest site, and integrate properly with the bone. To address possible issues with the interference screw and button fixation method, a new approach called cross-fixing of the hamstrings has been developed for ACL restoration. Nevertheless, there is a lack of knowledge regarding the use of cross pins, as they are a new way of graft stabilization. Surgery for ACL reconstruction has recently advanced with the all-inside ACL reconstruction technique. In terms of restoring anterior and rotational stability, prior clinical findings suggest that double-bundle ACL restoration is on par with or even better than single-bundle ACL reconstruction.

No Conflict of interest.

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