



Mission (im)possible: meniscal preservation and cartilage regeneration

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It is estimated that almost one-third of all adults have radiological signs of osteoarthritis (OA), with the knee being the most common site affected [1]: the global scientific community is providing a tremendous effort to allow an early diagnosis and a timely treatment to spare the joint from metal [2, 3].

How does the meniscus play a role in this scenario? After decades of clinical experience, we have now gained some evidence-based answers [4]: the straightforward association between a meniscal tear and knee pain justified, for almost one century, the aggressive treatment offered for meniscal lesions, i.e. partial or even total meniscectomy [5, 6]. The advent of arthroscopy even simplified these procedures that rapidly became part of the routine clinical practice [7]. The immediate functional and symptomatic relief obtained after surgery was years later counterbalanced by the dramatic increase in the incidence of severe knee OA in that population of patients, with a three-fold increase in arthroplasty rates [8]. Moreover, despite this well-established knowledge, arthroscopic partial meniscectomy is still one of the most common knee procedure performed in the USA [9]. It appears therefore necessary to continue the investigation in the field of meniscus, starting from a basic classification of meniscal lesions: traumatic or degenerative. In fact, a pure traumatic meniscal tear occurring in the white zone of the meniscus would benefit

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from a partial meniscectomy [10]. Conversely, when the lesion affects the vascularized zone of the meniscus, a primary repair should be always aimed at [11]. On the opposite side of the continuum of lesions that could affect the meniscus, we include the degenerative meniscus. That represents a complex disease, since concomitant cartilage changes are often present and therefore a more conservative approach would certainly be more auspicious [12].

However, beyond the mere academic distinction between traumatic and degenerative, even more attention should be given to the treatment options available, and the orthopaedic surgeon is nowadays endowed with skills and equipment to repair and preserve rather than remove and replace [4].

This awareness opened the way to the development of a new “portfolio” of repair techniques and even regenerative treatment options [10].

Given the premises above, the rationale of the present Special Issue becomes clearer. In fact, as orthopaedic surgeons, it is only through emphasizing a correct diagnosis and experimenting new suitable treatment options that we could make a significant contribution. This is done to avoid meniscal disruption and, ultimately, to prevent or postpone cartilage degeneration [13]. In our Special Issue, we are presenting works able to accomplish our urgent need to face this “old” problem but with new weapons. In order to do that, we felt the urge to start from the very basis of the problem itself: epidemiology and diagnosis. We are presenting one paper discussing the epidemiological feature of medial meniscus root tears, evidencing how higher BMI could be associated to a significantly younger age of onset of these meniscal tears [14]. One study also evidenced the fundamental role of magnetic resonance imaging (MRI) and deep learning in detecting meniscal lesions [15]. Regarding the therapeutical options, as mentioned before, repair should always be aimed at. One research on the topic, retrospectively, evaluated clinical outcomes of patients undergoing a meniscus all-inside repair and, after six to eight weeks, an ACL reconstruction. At long-term follow-up, the authors analyzed how, even if meniscal healing was considered incomplete at the second-look arthroscopy, clinical outcomes were still successful [16].

To this regard, we are also including in our Special Issue two papers which both concluded how lateral meniscus changes surprisingly did not jeopardize the clinical outcomes in patients who underwent medial unicompartmental knee arthroplasty [17, 18].

When it comes to degenerative meniscus, the altered tissue does not qualify the meniscus for a primary repair; hence, more conservative options should be tempted. Firstly, a proper regimen of physical therapy should always be prescribed as a first-line treatment in patients without mechanical symptoms and surgery should address only non-responsive patients [19]. Nonetheless, for the latter population of patients, meniscectomy should only represent the last resort.

In fact, biological products such as platelet-rich plasma (PRP) or mesenchymal stem cells (MSCs) gained extreme popularity and recent studies outlined their possible potential. Small-sized clinical trials demonstrated the benefits of biological products injected directly inside the degenerative meniscus and good results were also documented using a collagen membrane enhanced with bone marrow concentrate [20]: however, it is imperative to obtain more clinical results prior to recommending these procedures as part of the routine clinical practice [21, 22].

Nonetheless, even when regenerative approaches fail, meniscal transplantation comes to help us. In fact, after its first application in 1984, meniscal allograft transplantation gained consensus among orthopaedic surgeons for both its safety and clinical results [23]. Our special issue supports these findings, presenting a paper which suggests that meniscal allograft is able to provide good clinical results even in combination with high tibial osteotomy and anterior cruciate ligament reconstruction [24]. However, we are well aware of the practical difficulties encountered by surgeons when it comes to retrieving a donor and, ultimately, to appropriately size the allograft. Therefore, we judged very interesting the findings of a trial where 3D modelling of the contralateral meniscus proved to be a reliable option to assess the shapes for meniscal allograft and biomimetic implants as well [25]. In fact, artificial meniscal substitutes (made by collagen or poly-urethane) have provided satisfactory clinical results [26] and will hopefully represent a further field of development in the next decades: the ongoing MEFISTO European project, whose Consortium include several institutions from all over Europe, is working on “functionalization” of novel meniscal scaffolds that should be able not only to provide mechanical support but also to convey pro-active substances (i.e., anti-inflammatory drugs or growth factors) into the target tissue and the joint, as true drug-delivery systems.

Ultimately, it is crucial to recognize that, despite the efforts abovementioned, osteoarthritis is sometimes unavoidable [27]. We therefore could not exclude some recent findings in terms of both molecular processes involved and clinical outcomes achieved by modern cartilage repair techniques [28–32].

In summary, with this special issue, we hope to give the reader an updated overview on the landscape of both meniscus and cartilage preservation. We hope to raise awareness on both the many steps forward taken in the last years [33, 34], on the plenty of avenues left to explore, and, maybe, on the groundbreaking advancements right around the corner [35].

Therefore, our mission, should we accept it, will be to pursue the complex paths of meniscal and cartilage repair and, why not, hoping for their regrowth. (Im)Possible? Only the future will tell!

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