

The Different Modalities Of Treatment Of Torn Meniscus: A Review

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Abstract

In a recent meta-analysis, Howell et al conclude that the management of meniscal injuries in adult is still controversial. In fact, there are very few randomized trials comparing different treatment modalities. Furthermore, the assessment tools of the outcome are numerous, some focusing on imaging, others on physical examination (so called objective outcome measures) others on questionnaires and it is difficult to compare the results shown by different authors. It is now clear that the so called subjective outcome measures have a higher validity and reliability than the objective ones. In recent years there has been increase awareness of the biomechanical and functional importance of the meniscus and this is why treatment modalities seem to have evolved from total meniscectomy to partial meniscectomy to meniscus repair and finally meniscus transplant. Is less better? Does repaired/replaced meniscus work? It is a very broad question that certainly has no answer as the confounding factors are numerous (difference in patients weight, occupation, hobbies, different surgical techniques, other injuries associated to the meniscus tear, different outcome measures used) but it is worthwhile reviewing the recent literature. In our article, after a brief review of the anatomy and function of the meniscus, we focus on the different modalities of treatment of torn meniscus and their outcome.

ANATOMY AND FUNCTION OF THE MENISCI

The menisci are two semi-lunar wedges in the knee joint positioned between the femur and the tibia. They are essentially extensions of the tibia that act to deepen the articular surface of the otherwise flat tibial plateau to accommodate the relatively round femoral condyles.

Most meniscal tissue is avascular and depends on passive diffusion and mechanical pumping to provide nutrition to the fibrocytes within the meniscal substance. Arnoczky and Warren¹ have demonstrated the important vascular anatomy of the menisci. The limited peripheral blood supply originates from the medial and lateral inferior and superior geniculate arteries. Branches from these vessels give rise to a perimeniscal capillary plexus within the synovium and joint capsule, which in turn, supplies the meniscus periphery. Various zones of the meniscus are described based on the blood supply: the red zone is the well vascularized periphery, the red-white zone is the middle portion with vascularity peripherally but not centrally, and the white zone is the central avascular portion. This tenuous blood supply has been implicated in the limited healing potential of the meniscus.

The menisci provide several integral elements to the knee function, including load transmission, shock absorption, joint lubrication, and friction reduction, protection from daily joint wear, joint nutrition and stability. Fifty percent of the compressive load in the knee is transferred by the menisci in extension, while up to 85% is transferred at 90 degree of flexion. The collagen orientation makes this possible by converting compressive forces to tensile forces. Load and forces are distributed across a much larger surface area because of the menisci.

MENISCAL INJURY AND THEIR CLASSIFICATION

Two methods of classification of meniscal tear exist: That based on location with reference to the blood supply (vascular zones) and that based on orientation and appearance of the tear (tear patterns). The red-red zone which has a good blood supply and therefore good healing potential, the red-white zone which is located more medially and has a variable blood supply and a variable healing capacity, and the most medial part of the meniscus, the white-white zone with little or no healing potential due to its lack of blood supply. Although this classification helps in determining which meniscal tear will benefit from a repair

procedure it only defines the location of the tear in a radial dimension. The most commonly used classification is based on tear patterns. They are typically divided into horizontal tears, vertical tears or complex tears.

TREATMENT MODALITIES AND THEIR OUTCOME

SURGICAL VS NON-SURGICAL MANAGEMENT

No randomized trials comparing surgical vs. non surgical treatment of symptomatic meniscus injuries are present in the literature, however not all meniscal tears are symptomatic. Furthermore MRI has greater sensitivity then specificity, and meniscal anomalies identified using MRI may not represent meniscal tear. Therefore, not all meniscal lesions need to be managed surgically. The extent, duration, and location of the injury will influence the choice of treatment but also influential is the opportunity allowed by diagnostic arthroscopy to extend this to surgical treatment. The main factors in the decision making of conservative Vs surgical management are the nature of the patient's symptoms and whether the patient can afford a period of observation (patient's occupation, hobbies) ².

MENISCECTOMY

Partial Vs Total: Compared with total meniscectomy, partial meniscectomy is associated with shorter operating times, a faster recovery, superior post operative functional scores, and better subjective assessment of outcome. No reduction in the incidence of post operative osteoarthritis has been demonstrated in the short term. The only prospective randomized long term follow up comparing partial and total meniscectomy showed better functional results of partial resection. However it did not show better results with regards to the development of radiological OA ³. In a long term follow up study of arthroscopic partial Vs total meniscectomy, Andersson and Karlson ⁴ report that the frequency of radiographic changes 14 years after meniscectomy is related to the size of the meniscus removed, but the grades of these changes are low and have little influence on activity and knee function. Burks et al reported 88% good to excellent results of arthroscopic meniscal resection in 146 patients with isolated meniscal injury. Results were based on the Lysholm score, satisfaction index at an average follow up of 15 years.

Open Vs Arthroscopic: With regards to the surgical route, there is insufficient evidence available from randomised trials to establish whether arthroscopic surgery is better then open surgery. The choice of method depends on a surgeons'

experience and patient preference with the two methods, but the potential of a skilled application of arthroscopy to limit the damage to knee structures and enhance the rate of recovery makes arthroscopy an attractive option. Several investigations have directly compared the results of arthroscopic and open technique for meniscal resection showing that outcome with the former is better than with both open partial and total meniscectomy.

With better understanding of the benefits of preservation of intraarticular structures, the new measuring stick for interpretation of results after arthroscopic meniscectomy is meniscal repair.

REPAIR OF MENISCUS

The approach to meniscal repair has significantly evolved in the past 10 years and continues to expand. Recent advances and continuing work have contributed to a greater understanding of the anatomic structure, biomechanical function, and importance of meniscal tissue in joint load distribution, stability, and congruence as well as cartilage homeostasis and proprioception ⁵. The indications for meniscal repair include the position and pattern of the tear, the age of the tear, the age of the patient, their expected compliance with postoperative instructions and their activity levels and occupation. Traditionally meniscal repair is reserved for young, compliant patients with acute (< 8 weeks) peripheral longitudinal tears which lie within the vascular zone of the meniscus and occur in otherwise stable or concomitantly reconstructed knees. Repaired meniscal tears heal if there is adequate blood supply. Recent studies have demonstrated that meniscal repair can be successfully achieved with tears in less vascular zones (White-White tears), more complex geometric configurations, and isolated tears in younger patients (discoid variants) ⁶. The potential to biologically augment these at risk repairs has been reported and continues to increase. A stable knee is also important and increased healing rates have been seen with repairs done at same time as ACL reconstruction ⁷. The location of the tear in the knee can also influence the outcome of meniscal repair. There is a higher rate of healing in the medial meniscus then in the lateral meniscus. This is likely because the lateral meniscus is more mobile then the medial meniscus. In addition, there is less vascularity in the periphery of the lateral meniscus because of the presence of the popliteal hiatus ⁸. There is currently no reliable treatment option that addresses tears located in the inner two third of the meniscus, although repair of tears in this area have been attempted ⁹. Kocabey et al ¹⁰ repaired 29 menisci

in the red-red zone and 26 in the red-white zone with excellent results at 12 months. Some authors¹¹ have reviewed the healing potential of tears extending into the avascular zone in patients age 40 years or older and in patients aged 20 years and younger. In the older cohort, 93% of tears were asymptomatic for tibio femoral joint symptoms. On second look arthroscopy, only one out of 6 tears was completely healed, two were partially healed, and three had failed. Comparable results were obtained with the younger patient cohort. Post operative protocols vary but the majority of patients will be asked to follow a strict physiotherapy regime and avoid contact sports for 6 months, as opposed to partial meniscectomy when patients can resume normal activities after 2 weeks.

REPLACEMENT OF MENISCUS

Although many meniscus tears can be successfully repaired, not all are salvageable, especially if considerable tissue damage has occurred. Meniscus transplantation has been shown to be an acceptable procedure for younger patients. The primary candidate is a patient younger than age 50 years who has had a total meniscectomy and who either has pain in the tibiofemoral component, arthroscopic evidence of articular cartilage deterioration or both. Contraindications are advanced knee joint arthrosis, with flattening of the femoral condyle, concavity of the tibial plateau and osteophytes that prevent anatomic seating of the meniscus allograft; axial malalignment, knee joint instability; knee arthrofibrosis; muscular atrophy; and prior joint infection. In a recent paper, Noyes et al¹² prospectively evaluate the results of meniscal transplantation in a consecutive series of young patients treated for pain in the tibio-femoral compartment following a previous meniscectomy. 89% of the 38 patients rated the knee condition as improved. 76% of patients returned to light low-impact sports without problems. Some authors have shown that there is a significant difference in the clinical results between lateral and medial meniscal transplants. In fact, the cumulative survival rate of the lateral, medial and combined allograft in the same knee was 76%, 50% and 67% respectively¹³.

CONCLUSION

Overall it is difficult to judge the success rate of meniscus repair or transplantation. Many methods can be used to measure the success of surgical treatment of meniscal tears, including history taking, physical examination, MRI, second

look arthroscopy and a prospective randomized controlled trial with long term follow up is necessary in order to compare the different modalities of treatment. The management of meniscal injuries in recent years has gone from total excision of the meniscus to preservation or transplant of this structure. Developments are on the horizon in molecular biology and gene therapy that will continue to provide improved biological solutions for meniscal repair and increased capability to regenerate meniscal tissue. Many of these basic science methods represent the potential future of orthopaedics and very likely may soon be a reality in clinical practice.

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