

Letter to the Editor

Corneal biomechanical properties in patients with Graves' Disease

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Editor,

In Graves' disease (GD), various organ systems are affected. Apart from well-known general symptoms, including nervousness, palpitations, sweating, heat intolerance, weight loss, fatigability, dyspnoea, fatigue, oligomenorrhoea, increased appetite and diarrhoea, there are also ocular manifestations related to Graves' orbitopathy such as exposition keratopathy, diplopia and compressive optic neuropathy (Menconi et al. 2014). On the other hand, there is evidence that hormonal disorders can affect corneal biomechanical properties (Gatziofias et al. 2014; Ozkok et al. 2014). In this study, we aimed to investigate the effect of thyroid status on central corneal thickness (CCT) and corneal biomechanics in patients with GD.

This prospective observational study included patients with newly diagnosed GD without prior treatment. Exclusion criteria were as follows: Graves ophthalmopathy > Class 2 according to NOSPECS classification, the existence of underlying corneal disease, age < 18 years, previous ocular surgery, history of severe ocular pathology or inflammation and previous antiglaucomatous or other eye drop treatment. A group of healthy subjects (same exclusion criteria as described above) was recruited and served as control group.

Ophthalmological examination included visual acuity, corneal pachymetry by Pentacam, (OCULUS Optikgerate GmbH, Wetzlar, Germany), measurement of corneal hysteresis (CH), corneal resistance factor (CRF), IOPcc (corneal-compensated intraocular pressure [IOP]) and IOPg (Goldmann-correlated IOP) by Ocular Response Analyser (ORA, Reichert Ophthalmic Instruments, Depew, New York, USA), Goldmann applanation tonometry (GAT), slit-lamp biomicroscopy, fundoscopy, Hertel exophthalmometry, automated visual field testing and orthoptic examination. For all ORA measurements, the waveform score was >7. All non-contact corneal measurements were made before any contact measurements. All patients were examined by the same physician.

All parameters used in the study were expressed as the mean \pm standard deviation (SD). Normality of the data was tested with the Kolmogorov-Smirnov test, and comparison of quantitative characteristics was performed using the Student's *t*-test. Furthermore, Pearson's correlation coefficient was used to analyse potential statistical associations. *p* values below 0.05 were considered statistically significant. Statistical analysis was performed using MEDCALC ver.10.2 (MedCalc®, Ostend, Belgium).

Forty-nine eyes of 49 patients were included in the study (GD group, *n* = 24 eyes of 24 patients, control group, *n* = 25 eyes of 25 patients). The mean age was 41.96 \pm 8.16 years for the patients in GD group and 41.44 \pm 6.56 years for the control group (*p* = 0.81). Female/male distribution was not different between the two groups (21/03 in GD group and 20/05 in control group (McNemar test, *p* = 0.69). Demographical characteristics of both groups are summarized in Table 1.

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The mean CCT was 549.58 \pm 36.44 μ m in the GD group and 536.12 \pm 42.47 μ m in the control group. No significant difference was observed (*p* = 0.24) between the two groups.

Mean CRF was 10.97 \pm 1.94 mmHg in the GD group and 8.91 \pm 1.80 mmHg in the control group. Significant difference was observed (*p* = 0.0003) between the two groups.

Mean CH was 10.77 \pm 1.88 mmHg in the GD group and 7.79 \pm 2.33 mmHg in the control group. Significant difference was observed (*p* < 0.0001) between the two groups.

Regarding the IOP values (IOPcc, IOPg, IOP GAT), significant difference was observed between study and control group (all *p* < 0.05). The detailed profile of CH, CRF, CCT, IOPcc, IOPg, and IOP GAT in both groups is depicted in Table 1.

In the GD group, positive and significant correlations were observed between CRF and CCT (*r* = +0.438, *p* = 0.032) and between CH and CCT (*r* = +0.486, *p* = 0.016).

The principal finding of this study is that patients with GD present significantly higher values of CH and CRF than healthy subjects. Recently, Ozkok et al. (2014) have showed that CH and CRF are higher in acromegalic patients than in healthy subjects. Our group has reported that treatment with thyroxine supplementation may improve corneal biomechanics in patients with GD (Gatziofias et al. 2014). On the other hand, no significant differences in CCT values were observed between GD and control group. This finding is in agreement with a previous report (Konuk et al. 2008). Similarly, significant

Table 1. Demographical data, characteristics and detailed status of corneal biomechanical properties and CCT of the GD and control group.

	Graves' disease group	Control group	<i>p</i>
MPatients/Eyes			
No. of patients	24	25	
No. of eyes	24	25	
Gender	21 ♀, 3 ♂	20 ♀, 5 ♂	0.69
Age (mean \pm SD)	41.96 \pm 8.16	41.44 \pm 6.56	0.81
Race	All Caucasian	All Caucasian	
CCT (μ m)	549.58 \pm 36.44	536.12 \pm 42.47	0.24
CRF (mmHg)	10.97 \pm 1.94	8.91 \pm 1.80	0.0003
CH (mmHg)	10.77 \pm 1.88	7.79 \pm 2.33	<0.0001
IOPcc (mmHg)	16.3 \pm 1.7	15.0 \pm 2.1	0.0216
IOPg (mmHg)	15.7 \pm 1.6	14.4 \pm 2.1	0.019
IOP GAT (mmHg)	15.1 \pm 1.7	13.8 \pm 2.2	0.0255

positive correlation between CH and CRF values and CCT was reported in acromegalic patients (Ozkok et al. 2014).

GD-associated ophthalmopathy is an inflammatory disease of the orbital tissues. The effects of inflammation, mediated through cytokine release, include proliferation of fibroblasts, increased deposition of extracellular matrix, and adipocyte differentiation and proliferation in the orbital space (Hatton & Rubin 2002). We assume that oedema, enlargement of the extraocular muscles and increased volume of the orbital soft tissues may account for the modified biomechanical behaviour of the globe, as reflected by the corneal biomechanics.

To our knowledge, this is the first study to evaluate the corneal biomechanics in patients with GD. We report higher CH and CRF values

in cases with GD without CCT changes. These modifications may also have an impact on the measurement of IOP in patients with GD. Therefore, ophthalmologists should be aware of the corneal biomechanical variations in these patients.

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