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Influence of interfacial rheology on stabilization of the tear film

M. SAAD BHAMLA, GERALD G. FULLER, Stanford University — The tear film that protecting the ocular surface is a complex, thin film comprised of a collection of proteins and lipids that come together to provide a number of important functions. Of particular interest in this presentation is meibum, an insoluble layer that is spread from glands lining our eyelids. Past work has focussed on the role of this layer in reducing evaporation, although conflicting evidence on its ability to reduce evaporative loss has been published. We present here the beneficial effects that are derived through the interfacial viscoelasticity of the meibomian lipid film. This is a duplex film is comprised of a rich mixture of phospholipids, long chain fatty esters, and cholesterol esters. Using interfacial rheology measurements, meibum has been shown to be highly viscoelastic. By measuring the drainage and dewetting dynamics of thin aqueous films from hemispherical surfaces where those films are laden with insoluble layers of lipids at controlled surface pressure, we offer evidence that these layers strongly stabilize the films because of their ability to support surface shearing stresses. This alternative view of the role of meibum can help explain the origin of meibomian gland dysfunction, or dry eye disease, where improper compositions of this lipid mixture do not offer the proper mechanical resistance to breakage and dewetting of the tear film.

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