

Transportal vs. all-inside technique in anterior cruciate ligament reconstruction.

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Abstract

Introduction: The principle of anatomic Anterior Cruciate Ligament Reconstruction (ACLR) is to create a femoral and tibial tunnel that resembles the insertion of the Native Anterior Cruciate Ligament (ACL). The aim of this study is to investigate the best method to achieve anatomical reconstruction of femoral and tibial tunnel insertion of the ACL and thus, a more horizontal orientation of the ACL.

Methods: A literature study was undertaken using PubMed, Medline, Google Scholar, and EMBASE up to November 2022 to discover articles concentrating on AIT and TPT of ACL repair.

Results: When compared to traditional ACL reconstruction surgery, AIT is a good choice for conserving bone tissue and gracilis tendon resulting in less discomfort following surgery, higher knee flexor strength, and similar outcomes. TPT had no negative effect on graft healing. In addition, TPT in ACL reconstruction showed similar femoral tunnel positions and clinical outcomes. Acceptable graft healing and clinical outcomes can be obtained for TPT in ACL reconstruction

Keywords: Transportal, All inside technique, ACL reconstruction, Graft, Tendon.

Introduction

The Anterior Cruciate Ligament (ACL) can be injured while cutting and rotating, as well as when landing after a jump [1]. The greatest risk of injury is among athletes; with a female majority [2, 3]. The ACL has a limited capacity for biological healing. If untreated, ACL deficiency knee can cause significant morbidity and permanent disability [4]. Hence surgical restoration of the ACL is frequently necessary to maintain functional stability and delay the onset of knee joint deterioration [5].

Anterior Cruciate Ligament Reconstruction (ACLR) is the recommended course of treatment for ACL damage. With the aim of developing a less intrusive and more anatomical reconstructive technique, ACLR has changed throughout time [6]. Previous non-anatomic repairs were shown to have a higher risk of graft impingement, rotational instability, and graft attenuation [7-11]. The ACLR is a frequently performed procedure in the field of sports medicine. However, there are several contentious issues surrounding the management of

ACL tears, leading to debates among surgeons and researchers in the quest for the optimal approach. Various methods for The rebuilding of the ACL and its variants are well described in the available literature [12-15]. The drilling technique used to make a femoral tunnel is critically important for determining outcomes after ACLR reconstruction [16, 17].

The most often utilized reconstruction techniques in modern clinical practice are Trans Portal (TP) and All-Inside Techniques (AIT) [18]. A commonly used method of ACLR is the TP approach, which distinct femoral shaft drilling [19, 20]. The disadvantage of this strategy is that it may result in graft to experience disproportionate stress, which raises the risk of graft failure, femoral posterior wall rupture, and a short femoral tunnel length [20-24]. A previous review highlighted some disadvantages associated with the TP method, for instance challenges in analysing during hyper flexion which could cause inadvertent chondral injury, technical complexity, the implementation of tiny or bicortical sockets which may restrict stabilization possibilities, a greater likelihood of requiring revision, a heightened risk of common peroneal

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nerve damage and a reduction in extension during the stance phase [25]. AIT has gained recognition as a potential replacement for the TP approach [26]. The crossing internal suture Augmentation Technique (AIT) is a method in which suture tape is used to reinforce the hamstring tendon autograft, with the tape anchored on the moveable cortical buttons on both the femoral and tibial sides. This internal suture provides support and protection for the graft during the healing and ligamentization processes, until it is fully established. The tape is applied with the knee in extension, and its ends are secured to the tibial button, along with a knotless anchor. One of the advantages of this technique is that it involves only minor incisions, is minimally invasive, and conserves bone stock by using sockets. It also facilitates a safer rehabilitation process, enabling an earlier return to activity and reducing the risk of premature graft failure or strain [27]. A minor incision is made during AIT for cosmetic purposes [28]. Instead of using entire tunnels, it employs sockets within the approximately halfway tunnel, which decreases discomfort following surgery, edoema, and the likelihood of synovial circulation or flooding at the graft-bone contact. Because the sockets eliminate dead space, they can help prevent tunnel enlargement and expedite graft age. [29]. AIT provides a number of benefits, such that it is less invasive and offers a variety of graft options [30].

Over which method is better, there is, nevertheless, ongoing discussion. In order to make recommendations for future use, this review evaluated and compared the clinical outcomes and side effects of these two procedures.

Methods

In order to find papers focusing on AIT and TPT of ACL repair, a literature analysis was undertaken using PubMed, Medline, Google Scholar, and EMBASE up to November 2022. Animal experiments, cadaveric studies, case reports, technical notes,

and studies with no quantitative data or subjects were all removed with morbid diseases. This evaluation included 274 studies, eight of which were comparative studies. A whole group of 60 patients received AIT, with 34 undergoing TPT for ACLR.

Results

When compared to standard ACL reconstruction surgery, AIT is a good choice for conserving bone tissue and gracilis tendon with reduced discomfort following the procedure (Figure 1-3), better knee flexor durability, and comparable outcomes.

The study from 2015 in which thirty-two patients were included, indicates that trans portal, Digging into the femoral tunnel results in an increased horizontal graft placement of the Ligament with no variations in clinical effects.[31]

A comparative study from 2013 proved that the TP group shows significantly better International Knee Documentation Committee (IKDC score), greater anterior-posterior stability of the knee as measured by the Lachman test, and a shorter time to recover following surgery as compared to AIT.

Another comparative study from 2018 states that TP central femoral tunnel ACLR has a higher failure rate and earlier failure than AIT. [32]

According to the study published in 2015, both TPT and AIT In ACL reconstruction, the femoral and tibial tunnel sites can be quite consistent. TPT demonstrated a substantial degree of heterogeneity in femoral tunnel length and allograft bending angles. Therefore, the TPT in ACL restoration is thought to be the most effective way for surgeons to create stronger femoral tunnels.[33]

TPT had no detrimental effects on graft repair. Furthermore, TPT in ACL restoration demonstrated identical femoral tunnel

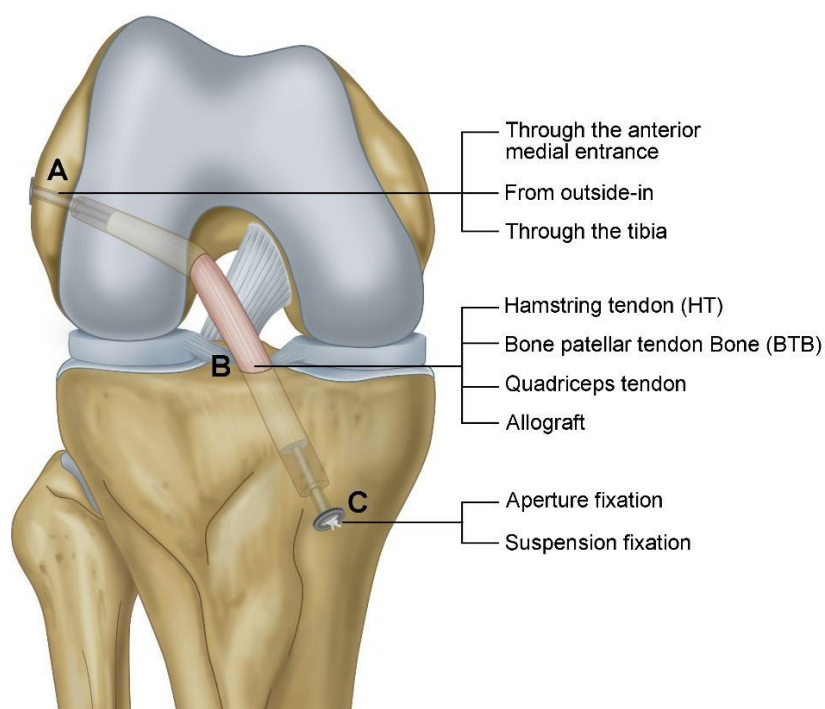


Figure 1: All-Inside Anterior Cruciate Ligament Reconstruction surgical procedure.

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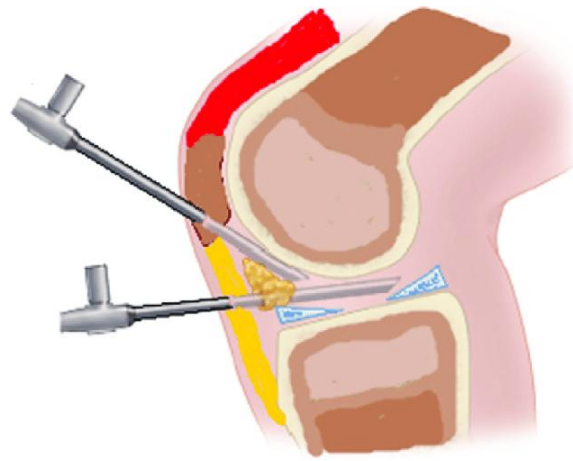


Figure 2: Portal placement; high portal in TT Technique, low portal in anteromedial portal technique.

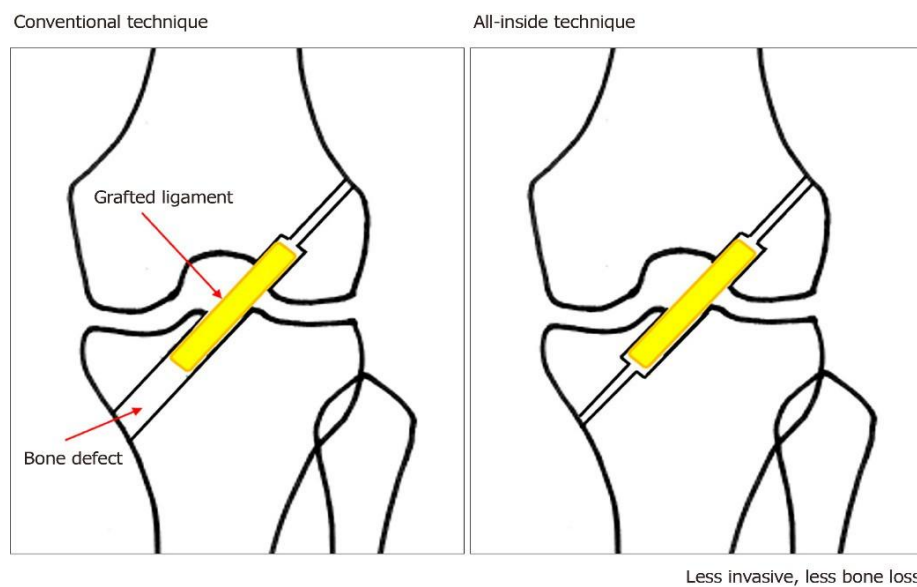


Figure 3: Difference between conventional and all-inside technique.

regions and clinical results. Excellent graft recovery and clinical results are attainable for TPT in ACL reconstruction. [34]

Considering the aforementioned pros and cons, AIT appears to be a preferable ACLR technique to TP. It is an appealing alternative since it preserves both the gracilis tendon and bone tissue while delivering results that are similar to conventional ACL repair surgery, with reduced post-operative pain and enhanced knee flexor strength. This reflects a current trend in orthopedic surgery towards less invasive techniques that yield positive patient outcomes. Furthermore, AIT improves bone preservation and diminishes postoperative discomfort. Some studies have indicated that TPT may result in a more horizontal ACL graft orientation, faster recovery, and greater stability than AIT. Nevertheless, further research is needed to assess the outcomes more comprehensively

Discussion

AIT and TP group post-operative functional outcomes were not significantly different, according to the literature evaluation. The aim of ACLR is to develop an enhanced anatomical yet less aggressive rebuilding process. In order to correct the

knee's kinematics and stop the onset of early osteoarthritis. The impact of various trajectories of ACL allograft in the femoral shaft on the stress generated during knee action, close to the femur remains uncertain. However, it appears that the location of the tunnel post-repair using TPT method may when compared to the modified AIT approach, have a stronger influence on the femur's stress rise [35]. However, in prospective research comparing the two procedures, following surgery VAS pain levels and morbidity rates were reduced in the AIT cohort than to the TP group, indicating that AIT is a good alternative choice, particularly for treating sportsmen with ACL injuries.

Femoral tunnel creation is a critical aspect of ACL reconstruction. Over time, the favored the transtibial approach to ACLR has given way to the TP method, which entails employing an Anteromedial (AM) arthroscopic portal or an additional AM portal to restore the anatomical femoral tunnel. [36, 37]. A single anatomical bundle TPT for rebuilding the ACL is a reliable approach which offers Short-term follow-up outcomes were acceptable. It offers the advantage of lowering rotational instability by positioning the graft horizontally [38]. A significant characteristic of the TP

method is the availability of the AM portal, which allows the surgeon to adjust the portal's configuration to suit the ideal requirements for ACLR was chosen based on their knowledge of femoral architecture and technical skills. [39]. TPT runs the risk of insufficiently short tunnel length. It is important to apply each method flexibly to each case because no single best approach was found [40]. When the femoral tunnel was placed more eccentrically in the AM bundle center position during ACL reconstruction using the TPT technique, better and more satisfactory clinical and functional results were achieved with a lower failure rate [41]. According to biomechanical and clinical research, the physiological location of the femur tube in the TP method additionally enhanced strength; nonetheless, over time clinical effects and this procedure rejection remain debatable. [42, 43].

The portal tightness and trouble viewing in hyper flexion are drawbacks of the TP method. Apart from the challenges of creating technically difficult Sockets that are too narrow or too bicortical can limit anchoring possibilities. The TP technique has various drawbacks that may affect the clinical result following ACLR. These include posterior-wall blowout, a higher rate of revision, extension deficit throughout the phase of stance, articular cartilage degradation, and a greater likelihood of injury of common peroneal nerve injury [44-47].

The all-inside method is viewed by many as a distinct and less intrusive ACLR method. Unlike other ACLR procedures, the All-inside approach employs a "socket" or "half-tunnel" on each of the femoral and tibial sides [48]. Lubowitz claims that fewer tibial skin incisions and tibial periosteal irritation are to blame for a reduction in postoperative pain [49]. The socket has been proposed as a means of accelerating graft growth and preventing tunnel growth due to the removal of wasted space. The proposed benefits of the AIT technique for ACL reconstruction also include a reduced risk of complications like tibial plateau fractures, more anatomically correct placement of the tibial tunnel, better bone-graft integration due to manual drilling, improved preservation of postoperative muscle, tendon, and bone, and enhancements in long-term function [50-52]. The biggest benefit is the improvement in cosmetics due to the removal of the wide incision needed for tibial drilling on the medial side of the tibia [53, 54]. The All-inside ACLR approach offers some advantages over the conventional reconstruction technique, which has caused its adoption to grow over the past few years. The AIT-ACLR approach has the potential to reliably produce broad grafts without the need for allograft augmentation [55].

Suspensory fixation may lead to the bungee cord and windshield wiper phenomenon, which is cause for alarm. When compared to entire tunnels shown in normal ACL procedures on x-ray and CT scans, sockets drilled with an all-inside ACL technique showed less socket growth and retained bone stock [56, 57]. Compared to full tunnels, closed-sockets have less graft length available for the windshield-wiper and bungee cord phenomenon.

While AIT-ACLR has various benefits, there are some disadvantages to consider. Precautions must be taken when

creating a socket using a retro drill to avoid harming the extra-articular surface. Additionally, according to a report, suspensory fixation may increase the risk of tunnel widening due to the "windshield wiper" phenomenon in the context of graft fixation [58, 59]. Contrarily, circumferential filling of the socket with the graft may increase bone to graft contact and reduce synovial fluid backflow into the socket when compared to interference screws [60, 61].

Different scoring methods, such as IKDC, Lysholm, KSS, SF-12, KOOS, and VAS, were utilized to evaluate the outcomes of ACLR in the studies. The most appropriate scoring system for assessing the effectiveness of ACLR is still uncertain. The findings indicate that, except for the VAS pain score, there were no significant variations in pre- and post-operative scores between AIT and TP ACLR methods [62-67]. It is important to note that all-inside surgery took longer than traditional open surgery to complete. It could be clarified through pointing out that AIT is an innovative technique and that with gaining greater expertise leads to quicker surgeries. AIT is just as successful as In terms of outcome, AIT outperformed the TP approach, with a lower pain rating with fewer mid-term difficulties, highlighting the benefits of AIT over TP technique

Conclusion

According to the studied literature, both the TP and AIT approaches have benefits as well as drawbacks. Nevertheless, because of its capacity to preserve bone tissue and the gracilis tendon, the AIT is an excellent replacement procedure, resulting in fewer following surgery discomfort and problems, as well as enhanced knee flexor strength and equivalent outcomes to the TP technique. Finally, the therapy of choice is determined by elements such as surgeon preference, available equipment, efficacy, patient demographics and activity level, and other relevant variables. More research is needed to discover the best strategy for generating a femoral tunnel during ACLR, and the purpose of this study was to compare the characteristics of these two approaches.

Declarations

Ethical approval of the study:

Not applicable.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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