

Editorial Commentary: All-Inside Double-Vertical Cross-Suture is an Effective Technique for Knee Meniscus Radial Tear Repair, but There is No Gold-Standard Evaluation Tool for Evaluating Healing and Function of the Repaired Meniscus



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Abstract: Treatment of radial tears of the lateral meniscus is challenging. Previous studies after repairing radial tears showed low healing rates. Various suture techniques are now being developed, and biomechanical and clinical studies using these new techniques are underway. Amid development, the all-inside double vertical cross-suture technique seemed to be effective. However, limited evaluations after meniscal repair might not fully reveal whether the repaired meniscus can maintain its function. Because the best single method that can completely evaluate meniscal healing and its function after repair is still lacking, we should introduce various assessments and consider them in a comprehensive way.

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Menisci play an important role in load distribution, transmission, and shock absorption along with the cartilage in the knee joint. Because menisci also have a chondroprotective function, loss of meniscal function causes cartilage degeneration and induces osteoarthritic changes.

Radial tears of the lateral meniscus are commonly seen in sports injuries in young athletes.¹ This tear pattern disrupts the major fibers of the meniscus, circumferential fibers that transfer a compressive load onto the tibiofemoral joint. As a result, biomechanically, radial tears have a detrimental effect on meniscal function.^{2,3} Ideally, meniscal repair should be performed to restore this important function and the efforts to repair, including this interesting study, "Repairing Complete Radial Tears of the Lateral Meniscus: Arthroscopic All-Inside Double Vertical Cross-Suture Technique Is Effective and Safe With 2-

Year Minimum Follow-Up,"⁴ by Yeh, Ma, Hsu, Chen, Chiang, and Chang, are indispensable and valuable. To assess meniscal healing after repair, the location of the torn meniscus is very important. In sports injuries, isolated radial tears of the lateral meniscus are often located in the midbody, whereas radial tears associated with anterior cruciate ligament injuries are usually located in the posterior segment. The posterior segment near the root has rich vascularization, whereas the midbody near the popliteal fossa has poor vascularization. Our previous studies using arthroscopy showed that posterior radial tears with anterior cruciate ligament injuries exhibit higher complete healing rates (60%) than isolated midbody radial tears (22%).^{5,6} Thus the location of the torn site should be examined to discuss the healing status.

The inside-out meniscus repair is believed to be the most popular technique, but the suture is tightened on the capsule. Thus physiological meniscal movement might be inhibited. To restore normal movement of the meniscus, all-inside suture (AIS) repair is reasonable.⁷ Furthermore, it should be noted that the AIS suture technique differs from all-inside techniques using implants because the AIS suture technique is a truly all-inside-meniscus suture, whereas using implants is transcapsular repair. Taken together, the all-inside

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double vertical cross-suture technique seems to be a more useful suture method.⁴ In addition, biomechanical tests revealed that the double vertical cross technique showed superior properties in load to failure and stiffness than double vertical or double horizontal sutures.⁸

Magnetic resonance imaging (MRI) examination as an assessment of healing status was performed only at 6 months after operation in this study,⁴ and longer-term image analysis has not been shown. After returning to sports, meniscal status may change; thus longer-term outcomes on MRI are required to assess whether this technique is useful for preventing degenerative changes. As the healing rate of this MRI result was very high compared to the previous arthroscopic result,^{4,6} a definite MRI evaluation method seems to be established.

Postoperative rehabilitation programs are also difficult to implement. Unlike longitudinal tears, which can permit weightbearing in the early phase, even partial weightbearing might cause the torn edge to push apart in case of radial tears. Thus a longer period of non-weightbearing is desirable to maintain the torn edge in the sutured state. However, in practice, recovering walking ability is required to live their everyday lives. In our experience, 6 weeks of non-weightbearing should be the limit. In this respect, the postoperative schedule was reasonable in this study.⁴

After the meniscus is repaired, meniscal function can be evaluated on the basis of several aspects, such as clinical symptoms/findings, radiographic examination, MRI, and arthroscopy.^{5,9}

Representative clinical symptoms of meniscal tears include pain, catching, and locking, and physical findings include ballottement, joint line tenderness, McMurray test, and restriction of range of motion. Therefore it is important to improve these symptoms and findings. Patient-reported outcome measures (PROMs) are useful for examining these findings through numerical evaluation. However, according to a previous report,⁶ even if the arthroscopically confirmed healing rate was low, all patients had no pain and no tenderness at 6 months after surgery. Thus we suggest that it is inadequate to evaluate meniscal function only with clinical symptoms or findings, including PROMs.

Radiography is the simplest examination for assessing the status of knee joint. In cases of meniscal tears, the joint space width might indicate how the repaired meniscus is restored. Long-term outcomes should include X-ray results because osteoarthritic changes can be examined simply. Thus we periodically checked by radiography, including flexion weight-bearing views (Rosenberg view), to assess postoperative changes and side-to-side differences.

MRI is the most useful method to evaluate meniscal morphology. If the meniscus is torn, it can be diagnosed

by MRI, and meniscal extrusion has become an important finding related to meniscal function.¹⁰ Even if the meniscus is repaired, its collagen fibers might not be reorganized in the same manner as the normal status, and the semi-lunar shape meniscus results in extruding radial direction. Therefore meniscal extrusion should be examined in both coronal and sagittal slices in conventional MRI.^{11,12} Additionally, MRI examination immediately after surgery is useful to assess postoperative changes.¹³ Assessing the healing status of the repaired meniscus is still difficult in conventional MRI, but T2 mapping can differentiate the healing status.¹⁴ However, it should be noted that these images were taken with the patient in the supine position and static states. We believe that load-bearing or changing knee flexion angles on MRI is also useful and will become practically available in the near future. Even with the development of MRI technology, various parameters are needed to predict meniscal healing status and function.

When evaluating the healing status of the repaired meniscus, arthroscopy is still thought to be the most useful tool.⁶ Whether the torn lesion is healed or the stability of the repaired meniscus can be checked only by direct probing on arthroscopy. In addition, its chondroprotective function can be evaluated to determine whether cartilage degeneration in the same compartment exists. However, because it is invasive, it cannot always be performed in all patients, and it cannot be repeated. Because the best single method that can completely evaluate meniscal healing and its function after repair is still lacking, we should introduce various assessments and consider them in a comprehensive way.^{5,9}

Efforts to repair techniques for radial tears have recently increased, but according to another editorial commentary,¹⁵ there is still room for improving the meniscal suture technique. We should also improve the existing evaluation methods or develop a new technique for evaluating meniscal healing and its function.

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