

Meniscal Repair in the Young Athlete*

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ABSTRACT

Twenty-nine meniscal repairs in 26 patients 17 years of age or younger were performed using arthroscopic techniques. Clinical follow-up examinations were performed and the SF-36 Health Status Survey and International Knee Documentation Committee evaluation form were administered. A Lysholm score was determined for each patient. All 26 patients were seen for follow-up at an average of 5.0 years (range, 2.0 to 13.5). All patients had a full range of motion with no effusion, joint line tenderness, or McMurray sign present at the time of examination. No patient experienced symptoms of locking. No patient underwent repeat surgery for a nonhealed meniscal repair. The clinical healing rate in this group was 100%. The SF-36 data demonstrated an average physical functioning score of 91 and an average role physical score of 91. The average Lysholm score was 90. Twenty-two patients (85%) were performing level I activities based on the International Knee Documentation Committee rating. Excellent rates of healing, even higher than those obtained in the adult population, can be obtained with meniscal repairs performed in this young age group.

The role of the menisci as intraarticular load sharing and energy absorbing components of the knee joint is well established in the orthopaedic literature.^{25,33,36,37,43} The menisci share a role as biomechanical stabilizers of the knee and contribute to normal physiologic function by providing lubrication of the articular cartilage.^{4,22,26} Long-term follow-up studies of patients who have undergone total meniscectomies have consistently reported early radiographic signs of knee joint degeneration in addition to clinical symptoms of premature arthritis and

disability.^{12,17} These findings are even more compelling in the pediatric and adolescent age groups.^{2,8,28,30,40} As a result of this appreciation that the menisci serve a crucial role in the normal functioning of the knee joint, partial meniscectomies and meniscal repair have replaced total meniscectomies.^{10,13-16,18,23,29,42}

Long-term survival studies of both arthroscopic and open techniques of meniscal repair have reported successful healing rates of between 65% and 92% when the procedure is performed for unstable peripheral meniscal tears.^{7,9,10,14-16,19,31,32} Results of meniscal repair and healing appear to be improved in the younger patient population.⁴¹ However, the majority of these long-term survival studies of meniscal repair have focused on the adult orthopaedic population.

To date, no study in the orthopaedic literature has specifically addressed the success rate and outcome of meniscal repair in the adolescent population. This young athletic population, in terms of their long-term life expectancy and level of activity, would seem to gain the greatest benefit from normal knee function. Given the rising incidence of reported intraarticular knee injuries in the young athlete, it would be helpful for the surgeon, patient, and family to know what can be expected with regard to the surgical success of meniscal repair and the likelihood of return to athletic play in this active population.^{1-3,8,21,24,39} This study was performed to determine the success rate of meniscal repair in this young athletic population.

MATERIALS AND METHODS

Twenty-six patients 17 years of age or younger underwent arthroscopic meniscal repair between 1984 and 1995 at the New England Medical Center/Boston Floating Children's Hospital (minimum 2 year follow-up). All procedures were performed by the senior author (JCR). Records were reviewed to determine age at time of injury, sport involved, and concomitant intraarticular knee injuries. Delay from time of injury to surgical repair was determined, and plain radiographs and MRI scans were reviewed to determine if the physes were open at the time of surgery. The size, type, and location of the meniscal tear were recorded from the operative notes and intraoperative

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arthroscopy photographs present in the patient's record. Additional reconstructive procedures performed at the time of meniscal repair were noted. Level and type of sport played just before the time of injury and surgery were recorded. Postoperative complications were also recorded. Repeat surgical procedures performed at a later time were determined from the records and patient and family interviews.

Patients were seen for follow-up review and physical examination. All patients were asked to complete the SF-36 Health Status Survey.³⁸ Each patient had a physical functioning, role physical, and bodily pain score calculated from the SF-36 data. The International Knee Documentation Committee (IKDC) level of activity²⁰ was determined and a Lysholm score²⁷ for the involved knee was calculated. The type and level of sport returned to after surgery was determined during the interview. Information with regard to current physical limitations as well as present level of activity was obtained. The presence of knee pain and activities during which pain was experienced were documented. Symptoms of mechanical locking and episodes of giving way were recorded.

Physical examination was performed to determine the knee range of motion in the injured and contralateral knees. The injured knee was specifically examined by an independent surgeon not involved in the surgical procedure (CMM) to document the absence or presence of intraarticular effusion or joint line tenderness. A McMurray test was performed on each patient. As second-look arthroscopy was not performed, clinical healing was inferred from subjective symptoms reported by the patient and objective findings determined during clinical examination. The absence of subjective complaints, including pain, swelling, catching, and locking, in addition to the clinical signs of a negative McMurray test, absence of joint line tenderness, and lack of effusion, were all taken to be consistent with a healed meniscus. Previous studies have relied on subjective and objective knee findings to support the conclusion of meniscal healing.^{13-16,18}

Manual Lachman and anterior drawer tests and KT-1000 arthrometer testing (Medmetric, San Diego, California) were performed on the injured and contralateral knee. Manual maximum side-to-side difference was calculated. The surgical scars were examined for signs of hypersensitivity or presence of a Tinel's sign. Each patient was questioned about any problems experienced with regard to their scar.

RESULTS

Data and follow-up information were available for all 26 patients, with a minimum follow-up of 2 years. The average time for follow-up was 5.0 years (range, 2.0 to 13.5). Sixteen of the 26 patients were 5 or more years out from their surgical repair. There were 14 female and 12 male patients. Average age at time of injury was 15.3 years (range, 11 to 17). Fourteen left knees and 12 right knees were involved. There were 12 medial meniscal repairs and 17 lateral meniscal repairs (3 knees had both the medial and lateral meniscus repaired). Thirteen of the 17 knees

that had a lateral meniscal repair also had a torn ACL. Four patients had open physes at the time of surgery.

Twenty-two patients (85%) were involved in varsity athletics at the time of injury. Injuries resulted during a wide range of sporting events: six injuries (23%) occurred during soccer; five (19%) during football; two each during basketball, skiing, wrestling, hockey, gymnastics (8% each); and one (4%) during baseball.

Delay from time of injury to date of surgery averaged 6.7 months (range, 3 days to 27 months). The cases that demonstrated a long delay from injury to surgery were those that were observed by a primary care physician and had a delay in referral to the orthopaedic surgeon. Several patients were observed by community orthopaedic surgeons who did not think that such young patients could have meniscal tears that would need to be addressed surgically.

Twenty-eight of the 29 repairs were performed in the peripheral one-third of the meniscus (22 of the 28 were in the red-on-red zone and 6 were in the red-on-white zone as determined during arthroscopic visualization). One repair was performed in the central one-third of the meniscus, and this repair was in the white-on-white zone in a 12-year-old patient. All tears were in the posterior horn of the meniscus. The average distance from the meniscosynovial junction to the meniscal tear was 2 mm, with a range of 0 mm (peripheral detachment) to 6 mm. The average length of the meniscal tears was 2.3 cm (range, 1.5 to 3.0). These measurements were obtained from the operative notes and photographs. The operating surgeon used the gradations of the meniscal probe to estimate distances. All repaired meniscal tears were documented to be unstable, with arthroscopic probing displacing a minimum of 5 mm into the joint. Fifteen of the patients had ACL tears that were reconstructed at the same time as the meniscal repair. One patient had an associated minimally displaced tibial plateau fracture that did not require surgical treatment.

All meniscal repairs were performed arthroscopically. Twenty-five repairs in 22 knees were performed using nonabsorbable suture as described by Scott et al.³⁵ The stitches were spaced 3 to 4 mm apart, alternating top and bottom placement. A combination of vertical and horizontal mattress sutures was used. Fibrin clot was not used. Four meniscal repairs were performed using T-Fix (Acufex, Mansfield, Massachusetts). There were no intraoperative complications. Patients with repairs performed before 1989 (five) were treated with nonweightbearing in a knee immobilizer for 4 weeks. Patients with repairs performed after 1989 (21) were allowed weightbearing as tolerated in a knee immobilizer for 4 weeks. Both groups of patients were allowed to remove the immobilizer during the first 4 weeks to work on range of motion exercises. Postoperatively, one patient developed a painful neuroma that required surgical excision, which was performed simultaneously with hardware removal as noted later.

The average range of knee motion was 0° to 142°. The average range of motion in the contralateral knee was 0° to 142° as well. At the time of follow-up examination, no patient demonstrated an intraarticular effusion. No pa-

tient had joint line tenderness. No patient had a painful McMurray test. No patient demonstrated a positive Lachman or anterior drawer test. The KT-1000 arthrometer measurements demonstrated an average manual maximum side-to-side difference of 1.0 mm in the group of patients that underwent a meniscal repair and an ACL reconstruction, and -1.0 mm manual maximum difference in the group of patients that underwent meniscal repair alone. One patient demonstrated a hypersensitive scar. All other scars were well healed and benign. No scar demonstrated a Tinel's sign.

Four patients underwent subsequent surgery after the original repair. One patient underwent a tibial tubercle transfer for a maltracking patella; two patients underwent hardware removal after ACL reconstruction, one of whom underwent simultaneous excision of a painful neuroma of the infrapatella branch of the saphenous nerve at the posteromedial incision; and one patient with open physes who had undergone an extraarticular ACL reconstruction at the time of meniscal repair went on to require an intraarticular ligament reconstruction at skeletal maturity. The lateral meniscal repair performed 3 years earlier in this patient was healed. No patient underwent additional surgery for meniscal abnormalities.

The SF-36 questionnaire demonstrated an average physical functioning score of 91, an average role physical of 91, and an average bodily pain score of 76. The average Lysholm score was 90. Twenty-two patients were functioning at level I activities based on the IKDC scoring scale, defined as participating in strenuous activities that include jumping, pivoting, and hard cutting. Four patients were functioning at level II activities, defined as participating in moderate activities such as heavy manual work and sports such as skiing and tennis.

All but two patients returned to their previous level of sports activity. The two patients who did not return to their previous level of sports activity cited reasons unrelated to their meniscal surgery. No patient felt limited in sporting activities; however, two patients stated that they felt occasional stiffness in the knee. Both of these patients had undergone ACL reconstruction as well as the meniscal repair. No patient experienced mechanical symptoms of catching or locking.

DISCUSSION

Knee meniscectomy is not a benign procedure. As early as 1948, Fairbank¹⁷ radiographically demonstrated degenerative changes in knees that had undergone meniscectomy. Long-term studies of meniscectomies in children and adolescents have further shown ligament laxity, early degenerative arthritis, and symptomatic knees with very few findings of good and excellent functional results.^{28,30,34,40,44}

Follow-up studies have confirmed the viability and success of meniscal repairs.^{6,7,10,13-16,18,23,42} Often, greater than 90% of meniscal repairs where the patient is properly selected and the repair technically executed have been reported to have excellent long-term survival rates.¹⁷⁻¹⁹ The idea, although not yet proven, is that this successful

preservation of meniscal tissue will translate into lower rates of premature radiographic and clinical signs of joint arthritis and instability over the ensuing decades for this patient population.

This study specifically evaluated meniscal repair in the young athletic adolescent patient population. All 26 patients reviewed in this study were asymptomatic at follow-up and demonstrated clinically healed meniscal repairs. The rate of healing documented in this study, 100%, is higher than that reported in the adult population. This may be related to a greater potential for healing based on more extensive vascularity of the younger menisci.^{5,11} Patient selection bias, with conservative selection of repairable lesions, may also account for the excellent rate of healing. All but one tear was located in the peripheral one-third of the meniscus. Additionally, concomitant ACL reconstruction surgery, performed in 58% of knees (15 of 26), may have improved the healing rates.^{7,9,19,32}

Nearly all patients returned to sports at their previous levels of competition. The SF-36 data demonstrated excellent results in the physical function and the role physical scores. The excellent average Lysholm score of 90, as well as the IKDC level of activity achieved correlates well with the patients' postoperative level of function and return to sports.

The excellent results obtained in this population support the concept of meniscal preservation by repair of torn tissue, especially in the young athletic population. The potential for meniscal healing encourages us to aggressively repair menisci in the young athlete. Long-term follow-up will need to be performed to see if successful repair translates not only into return to sport but also into a decrease in the onset of early degenerative joint changes.

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