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Analysis of keratometric and optical biometric measurements in patients with allergic conjunctivitis before and after the treatment of topical 0.2 % olopatadine

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Abstract

To determine the optical biometric measurements of patients with allergic conjunctivitis before and after topical 0.2% olopatadine treatment using autokerato-refractometry and optical biometry. In this prospective study, 96 eyes of 48 patients with allergic conjunctivitis were examined. All participants had a detailed ophthalmic examination including best-corrected visual acuity (BCVA), intraocular pressure (IOP), anterior, posterior segment examination using slit-lamp biomicroscopy, autokerato-refractometric, and optical biometry measurements (including spherical and cylindrical values, keratometry, corneal astigmatism with axis, axial length and anterior chamber depth) before and one month after topical 0.2% olopatadine treatment. The mean age of 48 patients (31 women, 17 men) with allergic conjunctivitis was 26.3 ± 16.2 years (6-76). While the pre-treatment autokerato-refractometric measurements showed cylindrical aberration in 79.8% of the patients, this ratio in the post-treatment period was 65.6%. The comparisons of the classification of maximum astigmatism and corneal astigmatism in both visits were statistically significant ($p=0.000$, $p=0.003$ respectively). However, the classification of corneal astigmatism obtained with optical biometry was similar ($p=0.10$). The measurements of maximum astigmatism and keratometry recorded by autokerato-refractometry, and anterior chamber depth showed a significant decrease after the treatment. We determined that the values of cylindrical aberration, keratometry, anterior chamber depth, and the sort of astigmatism may change after the acute phase of allergic conjunctivitis. So, while prescribing spectacles, we should review all these factors.

Keywords: Allergic conjunctivitis, astigmatism, cornea, olopatadine

Introduction

Allergic conjunctivitis is a type 1 hypersensitivity response to allergens such as pollen, sunlight, warm weather, etc. [7]. Patients may have clinical manifestations, including ocular itching, redness, swelling of the eyelids, tearing, mucous secretion, photophobia, and foreign body sensation [6]. These symptoms may be aggravated by the co-existence of infection, trauma, or photosensitization. These patients may have additional pre-existing allergic diseases such as asthma, eczema or a family history of atopy.

In allergic conjunctivitis, the corneal involvement due to inflammatory reactions and mechanic trauma may lead to biomechanical changes in the corneal stroma that results in refractive aberrations [8]. Consequently, allergic conjunctivitis can affect true spectacle prescription.

In the current study, we evaluated the optical biometric measurements of patients with allergic conjunctivitis before and after 0.2% olopatadine treatment using autokerato-refractometry and optical biometry.

Materials and Methods

This prospective and cross-sectional clinical study was conducted according to the tenets of the Helsinki Declaration. Each participant signed the informed consent after the approval of the medical ethics committee for this study. The study was conducted according to the tenets of the Helsinki Declaration and approved the medical ethics committee for this study (2019/7/42)

Patients and measurement protocol

In this study, 218 eyes of 109 patients with allergic conjunctivitis were examined at baseline. However, 48 of them came to the control examination, so only these 48 patients were evaluated in the current study. Patients were diagnosed with allergic conjunctivitis according to clinical signs and ophthalmological

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examination by an experienced ophthalmologist and treated with 0.2% olopatadine topical agent once a day for one month. All patients had a detailed ophthalmic examination including best-corrected visual acuity (BCVA) measured by Snellen chart, intraocular pressure (IOP, mmHg) measured by applanation tonometry, anterior segment and fundus examination using slit-lamp biomicroscopy, axial length, anterior chamber depth, and optical biometric measurements including spherical and cylindrical values, keratometry, corneal astigmatism with axis obtained using autokerato-refractometry (Topcon KR_8100A, Japon) and optical biometry (IOL MASTER, Carl Zeiss Meditec AG, Jena, Germany) before and one month after topical 0.2% olopatadine treatment. The classification of astigmatism has been done according to Duke-Elder [2] and Borish's [3] classification as being with the rule (WTR) astigmatism, against the rule (ATR) astigmatism and oblique astigmatism. WTR astigmatism; if the minus cylinder axis is within 15° of 180°, ATR astigmatism; if the minus cylinder axis is within 15° of 90°, or oblique astigmatism is other than WTR or ATR [4]. A refractive error greater than 0.25 diopter was defined as myopia, hypermetropia, and astigmatism. The patients with keratitis, bacterial conjunctivitis, uveitis, dry eye, history of ocular surgery, and treatment were not included in the study.

Statistical analysis

Statistical analysis was performed using the SPSS software version 22. Kolmogorov-Smirnov test was used to detect normal distribution. The Wilcoxon test was used to compare the measurements before and after topical 0.2 % olopatadine treatment. A p-value of less than 0.05 was considered to represent

a statistically significant result.

Results

The mean age of the patients (31 women, 17 men) was 26.3 ± 16.2 years (6-76). All patients had ocular itching, mucous secretion, photophobia, foreign body sensation, redness, and tearing. Papillary reaction and hyperemia were common in the conjunctival examination. At post-treatment 1 month, the complaints of ocular itching, mucous secretion, photophobia, foreign body sensation, redness, and tearing had completely disappeared.

Before the treatment, 41.5% of the patients had myopic aberration, 58.5% of the patients had hyperopic aberration and 79.8% of the patients had cylindrical aberration. After the treatment, 49% of the eyes had myopic aberration, 51% of the eyes had hyperopic aberration and 65.6% of the eyes had cylindrical aberration.

The sort of the astigmatic power before and after treatment were represented in Tables 1 and 2, respectively. The sort of maximum astigmatism and corneal astigmatism measured by autokerato-refractometry showed significant differences between pre- and post-treatment measurements ($p=0.000$, $p=0.003$ respectively).

The optical biometric measurements measured by autokerato-refractometry and IOL MASTER before and after topical 0.2% olopatadine treatment were summarized in table 3.

The keratometric values measured by autokerato-refractometry and maximum astigmatism values showed significant decreases after the treatment ($p=0.01$, $p<0.001$, respectively). In addition,

Table 1. The classification of baseline astigmatism in patients with allergic conjunctivitis

Measurements (%)	WTR Astigmatism	ATR Astigmatism	Oblique Astigmatism
Maximum Astigmatism*	46.7	22.7	30.7
Corneal Astigmatism**	77.3	1.3	21.3
Corneal Astigmatism***	80.3	2.8	16.9

*Measured by autorefractometry, **Measured by autokerato-refractometry, *** Measured by IOL MASTER, WTR: With the rule, ATR: Against the rule

Table 2. The classification of post-treatment astigmatism in patients with pre-existing allergic conjunctivitis

Measurements (%)	WTR Astigmatism	ATR Astigmatism	Oblique Astigmatism
Maximum Astigmatism*	68.5	10.1	21.3
Corneal Astigmatism**	85.4	4.5	10.1
Corneal Astigmatism***	76.4	6.7	16.9

*Measured by autorefractometry, **Measured by autokerato-refractometry, *** Measured by IOL MASTER, WTR: With the rule, ATR: Against the rule

Table 3. The comparison of the measurements performed by autorefractometry and IOL MASTER

Parameters (mean $\pm$ SD)	Autorefractometry			IOL MASTER		
	Pre-treatment	Post-treatment	P	Pre-treatment	Post-treatment	P
Spheric Aberration (D)	0.04 $\pm$ 1.44	0.05 $\pm$ 1.45	0.08			
Max. Astigmatism (D)	-0.48 $\pm$ 0.42	-0.44 $\pm$ 0.43	0.01			
Corneal Astigmatism (D)	-1.00 $\pm$ 0.66	-0.94 $\pm$ 0.44	0.35	-1.03 $\pm$ 0.55	-1.01 $\pm$ 0.50	0.58
Keratometry (D)	44.05 $\pm$ 1.45	43.89 $\pm$ 1.45	0.000	44.09 $\pm$ 1.45	44.08 $\pm$ 1.48	0.57
Axial Length (mm)				23.02 $\pm$ 0.83	23.01 $\pm$ 0.83	0.14
ACD (mm)				3.39 $\pm$ 0.34	3.37 $\pm$ 0.34	0.000

SD: Standard deviation, ACD: Anterior chamber depth, D: Diopter

anterior chamber depth also showed a significant decrease after the treatment ($p<0001$).

Discussion

Both cornea and conjunctiva might be affected by allergic response [16]. Cells and mediators that occur in ocular allergic inflammation may cause some changes in both cornea and conjunctiva. The interaction of the cornea and conjunctiva can trigger inflammation cascade and tissue damage.

Corneal topography studies have shown that allergic reactions may cause the development of refractive disorders [9,10,11] and keratoconus [2,3,9,10] due to frequent eye rubbing and chronic inflammation [12-14] which lead to biomechanical changes such as thinning and ectasia in the corneal stroma [15].

Previous studies reported that WTR astigmatism was observed more frequently than ATR astigmatism in normal population [17] but the frequency may be altered due to some factors such as eyelid tension change, mechanical trauma, etc. [22-24]. De Smedt et al. reported that cylindric aberration was often seen in children with allergic conjunctivitis [7] and the sort of astigmatism could change with the severity of allergic conjunctivitis [7]. In some studies that used in-vivo confocal microscopy, patients with allergic conjunctivitis showed some damage on the superficial corneal epithelium, basement membrane, and anterior stroma [25]. Meanwhile some studies concluded that allergic reactions deteriorated the corneal structure in patients with keratoconus [2,3,9,10].

In the current study, the most common refractive disorder was astigmatism especially WTR astigmatism as well as the normal population. However, the percentage of cylindrical aberration decreased, the percentage of WTR astigmatism increased and the keratometric values significantly decreased following the treatment of allergic conjunctivitis. These results demonstrated that the mechanical trauma with eye itching and conjunctival and eyelid inflammation may affect the refractive and keratometric measurements and the sort of astigmatism. Besides, this report showed a steepening on the corneal curve in the pre-treatment period, and this steepening decreased after the treatment. Changes in the anterior chamber depth values may be associated with the allergic conjunctivitis-induced corneal curve steepening.

In conclusion, all these changeable keratometric and optical biometric factors in patients with allergic conjunctivitis may improve after anti-allergic treatment. To the best of our knowledge, no report has been documented about keratometric and optical biometric measurements before and after the treatment of allergic conjunctivitis. The clinical relevance of this study is that the ophthalmologists should review all these factors while prescribing spectacles.

Conflict of interests

The authors declare that they have no competing interests.

Financial Disclosure

All authors declare no financial support.

Ethical approval

The study was conducted according to the tenets of the Helsinki Declaration and approved the medical ethics committee for this study (2019/7/42)

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