

# The Hybrid Transtibial Technique Using the LARS Device in Primary Anterior Cruciate Ligament Reconstruction

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**Background:** The recently published hybrid transtibial technique (HTT) using the Pathfinder Guide with a flexible transtibial technique (TT) guide wire may represent a beneficial combination of both the anteromedial portal and TT technique. The HTT has been described as especially suitable for anterior cruciate ligament (ACL) reconstruction in adolescents or ACL revision. However, we also found that the HTT worked for primary ACL reconstruction in adults also using the Ligament Advanced Reinforcement System (LARS).

**Indications:** Acute ACL rupture in active patients who are eager to return to sports quickly.

**Technique Description:** The HTT combined with the conventional LARS reconstruction procedure improves the placement of the femoral tunnel, which involves a guiding vessel clamp through the anteromedial portal combined with a 2.0 mm Kirschner wire via the tibial tunnel. Finally, we used a metal screw for fixation of the ligament.

**Results:** The patient experienced satisfactory reconstruction of his ACL and regained active range of motion in 1 month and a full return to sports in 6 months.

**Discussion/Conclusion:** The HTT using the LARS for primary ACL reconstruction is easy, safe, and reproducible. This combined technique has not yet been published and it may provide good functional results that allow patients to recover quickly and return to sports as soon as possible.

**Patient Consent Disclosure Statement:** The author(s) attests that consent has been obtained from any patient(s) appearing in this publication. If the individual may be identifiable, the author(s) has included a statement of release or other written form of approval from the patient(s) with this submission for publication.

**Keywords:** hybrid transtibial technique; LARS; ACL; ligament reconstruction; HTT

## VIDEO TRANSCRIPT

Hi! My name is Tian You and I am a member of the Center of Sports Medicine and Rehabilitation department at Peking University Shenzhen Hospital.

Today, I'm presenting a clinical case of primary anterior cruciate ligament (ACL) reconstruction using the hybrid transtibial technique (HTT) along with the Ligament Advanced Reinforcement System (LARS) device.

The ACL is the most commonly injured ligament of the knee requiring surgical reconstruction, which requires the creation of a femoral tunnel via a separate anteromedial (AM) portal or transtibial (TT) technique.<sup>5</sup> The HTT was first named in 2017 and uses the medial portal guidance of a TT guide wire without knee hyperflexion.<sup>3</sup> This technique offers anatomic tunnel placement while maintaining the relative ease of a TT technique, which may represent

a beneficial combination of both the AM portal and TT technique.<sup>8</sup> It has been shown to be especially suitable for ACL reconstruction in adolescents.<sup>2,4</sup>

Owing to good functional and quality of life-related results,<sup>6</sup> the LARS has been the first treatment choice for ACL reconstruction by active people who pursue a rapid recovery in China. Nevertheless, few studies have been published on how to prepare the femoral tunnel in the LARS for ACL reconstruction. In the preparation of femoral tunnel, the HTT could harvest an adequate length and intact posterior wall that is better for LARS with metal screw fixation. Moreover, it can acquire a more anatomic and minimally angulated tunnel that may improve biomechanical, kinematic, and clinical outcomes. At last, this technique has been shown to be technically consistent, easy, and have a low risk of complications.

The patient in this study was a 34-year-old man highly engaged in American football. He sprained his right knee during a game on December 10, 2021. He described a popping sound, followed by immediate pain and swelling of the knee. Clinical examination showed positive outcomes in



the anterior drawer test, Lachman test, floating patella test, and negative outcome in the pivot shift test. Magnetic resonance imaging (MRI) showed that his ACL fibers were totally ruptured, with a typical kissing contusion and joint fluid. The diagnosis was an acute ACL rupture. Subsequently, we comprehensively evaluated the advantages and disadvantages of the LARS devices and autologous tendons, and thereafter we chose to perform the HTT using the LARS device for reconstruction of his ACL because the patient was a high-performance youth with acute lesions and functional impairment. Also, his job as a policeman prohibited him from being off the job for at least 1 year, if autograft reconstruction was used. We estimated that the patient can return to his preinjury exercise level, take part in competitive sport, and will not feel knee instability and pain during exercise and life after performing the HTT using the LARS device for reconstruction of his ACL.

There are some surgical techniques performed during this operation that require particular attention. First, it is important to moderately clean the residual end of the ACL while accurately locating the isometric points. Second, it is necessary to measure the distance between the Kirschner wire tip and the femoral footprint area after drilling the Kirschner wire into the tibial side; a distance of 4 to 5 mm is acceptable. Third, it is necessary to measure the distance using the Kirschner wire tip after completing the tibial lateral bone tunnel (2.0/1.5 mm Kirschner wire). At this point, a distance of 2 to 3 mm from the femoral footprint area is acceptable. Subsequently, we inserted a vascular forceps through the anterior internal approach, pushing the wire tip to the femoral footprint point, thereafter drilling it out to the outside of the femoral cortex using an electric drill. Finally, it is recommended to drill a bone tunnel from the outside of the joint to the inside of the joint, instead of using a hollow drill to drill through the femoral tunnel via the tibial tunnel on the femoral side, to avoid the expansion of the tibial tunnel and damage to the residual end of the ACL.

The patient was placed in the horizontal position. We identified the fibers of the ACL that were totally ruptured from the femoral side. Then, the ligament stump was moderately debrided, allowing for the precise positioning of the bone tunnel, which was the key to a successful ACL reconstruction. However, retaining a little of the remnant helps prevent the joint fluid from leaking into the bone tunnel. The posterior cruciate ligament and medial tibial intercondylar crest were used as landmarks, and the tibial tunnel

position was a little further back than the site of the autograft reconstruction. At this stage, a 2.5 mm Kirschner wire was used as the guide pin. If the pin was at a good position, an estimation of where to point it was made in the range from 60° to 90° of the knee flexion. Usually, if the needle tip is only 3 to 5 mm from the femoral footprint, it can be moved to the right position after reaming with a 7.5 mm hollow drill. Next, the nearly isometric femoral tunnel was positioned on the lateral intercondylar ridge or the extension of the femoral posterior cortex line, 7 to 8 mm distal to the femoral posterior cortex wall, to avoid rupturing the posterior wall. Then, a 2.0 mm Kirschner wire was placed inside the tibia to find the nearly isometric femoral point according to the HTT, instead of the previous 2.5 mm pin. Because the 2.0 mm Kirschner wire was thinner and more flexible, it allowed for a greater adjustment angle. As you can see in the video, when a 2.5 mm Kirschner wire was used, its tip was 1 to 2 mm away from the femoral position. A 2.0 mm Kirschner wire allows for the tip to reach the edge of the femoral site. After this, a vascular forceps was placed through the AM portal. The Kirschner wire was clamped, pushed into the femoral point, and tightened by a hammer. Previously, the HTT was performed using the Pathfinder ACL Guide and a flexible Guide Pin to finish the preparation of femoral tunnel. However, we used a vascular forceps and a thin Kirschner wire of 2.0 mm to reach the same goal. Then, we drilled the Kirschner wire inside to outside of the joint. The position of the needle tip should be in front of the extension line of the femoral lateral condyle, and the needle tail distance from the back wall must be more than 5 mm. After confirmation of correct placement, the femoral tunnel was reamed with a 7.5 mm hollow drill from the outside to the inside of the joint. Debridement was needed if metal debris was present to avoid postoperative synovitis. Afterward, the 2.0 mm Kirschner wire was used as the screw guide and placed under the pull wire to prevent the Kirschner wire from entangling the artificial ligament. After pulling the ligament, the outer part of the LARS ligament should be 1 to 2 mm out of the femoral tunnel entrance. After that, we fixed the femoral screw first and rotated it externally to tighten the ligament fibers. At last, we rechecked the LARS graft. If it was isometric, we would fix the screw in the extended position; otherwise, we fixed the graft at the longest position.

The day after surgery, a 3-dimensional computed tomography scan showed that the proximal and distal tunnels were in good position. The patient was in a knee brace

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and on crutches for 3 weeks. After the operation, his knee flexion and extension was completely normal. There was slight atrophy of the quadriceps femoris during the first month. Also, both his functional scores and stability were very good. He was allowed to perform gentle sports without body contact after 3 months and resumed playing football 6 months after the reconstruction. We can see the number 5 player was the patient. The patient's MRI reexamination revealed that the graft was continuous, with good tension, and no synovitis reaction. He had a Lysholm score of 94 points, an International Knee Documentation Committee (IKDC) score of 85 points, and a GNRB (GENOUROB) antedisplacement of 2 mm at 6 months after surgery.

The patient recovered well after surgery. According to the recent consensus by Chinese specialists on LARS device reconstruction of the ACL, there is a general consensus that synovitis is an occasional complication and a high consensus that joint infection is an incidental complication with a lower incidence than that in autologous tendon graft.<sup>1</sup> However, in individual studies, the revision rate and complication rate are higher; this may be related to the use of early and immature technology or older patient age. Generally, there is no difference in Lysholm, IKDC, and Tegner scores between LARS device and autologous tendon for most patients after surgery. Moreover, patients who use LARS device exhibit better and early motor recovery and improved quality of life in the early postoperative period.<sup>7</sup>

Here, we have the articles reviewed for this case. Thank you for your attention.

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