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Original Research Article

A Retrospective Assessment of Ocular Anterior Segment and Corneal Parameters in Individuals with Celiac Disease

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Abstract

Aim: To assess ocular anterior segment and corneal parameters in individuals with celiac disease.

Materials and Methods: This study was conducted in the department of Ophthalmology, Patna medical college and hospital, Patna, Bihar, India for 7 months. Adult subjects with a diagnosis of celiac disease, consecutively evaluated and a control group of healthy subjects chosen among spouses of patients and hospital staff were enrolled in this retrospective study. Diagnosis of celiac disease was confirmed by intestinal biopsy and serology, regardless of the time of diagnosis. Since the diagnosis, all celiac patients were under treatment with a gluten-free diet. Concerning control subjects, they had at least one negative specific serology for celiac disease and no diagnosis of any gastrointestinal diseases.

Results: Seventy patients with celiac disease and 70 healthy subjects were included, while three celiac patients with anterior segment disease (two patients with Fuchs disease and one with pterygium) and another who underwent refractive surgery were excluded. The mean disease duration of the celiac patients was 9.3 ± 8.5 years (range: 0–41 years). The demographic characteristics of the two groups, no statistically significant differences for gender, age and AL between the two groups. Concerning slit-lamp examination, no clinical signs of corneal damage were found in the included celiac patients. Regarding all analyzed tomographic parameters, no statistically significant differences were found between the two studied groups. The same results were obtained by comparing males and females between the two groups.

Conclusion: In conclusion, the ocular anterior segment parameters of celiac patients are not significantly different from those of healthy subjects, suggesting none of the underlying pathogenetic implications of this disease affects the assessed structures. Nevertheless, due to the association between celiac disease and other ocular disorders, such as cataract, uveitis, dry eye, neuro-ophthalmic manifestations, night blindness, occlusion of the central retinal vein, and orbitopathy associated with thyroid, a routine ophthalmological examination for all celiac patients should be recommended throughout their lifetimes.

Keywords: Ocular anterior segment, Corneal parameters, Celiac disease

Introduction

Celiac disease (CD) is a chronic autoimmune disorder primarily affecting the small intestine in genetically predisposed individuals upon the ingestion of gluten. It is characterized by a wide array of gastrointestinal and extra-intestinal manifestations, leading to a significant impact on various organ systems, including the eyes. The ocular manifestations of CD have gained increasing attention in recent years, with studies suggesting potential alterations in the anterior segment and corneal parameters among patients with celiac disease. [1-4] The anterior segment of the eye includes structures such as the cornea, iris, ciliary body, and lens, which play crucial roles in maintaining visual acuity and ocular health. The cornea, being the transparent front part of the eye, is particularly vital for refracting light and contributing to the overall optical power of the eye. Any alterations in the corneal parameters, such as thickness, curvature, or biomechanical properties, can significantly affect visual function and may be indicative of underlying systemic diseases .

Research indicates that autoimmune diseases, such as celiac disease, can lead to various ocular manifestations. For instance, CD has been associated with dry eye syndrome, uveitis, and retinal vasculitis. [5-11] However, the impact of CD on the anterior segment and corneal parameters remains an area of active investigation. The autoimmune nature of CD suggests that inflammatory processes could potentially affect the cornea and other anterior segment structures, leading to detectable changes in their parameters. Several studies have explored the relationship between CD and changes in corneal parameters. The evaluation of anterior segment and corneal parameters in patients with CD typically involves advanced diagnostic tools such as optical coherence tomography (OCT), corneal topography, and pachymetry. These non-invasive imaging techniques provide detailed insights into the structural and functional aspects of the cornea and anterior segment, allowing for the early detection of abnormalities and the monitoring of disease progression. Understanding the ocular manifestations of celiac disease is essential for comprehensive patient care. Early identification of changes in the anterior segment and corneal parameters can facilitate timely intervention and prevent potential complications. Furthermore, regular ophthalmic examinations should be considered for patients with CD to monitor for any ocular changes and ensure optimal visual health. [12-16]

Materials and Methods

This study was conducted in the department of Ophthalmology, Patna medical college and hospital, Patna, Bihar, India for 7 months. Adult subjects with a diagnosis of celiac disease, consecutively evaluated and a control group of healthy subjects chosen among spouses of patients and hospital staff were enrolled in retrospective study.

Diagnosis of celiac disease was confirmed by intestinal biopsy and serology, regardless of the time of diagnosis. Since the diagnosis, all celiac patients were under treatment with a gluten-free diet. Concerning control subjects, they had at least one negative specific serology for celiac disease and no diagnosis of any gastrointestinal diseases.

Subjects younger than 18 years of age or with systemic and ocular diseases, or patients who underwent other ophthalmic surgical procedures which could affect the anterior ocular segment were excluded from this study.

Methodology

According to the Declaration of Helsinki's ethical principles, all participants were informed about the study's purpose, and a written informed consent was acquired. A comprehensive ophthalmological evaluation, including clinical history, slit-lamp examination, Snellen best-corrected visual acuity, axial length (AL) measurements. During the tomographic exam, all participants were asked to sit in front of the device, with chin and forehead resting on the appropriate supports, to keep both eyes open and to fixate on a blinking fixation target in the camera's center. The operator visualized the image of the patient's eye on a computer screen and focused it by moving the joystick of the instrument. As soon as the image was perfectly aligned, the scan automatically started, while the participant was asked not to move and to keep eyes open.

Statistical Analysis

All data were analyzed with SPSS version 20. P values less than 0.05 were considered statistically significant.

Results

Seventy patients with celiac disease and 70 healthy subjects were included, while three celiac patients with anterior segment disease (two patients with Fuchs disease and one with pterygium) and another who underwent refractive surgery were excluded. The mean disease duration of the celiac patients was 9.3 ± 8.5 years (range: 0–41 years). The demographic characteristics of the two groups are summarized in Tables Tables1,1, ,2,2, ,3,3, showing no statistically significant differences for gender, age and AL between the two groups.

Table 1: Demographic characteristics of the two study groups.

	Celiac patients		Healthy Controls		P-value
	Mean ± SD (Range)	Median (IQ range)	Mean ± SD (Range)	Median (IQ Range)	
Patients (number)	70	–	70	–	–
Eye (number)	70	–	70	–	–
Gender (M/F)	19/51	–	25/45	–	0.36[a]
Age (years)	40.2 ± 11.4 (18.0–66.0)	41.5 (30.8–48.3)	39.8 ± 14.0 (23.0–69.0)	36.0 (26.0–53.0)	0.75[b]
AL (mm)	23.62 ± 0.96 (21.70–26.12)	23.53 (22.85–24.23)	23.84 ± 1.05 (20.82–26.11)	23.76 (23.26–24.51)	0.21[c]
Astigmatism (D)	−0.90 ± 0.70 (−3.4 to 0.5)	−0.8 (−1.4 to −0.5)	−0.90 ± 0.70 (−3.1 to 1.1)	−0.9 (−1.4 to −0.6)	0.77[b]

Astigmatism type (WTR/ATR/OBL)	58/4/8	–	58/5/7	–	0.99[a]
Age disease (years)	9.3 ± 8.5 (0–41)	7.5 (2.8–15.0)	–	–	–

A Chi-square test with Yates correction. B Mann Whitney U test. C Student t-test unpaired.SD: Standard Deviation; IQ: interquartile; AL: Axial Length; D: Diopter; WTR: With-the-Rule; ATR: Against-the-Rule; OBL: Oblique.

Table 2: Demographic characteristics of the two male groups.

Celiac males		**Healthy males**		**P-value**	
Mean ± SD (Range)	**Median (IQ range)**	**Mean ± SD (Range)**	**Median (IQ Range)**		
Patients (number)	19	–	25	–	–
Eye (number)	19	–	25	–	–
Age (years)	42.1 ± 13.5 (18.0–66.0)	44.0 (34.0–51.0)	45.7 ± 12.8 (25.0–63.0)	50.0 (30.0–56.5)	0.18[b]
AL (mm)	23.64 ± 0.76 (22.42–24.85)	23.74 (22.83–24.24)	23.97 ± 0.95 (22.42–26.11)	23.83 (23.43–24.42)	0.22[c]
Astigmatism (D)	−0.90 ± 1.00 (−3.4 to 0.5)	−0.6 (−1.4 to −0.2)	−0.72 ± 0.78 (−2.2 to 1.0)	−0.9 (−1.3 to −0.1)	0.52[c]
Astigmatism type (WTR/ATR/OBL)	12/4/3	–	17/3/5	–	0.98[a]

Table 3: Demographic characteristics of the two female groups.

Celiac females		**Healthy females**		**P-value**	
Mean ± SD (Range)	**Median (IQ range)**	**Mean ± SD (Range)**	**Median (IQ Range)**		
Patients (number)	51	–	45	–	–
Eye (number)	51	–	45	–	–
Age (years)	39.5 ± 10.6 (21.0–58.0)	39.0 (30.0–48.0)	36.5 ± 13.6 (23.0–69.0)	32.0 (25.0–48.5)	0.08[b]
AL (mm)	23.61 ± 1.04 (21.70–26.12)	23.49 (22.86–24.23)	23.76 ± 1.11 (20.82–25.77)	23.72 (23.13–24.67)	0.50[c]
Astigmatism (D)	−0.96 ± 0.57 (−2.9 to 0.4)	−0.8 (−1.4 to −0.6)	−1.01 ± 0.72 (−3.1 to 1.1)	−1.0 (−1.5 to −0.6)	0.60[b]
Astigmatism type (WTR/ATR/OBL)	46/0/5	–	41/2/2	–	0.57[a]

Concerning slit-lamp examination, no clinical signs of corneal damage were found in the included celiac patients. Regarding all analyzed tomographic parameters, no statistically significant differences were found between the two studied groups, as summarized in Table 4. The same results were obtained by comparing males and females between the two groups, as shown in Tables 5,6.

Table 4: Tomographic parameters assessed in the two study groups.

	Celiac patients		**Healthy controls**		**P-value**
	Mean ± SD (Range)	**Median (IQ Range)**	**Mean ± SD (Range)**	**Median (IQ Range)**	
K_1 front (D)	43.1 ± 1.3 (40.0–47.0)	43.0 (42.4–43.6)	43.3 ± 1.5 (40.8–47.5)	43.2 (42.1–44.2)	0.56[a]
K_2 front (D)	44.1 ± 1.4 (40.7–48.2)	43.9 (43.2–44.8)	44.3 ± 1.5 (41.3–48.8)	44.3 (43.1–45.2)	0.33[a]
K_{mean} front (D)	43.6 ± 1.3 (40.4–47.4)	43.6 (42.8–44.3)	43.8 ± 1.5 (41.1–48.2)	43.9 (42.5–44.7)	0.39[a]
K_{max} (D)	44.7 ± 1.5 (41.1–48.7)	44.3 (43.7–45.6)	44.8 ± 1.5 (41.7–49.1)	44.9 (43.7–45.8)	0.40[a]
K_1 back (D)	−6.1 ± 0.2 (−6.7 to −5.6)	−6.1 (−6.3 to −6.0)	−6.2 ± 0.3 (−7.0 to −5.6)	−6.2 (−6.3 to −6.0)	0.82[a]
K_2 back (D)	−6.5 ± 0.2	−6.4	−6.5 ± 0.3	−6.5	0.92[a]

	(−7.2 to −5.9)	(−6.6 to −6.3)	(−7.3 to −5.9)	(−6.6 to −6.2)	
Q-value front	−0.32 ± 0.11 (−0.62 to −0.02)	−0.31 (−0.38 to −0.25)	−0.32 ± 0.14 (−0.73 to −0.07)	−0.31 (−0.39 to −0.23)	0.94[b]
Q-value back	−0.36 ± 0.14 (−0.83 to −0.10)	−0.36 (−0.43 to −0.26)	−0.35 ± 0.14 (−0.64 to −0.09)	−0.34 (−0.46 to −0.22)	0.55[b]
PD (mm)	3.04 ± 0.54 (2.05–4.49)	3.01 (2.69–3.32)	3.09 ± 0.54 (2.26–4.58)	3.02 (2.71–3.48)	0.72[a]
PC (µm)	542.2 ± 32.9 (475.0–643.0)	536.0 (520.3–560.3)	538.7 ± 32.1 (434.0–603.0)	541.5 (514.0–561.3)	0.77[a]
CA (µm)	543.2 ± 32.3 (477.0–645.0)	537.5 (522.8–560.3)	539.8 ± 32.4 (438.0–614.0)	541.0 (514.0–563.5)	0.53[b]
TP (µm)	537.2 ± 32.7 (471.0–642.0)	532.5 (514.8–557.0)	533.0 ± 32.1 (432.0–603.0)	537.0 (507.0–557.0)	0.54[b]
CV (mm^3)	60.6 ± 3.2 (53.8–67.9)	60.4 (58.6–62.5)	60.3 ± 4.4 (50.2–69.7)	59.6 (57.5–63.1)	0.72[c]
ACD_{epi} (mm)	3.40 ± 0.34 (2.48–4.08)	3.42 (3.17–3.62)	3.49 ± 0.37 (2.62–4.27)	3.51 (3.20–3.76)	0.15[b]
ACD_{endo} (mm)	2.86 ± 0.34 (1.97–3.51)	2.86 (2.63–3.08)	2.95 ± 0.37 (2.00–3.76)	2.94 (2.68–3.24)	0.14[b]
ACV (mm^3)	160.7 ± 35.4 (84.0–240.0)	160.0 (134.8–186.3)	168.4 ± 40.4 (82.0–249.0)	166.0 (132.8–193.3)	0.24[b]
ICA (degrees)	35.0 ± 5.8 (21.6–48.6)	35.0 (31.5–39.5)	35.6 ± 5.9 (21.3–48.0)	36.1 (31.2–39.6)	0.51[b]

A Mann Whitney U test. b Student t-test unpaired.

SD: Standard Deviation; IQ: Interquartile; D: Diopter; PD: Pupil Diameter; PC: Pupil Center; CA: Corneal Apex; TP: Thinnest Point; CV: Corneal Volume; ACDepi: Anterior Chamber Depth from epithelium; ACDendo: Anterior Chamber Depth from endothelium; ACV: Anterior Chamber Volume; ICA: Iridocorneal Angle

Table 5-Tomographic parameters assessed in the two male groups

	Celiac males		**Healthy males**		**P-value**
	Mean ± SD (Range)	**Median (IQ Range)**	**Mean ± SD (Range)**	**Median (IQ Range)**	
K_1 front (D)	43.1 ± 1.3 (41.3–46.5)	42.8 (42.3–43.5)	43.4 ± 1.7 (40.9–47.5)	43.5 (42.0–44.2)	0.56[a]
K_2 front (D)	44.1 ± 1.4 (41.8–47.9)	43.8 (43.0–45.3)	44.3 ± 1.7 (41.3–48.8)	44.3 (42.9–45.0)	0.71[a]
K_{mean} front (D)	43.6 ± 1.3 (41.7–47.2)	43.4 (42.6–44.5)	43.9 ± 1.7 (41.1–48.2)	43.9 (42.6–44.5)	0.62[a]
K_{max} (D)	44.7 ± 1.4 (43.0–48.4)	44.4 (43.4–45.9)	45.0 ± 1.6 (42.6–49.1)	44.9 (43.9–45.6)	0.60[a]
K_1 back (D)	−6.1 ± 0.2 (−6.7 to −5.8)	−6.1 (−6.2 to −6.0)	−6.2 ± 0.3 (−7.0 to −5.6)	−6.2 (−6.4 to −5.9)	0.65[a]
K_2 back (D)	−6.5 ± 0.2 (−7.1 to −6.2)	−6.5 (−6.6 to −6.3)	−6.5 ± 0.4 (−7.3 to −5.9)	−6.4 (−6.7 to −6.2)	0.99[a]
Q-value front	−0.33 ± 0.14 (−0.52 to −0.02)	−0.32 (−0.46 to −0.23)	−0.31 ± 0.18 (−0.73 to −0.09)	−0.26 (−0.43 to −0.18)	0.80[a]
Q-value back	−0.41 ± 0.18 (−0.83 to −0.12)	−0.37 (−0.49 to −0.30)	−0.36 ± 0.16 (−0.64 to −0.09)	−0.31 (−0.52 to −0.22)	0.32[b]
PD (mm)	2.86 ± 0.68 (2.05–4.49)	2.70 (2.47–3.19)	2.93 ± 0.53 (2.26–4.47)	2.73 (2.53–3.34)	0.39[b]
PC (µm)	540.1 ± 30.9 (475.0–598.0)	540.0 (524.0–555.0)	540.5 ± 35.4 (434.0–589.0)	545.0 (516.0–566.5)	0.97[a]
CA (µm)	541.9 ± 30.5 (477.0–601.0)	542.0 (528.0–556.0)	541.8 ± 35.2 (438.0–588.0)	548.0 (515.5–567.0)	0.99[a]
TP (µm)	534.1 ± 30.6 (471.0–593.0)	534.0 (514.0–553.0)	535.1 ± 35.0 (432.0–582.0)	539.0 (506.5–560.0)	0.92[a]

CV (mm^3)	60.2 ± 2.9 (53.8–64.4)	60.3 (58.7–62.4)	60.6 ± 4.9 (50.5–69.7)	59.5 (58.0–64.8)	0.73[a]
ACD_{epi} (mm)	3.45 ± 0.41 (2.72–4.08)	3.47 (3.12–3.92)	3.47 ± 0.42 (2.67–4.27)	3.42 (3.16–3.82)	0.91[a]
ACD_{endo} (mm)	2.91 ± 0.41 (2.22–3.51)	2.95 (2.58–3.39)	2.93 ± 0.42 (2.16–3.76)	2.90 (2.61–3.30)	0.92[a]
ACV (mm^3)	163.5 ± 41.5 (106.0–240.0)	160.0 (132.0–187.0)	168.5 ± 44.4 (92.0–246.0)	170.0 (126.5–206.0)	0.70[a]
ICA (degrees)	34.5 ± 6.1 (21.7–42.8)	35.2 (29.6–39.6)	34.7 ± 6.5 (22.2–47.6)	35.1 (30.2–39.0)	0.91[a]

SD: Standard Deviation; IQ: Interquartile; D: Diopter; PD: Pupil Diameter; PC: Pupil Centre; CA: Corneal Apex; TP: Thinnest Point; CV: Corneal Volume; ACD_{epi}: Anterior Chamber Depth from epithelium; ACD_{endo}: Anterior Chamber Depth from endothelium; ACV: Anterior Chamber Volume; ICA: Iridocorneal Angle.

Table 6-Tomographic parameters in two female groups.

	Celiac females		**Healthy females**		**P-value**
	Mean ± SD (Range)	**Median (IQ Range)**	**Mean ± SD (Range)**	**Median (IQ Range)**	
K_1 front (D)	43.2 ± 1.3 (40.0–47.0)	43.0 (42.5–43.8)	43.2 ± 1.4 (40.8–45.8)	43.0 (42.1–44.4)	0.83[a]
K_2 front (D)	44.1 ± 1.5 (40.7–48.4)	43.9 (43.2–44.8)	44.3 ± 1.4 (41.4–46.6)	44.4 (43.2–45.3)	0.63[b]
K_{mean} front (D)	43.7 ± 1.4 (40.4–47.4)	43.6 (42.9–44.3)	43.8 ± 1.4 (41.2–46.2)	43.9 (42.5–44.8)	0.47[a]
K_{max} (D)	44.7 ± 1.5 (41.1–48.7)	44.3 (43.7–45.6)	44.8 ± 1.4 (41.7–46.9)	44.9 (43.7–45.8)	0.77[b]
K_1 back (D)	−6.1 ± 0.2 (−6.7 to −5.6)	−6.1 (−6.3 to −6.0)	−6.2 ± 0.3 (−6.7 to −5.7)	−6.1 (−6.3 to −6.0)	0.91[a]
K_2 back (D)	−6.5 ± 0.3 (−7.2 to −5.9)	−6.4 (−6.6 to −6.3)	−6.5 ± 0.3 (−6.9 to −5.9)	−6.5 (−6.6 to −6.2)	0.77[a]
Q-value front	−0.32 ± 0.11 (−0.62 to −0.06)	−0.30 (−0.38 to −0.25)	−0.32 ± 0.11 (−0.63 to −0.07)	−0.32 (−0.39 to −0.25)	0.71[b]
Q-value back	−0.34 ± 0.12 (−0.67 to −0.10)	−0.33 (−0.42 to −0.25)	−0.34 ± 0.13 (−0.64 to −0.11)	−0.34 (−0.45 to −0.22)	0.93[b]
PD (mm)	3.11 ± 0.47 (2.11–4.43)	3.13 (2.79–3.33)	3.18 ± 0.53 (2.26–4.58)	3.10 (2.79–3.51)	0.53[b]
PC (μm)	543.0 ± 33.9 (477.0–643.0)	536.0 (518.0–562.0)	537.7 ± 30.4 (469.0–603.0)	538.0 (514.0–559.5)	0.52[a]
CA (μm)	543.7 ± 33.3 (477.0–645.0)	537.0 (521.0–561.0)	538.6 ± 31.2 (472.0–614.0)	537.0 (514.0–560.5)	0.50[a]
TP (μm)	538.3 ± 33.6 (474.0–642.0)	532.0 (515.0–557.0)	533.0 ± 30.7 (466.0–603.0)	536.0 (509.0–553.5)	0.55[a]
CV (mm^3)	60.7 ± 3.4 (54.0–67.9)	60.5 (58.1–63.8)	60.2 ± 4.2 (50.2–69.2)	59.7 (57.2–62.9)	0.49[b]
ACD_{epi} (mm)	3.38 ± 0.32 (2.48–4.06)	3.34 (3.22–3.62)	3.50 ± 0.34 (2.62–4.12)	3.52 (3.21–3.74)	0.09[b]
ACD_{endo} (mm)	2.84 ± 0.31 (1.97–3.44)	2.79 (2.67–3.06)	2.96 ± 0.35 (2.00–3.64)	3.00 (2.72–3.19)	0.07[b]
ACV (mm^3)	159.7 ± 33.3 (84.0–240.0)	160.0 (135.0–186.0)	168.3 ± 38.5 (82.0–249.0)	161.0 (141.5–188.5)	0.24[b]
ICA (degrees)	35.1 ± 5.8 (21.6–48.6)	34.9 (31.9–39.5)	36.1 ± 5.6 (21.3–48.0)	36.5 (32.7–40.5)	0.41[b]

[a]Mann Whitney U test.
[b]Student t-test unpaired.

SD: Standard Deviation; IQ: Interquartile; D: Diopter; PD: Pupil Diameter; PC: Pupil Centre; CA: Corneal Apex; TP: Thinnest Point; CV: Corneal Volume; ACD_{epi}: Anterior Chamber Depth from epithelium; ACD_{endo}: Anterior Chamber Depth from endothelium; ACV: Anterior Chamber Volume; ICA: Iridocorneal Angle.

Discussion

Celiac disease is a systemically involved autoimmune condition that primarily affects the small intestine but could also exhibit multiple extraintestinal symptoms. Among these, the eye definitely represents one of the disease's target organs, and cataract, uveitis, dry eye, neuro-ophthalmic manifestations, night blindness, occlusion of the central retinal vein, and orbitopathy associated with thyroid can occur. [16]

The present study is the largest one comparing the ocular anterior segment of celiac patients to a control healthy group, with the purpose to point out potential differences that could be explained by the underlying pathogenetic mechanisms of the celiac disease. However, no statistically significant differences were found in this study for any of the parameters tomographically assessed. The results of the present study are in contrast with that ones provided by two previous studies published in the literature. [9,10] Karatepe Hashas et al. [9] utilized the Pentacam system to appraise 31 celiac children and 34 controls (62 eyes and 68 eyes, respectively), revealing ACD and ACV of celiac patients to be significantly smaller than control subjects. The authors tried to explain these findings with the auto-antibodies affinity to trabecular network, suggesting further pathophysiological studies to verify their hypothesis. Inversely, Hazar et al. [10] using the Sirius system to evaluate 31 adult celiac patients and 25 healthy controls (58 eyes and 50 eyes, respectively), found ACD and iridocorneal angle of celiac patients to be significantly larger than healthy subjects, while no significant difference for ACV was found. Even in this case, the authors tried to explain their results with the autoantibodies affinity to anterior segment structures, as they also found a positive correlation between ACV and anti-gliadin IgA. Furthermore, they also hypothesized that their findings could be due to the autoantibodies or circulating immune complexes deposition in the eye tissue, suggesting to perform further long-term follow-up studies. Several explanations could be adduced to try to clarify the differences between these two studies and with the present one. [9,10] First of all, the present study has been carried out on a larger sample size, which was determined with the power calculation evaluation. [15] For this reason, previous studies [9,10] may have provided statistically significant results, conflicting with each other, due to a not large and significant enough sample size. Moreover, the present study examined only one eye for each participant, while both the previous studies [9,10] assessed both eyes in some patients and in some others only one eye. This could create a potential statistical bias which could alter the results, as discussed by McAlinden et al. [17,18] Besides, the present study evaluated two different ACD measurements; ACDepi, which is the ACD measured from the corneal epithelium, and ACDendo, that is the ACD measured from the corneal endothelium. However, no statistically significant difference was found in the present study between the two study groups for these parameters, while the previous studies [9,10] showed a contrasting statistically significant difference without specifying which ACD was evaluated. Another difference with the previously published studies could be the difference in the age of the appraised groups. In fact, Karatepe Hashas et al. [9] and Hazar et al. [10] evaluated participants with a mean age of approximately 30 and 10 years respectively younger than those of this study. Ocular anterior segment structures have been shown to change with age19–21, but in our opinion this should not explain the differences, both because celiac and control groups were in the same age range, and because potential differences should be related to the progression of the disease, and not be present in the early stages of life. Finally, Hazar et al. [10] utilized a different Scheimpflug device (Sirius) in their study. It has been proven that Scheimpflug devices utilize slightly different measurement algorithms [22,23] and maybe this could account for the differences between the two studies.

Conclusion

In conclusion, the ocular anterior segment parameters of celiac patients are not significantly different from those of healthy subjects, suggesting none of the underlying pathogenetic implications of this disease affects the assessed structures. Nevertheless, due to the association between celiac disease and other ocular disorders, such as cataract, uveitis, dry eye, neuro-ophthalmic manifestations, night blindness, occlusion of the central retinal vein, and orbitopathy associated with thyroid, a routine ophthalmological examination for all celiac patients should be recommended throughout their lifetimes.

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