

Arthroscopic Techniques

# Implant free techniques in surgeries for sports related injuries of the knee

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## ABSTRACT

Arthroscopic surgeries can be made cost effective by avoiding the use of implants whenever possible. Usage of confluent tunnels, suture bridges, bone bridges, and modifications in standard arthroscopic procedures will help us in achieving comparable mechanical as well as the functional outcome at the same time have technical advantages and cause less financial burden to the patient. On this technical note, we propose the use of various implant free techniques in arthroscopic and other sports related surgeries of the knee.

**Keywords:** Implant free techniques, Sports injuries, Confluent tunnel, Suture bridge, Bone bridge

## CONFLUENT TUNNEL TECHNIQUES

One of the technical arduity in multi-ligament reconstruction is the drilling of separate tunnels for each ligament as they have a likelihood of convergence, especially with small knees as encountered in the Indian population.<sup>[1]</sup> Confluent tunnel techniques aid in overcoming this concern. Here, we discuss a few such techniques where a confluent tunnel could abet the surgeon.

### Combined posterior cruciate ligament (PCL) and medial collateral ligament (MCL) reconstruction

In combined PCL and MCL reconstruction, there is a high chance of femoral tunnel convergence since both are on the medial femoral condyle unlike combined anterior cruciate ligament (ACL) and MCL reconstruction. Bonadio *et al.* proposed the use of a single femoral tunnel technique to avoid femoral tunnel convergence in combined PCL and MCL reconstruction.<sup>[2]</sup> However, this technique requires posteromedial exposure and used Achilles bone tendon allograft.

#### Author's preferred technique

PCL is reconstructed using hamstring graft, Semitendinosus Tendon 4 strands (ST4) + Gracilis Tendon (GT) and the remaining length of a single strand of GT, after passing through suspensory device loop is used for MCL reconstruction. The femoral tunnel is drilled in an outside

in fashion starting at the isometric point for MCL (posterior and proximal to medial epicondyle) and exiting at the PCL footprint on the medial wall of the intercondylar notch. After achieving aperture fixation for PCL graft at the tibial side and suspensory fixation at the femur, the remaining length of GT graft is further tunneled to exit at the MCL isometric point on the tibia and fixed with an interference screw [Figure 1].

### Combined ACL and lateral collateral ligament (LCL) reconstruction

Combined ACL and posterolateral corner (PLC) injury including LCL injury amount to approximately 10% of complex knee ligamentous injuries. Fibular head based isometric reconstruction is a reliable and accepted technique for the reconstruction of PLC injuries. Angelini *et al.* proposed a confluent tunnel technique for reconstruction of ACL & PLC including LCL. They proposed an outside in technique for drilling the femoral tunnel followed by passage of hamstring graft for ACL and LCL reconstruction through it, after achieving suspensory fixation for ACL graft, the LCL graft is tunneled under the Ilio-Tibial Band (ITB) and fixed at the fibular head isometric point.<sup>[3]</sup>

#### Author's preferred technique

ST4 used for ACLR is passed through a standard tibial tunnel and outside in drilled femoral tunnel. GT graft for LCL

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reconstruction is first fixed at the fibular head with a cinch knot and free ends of both grafts fixed at the femoral end using a single interference screw in full extension, followed by tensioning the ACL graft and fixation at the tibial end in 30 degrees of flexion [Figure 2].

**Combined ACL and antero-lateral ligament (ALL) reconstruction**

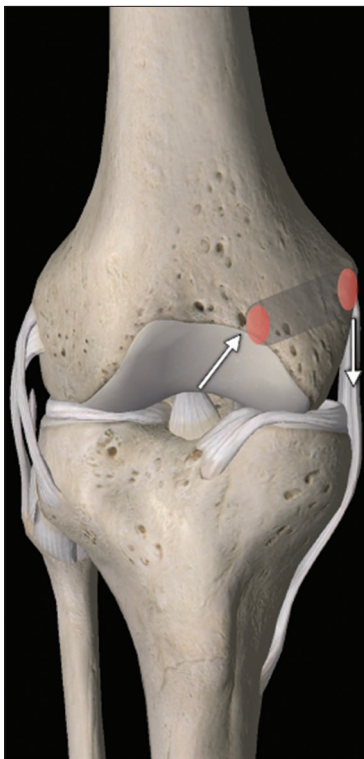
ALL reconstruction along with ACL reconstruction has been shown to reduce graft rupture rates, reduce pivot shift, and found to be superior to extra articular tenodesis procedures for ALL. The isometric points for ALL are at the lateral epicondyle, Gerdy’s tubercle, and fibular head.<sup>[4]</sup>

**Author’s preferred technique**

Confluent femoral tunnel is drilled starting from the intercondylar notch at 2 or 10’ o clock position for left and right knee, respectively, exiting proximal and posterior to lateral femoral epicondyle (femoral footprint for ALL). ST4 along with single bundle GT together reconstructs the ACL achieving 8 mm diameter for ACL graft. After passing the GT tendon through the suspensory device loop, the remaining portion is further tunneled under the ITB and through a tibial tunnel drilled from isometric point to exit near the tibial tunnel for ACL graft achieving a 4.5 mm diameter for ALL graft [Figure 3].



**Figure 2:** Single tunnel technique for combined ACL and LCL reconstruction. The white arrows show the direction of ACL and LCL graft passage.



**Figure 1:** Confluent tunnel technique for combined PCL and MCL reconstruction. The white arrows show the direction of PCL and MCL graft passage.



**Figure 3:** Single tunnel technique for combined ACL and ALL reconstruction. The arrow head shows the bone bridge over which ACL and ALL grafts will be tied.

## SUTURE BRIDGE TECHNIQUES IN PATELLA

Patella being a thinner bone and subcutaneously located, it is preferable to use lesser implants in surgeries of the patella; here, we discuss suture bridge techniques applicable in surgeries of the patella.

### Osteochondral defect reconstruction

Osteochondral fragments arising from under the surface of the patella need fixation to prevent patellofemoral arthritis and anterior knee pain. Several methods of fixation have been described in the literature, from compression screws, bioabsorbable screws to fibrin glue. Metallic screws need removal at a later date whereas bioabsorbable screws have the disadvantages of tissue reactions, late degradation, and bone cyst formation. Vogel *et al.* proposed a fragment preserving fixation technique using suture anchor and vicryl sutures; however, that has an added cost constraint.<sup>[5]</sup>

#### Author's preferred technique

We propose the use of a suture bridge technique [Figure 4] which avoids the use of any implants in fixing such osteochondral fragments. After making drill holes through the osteochondral fragment and the surrounding bone, fiber wire is passed through these drill holes. The osteochondral fragment is tied through fiber wire to the surrounding intact patellar surface and parapatellar soft tissues.

### Medial patellofemoral ligament (MPFL) reconstruction

MPFL reconstruction has become the gold standard in the management of recurrent patellar instability.

#### Author's preferred technique

We propose the use of a single-knot trans osseous suture technique, where No 5 Ethibond suture is passed through 2 parallel 2.5 mm tunnels drilled horizontally in the patella and brought out medially and tied to a hamstring graft which is then fixed at the Schottle's point [Figure 5].

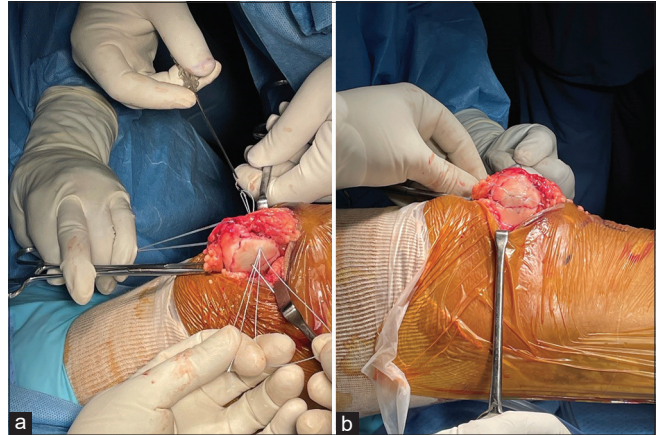
## AVOIDING A SCREW IN FIBULA

### LCL cinch knot for LCL reconstruction

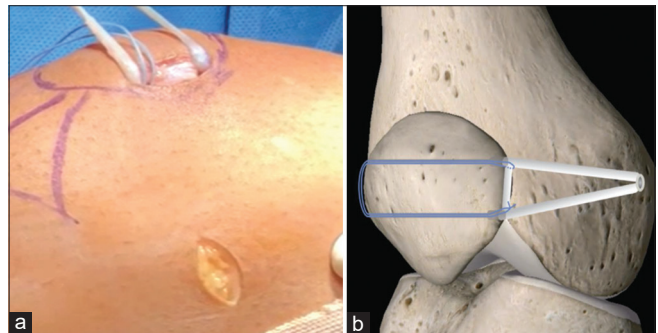
In the reconstruction of LCL fixation of the graft at fibular head requires a screw fixation. We propose the use of an LCL cinch knot technique wherein a cinch knot is taken after the double stranded hamstring graft is tunneled through the fibular head drill hole and is further fixed at the femoral isometric point with an interference screw [Figure 6].

#### Modified Larson's technique

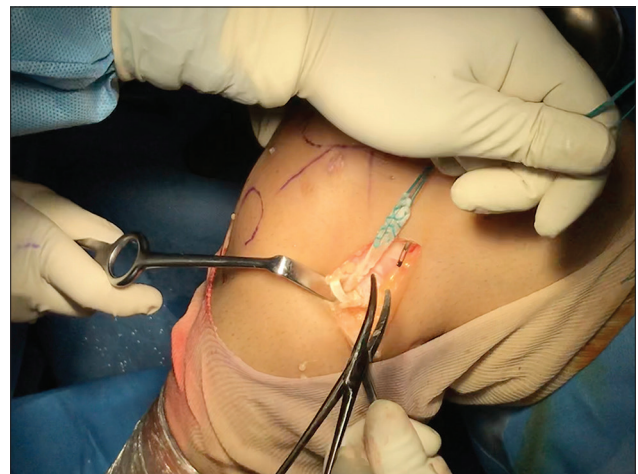
Larson's procedure was one of the first fibular-based techniques and reconstructs the LCL and Popliteo-Fibular Ligament (PFL) with distal insertion sites located at the fibula. A modification of this technique was proposed by Niki *et al.*, where a semitendinosus graft is looped through the fibular



**Figure 4:** Suture bridge technique for OCD patella reconstruction (a) Multiple fiber wires are passed through a drill hole in OCD fragment. (b) OCD fragment is tied to surrounding bone and soft tissues.



**Figure 5:** (a and b) Single-knot trans osseous suture technique for MPFL reconstruction.



**Figure 6:** A cinch knot using hamstring graft on the fibular head to reconstruct LCL

head, one end tunneled under ITB and fixed at anatomical insertion sites for LCL and PFL on the lateral femoral condyle under 10N tensioning using two endobuttons and an interference screw.<sup>[6]</sup> However, to prevent graft motion within



the fibular head they used a 5 mm interference screw at the fibular head.

**Author’s preferred technique**

The fibular sided interference screw can be avoided by taking running stitches through the semitendinosus graft.

**TIBIAL BONE BRIDGE TECHNIQUES**

**Combined ACL and ALL reconstruction**

In combined ACL and ALL reconstruction one can avoid the use of an added interference screw to fix the ALL graft by taking advantage of a bone bridge between the tibial tunnels for ACL and ALL and tying the grafts over this bone bridge [Figure 7].

**Combined ACL reconstruction and meniscal root repairs**

Meniscal root repair through the transtibial pull-through technique makes use of an endobutton for suture fixation at the aperture of the tunnel. In a combined ACL reconstruction and meniscal root repair, the use of this endobutton can be forgone using the bone bridge between ACL tibial tunnel and the one for meniscal root repair, to tie the suture end.

**MCL tibial repairs**

While repairing tibial sided avulsion of MCL the use of a ligament anchor can be avoided. Two 4.5 mm parallel, medial to lateral directed drill holes are made at the tibial attachment of MCL.

Two sets of Krackow stitches using No 5 Ethibond are taken on MCL and these Ethibond sutures are passed through the tibial drill holes and tied over the lateral sided bone bridge [Figure 8].

**Combined high tibial osteotomy (HTO) and meniscal root repairs**

In combined HTO and meniscal root repair by trans-tibial pull through technique, the use of endobutton for meniscal root repair can be avoided by tying the suture to the plate used for HTO fixation.

**Combined HTO and ACL reconstruction**

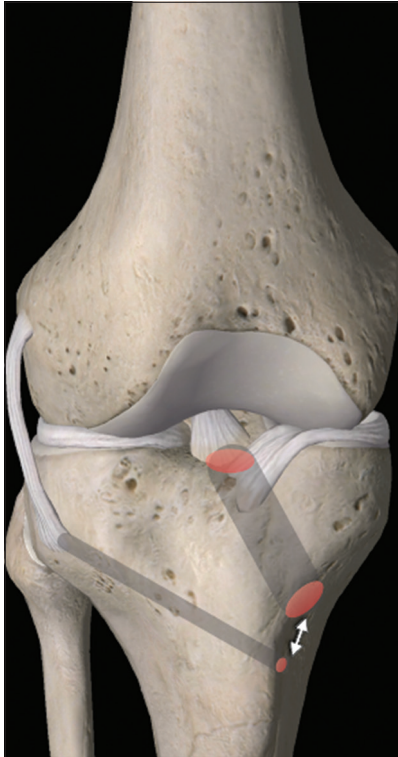
In combined HTO and ACL reconstruction, the tibial interference screw can be avoided by tying the ACL graft to the plate used for fixing HTO.

**RAMP LASSO FOR RAMP REPAIR**

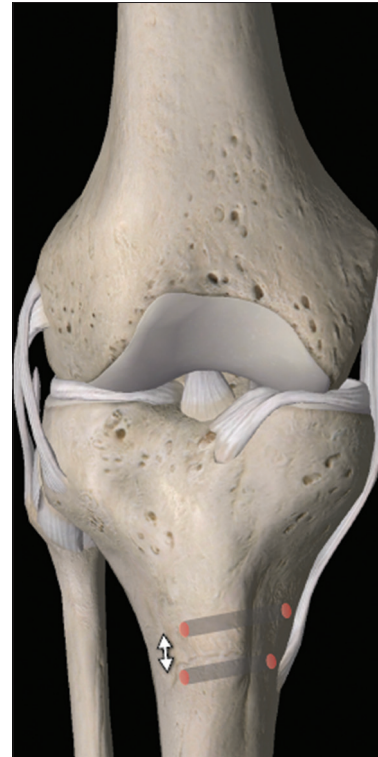
Ramp tear usually requires the use of an all inside repair system which adds to the cost of surgery. An all inside repair can be recreated avoiding the use of an all inside repair system using a posteromedial working portal and passing a Lasso to reach the posterior capsule and fiber wire threaded across the ramp tear. The fiber wire is then tied using a sliding knot through the posteromedial portal so that the knot lies over the capsule. The pros and cons of implant free techniques are enumerated in [Table 1] and the comparison with conventional techniques given in [Table 2].

**Table 1:** Pros and cons of implant free techniques.

Techniques	Pros	Cons
Confluent tunnel techniques	<ul style="list-style-type: none"> <li>• Avoids tunnel convergence</li> <li>• Advantageous in small sized knees where landmarks will be closer to each other</li> <li>• Reduced cost</li> </ul>	<ul style="list-style-type: none"> <li>• Higher load on the implant</li> <li>• Steeper learning curve</li> </ul>
Suture Bridge techniques in Patella	<p>OCD fixation</p> <ul style="list-style-type: none"> <li>• Versatile technique as it helps to fix fragments in a different orientation</li> <li>• Avoids implant prominence</li> <li>• Smaller fragments can be addressed by taking bites through attached soft tissues</li> <li>• Reduced cost</li> <li>• Less tissue reaction and bone cyst formation</li> </ul> <p>MPFL reconstruction</p> <ul style="list-style-type: none"> <li>• Smaller bone tunnels risk a lesser chance of fracture</li> <li>• Reduced cost</li> </ul>	<p>OCD fixation</p> <ul style="list-style-type: none"> <li>• Lesser stability compared to implants</li> <li>• Delayed rehab</li> </ul> <p>MPFL reconstruction</p> <ul style="list-style-type: none"> <li>• Lesser stability compared to implants</li> </ul>
Avoiding screw in Fibula	<ul style="list-style-type: none"> <li>• Less chance of iatrogenic Fibular head fracture</li> <li>• Reduced cost</li> </ul>	<ul style="list-style-type: none"> <li>• Longer free graft required</li> <li>• Chances of graft motion within the fibular tunnel</li> <li>• Suture prominence</li> </ul>
Tibial bone bridge techniques	<ul style="list-style-type: none"> <li>• Avoids an extra implant</li> <li>• Reduced cost</li> <li>• Better approximation to foot print in case of repairs</li> </ul>	
Ramp Lasso	<ul style="list-style-type: none"> <li>• Avoids the use of an all inside repair device</li> <li>• Reduced cost</li> </ul>	<ul style="list-style-type: none"> <li>• Steeper learning curve</li> </ul>



**Figure 7:** Tibial bone bridge in combined ACL and ALL reconstruction, avoiding a suspensory device. The arrow head shows the bone bridge over which ACL and ALL grafts will be tied.



**Figure 8:** Making use of the tibial bone bridge in MCL tibial sided repair. Arrow head shows the bone bridge over which No 5 Ethibond used for MCL repair will be tied.

**Table 2:** Comparison with conventional techniques.

	Conventional Technique	Author's Preferred Technique
PCL & MCL reconstruction	Bonadio <i>et al.</i> <sup>[2]</sup> <ul style="list-style-type: none"> <li>Needs posteromedial exposure &amp; detachment of popliteus</li> <li>Uses Achilles bone tendon allograft</li> </ul>	<ul style="list-style-type: none"> <li>Mini open technique</li> <li>Uses Hamstring graft</li> </ul>
ACL & LCL reconstruction	Angelini <i>et al.</i> <sup>[3]</sup> <ul style="list-style-type: none"> <li>Uses suspensory device for ACL graft on femoral end and interference screw for LCL at the fibular head</li> </ul>	<ul style="list-style-type: none"> <li>Single interference screw fixes both ACL and LCL grafts at the femoral end</li> <li>No implant at fibular head</li> </ul>
ACL & ALL Reconstruction	Sonnery-Cottet <i>et al.</i> <sup>[4]</sup> <ul style="list-style-type: none"> <li>Outside in femoral tunnel</li> <li>ALL graft looped through the tibial tunnel and fixed at femoral end</li> </ul>	<ul style="list-style-type: none"> <li>Trans-portal inside out femoral tunnel drilling</li> <li>ALL graft passed through a tibial tunnel to exit near ACL tunnel and tied over the bone bridge to ACL graft</li> </ul>
Patella OCD fixation	Vogel <i>et al.</i> <sup>[5]</sup> <ul style="list-style-type: none"> <li>Uses suture anchor for fixation</li> </ul>	<ul style="list-style-type: none"> <li>Avoids suture anchor and makes use of patellar bone bridges for fixation</li> </ul>
MPFL reconstruction	Schottle <i>et al.</i> <sup>[7]</sup> <ul style="list-style-type: none"> <li>Uses either screwed anchors or impacted anchors for hamstring graft fixation on the patella</li> </ul>	<ul style="list-style-type: none"> <li>Avoids the use of an implant on the patellar side for fixation</li> </ul>
LCL Cinch knot technique	LaPrade's Technique <sup>[8]</sup> <ul style="list-style-type: none"> <li>Uses Interference screw for graft fixation at the fibular head</li> </ul>	<ul style="list-style-type: none"> <li>Taking a cinch knot with hamstring graft around fibular head avoids the interference screw</li> </ul>
Modified Larson's Technique	Niki <i>et al.</i> <sup>[6]</sup> <ul style="list-style-type: none"> <li>Uses interference screw on the fibular head to prevent graft motion</li> </ul>	<ul style="list-style-type: none"> <li>Taking a running stitch on the graft to prevent graft motion within the tunnel</li> </ul>
Ramp Lasso	Li <i>et al.</i> <sup>[9]</sup> <ul style="list-style-type: none"> <li>Uses all inside repair device</li> </ul>	<ul style="list-style-type: none"> <li>No all inside repair device required</li> </ul>

## CONCLUSION

Implant free techniques in arthroscopic and sports related surgeries of the knee provide comparable surgical results to conventional techniques and can be considered a cost-effective alternative.

### Declaration of patient consent

Patient's consent not required as patients identity is not disclosed or compromised.

### Financial support and sponsorship

Nil.

### Conflicts of interest

There are no conflict of interest.

## REFERENCES

1. Kim TK, Phillips M, Bhandari M, Watson J, Malhotra R. What differences in morphologic features of the knee exist among patients of various races? A systematic review. *Clin Orthop* 2017;475:170-82.
2. Bonadio MB, Helito CP, Foni NO, Albuquerque RF, Pécora JR, Camanho GI, *et al.* Combined reconstruction of the posterior cruciate ligament and medial collateral ligament using a single femoral tunnel. *Knee Surg Sports Traumatol* 2016;25:3024-30.
3. Angelini FJ, Helito CP, Tozi MR, Pozzobon L, Bonadio MB, Gobbi RG, *et al.* Combined reconstruction of the anterior cruciate ligament and posterolateral corner with a single femoral tunnel. *Arthrosc Tech* 2013;2:e285-8.
4. Sonnery-Cottet B, Daggett M, Helito CP, Fayard JM, Thauinat M. Combined anterior cruciate ligament and anterolateral ligament reconstruction. *Arthrosc Tech* 2016;5:e1253-9.
5. Vogel LA, Fitzsimmons KP, Lee Pace J. Osteochondral fracture fixation with fragment preserving suture technique. *Arthrosc Tech* 2020;9:e761-7.
6. Niki Y, Matsumoto H, Otani T, Enomoto H, Toyama Y, Suda Y. A modified Larson's method of posterolateral corner reconstruction of the knee reproducing the physiological tensioning pattern of the lateral collateral and popliteofibular ligaments. *Sports Med Arthrosc Rehabil Ther Technol* 2012;4:21.
7. Schottle PB, Romero J, Schmeling A, Weiler A. Technical note: Anatomical reconstruction of the medial patellofemoral ligament using a free gracilis autograft. *Arch Orthop Trauma Surg* 2008;128:479-84.
8. Moatshe G, Dean CS, Chahla J, Serra Cruz R, LaPrade RF. Anatomic fibular collateral ligament reconstruction. *Arthrosc Tech* 2016;5:e309-14.
9. Li WP, Chen Z, Song B, Yang R, Tan W. The FasT-Fix repair technique for ramp lesion of the medial meniscus. *Knee Surg Relat Res* 2015;27:56-60.

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