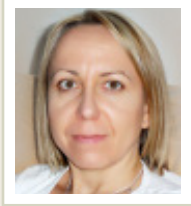


Contact Lens Update

CLINICAL INSIGHTS BASED IN CURRENT RESEARCH

Contact lens interaction with the conjunctiva and its influence on comfort

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Despite constant improvement in contact lens materials and designs available, the leading cause of discontinuation from contact lens wear is discomfort. Comfort during contact lens wear is not easily predicted by clinical signs and is thought to be related to a number of factors, including the lens' effect on the tear film layer and its mechanical interaction with the ocular surfaces. The following editorial describes the presentation, location and presumed mechanical causes of lid wiper epitheliopathy, lid parallel conjunctival folds, conjunctival epithelial flap and conjunctival staining and their possible effect on comfort based upon a number of recent clinical presentations related to the mechanical effects of contact lenses.

Lid wiper epitheliopathy

Lid wiper epitheliopathy (LWE) is an alteration of the advancing lid margin in the area of contact between the upper eyelid and ocular surfaces (the lid wiper), caused by friction during lid movements. It was described as "lid wiper epitheliopathy" initially by Korb et al.^{1,2}.

LWE is assumed to be related to the mechanical forces that occur during blinking and the repeated rubbing of the lid margin epithelium against the cornea or contact lens surface^{3,4}. In the presence of a contact lens, the tear film is known to be thinner or less stable and therefore less able to maintain adequate lubrication between the two moving surfaces to minimize friction during the blink. The repeated "wiping" action of the upper eyelid over the contact lens surface can lead to mechanical trauma of the lid margin and epithelial cells, visualized clinically as increased staining along the upper lid margin.

LWE has been suggested as an early indicator of dry eye disease⁵ and has been identified as a clinical sign more prevalent and more severe during contact lens wear and in symptomatic contact lens wearers than asymptomatic wearers^{6,7,8,9,10}. LWE has also been observed on the lower eyelid but without any significant difference between contact lens wearers with and without dry eye symptoms^{11,12}.

Recently, a study explored the relationship between comfort and LWE in contact lens wearers. The assessment after ten days of wear of lotrafilcon A or comfilcon A showed that LWE of the upper lid increased during contact lens wear; however, the study failed to demonstrate an association between LWE and comfort¹³.

Lid parallel conjunctival folds

Lid parallel conjunctival folds (LIPCOF) are located in the lateral lower quadrant of the bulbar conjunctiva, parallel to the lower lid margin¹⁴; these subclinical conjunctival folds are not associated with aging and, to distinguish them from conjunctivochalasis, were initially described in dry eye subjects as LIPCOF by Hoh (1995).

Similar to LWE, LIPCOF has been reported to increase significantly in symptomatic contact lens wearers^{15,16} and may be a predictor of contact lens-induced dry eye symptoms¹⁷.

Conjunctival epithelial flap

Conjunctival epithelial flaps (CEF) are lesions of the bulbar conjunctiva, usually bilateral and only observed in the superior or inferior quadrants; they are thought to be composed of vital epithelial and goblet cells^{18,19,20}. Conjunctival epithelial flaps were first reported in overnight extended wear of silicone hydrogels by Lofstrom and Kruse in 2005; since then CEFs have also been observed with daily wear of silicone hydrogels^{21,22,23,24}. They are believed to result from the repeated interaction of the lens periphery and the ocular surface, initially observed by clinicians as contact lens-induced conjunctival staining. Lofstrom and Kruse further hypothesised that CEFs were linked to contact lens fit, edge design, base curve and material modulus, with higher modulus materials with non-round edge designs more likely to produce CEFs. The occurrence of CEF is generally asymptomatic and is not related to any discomfort. Initial reports of CEF showed no direct impact on lens wearing satisfaction or comfort^{25,26}; however, the long term effect of this condition on discomfort is unknown.

Conjunctival staining

Limbal staining, also referred to as circumlimbal staining or contact lens-induced conjunctival staining (CLICS), is produced by direct contact between the lens periphery and the ocular surface; its severity is dependent upon both the lens design (edge profile) and material rigidity (modulus)^{27,28,29,30}, with the least staining produced by “rounded” edge contact lenses with the apex away from the ocular surface and the greatest staining by “knife-point” edge design in close apposition with the ocular surface. Several studies have shown that increased circumlimbal staining, indicative of mechanical disturbance, was not a significant factor associated with decreased comfort; in fact recent data from our group and others^{31,32,33,34,35,36} showed that the rounded edge contact lenses, which created the least circumlimbal staining, produced the worst comfort and the knife-point edge contact lenses with the worst staining and tighter fit achieved the best comfort.

Bulbar staining away from the limbus, outside of the area covered by the contact lens, is believed to be more an exposure-type staining resulting from the poor stability of the tear film spreading over the whole ocular surface in the presence of a contact lens and subsequent increased evaporation. Bulbar staining has been associated with an increase in dry eye symptomatology in contact lens wearers^{37,38,39}. More recently, the presence of staining in the bulbar region of the conjunctiva was associated with a significant decrease in comfort for contact lenses with knife-point edge design⁴⁰.

The above findings suggest that the primary factor controlling comfort is the lens edge design, its potential interaction with the eyelids and its effect on fit, and that ocular tissue dehydration is an important secondary factor⁴¹. Limbal staining does not appear to influence immediate contact lens acceptance; however the long term effect of limbal staining is unknown. Comparative studies looking at the effect of LWE and LIPCOF with contact lens materials that have different surface characteristics (surface wettability, friction) and with different comfort responses are needed to investigate any association with comfort.

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