

Understanding the Meniscus

Of all the structures within or about the knee, the meniscus is, perhaps, the least understood. Once described as the functionless remains of leg muscle, the menisci were relegated to an obscure role within the knee and were often removed with impunity. Basic investigation into the function of the meniscus has identified the menisci as integral components in the complex biomechanics of the knee and has underscored the importance of preserving these structures if at all possible.^{1,2} These realizations have prompted many orthopaedic surgeons to consider primary repair of certain meniscal lesions rather than traditional meniscectomy. However, because of its meager blood supply, the meniscus' ability to heal has long been debated. Recent experimental and clinical investigations have added extensively to our understanding of meniscal blood supply,³ healing,⁴ and repair.⁵ In this issue of the *Quarterly*, Drs. Fanton and Andrish⁶ propose an intra-operative technique to identify more clearly the extent of meniscal vasculature.

The blood supply to the human menisci varies from 10% to 30% of the meniscal width.³ This variability has been observed not only between menisci but also within the individual meniscus. Thus, arbitrary "rules of thumb" are not applicable when estimating the extent of meniscal blood supply. By using an accepted diagnostic technique, the authors have demonstrated the reliability of fluorescein angiography in determining the location of a functional blood supply within the meniscus and in relation to a meniscal tear.

Although it might be argued that visualization of a bleeding surface would serve as sufficient evidence of the presence or absence of blood vessels within a meniscal tear, fluorescein angiography can delineate the distance of a "non-bleeding" tear from the functional blood supply, an important consideration in determining the amount of avascular tissue to be resected to expose a bleeding and potentially reparable surface.

Drs. Fanton and Andrish have demonstrated the efficacy of meniscofluoresis in the experimental situation and have elegantly reemphasized the importance of meniscal blood supply in the physiology of meniscal healing. However, the applicability of meniscofluoresis in a clinical situation and in conjunction with the arthroscopic examination is not yet determined. Technical difficulties in providing adequate ultraviolet light through the arthroscope as well as potential problems in visualizing fluorescence through a liquid medium within the confines of the knee joint may limit the use of meniscofluoresis to "open" examinations of the knee.

Also, this study represents only a qualitative assessment of the blood supply. In the experimental situation in which a fresh "tear" is created in a vascular area, verification of functional blood supply may represent little challenge. The real difficulty lies in quantitative assessment of blood supply in marginally vascularized tissue. How much vascularity (fluorescence) is necessary for meniscal repair? This would be of special importance in chronic tears in which blood supply, although present, is significantly decreased.

Although fluorescein angiography has been used widely in diagnosing and evaluating treatment of diseases of the retina, uveal tract, and optic nerves as well as being an indicator of skin flap viability, it is not a totally innocuous procedure. Adverse reactions ranging from nausea and vomiting to more serious side effects such as anaphylactic reactions, acute pulmonary edema, and hypotension have been reported in 10% of the 1471 patients who have undergone fluorescein angiography.⁷⁻⁹ Although serious side effects are rare, the orthopaedic surgeon contemplating fluorescein angiography as a diagnostic technique should be aware of its potential complications.

Although clinical experience ultimately dictates how meniscal lesions are diagnosed and treated, investigations of the meniscus such as that of Fanton and Andrish may provide further insight. The prudent orthopaedist should view the experimental data, not as a substitute for

clinical experience, but as a means of gaining a fundamental understanding of the meniscus' biological capabilities and limitations.

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