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R. Strocchi et al.: The human anterior cruciate ligament—histological and ultrastructural observations: *Journal of Anatomy* (1992) 180, 515–519.

R. Strocchi et al. described different fibril populations in the normal human anterior cruciate ligament (ACL). In figure 3, they showed a separate nonuniform fibril population with irregular outlines. They speculated that these larger inhomogeneous fibrils are specialised for resisting high tensile stresses. The fibrils shown in the figure are also called 'flower-like fibrils' (synonyms: spiralled collagen, composite fibrils, hyperfibrils, frayed fibrils) in the literature. They may occur in altered lumbar spine ligaments, autolytic tissues, badly fixed specimens, some connective tissue diseases, anterior cruciate ligament ruptures (see Fig.), and in fibrotic tissues undergoing remodelling (Ghadially, 1982; Holbrook & Byers, 1987; Yahia et al 1989; Emonard et al. 1991; Neurath et al. 1992). It was suggested that these fibrils reflect breakdown states of collagen fibrils in vivo and that their origin is due to confrontation with degradative, proteolytic enzymes (Emonard et al. 1991). In all these diseases, hyperfibrils represent the highest degree of collagen polymerisation, because these fibrils are probably derived by an aggregation of some minor fibrils.

Based on our own ultrastructural and immunoelectron-microscopical studies in 100 human cruciate ligaments (Neurath and Stofft, 1992*a, b*), we found a completely different fibril structure. There was a unimodal distribution

of fibril diameters in the human ACL ranging between 20 and 185 nm with a mean value of 84.2 nm (s.d. 25.8 nm). In none of these normal ligaments was spiralled collagen detected. However, these fibrils may occur in the ACL of patients with rheumatoid arthritis and osteoarthritis (personal observations).

In summary, we cannot accept the conclusion of the authors that large numbers of hyperfibrils occur in the normal healthy ACL. We conclude that the presence of spiralled collagen in the ACL is only a pathological or an artifactual feature, and that these fibrils have no specific function in the normal ACL.

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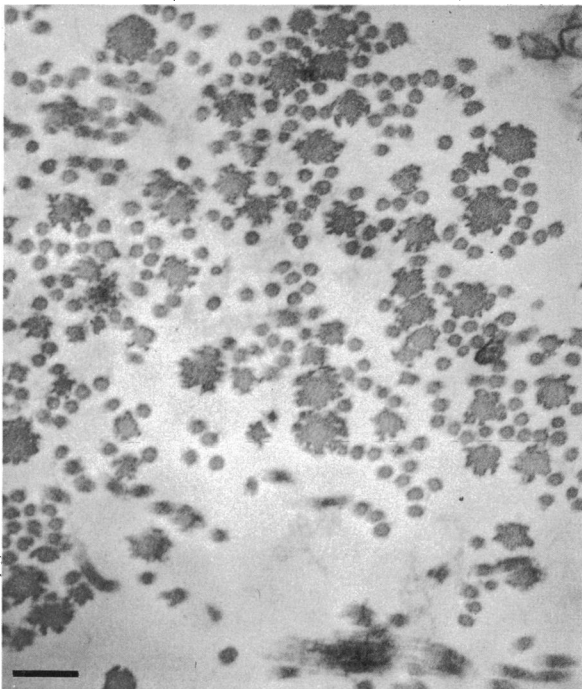


Fig. Transmission electron micrograph of spiralled collagen in a ruptured anterior cruciate ligament. Bar, 0.2 μ m.

A. Ruggeri replies

Our observations indicate the presence of 2 types of collagen fibrils and are confirmed by computer analysis using the Leitz ASM image analysis system. Despite an irregular outline, the large fibrils are never flower-like with typical clefts; instead they appear as normal fibrils with microfibril-like filaments at their periphery. The age of our patient population (range 45–87 y) may explain these diameter and