

[Orthopaedic Surgery]



Weightbearing Versus Nonweightbearing After Meniscus Repair

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Context: Optimal rehabilitation after meniscal repair remains controversial.

Objective: To review the current literature on weightbearing status after meniscal repairs and to provide evidence-based recommendations for postoperative rehabilitation.

Data Sources: MEDLINE (January 1, 1993 to July 1, 2014) and Embase (January 1, 1993 to July 1, 2014) were queried with use of the terms *meniscus* OR/AND *repair* AND *rehabilitation*.

Study Selection: Included studies were those with levels of evidence 1 through 4, with minimum 2 years follow-up and in an English publication.

Study Design: Systematic review.

Level of Evidence: Level 4.

Data Extraction: Demographics and clinical and radiographic outcomes of meniscus repair at a minimum of 2 years follow-up were extracted.

Results: Successful clinical outcomes ranged from 70% to 94% with conservative rehabilitation. More recent studies using an accelerated rehabilitation protocol with full weightbearing and early range of motion reported 64% to 96% good results.

Conclusion: Outcomes after both conservative (restricted weightbearing) protocols and accelerated rehabilitation (immediate weightbearing) yielded similar good to excellent results; however, lack of similar objective criteria and consistency among surgical techniques and existing studies makes direct comparison difficult.

Keywords: meniscus; repair; weightbearing; rehabilitation

Meniscus tears represent one of the most commonly treated knee injuries. The meniscus is critical to normal function of the knee, including load transmission, joint stability, lubrication, and nutrition of the articular cartilage. Loss of normal meniscus function leads to increases in knee contact pressures and articular cartilage degeneration over time.¹⁰ Axial loading of the knee results in distribution of forces across the lateral and medial compartments. Seventy percent of the force within the lateral compartment and 50% of the force within the medial compartment is transmitted through the respective menisci, reflecting their relative contact areas in the femorotibial joint.¹⁴

The importance of this role in force distribution is illustrated by the linear increase in peak joint forces associated with increasingly larger portions of meniscus removed. As a result of the increasing understanding of the biomechanical properties of the meniscus, there has been a shift from routine meniscectomy to meniscal preservation techniques. Ideally, a successful meniscal repair should relieve mechanical and pain symptoms, allow patients to return to activities, and restore the vital anatomic and mechanical functions of the knee.

Meniscus repair is associated with greater technical demands of the surgeon, longer surgical time, and historically, a more restricted rehabilitation protocol as compared with

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meniscectomy. Early meniscus repair literature supported restricted rehabilitation until the meniscus was healed.^{6,8} This was based on the premise that range of motion and weightbearing through the knee interfered with meniscal healing. In 1999, Vedi et al¹⁹ evaluated weightbearing magnetic resonance imaging (MRI) studies of the knee during deep flexion. Imaging demonstrated subluxation of the lateral meniscus posteriorly due to roll-back of the lateral femoral condyle. This same study showed that the posterior horn of the medial meniscus was exposed to compressive forces between the posterior medial femoral condyle and medial tibial plateau during deep flexion.¹⁹ In contrast, more recent studies have suggested no biomechanical disadvantage associated with immediate weightbearing.^{2,9,13} A cadaveric study used biomechanical models to determine the forces placed across a meniscal repair site at different knee angles of knee flexion, external or internal rotation, and with or without axial loading.² Lower compressive forces were observed between 45° and 65° of knee flexion, and the highest loads were seen in full extension. Neither the knee position nor load was found to consistently result in loads large enough to cause repair failure.² Other basic science and clinical research studies have confirmed that these hoop stresses associated with weightbearing actually facilitate meniscal healing.^{16,18} Furthermore, mobilization after meniscal repair in animal models promotes blood flow into the repaired area compared with immobilization.³

The postoperative goal after meniscal repair is to protect the surgical repair while also balancing the costs of immobilization and disuse. Widely accepted rehabilitation protocols after meniscus repair are not available. Although some authors have demonstrated success with an accelerated program with earlier weightbearing,^{1,9,13} proponents of more conservative regimens argue that the risks of early motion and weightbearing are greater than the benefits.^{6,8}

The purpose of this study was to review the current literature on weightbearing status after meniscus repair and determine an evidence-based recommendation for rehabilitation.

METHODS

A systematic review of the literature was performed to determine the outcomes of meniscus repair with respect to weightbearing status when the postoperative protocol was restricted to nonweightbearing or touch-down weightbearing as compared with an accelerated rehabilitation program with immediate, full weightbearing. Inclusion criteria were the outcome of the meniscal repair, a minimum of 2-year follow-up, primarily adult patients, a cohort size of at least 10 patients, and English-language publications. MEDLINE (January 1, 1993 to July 1, 2014) and Embase (January 1, 1993 to July 1, 2014) were queried with use of the terms *meniscus* OR/AND *repair* AND *rehabilitation*. In total, 105 studies were identified. Of these, 7 studies included concomitant anterior cruciate ligament (ACL) reconstruction, 8 included all-inside repairs, and 6 included inside-out or outside-in meniscal repair. Two reviewers

examined the citation information for each result from the databases for relevant studies. The full articles of those studies that met inclusion criteria were reviewed. The bibliographies of these articles were also reviewed to identify other potential studies.

RESULTS

Restricted Rehabilitation

Chiang et al⁴ reviewed 31 patients with a mean age of 31 years (range, 18–44 years) who underwent arthroscopic meniscal repair. Eighteen patients had isolated meniscus tears, and 13 had concomitant ACL injuries.⁴ All meniscal tears in this series were at least 10 mm and more than 6 mm from the meniscocapsular junction. An all-inside technique with the Fast-Fix system (Smith & Nephew) was used. Patients had not undergone prior meniscal surgery, and none had evidence of knee osteoarthritis. Eighteen patients with meniscal repair alone were nonweightbearing but allowed full range of motion for 6 weeks and then advanced to full weightbearing. Thirteen patients with concomitant ACL injuries were nonweightbearing with flexion limited to 60° for 2 weeks and then advanced to 90° and full weightbearing at 6 weeks. Patients were allowed to return to unrestricted activity at 6 months. Patients were followed for an average of 36 months with clinical examination and radiographs. Patients were considered clinically healed if they had no joint line tenderness or knee effusion and a negative McMurray test. Lysholm and Tegner scores showed significant improvement: 10% to 25% from preoperative scores. Thirty of 31 patients were considered clinically healed, while 1 patient continued to have joint line tenderness postoperatively.

Haas et al⁵ reported on 37 patients (42 menisci) who underwent meniscal repair using the Fast-Fix all-inside device. Inclusion criteria included unstable longitudinal tears at least 10 mm in length and within 2 mm of the peripheral rim. The postoperative protocol consisted of 4 weeks of nonweightbearing with knee flexion limited to 90° and no return to sports for a minimum of 4 months. Successful repair was defined as nearly normal or normal findings on objective International Knee Documentation Committee (IKDC) testing, a subjective IKDC score of 80, and an absence of mechanical symptoms or joint line tenderness. Patients were considered a failure if they underwent repeat arthroscopy, had a subjective IKDC score less than 80, or any mechanical symptoms. Postoperative subjective IKDC scores and Lysholm scores significantly improved from preoperative scores. Five patients were deemed clinical failures, with 4 having poor to fair IKDC scores and 1 requiring partial meniscectomy.

In a study by Hoeffelner et al,⁷ 32 patients older than 45 years underwent arthroscopic all-inside meniscal repair for acute vertical tears close to the meniscal rim.⁷ Five patients were failures and excluded from final results because they required repeat arthroscopy and partial meniscectomy within 1 year. Weightbearing was restricted for 4 to 6 weeks postoperatively, and motion was allowed within a pain-free arc of motion,

avoiding forced knee flexion. At an average follow-up of 4.5 years, 19 of 27 patients (70.4%) were considered a clinical success and had no subjective complaints. Five patients had a positive McMurray sign postoperatively. The average Lysholm score was 76, and mean Tegner score was 6. MRI demonstrated 6 retears.

Tucciarone et al¹⁷ reported on 40 patients with an average age of 20 years (range, 14-26 years) who underwent arthroscopic meniscal repair using the Fast-Fix with 24-month follow-up. Success was defined as 65 points or greater on the IKDC scale.¹² Postoperative rehabilitation consisted of nonweightbearing for 4 weeks, partial weightbearing for 2 weeks, and then full weightbearing at 6 weeks. Range of motion was limited to 10° to 60° of flexion until week 2, and then gradually advanced. Twenty patients had an isolated meniscal repair, and 20 had concomitant ACL reconstruction. In the isolated meniscal repair group, 18 of 20 were asymptomatic while 2 had occasional pain and swelling. MRI showed healing in all 18 and absence of healing in the 2 symptomatic patients. Ninety percent of patients returned to recreational and competitive sport at their preinjury level. IKDC significantly improved from preoperative scores by an average of 50.6 points, with a mean score of 81.

Accelerated Rehabilitation

Lind et al¹² performed a randomized controlled trial including 60 patients (age range, 18-50 years) who underwent meniscus repair using an all-inside technique (Fast-Fix or meniscal arrow). Patients were randomized to free ($n = 32$) or restricted ($n = 28$) rehabilitation. Patients with continued joint line pain underwent MRI or repeat arthroscopy to evaluate healing. Repeat arthroscopy demonstrated partial or lack of healing in 28% in the free rehabilitation group and 36% of patients in the restricted rehabilitation group ($P = 0.53$). The knee arthritis outcomes score, Tegner scores, and patient satisfaction scores were similar between groups at all time points during follow-up. They concluded that unrestricted rehabilitation after meniscus repair was safe and did not result in increased failure rates.

In a study by Mariani et al,¹³ 22 patients underwent meniscal repair using an outside-in technique and an accelerated rehabilitation protocol that included immediate weightbearing and full range of motion. They were evaluated postoperatively with clinical examination and MRI at an average 28-month follow-up (range, 17-38 months). Three of 22 patients showed clinical signs of retear and had evidence of a rim gap >1 mm from the meniscal wall on MRI. They concluded that the low failure rate in this cohort suggests that an aggressive rehabilitation regimen may be prescribed without compromising results.

Barber et al¹ prospectively reviewed 41 patients who underwent meniscal repair using an all-inside technique followed by accelerated rehabilitation that allowed full weightbearing without bracing and limitation of flexion to 90° for 4 weeks. Return to sport was allowed when patients could demonstrate full range of motion and had no knee effusion. The average length of follow-up was 31 months (range, 24-56 months). Clinical success was defined as absence of joint line

tenderness or knee effusion and a negative McMurray test. Lysholm, Tegner, Cincinnati, and IKDC scores were significantly improved postoperatively when compared with preoperative assessments. Second-look arthroscopy was used to assess healing: 7 (17%) of 41 patients had failure at the meniscal repair site. They concluded that an all-inside meniscus repair and accelerated rehabilitation was successful in 83% of patients.

Lee and Diduch¹¹ reported on a cohort of 32 patients who underwent meniscal repair using an all-inside repair with concomitant ACL reconstruction. Meniscal tears consisted of vertical or longitudinal tears located in the red-red or red-white zones. Patients were allowed immediate weightbearing and full unimpeded range of motion. Failure was defined as requiring meniscectomy or presence of mechanical symptoms, joint effusion, and joint line tenderness. At initial follow-up of all 32 patients at 2.3 years, 90% were considered successful. However, 28 patients were available for follow-up at an average 6.6 years; only 71% were considered successful, with 8 failures (7 meniscectomies, 1 clinical).

DISCUSSION

Given the anticipated progression to early degeneration due to altered joint biomechanics after meniscectomy, there is a general consensus that efforts should be made to repair a torn meniscus when possible. There is considerable variability regarding the ideal postoperative rehabilitation program after meniscal repair. The repair technique plays a large role in outcomes and is difficult to separate from the rehabilitation protocol when it comes to outcomes. In cadaveric models, newer all-inside repair devices have similar if not better pull-out strength, stiffness, and load to failure/displacement when compared with more conventional suture techniques.^{15,20} In addition, the meniscus repair studies vary widely with regard to patient age, location of tear, and criteria for repair.

Because of the variations in surgical technique and the lack of randomized prospective controlled trials, strong recommendations for the ideal postoperative rehabilitation program remain difficult. Early studies in which the rehabilitation protocol was more restrictive and limited weightbearing reported good results after meniscus repair for the majority of patients, but these studies did not necessarily utilize current, similar techniques for repair.^{1,9,13} Vascellari et al¹⁸ published a systematic review of the clinical outcomes of meniscal repair using only the all-inside Fast-Fix device comparing a standard rehabilitation program with an accelerated rehabilitation protocol. Eight studies were identified for inclusion. The failure rate was 13% for patients who followed an accelerated rehabilitation regimen and 10% for standard protocol. On the basis of the clinical outcomes of these studies, there was no difference between an accelerated rehabilitation regimen and a standard postoperative rehabilitation program for this device and type of tear.

Successful clinical outcomes ranged from 70% to 94% in the studies reviewed here. More recent studies have trended toward

an accelerated rehabilitation protocol with full weightbearing and early range of motion. Reported outcomes in the studies reviewed are comparable (64% to 96% good results) to the more conservative protocols. Compliance may be improved with an accelerated rehabilitation program and facilitate an earlier return to preinjury activities when these protocols are used. While recent reports using new devices and accelerated rehabilitation programs are encouraging, direct comparisons cannot be made because of confounding variables. Future studies controlling for size, location, and type of tear as well as objective outcomes would allow for meaningful conclusions to be drawn. Ultimately, at this point in time, surgeons should base their decision for a specific rehabilitation protocol and timing of weightbearing on intraoperative findings, satisfaction with repair, and patient factors.

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