Technical Note

A Simplified Arthroscopic Outside–In Meniscus Repair Technique

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Abstract: A simple and reproducible technique for meniscus tear repair is described. The technique requires the use of a 16-gauge intravenous catheter, a suture hook, and a knot pusher. The catheter is used for perforation of the meniscus and the tear site in two adjacent locations, then the two free suture ends are retrieved and passed along a small arthroscopic cannula placed at the ipsilateral joint space, and finally a sliding arthroscopic knot is tied and advanced to the meniscus surface with a knot pusher. This simple technique provides secure fixation of the meniscus tear during the healing period and has been proven successful and without complications in the patients in whom it has been used.
Key Words: All-inside—Knee—Meniscus—Suture repair.

Meniscal tears represent one of the most common knee problems leading to arthroscopic surgery and often accompany acute and chronic anterior cruciate ligament (ACL) tears. The presence of the meniscus in the knee joint serves several purposes, including a stabilizing and load-transmitting function. Preservation of the meniscus is of utmost importance to prevent knee kinematic alteration and late joint degeneration, especially in young and athletic individuals who impose high stress on their knees.[1,2] Although meniscal repair is feasible only in a minority of tears, effort should be given to repair a torn meniscus, especially in young patients with an isolated meniscus tear associated with or without an ACL or posterior cruciate ligament (PCL) tear. Several open and arthroscopic techniques have been described to repair a medial or lateral meniscal tear.[2-6] All available techniques aim at reapproximating the torn edges of the meniscus allowing them to heal to restore and preserve meniscal function. When appropriate, meniscus repair is successful with a healing rate of 95%.[7]

The purpose of this article is to describe a simple outside–in technique meniscus repair technique and to report the results of its use in a small group of patients.

DESCRIPTION OF THE TECHNIQUE

Initially, comprehensive routine arthroscopic examination is performed using standard anteromedial and anterolateral portals. Whenever a suitable repair meniscal tear is identified, the following steps are undertaken. Initially, the tear surfaces are prepared with a rasp to encourage healing. The technique starts as an outside–in technique using a 16-gauge long intravenous cannula. The area of the meniscus tear is located on the skin surface by transillumination. A 0.5-cm long skin incision is performed and the subcutaneous tissue is dissected bluntly to the knee joint capsule to avoid nerve entrapment by the suture. The catheter is inserted through the skin with the wound perforating the knee capsule and the outer part of the torn meniscus is then advanced through the tear to the inner part

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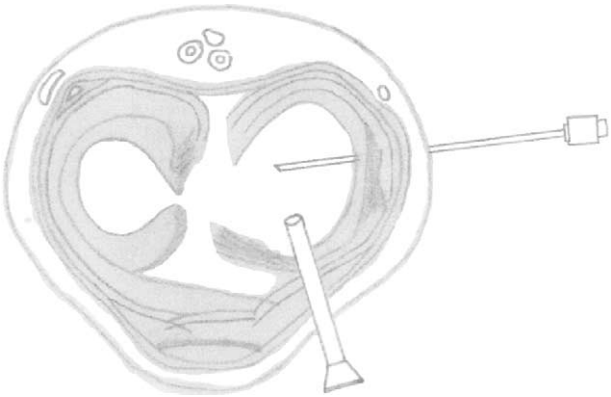

FIGURE 1. A long intravenous catheter is used for perforation of the meniscus tear. A small-diameter arthroscopic cannula is inserted in the ipsilateral knee joint compartment.

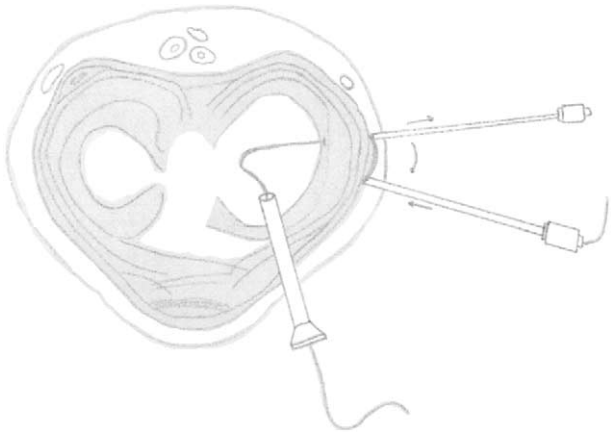

FIGURE 3. The suture limb is driven out of the knee joint and the cannula is repositioned in a more anterior (superior or inferior) location.

of the meniscus. Usually, the posterior part of the tear is first approached (Fig 1). The free limb of a no. 1 nonabsorbable suture is advanced through the cannula, captured with an atraumatic arthroscopic suture forceps (Fig 2), and driven through the small-diameter arthroscopic cannula out of the knee cavity (Fig 3). The needle is withdrawn carefully to avoid suture wear or tear, back to the external surface of the knee capsule, but not through the skin, and is reinserted in a more anterior location, superiorly or inferiorly to the previous meniscal perforation. According to the position of the second meniscal perforation, horizontal or vertical mattress suturing can be performed. In this step, the middle part of the suture limb that egresses through the skin wound is still within the cannula. As soon as the cannula exits at a desirable location, the suture is advanced forming a loop in the joint (Fig 4). The loop is pulled with a suture hook and the free end of the suture is pulled through the arthroscopic cannula along with the other suture limb (Fig 5). The cannula is slowly withdrawn and removed through the skin wound. The two suture limbs are used to form a sliding knot, which is advanced to the meniscal surface with a knot pusher (Fig 6). The suture limb exiting closer to the synovial surface of the tear is used as a post to help to position the knot as far as possible from the articulating meniscal surface. The knot is locked and pushed toward the capsule and the stability of the repair is evaluated with a probe (Fig 7). Care is taken to avoid meniscal tissue eversion by appropri-

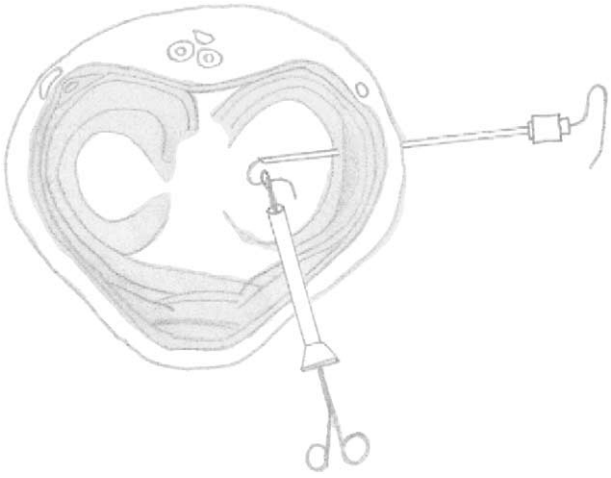

FIGURE 2. A no. 1 nonabsorbable suture is advanced through the cannula and grabbed with an atraumatic suture forceps.

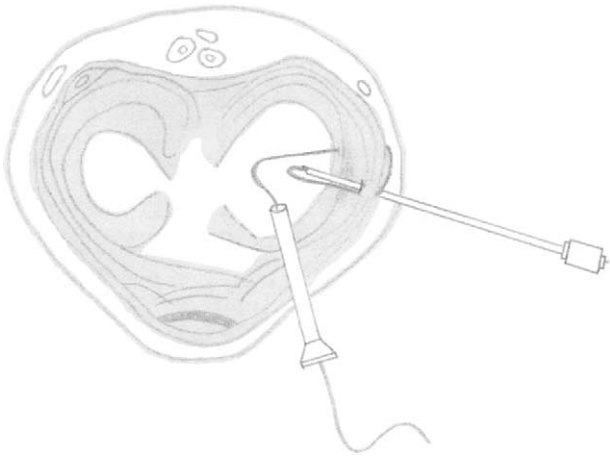

FIGURE 4. The cannula perforates the meniscus and drives the other suture limb into the joint.

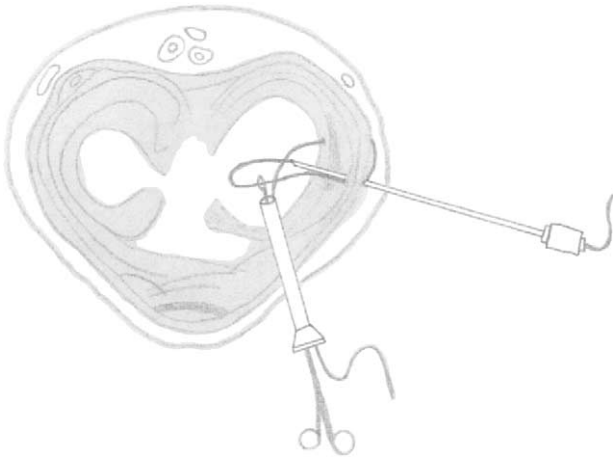

FIGURE 5. The free end of the suture is driven through the ipsilateral arthroscopic cannula with a suture hook or a suture forceps. Two suture limbs exit now through the same arthroscopic cannula.

ately adjusting the knot tension and the suture position. The procedure is repeated as often as necessary to yield a stable meniscus repair. With the use of this technique, meniscus repair can be accomplished within 10 to 15 minutes.

MATERIALS AND METHODS

This technique was used in eight patients from 2001 to 2002. All were male with a mean age of 24 years. All tears were longitudinal, full-thickness, traumatic, located at the red–red zone or the red–white zone, with a length of 1 to 3 cm. In four patients, meniscal repair was performed in conjunction with quadruple hamstring ACL reconstruction. In five patients, the tear was located at the medial and in three cases at the lateral meniscus. Postoperatively, the knee was immobilized in a brace, weightbearing was allowed as tolerated with the brace locked in extension, and knee flexion was limited to 90° for the first 6 weeks. Full athletic activity was permitted after 6 months.

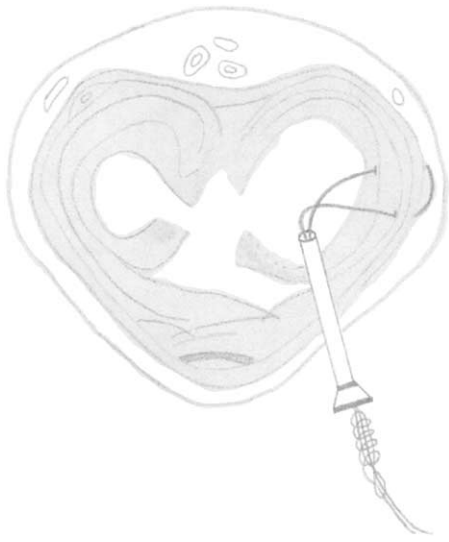

FIGURE 6. An arthroscopic sliding knot is performed, which is advanced with a knot pusher to the meniscal surface.

FIGURE 7. The stability of the final meniscal repair is examined with a probe. If the tear is large, the technique can be repeated and a second suture can be inserted.

RESULTS

There were no intraoperative complications related to the meniscal repair. Meniscus repair was performed in 11 ± 3 minutes. After a follow-up of 6 to 14 months (mean, 8.2 months), no patient had meniscal tear-related symptoms such as clicking, catching, or locking. In two patients with ACL reconstruction, terminal knee flexion was slightly restricted. All ACL reconstructed knees were classified in accordance with the International Knee Documentation Committee (IKDC) scale in group A and all patients returned to their previous activity level. Second-look arthroscopy was performed in one patient and revealed peripheral tear healing.

DISCUSSION

A simple and fast technique for meniscal repair is described that eliminates the need for expensive instrumentation and provides stable and secure meniscal repair. Although only a minority of meniscal tears are suitable for repair in these cases, especially in younger

patients or athletes with an acute knee injury, repair and preservation of the meniscus is of utmost importance. The "ideal," suitable for repair of a meniscal tear, is a clean, vertical tear at the red–red zone, longer than 1 cm, in a stable or ACL reconstructed knee of a young patient. In such suitable patients, meniscal repair rates approximate 95%.[1,2,7] During the last several years, the indications for meniscal preservation have expanded. Meniscal preservation is desirable in patients older than 40 years even in tears extending into the avascular zone, especially when combined with ACL reconstruction.[8] Meniscal repair and preservation could be successful in complex tears extending to the avascular zone, because meniscal preservation outweighs the risks of a revision operation or a subsequent meniscectomy.[9]

Postoperative protection of the healing meniscal tissue is indispensable to avoid repair failure. Several meniscal repair techniques have been described, including open, arthroscopic, and arthroscopically assisted techniques.[1-4,6] Arthroscopic repair could be performed using three techniques: the inside–out, the outside–in, and the all-inside. Several bioabsorbable devices, which facilitate all-inside meniscal repair (arrows, staples), have been devised, but their use is not indicated in any tear configuration, whereas several material-related complications have been reported.[10-12] Concerning the suturing technique, sutures can be placed horizontally, obliquely, or vertically. Vertical orientation is preferred as a result of stronger gripping of the circumferential collagen fibers, whereas horizontally placed sutures are more apt to cause eversion of torn meniscal edges. With the described technique, suture placement can be performed in either way, accommodating every tear configuration. A nonabsorbable suture was used with the purpose of permanent repair stability, avoiding absorption-related loss of suture strength. A large-diameter cannula was used to avoid bending on meniscal perforation and to facilitate steering. Application of the described technique is difficult in posterior horn tears, as is the case with every outside–in technique. Suture repair provides higher fixation strength compared with absorbable repair devices and is favored over them. In selected cases, the two repair methods could be combined, for example, absorbable devices could be used to fix posterior horn tears, whereas sutures could be used to repair more easily accessible anterior and middle meniscal tears.[13] In conclusion, we described a simple meniscal repair technique that is reliable, provides strong fixation, and yields good clinical results.

REFERENCES

1. Kurzweil PR, Friedman MJ. Meniscus: Resection, repair, and replacement. *Arthroscopy* 2002;18(suppl 1):33-39.
2. Rodeo S. Arthroscopic meniscal repair with use of the outside–in technique. *J Bone Joint Surg Am* 2000;82:127-141.
3. Bender B, Shabat S, Mann G, Oz H, Adar E. The double-loop technique for meniscal suture. *Arthroscopy* 2002;18:944-947.
4. Miura H, Kawamura H, Arima J, et al. A new, all-inside technique for meniscus repair. *Arthroscopy* 1999;15:453-455.
5. Snyder RL, Jansson KA. Technical note: Peripheral meniscus repairs anterior to the popliteal hiatus. *Arthroscopy* 2000;16: E19.
6. Tao SS, Beach WR. Use of a Caspari suture punch to repair a radial tear of the lateral meniscus. *Arthroscopy* 2002;18:206-210.
7. Rockborn P, Gillquist J. Results of open meniscus repair. Long-term follow-up study with a matched uninjured control group. *J Bone Joint Surg Br* 2000;82:494-498.
8. Noyes FR, Barber-Westin SD. Arthroscopic repair of meniscus tears extending into the avascular zone with or without anterior cruciate ligament reconstruction in patients 40 years of age and older. *Arthroscopy* 2000;16:822-829.
9. Rubman MH, Noyes FR, Barber-Westin SD. Arthroscopic repair of meniscal tears that extend into the avascular zone. A review of 198 single and complex tears. *Am J Sports Med* 1998;26:87-95.
10. Miller MD, Kline AJ, Gonzales J, Beach WR. Pitfalls associated with FasT-Fix meniscal repair. *Arthroscopy* 2002;18:939-943.
11. Song EK, Lee KB, Yoon TR. Aseptic synovitis after meniscal repair using the biodegradable meniscus arrow. *Arthroscopy* 2001;17:77-80.
12. Seil R, Rupp S, Dienst M, Mueller B, Bonkhoff H, Kohn DM. Chondral lesions after arthroscopic meniscus repair using meniscus arrows. *Arthroscopy* 2000;16:E17.
13. Barber FA, Herbert MA. Meniscal repair devices. *Arthroscopy* 2000;16:613-618.