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<p>The menisci are 2 fibrocartilaginous crescents anchored via bony and ligamentous attachments to surrounding structures. Their biochemical composition and multilayered structure make them ideal for converting compressive forces to tensile forces in addition to improving joint congruity and providing shock absorption to weight bearing. The medial meniscus maintains more attachments at both the horns and the midbody than the lateral meniscus, making it more susceptible to injury. Understanding of the gross anatomy, vascular anatomy, biochemical composition, and microstructure is key to understanding causes of meniscal pathology as well as treatment options for restoring its primary functions.</p>	
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<p>Meniscus injuries affect the young and physically active population. Although meniscus injuries are common in many sports, football, soccer, basketball, and wrestling are associated with the greatest risk. In an occupational setting, jobs requiring kneeling, squatting, and increased physical activity level have the greatest risk. Meniscus injury can be isolated to the meniscus or associated with other concomitant injuries, including anterior cruciate ligament tears and tibial plateau fractures. The frequency of meniscal repair is increasing because of a better understanding of meniscal pathophysiology, technological advancements, and a focus on meniscal preservation following injury to mitigate long-term consequences such as osteoarthritis.</p>	
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<p>The meniscus plays an important, complex role in maintaining the homeostasis and health of the knee. Meniscal tears are a risk factor for early chondral injury and eventually knee osteoarthritis. There is a growing body of evidence about the early biological changes associated with meniscal injury that likely start the process of joint degeneration. This review highlights the basic science, translational and clinical studies of the detrimental effects of meniscal injury and deficiency on the biology of the knee.</p>	

**Meniscal Repair Techniques**

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Tim Spalding, Iswadi Damasena, and Robert Lawton

Video content accompanies this article at <http://www.sportsmed.theclinics.com>.

The menisci play a vital role in knee joint stability, load distribution, and lubrication, protecting the joint surfaces from degenerative change. Meniscal repair protects the joint from increased loading and when successful reduces progression of osteoarthritis. Successful repair involves accurate surgical techniques, guarded postoperative rehabilitation, and potential use of additional biologics to promote healing. An integrated approach to meniscal surgery is required as part of an overall strategy to preserve and restore knee function, preserving meniscal tissue whenever possible. This article reviews the repair techniques: procedures, indications, and rehabilitation for meniscal repair.

**Injury of the Meniscus Root**

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Mitchell I. Kennedy, Marc Strauss, and Robert F. LaPrade

Meniscus root tears biomechanically disrupt normal joint loading and lead to joint overload with the possible development of spontaneous osteonecrosis of the knee and early-onset osteoarthritis. Proper identification and treatment of meniscal root tears has been proven to restore joint loading and improve patient outcomes.

**Ramp Lesions: An Unrecognized Posteromedial Instability?**

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Bertrand Sonnery-Cottet, Raphael Serra Cruz, Thais Dutra Vieira, Rodrigo A. Goes, and Adnan Saithna

Meniscal ramp lesions occur much more frequently than was previously considered, and particularly so in ACL-injured knees. The historically high rate of missed diagnoses is a result of unfamiliarity with this injury pattern within the orthopedic community, and also the difficulty in diagnosis. A systematic exploration of the posteromedial compartment of the knee is mandatory to reliably identify ramp lesions. Failure to recognize and repair these injuries is associated with persistent anterior and posteromedial instability. Understanding their nature, biomechanics, and epidemiology is essential in allowing orthopedic surgeons to suspect their presence and adequately treat these lesions.

**Meniscus Scaffolds for Partial Meniscus Defects**

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Francesca de Caro, Francesco Perdisa, Aad Dhollander, Rene Verdonk, and Peter Verdonk

The meniscus is a crucial player in knee joint homeostasis. Loss of meniscus tissue can result in early onset of clinical symptoms like pain and loss of function, and structural degeneration of the articular cartilage. In case of a symptomatic segmental defect of the medial or lateral meniscus, different innovative options using biological or synthetic scaffolds are now available to regenerate meniscuslike tissue, with the aim of allowing a satisfactory clinical improvement to patients. However, the

role of any of these procedures in terms of chondroprotection is questionable, and the overall outcomes in the long term still can be improved.

### **Meniscal Allograft Transplants**

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Taylor M. Southworth, Neal B. Naveen, Tracy M. Tauro, Jorge Chahla, and Brian J. Cole

Meniscus allograft transplantation is an established surgical treatment indicated in symptomatic meniscus-deficient patients with minimal to no arthritis. Treatment decision making should be individualized after a thorough history and physical examination, with diagnostic imaging and arthroscopy to assess the status of the meniscus. The senior author prefers to use a bridge-in-slot technique, where osseous fixation of the allograft is completed through passage of a bone bridge to a tibial slot. Outcomes in meniscus allograft transplantation are favorable, with reported significant improvements in clinical outcome and low failures in short- and midterm follow-up studies.

### **Meniscus Repair and Regeneration: A Systematic Review from a Basic and Translational Science Perspective**

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John Twomey-Kozak and Chathuraka T. Jayasuriya

Meniscus injuries are among the most common athletic injuries and result in functional impairment in the knee. Repair is crucial for pain relief and prevention of degenerative joint diseases like osteoarthritis. Current treatments, however, do not produce long-term improvements. Thus, recent research has been investigating new therapeutic options for regenerating injured meniscal tissue. This review comprehensively details the current methodologies being explored in the basic sciences to stimulate better meniscus injury repair. Furthermore, it describes how these preclinical strategies may improve current paradigms of how meniscal injuries are clinically treated through a unique and alternative perspective to traditional clinical methodology.

### **Meniscus Injuries: A Review of Rehabilitation and Return to Play**

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Seth L. Sherman, Zachary J. DiPaolo, Taylor E. Ray, Barbie M. Sachs, and Lasun O. Oladeji

Meniscal injury potentiates a sequence of events that leads to degenerative changes and early osteoarthritis. It is therefore imperative to preserve the meniscus whenever possible. Given the expanding indications for meniscus repair, it is important to continually analyze and advance the understanding of rehabilitation and return to play following meniscal surgery. This article presents evidence-based rehabilitation and return-to-play guidelines as well as a brief review of return-to-play outcomes following isolated meniscus repair.

### **Return to Play Following Meniscal Repair**

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Taylor J. Wiley, Nicholas J. Lemme, Stephen Marcaccio, Steven Bokshan, Paul D. Fadale, Cory Edgar, and Brett D. Owens

Meniscal injuries in athletes present a challenging problem. Surgeons must balance the needs of the healing meniscus with the desire of the athlete to

return to play as quickly as possible. Evidence-based rehabilitation protocols are important for ensuring a successful meniscal repair and preventing athletes from returning to play prematurely. Ultimately, however, the return to play determination requires a shared decision-making approach between the physician, the athlete, and the providers involved in the athlete's rehabilitation process. This decision considers not only the athlete's ability to meet return-to-play criteria but also their season-specific and career goals.

### **Degenerative Meniscus Tear in Older Athletes**

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Brian R. Wolf and Trevor R. Gulbrandsen

Older athletes consist of a relatively healthier population with a high desire for return to sport despite knee injury. A meniscal tear is a common injury that has lasting impacts on joint function and activity level. Lower extremity loading from sporting activity in conjunction with degenerative meniscal changes increases the risk of meniscal tear in older athletes. Optimal treatment of degenerative meniscal tears is often debated with varying studies reporting the benefits of strictly nonoperative treatment or the value of surgery. Postoperative rehabilitation is crucial to enhance the possibility of return to sport.

### **Role of Alignment and Osteotomy in Meniscal Injuries**

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Pablo Eduardo Gelber, Bjorn Barenius, and Simone Perelli

Meniscal injuries are common in patients with varus or valgus malalignment, but consensus is lacking as to when surgery should address the meniscal injury only and when it should be combined with an osteotomy. Several factors need to be evaluated to provide the most appropriate treatment in each case. Here we highlight the most relevant literature on the subject and suggest a rationale for surgical treatment.