

Original Article

Consequences of Seasonal Allergic Conjunctivitis on Ocular Parameters of Anterior and Posterior Segments: An Up-To-Date Imaging Approach

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ABSTRACT

Aims: To investigate consequences of seasonal allergic conjunctivitis (SAC) on the ocular anterior and posterior segment parameters. **Materials and Methods:** Forty healthy participants (mean age: 25.90 ± 5.7 years, 20 females, 20 males) and 40 patients with SAC (mean age: 26.20 ± 5.7 years, 20 females, 20 males) were included in this prospective study. The anterior segment parameters including central corneal thickness (CCT) and anterior chamber depth (ACD) were measured by Scheimpflug imaging system. Axial length (AL) was measured by optical biometry. The posterior segment parameters, including retinal nerve fiber layer (RNFL), subfoveal choroidal thickness, and central macular thickness were measured by optical coherence tomography. **Results:** Similar values of the ACD, AL, RNFL as well as central macular thickness between healthy participants and patients with SAC were revealed. Despite the CCT being thinner in SAC, there was no statistically significant difference between the two groups. On the other hand, SAC was found to be associated with an increase in subfoveal choroidal thickness, the condition of which may be attributed to the inflammatory nature of the disease. **Conclusion:** The present study has managed to demonstrate non-significant alterations in the ocular anterior and posterior segment parameters of patients with SAC. Yet, the increase in subfoveal choroidal thickness may be linked to the accompanying inflammation of both the conjunctiva and other ocular tissues, particularly the choroidal layer.

KEYWORDS: Anterior chamber depth, central corneal thickness, nerve fiber layer, seasonal allergic conjunctivitis, sub-foveal choroidal thickness

INTRODUCTION

Allergic conjunctivitis (AC) refers to a group of ocular allergic reactions: seasonal allergic conjunctivitis (SAC) and perennial AC, which are acute, and vernal keratoconjunctivitis and atopic keratoconjunctivitis, which are chronic.^[1-3] Many studies have investigated the ocular anterior and posterior segment parameters in atopic and vernal keratoconjunctivitis, and allergic rhinoconjunctivitis.^[4-6] We believe this is the first study in which investigation of the ocular anterior and posterior segment parameters in SAC has been performed. Accordingly, we hypothesized that inflammatory processes generated by AC, eye rubbing due to itchiness in SAC, and medical therapy may have consequences on the ocular parameters.

MATERIALS AND METHODS


This study was undertaken on the basis of the control physical examination findings revealed in the last 3 months, that is, between April 2018 and June 2018, of patients with mild AC who were followed-up due to SAC disorder in the Cornea unit at Afyonkarahisar Health Sciences Department of Ophthalmology. Participants were divided into a study group of 40 patients with SAC (40 eyes) and a control group

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of 40 age- and sex-matched healthy participants (40 eyes). Inclusion criteria consisted of absence of a history of any ocular surgery, absence of any systemic diseases such as diabetes mellitus and hypertension, and refractive errors within ± 2 diopters. Conditions associated with structural alteration of anterior and/or posterior segments such as the presence of systemic diseases including diabetes mellitus and hypertension, history of any ocular surgery, regular medications due to any systemic diseases, and refractive errors $> \pm 2$ were among the exclusion criteria. Approval by the local ethic committee and written informed consents from all participants were obtained before the study. The study was conducted according to the tenets of the Declaration of Helsinki.

A thorough ophthalmological examination including the best-corrected visual acuity and slit-lamp biomicroscopic examination, intraocular pressure measurement with the Goldmann applanation tonometry, axial length (AL) measurement with the optical biometry (Axial Length-Scan, Nidek CO, Aichi, Japan) were performed. Central corneal thickness (CCT) and anterior chamber depth (ACD) were measured with Scheimpflug-placido topographer (The Sirius system-Costruzione Strumenti Oftalmici, Florence, Italy). Retinal nerve fiber layer (RNFL), subfoveal choroidal thickness, and central macular thickness were measured by optical coherence tomography (OCT) (Heidelberg Engineering, Heidelberg, Germany). The choroidal thickness was defined as the distance between the hyper scattering line of the retinal pigment epithelial layer and the inner surface of the sclera. All OCT scans were performed by the same operator.

RESULTS

Both groups had respective 40 participants of whom 20 were females and 20 males, and their mean ages were 26.20 ± 5.7 years for the patients with SAC and 25.90 ± 5.7 years for the control group. There were no statistically significant differences in terms of age and gender between the two groups ($P > 0.05$).

Even though the mean CCT was lower in patients with SAC, there was a statistically non-significant difference between the two groups. The ocular anterior and posterior segment parameters are demonstrated in Table 1.

DISCUSSION

The current study investigated whether the ocular anterior and posterior segment parameter values of the inflammatory processes associated with AC, eye rubbing due to itching and SAC treatment differ between the patients in the SAC group and the healthy individuals in the control group. In comparison to the healthy participants, an increase in subfoveal choroidal thickness was revealed in SAC. The authors fervently believe that allergic sensitivity may play an important role in increased choroidal thickness. One study, published by Yenigun *et al.*,^[7] reported a significant association between increased choroidal thickness and allergic rhinitis compared to healthy subjects. Like in allergic rhinitis, the immunological mechanism of AC is characterized by immunoglobulin (Ig)-E mediated mast cell degranulation and/or T-lymphocyte-mediated immune response. Further, diffuse infiltration of the conjunctiva with inflammatory cells, including neutrophils, eosinophils, lymphocytes, and macrophages have been identified in AC histological findings. As mentioned by Cordova *et al.*,^[8] chronic form of AC may lead to ocular surface tissue remodeling. Even so, the inflammatory process of AC and its association to the alteration of choroidal thickness has not been entirely elucidated. On the other hand, both healthy participants and patients with SAC had similar ACD, AL, RNFL and central macular thickness.

Keratoconus is a corneal progressive degenerative disorder associated with the vernal keratoconjunctivitis, atopy, as well as eye rubbing.^[9,10] Relationship between keratoconus and allergic diseases has been explained in previous studies.^[5,11] Yet, this relationship has not been fully established. The eye rubbing due

Table 1: Analysis of the intergroup parameters

	Seasonal allergic conjunctivitis group	Control healthy group	P
Age (year)	25.20 \pm 5.71	25.90 \pm 5.79	0.870
Female:male ratio	20:20	20:20	1.0
Best-corrected visual acuity (LogMAR)	0.00 \pm 0.00	0.00 \pm 0.00	1.0
Axial length (mm)	22.94 \pm 0.98	23.05 \pm 0.84	0.725
Sub-foveal choroidal thickness (μ m)	400.95 \pm 73.80	228.40 \pm 49.65	<0.001
Central macular thickness (μ m)	263.30 \pm 17.20	255.05 \pm 17.20	0.294
Retinal nerve fiber layer (μ m)	98.85 \pm 8.81	97.50 \pm 5.98	0.574
Anterior chamber depth (mm)	2.47 \pm 0.36	3.37 \pm 0.19	0.590
Central corneal thickness (μ m)	533.85 \pm 43.99	530.55 \pm 16.39	0.087
Iridocorneal angle ($^{\circ}$)	44.10 \pm 6.51	43.85 \pm 2.41	0.873

to allergy-related itching has been proposed as one of the main causative factors for keratoconus.^[12,13] McMonnies *et al.*^[14] reported the association between the eye rubbing and the development and progression of keratoconus. Another study mentioned the importance of evaluation of the corneal thickness in provision of clinically useful information on the health status of the cornea.^[15] Likewise, Kaya *et al.*,^[16] reported lower CCT in eyes with keratoconus compared to non-atopic eyes. And, Ondas *et al.*^[6] reported lower CCT in atopic keratoconjunctivitis compared to the control group. In consistent with these results, it has been shown in the present study that eyes with SAC had lower CCT than healthy participants.

The AL has been reported to affect subfoveal choroidal thickness.^[7] However, the present study revealed statistically non-significant change in the AL between patients with SAC and healthy participants. Other studies investigating the inflammatory diseases such as ankylosing spondylitis, psoriasis, Vogt-Koyanagi-Harada and Behçet have also reported the increase in the choroidal thickness due to these diseases.^[17,18] Correspondingly, results of the present study in which SAC as an inflammatory disease in nature was investigated in relation to the ocular anterior and posterior segment parameters, revealed the increase in subfoveal choroidal thickness in patients with SAC, the mechanism of which has been explained by the ocular inflammatory process.

The most effective therapeutic agents in the treatment of SAC and allergic rhinitis are corticosteroids, as they manage all various facets of the allergic symptoms. They do reduce allergic inflammation through changes in circulation and migration of pro-inflammatory cells and by modifying the functions of these cells.^[19-21] As long as topical corticosteroids provide effective relief of a broad range of the signs and symptoms of ocular inflammation, these agents are considered an effective acute treatment option for SAC.^[2,22-26] The topical corticosteroids are commonly associated with ocular adverse effects such as intraocular pressure elevation, induction or exacerbation of glaucoma, formation of cataracts, delayed wound healing as well as increased susceptibility to infection or superinfections.^[27] The mechanism of intraocular pressure elevation-a risk factor for glaucoma development has been proposed to occur through corticosteroid-induced increases in resistance to aqueous outflow in the trabecular meshwork through a variety of mechanisms.^[28,29] Under this circumstance, the RNFL thickness measurement is a favorable method in diagnosis and evaluation of the glaucoma progression. The present study revealed similar results of central

macular thickness and RNFL between the two groups. Accordingly, it has been suggested by the authors that SAC may neither have an effect on central macular thickness nor RNFL. This may be attributed to the acuteness course of the disease. Still, chronic form of AC may bring about alterations in these parameters, for which further studies with long follow-periods and large-study population would yield more accurate results.

The present study possesses some limitations that merit particular discussion. Firstly, the sample size of the participants may be considered small from a perspective of the statistical significance. Notwithstanding this fact, a large-scale study could yield more accurate results. Secondly, as all participants were living just in the same particular region in Turkey, which compared to other hot regions, is rather cold for allergic reaction activations, therefore, there is a limited geographical environment spread enough for higher diversity of patients with SAC. Thirdly, as far as we can tell, this is the first study associated with measurement and investigation of the ocular anterior and posterior segment parameters in patients with SAC. Thus, more importantly, there is an impossibility of comparing our data to those of the other studies. An enhanced version of this study, taking these factors into account, would be of merit. This study, even with the limitations described above, has somehow supported research findings.

In conclusion, the present study has managed to demonstrate that there were no significant alterations in the ocular anterior and posterior segment parameters relative to SAC. However, the increase in subfoveal choroidal thickness in SAC (**34 out of 40 patients**) may be linked to the natural inflammatory course of this disease.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

Ethics approval and consent to participate

The study protocol complied with the ethical principles of the Declaration of Helsinki and received full approval from the institutional review boards of Afyonkarahisar Health Sciences University Ethics Committee (no. 2020/3). The approval date is March 6, 2020.

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Conflicts of interest

The Author(s) declare(s) that there is no conflict of interest.

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