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Prevalence, risk factors, and morbidity of eye lid laxity in a veteran population

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Abstract

Purpose—To study the prevalence, risk factors, and morbidity of eyelid laxity in a veteran population

Design—Prospective, cross sectional study with retrospective chart review

Participants—150 subjects were evaluated from either an outpatient eye or a geriatric clinic at the Miami Veterans Affairs Hospital from June through August 2013.

Methods—Clinical data were gathered from a questionnaire and a computerized medical record system including demographics, medical history, and ocular irritation history. Upper and lower eyelid laxity was clinically graded.

Main Outcome Measures—The prevalence of eyelid laxity, risk factors for its presence, and its correlation to ocular surface symptoms.

Results—Fifty-four percent of participants (n=81) had laxity (grade 1 or higher) in either the upper and/or lower eyelids. Risk factors for eyelid laxity in our population included older age, higher body mass index (BMI), and a diagnosis of sleep apnea. Patients with any eyelid laxity (grade 1 or more in any eyelid) had a 2.23 fold risk of severe ocular surface symptoms (score of 12 or higher on the Dry Eye Questionnaire 5) compared to those without laxity (95% confidence interval (CI) 1.15-4.31, p=0.017), and this was primarily driven by the presence of upper eyelid laxity.

Conclusions—We found a high prevalence of eyelid laxity in our population, and its presence was associated with significant ocular surface morbidity. This study reinforces the need to incorporate dynamic eyelid testing into the ophthalmic exam in patients with ocular surface discomfort.

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Keywords

Floppy Eyelids; Floppy Eyelid Syndromes; Eyelid laxity; Dry Eye; Risk factors of Dry Eye; DES; veteran

Introduction

Excessive eyelid laxity is a condition in which the eyelids are easily malpositioned by mechanical force. Eyelid laxity is often thought of as an early entity on the continuum of the hyperelasticity syndromes, whose more severe manifestations include floppy eyelid syndrome (FES) and eyelid imbrication syndrome. These syndromes, particularly FES, have garnered attention because of their association with systemic diseases such as obstructive sleep apnea. [1-5]

Several theories have been postulated in the literature that may describe the pathophysiology of eyelid laxity on a microscopic level – ranging from natural aging to solar actinic exposure.[6-9] Mechanical rubbing and/or pressure induced ischemic events may explain the losses of elastin fibrils in hyper elasticity syndromes such as FES but it is unclear if these events contribute to the development of eyelid laxity in all circumstances.[10] The clinical manifestations of involutional changes seen in the adnexa are numerous and dependent on the source of laxity. Senile atrophy of the tarsus, laxity of the lateral and medial canthal tendons, and laxity of the skin secondary to gravitational pull are just a few mechanisms implicated in lax eyelids.[11-13]

There are little data on the prevalence of eyelid laxity in the general population. Part of the reason is likely that dynamic physical testing in the form of eyelid manipulation is needed to arrive at the diagnosis. Dynamic eyelid testing is rarely performed in the routine evaluation of the ophthalmic patient unless there is obvious eyelid malposition. The prevalence of the more severe form of eyelid laxity, FES, has been better characterized in some populations, including in patients with sleep disturbances and obstructive sleep apnea (OSA) and these two conditions have been consistently demonstrated as an independent risk factor for its presence. [5, 14, 15] McNab was first to investigate the link between FES and sleep by referring 8 patients with loose upper eyelids and papillary conjunctivitis to undergo sleep studies. He found that all 8 fit the criteria for OSA with one patient falling under the category of severe OSA.[15] A more recent prospective study evaluated 114 patients consecutively admitted for a sleep study and found that 14 (16%) had hyperlaxity of both lower and upper eyelids with papillary conjunctivitis, while 54 (60%) had hyperlaxity alone.[16]

Despite this interest in hyperelasticity syndromes, there is little documented in the literature regarding the prevalence and morbidity of eyelid laxity in non-sleep study populations. Our hypothesis is that eyelid laxity is an under diagnosed problem in the elderly population. In order to test this hypothesis, we examined the prevalence, risk factors, and morbidity of eyelid laxity in a non sleep population to better understand the epidemiology of this condition.

Methods

Study Population

Study participants were sampled from either a geriatrics clinic (1 day a week), a comprehensive ophthalmology clinic (1 day a week), or cornea clinic (1/2 day a week) at the Miami Veterans Affairs hospital between June 2013 and August 2013. All participants were invited to complete a questionnaire regarding ocular surface symptoms and underwent dynamic eyelid laxity testing of their lower and upper eyelids. The VA ophthalmology service initiated this study as a quality improvement project. Miami VAMC Institution Review Board review and approval was later obtained to perform a chart review and link patient data to the questionnaires. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Determination of Eyelid laxity

The presence of lower eyelid laxity was determined by the snap back test. A grade of 0 indicated laxity within normal limits, a grade of 1 indicated a delay of two to five seconds for the lower lid to return to its native state. A grade of 2 indicated persistent separation necessitating a blink to return to the normal state. Upper eyelid laxity was determined by the lid distraction test. A grade of 0 indicated laxity within normal limits. A grade of 1 indicated 7-10 mm of distraction, and a grade of 2 indicated greater than 10 mm of distraction.

Data Collection

Data from a study-specific designed questionnaire were collected at the time of the respondents' visit and entered into a standardized database. Participants were asked about a history of sleep apnea, use of a continuous positive air pressure (CPAP) machine, snoring, nocturnal breathing patterns, red eyes, eye crusting or discharge, and eye rubbing. Furthermore, all participants filled out the dry eye questionnaire 5 (DEQ5). The Dry Eye Questionnaire 5 (DEQ5) is a validated questionnaire consisting of 5 questions regarding the presence and severity of eye discomfort, dryness, and tearing over a 1-month recall period.[17, 18] The score ranges from 0 to 22, with 0 indicating no ocular surface symptoms and 22 reflecting a large number of symptoms. As per previously set guidelines, mild to moderate ocular surface symptoms was defined as a DEQ5 score between 6 and 11 and severe ocular surface symptoms was defined as a score of 12 or greater. [17]

The Veterans Affairs' computerized patient record system was used to retrospectively collect other data including demographic information (age, sex), past ocular history, presence of an acute ocular condition (i.e. active uveitis, recent surgery, abrasion, ulcer) past medical history (including psychiatric history), medication use, and ocular examination findings from the day the patient filled out the questionnaires.[19]

Main Outcome *Measures*

The main outcome measures were the prevalence of eyelid laxity, risk factors for its presence, and its correlation to ocular surface symptoms.

Statistical Analysis

All statistical analyses were performed using SPSS 20.0 (SPSS Inc., Chicago, Illinois, USA) statistical package. Demographic and clinical characteristics were summarized using descriptive statistics. Independent t-test and Chi squared analyses were used to evaluate for demographic and clinical differences between those with and without eyelid laxity. Logistic regression analyses were used to evaluate the relationship between eyelid laxity and ocular surface symptoms and the relationship between various risk factors and the presence of laxity.

Results

Study population

Of the 151 patients seen in one of the clinics during the time period, 99.3% (n=150) elected to fill out the questionnaire and undergo eyelid testing and clinical examination. Demographic and clinic information are found in Table 1. Mean respondent age was 68 (range 25-94, standard deviation [SD] 13.7). Ninety-six percent were male with an average weight of 187.7 pounds (range 93-323 pounds, standard deviation [SD] 38.3). Thirty-two percent (n=38) of patients carried a diagnosis of sleep apnea and 17% (n=25) endorsed using a constant positive air pressure (CPAP) machine.

Prevalence of eyelid laxity and its associated risk factors

In our population, 54% of the participants (n=81) had laxity (grade 1 or higher) in either the upper and/or lower eyelids (Table 2). Risk factors for eyelid laxity in our population included older age (odds ratio (OR) 1.03, p=0.01), higher body mass index (BMI) (OR 1.10 p=0.005), and a diagnosis of sleep apnea (OR 2.48 p=0.014). (Table 3) In a multivariable analysis considering weight, BMI, and a history of sleep apnea as predictors of any laxity, only BMI remained a significant predictor (OR 1.10, 95% Confidence Interval (CI) 1.03-1.17, p=0.005). While not statistically significant, those who reported sleeping on their stomach had a higher frequency of any laxity (grade 1 or higher) than those who slept in any other position; stomach 86% (6/7), back 49% (20/41); right or left 53% (53/100).

Morbidity associated with eyelid laxity

Patients with any eyelid laxity (grade 1 or higher in any eyelid) had a 2.23 fold risk of severe ocular surface symptoms (score of 12 or higher on the DEQ5) compared to those without laxity (95% confidence interval (CI) 1.15-4.31, p=0.017). This finding seems to be driven by upper eyelid laxity as patients with any upper laxity had a 2.71 fold risk of severe symptoms (95% CI 1.35-5.44) p=0.005). Mean DEQ scores were higher in patients with higher (more severe) laxity grading. Patients with little or no laxity had a mean DEQ a score of 9.04 (SD 5.47), patients with mild or grade 1 laxity had a mean of 11.2 (SD 5.61), and patients with grade 2 or higher laxity had a mean DEQ of 14.71 (SD 5.91), p=0.0001.

There was no significant relationship between the presence of lower eyelid laxity, self-reported red eyes, or self-reported crusty eyes and severe ocular surface symptoms. In a multivariable model considering any eyelid laxity and including common confounders of DES symptoms (i.e. depression, post-traumatic stress disorder, smoking, recent surgery,

presentation for acute ocular condition, and the use of glaucoma drops), the two factors that remained predictive of severe ocular symptoms were the presence of any eyelid laxity (OR 2.41, p=0.01) and depression (OR 2.39, p=0.02).

In evaluating the effect of continuous positive airway pressure (CPAP) machine use on ocular surface symptoms, we examined those patients with sleep apnea (n=48) that did (n=25) and did not (n=23) use a CPAP. Mean DEQ5 scores were slightly higher in those that did not use a CPAP (mean DEQ5 14, standard deviation (SD) 6.3) compared to those that did (mean DEQ5 12, SD 4.7), but this result was not statistically significant (p=0.24). Correlations between upper eyelid laxity and lower eyelid laxity (right versus left) were strong with a Pearson correlation coefficient (r) of 0.87 between the upper eyelids and 0.92 between the lower eyelids Correlations between upper and lower eyelid laxity in the same eye, on the other hand, were weak to moderate with an r of 0.30 for the right and 0.27 for the left eye (p-value < 0.01 for all correlations).

Discussion

We found that eyelid laxity was present in a majority of patients who were interviewed in an eye and geriatric clinics. The finding that 54% of our population had eyelid laxity falls within the limits of previous estimates, which reported widely variable frequencies of 30% and 88%, respectively.[4, 20] The high variability of eyelid laxity prevalence in the literature can be partially explained by differences in clinic types – the prevalence of eyelid laxity may be skewed higher in clinics that have patient populations with more risk factors. In our veteran population, a predominantly male and elderly cohort, the prevalence of laxity may have been high by virtue of having more risk factors for eyelid laxity. Previous studies that investigated laxity have also been completed in sleep clinics, which tend to be secondary referral centers and therefore may have a high preponderance of obese, male participants resulting in sampling bias. Yet interestingly, despite the large variability of frequencies, eyelid laxity is still high in both populations.

Previously reported risk factors for eyelid laxity include older age, increasing weight, male gender, and obstructive sleep apnea (with greater severity of disease associated with greater prevalence of laxity). [4, 21, 22] Our data in non-sleep study population corroborate some these results as we found a higher prevalence of laxity in those with increased weight, higher BMI, and a previous diagnosis of sleep apnea. Interestingly, our mean BMI (29) in those with laxity was much lower than that of prior case series by McNab et al which reported a mean BMI of 38 (SD 8) in their population of sleep clinic patients with FES.[15] It is quite possible, however, that the frequency of obesity and high BMIs seen in the prior studies is due to patients having more severe disease (e.g. laxity with an associated papillary conjunctivitis). In a similar manner, the high BMI previously reported in sleep clinics may be a result of sampling bias, as patients with OSA and sleep disturbances tend to be obese. [23, 24]

With respect to ocular disorders, the presence of glaucoma[25] and keratoconus[26] have been reported to associated with OSA and FES. In our population, however, we did not find a

difference in the prevalence of laxity in those using versus not using glaucoma medications. We did not identify any patients in our study with keratoconus based on clinical exam.

Regarding symptoms, we found that the presence of eyelid laxity had clinical implications with patients more frequently complaining of severe ocular surface symptoms. This finding remained significant even when adjusting for confounding factors such as the use of glaucoma medications and psychiatric disease. The presence of ocular surface symptoms in the setting of laxity has biologic plausibility, as the eyelids are known to be important in maintaining a healthy tear film dynamic. Previous studies have demonstrated that with a normal blink, the lipid film spreads in a horizontal direction, propagating from the lower to upper cornea. [27-29] In patients with floppy eyelids, however, this pattern is disrupted with delayed spreading and abnormal wave propagation (vertical and mixed as opposed to horizontal).[30] In a study evaluating the effect of eyelid laxity on tear film dynamics in 16 patients with clinically diagnosed FES, it was shown that patients with FES had an increased ocular surface evaporation in patients compared to normal subjects using a high sensitivity humidity sensor ($p=0.001$).[30] It can be postulated that the altered tear mechanics seen in FES patients are at play in patients with severe eyelid laxity without FES as well.

As with all reports, our study has limitations that need to be considered when interpreting the study results. Our study relied on patient-self report of ocular surface symptoms. As such, there may have been variables other than laxity that could have affected symptoms. While we controlled for some of these (glaucoma medication use, presence of an acute ocular condition) other factors were not controlled for such as the status of the tear film. However, we presume that the ocular surface symptoms reported in patients with laxity were in part driven by unhealthy tear film parameters. Furthermore, a discussion is warranted regarding the grading of laxity in this study and others. While previous authors established criteria that have been use to clinically grade laxity based on the presence of papillary conjunctivitis and/or degree of tarsal eversion, there are presently no available guidelines as to the standardization of this entity.[5, 3115] Laxity, therefore, may be clinician dependent and subject to variability. Another limitation is that our patient population, which consisted of veterans seen in an eye clinic and a geriatrics clinic, may not be representative of the overall veteran population, nor of other non-veteran clinic populations. Additional studies evaluating eyelid laxity in other populations are therefore needed. Lastly, our cross-sectional design does not allow us to address many unanswered questions with regards to eyelid laxity including its natural history, optimal treatments, and interaction with other signs of dry eye all of which warrant further investigation.

Despite these limitations, this study sought to evaluate the presence and morbidity of eyelid laxity in a non-sleep clinic population. We found that eyelid laxity was prevalent in our population and its presence was associated with ocular surface morbidity. Our data suggests that dynamic eyelid testing should be incorporated into the ophthalmic exam in patients with ocular surface discomfort.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1

Demographic and clinical information of patient population

	Eyelid laxity *	No eyelid laxity	p-value
Number	81	69	
Height (inches), mean±SD	69±3.2	69±2.9	0.73
Weight (pounds), mean±SD	196±40	178±34	0.004
Body mass index, mean±SD	29±6.1	27±4.6	0.004
Age (years), mean±SD	71±12	65±15	0.009
Gender (% male)	98% (79)	94% (65)	0.30
Exercise 3 times per week	51% (41)	58% (40)	0.37
Prior diagnosis of sleep apnea	41% (33)	22% (15)	0.01
CPAP use	17% (14)	16% (11)	0.83
Self-reported snoring	72% (58)	67% (46)	0.51
Self-reported eyelid rubbing	14% (11)	22% (15)	0.19
Self-reported red eyes	32% (26)	28% (19)	0.54
Self-reported crusty eyes	46% (37)	39% (27)	0.42
Glaucoma medication use	19% (15)	26% (18)	0.27
Ocular surgery in past month	16% (13)	13% (9)	0.61
Acute ocular condition †	9% (7)	13% (9)	0.38
Current smoker	12% (10)	16% (11)	0.53
PTSD diagnosis (by ICD)	19% (15)	17% (12)	0.86
Depression diagnosis (by ICD)	28% (23)	33% (23)	0.51
DEQ5 score, mean±SD	12±5.9	9±5.4	0.001
Severe ocular surface symptoms (DEQ5≥12)	54% (44)	35% (24)	0.02

SD=standard deviation; PTSD=post trauamatic stress disorder; DEQ5=dry eye questionnaire 5

* any upper or lower eyelid laxity (grade 1 or above)

† uveitis, keratitis, corneal abrasion

Table 2

Eyelid laxity information

	Grade	Right eye	Left eye
Upper eyelid laxity	Mild (grade 1) Severe (grade 2)	26% (39) 9% (14)	24% (36) 9% (13)
Lower eyelid laxity	Mild (grade 1) Severe (grade 2)	23% (35) 9% (13)	25% (37) 8% (12)

Table 3

Risk factors for the presence of any eyelid laxity (grade 1 or above)

	OR	95% CI	p-value
Age (year)	1.03	1.01-1.06	0.01
Gender (female/male)	0.41	0.07-2.31	0.31
Body mass index	1.10	1.03-1.17	0.005
Exercise (yes/no)	0.74	0.39-1.42	0.37
Self-reported eye rubbing (yes/no)	0.57	0.24-1.33	0.19
Self-reported sleep disturbance (yes/no)	1.16	0.56-2.41	0.69
Diagnosis of sleep apnea (yes/no)	2.48	1.2-5.1	0.014
Use of a CPAP machine (yes/no)	1.10	0.46-2.62	0.83
Self-reported snoring (yes/no)	1.26	0.63-2.53	0.51
Glaucoma medication use (yes/no)	1.55	0.71-2.28	0.27

F=female; M=male; CPAP= continuous positive airway pressure machine