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Dissertation Defense

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SPECTROSCOPIC MEASUREMENTS OF MEIBUM COMPOSITIONAL, STRUCTURAL AND FUNCTIONAL RELATIONSHIPS TO ELUCIDATE THE ROLE OF MEIBUM IN DRY EYE

Abstract

Dry eye disease (DED) affects more than 16 million people in the United States, causing symptoms that can lead to visual disturbance.[1] Although etiology of DED is multifactorial, an abnormal lipid layer of the tear film may be a major factor.[2, 3] These lipids, primarily from the meibomian gland, give stability, lubrication, and confer anti-microbial properties to the tear film and the corneal surface.[4] Cholesteryl ester (CE) and Wax ester (WE) lipids make up ~ 80% of human meibum and CE/WE ratio has been shown to decrease in patients with DED due to meibomian gland dysfunction.[5] Model studies outside of this thesis used synthetic CE and WE and have provided some insight, however, the application to human meibum lipids is weak as human CE and WE contain variable amounts of hydrocarbon chain branching, saturation and chain length all of which could influence the structure and conformation and structure of the lipids. As almost all the WE and CE moieties found in human meibum cannot be purchased and have not been synthesized, it is almost impossible to model the diverse composition of human meibum lipids using synthetic WE and CE. In an effort to understand the relationships between CE/WE and DED, we used extracted human meibum lipids to investigate CE/WE interactions and the relationships between meibum lipid conformation and composition changes. Our spectroscopic techniques present better alternatives for lipid structural analysis due to their low risk for sample contamination and destruction, ease of use, and little to no requirement for sample derivatization.[6] As DED disease is a comobidity of Sjögren syndrome,[7, 8] we compared CE/WE ratios from the meibum of donors with Sjögren syndrome with donors without DED, to better understand the relationships between dry eye disease and meibum compositional differences. Another aspect of our research involved hyaluronic acid (HA)-lipid interactions that have been implicated in the occurence of vitreal liquefaction. HA is also used in eye drops with other therapeutics for dry eye symptoms mitigation. We studied HA-lipid interactions using synthetic meibum lipids found in meibum which is relevant to dry eye treatment.

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