Managing Ocular Allergy in Optometric Practice

Introduction

Ocular allergy is an umbrella term used to capture a range of allergic inflammatory conditions that affect the eye. These conditions, like all allergic reactions, are the result of immune hypersensitivity to normally harmless substances, known as environmental antigens or allergens – typically pollen, dust, mould, and animal dander (Shaker & Salcone 2016). In patients attending optometric practice, the prevalence of ocular allergy is reported to be approximately 8% (Wolffsohn et al. 2011), but is likely to be higher due to under-diagnosis as a result of seasonal ocular allergies being conflated with hay fever symptoms (Leonardi et al. 2015; Gomes 2014) – hence the true number of cases represents a significant figure that need to be managed in practice. Indeed, ocular allergies and conjunctival symptoms are present in 30-71% of patients with allergic rhinitis, yet the prevalence of ocular allergies alone ranges from 6-30% in the general population (Leonardi et al. 2015) – this wide range is the result of studies including various ocular allergy subtypes. Subtypes of ocular allergy include allergic conjunctivitis (AC), vernal keratoconjunctivitis (VKC), atopic keratoconjunctivitis (AKC) and giant papillary conjunctivitis (GPC).

Although symptoms are often mild to moderate in the majority of cases, ocular allergies can have significant impact on patients in their daily lives. In a study of patients suffering seasonal allergic conjunctivitis versus controls in cities across Spain, data from a range of validated questionnaires revealed sufferers had significantly reduced quality of life scores and increased healthcare costs to manage their symptoms, approaching 350 Euros per annum (Smith et al 2005). Likewise, in a UK setting with same methodology, sufferers had significantly higher degrees of pain/discomfort, and lower perception of health compared to controls; and increased costs to manage symptoms – ranging from over £60 per year for a pensioner to over double that for those in paid employment (>£120), while the latter also reported lower weekly earnings and lower working hours compared to controls (Pitt et al. 2004). In a study of over 2,500 participants diagnosed with nasal and/or ocular allergies, telephone questionnaires revealed that 29% reported their or their child's daily life was impacted "a lot" and workers reported their productivity was 29% lower during peak allergy symptoms compared to no symptoms (Bielory et al. 2014). It is clear from these studies that ocular allergies represent not only a significant burden on quality of life, but also financially by the often life-long need to manage their symptoms. However, these management strategies are often inappropriate due to self-prescribing and many suffer without seeking treatment (Leonardi et al. 2015; Gomes 2014).

Together with the widely reported increasing prevalence of ocular allergy (Rosario & Bielory 2011; Singh et al. 2010) and allergies in general (Gomes 2014; Gupta et al. 2007), these patients represent a growing group with allergic eye conditions that are often under-diagnosed and inadequately managed. This article will therefore aim to focus on the effective identification and treatment modalities for the most common subtype of ocular allergy known as allergic conjunctivitis, which accounts for up to 95% of cases (Kubaisi et al. 2017). In addition, discussion will also include issues encountered in optometric practice relating to contact lens wear in such patients.

Diagnosis of Allergic Conjunctivitis

Allergic conjunctivitis (AC) is subdivided into two forms – seasonal (SAC) and perennial (PAC). As their names suggest, SAC occurs during periods of the year when the offending allergen (typically tree, grass, and weed pollens; outdoor moulds) reaches its peak atmospheric concentration; whereas PAC occurs year round (due to house dust mites, animal dander, and indoor moulds) with possible seasonal exacerbations as patients may be sensitized to more than one allergen (Prince et al. 2018; Kubaisi et al. 2017). Prevalence of AC ranges from 15-20%, but recent cross-sectional studies in the US suggest it may be as high as 40%, with SAC far more common than PAC (Singh et al. 2010). SAC often occurs as part of seasonal hay fever (rhinoconjunctivitis), and risk factors for susceptible individuals include atopic disposition such as eczema and asthma (Leonardi et al. 2015; Rosario and Bielory 2011). In a study of over 450 children with either asthma, eczema or rhinitis, prevalence of AC was over 25% in each group, being highest (42%) in those with rhinitis. In those with AC (30%), 97% had rhinitis, 56% asthma, and 33% eczema respectively (Gradman & Wolthers 2006). Thus, detailed history taking is crucial to aid in the diagnosis of AC, in addition to identifying the offending allergen(s).

The pathophysiology of SAC and PAC is an IgE (type of antibody) mediated hypersensitivity response of mast cells, or “Type I” reaction, usually based on the traditional Coombs and Gell (1963) classification (Leonardi et al. 2012; Ono & Abelson 2005). The response is the result of a complex chain of immunological events triggered by an allergen binding to a mucous membrane, such as the conjunctiva (Leonardi et al. 2012; Chigbu 2009). In summary, this causes the allergen molecules to bind with specific IgE antibodies to that allergen that are bound to the surface of sensitised mast cells – the IgE cross-link and cause an influx of calcium ions across the mast cell membrane which results in a process called degranulation (Leonardi et al. 2012; Chigbu 2009). This process releases preformed inflammatory mediators into the extracellular space, notably histamine, which produces the signs and symptoms of AC after binding to receptors (H_1 and H_2) on surrounding blood vessels (De Gaulle 2009). Signs are frequently bilateral and typical of inflammation - diffuse bulbar hyperaemia due to blood vessel dilatation; chemosis and eyelid swelling due to increased vascular permeability; and conjunctival papillae as a result of chronic inflammation - all caused by histamine stimulation of H_1 receptors on capillary endothelium (Ono & Abelson 2005; Abelson & Loeffler 2003). Symptoms include bilateral epiphora and itching – the latter a pathognomonic sign as histamine stimulate H_1 receptors on nearby sensory nerves (Leonardi et al. 2012; Ono & Abelson 2005; Abelson & Loeffler 2003).

Clinically, these effects last 20-30 minutes as measured by conjunctival allergen challenge tests (Abelson & Loeffler 2003), and is often why patients report a significant reduction in symptoms upon presentation to the optometrist after an acute episode - due to the short acting nature, it is known as the early phase allergic response. However, due to increased exposure to the offending allergen during peak season, the signs and symptoms occur intermittently in SAC during this period. This effect is the result of the late phase allergic response in which mast cell degranulation leads to production of newly formed inflammatory mediators such as prostaglandins which prolong inflammation; cytokines and chemotactic factors which stimulate production of more IgE antibodies from B-cells and cause endothelial cells to release chemokines and adhesion molecules (De Gaulle 2009). The latter two cause infiltration of a variety of white blood cells (eosinophils, lymphocytes) to the site of inflammation – together with sustained mast cell activation and newly formed mediators, this leads to signs and symptoms recurring 3-12 hours after initial allergen exposure which can persist up to 24 hours (De Gaulle 2009; Ono and Abelson 2005; Bacon et al. 2000). PAC is therefore the result of continuous allergen exposure inducing long-term mast cell activation and cellular infiltration – however, although signs and symptoms in PAC are the same as SAC, they are generally milder (Leonardi et al. 2012).

Based on this discussion the diagnosis of SAC and PAC in the vast majority of cases is clinical, where detailed patient history to record symptoms, and slit lamp examination to identify signs are sufficient and readily available to optometrists. The key indicators for AC and to aid differential diagnosis are:

- Age of Onset – the first episode in AC normally occurs in adolescence and young adults, with 80% of cases presenting in patients younger than 30 years old (Leonardi et al. 2017)

- Time & Duration – the onset and duration of symptoms follows the course of the pollen season subject to local variability in pollen counts; and recur each year at the same time in SAC (Prince et al. 2018; Leonardi et al. 2017). In PAC, symptoms are year round but may spike following increased exposure to the offending allergen (Leonardi et al. 2017).

- Co-morbidities – as described above, AC sufferers frequently have history of rhinitis, asthma, and/or eczema

- Itching – as described before, this is a hallmark of allergic inflammation. However, itching may also be present in blepharitis, particularly demodex infestation. Hence careful eyelid examination is required to detect any debris at the base of the eyelashes (Kabatas et al. 2017)

- Laterality – AC is typically bilateral as both eyes are likely to be exposed to the allergen at the same time. Infectious conjunctivitis may also be bilateral, but one eye is usually affected upon onset, followed by fellow eye few days later (Rietveld et al. 2003)

- Hyperaemia – of the bulbar and tarsal conjunctiva is diffuse, whereas localised redness is suggestive of episcleritis (Jabs et al. 2000)

- Oedema – chemosis of the bulbar and tarsal conjunctiva may be subtle, but can be alarming in acute stages of inflammation following high allergen exposure. The patient can be distressed at the appearance; and care must be taken to differentiate from orbital cellulitis where the eyelids are swollen, particularly in children (Nageswaran et al. 2006)

- Papillae – on the tarsal conjunctiva is the result of chronic inflammation, but this may also be encountered in infective conjunctivitis

- Discharge – watery eyes is common in AC, but is non-specific. Discharge is usually purulent/mucopurulent in infectious conjunctivitis, and eyelids can be stuck together on waking (Rietveld et al. 2003)

- Pain & Photophobia – is not associated with AC (Leonardi et al. 2017)

As with all cases of acute red eye, particularly in SAC, it is paramount that other sight threatening causes are excluded, so eyelid eversion to detect foreign bodies and use of ophthalmic dyes (fluorescein) to detection of any corneal lesions is essential (Leonardi et al. 2017). The use of grading scales (such as Efron Grading Scales for Contact Lens Complications, Visioncare Institute Clinical Grading Scale; Efron et al. 2011) is also important

in order to establish severity and response to treatment (Leonardi et al. 2017). Grading of clinical features such hyperaemia, chemosis, and papillae to 1 decimal place with validated grading scales enables more accurate score which is more sensitive to change over time (Wolffsohn et al. 2015).

Although unlikely in SAC and PAC, where the allergen cannot be reliably identified or where symptoms persist despite treatment, allergen identification is required by referral to an allergy clinic. Skin prick tests (SPTs) are likely to be conducted, which are considered gold standard for detecting IgE mediated sensitisation (Heinzerling et al. 2013) - here, a single drop of different allergen solutions (suggested from history) are placed on the volar aspect of the forearm 2cm apart, including histamine (positive control) saline (negative control) and marked with a pen. The tip of sterile needle is placed in the centre of each drop (using a new needle each time) to gently pierce the skin. After 20 minutes, the size of the wheal response (circular elevation of skin surrounded by red flare due to allergic inflammation) is measured – a positive result for the allergen occurs when the lesion diameter is ≥3mm (Heinzerling et al. 2013). Where SPT is inconclusive or not does not correlate with clinical history, serum testing (typically radioallergosorbent test; RAST) can be performed to detect the amount of IgE in the serum bound to a specific allergen after mixing (presented as a severity score) to determine if one is sensitised to the allergen (Leonardi et al. 2017). Once the sensitisation has been established, more specific testing of the eye can be done through conjunctival allergen provocation testing (CAPT) in specialist centres. In CAPT, allergen solutions are applied to one eye (saline to fellow eye - control) in two-fold increasing concentrations every 15 minutes until a composite score of ≥5 is achieved using a standardised scoring method for conjunctival allergic inflammation (Fauquert et al. 2017). As only one allergen can be tested per day (24 hour washout), this process is time consuming.

However, CAPT may be indicated if SPT or serum testing is negative or inconclusive – indeed, the conjunctival tissue can uniquely sensitised in the absence of systemic hypersensitivity – i.e. the IgE for the offending allergen is produced locally (Leonardi 2005). Studies have shown that positive systemic test results (SPT, serum tests) in patients with ocular allergy are as low as 20% (Leonardi 2005; Asbell & Ahmad 2003). Furthermore, only 71% of allergic conjunctivitis patients had positive agreement between systemic (RAST) and ocular (CAPT) allergy testing – this suggests systemic tests may detect sensitisation to allergens that do not affect the conjunctiva and vice versa (Leonardi et al. 1990). This highlights the need for specific and targeted treatment of AC to the eye, rather than through systemic/non-ocular approaches as in hay fever treatment (oral tablets, nasal sprays) .

Treatment of Allergic Conjunctivitis

It is clear from the pathophysiology of AC that preventing the exposure of the allergen to the ocular surface will not allow the allergic inflammatory cascade to develop and in turn prevent the associated signs and symptoms. Although little information is available in the scientific literature specific to pollen allergen avoidance, strategies include (Veys 2004):

- Limiting outdoor activity or remain indoors during peak pollen season and when symptoms active
- Keep windows closed and use air conditioning in cars and home for ventilation as they filter pollen
- Wear close fitting wraparound sunglasses when outdoors
- Wash hands and hair, and avoid rubbing/touching eyes after being outdoors

A vastly larger body of evidence is available for allergen avoidance strategies in chronic allergic conditions such as rhinitis and asthma that relate directly to PAC due to similar aetiology, but often studies are limited by their sample size and methodological control procedures (Nurmatov et al. 2012, Van Cauwenberge et al. 2000). Nonetheless, Nurmatov et al. (2012) suggest the following strategies to help prevent allergen exposure:

Dust Mites

- Regularly changing and washing (no less than 60°C) pillow, duvet and mattress covers
- Mite-proof pillow, duvet and mattress covers
- Clean, vacuum and damp dust house, particularly areas that gather dust on daily basis
- Reduce humidity in home to between 35-50% with de-humidifier

Animal Dander

- Keep all pets outdoors or avoid keeping altogether
- Wash hands, hair and clothes, and avoid rubbing/touching eyes after coming into contact with animals
- Clean, vacuum areas that gather animal fur/hair daily; ideally removing carpets and use hard floors as they are more easily cleared

These avoidance strategies should be emphasised in all cases of AC – however, identification of the allergen(s) in order to develop an avoidance strategy requires careful history to determine when peak symptoms occur and trying to match this to pollen types airborne at that time of year in the local area in the absence of clinical allergen identification techniques (SPT, CAPT). Information can be easily and freely accessed from the UK Met Office (www.metoffice.gov.uk/health/public/pollen-forecast) website to determine the pollen concentration and species from pollen forecasts and calendars. However, it is recognised that pollen exposure is difficult to avoid completely due to its ubiquitous nature (Van Cauwenberge 2000).

During active phases of mild AC, non-pharmacological treatments include use of cold compresses and refrigerator cooled saline or artificial tears (2-4°C). The rationale for this based on the cold sensation inducing conjunctival vasoconstriction to reduce hyperaemia, chemosis, and eyelid swelling; and the use of saline and artificial tears also serve to remove or wash out allergens from the ocular surface (Bilkhu et al. 2014, Bielory et al 2013). These interventions can be advised and provided easily to patients by optometrists, and should be encouraged prior to and between any medication doses if symptoms are severe to help provide relief. The recommendations are often based on expert consensus, but one randomised controlled trial has shown that both artificial tears and cold compresses resulted in clinically significant reduction in conjunctival hyperaemia and allergic symptoms (which was enhanced when used in combination) in patients with active AC induced by CAPT (Bilkhu et al. 2014).

In cases where avoidance strategies and non-pharmacological interventions are insufficient to prevent/alleviate symptoms, therapeutic management is advised (Table 1). These have been developed over many years in conjunction with increased knowledge of the pathophysiological mechanism of ocular allergy, which target different aspects of the inflammatory process (Bielory 2012). A major ophthalmic drug class called antihistamines work by binding to H_1 receptor sites in the conjunctiva and eyelids; and thus prevent histamine causing the signs and symptoms of AC. Topical preparations available to advise by entry level optometrists (as Pharmacy only medicines) include antihistamine-sympathomimetic (antazoline sulphate 0.5% and xylometazoline 0.05%) combination eye drop; and the

sympathomimetic naphazoline hydrochloride 0.012% - the latter is also available combined with witch-hazel, which has purported astringent properties and thus may be useful for those with significant mucous discharge (Bielory 2012). Oral antihistamines can also be advised where ocular symptoms occur alongside nasal symptoms in rhinoconjunctivitis (hay fever), with a wide range of P-only medications available to entry level optometrists (Bielory et al. 2005). Studies have shown improved effectiveness in relieving SAC when combined with topical medications (Bielory et al. 2005).

Another major drug class are mast cell stabilizers – these work by preventing the calcium ion influx in the mast cell membrane after allergen binds to IgE receptors and therefore prevent degranulation and the associated inflammatory cascade (Bielory 2012). Very commonly used for treating GPC, sodium cromoglicate 2% is available to entry level optometrists. It has been studied extensively in clinical trials as an active control and demonstrates clinically proven efficacy in relieving the signs and symptoms of AC (Owen et al. 2004, Leino et al 1992). Contrary to the long held consensus that mast cell stabilisers only work prophylactically through 2 week loading doses, studies have shown effectiveness (relief of hyperaemia and itching) in the active phase as early as 2 minutes post application (Owen et al. 2004, Montan et al. 1994). The other drug in this class is lodoxamide trometamol 0.1%, but is only available as a prescription only medicine (POM) and thus only additional supply and independent prescribing optometrists can advise. Nedocromil sodium 2% (POM) has been discontinued and thus no longer available.

Other therapeutic options include azelastine hydrochloride 0.5mg/ml. epinastine hydrochloride 0.5mg/ml, olopatadine hydrochloride 1mg/ml, and ketotifen fumarate 0.25mg/ml (all POMs) – these are all antihistamines with mast cell stabilising properties, such that their mechanism of action is two-fold. All have demonstrated significant reduction in signs of hyperaemia, itching, and chemosis compared to placebo (saline) in randomised controlled clinical trials, where allergic conjunctivitis was induced via CAPT (Abelson et al. 2004, Abelson & Turner 2003, Greiner et al. 2003, Friedlaender et al. 2000).

Name	Legal Category	Drug Class	Age Limitations	Dosing
Antazlone Sulphate 0.5% & Xylometazoline Hydrochloride 0.05%	P-only	Antihistamine combined with Sympathomimetic	12 and older	1 drop 2-3 times daily, maximum 7 days
Azelastine Hydrochloride 0.5mg/ml	POM	Anti-histamine Mast cell stabiliser	SAC – 4 and older PAC – 12 and older	1 drop 2-4 times daily, maximum 6 weeks use
Diclofenac Sodium 1mg/ml	POM	NSAID	Adults (18+)	1 drop 4 times daily
Epinastine Hydrochloride 0.5mg/ml	POM	Antihistamine Mast cell stabiliser	12 and older	1 drop twice daily, maximum 8 weeks use
Ketotifen Fumarate 0.25mg/ml	POM	Antihistamine Mast cell stabiliser	3 and older	1 drop twice daily
Lodoxamide Trometamol 0.1%	POM	Mast cell stabiliser	4 and older	1 drop four times daily

Naphazoline Hydrochloride 0.012%	P-only	Sympathomimetic	12 and older	1 drop 2-3 times daily, maximum 7 days
Olopatadine Hydrochloride 1mg/ml	POM	Antihistamine Mast cell stabiliser	3 and older	1 drop twice daily, maximum 4 months
Sodium Cromoglicate 2%	P-only (max size 10ml) POM	Mast cell stabiliser	All children and adults	1 drop four times daily

Table 1: List of Topical Anti-Allergy Eye Drops Available in the UK

Given the wide range of drug choice available to AS and IP optometrists (Table 1), selecting one to prescribe is not clear – meta-analyses have shown similar efficacy and onset of action of topical mast cell stabilisers and antihistamines versus placebo (typically saline) and in comparison between these drug classes (Owen et al. 2004). More recent comparison studies have however demonstrated conflicting results. In an environmental clinical trial, where subjects with known SAC were divided to receive at random one of olopatadine, ketotifen, epinastine, emedastine (no longer available in the UK) and fluorometholone (steroid) twice daily for 2 weeks in one eye (the fellow receiving saline as a placebo) during the local allergy season – all were significantly better at relieving tearing, chemosis and eyelid swelling compare to placebo and fluoromethalone; however there was no significant difference between the anti-allergic medications (Borazan et al. 2009). Other CAPT induced SAC clinical trials have shown olopatadine to be superior to sodium cromoglicate (Katelaris et al. 2002), ketotifen (Aguilar 2000), ketorolac, (Deschenes et al. 1999), and epinastine (Lanier et al. 2004). What is clear from these results is that the methodologies to investigate effectiveness vary – environmental studies suffer from lack of control of exposure to the allergen, so that participants may experience more or less signs and symptoms, which in turn may confound the results (Abelson and Loeffler 2003). CAPT style studies offer such control as all subjects are required to exhibit a minimum standard allergic response in each eye which is repeatable (Ableson & Loeffler 2003). Interestingly, there have not been studies which compare P-only medications to one another or in combination; the results of which would be most valuable to entry level optometrists whose therapeutic options are limited. Thus, given the current evidence available, the choice of drug to prescribe should be based on convenience, where fewer applications aids compliance and reduces risk of side effects; and cost, as no major side effects have been reported in clinical trials with topical medications (Owen et al. 2004). Indeed, potential contraindications and interactions, and patient preference must also be considered while making a prescribing decision – however, dual action medications such as olopatadine are shown to be most effective at relieving itching and redness (Ackerman et al. 2016).

In the vast majority of SAC and PAC cases, the above management should be sufficient given the relatively mild symptoms and low risk of long-term complications. However, in cases unresponsive to conventional treatment, other therapeutic options are available to AS and IP optometrists. These include topical non-steroidal anti-inflammatory drugs (NSAIDs) such as diclofenac sodium 0.1% and ketorolac trometamol 0.5%, but care must be taken in prescribing to those with aspirin hypersensitivity – there have been reports of inducing asthma attacks, and as such should not be prescribed to those with asthma and nasal polyps without confirmation of aspirin/NSAID tolerability from their GP (Swamy et al. 2007). In a meta-analysis of these medications in treating SAC, NSAIDs significantly improved symptoms of itching and signs of conjunctival injection versus placebo (Swamy et al. 2007). Topical

corticosteroids are well known as powerful anti-inflammatories, and may be prescribed in severe cases (Bielory et al. 2012). Long-term environmental studies have shown loteprednol etabonate 0.2% to be more effective compared to placebo in SAC and PAC with low risk of side effects over at least 12 months (Ilyas et al. 2004); and in CAPT style clinical trials (Dell et al. 1998); although as with all patients using topical steroids, they should be closely monitored for steroid induced side effects such as raised IOP/glaucoma, and cataract formation (Dell et al. 1998). To date, only loteprednol has been studied specifically for allergic inflammation, and was originally designed as a low dose non-penetrating drug to overcome the limitations of older topical corticosteroids with respect to risk of side effects with long term use (Bielory et al. 2012).

Allergic Conjunctivitis & Contact Lens Wear

Traditionally, patients with acute signs and symptoms have been advised to cease contact lens wear while topical treatment is prescribed to prevent build-up and subsequent drug toxicity reactions, and to prevent build-up of the allergens on the lens surface which may otherwise prolong symptoms, particularly those with re-usable modalities (Lemp & Bielory, 2008). While this still holds for severe cases, Brodsky et al. (2003) showed significant improvement in ocular comfort and increased contact lens wear time (mean 2.1 hours longer) following application of one drop olopadatine 15 minutes prior to contact lens insertion compared to placebo in patients with CAPT induced SAC. Similarly, Nichols et al (2009) reported increased total and comfortable wearing time, and improved symptoms itching during the allergy season in SAC patients using one drop epinastine twice daily and rewetting drops as needed versus those with rewetting drops as needed alone. Thus patients with active SAC can be managed by prescribing anti-allergy medications once or twice daily (prior to insertion and after lens removal) without need to cease lens wear completely during the local allergy season.

Where SAC and PAC patients are not inclined/contraindicated to consider use of topical medications to manage through the allergy season, increasing lens replacement frequency together with careful and regimental rub and rinse strategy to minimise allergen build-up is advised (Lemp & Bielory 2008). Indeed, changing to daily disposables during this period or long-term would be ideal, as new lens is inserted daily without the need for strict lens maintenance. Of 128 re-usable (2 weekly and monthly) contact lens wearing patients with history of SAC; 67% reported improved comfort with daily disposable lenses compared to their habitual lenses in a cross over study during the local allergy season; versus only 18% who preferred a fresh pair of their habitual lenses (Hayes et al. 2003). In addition, signs of conjunctival hyperaemia, palpebral roughness and corneal staining was improved to greater extent after wearing daily disposables compared to baseline than with habitual lens wear (Hayes et al. 2003) – this study is relatively old, and newer materials with surface treatments have been developed since then and it would be very useful addition to the literature to understand the impact of these advances in controlling allergic symptoms. Interestingly, and contrary to traditional thought, lens wear during allergen exposure has been shown to reduce signs and symptoms of AC – in patients with SAC wearing daily disposable lenses, signs of redness, conjunctival papillae and ocular surface staining were significantly reduced compared to their no lens wear state after exposure to airborne pollen in a specially designed chamber device (Wolffsohn & Emberlin 2011). The duration of symptoms were 1.7-2 times shorter compared to no lens wear, and these effects were increased when wearing a daily disposable lens with enhanced surface lubrication properties (Wolffsohn & Emberlin 2011). Thus, contact lenses may in fact provide an ocular barrier effect to allergen exposure, and be

used as a vehicle to deliver therapeutic concentrations of anti-allergic drugs to the ocular surface, negating the need to cease wear or use eye drops (Gonzalez-Chomon et al. 2016, Xu et al. 2011). In all cases, if symptoms persist despite attempts to maintain lens wear, a period of cessation along with topical therapy is required (Lemp & Bielory 2008).

Conclusions

SAC and PAC are major subtypes of ocular allergy, are frequently encountered in optometric practice, and cause significant impact on sufferers with respect to both symptoms and lifestyle. With the increasing prevalence of allergies generally, patient episodes are likely to increase and as such optometrists are ideally positioned in primary care to help manage SAC and PAC. Diagnosis is essentially clinical, but requires very careful history and slit lamp examination to recognise and exclude other conditions as part of the differential. However, in rare cases where symptoms persist despite treatment and all other potential causes have been excluded, referral to an allergy clinic is required to help identify the causative allergen(s).

Treatment should be focussed on preventing allergen exposure, with detailed written advice and/or directions to evidence based resources to implement avoidance strategies. Where avoidance is not feasible or symptoms persist, effective non-pharmacological and pharmacological topical treatments are available to entry level optometrists, although research to determine whether combination therapy with P-only medications are more effective is warranted to enhance the evidence basis for those yet unable to prescribe POMs. AS and IP optometrists have access to a number of therapeutic agents licenced for SAC and PAC, although the selection should be based on patient convenience, preference and cost, as little evidence exists to recommend one over another in active phase of disease. However, olopatadine, an antihistamine-mast cell stabiliser drug does demonstrate superior efficacy to most in well designed and controlled clinical trials, together with only twice daily dosing.

Contact lens wear can be maintained in patients with active SAC and PAC with carefully planned medication regimens, and increasing replacement frequency – there is evidence to show contact lenses can help reduce SAC symptoms, at least prophylactically and may be a possible route for delivering future anti-allergic medications.

References

Abelson MB, & Loeffler O. (2003) Conjunctival allergen challenge: models in the investigation of ocular allergy. Curr Allergy Asthma Rep 3, 363-68.

Abelson MB, & Turner D. (2003) A randomized, double-blind, parallel-group comparison of olopatadine 0.1% ophthalmic solution versus placebo for controlling the signs and symptoms of seasonal allergic conjuctivitis and rhinoconjunctivitis. Clin Ther 25, 931-47.

Abelson MB, Gomes P, Crampton HJ et al. (2004) Efficacy and tolerability of ophthalmic epinastine assessed using the conjunctival antigen challenge model in patients with a history of allergic conjunctivitis. Clin Ther 26, 35-47.

Ackerman S, Smith LM, Gomes PJ (2016) Ocular itch associated with allergic conjunctivitis: latest evidence and clinical management. Ther Adv Chronic Dis 7, 52-67.

Aguilar AJ. (2000) Comparative study of clinical efficacy and tolerance in seasonal allergic conjunctivitis management with 0.1% olopatadine hydrochloride versus 0.05% ketotifen fumarate. Acta Ophthalmol Scand 78, 52-5.

Asbell PA, & Ahmad SM. (2003) Diagnostic assays in ocular allergy. Int Ophthalmol Clin 43, 83-93.

Bacon AS, Ahluwalia P, Irani AM et al. (2000) Tear and conjunctival changes during the allergen-induced early-and late-phase responses. J Allergy Clin Immunol, 106, 948-54.

Bielory L, Skoner DP, Blaiss MS et al. (2014) Ocular and nasal allergy symptom burden in America: the Allergies, Immunotherapy, and RhinoconjunctivitiS (AIRS) surveys. Allergy Asthma Proc 35, 211-18.

Bielory L, Meltzer EO, Nichols KK et al. (2013) An algorithm for the management of allergic conjunctivitis. Allergy Asthma Proc 34, 408-20.

Bielory L (2012). Allergic conjunctivitis: the evolution of therapeutic options.Allergy Asthma Proc 33, 129-39.

Bielory BP, O'Brien TP, & Bielory L. (2012) Management of seasonal allergic conjunctivitis: guide to therapy. Acta Ophthalmol 90, 399-407.

Bielory L, Lien KW, & Bigelsen S. (2005) Efficacy and tolerability of newer antihistamines in the treatment of allergic conjunctivitis. Drugs 65, 215-28.

Bilkhu PS, Wolffsohn JS, Naroo SA et al. (2014). Effectiveness of nonpharmacologic treatments for acute seasonal allergic conjunctivitis. Ophthalmol 121, 72-8.

Borazan M, Karalezli A, Akova YA et al. (2009) Efficacy of olopatadine HCI 0.1%, ketotifen fumarate 0.025%, epinastine HCI 0.05%, emedastine 0.05% and fluorometholone acetate 0.1% ophthalmic solutions for seasonal allergic conjunctivitis: a placebo-controlled environmental trial. Acta Ophthalmologica 87, 549-554.

Brodsky M, Berger WE, Butrus S et al. (2003) Evaluation of comfort using olopatadine hydrochloride 0.1% ophthalmic solution in the treatment of allergic conjunctivitis in contact lens wearers compared to placebo using the conjunctival allergen-challenge model. Eye Contact Lens 29, 113-6.

De Gaulle IC. (2009) The pathophysiology of ocular allergy: a review. Contact Lens Anterior Eye 32, 3-15.

Dell SJ, Lowry GM, Northcutt JA et al. (1998) A randomized, double-masked, placebo-controlled parallel study of 0.2% loteprednol etabonate in patients with seasonal allergic conjunctivitis. J Allergy Clin Immunol 102, 251-55.

Deschenes J, Discepola M, & Abelson M. (1999) Comparative evaluation of olopatadine ophthalmic solution (0.1%) versus ketorolac ophthalmic solution (0.5%) using the provocative antigen challenge model. Acta Ophthalmol Scand 77, 47-52.

Efron N, Pritchard N, Brandon K, et al. (2011) A survey of the use of grading scales for contact lens complications in optometric practice. Clin Exp Optom 94, 193-199.

Fauquert JL, Jedrzejczak-Czechowicz M, Rondon C et al. (2017) Conjunctival allergen provocation test: guidelines for daily practice. Allergy 72, 43-54.

Friedlaender MH, Harris J, LaVallee N et al. (2000) Evaluation of the onset and duration of effect of azelastine eye drops (0.05%) versus placebo in patients with allergic conjunctivitis using an allergen challenge model. Ophthalmol 107, 2152-57.

Gomes PJ. (2014) Trends in prevalence and treatment of ocular allergy. Curr Opin Allergy Clin Immunol 14, 451-56.

González-Chomón C, Silva M, Concheiro A et al. (2016) Biomimetic contact lenses eluting olopatadine for allergic conjunctivitis. Acta Biomaterialia 41, 302-11.

Gradman J, & Wolthers OD. (2006) Allergic conjunctivitis in children with asthma, rhinitis and eczema in a secondary outpatient clinic. Ped Allergy Immunol 17, 524-26.

Greiner JV, Mundorf T, Dubiner H et al. (2003). Efficacy and safety of ketotifen fumarate 0.025% in the conjunctival antigen challenge model of ocular allergic conjunctivitis. Am J Ophthalmol 136, 1097-105.

Gupta R, Sheikh A, Strachan DP et al. (2007). Time trends in allergic disorders in the UK. Thorax 62, 91-6.

Hayes VY, Schnider CM, & Veys J. (2003) An evaluation of 1-day disposable contact lens wear in a population of allergy sufferers. Contact Lens Anterior Eye 26, 85-93.

Heinzerling L, Mari A, Bergmann KC et al. (2013) The skin prick test–European standards. Clin Trans Allergy 3, 3.

Ilyas H, Slonim CB, Braswell GR et al. (2004) Long-term safety of loteprednol etabonate 0.2% in the treatment of seasonal and perennial allergic conjunctivitis. Eye Contact Lens 30, 10-3.

Jabs DA, Mudun A, Dunn JP et al. (2000) Episcleritis and scleritis: clinical features and treatment results. Am J Ophthalmol 130, 469-76.

Kabataş N, Doğan AŞ, Kabataş EU et al. (2017) The effect of Demodex infestation on blepharitis and the ocular symptoms. Eye Contact Lens 43, 64-7.

Katelaris CH, Ciprandi G, Missotten L et al. (2002) A comparison of the efficacy and tolerability of olopatadine hydrochloride 0.1% ophthalmic solution and cromolyn sodium 2% ophthalmic solution in seasonal allergic conjunctivitis. Clin Ther 24, 1561-75.

Kubaisi B, Samra KA, Syeda S et al. (2017) Ocular allergy: an updated review. J Allergy Immunol, 1.

Lanier BQ, Finegold I, D'Arienzo P et al. (2004) Clinical efficacy of olopatadine vs epinastine ophthalmic solution in the conjunctival allergen challenge model. Curr Med Res Opin 20, 1227-33.

Leino M, Ennevaara K, Latvala AL et al. (1992) Double-blind group comparative study of 2% nedocromil sodium eye drops with 2% sodium cromoglycate and placebo eye drops in the treatment of seasonal allergic conjunctivitis. Clin Exp Allergy 22, 929-32.

Lemp MA, & Bielory L. (2008) Contact lenses and associated anterior segment disorders: dry eye disease, blepharitis, and allergy. Immunol Allergy Clin North Am 28, 105-17.

Leonardi A, Fregona IA, Gismondi M, et al. (1990) Correlation between conjunctival provocation test (CPT) and systemic allergometric tests in allergic conjunctivitis. Eye 4, 706-711.

Leonardi A. (2005). In-vivo diagnostic measurements of ocular inflammation. Curr Opin Allergy Clin Immunol 5, 464-72.

Leonardi A, Bogacka E, Fauquert JL et al. (2012). Ocular allergy: recognizing and diagnosing hypersensitivity disorders of the ocular surface. Allergy 67, 1327-37.

Leonardi A, Castegnaro A, Valerio AL et al. (2015) Epidemiology of allergic conjunctivitis: clinical appearance and treatment patterns in a population-based study. Curr Opin Allergy Clinical Immunol 15, 482-88.

Leonardi A, Doan S, Fauquert JL et al. (2017) Diagnostic tools in ocular allergy. Allergy, 72, 1485-98.

Montan P, Zetterström O, Eliasson E et al. (1994) Topical sodium cromoglycate (Opticrom®) relieves ongoing symptoms of allergic conjunctivitis within 2 minutes. Allergy 49, 637-40.

Nageswaran S, Woods CR, Benjamin Jr DK et al. (2006) Orbital cellulitis in children. The Ped Infect Dis J 25, 695-99.

Nichols KK, Morris S, Gaddie IB et al. (2009) Epinastine 0.05% ophthalmic solution in contact lens-wearing subjects with a history of allergic conjunctivitis. Eye Contact Lens 35, 26-31.

Nurmatov U, Van Schayck CP, Hurwitz B et al. (2012) House dust mite avoidance measures for perennial allergic rhinitis: an updated Cochrane systematic review. Allergy 67, 158-65.

Ono SJ, & Abelson MB. (2005) Allergic conjunctivitis: update on pathophysiology and prospects for future treatment. J Allergy Clin Immunol 115, 118-22.

Owen CG, Shah A, Henshaw K et al. (2004) Topical treatments for seasonal allergic conjunctivitis: systematic review and meta-analysis of efficacy and effectiveness. Br J Gen Pract 54, 451-56.

Pitt AD, Smith AF, Lindsell L et al. (2004) Economic and quality-of-life impact of seasonal allergic conjunctivitis in Oxfordshire. Ophthal Epidemiol 11, 17-33.

Prince A, Norris MR, & Bielory L. (2018) Seasonal ocular allergy and pollen counts. Curr Opin Allergy Clin Immunol 18, 387-92.

Rietveld RP, van Weert HC, ter Riet G et al. (2003) Diagnostic impact of signs and symptoms in acute infectious conjunctivitis: systematic literature search. Br Med J 327, 789.

Rosario N, & Bielory L. (2011) Epidemiology of allergic conjunctivitis. Curr Opin Allergy Clin Immunol 11, 471-76.

Shaker M, & Salcone E. (2016) An update on ocular allergy. Curr Opin Allergy Clin Immunol 16, 505-10.

Singh K, Axelrod S, & Bielory L. (2010) The epidemiology of ocular and nasal allergy in the United States, 1988-1994. J Allergy Clin Immunol 126, 778-83.

Smith AF, Pitt AD, Rodruiguez AE et al. (2005) The economic and quality of life impact of seasonal allergic conjunctivitis in a Spanish setting. Ophthal Epidemiol 12, 233-42.

Swamy BN, Chilov M, McClellan K et al. (2007) Topical non-steroidal anti-inflammatory drugs in allergic conjunctivitis: meta-analysis of randomized trial data. Ophthal Epidemiol 14, 311-19.

Van Cauwenberge P, Bachert C, Passalacqua G et al. (2000) Consensus statement* on the treatment of allergic rhinitis. Allergy 55, 116-34.

Veys J. (2004) Managing the contact lens wearing allergy sufferer. Optician 5950, 22-6.

Wolffsohn JS, Naroo SA, Gupta N et al. (2011) Prevalence and impact of ocular allergy in the population attending UK optometric practice. Contact Lens Anterior Eye, 34 133-38.

Wolffsohn JS, & Emberlin JC. (2011) Role of contact lenses in relieving ocular allergy. Contact Lens Anterior Eye 34, 169-72.

Wolffsohn JS, Naroo SA, Christie C et al. (2015) Anterior eye health recording. Contact Lens Anterior Eye 38, 266-71.

Xu J, Li X, & Sun F. (2011) In vitro and in vivo evaluation of ketotifen fumarate-loaded silicone hydrogel contact lenses for ocular drug delivery. Drug Delivery 18, 150-58.