

# Serum Immunoglobulin E Levels in Patients with Allergic Conjunctivitis and Contact Lens Wearers

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**Aim:** To determine the differences between total and serum-specific immunoglobulin E levels in patients with type 1 allergic conjunctivitis and asymptomatic contact lens wearers. The correlation of total serum immunoglobulin E level of asymptomatic contact lens wearers with contact lens wearing time, and total duration of contact lens use was also evaluated.

**Methods:** This was a case-control study involving 25 asymptomatic contact lens wearers, 25 patients with type 1 allergic conjunctivitis, and 25 age- and sex-matched healthy controls. Total serum immunoglobulin E levels were detected by enzyme-linked immunosorbent assay. Serum-specific IgE analysis against the listed indoor, food, and outdoor allergens were studied by immunofluorescence assay for participants whose total serum immunoglobulin E levels were >100 IU/mL. Pearson's and Spearman's correlations were used for bivariate analysis. Statistical significance was accepted at the 0.05 level.

**Results:** The mean level of total serum immunoglobulin E was greater for patients with type 1 allergic conjunctivitis than for contact lens wearers and controls. Serum-specific immunoglobulin E detected in patients with type 1 allergic conjunctivitis was against indoor, food, and outdoor allergens, while serum-specific immunoglobulin E detected in contact lens wearers was only against outdoor allergens. A statistically significant correlation was found for total serum immunoglobulin E levels of contact lens wearers with contact lens wearing time.

**Conclusions:** These results suggest that differences in serum total and specific immunoglobulin E levels exist between patients with type 1 allergic conjunctivitis and CL wearers and controls. Further research in a larger group of patients is needed to validate these findings.

**Key words:** Case-control studies, Conjunctivitis, allergic, Contact lenses, Immunoglobulins

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## Introduction

Allergy is considered to be a state of immune dysregulation from T helper 1 (Th1)- and Th2-cell balance, and this state leads to over-production of immunoglobulin (Ig) E, which plays a central role in the pathogenesis of atopic diseases.<sup>1</sup> Allergen-specific IgE production is regarded as the key event, and increase in serum-specific IgE is considered to be an indicator of type 1 hypersensitivity response.<sup>2</sup> Seasonal and perennial allergic conjunctivitis (SAC and PAC) are the only ocular diseases to involve solely type I hypersensitivity.<sup>3</sup>

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The other main forms of allergic conjunctivitis, vernal and atopic keratoconjunctivitis, have a more complex immunological basis and a chronic inflammatory component.<sup>3</sup> Ocular surface changes induced by contact lens (CL) wear and deposit build-up on CL surfaces have been implicated in inducing an ocular hypersensitivity response in relation to CL wear.<sup>4</sup>

The purpose of this study was to determine the differences in total and serum-specific IgE levels in patients with type 1 allergic conjunctivitis, asymptomatic CL wearers, and age- and sex-matched healthy controls. The correlation of total serum IgE level in asymptomatic CL wearers with CL wearing time and total duration of CL use was also evaluated.

## Methods

This was a retrospective case-control study involving 25 asymptomatic CL wearers, 25 patients with type 1 allergic conjunctivitis,

and 25 age- and sex-matched healthy controls. The participants were enrolled according to the principles of the Declaration of Helsinki and ethics committee approval was obtained. Written informed consent was obtained from all patients.

Patients with allergic conjunctivitis had been diagnosed with either SAC or PAC according to their past medical history. They had clinical symptoms of itching, redness, and tearing, and clinical signs of injection of conjunctival vessels and mild to moderate papillary reaction in the palpebral conjunctiva. They had not been receiving any systemic or topical antiallergic treatment and had not previously used CL.

CL wearers had been using conventional hydrogel lenses for a minimum of 6 hours/day for a minimum duration of 6 months. The eyelids of CL wearers were examined for the presence of papillae, and all CL wearers had normal slit-lamp examination findings.

The control participants had no ocular pathologies other than refractive errors. They had 20/20 vision with ametropia of <3 D,

**Table 1. Indoor, food, and outdoor allergens tested for in patients with type 1 allergic conjunctivitis, asymptomatic contact lens wearers, and control participants.**

Indoor and food allergens	Outdoor allergens
Egg white	Populus salix
Egg yolk	Eucalyptus
Cow's milk	Quercus alba
Peanuts	Olea europea
Alternaria	Pinus species
Aspergillus	Salix lasolepis
Candida	Poa pralensis
Cladosporium	Artemissa vulgaris
Penicillium	Festuca elatior
Cat dander	Plantago lanceolata
Dog dander	Phleum pralense
Wheat	Avena sativa
Cockroach	Lolium perenne
Mite plenory	Alnus glutinosa
Mite farienae	Parietarla officinalis

and anisometropia of <1 D. None of the control participants had previously used CL. The control participants were otherwise healthy and were not using any topical or systemic medication.

Total serum IgE levels were detected by using enzyme-linked immunosorbent assay.<sup>5</sup> Serum-specific IgE analysis against indoor, food, and outdoor allergens (Table 1) were studied by using immunofluorescence assay<sup>6</sup> for participants whose total serum IgE levels were >100 IU/mL. Luminescence units (LU) were used to classify the allergen concentrations as undetectable, low, medium, or high according to serum-specific Ig E level.

Statistical analysis was done by using the Statistical Package for the Social Sciences version 15 for Windows (SPSS Inc, Chicago, USA). Pearson's and Spearman's correlations were used for bivariate analysis. Statistical significance was accepted at the 0.05 level.

## Results

Eight (32%) patients had PAC, and 17 (68%) had SAC. CL wearers had been wearing CL for a mean of 10.56 hours/day (SD, 3.39 hours/day; range, 6-24 hours/day), and had been using CL for a mean of 3.32 years (SD, 2.15 years; range, 6 months to 8 years). The demographic characteristics are shown in Table 2.

The mean levels of total serum IgE of patients with type 1 allergic conjunctivitis, CL wearers, and controls were 227.40 IU/mL (SD, 288.60 IU/mL; range, 36-1015 IU/mL), 63.68 IU/mL (SD, 107.09 IU/mL; range, 16-551 IU/mL), and 36.36 IU/mL (SD, 24.98; range, 19-85 IU/mL), respectively. The level of serum-specific IgE detected as LU in patients with type 1 allergic conjunctivitis was high; the most common allergens are shown in Table 3. The level of serum-specific IgE detected as LU in CL wearers was low, and there was no detectable serum-specific IgE in control participants. There was a statistically significant correlation of total serum IgE levels in CL wearers with CL wearing time (Pearson's correlation coefficient = 0.863; Spearman's correlation coefficient = 0.626;

**Table 2. Patients' demographic characteristics and immunoglobulin E levels in patients with type 1 allergic conjunctivitis, asymptomatic contact lens wearers, and control participants.**

	Type 1 allergic conjunctivitis	Contact lens wear	Controls
Number of participants	25	25	25
Sex			
Male	11	9	12
Female	14	16	13
Age (years)			
Mean (SD)	23.88 (6.12)	22.92 (4.76)	21.72 (4.52)
Range	17-40	18-38	18-39
Total serum IgE (IU/mL)			
Mean (SD)	227.40 (288.60)	63.68 (107.09)	36.36 (24.98)
Range	36-1015	16-551	19-85
Specific serum IgE (LU)	High	Low	Undetectable
Allergens	Indoor, food, and outdoor	Outdoor	—

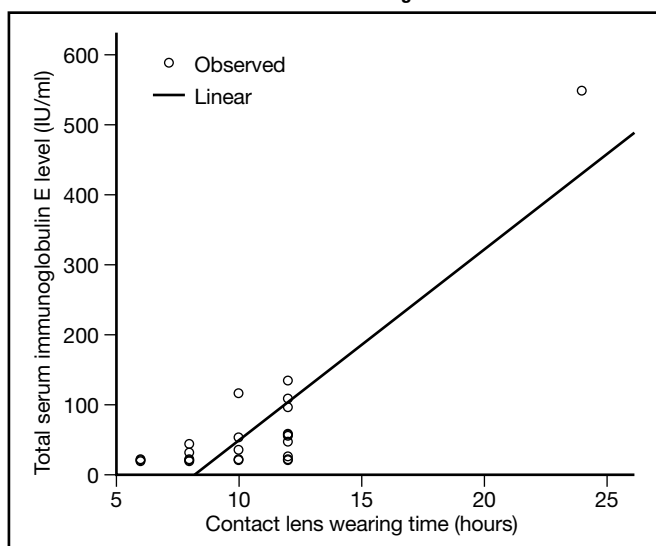
Abbreviations: IgE = immunoglobulin E; LU = luminescence unit.

# Immunoglobulin E in Allergic Conjunctivitis

**Table 3. Indoor, food, and outdoor allergens in patients with type 1 allergic conjunctivitis and asymptomatic contact lens wearers.**

	Indoor and food allergens	Outdoor allergens
Seasonal allergic conjunctivitis		Festuca elatior, Poa pralensis, Pinus, Phleum pralense, Plantago lanceolata, Lolium perenne
Perennial allergic conjunctivitis	Cat and dog dander, Cockroach, Mite plenory, Mite farienae, Aspergillus, Cladosporium, Cow's milk, Wheat	
Asymptomatic contact lens wearers		Artemisia vulgaris, Parietarla officinalis, Poa pralensis, Salix lasolepis, Populus salix, Pinus

**Figure 1. Correlation of total serum immunoglobulin E level of asymptomatic contact lens wearers with contact lens wearing time.**



correlation is significant at the 0.01 level) [Figure 1]. No significant correlation was found between duration of CL use and total serum IgE level (Pearson's correlation coefficient = 0.092; Spearman's correlation coefficient = 0.044; correlation is not significant at the 0.05 level).

## Discussion

SAC and PAC are the most common forms ocular allergic disorders that are primarily IgE-mediated, and share features in common with other atopic conditions.<sup>7</sup> PAC appears to be an extension of SAC in that both conditions show increased TH1/TH2 cytokine ratios, increased expression of adhesion molecules, mast cell activation, and release of mediators, particularly histamine, which appear to play an integral role in the inflammatory process.<sup>8</sup> In contrast, vernal keratoconjunctivitis and atopic keratoconjunctivitis are complex diseases, involving both early- and late-phase allergic responses, and are characterised by severe chronic immune inflammation with T-cell infiltration in the conjunctiva.<sup>9</sup>

In this study, patients with type 1 allergic conjunctivitis, either SAC or PAC, were selected because of their common pathogenesis, which is also shared by the ocular hypersensitivity response to CL wear. Tear IgE is considered to be a product of local synthesis,<sup>10</sup>

and its level has been shown to increase during an acute event of CL-induced papillary conjunctivitis.<sup>10,11</sup> Ocular surface changes induced by CL wear have been classified as subclinical conjunctival inflammation rather than an acute event in healthy asymptomatic CL wearers.<sup>4</sup> Subclinical conjunctival inflammation in healthy asymptomatic CL wearers might increase total and serum-specific IgE levels, rather than locally synthesized tear IgE level. Since healthy CL wearers have normal tarsal conjunctivae without the presence of papillae, they remain asymptomatic despite the elevations in total and serum-specific IgE levels. Decreased mucin production from conjunctival goblet cells and non-goblet epithelial cells might be an important risk factor for development of the symptoms.

This study compared the differences in total and serum-specific IgE levels between patients with type 1 allergic conjunctivitis, including SAC and PAC, and healthy asymptomatic CL wearers. Patients with SAC have been reported to show the highest positivity rate for specific allergens, including grass and tree pollens.<sup>12</sup> Patients with PAC have been shown to have high sensitivity to indoor antigens such as house dust mite.<sup>13</sup> The mean serum IgE level has been shown to be more highly elevated in patients with allergic conjunctivitis than in healthy asymptomatic CL wearers and those with CL-related papillary conjunctivitis.<sup>10</sup> This study showed a greater increase in mean total serum IgE level in patients with type 1 allergic conjunctivitis than in healthy asymptomatic CL wearers and controls. This study also found an increase in serum-specific IgE of patients with SAC against outdoor allergens, including tree and grass pollens such as pinus species, festuca elatior, poa pralensis, phleum pralense, plantago lanceolata, and lolium perene. The increase in serum-specific IgE of patients with PAC was mostly against indoor and food allergens, including cat and dog dander, cockroach, mite plenory, mite farienae, aspergillus, cladosporium, cow's milk, and wheat. The increase in serum specific IgE level for healthy asymptomatic CL wearers was lower than that for patients with SAC and PAC, and was found to be only against outdoor allergens rather than food and indoor allergens. The most common outdoor allergens for healthy asymptomatic CL wearers were similar to those for patients with SAC, and included grass and tree pollens such as artemisia vulgaris, parietarla officinalis, poa pralensis, salix lasolepis, populus salix, and pinus species. Environmental factors

have been suggested to cause ocular surface symptoms such as ocular irritation, discomfort, and dryness in CL wearers.<sup>14</sup> This study also found sensitisation to outdoor allergens in CL wearers. Conjunctival cytological changes by impression cytology have been reported in asymptomatic CL wearers, and the intensity of the cytological changes have been related to the CL wearing time.<sup>15</sup> This study is the first to show a statistically significant correlation between total serum IgE level of healthy asymptomatic CL wearers and daily CL wearing time. However, no significant correlation was found between the duration of CL use and total serum IgE level of healthy CL wearers. CL might trap outdoor allergens at increased concentrations, thus being an inciting factor for elevated serum IgE levels in this group. Unfortunately, this study did not look for allergens trapped on the CL. Frequent removal and cleaning of CL is recommended, and individuals should be tested for total serum IgE level prior to CL wear.

These results suggest that differences in serum total and specific IgE levels exist between patients with type 1 allergic conjunctivitis, including SAC and PAC, and healthy asymptomatic CL wearers. Total serum IgE levels were greater in patients with type 1 allergic conjunctivitis than in healthy asymptomatic CL wearers or control participants. There was a statistically significant linear correlation between total serum IgE levels in healthy CL wearers and daily CL wearing time. However, this study included a relatively small number of patients, and further research in a larger group of patients is needed to validate the findings of this study.

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