Does the conjunctivochalasis accompanied by pseudoexfoliation syndrome affect the ocular surface and anterior segment structures?

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Received: 16 December 2021 / Accepted: 12 March 2022 / Published online: 30 March 2022
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Abstract

Purpose The probability of the coexistence of conjunctivochalasis and pseudoexfoliation syndrome (PES) in the same individual may increase with aging. We investigated the effects of conjunctivochalasis accompanied by PES on the ocular surface (OS) and anterior segment (AS) structures.

Methods Cases with only conjunctivochalasis were determined as Group 1 (n = 62), cases with conjunctivochalasis accompanied by PES as Group 2 (n = 45), and healthy individuals as Group 3 (n = 56). The OS and AS parameters of the groups were compared.

Results There were a higher grade-3 conjunctivochalasis rate (17.7% vs. 46.7%, \( p = 0.039 \)), a greater “mean grade of conjunctivochalasis” value (1.72 ± 0.24 vs. 2.29 ± 0.32, \( p = 0.036 \)), and a higher “total conjunctivochalasis score” (4.27 ± 1.13 vs. 6.12 ± 1.35, \( p = 0.025 \)) in Group 2 than in Group 1. Additionally, Group 2 had a shorter tear film break-up time (TBUT) (9.17 ± 2.53 vs. 5.41 ± 1.32, \( p = 0.010 \)) and a greater OS disease index (OSDI) score (16.28 ± 3.15 vs. 27.36 ± 4.12, \( p = 0.037 \)) than Group 1. Moreover, both Group 1 and Group 2 had shorter TBUTs (Group 1–3: \( p = 0.004 \); Group 2–3: \( p < 0.001 \)) and greater OSDI scores (Group 1–3: \( p = 0.042 \); Group 2–3: \( p = 0.019 \)) compared to Group 3. The groups’ ocular surface staining scores, Schirmer 1 tests, central corneal thicknesses, keratometries, axial lengths, anterior chamber depths, lens thicknesses, and intraocular pressures were similar (\( p > 0.05 \)).

Conclusions To our knowledge, this was the first study comprehensively investigating the effects of conjunctivochalasis accompanied by PES on the OS and AS structures together. We found that conjunctivochalasis might cause the OS disease, while the presence of PES in conjunctivochalasis cases might worsen both the OS disease and conjunctivochalasis findings.

Keywords Anterior segment · Conjunctivochalasis · Ocular surface · Pseudoexfoliation · Total conjunctivochalasis score

Introduction

Conjunctivochalasis is described as a redundant, loose, and nonedematous conjunctival folds most typically located in the inferior bulbar conjunctiva [1]. The bulbar conjunctiva is a tissue rich in collagen and elastic fibers. Elastic fibers are one of the main components of the extracellular matrix, and they provide the elasticity of tissues [2]. Aging and mechanical friction were thought to cause the overexpression of matrix metalloproteinases by increasing the inflammatory cytokines, thus disrupting the fibrillin
molecule’s structure [1–4]. Under the influence of these factors, elastic fiber degeneration and collagenolysis in the bulbar conjunctiva may occur [1, 3, 5–7]. As a result, the adhesion of the bulbar conjunctiva to the eye may be impaired, and conjunctival folds may develop [2].

Pseudoexfoliation syndrome (PES) is a disease characterized by the excessive synthesis and accumulation of white-colored abnormal elastic fibrillar material in intraocular and extraocular tissues [8, 9]. In the etiopathogenesis of PES, aging and oxidative damage were thought to disrupt the balance between matrix metalloproteinases and matrix metalloproteinase inhibitors by increasing the inflammatory cytokines, thus causing the abnormal elastic microfibril synthesis [10–14]. Consequently, abnormal elastic fibrillar material may accumulate in ocular structures such as conjunctiva, corneal endothelium, pupillary margin, anterior lens capsule, and/or zonular fibers [8, 9]. In the literature, the prevalences of conjunctivochalasis and PES were reported to increase with aging [15–17]. Additionally, the etiopathogenesis of conjunctivochalasis and PES appears to be similar. Therefore, the probability of the coexistence of these two diseases in the same individual may increase with aging, and it is reasonable to assess the condition of the eye in cases with both conjunctivochalasis and PES. To our knowledge, this was the first study comprehensively investigating the effects of conjunctivochalasis accompanied by PES on the ocular surface (OS) and anterior segment structures together. Correlations between clinical characteristics with the mean grade of conjunctivochalasis (MGC) and total conjunctivochalasis score (TCS) were also evaluated in this study.

Methods

This comparative and cross-sectional study was performed with the approval of Izmir Tepecik Training and Research Hospital’s Medical Research Ethical Committee (approval number: 2020/10-10) and in-line with the ethical principles of the Declaration of Helsinki. Detailed information about the study was given to all individuals, and the risks were explained. Written consent forms were received from all participants.

The diagnosis of conjunctivochalasis was made with the presence of redundant conjunctival folds on slit-lamp examination. In addition, the pseudoexfoliation material accumulation on ocular structures such as anterior lens capsule, iris surface, or pupillary margin was evaluated in detail by slit-lamp examination and gonioscopy. The cases that had (1) pseudoexfoliation material accumulation, (2) normal optic disk head, (3) intraocular pressure (IOP) less than 22 mmHg, and (4) normal visual field were defined as PES [18]. Cases with only conjunctivochalasis were determined as Group 1 \((n=62)\), while cases with conjunctivochalasis accompanied by PES were determined as Group 2 \((n=45)\). In the similar age range with Group 1 and Group 2, 56 healthy individuals without any ocular and systemic diseases were defined as Group 3. The cases having ocular trauma or surgery, the individuals who had previously been followed up and treated for dry eye, the contact lens wearers, and the individuals having chronic ocular disease and/or systemic disease capable of affecting the ocular structures other than the conjunctivochalasis, pseudoexfoliation, or lens opacity were not included.

All individuals’ personal and family histories, age, and gender characteristics were recorded. The best corrected visual acuity (BCVA) was detected by the Snellen chart. Detailed anterior and posterior segment examinations were done with a slit-lamp biomicroscope and Goldmann three-mirror lens. IOP was measured by a Goldmann applanation tonometer. The visual field examination was made with the Humphrey Field Analyzer (Zeiss Humphrey Instruments, USA). Modified Meller and Tseng’s grading system was used to grade the conjunctivochalasis [5]. TCS was determined according to the system used by Mimura et al. [19, 20]. In this grading and scoring system (Fig. 1), the number of conjunctival folds and relationship to the tear meniscus height [grade (0): no persistent fold, grade (1): single, small fold, grade (2): two or more folds and not higher than the tear meniscus, grade (3): multiple folds and higher than the tear meniscus], the location of conjunctival folds [(N): nasal part of the lower lid, (T): temporal part of the lower lid, and (M): middle part of the lower lid (or inferior to the limbus)], the extent (E) of conjunctival folds \([E (0): \text{none}, E (1): \text{at one location}, E (2): \text{at two locations}, E (3): \text{affecting the whole eyelid}]\), the changes provoked with downward gaze
(DG) [DG (0): no difference, DG (1): height or extent of conjunctivochalasis increases], the changes provoked with digital pressure (DP) [DP (0): no difference, DP (1): height or extent of conjunctivochalasis increases], and the presence of superficial punctate staining (SPS) at the lower eyelid margin [SPS (0): absent, SPS (1): present] were evaluated [5, 19, 20]. TCS of the cases was scored between 0 and 9 [19].

Tear film break-up time (TBUT) and Schirmer 1 test with topical anesthesia were used for the ocular surface evaluation. In TBUT test, the fluorescein strip (Fluorescein paper, Haag-Streit AG, Switzerland) was moistened with saline solution and touched to the lower fornix. Individuals were told to keep their eyes open until the first dry spots were seen on the tear film under the illumination with cobalt blue light. The time interval between the last blinking and the appearance of the first dry spots was measured. Three measurements were made by the same researcher, and the mean value of the three measurements was used. Additionally, the integrity of the OS was assessed with the Oxford staining scale. The OS staining was graded on a scale of 0 to 5 (0 = absent, 1 = minimal, 2 = mild, 3 = moderate, 4 = marked, 5 = severe) according to the Oxford staining scale [21–23]. In Schirmer 1 test with topical anesthesia, proparacaine HCl 0.5% (Alcain; Alcon Company, Belgium) was dropped, followed by a five-minute wait [24]. The Schirmer test paper (SNO strips, Laboratory Chauvin, France) was placed on 1/3 outer edge of the lower eyelid. After five minutes, the amount of wetting on the paper was measured [24, 25]. The presence, frequency, and severity of the dry eye symptoms were detected by the OS disease index (OSDI) questionnaire [25]. Central corneal thickness (CCT), keratometry, axial length (AL), anterior chamber depth (ACD), and lens thickness (LT) were determined by the optical biometry device (LenStar LS900, Haag-Streit Diagnostic, Switzerland). Only one eye of each individual was included in the study. If both eyes were suitable for the study, the eye with more severe findings was selected. If the findings of both eyes were equal, one eye was chosen at random. All measurements were taken by the same masked researcher between 10.00 and 12.00 a.m. The average value of the three measurements was recorded. The groups’ age and gender characteristics, TBUTs, ocular surface staining scores, Schirmer 1 test values,
OSDI scores, CCTs, keratometry values, ALs, ACDs, LTs, and IOPs were compared. Moreover, comparisons between Group 1 and Group 2 in terms of the conjunctivochalasis grades, conjunctivochalasis locations, MGC values, and TCSs were made. Correlations between clinical characteristics with MGC and TCS were also investigated in Group 1 and Group 2.

Statistical Package for Social Sciences (SPSS 20.0; IBM, USA) software was used for the statistical data analysis. Before beginning this study, a post hoc power analysis was done, and it was determined that the number of sample size was 20 to identify a statistically significant difference among the main variables, with 80% statistical power and an alpha error of 0.05. Continuous variables were expressed as mean ± standard deviation (minimum–maximum) values, while count data were given as case number and percentage. The Kolmogorov–Smirnov test was used to determine whether the variables complied with normal distribution in groups. Comparisons of the groups were made by the Chi-square test, Mann–Whitney U test, and one-way analysis of variance (ANOVA) with post hoc tests. In Group 1 and Group 2, the relationships between clinical characteristics with MGC and TCS were evaluated by the Pearson correlation analysis. \( p < 0.05 \) was considered statistically significant.

**Results**

The BCVAs of all cases were 20/20. Biomicroscopic fundus examinations of all individuals were normal. PES was detected in 42.1% (45/107) of all conjunctivochalasis cases. The age and gender distributions of the groups were similar (\( p > 0.05 \)). Group 2 had a significantly lower grade-1 conjunctivochalasis rate (45.2% vs. 17.8%, \( p = 0.042 \)) and a higher grade-3 conjunctivochalasis rate (17.7% vs. 46.7%, \( p = 0.039 \)) compared to Group 1. In intragroup comparison, the distribution of conjunctivochalasis locations was similar in both Group 1 and Group 2 (\( p > 0.05 \)). In intergroup comparison, nasal, temporal, and middle conjunctivochalasis location rates of Group 1 were similar to those of Group 2 (\( p > 0.05 \)). There were a greater MGC value (1.72 ± 0.24 vs. 2.29 ± 0.32, \( p = 0.036 \)) and a higher TCS (4.27 ± 1.13 vs. 6.12 ± 1.35, \( p = 0.025 \)) in Group 2 than in Group 1.

1. Conjunctivochalasis characteristics of Group 1 and Group 2 were given in Table 1.

Group 2 had a shorter TBUT (9.17 ± 2.53 vs. 5.41 ± 1.32 s, \( p = 0.010 \)) and a greater OSDI score (16.28 ± 3.15 vs. 27.36 ± 4.12, \( p = 0.037 \)) than Group 1. Moreover, both Groups 1 and 2 had significantly shorter TBUTs (9.17 ± 2.53 vs. 14.23 ± 3.52 s, \( p = 0.004 \) for Group 1–3 comparison; 5.41 ± 1.32 vs. 14.23 ± 3.52 s, \( p < 0.001 \) for Group 2–3 comparison) and greater OSDI scores (16.28 ± 3.15 vs. 7.46 ± 3.07, \( p = 0.042 \) for Group 1–3 comparison; 27.36 ± 4.12 vs. 7.46 ± 3.07, \( p = 0.019 \) for Group 2–3 comparison) compared to the healthy cases (Group 3). The OS staining score was 0.85 ± 0.39 in Group 1, 1.04 ± 0.45 in Group 2, and 0.49 ± 0.28 in Group 3. There were no significant differences among the groups in terms of the OS staining score (\( p > 0.05 \)). Schirmer 1 test values, CCTs, keratometry values, ALs, ACDs, and LTs were similar in all groups (\( p > 0.05 \)). The IOP value was 13.8 ± 2.1 mmHg in Group 1, 14.3 ± 1.7 mmHg in Group 2, and 14.1 ± 2.5 mmHg in Group 3. There were no significant differences among the groups regarding the IOP value (\( p > 0.05 \)). The clinical and ocular parameters of the groups were given in Table 2.

Correlations between clinical characteristics with MGC and TCS for Group 1 and Group 2 were also investigated. In Group 1, as the age increased, both MGC (\( r = 0.349, p = 0.043 \)) and TCS (\( r = 0.322, p = 0.046 \)) increased. Similarly, in Group 2, as the age increased, both MGC (\( r = 0.403, p = 0.022 \)) and TCS (\( r = 0.372, p = 0.031 \)) increased. Additionally, in Group 2, as both MGC and TCS increased, TBUT (\( r = -0.370, p = 0.034; r = -0.401, p = 0.025 \), respectively) decreased, and OSDI score (\( r = 0.338, p = 0.045; r = 0.362, p = 0.040 \), respectively) increased. On the other hand, Schirmer 1 test value, CCT, keratometry value, AL, ACD, LT, and IOP were not significantly correlated with MGC and TCS in Group 1 and Group 2 (\( p > 0.05 \)).

**Discussion**

Both the aging effect and the similarity in etiopathogenesis may increase the probability of the coexistence of conjunctivochalasis and PES in the same individual with aging [1–4, 10–13, 15–17]. Kocabeyoglu et al. investigated the conjunctivochalasis in...
PES cases, and the authors found that 56.6% of PES cases had conjunctivochalasis. They also stated that conjunctivochalasis was significantly seen more frequently in cases with PES compared to those without PES [14]. PES was detected in 42.1% of all conjunctivochalasis cases in our study. To the best of our knowledge, the possible effects of the coexistence of these two diseases on the OS and anterior segment structures were evaluated comprehensively for the first time with our study.

TBUT, Schirmer test, and OSDI questionnaire can be used to diagnose the OS disease. Ozek et al. found that TBUT of the patients with conjunctivochalasis was significantly shorter than that of the healthy individuals [26]. Wang et al. also reported a significantly shorter TBUT in conjunctivochalasis cases than in healthy controls [27]. Inadequate tear film distribution on the OS was considered to decrease the TBUT in conjunctivochalasis cases [1, 26]. Noori et al. stated that TBUT of the PES cases was significantly lower than that of the normal individuals [28]. Kozobolis et al. also detected a significantly lower TBUT value in patients with PES than in healthy controls [29]. This reduction was associated with the destabilization of the tear film in PES cases [28]. In our study, both Group 1 and Group 2 had significantly shorter TBUTs than healthy cases (Group 3). Moreover, TBUT was even shorter in Group 2 compared to Group 1. According to these findings, we thought that the presence of PES in conjunctivochalasis cases might further decrease the TBUT value. The OS staining can be used to evaluate the OS integrity [21–23]. Ozek et al. determined that the Oxford staining score of the patients with conjunctivochalasis was similar to that of the healthy individuals [26]. Similarly, there were no significant differences among the groups regarding the OS staining score in our study.

Wang et al. stated that Schirmer test value of the conjunctivochalasis cases was similar to that of the healthy controls [27]. Ozek et al. also found no
significant difference between the conjunctivochalasis cases and healthy individuals in terms of the Schirmer test result. The authors determined that conjunctivochalasis impaired the tear distribution, but it did not affect the tear amount [26]. On the other hand, Noori et al. reported that Schirmer test value of the PES cases was significantly lower than that of the normal individuals [28]. Kozobolis et al. also detected a significantly lower Schirmer test result in patients with PES compared to the healthy controls [29]. However, there were no significant differences among the three groups in our study in terms of the Schirmer 1 test value. This may be due to the fact that the conjunctival folds existing in both Group 1 and Group 2 might cause delayed tear clearance by impeding the tear flow or mechanically occluding the punctum [1, 26]. We considered that delayed tear clearance might also mask the negative effect of PES on the Schirmer 1 test in Group 2. Therefore, TBUT test may be more important than the Schirmer test in diagnosing the OS disease in cases with conjunctivochalasis [26]. In the literature, OSDI score was found to be significantly higher in conjunctivochalasis cases than in healthy controls [26, 30]. Kocabeyoglu et al. reported a significantly greater OSDI score in patients with PES compared to the healthy cases [14]. In our study, both Group 1 and Group 2 had significantly higher OSDI scores compared to the healthy individuals (Group 3). In addition, OSDI score was even greater in Group 2 compared to Group 1. According to these findings, we thought that the presence of PES in conjunctivochalasis cases might further increase the dry eye complaints.

As far as we know, the relationships of conjunctivochalasis with anterior segment parameters except for the AL [31] had not been investigated until our study. Mimura et al. evaluated the relationship between the AL and conjunctivochalasis. The authors stated that conjunctivochalasis was seen more frequently in individuals with short AL [31]. Moghimi

Table 2 Clinical and ocular parameters of the groups

| Clinical characteristics | Cases with only conjunctivochalasis (Group 1, n = 62) | Cases with conjunctivochalasis accompanied by PES (Group 2, n = 45) | Healthy cases (Group 3, n = 56) | Two-way comparisons p value |
|--------------------------|-----------------------------------------------------|-----------------------------------------------------------------|-------------------------------|----------------------------|
| Gender (male/female)     | 33/29                                               | 23/22                                                           | 27/29                         | Group 1–2 0.798 0.612 0.764 |
| Age (year)               | 64.6 ± 3.8 (54–85)                                  | 66.2 ± 3.9 (53–85)                                              | 63.8 ± 3.2 (53–84)            | Group 1–3 0.589 0.654 0.501 |
| TBUT (s)                 | 9.17 ± 2.53 (6–14)                                  | 5.41 ± 1.32 (3–10)                                              | 14.23 ± 3.52 (9–18)           | Group 2–3 <0.001 |
| Ocular surface staining score (0–5) | 0.85 ± 0.39 (0–2)                                 | 1.04 ± 0.45 (0–2)                                               | 0.49 ± 0.28 (0–1)             |                              |
| Schirmer 1 test (mm)     | 12.65 ± 2.24 (8–16)                                 | 12.81 ± 3.32 (8–17)                                             | 13.37 ± 3.65 (9–19)           | Group 1–2 0.892 0.539 0.614 |
| OSDI score (0–100)       | 16.28 ± 3.15 (13–21)                                | 27.36 ± 4.12 (23–32)                                            | 7.46 ± 3.07 (3–11)            | Group 1–3 0.037 0.042 0.019 |
| CCT (µm)                 | 546.41 ± 26.14 (512–579)                            | 544.38 ± 17.43 (515–572)                                        | 547.22 ± 23.36 (510–578)     | Group 2–3 0.721 0.806 0.434 |
| Keratometry (diopter)    | 41.55 ± 1.30 (40.00–43.25)                          | 41.62 ± 1.40 (40.00–43.50)                                     | 41.58 ± 1.20 (40.00–43.50)    | Group 1–2 0.526 0.892 0.835 |
| Axial length (mm)        | 22.43 ± 0.32 (22.06–22.87)                          | 22.62 ± 0.27 (22.24–22.95)                                     | 22.74 ± 0.41 (22.23–23.20)    | Group 1–3 0.462 0.318 0.684 |
| Anterior chamber depth (mm) | 3.38 ± 0.12 (3.24–3.63)                           | 3.37 ± 0.13 (3.20–3.58)                                         | 3.40 ± 0.15 (3.21–3.66)       | Group 2–3 0.764 0.627 0.512 |
| Lens thickness (mm)      | 3.27 ± 0.15 (3.04–3.50)                             | 3.24 ± 0.12 (3.05–3.42)                                         | 3.26 ± 0.13 (3.07–3.43)       | Group 1–2 0.563 0.789 0.645 |
| Intraocular pressure (mmHg) | 13.8 ± 2.1 (10–17)                                | 14.3 ± 1.7 (11–18)                                              | 14.1 ± 2.5 (10–18)            | Group 1–3 0.572 0.683 0.774 |

Descriptive characteristics were expressed as mean ± standard deviation (minimum–maximum) values

PES Pseudoexfoliation syndrome, n number of cases, TBUT tear film break-up time, OSDI OCular surface disease index, CCT central corneal thickness

Chi-square test for gender, and one-way analysis of variance (ANOVA) with post hoc test for others, p < 0.05 statistically significant
et al. detected that the AL of PES cases was similar to that of the healthy individuals [18]. Doganay et al. found no significant difference between the PES cases and healthy individuals in terms of the ACD value [32]. Conflicting results were reported regarding the effect of PES on CCT. Inoue et al. showed that the CCT was significantly thinner in PES cases than in healthy individuals [33]. On contrary, Puska et al. determined a significantly thicker CCT value in PES patients compared to the healthy controls [34]. However, in the literature, PES was reported to have mostly no effect on CCT [18, 32, 35]. To our knowledge, there was also no study evaluating the effects of the coexistence of conjunctivochalasis and PES on anterior segment structures. In our study, CCTs, keratometry values, ALs, ACDs, and LTs were similar in all groups.

In a community-based epidemiologic study, 53.52% of conjunctivochalasis eyes were reported as grade-1, 36.72% as grade-2, and 9.19% as grade-3 conjunctivochalasis [16]. In our study, 45.2% of the cases with only conjunctivochalasis had grade-1, 37.1% had grade-2, and 17.7% had grade-3 conjunctivochalasis. In contrast, in cases with conjunctivochalasis accompanied by PES, the rates were 17.8% for grade-1, 35.5% for grade-2, and 46.7% for grade-3. In our study, Group 2 had a significantly lower grade-1 conjunctivochalasis rate, a higher grade-3 conjunctivochalasis rate, a greater MGC, and a higher TCS compared to Group 1 in intergroup comparison. Moreover, in the presence of PES in conjunctivochalasis cases, as both MGC and TCS increased, TBUT decreased, and OSDI score increased. According to these results, we thought that the presence of PES in conjunctivochalasis cases might worsen both the conjunctivochalasis findings and dry eye related findings. However, we detected that the presence of PES might not affect the distributions of conjunctivochalasis locations.

In the literature, the number and height of conjunctival folds and the severity of conjunctivochalasis were stated to increase with aging [15, 16, 36]. Similarly, we determined that in Group 1 and Group 2, as the age increased, both MGC and TCS increased. Marmalidou et al. hypothesized that with aging, a decrease in subconjunctival connective tissue might occur similar to aged skin, and this tissue change might cause conjunctival laxity by disrupting the adhesion of the bulbar conjunctiva to the sclera. The authors also considered that this conjunctival laxity might induce inflammation by leading to chronic mechanical friction. Eventually, the conjunctivochalasis might develop or progress in a vicious cycle containing the conjunctival laxity, mechanical friction, inflammation, and disruption of the extracellular matrix [1].

This study had some limitations. The first limitation was that the levels of inflammatory mediators on the OS could not be measured in cases. The second limitation was that the number of cases was relatively small. There might be other undetectable additional factors affecting the ocular structures. In the future, prospective follow-up studies with large case numbers can be planned. In the literature, there were some studies related to the OS changes in cases having only conjunctivochalasis [15, 16, 26, 27]. However, the first difference of our study from the previous studies was that it included not only the cases with conjunctivochalasis (Group 1) but also the cases having both conjunctivochalasis and PES (Group 2). In our study, we added Group 2 to determine whether the presence of PES further might affect the OS and conjunctivochalasis parameters (e.g., conjunctivochalasis locations, MGC, and TCS) in patients with conjunctivochalasis. The second difference of our study from the previous studies was that it included not only the OS and conjunctivochalasis parameters but also the anterior segment parameters (e.g., CCT, keratometry value, AL, ACD, and LT). Moreover, these anterior segment parameters were also compared with those of the healthy individuals (Group 3). Therefore, we believed that this study could provide valuable information about the effects of the coexistence of these two diseases on the OS and anterior segment structures.

In summary, we determined that both Group 1 and Group 2 had significantly shorter TBUTs and higher OSDI scores compared to the healthy cases. Moreover, Group 2 had a shorter TBUT, a higher OSDI score, a greater MGC, and a higher TCS than Group 1. The CCTs, keratometry values, ALs, ACDs, and LTs were similar in all groups. In the presence of PES in conjunctivochalasis cases, as both MGC and TCS increased, TBUT decreased, and OSDI score increased. In conclusion, we found that conjunctivochalasis might cause the OS disease, while the presence of PES in conjunctivochalasis cases might
worsen both the OS disease and conjunctivochalasis findings.

Author’s contributions All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by [Bediz Özen] and [Hakan Öztürk]. The first draft of the manuscript was written by [Bediz Özen] and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.

Funding No funds, grants, or other support was received.

Declarations

Conflict of interest The authors declare no conflict of interest.

Consent to participate Informed consent was obtained from all individual participants included in the study.

Consent to publish Written informed consent was obtained from the parents.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. This study was performed with the approval of Izmir Tepecik Training and Research Hospital’s Medical Research Ethical Committee (approval number: 2020/10–10) and in-line with the ethical principles of the Declaration of Helsinki.

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