Current Status of Meniscal Reconstruction

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Meniscal tears are the most common knee injury and arthroscopic partial meniscectomy is the single most frequent orthopaedic procedure performed in developed countries[1,2]. It is now well recognised that the meniscus plays a crucial role in protecting the articular cartilage and in providing secondary stability to the knee.



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Meniscal repair and preservation is performed whenever possible, in an attempt to avoid the long-term degenerative consequences of total or subtotal meniscectomy. Unfortunately, many young patients still undergo resection of a large proportion of the meniscus and some of these patients will consequently develop pain and early degenerative change. Meniscal scaffolds and meniscal allograft transplantation has been shown to provide significant functional and symptomatic improvement to these individuals[3,4]. This article details the current indications and outcomes of meniscal reconstruction.

The Menisci

The menisci improve congruence and stability of the tibiofemoral joint secondary to their shape and structure. Only the outer 10-30% of the meniscal tissue is vascularised, the remainder is nourished through synovial fluid; this limits their capacity to heal following injury[5] (Figure 1). The lateral meniscus transmits 70% and the medial meniscus transmits 50% of the load through their respective compartments, and complete loss of meniscal function results in peak contact pressures increasing by up to 235%[6]. Historically, total meniscectomy was a common procedure but as the importance of the menisci has become better recognised, there has been a shift towards meniscal preserving surgery whenever possible. There is a higher incidence of osteoarthritis and resultant total knee replacement following a total meniscectomy[4,7].

Meniscal tears are classified as either degenerative or traumatic, and are further subdivided according to their orientation within the meniscus (Figure 2).

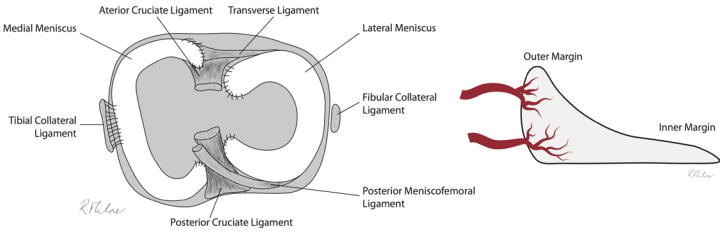


***Figure 1:** Anatomy of the Menisci*

Repair of acute traumatic meniscal tears in young individuals is strongly advocated but sometimes meniscal preservation is not possible, such as following a chronically displaced bucket handle tear or a complex, deformed discoid meniscus.

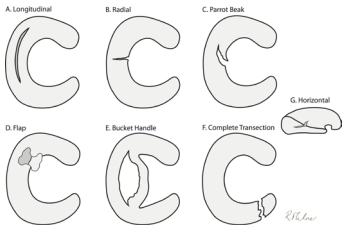


***Figure 2:** Meniscal Tear Patterns*

Indications for Meniscal Reconstruction

Some patients will develop persistent activity-related pain or swelling following meniscectomy. Patients should have had symptoms for at least six months despite appropriate rehabilitation before considering reconstruction. There is currently no evidence to support prophylactic meniscal reconstruction at the time of initial meniscectomy. Depending on the pattern of meniscal tissue loss, the options for reconstruction are either synthetic meniscal scaffolds or meniscal allograft transplantation.

Meniscal Scaffolds

Meniscal scaffolds (Actifit or Collagen Meniscus Implant - CMI) are used in patients with partial meniscal defects if the following specific criteria are met: 1) intact anterior and posterior horns to allow stable fixation of the implant to host tissue, 2) a complete intact peripheral rim of the native meniscus to support the hoop stresses, 3) articular cartilage wear up to International Cartilage Repair Society (ICRS) grade 3A (partial thickness loss greater than 50% but not down to bare bone). Meniscal scaffold reconstruction is contra-indicated in the presence of a meniscal root tear, a complete radial tear, or if the meniscus is extruded outside the joint margin, as the implant does not provide circumferential continuity and support. Full thickness articular cartilage defects (ICRS grade 3B or greater) are a relative contra-indications as the joint surface is likely to be too abrasive against the scaffold, limiting the regenerative potential. The results of combining articular cartilage repair procedures with an implant in this situation are unclear.

The technique of implanting a meniscal scaffold involves trimming the remaining tissue to give a rectangular defect within the healthy meniscal tissue. The vascularised outer zone of the meniscus should be reached, but not breached. The length of the defect is measured and a 10% oversized implant is fixed into the defect with conventional meniscal repair techniques (Figure 3a-d). Studies have reported improved clinical outcomes in the short to medium term, with an average failure rate of 10%[4].

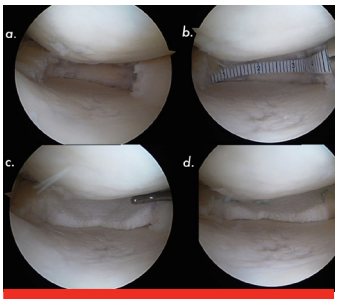


Figure 3: *Meniscal Scaffold - a) Meniscal defect prepared; b) Defect measured; c) Scaffold inserted; d) Scaffold sutured in place*

Meniscal Allograft Transplantation

Meniscal allograft transplantation is performed in patients with post-meniscectomy symptoms and a history of a total meniscectomy. The ideal candidate for meniscal allograft transplantation is a young to middle aged patient, without advanced arthritis. Malalignment, ligament instability and chondral deficiency can be addressed at the time of transplantation or in a staged procedure. The presence of full thickness chondral loss has traditionally been reported as a contra-indication to meniscal allograft transplantation, but recently surgeons have stretched the indications to selectively include such patients, accepting a slightly higher failure rate by combining meniscal allograft transplantation with articular cartilage repair procedures, osteotomy and ligament stabilisation. Similar functional outcome has been achieved to patients with preserved articular cartilage[8].

Meniscal allograft transplantation involves implanting an appropriate size and side matched donor meniscus by a variety of arthroscopic assisted techniques. The meniscal roots are fixed to the tibia with bone blocks or sutures through bone tunnels, with the peripheral margin of the meniscus sutured to the capsule (Figure 4a-d). Post-operative rehabilitation should lead to a return to normal activity at approximately 9-12 months, although patients are usually advised to avoid high impact sports because of the risk of tearing the allograft.

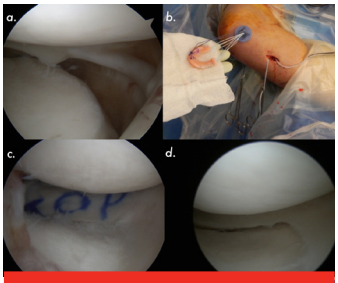


Figure 4: *Meniscal allograft transplantation - a) Meniscal deficient lateral compartment; b) Allograft prior to insertion; c) Meniscal allograft in-situ; d) one year post-operative graft appearance*

Systematic reviews of the outcomes following meniscal allograft transplantation show clinically meaningful improvements in all patient-reported outcome measures at final follow-up. A recent systematic review reported that the mean change in the Lysholm knee score was from 55 before to 81 following surgery[3]. The average patient age at time of meniscal allograft transplantation was 34 years and the usual upper limit is 50 years. The average complication rate is reported to be approximately 10%[3]. There are relatively few studies that report long term survival but a 50% graft survival at approximately 15 years has been[9,10].

The intended outcomes of meniscal allograft transplantation are to relieve pain, restore function, and hopefully prevent progressive chondral damage and osteoarthritis. High quality long-term follow up studies are currently lacking, but early to midterm evidence, based upon plain radiographs and MRI, indicates that meniscal allograft transplantation may offer some chondroprotective benefit[11-13]. However, the evidence is of limited quality and further studies are needed to address this hypothesis.

Conclusion

The importance of the menisci in protecting the knee joint is now well understood. Current surgical aims are to preserve and repair as much of the native meniscus as possible. In the event of a subtotal or total meniscectomy, meniscal reconstruction has been shown to relieve pain and improve quality of life in a young patient population.

Tim Spalding is a specialist knee surgeon at University Hospitals Coventry and Warwickshire NHS Trust, and Honorary Associate Professor at the University of Warwick. He has been involved with meniscal reconstruction since his fellowship with John Cameron in Toronto in 1995 and subsequent work with Rene Verdonk, one of the pioneers of meniscal transplantation.

References

References can be found online at *www.boa.ac.uk/publications/JTO* or by scanning the QR Code.