

## Technical Note

# Meniscal Allografting: The Three-Tunnel Technique

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**Abstract:** This technical note describes an improved arthroscopic technique of meniscal transplantation that simplifies the surgical procedure and secures the allograft to the tibia at 3 sites. The technique is useful for both medial and lateral meniscal transplantation and has been used in our clinic for over 60 meniscal transplantation procedures. **Key Words:** Meniscal allografting—Arthroscopic techniques—Surgical techniques.

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**M**eniscus cartilage replacement with cadaveric allograft menisci has become more common since first introduced by Milachowski et al.<sup>1</sup> in 1986. The senior<sup>2</sup> author first published the surgical technique of meniscus replacement in 1993. This note represents an update of that technique reflecting refinements that have made the procedure easier, safer, and faster. The following points should be emphasized:

Preserving the meniscal rim prevents subluxation of the meniscus into the gutter. Previous reports of shrinkage are most likely due to this subluxation. The meniscus inserts on the tibial plateau through meniscal tibial ligaments, not to the capsule. Therefore, it is crucial to secure the allograft to the tibia anatomically and the remnant meniscal rim. Soaking the meniscus in alcohol for 5 minutes before implantation reduces the risk of bacterial contamination that may have occurred during the initial harvest.

## TECHNIQUE

For medial meniscus allografting, the patient is placed in a full circumferential leg holder. The full leg holder is crucial for patients with tight knees as valgus stress at varying angles are often required for visualization of meniscal horn insertion sites. After routine skin prep, arthroscopy portals are established and the following steps carried out.

1. The meniscus remnant is shaved to produce a rough consistent rim, taking care to preserve 2 to 3 mm of meniscus if possible. The new meniscus will be sewn into the remnant rim. This step helps prevent subluxation into the gutter and the pseudo-shrinkage that has been previously reported.

2. The meniscus remnant is bloodied using a K-wire through a cannula pushed into the inferior and superior aspects of the meniscus. Additionally, the deep fibers of the medial collateral ligament are perforated permitting slightly increased valgus of the joint to permit increased visualization.

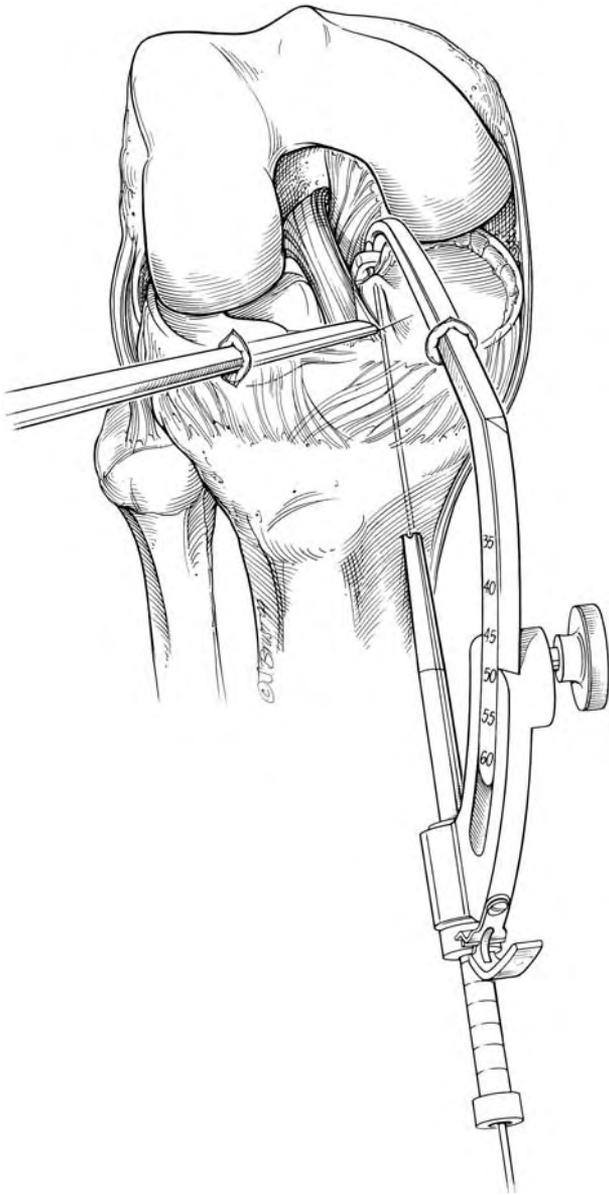
3. The posterior horn of the meniscus is visualized at its insertion on the back of the posterior medial tibial spine below the level of the tibial plateau by clearing the space between the posterior cruciate ligament and the lateral border of the medial femoral condyle. If the tibial spine is particularly high, it is shaved down to insure visualization of the horn insertion. The anteromedial arthroscopy portal is widened to 2 cm and care is taken to shave all potentially entrapping fat-pad tissue at the portal.

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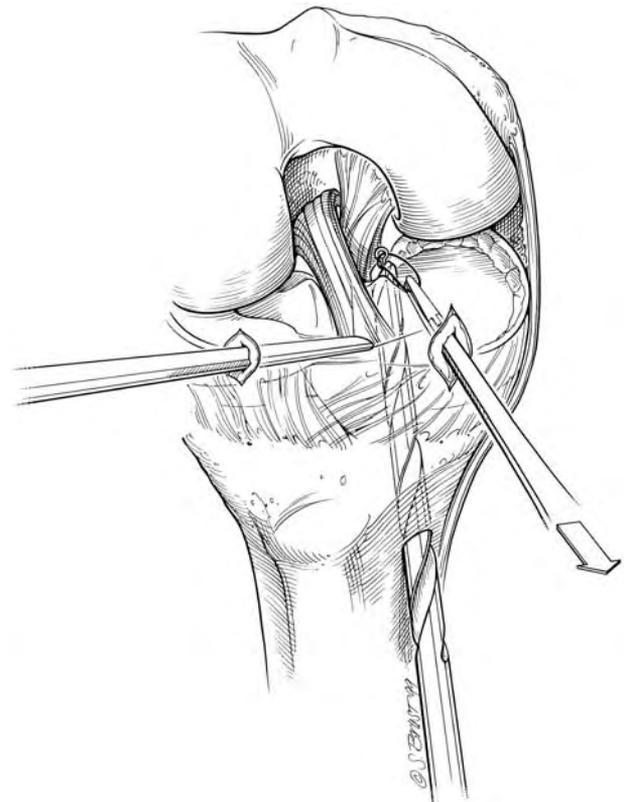
**FIGURE 1.** Placement of the posterior horn guide for meniscus allograft fixation at the base of the posterior slope of the tibial eminence.

4. A custom-designed posterior drill guide (Linvatec, Clearwater, FL) is brought into place from the anteromedial portal. Next, a guide pin is placed from the anterior medial tibial cortex exiting at the posterior slope of the medial tibial eminence at the site of the posterior horn medial meniscus insertion under direct visualization (Fig 1). This pin is then overdrilled with a 7-mm cannulated drill (Fig 2). A suture passer (Acufex, Mansfield, MA) is passed with No. 1 nylon

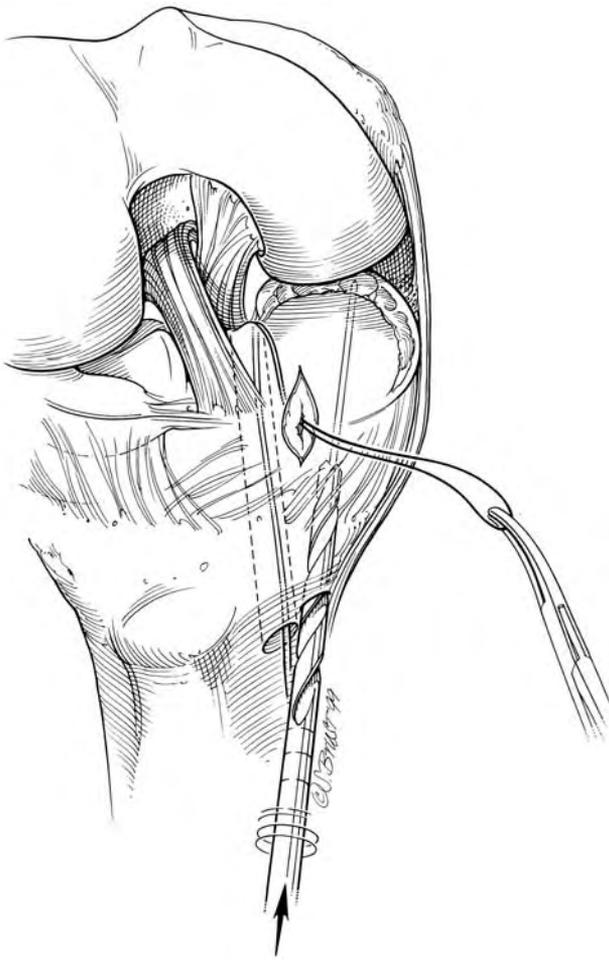
suture (Johnson & Johnson, New Brunswick, NJ), and the suture loop brought out through the knee antero-medially and clamped.

5. The guide is placed again at the posterior one third of the medial meniscus approximately 2 cm from the posterior horn insertion. A guide pin is passed under direct visualization to the posterior margin of the articular cartilage and bone. A 4.5-mm drill is then overdrilled over the guidewire and a No. 1 PDS suture passed up the bore of the 4.5 drill and the suture brought out through the anteromedial portal (Fig 3).

6. Attention is turned to the anterior horn of the medial meniscus, which is debrided. A drill pin is drilled from the anteromedial portal into that site and overdrilled with a 7-mm reamer to a depth of 10 mm (Fig 4). A triangle drill guide is then placed into this hole (Fig 5). A drill pin is placed from the anteromedial tibial cortex and then overdrilled with a 4.5-mm cannulated drill (Fig 6). Using an Acufex suture passer, a suture loop is passed up the cannulated bore of the 4.5-mm drill and grasped to exit anteromedially.



**FIGURE 2.** Overdrilling of the guide pin with a 7-mm drill to create a tunnel for fixation of the posterior horn of the meniscus allograft.



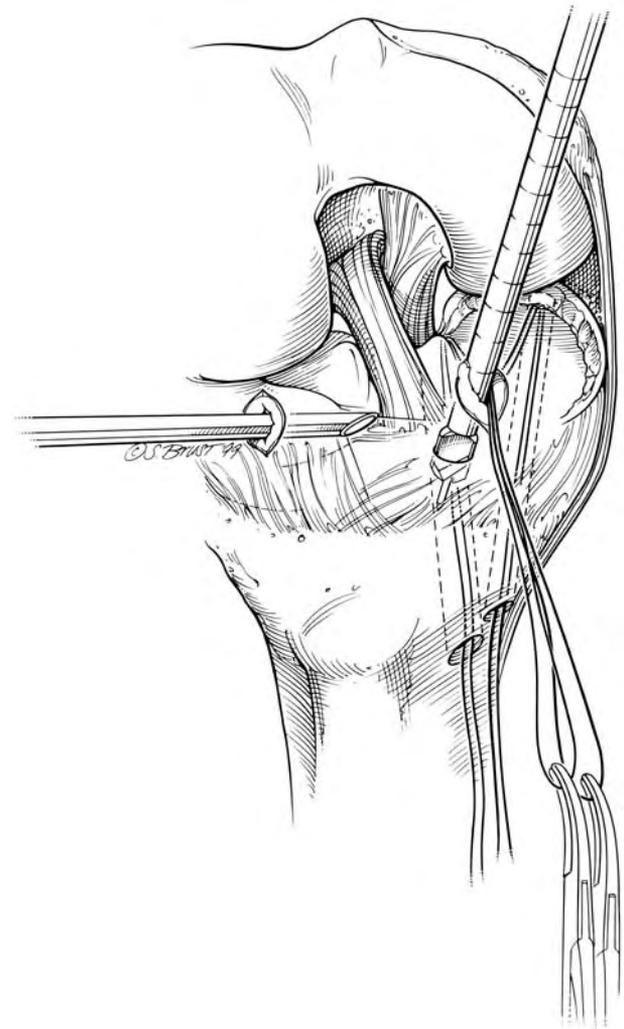
**FIGURE 3.** Pin placement for the posterior one-third hole approximately 2 cm from the posterior tunnel at the back edge of the tibial plateau, with overdrilling the guide pin for the posterior one-third tunnel.

7. Attention is then turned to the medial meniscus allograft. The allograft is soaked in 70% isopropyl alcohol for 5 minutes. The allograft bone is removed except for a sliver at each horn. Blue lines are painted on the bottom surface of the meniscus to help maintain orientation of the meniscus when inserted into the knee.

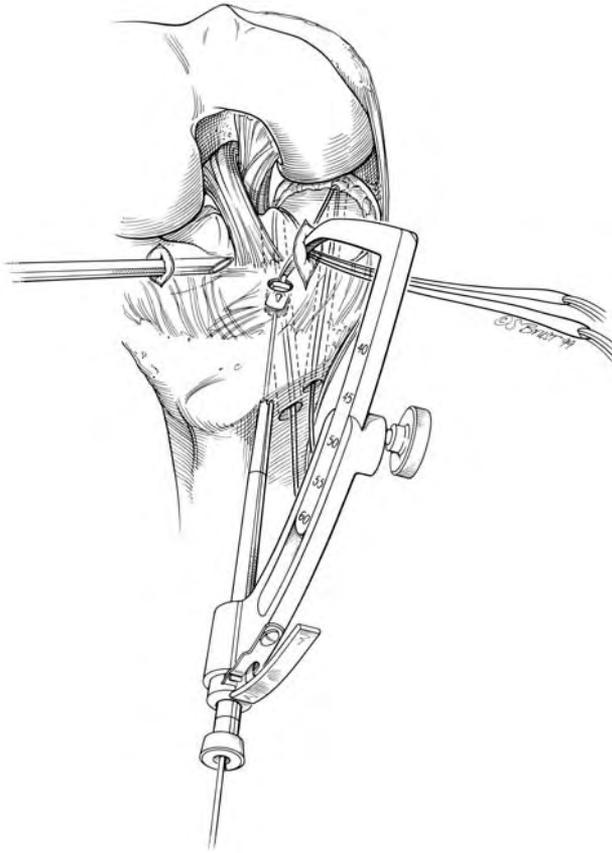
8. The medial meniscal allograft is prepared by loading 2 No. 2 braided sutures in a mattress fashion on the posterior horn of the meniscus, 1 suture at the posterior one third of the meniscus and 2 sutures at the anterior horn of the meniscus. The meniscal allograft sutures are then passed through the suture loops that had been passed at the posterior horn and at the posterior one third of the meniscus and pulled into the knee joint (Fig 7). The braided sutures are clamped

with tension over the anterior tibial cortex to be tied at the end of the procedure.

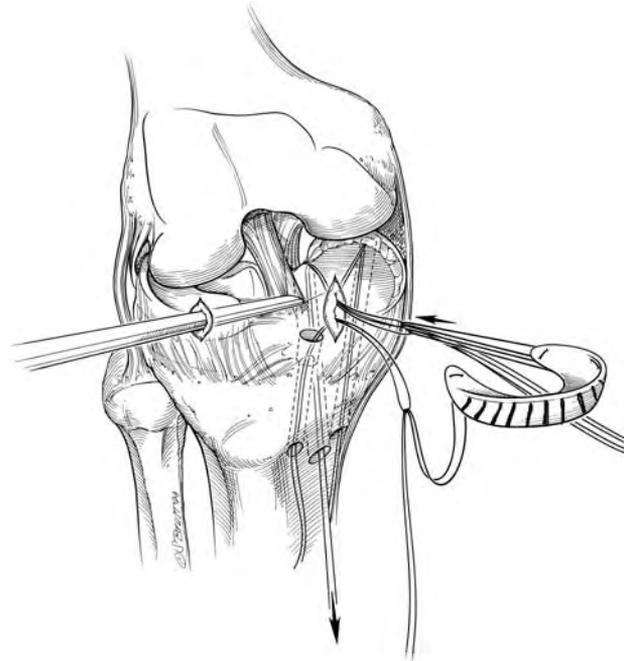
9. Using a modified Concept Zone specific meniscal repair set (Linvatec, Clearwater, FL), the PDS sutures are passed in a vertical fashion from the posterior one third to the anterior portion of the meniscal cartilage. The needles are passed through the capsule and tent the skin posteromedial. A small skin puncture with a No. 15 blade is made. The subcutaneous tissues and deep tissues are spread with a small curved clamp. The needles are then pulled through this small incision and the sutures tied directly over the capsule (Fig 8). Usually, 2 or 3 punctures are required to capture all the needles. Open dissection with posterior medial



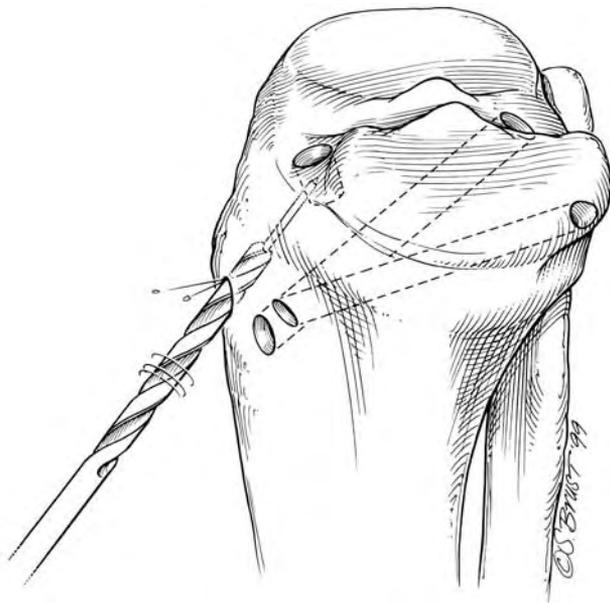
**FIGURE 4.** Creating the socket for the anterior meniscus horn insertion by overdrilling a guide pin placed from the anterior medial portal into the insertion site for the medial meniscus.



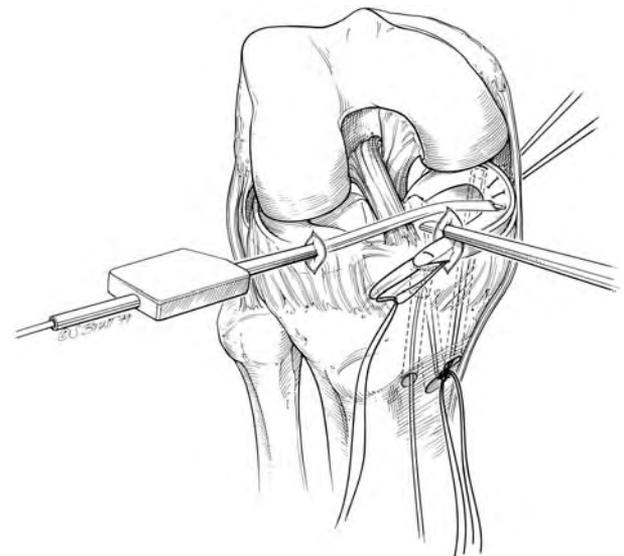
**FIGURE 5.** Placement of the drill guide into the socket for drilling the anterior tunnel for the anterior meniscal horn insertion.



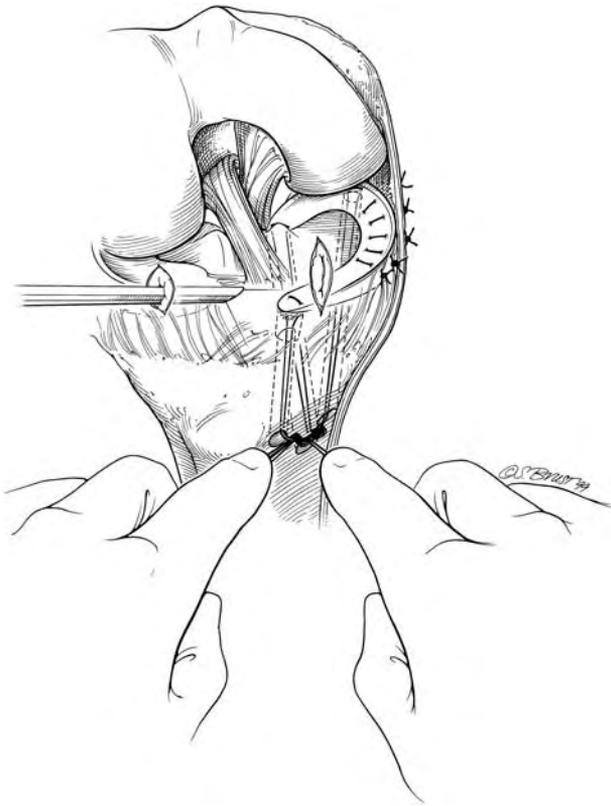
**FIGURE 7.** Pulling the meniscal allograft into place through the widened anterior portal.



**FIGURE 6.** Lateral view of the 3 tunnels placed through the tibia for meniscal insertion and tibial fixation.



**FIGURE 8.** Suturing the periphery of the meniscus allograft to the rim of the remnant native meniscus using an inside out technique. The sutures exit through small punctures through the skin and are tied directly over the capsule using fisherman's slipknots.



**FIGURE 9.** Tying the meniscal tunnel sutures over the border of the anterior tibia.

incisions has been eliminated by this technique with a reduction of entrapment of superficial sensory nerves.

10. The 3 tunnel sutures are then tied under direct visualization, ensuring that the horns are pulled securely into the sockets in the plateau (Fig 9).

11. A Caspari suture punch is then loaded with No. 1 PDS suture and passed twice into the anterior one third of the meniscus. These sutures are used to close the anterior horn of the meniscus to the anterior capsule. The knee is taken through a range of motion and the meniscus is checked for stability.

For lateral meniscus allograft insertion, the same technique is used utilizing the anterior lateral arthroscopy portals. We avoid using bone bridges and prefer the three-hole technique as described above.

### SUMMARY

Arthroscopic meniscal allografting techniques have improved to address problems that have arisen over the past decade of meniscal transplantation. This technical note highlights certain improvements that have permitted accurate placement and secure fixation for both medial and lateral menisci. The focus on an all-arthroscopic technique, 3-tunnel fixation of the meniscus to the tibia, suturing of the meniscus to the remnant native meniscus, and the use of protected drill guides for placement of the tunnels have resulted in a satisfying and reproducible procedure. Long-term results of meniscus allografting using improved techniques in both arthritic and pristine knees are under evaluation.

### REFERENCES

1. Milachowski KA, Weismeier K, Wirth CJ. Homologous meniscus transplantation. Experimental and clinical results. *Int Orthop* 1989;13:1-11.
2. Stone KR, Rosenberg T. Technical note. Surgical technique of meniscal replacement. *Arthroscopy* 1993;9:234-237.