

Contact lenses and allergy

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Purpose of review

Ocular allergic conditions and contact lens wear affect a large percentage of the population; the implications for interaction of allergy and changes induced by contact lens wear are significant. In addition, contact lenses are used in the treatment of severe forms of ocular allergic disease.

Recent findings

The major themes of this review are the effects of contact lens wear on tear-film dynamics and structure, the effects of ocular allergy on tear dynamics and structure, the intersection of these two influences, management of contact lens wear in the allergic patient and the use of contact lenses to manage severe ocular allergic disease.

Summary

The use of newer oral and topical antiallergic drugs in contact lens patients, changes in recommendation for use and wearing schedules and recommendations for the use of scleral lenses in severe allergic-based ocular surface disease are discussed.

Keywords

antiallergic medication, contact lenses, ocular allergy

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Introduction

There are a limited number of pertinent publications detailing new findings within the general time period (12–18 months) of purview for this clinical review. There are, however, a number of newly published review articles particularly timely in their statement of newer recommendations for management, explication of mechanisms operative in allergic eye disease in the presence of a contact lens, or which speak to new findings of interest. In addition, this review will include a limited number of references from earlier publications, which are important to understand mechanisms or clinical significance of current management.

Structure and function of the tear film

Our understanding of the structure and function of the tear film and its breakdown in disease has undergone extensive revision over the last decade. This understanding is being further refined and is essential to clinical decision-making in the area under consideration. Let us briefly review this.

The tear film is a dynamic structure that serves multiple functions to maintain the health of the ocular surface, protect it against noxious influences, repair damage and create an optically clear and stable anterior refracting

surface of the eye to subserve clear vision. These concepts and the following aspects of tear physiology and the effects of contact lenses on the tear film are discussed in a comprehensive yet succinct manner in recent reviews [1[•],2[•]].

The structure of the tear film is thought to be that of a meta-stable film between blinks consisting of three major components, an innermost membrane-spanning mucin layer contributing to the structure of the epithelial cell surface and anchoring the overlying aqueous gel. The membrane-spanning mucins are the product of the corneal and conjunctival epithelial cells; the gel-forming mucins of the overlying aqueous gel are produced by the goblet cells of the conjunctiva and stabilize the tear-film, interact with the outermost lipid layer and serve to cleanse the surface of the wiping away debris, exfoliating cells and microbial contaminants. The lipid layer produced by the meibomian glands of the eyelids retards evaporative tear loss and with the gel-forming mucins provides lubrication between the lids and the ocular surface.

The aqueous component of the tears produced by the main and accessory lacrimal glands contains all the water-soluble elements of the tears including electrolytes and hundreds of proteins and peptides. Although there is a resident population of a few relatively stable proteins, for

example, albumin, lipocalin, lysozyme, lactoferrin and others, many represent cytokines, growth factors and other groups of agents normally present in only nanogram quantities or absent and can increase in response to disease, injury or environmental stress, for example, IgE in ocular allergy. This exquisitely balanced and responsive system is referred to as the lacrimal functional unit and is linked by a neural network consisting of sensory receptors, afferent nerve fibers to the central nervous system, efferent fibers to the lacrimal and meibomian glands. The communication between the structure of the ocular surface and glandular structures regulate secretory activity in response to disease, injury and environment stress. Breakdown in one or more of these elements can lead to mild-to-severe dysfunction of the tear film and ocular surface, which is the hallmark of dry eye disease. For readers interested in a more detailed discussion of this area, please refer to [1^{••},2^{••}].

Effects of a contact lens on the tear film and ocular surface

A contact lens is a foreign body placed in the precorneal tear environment. Contact lenses have been shown to have a number of effects on the ocular surface and tear film [1^{••}]. These include hypoxia, a slight elevation in corneal temperature, microtrauma to the cornea, a reduction in corneal metabolic rate, a decrease in the mitotic rate of the epithelium, increased epithelial fragility, compromised junctional integrity and an increase in corneal lactate. Despite these changes, most patients with normal ocular surface and tear film accommodate quite easily the presence of a contact lens.

Contact lenses have specific effects on the tear film. They disrupt the tear film, thin it and increase evaporative tear loss. Soft contact lenses allow evaporative water loss from the cornea actually drawing water out of it. In patients with adequate tear volume, contact lenses represent a tolerable stress on the tear film. In patients with a decreased reservoir of tears a contact lens can induce a dry eye state. This is estimated to occur in 20–30% of soft contact lens wearers and in over 80% of rigid contact lens wearers [3] (this is an excellent review of our contemporary understanding of the epidemiology of dry eye disease including the role of contact lens wear. This area has undergone a large expansion of knowledge in recent years).

Interactions of ocular allergy and contact lenses

As ocular allergy is widely prevalent affecting up to 30% of the general population, contact lens wear is common in patients suffering from seasonal allergic conjunctivitis or other forms of ocular allergy. Seasonal allergic conjunctivitis has been shown to result in tear-film instability [4]

(This is the first report in which the effect of allergy on the tear film and ocular surface was noted.); similar changes have been reported in patients with atopic keratoconjunctivitis and vernal conjunctivitis [5[•]]. When a contact lens is placed in the eye of a patient with borderline or more advanced dry eye disease with active ocular allergic disease, one can expect the disruptive effects to be magnified. Ocular allergy takes a number of forms, including nonspecific allergic conjunctivitis, seasonal and perennial conjunctivitis, atopic conjunctivitis, vernal conjunctivitis, drug-induced allergic conjunctivitis and contact-lens-induced giant papillary conjunctivitis. This condition seen in some contact lens wearers is thought to be, at least in part, associated with an allergic response [6] (this is an outstanding review of the current status of contact lens development and clinical usage by leaders in the field).

The key issue in the interaction of the contact lens with an allergic response is the development of a biofilm on the surface of the contact lens. This adaptive mechanism facilitating comfort provides a base for the accumulation of deposits consisting of denatured proteins, mucins, calcium and lipids. A coated lens can attract bacteria and antigens can bind to the surface [7] (this is an outstanding source for a complete review of the mechanisms associated with microbial ocular infection).

Management of contact lens wear in patients with ocular allergy

In order to effectively manage the patient who desires to wear contact lenses, though an ocular allergy sufferer, it is important to remember these useful guidelines.

Avoid or minimize contact lens wear during periods of active seasonal allergic disease. Patients with a history of ocular allergy, including atopy, have a higher incidence of contact-lens-related discomfort. This is true for both rigid and newer soft silicone and high-permeability lenses.

Furloughing patients from contact lens wear during flare-ups of ocular allergy is the safest way to avoid complications associated with lens and allergy interactions on the tear film and ocular surface. Should these prove difficult due to patient visual needs, for example, those with keratoconus or high myopia, effective cleaning of the lens to minimize biofilm build-up is recommended. In those patients whose visual needs can be satisfied with soft contact lenses, the use of daily disposable lenses is likely to minimize this problem. Although there is evidence that certain lenses tend to exhibit less deposit formation than others, individual responses are quite variable [8[•]].

Most build-up will occur within overnight wear, particularly with extended wear of contact lenses. In patients

experiencing ocular allergy, the extended wear of contact lenses is considered a contraindication.

It should also be noted that the concomitant use of topical antiallergic medication with contact lenses is generally frowned upon. Many of these formulations, particularly those containing the preservative, benzalkonium chloride, can be irritating to the ocular surface [9] (this is the best succinct, contemporary review of the role of preservatives and other ingredients of ophthalmic formulations and their possible side effects. There is nothing better since). For this reason, the concomitant use of these agents with contact lens wear is thought to have the potential to aggravate damage to the ocular surface. For this reason, the use of systemic antiallergic medications should mitigate this risk. Systemic antihistamines, however, have a drying effect and can decrease tear secretion in addition to their soporific effects [10] (still the current best source for review of this topic). Newer formulations with less tendency for drowsiness and drying make their use in contact lens wearers more attractive [11].

The interactions between topical medications, the lenses and the ocular surface are not yet well understood and their utility is under current investigation [1^{••}]. In this regard, however, a recent study [12[•]] has investigated patient perceptions of the use of topical olopatadine 0.2% in a large (330 patients) multicenter study of patients with active ocular allergic signs and symptoms. These patients had previously been treated with 0.1% olopatadine drops. Patients were more satisfied with the 0.2% formulation than their prior 0.1% drops. Of interest is a subset of patients who were wearing contact lenses. Eighty-eight percent of the 48 patients in this group believed they could wear their lenses as desired and no safety findings were reported in this 28-day study.

In summary, the use of contact lenses in periods of active allergic disease of the ocular surface should be avoided when possible. In other circumstances, meticulous cleaning of the lenses with effective disinfecting regimens is essential. Daily disposable lenses offer the best alternative to no lens wear although may not be feasible in all cases, for example, keratoconus.

A special case of the interaction between the contact lens and ocular allergic mechanisms is that of giant papillary conjunctivitis (contact-lens-induced papillary conjunctivitis). There is a separate chapter on this topic in this issue.

The use of therapeutic bandage contact lenses in severe ocular allergy

Although I have emphasized caution in the use of contact lenses in patients with active ocular allergic disease, there is a role for contact lenses as a therapeutic modality in the

treatment of severe ocular surface complications of allergy, that is, corneal ulceration [13[•]]. This condition is, fortunately, not common in most forms of ocular allergic disease but occurs in vernal conjunctivitis (shield corneal ulcers) and in more severe cases of chronic allergic keratoconjunctivitis.

The rationale for the use of therapeutic contact lenses in the treatment of corneal ulcers is that they can reduce frictional forces from the upper lid on the cornea allowing epithelial healing to occur. There are two types of contact lenses in use: rigid scleral lenses and soft hydrogel, silicone lenses or silicone–hydrogel polymer lenses [14]. The former have been in use for over 50 years. Newer materials with higher oxygen permeability have made their use more attractive and alleviated the need for fenestrations or channels. These latter attempts to provide access for oxygen to the ocular surface have been problematic with bubbles accumulating beneath the lens thus affecting vision. They are fitted to vault the corneal surface and thus provide a clear space behind the lens with the weight of the lens being borne on the sclera. They have been shown to be very effective in maintaining an intact ocular surface in chronic ocular surface disease such as filamentary keratitis, mucin-deficient states, for example, ocular pemphigoid, erythema multiforme and chemical burns and persistent epithelial defects seen in neurotrophic keratopathy and trichiasis [8[•]]. Their fitting is, however, thought to be highly specialized and availability of large lenses required for effective management is limited. For these reasons, they are not in wide use, although the excellent review article cited above points out that most cases can be fitted and managed in a straightforward manner.

More common is the use of therapeutic soft lenses for managing corneal ulcers and persistent epithelial defects – these two conditions are distinguished by their depth, the former involving the underlying stroma. In recent years, the development of newer soft contact lens materials, which greatly improve oxygen transmissibility have virtually eliminated corneal hypoxia associated with earlier soft lenses [6]. Prominent among these materials are the silicone–hydrogel hybrid polymers. Although they allow for sufficient oxygen transmission to support corneal metabolism, they have not eliminated the risk for infection particularly when they are worn for extended periods such as is the case in the treatment of persistent epithelial defects and corneal ulcers.

Soft therapeutic lenses provide a moist covering over the defect, reduce frictional forces of the upper lid on the surface and provide a smooth anterior lens surface facilitating vision. Soft lenses have a very thin postlens space and there is limited movement of the lens with blinking. This creates a sequestered space, which interferes with

tear exchange, entraps exfoliating cells and provides an environment in which bacteria can develop adherence to the cornea leading to microbial keratitis.

The use of supplemental artificial tears is mandatory to ensure sufficient moisture to maintain a wet corneal surface. The use of prophylactic antibiotics to protect against secondary infection is controversial. As these lenses are usually in place for long periods, there is concern that chronic antibiotic use will lead to the development of microbial resistance. Data on this are lacking but the general thought is that most microbial resistance encountered in ophthalmic practice is more related to the development of resistance by way of nonophthalmic use, for example, systemic drugs, commercial livestock feeds, etc. In any event, continual clinical monitoring is required to minimize the risk for serious infection. The healing of the defect itself with the use of the lenses would seem the best protection against infection.

In the use of soft therapeutic lenses for the treatment of peripheral corneal ulcers such as are typical of vernal shield ulcers, it is necessary to use a large diameter (22 mm or greater) bandage contact lens to provide adequate coverage and stability. In a recent report, the efficacy of this approach in the successful management of two cases of vernal ulcers refractory to treatment was demonstrated [14]. In one case, the ulcer healed within 2 weeks of the contact lens placement and in the other the patient was able to tolerate topical medications after the ulcer had healed under the lens.

Although there are no recent controlled studies comparing bandage contact lenses with other forms of management such as tarsorrhaphy, punctual occlusion and amniotic membrane transplantation, numerous earlier studies have confirmed the efficacy of these lenses in the successful treatment of corneal ulcers of various causes [15*].

Conclusion

The use of contact lenses in the presence of ocular allergy is a topic of high clinical relevance given the prevalence of ocular allergy and the widespread wear of lenses. As both lens wear and ocular allergy induce changes in the tear film and ocular surface, caution is necessary in contact lens use particularly in periods of allergic activity. Furloughing contact lens wear is the safest path, although in mild-to-moderate allergy, successful and safe lens wear is achievable. Overnight wear is generally contraindicated and the use of disposable lenses has widened lens wear possibilities. The use of newer antiallergic topical medications may allow for better management of allergic disease with lens wear.

In several forms of ocular allergic disease, such as atopy and vernal keratoconjunctivitis, contact lenses can play an important therapeutic role in the management of persistent epithelial defects and corneal ulcers. Supplementation of tears is essential in the use of both rigid scleral lenses and soft therapeutic lenses. Clinical monitoring to minimize the risk of infection is required; the use of prophylactic antibiotics is controversial but gaining acceptance.

References and recommended reading

Papers of particular interest, published within the annual period of review, have been highlighted as:

- of special interest
- of outstanding interest

Additional references related to this topic can also be found in the Current World Literature section in this issue (p. 496).

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- This recently published chapter is a comprehensive but succinct discussion of this area.
- 2 2007 Report of the International Dry Eye Workshop (DEWS). *Ocular Surf* 2007; 5:75–199.
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- For readers of French, this is an excellent review of contemporary concepts of ocular allergy.
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- There are not many articles published on the use of scleral lenses and this current review gives an excellent perspective.
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- 15 Tull SS, Schultz GS, Downer DM. Science and strategy for preventing and managing corneal ulceration. *Ocular Surf* 2007; 5:23–39.
- An unusual, comprehensive and clinically useful article on a difficult, vexing problem in clinical management.