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Viscoelastic Response of the Human Corneal Stroma Induced by Riboflavin/UVA Cross-Linking

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Abstract : In the past decades, the importance of corneal biomechanics in the normal and pathological functions of the eye has gained its credibility. In fact, the mechanical properties of biological tissues are essential to their physiological function. We are convinced that an improved understanding of the nanomechanics of corneal tissue is important to understand the basic molecular interactions between collagen fibrils. Ultimately, this information will help in the development of new techniques to cure ocular diseases and in the development of biomimetic materials. Therefore, nanotechnology techniques are powerful tools and, in particular, Atomic Force Microscopy has demonstrated its ability to reliably characterize the biomechanics of biological tissues either at the micro- or nano-level. In the last years, we have investigated the mechanical anisotropy of the human corneal stroma at both the tissue and molecular levels. In particular, we have focused on corneal cross-linking, an established procedure aimed at slowing down or halting the progression of the disease known as keratoconus. We have obtained the first evidence that riboflavin/UV-A corneal cross-linking induces both an increase of the elastic response and a decrease of the viscous response of the most anterior stroma at the scale of stromal molecular interactions.

Keywords : atomic force spectroscopy, corneal stroma, cross-linking, viscoelasticity
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