

Margin Convergence Continuous Lasso-Loop Overlocking Technique for the Repair of Horizontal and Longitudinal Knee Meniscal Tears



Oleg Milenin, M.D.

Abstract: Horizontal and longitudinal tears are the most common injuries of the meniscus. The arthroscopic all-inside suture technique using meniscal repair devices involving preloaded sutures and nonabsorbable implants is the most popular technique. The 2 main disadvantages of this technique are the high cost and complications associated with implants. We have adopted some modern shoulder surgery techniques to repair horizontal and longitudinal meniscal tears. Our technique is based on the continuous lasso-loop margin convergence technique for rotator cuff repair (Lafosse's continuous stitches). The technique is an implant-free, cost-effective procedure, which can be performed using general arthroscopic instruments.

The prevention and repair of meniscal injuries are very important for preventing early osteoarthritic changes.¹⁻³ Three groups of techniques have been developed for meniscal repair: outside-in, inside-out, and all-inside techniques. The all-inside technique has some benefits because it does not necessitate additional cuts for knot tying,⁴ with the arthroscopic all-inside suture technique using meniscal repair devices involving preloaded sutures and nonabsorbable implants being the most popular technique. Some devices such as the Sequent device (ConMed, Utica, NY) allow a continuous W-shaped suture application in meniscal repair and exhibit better mechanical properties than those of other devices that involve simple stitches.⁵

The 2 main disadvantages of the all-inside meniscal repair using devices are the high cost and complications associated with implants.⁶ The complications are implant migration, cyst formation, eruption through the meniscal tissue, and the potential risk of neurovascular injury from the implants.⁴

The modern trend in arthroscopic surgery is to adopt some techniques from shoulder and knee surgery. In 2006, Lafosse et al.⁷ described the lasso-loop technique for labral repair, which could significantly improve the mechanical properties of construction. This technique was later adapted in the margin convergence technique of rotator cuff repair. Other authors have described a similar technique.⁸

We have developed a technique for horizontal and longitudinal meniscal repair that is implant free and cost-effective and can be administered using general arthroscopic instruments.

Surgical Technique

Surgery is performed with the patient in the supine position with a leg holder allowing full range of motion. The use of an air tourniquet is strongly recommended for better visualization. We use 2 standard anterolateral and anteromedial portals. After diagnostic arthroscopy and meniscus examination with a probe, we prepare the tear surfaces with a shaver to obtain the optimal condition for healing (Fig 1). In case of degenerative tears or complex lesions, we prefer to remove meniscal flaps with poor tissue quality and to prepare the horizontal part of the meniscal tear until we approximate

From Moscow Centre for Research and Practice in Medical Rehabilitation, Restorative and Sports Medicine, Moscow, Russia.

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Address correspondence to Oleg Milenin, Moscow Centre for Research and Practice in Medical Rehabilitation, Restorative and Sports Medicine, 105120, Zemlyanoy VAL 53/1, Moscow, Russia. E-mail: olegmilenin@yandex.ru

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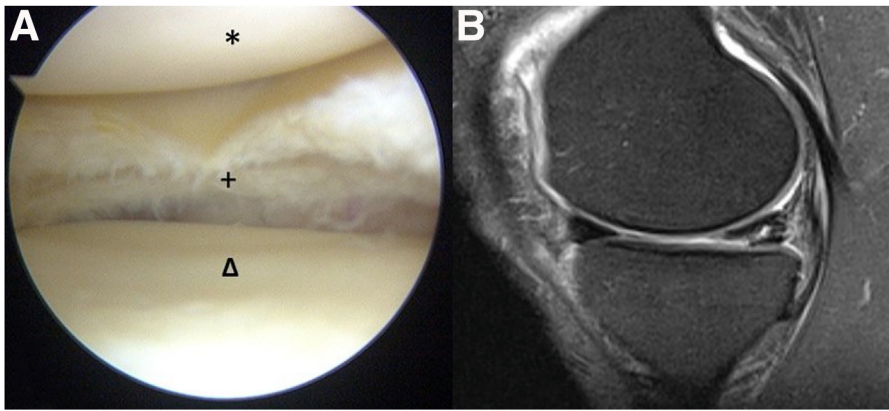


Fig 1. (A) Intra-articular view from anterolateral portal of horizontal medial meniscal tear in right knee. The asterisk indicates the medial femoral condyle; triangle, medial tibial plateau; and plus sign, medial meniscus. (B) Preoperative magnetic resonance imaging in sagittal plane showing horizontal medial meniscal tear in right knee.

the vascular red zone. This technique requires a probe, suture manipulator, knot pusher, suture cutter, and 18-gauge 50-mm injection needle. We prefer a No. 0 polydioxanone thread or No. 0 FiberWire suture (Arthrex, Naples, FL).

We localize the middle of the tear with a spinal needle through the skin in the outside-in direction. To reach the posterior horn of the medial meniscus, the needle should be inserted parallel to the joint line just medial to the insertion point of the semimembranosus tendon. For the posterior horn of the lateral meniscus, the needle should be inserted parallel to the joint line between the biceps tendon insertion and iliotibial band. Direct perpendicular needle insertion from the posterior aspect of the knee should be avoided to prevent injuries to the nerves and vessels.

At the start of the procedure, the suture is inserted into the needle and passed through the superior part of the tear (Fig 2). The tip of the suture is then passed

through the medial portal (Fig 3). The key in performing the technique is to gently pull the needle tip out just behind the meniscal rim and to pass it through or under the inferior part of the tear. This maneuver creates a loop (Fig 4). With probe manipulation, the loop is extended and the suture from the superior part is passed through the loop (Fig 5) and taken out of the portal to create an overlocking lasso-loop configuration (Fig 6). After this, the needle tip is withdrawn from the capsule and the lasso is tied by pulling on the posterior end of the suture (Fig 7). Then, the needle with the loop is passed through the superior part of the tear. The suture is passed through the loop, and the previous steps are repeated (Figs 8 and 9).

The aforementioned maneuvers create an M- or W-shaped configuration of overlocking sutures. At the end of the procedure, both threads are placed under the inferior surface of the meniscus. Both threads are held with the suture manipulator and passed through the

Fig 2. (A) Intra-articular view from anterolateral portal in right knee. (B) Model. The needle with the loop is inserted parallel to the joint line through the superior part of the meniscal tear. The asterisk indicates the medial femoral condyle; triangle, medial tibial plateau; plus sign, medial meniscus; and arrow, tip of needle.

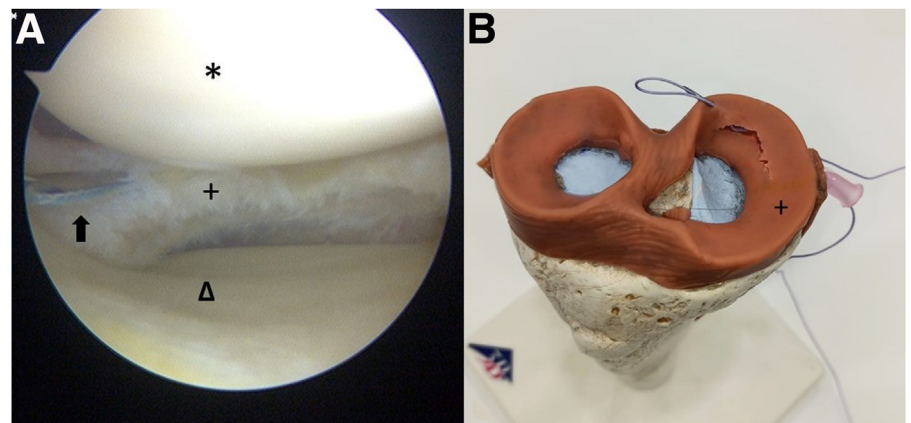


Fig 3. (A) Intra-articular view from anterolateral portal in right knee. (B) Model. The tip of the suture is passed through the medial portal. The asterisk indicates the medial femoral condyle; triangle, medial tibial plateau; and plus sign, medial meniscus.

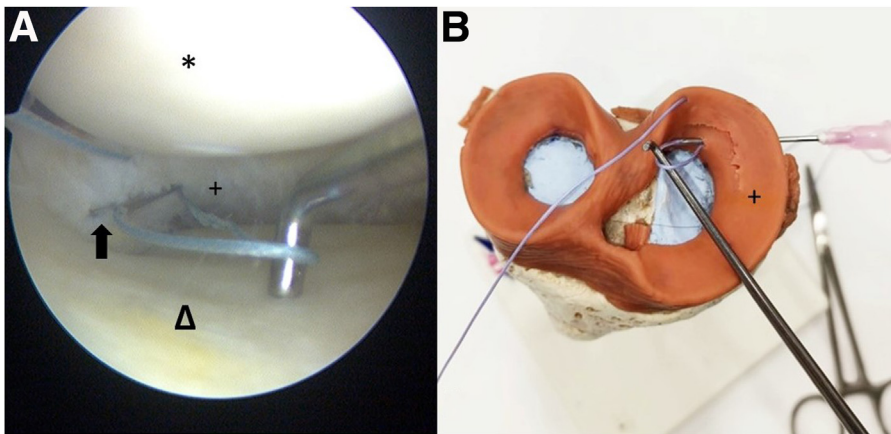
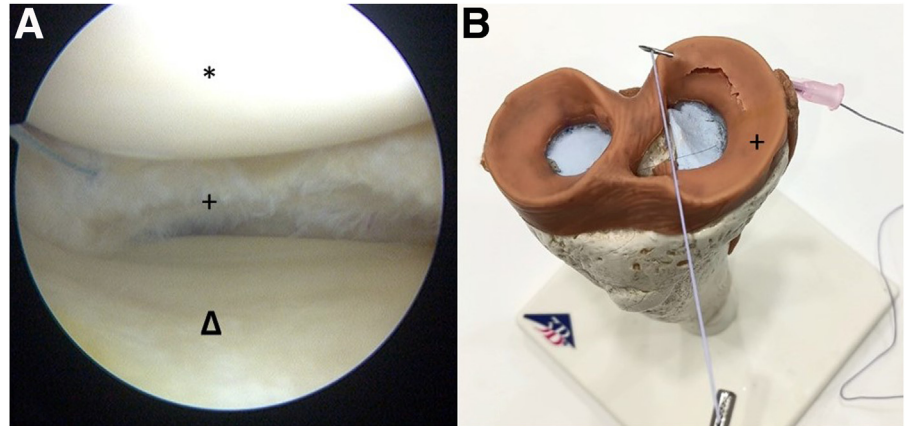
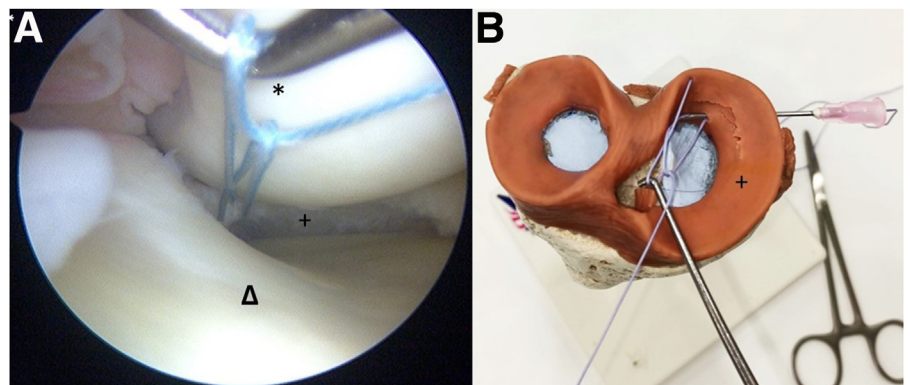


Fig 4. (A) Intra-articular view from anterolateral portal in right knee. (B) Model. The needle is passed through the inferior part of the tear. The loop is extended by a probe. The asterisk indicates the medial femoral condyle; triangle, medial tibial plateau; plus sign, medial meniscus; and arrow, tip of needle.

Fig 5. (A) Intra-articular view from anterolateral portal in right knee. (B) Model. The suture from the superior part is passed through the loop with a probe. The asterisk indicates the medial femoral condyle; triangle, medial tibial plateau; and plus sign, medial meniscus.



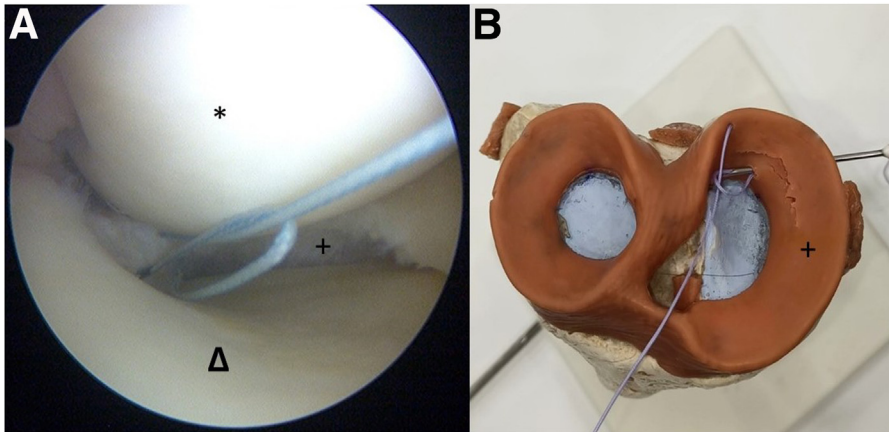


Fig 6. (A) Intra-articular view from anterolateral portal in right knee. (B) Model. The suture is taken out of the portal to create an overlocking lasso-loop configuration. The asterisk indicates the medial femoral condyle; triangle, medial tibial plateau; and plus sign, medial meniscus.

Fig 7. (A) Intra-articular view from anterolateral portal in right knee. (B) Model. The lasso loop is tied by pulling on the posterior end of the suture. The asterisk indicates the medial femoral condyle; triangle, medial tibial plateau; and plus sign, medial meniscus.

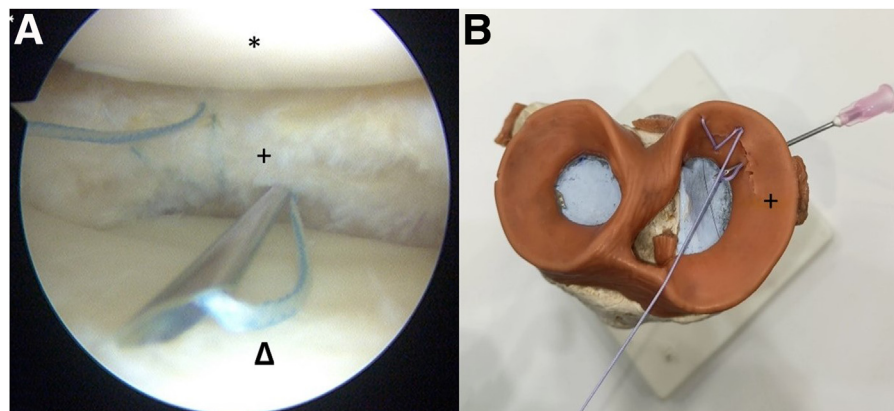
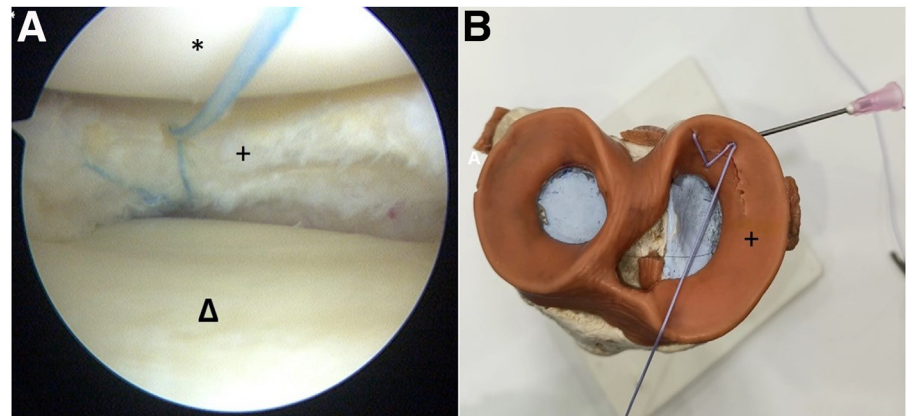


Fig 8. (A) Intra-articular view from anterolateral portal in right knee. (B) Model. The tip of the needle is passed through the inferior part of the tear; the loop is created, and the previous steps are repeated. The asterisk indicates the medial femoral condyle; triangle, medial tibial plateau; and plus sign, medial meniscus.

Fig 9. (A) Intra-articular view from anterolateral portal in right knee. (B) Model. The free end of the suture is passed through the loop and is taken out through the portal. The asterisk indicates the medial femoral condyle; triangle, medial tibial plateau; and plus sign, medial meniscus.

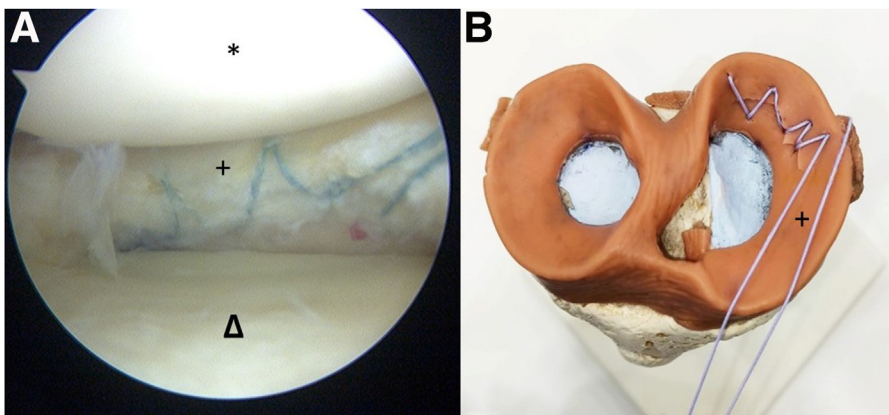
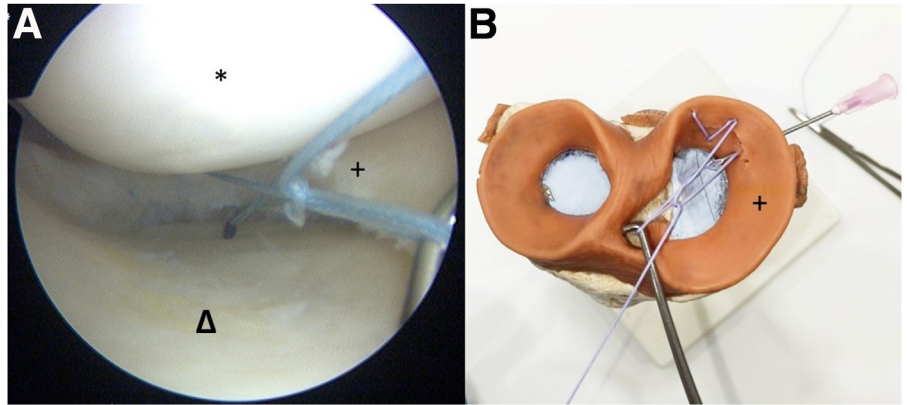
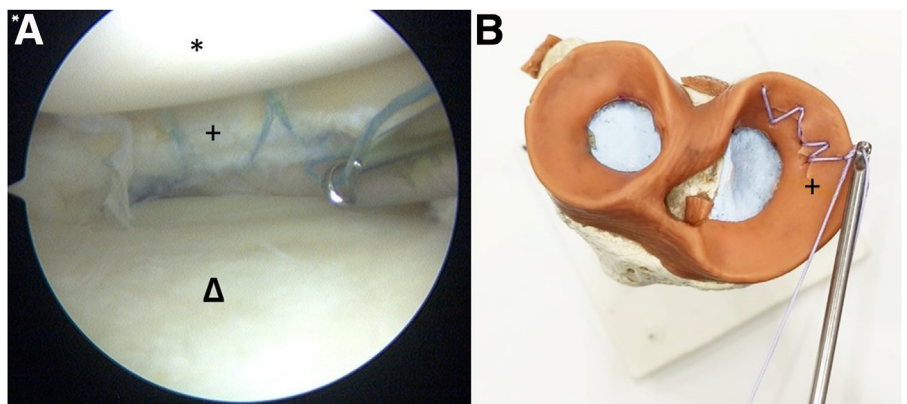


Fig 10. (A) Intra-articular view from anterolateral portal in right knee. (B) Model. Both ends of the sutures are passed through the anteromedial portal. The asterisk indicates the medial femoral condyle; triangle, medial tibial plateau; and plus sign, medial meniscus.

Fig 11. (A) Intra-articular view from anterolateral portal in right knee. (B) Model. Nonsliding knots are made with a knot pusher. The asterisk indicates the medial femoral condyle; triangle, medial tibial plateau; and plus sign, medial meniscus.



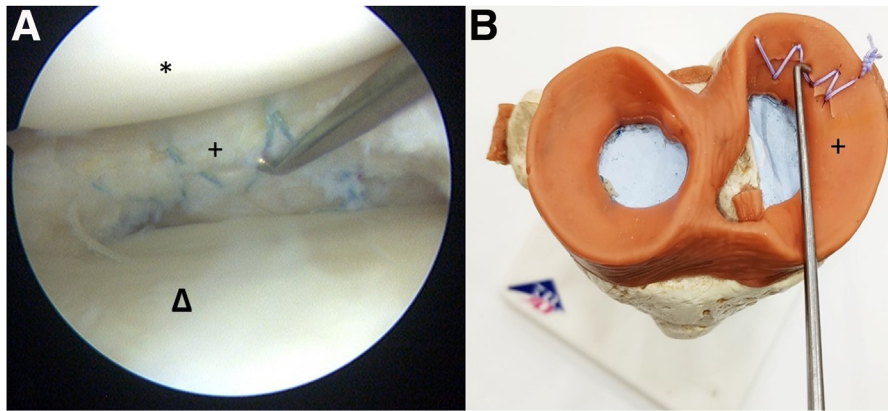


Fig 12. Final view of construction: intra-articular view from anterolateral portal in right knee (A) and model (B). The asterisk indicates the medial femoral condyle; triangle, medial tibial plateau; and plus sign, medial meniscus.

portal (Fig 10). Using the knot pusher, we prepare 6 knots with a nonsliding knot technique. We prefer a “Revo” knot half-hitch configuration (Fig 11). After the ends of the sutures are cut, the knot is placed under the inferior meniscal surface (Fig 12).

For complete longitudinal tears, we recommend initiating suturing from the superior surface of the meniscus and then completing the repair by suturing the inferior surface. If the meniscal tear is too large, we recommend applying the suture into 2 independent parts. All steps of the procedure are summarized in Video 1.

Discussion

The all-inside suture technique is popular in meniscal repair because of its time effectiveness.⁹ The main disadvantage of this technique is the persistence of nonabsorbable plastic components that irritate the tissue, potentiate cyst formation, and lead to chronic pain.^{4,10,11} Device displacement into the joint is also possible and can damage the cartilage.

Our technique can achieve the same configuration of stitches as that achieved via the lasso-loop technique,

which significantly improves the mechanical properties of the stitches.⁷ Implant-free technology is cost-effective and makes this procedure reproducible using standard arthroscopic instruments. In contrast to classic outside-in techniques that also use spinal needles, our technique avoids additional external incisions. It is safer for posterior horn suturing because the spinal needle perforates the medial or lateral structures once and entails overlocking maneuvers with the needle tip serving as a shuttle in an oblique direction to the meniscal rim. Table 1 shows pearls and pitfalls of the technique.

The potential disadvantage of our suturing technique is that in case of thread rupture in any part of the suture, the whole procedure fails. Consequently, a strong No. 0 FiberWire suture is recommended for this technique.¹¹ If the direction of the shuttle needle is too oblique, we recommend dividing this construction into 2 or 3 parts with independent knots. This technique bears a potential risk of neurovascular injury. For its prevention, a combination of our technique with other all-inside techniques may be considered.

Table 1. Pearls and Pitfalls of Technique

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Pearls	
Accurate debridement and preparation of the tear are critical for good healing.	
It is possible to pass the suture with a probe or a suture manipulator per the surgeon’s preference.	
The loop of every stitch should be locked by tying the suture that has been passed through the needle. The needle tip should be passed back just to the level of the peripheral rim of the meniscus and the capsule.	
Pitfalls	
The tension of the sutures is critical and can be corrected before final knot tying.	
Understanding the neurovascular anatomy of the knee is critical for the success of this technique.	

Table 2. Advantages and Disadvantages of Technique

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Advantages	
The technique is cost-effective.	
The technique is based on the well-known lasso-loop technique.	
The technique is implant free.	
There is no possibility of cyst formation.	
The technique can be performed using a standard instrumentation set.	
The suture configuration could be adopted for any type of meniscal tear.	
The technique could be used in combination with other techniques.	
Disadvantages	
The technique requires a high degree of surgical skill.	
Neurovascular injury is possible.	
The use of strong sutures is important because in case of suture failure, the entire construction will fail.	

Despite the simple instrumentation, a high degree of surgical skill and an understanding of the anatomy of the posterior structures of the knee are required. Table 2 summarizes advantages and disadvantages of the described technique. When surgeons begin to perform this technique, we recommend first stitching small horizontal or vertical tears of the meniscal body.

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