

## In Brief

### Meniscal Tears

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#### Introduction

Meniscal tears can cause considerable symptoms (pain, catching or locking, and effusions) and may subject the knee to premature degeneration of the joint. They also are one of the most common indications for an orthopaedic surgical procedure [3]. As such, although a tear of the meniscus is never life- or limb-threatening, its importance in orthopaedic surgery is undoubted.

#### Structure and Function

The word meniscus means “little moon” in Greek, a name evoked by its crescent shape (as seen from above). The menisci sit atop the medial and lateral plateaus of the tibia, contacting the rounded femoral condyles and distributing their weight across a broad surface area (Fig. 1A). The increased contact area accordingly decreases pressure and focal stress. The menisci also absorb shock; and by acting as a doorjamb, stabilize the joint (Fig. 1B).

The menisci once were believed vestigial, and as such were blithely removed. In 1948, however, Fairbank [2] reported a series of patients who presented soon after meniscectomy with joint-space narrowing, osteophytosis, and subchondral sclerosis. These classic signs of premature joint degeneration after meniscectomy are now known as Fairbank’s changes.

The meniscus is avascular, a fact that has broad implications for treatment: without a blood supply, healing does not occur. Only tears in close proximity to the joint capsule (which is vascular) have good healing potential.

#### Injury Considerations

Not all meniscal tears are correctly attributable to an acute injury: degenerated meniscal cartilage may fail under simple load conditions. By contrast, resilient meniscal tissue will tear only with substantial trauma. The prototypical mechanism of injury in the young athlete is a twist imposed on the slightly bent knee. This force may tear the meniscus within its substance, or at the mensiocapsular junction. Displacement of the torn meniscus can cause a so-called “locked knee”.

Meniscal tears also can occur in concert with other (more attention-grabbing) injuries, and must not be ignored in those settings. Meniscal injuries in the setting of anterior cruciate ligament tears and tibial plateau fractures must be considered.

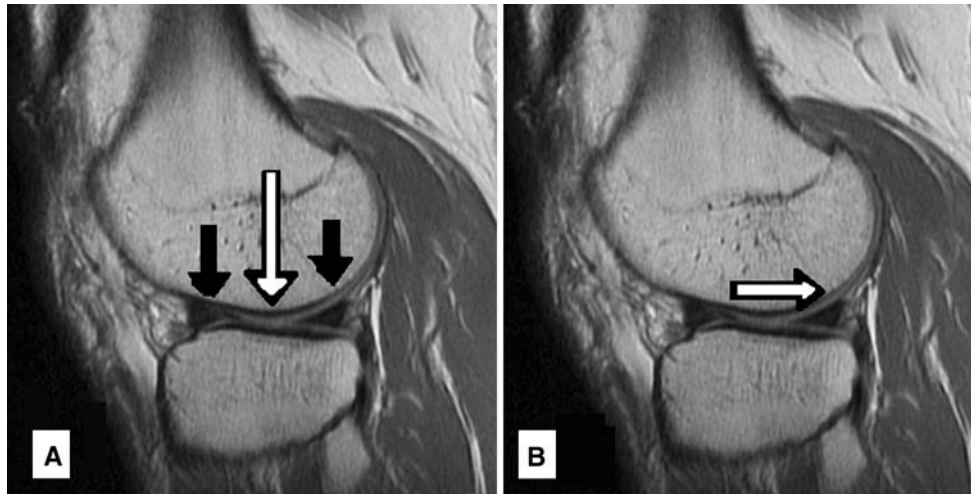
#### Diagnosis and Classification

The diagnosis of a meniscal tear ranges from the obvious (eg, a locked knee in a young athlete after a twisting injury, presenting with an effusion and focal tenderness on the joint line) to the obscure (diffuse complaints and no physical findings).

The diagnosis of a meniscal tear is best established by MRI. MRI is limited by the quality of the scanner and talent of the interpreter, but in good hands will be at least 90% accurate [4]. Of course, wise surgeons do not abdicate

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**Fig. 1A–B** The meniscus provides greater contact area between the round femoral condyle and relatively flat tibial plateau, and as such distributes load. This minimizes pressure (which is inversely proportional to contact area). **(A)** Without a meniscus the contact between the two bones would be focal (white arrow); with the meniscus

interposed, there is additional contact (black arrows). Beyond that, the meniscus also prevents anterior subluxation of the tibia. **(B)** The white arrow depicts the posterior force of the femur when such subluxation of the tibia is attempted. This force will be blocked by the body of the posterior horn of the meniscus.

medical decision-making to the scan, but rather integrate their knowledge of the pathoanatomy with the patients' presentations, expectations, and preferences for outcomes (including risk tolerance for complications.)

Plain radiographs have no power to show a meniscal tear, but are valuable in this area nonetheless: radiographs can limit underlying osteoarthritis or point to a concomitant injury.

Reports on sensitivity and specificity of special tests for meniscal tears are a staple of the orthopaedic literature, but close examination reveals these tests to perform rather poorly. Moreover, for many of these tests, their result is based on subjective responses from the patient [1]. Taken together, it is fair to say that the diagnosis of a meniscal tear with a particular emphasis on formulating a treatment plan remains an art.

Meniscal tears are described in terms of their geometry (size and configuration), but it probably is best to first categorize the quality of the meniscal tissue (healthy and robust versus degenerative and probably nonfunctional) and the state of the knee. This latter parameter includes not only the presence or absence of arthrosis and malalignment but also stability. In other words, to speak of the meniscal tear alone—even if described perfectly—is to tell only one side of the story.

The geometric configuration of tears can be described as radial, horizontal, and complex. A distinctly important configuration is the so-called bucket handle tear in which a large piece of meniscus is torn from the periphery yet anchored at its end. This allows the large meniscal fragment to swing (like the eponymous bucket handle) from its native position and lodge in the notch or under the femoral

condyle. In this displaced position, the meniscal fragment can block extension of the knee; moreover, the articular surface and the meniscal fragment can be damaged by the displaced fragment. Because displaced tears can mar the articular surfaces, and because such tears might be repairable but only if they are found before the displaced fragments are ground up by the articular surfaces, the diagnosis of a bucket handle tear should be made promptly.

Another important consideration is the location of the tear in relationship to the capsule. As noted, proximity to the vascular capsule is a necessary condition for healing. The region adjacent to the blood-rich capsule is called the red zone whereas the more central, avascular, area is called the white zone.

## Treatment

There are three broad categories of treatment: rehabilitation, removal, and repair. That is, the treatment choices comprise nonoperative modalities (such as analgesic anti-inflammatory medications and physical therapy); partial meniscectomy (almost always arthroscopic); and meniscal repair (often arthroscopic, but occasionally open).

The choice of treatment is dictated fundamentally by patient preferences, yet treatment should be encouraged for bucket handle tears in an otherwise healthy knee, because patients may be at risk for harming themselves more than they realize by attempting to avoid (or delay) surgical treatment.

Because the loss of a meniscus can lead to arthritis, it would be wise to try to fix all symptomatic tears amenable

to repair. That said, not all tears are reparable; some tears may heal spontaneously without surgery; and neither of these phenomena can be predicted precisely in advance. Thus, surgical indications are not rigidly defined.

Large tears in the red zone should be fixed. There are settings where a white zone repair may be worth attempting, for instance with a concomitant ligament reconstruction (see Pearl 5 below), or where the amount of meniscal tissue in need of resection otherwise would be unduly large.

Current research is directed at methods for augmenting the healing potential of white zone tears and bioengineering for meniscal replacement constructs.

## Outcomes

Most patients with meniscal tears do well in the short term. To start, many cases of meniscal tears in the setting of degeneration are really arthritis flares, and these can wane on their own [6]. Healthy knees from which torn meniscal tissue has been removed often are asymptomatic for years, although the long term may be less rosy, when the changes described by Fairbank set in. Meniscal repairs seem to work: they not only lead to elimination (or diminution) of pain, a high level of function should be expected [5]. Needless to say, if the meniscal tear is only part of a constellation of other (bigger) injuries, the quality of the end result is constrained by the other injury.

## Five Pearls

- 1. Acute meniscal tears in the setting of a prior ACL deficiency may lead to markedly increased instability, as the meniscus until then had served as a chock-block stabilizer. (In turn, primary ACL reconstruction with normal menisci, some suggest, protects the meniscus from later damage.)**
- 2. Patients with osteoarthritis and meniscal tears still will have osteoarthritis after you have removed their torn meniscus. Warn such patients about the risk of poor results before you operate.**
- 3. Take a history, perform a physical, think hard—but get MRI anyway. This is a safe, inexpensive, and effective test; and as long as you remain its master, it will serve you well.**
- 4. A white zone tear can be converted to a red-white junction tear by removing the thin rim of (white) meniscal remnant adherent to the capsule. This is a variation on the theme of preparing the bed for repair—an essential step in all cases.**
- 5. In conjunction with ACL repair, some white zone tears also may be amenable to repair: the bleeding caused by drilling tunnels for ligament reconstruction may deliver the biological factors necessary for healing.**

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