

# Prevalence and associated factors of external punctal stenosis among elderly patients in Turkey

## *Prevalência e fatores associados à estenose externa do ponto lacrimal em pacientes idosos na Turquia*

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### ABSTRACT

**Purpose:** To estimate the prevalence of external punctal stenosis (EPS) in the elderly population and investigate associated factors.

**Methods:** A total of 278 patients ≥65 years of age were evaluated for evidence of EPS from January to July 2016. Associated systemic, ocular, demographic, and lifestyle factors were investigated. Multiple logistic regression analyses were applied to evaluate the factors related to having EPS. P values <0.05 were considered statistically significant.

**Results:** The prevalence of EPS in this study population was 63.3%, with a mean age of 70.67 ± 7.85 (65-92 years). The ocular factor that was most commonly related to EPS was chronic blepharitis (48.9%). EPS was also associated with taking glaucoma medications (95% CI, 0.08-0.96, p=0.043), smoking history (95% CI, 0.13-0.84, p=0.021), ectropion (95% CI, 0.004-0.26, p=0.001), complaints of tearing (95% CI, 1.11-3.52, p=0.02), and outdoor occupational activity (95% CI, 3.42-9.97, p<0.05).

**Conclusions:** EPS is more common in elderly patients than in the general population. Outdoor occupational activity, taking antiglaucomatous medications, ectropion, and smoking are significantly associated with EPS. In addition, surgical treatment decisions should be made after complete evaluation and interviewing the patients.

**Keywords:** Lacrimal apparatus; Lacrimal duct obstruction; Blepharitis; Dry eye syndromes; Aged; Turkey/epidemiology

### RESUMO

**Objetivo:** Estimar a prevalência de estenose externa do ponto lacrimal (EEPL) na população idosa e investigar os fatores associados.

**Métodos:** Foram avaliados 278 pacientes ≥65 anos com estenose externa do ponto lacrimal de janeiro a julho de 2016. Todos os fatores sistêmicos, oculares, demográficos e de estilo de vida associados foram investigados. Foram utilizadas análises de regressão logística múltipla para avaliar os fatores relacionados a estenose externa do ponto lacrimal, valores de p<0,05 foram considerados estatisticamente significativos.

**Resultados:** A prevalência de estenose externa do ponto lacrimal foi de 63,3%, com idade média de 70,67 ± 7,85 (65-92 anos). O fator ocular mais relacionado com estenose externa do ponto lacrimal foi blefarite crônica. (IC de 95%, 0,08-0,96, p=0,043), história de tabagismo (IC 95%, 0,13-0,84, p=0,021), ectrópio (IC 95%, 0,004-0,26, p=0,001), queixa de lacrimejamento (95% IC, 1,11-3,52, p=0,02) e atividade ocupacional ao ar livre (IC 95%, 3,42-9,97, p<0,05).

**Conclusão:** A estenose externa do ponto lacrimal é um distúrbio mais comum em pacientes idosos do que na população em geral. Atividade ocupacional ao ar livre, medicação antiglaucomatosa, ectrópio e tabagismo foram significativamente associados com estenose externa do ponto lacrimal. A decisão sobre tratamento cirúrgico deve ser dada após a avaliação completa dos fatores associados em cada paciente.

**Descritores:** Aparelho lacrimal; Obstrução dos ductos lacrimais; Blefarite; Síndromes do olho seco; Idoso; Turquia/epidemiologia

### INTRODUCTION

External punctal stenosis (EPS) is a common disorder of the punctum. Regardless of the cause of EPS, this condition, which can be congenital or acquired, can cause epiphora as a result of blockage of the lacrimal passage. The acquired form can originate from topical or systemic medication use, various infections, lid malposition, or different forms of trauma and tumors<sup>(1-3)</sup>. Changes caused by aging are also a risk factor for EPS<sup>(4)</sup>. The prevalence of EPS increases with age, and has been reported to be between 17.3% and 54.3%<sup>(5,6)</sup>.

Because of the lack of research in this field, we aimed to evaluate the prevalence of EPS and associated factors in elderly patients in Turkey.

### METHODS

This cross-sectional study was performed in Konya, Turkey. Patients who were older than 65 years were recruited from the

patient population that visited our general ophthalmology clinic from January to July 2016. The participants were questioned about basic demographic data, complaints of epiphora, systemic disease, glaucoma therapy, smoking history (patients were categorized according to their smoking habits into three groups as follows: (1) current smokers (people who smoke any tobacco product occasionally), (2) nonsmokers, and (3) ex-smokers (people who had smoked regularly in the past and had quit smoking at least 1 year before the study), and occupational history (grouped as outdoor or indoor activity).

A slit-lamp biomicroscopy was used to evaluate the external punctum. EPS was visually graded according to the criteria used by Kashkouli et al.<sup>(7)</sup>. All patients with EPS had a grade 1 (severe punctal stenosis) or grade 2 (less severe punctal stenosis) punctal opening (Table 1). In addition, the presence of pterygium, eyelid malpositions (ectropion, entropion, trichiasis, and distichiasis), chronic dacryocystitis, cataract, and age-related macular degeneration were also documented. Chronic dacryocystitis was revealed by performing nasolacrimal duct irrigation. A dilated biomicroscopic examination

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of the fundus with a +78 diopters lens was performed to detect age-related macular degeneration.

Suspected dry eye was also evaluated with tear film breakup time (BUT), fluorescein and rose bengal staining, and Schirmer's test. The BUT was also measured by touching the inferotemporal bulbar conjunctiva with a fluorescein sodium strip wetted with a preservative-free isotonic saline. Patients were asked to blink, and the precorneal tear film was examined under blue light illumination using a slit-lamp biomicroscope. The mean value of three measurements was recorded. The BUT was considered low when it was less than 10 seconds. The corneal surface was then examined for fluorescein staining, and its presence or absence was recorded. The cases were labeled as asymptomatic if they did not complain of epiphora and their tear meniscus height was less than 2 mm. The patients were labeled as having dry eye if they had a BUT less than 10 s and positive corneal staining with fluorescein. Schirmer's test was performed in both eyes. Five minutes after the instillation of one drop of oxybuprocaine hydrochloride 0.4%, the inferior fornix was gently blotted, and a precalibrated standard filter strip was placed in the lower temporal fornix for 5 min. During this time, the participants were instructed to look slightly upward and blink normally. After removing the strip, the length of the strip that was wet was measured. The test result was considered positive if this measurement was  $\leq 5$  mm.

This study was approved by Baskent University Institutional Review Board and Ethics Committee (Project no: 94603339-604.01.02/2131) and supported by the Baskent University Research Fund. Informed consent was obtained from all participants. The study adhered to the tenets of the Declaration of Helsinki.

## STATISTICAL ANALYSIS

Statistical data were analyzed using SPSS version 21.0 (IBM Corp., Armonk, NY, USA). Values were expressed as the mean  $\pm$  standard deviation. The chi-square test with 95% confidence intervals (CIs) and Fisher's exact test were used to assess the effects of sex, systemic disease, topical or systemic medication, smoking, and occupational activity. Multiple logistic regression analyses were used to evaluate the independent factors related to having EPS. P values  $<0.05$  were considered statistically significant.

## RESULTS

A total of 278 patients were recruited, with a mean age of 70.67  $\pm$  7.85 (65-92 years). The prevalence of EPS was 63.3% (176/278) among this elderly population visiting our general eye clinic for routine ophthalmologic examination. One hundred thirty-five of the patients were men (48.6%) and 143 were women (51.4%). One

hundred twelve (40.3%) patients had bilateral EPS. The presence of epiphora was consistent with the EPS ratio ( $p=0.004$ ). No sex dominance was observed for EPS ( $p=0.45$ ).

Chronic blepharitis was found in 45.5% (80/176) of the patients with EPS (95% CI, 0.58-1.72,  $p=0.13$ ), and this was the most common ocular factor associated with EPS. The associations between the presence of EPS and other demographic, occupational, ocular, and systemic factors are presented in table 2.

**Table 2. Demographic, lifestyle, ocular, and systemic factors associated with external punctal stenosis**

	EPS (+)	EPS (-)	OR <sub>95%</sub>
Age (years)	72.77 $\pm$ 7.8	67.03 $\pm$ 6.54	0.89 (3.93-7.54)
Sex			
Male	88 (65.2%)	47 (34.8%)	0.95 (0.56-1.63)
Female	88 (61.5%)	55 (38.5%)	Reference
Complaints of tearing			
Yes	121 (69.5%)	53 (30.5%)	1.97 (1.12-3.52)
No	55 (52.9%)	49 (47.1%)	Reference
Dry eye			
Yes	17 (50.0%)	17 (50.0%)	0.72 (0.33-1.56)
No	159 (65.2%)	85 (34.8%)	Reference
Blepharitis			
Yes	80 (58.8%)	56 (41.2%)	1.00 (0.58-1.72)
No	96 (67.6%)	46 (32.4%)	Reference
Pterygium			
Yes	6 (40.0%)	9 (60.0%)	0.37 (0.11-1.23)
No	170 (64.6%)	93 (35.4%)	Reference
Ectropion			
Yes	33 (97.1%)	1 (2.90%)	0.03 (0.004-0.26)
No	143 (58.6%)	101(41.4%)	Reference
Hypertension			
Yes	67 (59.8%)	45 (40.2%)	0.71 (0.41-1.24)
No	109 (65.7%)	57 (34.3%)	Reference
Diabetes mellitus			
Yes	43 (58.1%)	31 (41.9%)	0.57 (0.31-1.05)
No	133 (65.2%)	71 (34.8%)	Reference
Congestive heart failure			
Yes	5 (50.0%)	5 (50.0%)	0.55 (0.12-2.40)
No	171 (63.8%)	97 (36.2%)	Reference
COPD			
Yes	6 (75%)	2 (25.0%)	2.12 (0.34-13.09)
No	170 (63%)	100 (37.0%)	Reference
Glaucoma drops			
Yes	20 (83.3%)	4 (16.7%)	3.33 (1.04-10.61)
No	156 (61.4%)	98 (38.6%)	Reference
Occupation			
Outdoor	134 (78.8%)	36 (21.2%)	0.73 (0.41-1.29)
Indoor	42 (38.9%)	66 (61.1%)	Reference
Smoking			
Smoker	22 (52.4%)	20 (47.6%)	0.14 (0.05-0.45)
Non-smoker	121 (62.7%)	72 (37.3%)	0.41 (0.18-0.93)
Ex-smoker	33 (76.7%)	10 (23.3%)	Reference

EPS= external punctal stenosis; COPD= chronic obstructive pulmonary disease.

**Table 1. Grading of different external punctal opening sizes**

Grade	Clinical findings	Methods of inserting A #00 bowman probe
0	No papilla and punctum (punctal atresia)	Need to create a papilla by surgery
1	Papilla is covered by a membrane (exudative or true membrane) or fibrosis, and is difficult to recognize	Need a no. 25 needle, followed by a punctal finder and then standard punctum dilator
2	Smaller than normal size, but recognizable	Need a punctal finder and then a standard punctum dilator
3	Normal	Need a regular punctum dilator
4	Small slit ( $<2$ mm)	No need for intervention
5	Large slit ( $\geq 2$ mm)	No need for intervention

Univariate and multivariate logistic regression analyses were used to identify the independent predictors of EPS (Table 3). Complaints of tearing (95% CI, 1.11-3.52,  $p=0.02$ ), ectropion (95% CI, 0.004-0.26,  $p=0.001$ ), glaucoma drop usage (95% CI, 0.08-0.96,  $p=0.043$ ), smoking (95% CI, 0.13-0.84,  $p=0.021$ ), and outdoor occupational activity (95% CI, 3.42-9.97,  $p<0.05$ ) were significantly associated with EPS according to the results of the multivariate logistic regression analysis. In contrast, we did not find significant associations between EPS and smoking or outdoor occupational activity.

## DISCUSSION

To date, this is the first study to evaluate EPS in elderly patients only. The prevalence of EPS was found to be 63.3% in this patient population. EPS is a common cause of epiphora, and recent studies have reported a wide range in the prevalence of the latter, from 8% to 54.3%<sup>(5,6,8,9)</sup>. Similarly, we had found a prevalence of EPS of 25.8% in our previous study<sup>(10)</sup>. All of these previous studies reported a positive correlation between the prevalence of EPS and increasing age. This association is thought to be the result of changes caused by aging and fibrosing of the tissue surrounding the punctum<sup>(4)</sup>. Studies that evaluated the histopathologic changes in EPS specimens reported that fibrosis is the most prevalent finding, followed by chronic inflammation<sup>(11,12)</sup>. The higher prevalence of EPS in our study can be explained according to the findings reported in these previous studies.

Previous studies reported female dominance in EPS<sup>(7,13)</sup>, and suggested that postmenopausal hormonal changes may be responsible for this sex difference; however, other reports did not show sex differences<sup>(5,6)</sup>. These authors suggested that this lack of sex difference could be related to differing sampling methods used in these studies. Similarly, we did not find any sex difference in our study. Our sample group was recruited from patients attending a general ophthalmology clinic, and we believe that this is an ideal method of recruitment to minimize bias.

Chronic blepharitis was diagnosed in 45.5% of our patients, and it was the most commonly related factor to EPS. However, we did not find any significant association between blepharitis and EPS. Conversely, the authors of previous studies showed that the most common underlying factor for EPS was blepharitis<sup>(5-7)</sup>; similarly, no significant association was found between EPS and blepharitis in these studies. However, the authors suggested that chronic blepharitis predisposes individuals to EPS on the basis of the inflammatory and cicatricial changes. Consistent with these reports, recent studies have showed that chronic inflammation is the most common finding in EPS specimens<sup>(11,12)</sup>. It is clear that the chronic inflammatory process resulting from chronic blepharitis plays an important role, even if not completely, in the development of EPS.

We also evaluated the association between EPS and dry eye, pterygium, and other levels of lacrimal pathway stenosis; however, we did not find any significant relationships. On the other hand, previous studies have reported an association between EPS and nasolacrimal ductal stenosis; topical medication use, systemic che-

motherapy, trachoma, and cicatrizing diseases of the conjunctiva are thought to be responsible for this relationship<sup>(13-16)</sup>. However, Kashkouli et al. did not find any association between EPS and lacrimal pathway stenosis<sup>(7)</sup>. Although an association between EPS and pinguecula was found in a recent study, the authors did not find any relationship between EPS and pterygium, as we did in our study<sup>(5)</sup>. They suggested that aging and sun exposure could be the common etiologic factors for these diseases.

Eyelid malposition, as seen in ectropion, may cause punctal stenosis, possibly due to underuse of an external punctum unopposed to the tear meniscus, or perhaps secondary to local inflammation<sup>(17)</sup>. Damasceno et al. revealed a decrease in elastic fibers in the pretarsal orbicularis oculi muscle, in the tarsal stroma, and in the eyelid skin in patients suffering from age-related involutional ectropion and entropion; these changes might have caused the fibrotic changes in the EPS specimens observed in previous research<sup>(18)</sup>. In our study, 18.8% (33/143) of the patients with EPS had ectropion ( $p=0.002$ ). Previous studies that studied EPS did not show any association between these two situations (*i.e.*; EPS and ectropion). Presumably, the authors felt that this relationship did not need to be evaluated because of the already well-known and strong association between these pathologies. However, the difference in treatment between EPS and ectropion means that it is important to show the relationship between these diseases.

Long-term treatment with several topical antiglaucoma agents has also been associated with punctal stenosis<sup>(15)</sup>. In addition, the conjunctiva and Tenon's capsule of the patients receiving long-term latanoprost therapy exhibit inflammatory changes<sup>(19)</sup>. However, this association has not been shown in population-based EPS studies until now. In our study group, EPS was significantly more prevalent in patients taking glaucoma medication ( $p=0.033$ ). Nonetheless, it is important to take into consideration the lack of discrimination of the type of glaucoma drops and the medication period.

There are two main types of risk factors: intrinsic and extrinsic. Extrinsic factors include parameters such as alcohol use, chronic exposure to sunlight, smoking, and nutrition deficit. The most important parameter, contributing to 80% of skin aging, appears to be sun exposure. Ultraviolet A rays induce the formation of reactive oxygen species that readily react with membrane lipids and amino acids, and are suspected of playing a substantial role in skin photoaging<sup>(21)</sup>. Skin photoaging can lead to fibrotic changes in punctal tissue and EPS. Therefore, we evaluated and found a significant association between outdoor occupational activity and EPS (95% CI, 3.42-9.97,  $p<0.05$ ). Agricultural workers constituted the majority of our study group. Similarly, Viso et al. found a significant relationship between these parameters and EPS<sup>(5)</sup>.

Previous studies that included histopathologic analysis have revealed that 10-15% of EPS specimens show squamous metaplasia<sup>(11,12)</sup>. Squamous metaplasia is known to be an epithelial response to chronic irritant exposure, and is typically seen in the airways of smokers. Therefore, we evaluated the effect of smoking on EPS, and found that current smokers have a significantly greater EPS ratio than non-smokers and ex-smokers (95% CI, 0.13-0.84,  $p=0.021$ ). If we had had a chance to assess the histopathology of these patients, we suspect that we might have found a high rate of squamous metaplasia. Conversely, a recent study did not find this difference in smokers compared to non-smokers<sup>(5)</sup>.

Dry eye is a common ocular surface disease in elderly patients<sup>(22)</sup>. The effectiveness of punctal occlusion in dry eye patients is reportedly comparable to that of other treatment modalities<sup>(23)</sup>. In our study, complaints of epiphora were significantly associated with the presence of EPS. However, 31.3% (55/176) of the patients with EPS had no complaints of epiphora, although increased tear meniscus was found after punctal occlusion in previous research<sup>(24)</sup>.

In addition, 92.7% (51/55) of these patients had no dry eye findings. These results indicate that EPS may help protect against dry eye in

**Table 3. Multivariate logistic regression analysis of potential associations with external punctal stenosis**


	OR	95% CI	p
Complaints of tearing	1.970	1.110-3.52	0.020
Ectropion	0.032	0.004-0.26	0.001
Glaucoma drops	0.290	0.080-0.96	0.043
Smoking	0.140	0.050-0.45	0.001
Outdoor occupation	0.330	0.190-0.55	0.000

elderly patients. According to the data, we suggest that surgical intervention for EPS in elderly patients should not be overly promoted to avoid impairment of this suspected protective mechanism.

In conclusion, to the best of our knowledge, this was the first study to evaluate EPS in elderly patients. We showed that its prevalence was higher in this group than in the general population. Chronic inflammation, antiglaucomatous medication use, ectropion, smoking, and sun exposure as a result of outdoor occupation activity are significant etiologic factors in the development of EPS. However, further studies with a large sample size supported by histopathologic analysis are needed in future to verify these associations.

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