On the Surface: Silicone Hydrogel Lenses and Lipid Deposits

Lipid deposits can degrade contact lens comfort and vision, making it harder to achieve the positive lens wear experience patients expect. But lens materials and surfaces differ, giving some lenses more effective deposit resistance than others. Christopher W. Lievens, OD, MS, FAAO

For many soft contact lens wearers, lipid and protein deposits are important impediments to lasting comfort and lens performance.1,4 The degree to which any given lens attracts deposits depends on multiple variables, including the lens material.2 Hydrogel lenses attract mostly protein deposits, while silicone hydrogels adsorb mainly lipids.2,5

Lipid deposition can reduce lens wettability, which can aggravate symptoms of contact lens-related dryness and precipitate further lipid deposition.6,7

LIPID DEPOSITION

Lipid deposits result from complex interactions between the tear film and the silicone hydrogel polymer. Tear lipids (mainly wax & cholesterol esters, triacylglycerol, with smaller concentrations of cholesterol, fatty acids, and other polar lipids such as phospholipids) comprise approximately 1% to 9% of the tear film and function to maintain its aqueous layer, refractive properties, and resistance to foreign bodies.8 Silicone hydrogel polymers contain inherently hydrophobic components. In the absence of a surface treatment or material modification, these materials repel water and attract tear lipids.6

The adsorption of lipids may begin within hours of lens placement.7 Free radicals then oxidize the adsorbed lipids, augmenting the hydrophobicity of the lens surface and increasing its coefficient of friction.5

Due to rotation about chemical bonds in the silicone hydrogel polymer backbone, lipid deposits on the surface may become absorbed into the inner matrix of the lens.6 Both on the surface and once embedded in the lens matrix, lipid deposits may be invisible to inspection and go unnoticed by clinicians.

THE AIR OPTIX® CONTACT LENS DIFFERENCE

Developers of silicone hydrogel lenses have employed a range of material modification strategies to mitigate hydrophobicity and lipid deposition. AIR OPTIX® AQUA (lotrafilcon B) and AIR OPTIX® NIGHT & DAY® AQUA (lotrafilcon A) contact lenses, for example, have a uniquely permanently bonded plasma coating that creates a uniform and uninterrupted hydrophilic surface to resist lipids and maintain wettability.8 By contrast, surface technology used in balafilcon A lenses results in discontinuous silicate islands and incomplete coverage of the hydrophobic lens matrix.5 Rather than resisting tear film lipids, a heterogeneous surface may even contribute to lipid immobilization and fouling of the lens.8

Studies have repeatedly demonstrated the superior lipid deposit resistance of AIR OPTIX® contact lenses compared with other silicone hydrogels.1,2,8 In vitro experiments have shown that AIR OPTIX® contact lenses adsorb significantly less cholesterol and phospholipid compared with balafilcon A, galafilcon A, or senofilcon A lenses.2,8 In a study of worn lenses, AIR OPTIX® AQUA contact lenses were also associated with significantly less cholesterol deposition than comparator silicone hydrogels, regardless of the lens care solution used.1

CLINICAL IMPORTANCE

In practice, some of the complex and dynamic silicone hydrogel lens polymers are susceptible to lipid sorption and spoilage.8 Lenses with surface treatments that maintain wettability and resist lipid deposits are likely to remain moist and comfortable on the eye.6 By limiting lipid deposition, such lenses also promote tear film stability, likely reducing contact lens-related dryness.6,8

AIR OPTIX® AQUA contact lenses have a uniquely designed surface that enables them to resist lipid deposits about as well as conventional hydrogel lenses.2 When daily disposable lenses are not an option, selecting a lens with best-in-class lipid resistance may be just the thing to provide the patient with long-term lens wear success.

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REFERENCES

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