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Research Article

Effect of Sleep Position on the Development of Ectropion or Entropion in Aged Population

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ABSTRACT

Purpose: To explore a potential correlation between the position of the head of a sleeping individual and the (presence) of a unilateral ectropion or entropion.

Method: A retrospective case series. Data were collected from all patients who had undergone repair of an involutional ectropion or entropion between 2004 and 2017 from all causes at the Soroka University Medical Center.

Results: Thirty-six patients were available for participation in the survey received a telephone questionnaire regarding their sleep position and preference. The questionnaire was aimed to determine the patient's quality of sleep, position, and side preference while asleep.

The ectropion group includes 16 patients who have had a statistically significant positive association between the preference of a head posture during sleep and the development of a unilateral ectropion (χ =6.11, $p<0.05$). There was no statistically significant correlation between head position preference and entropion occurrence.

Conclusions: This study firstly demonstrates the correlation between sleep position preference and the risk of developing an involutional ectropion.

Keywords: Involutional ectropion; Involutional entropion; Sleep position; Unilateral ectropion

INTRODUCTION

The relationship between sleeping position and the risk of various diseases is well known. Most subjects, specifically adults, favor sleeping while lying in a lateral position rather than supine [1,2]. Remaining on one side for prolonged periods may increase the potential for developing different pathologies related to changes in mechanical pressure, relative hypoxia and stretching of the tissues. Indeed, recently, there is evidence indicating that the link between sleeping position and morbidity may be much more extensive, affecting many systems in the body. Several papers have shown a correlation between different morbidities and sleeping postures [3-7].

Sleep position of the head has been associated with several ophthalmic pathologies; primarily the floppy eyelid syndrome (FES), the dry eye and meibomian gland dysfunction, keratoconus, and primary open-angle glaucoma may also be related [6-9]. Various mechanisms have been suggested, among them that prolonged mechanical pressure causes hypoxia and therefore continual and cumulative damage to the tissues [10].

Involutional entropion and ectropion occur commonly in the elderly population and can cause substantial damage to the ocular surface and in severe cases permanent damage to the eye and sight [11]. The pathogenesis of both diseases includes increased horizontal lid laxity, age-related atrophy of the orbital fat and relaxation of ligamentous support [12-14]. Several risk factors are known to be related to the development of involutional entropion and ectropion. Until now, sleeping position, notably of the head, has not been identified as a risk factor for entropion or ectropion. Since the laxity of the eyelid is the pathophysiological basis for ectropion and entropion, a

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correlation between those conditions and their development seems logical [15]. The hypothesis of the study is that prolonged sleeping on one side increases the risk for the development of involutional ectropion or entropion.

METHODS

A single-center, cross-sectional, retrospective, noninterventional, single-masked, non-randomized study based on the medical records of surgical procedures conducted at Soroka University Medical Center, Beer-Sheva, Israel. The study was conducted according to the principles of the Declaration of Helsinki, and an Institutional Review Board approval was obtained.

The data regarding all the patients who underwent repair of involutional ectropion or entropion between 2004 and 2017 from all causes were collected. The data collection period was between January 2018 to the end of March 2018.

The information included race, ethnicity, date of birth, age, sex, history of other ophthalmic diseases and operations, history of systemic diseases, and the use of eye drops and medications.

All the patients included in the study answered a telephone questionnaire regarding their sleep position and preference. The questionnaire was aimed to determine their sleep quality, head position, and side preference while asleep. Specifically, patients were asked to rate the quality of their sleep, to evaluate the number of hours they sleep every night, and to report how many times they awoke in a single night. In addition, the patients were required to determine, when feasible, whether they kept a single sleep posture (right, left, back, face-up, alternating sides, or without specific preference) and if a factor existed that limited their choice of a specific side, such as an orthopedic pain or paralysis on a specific side. The questionnaire is as follows:

Questionnaire:

How many hours do you sleep during a typical night?

How would you describe the quality of your sleep?

How many times do you wake up in a given night?

Do you have a preferred sleep position?

What is your most common sleep position?

If you don't have a common sleep position, assuming you should choose one - what would you choose?

Is there any difficulty limits your sleeping position such as orthopedic issues etc.?

Do you use a pillow?

If you use a pillow, is it soft or hard?

Are you have difficulties falling asleep?

Inclusion criteria included patients who had lower lid unilateral involutional ectropion or entropion repair at the age of 60 or older and (were)able to answer a telephone questionnaire (not cognitive impairment or have died). Exclusion criteria included non-involutional ectropion or entropion, age less than 60, or both eyes affected. The electronic records of all the patients participate in this were queried for cognitive impaired diagnoses such as Alzheimer's disease.

Questionnaire was performed by a medical student (H.H.) who was masked to the laterality of the affected eyelid of the patients. Data were collected and organized using Microsoft Word and Excel. IBM SPSS version 22.0 was used to analyze the data.

RESULTS

Of the 104 patients that met the inclusion criteria, 39 were cognitively able to participate in the phone questionnaire.

Thirty-three patients reported a specific side preference while asleep (right or left). Six patients did not have a specific side preference or slept on their back. Due to the small number of patients in this group, it was decided to eliminate them from the survey. The remaining 33 patients were divided with specific sleep side preference and included in a two by 2 table. Twenty patients were concordant (correlated with the research hypothesis) and thirteen patients were non-concordant.

An analysis of the head sleep position (Table 1) showed that 60.6% slept on their right side while 39.4% slept on their left side. Lower eyelid ectropion or entropion on the right side was 63.6%, and with left side was 36.4%. The age mean and standard deviation for the non-concordant group was 81.37 ± 5.87 and with the concordance group 75.88 ± 7.97. All patients were over 60 years old.

Table 1: Concordance analysis for either ectropion or entropion.

		Side sleeping	
		Right	**Left**
Ocular damaged side	Right	14 (42.4%)	7 (21.2%)
	Left	6 (18.2%)	6 (18.2%)

Note: Kappa: 0.16, Approximate significance: 0.35; Chi-Square: 0.89, p-value>0.05; Kappa coefficient was originally designed to assess the level of agreement between two raters which is supposed to account for cases in which agreement might occur by chance.
Complete agreement is K=1 while complete disagreement except for chance agreement is K=0.

The combined group of ectropion and entropion did not demonstrate a significant correlation between head position during sleep and the development of one eyelid positional pathology. Therefore, we divided the data from Table 1 into two categories: ectropion and entropion. Table 2 demonstrates the results of patients who had a unilateral ectropion. Using chi-square analysis, the p-value of right side sleep and right ectropion was $p<0.05$ and relative significance was 0.01. Table 3 shows the results of patients who had entropion only. Using chi-square analysis, there was no significant association between entropion and sleeping side preference. No significant impact of BMI, OSA and FES were found correlated to the research results.

Table 2: Concordance analysis – ectropion (16 diagnoses).

		Side sleeping	
		Right	Left
Ocular damaged side	Right	8 (50%)	2 (12.5%)
	Left	1 (6.2%)	5 (31.2%)

Note: Kappa: 0.61, Approximate significance: 0.01; Chi-Square:6.11, p-value<0.05 (small sampleàfisher exact test)

Ocular comorbidity was shown to have no specific impact on the survey. For instance, cataract in the concordance group was 23.5% compared with 26.1% in the non-concordance group (p<0.01).

Table 3: Concordance analysis – entropion (17 diagnoses).

Ocular damaged side	**Side sleeping**	
	Right	**Left**
Right	6 (35.3%)	5 (29.4%)
Left	5 (29.4%)	1 (5.9%)

Note: Kappa: -0.29, Approximate significance: 0.24; Chi-Square: 1.41, p-value>0.05 (small sampleàFisher's exact test)

DISCUSSION

In this study, we demonstrate a significant positive correlation between the laterality of unilateral right lower lid involutional ectropion and the preferred sleep position. Two different but complementarily theories may account for an association between a sleep position and eyelid malposition.

Tissue hypoxia may play a role in the development of eyelid malposition. During sleep time, transient and relative tissue hypoxia could develop due to direct pressure exerted on the eyelid [16]. Damasceno et al. examined the histopathologic features of involutional ectropion and entropion and found that the main histopathologic findings were a significant loss of elastic fibers, and the residual elastic fibers revealed an abnormal ultrastructure. Immunohistochemistry demonstrated a significant overexpression of MMP-2, MMP-7, and MMP-9 [17]. These findings could indicate evidence for chronic and prolonged hypoxia [18].

The association between FES and prone sleep position was reported widely in the literature and found to be highly significant in different reports [8,19]. Also, the prevalence of obstructive sleep apnea (OSA) among patients with FES was found to be as high as 85%. [20]. This strengthens the assumption that the damage to the eyelid in FES occurs during sleep time. The significant histopathologic findings in FES demonstrated by Schlotzer-Schrehardt are a significant decrease in the amount of elastin, and an abnormal ultrastructure with a diminished elastin core revealed in the residual elastic fibers. Interestingly, immunohistochemistry demonstrated an increased immunoreactivity for elastolytic proteases, particularly MMP-7 and MMP-9 similar to the findings of Damasceno et al. in involutional ectropion [18,21,22].

The primary pathology of both involutional ectropion and FES is lid laxity [15]. Figueira et al. also found that healthy patients without eyelid pathology demonstrate a correlation between the side on which they historically or customarily sleep and the laxity of the ipsilateral upper eyelid [19]. Beis has proposed that FES is an extreme situation of lid laxity. Our results could potentially broaden the already known relationship regarding sleep position and FES [15]. The difference we have found in the correlation between the preferred sleep side and the morbidity between the two groups may stems from the fact that hypoxia is more dominant in the pathophysiology of ectropion than entropion.

The association between sleep position and unilateral primary open-angle glaucoma or unilateral normal-tension glaucoma has been established in numerous studies [7,23,24]. The correlation that has been demonstrated in these studies was opposite to that demonstrated in our study – the preserved or less involved side was the patients' preferred sleep side. The explanation suggested by the authors was that due to gravity, the preferred sleep side receives more blood supply compared with the opposite side. These findings consisted with other reports of a possible association between OSA and transient hypotension, and thus hypoperfusion, which can lead to the development of open-angle glaucoma or normal-tension glaucoma [23].

Another possible theory to explain the association between preferred sleep position and the development of unilateral ectropion is the mechanical pressure theory. Similar to the pathogenesis of mechanical ectropion [25], the constant mechanical pressure exerted on the eyelid during the sleep time can produce prolonged micro-trauma to the eyelid, and eventually, change in shape and features of the eyelid. Alevi et al. found a correlation between preferable sleep side and the development of dry eye syndrome and meibomian gland disorder [6]. They propose that during sleep time the eyelid everts, resulting in continuous rubbing between the eye surface and the pillow. This rubbing causes constant microtrauma to the ocular surface and worsening of the dry eye symptoms. A similar explanation also describes the pathogenesis of FES [8]. Thus, these studies support the hypothesized mechanical pathogenesis: the position of the head, when lying on a given side, may cause the outward turning of the eyelid and, in the long run, the possible development of ectropion. Therefore, it seems logical to offer patients at risk (eg those who have undergone ectopic surgery) to use a belt that will limit their sleep position that may reduce the chance to develop ectropion [26]. Although entropion and ectropion are commonly referred to as different expressions of the same pathophysiology, the difference we found between the correlation with the preferred sleep side and morbidity, may suggest a difference in pathophysiology, as may suggest the difference in the incidence of disease between genders suggests [11].

This study has several limitations. First, the small sample size was analyzed. Ectropion and entropion are diseases of the older population. Thus, in a retrospective study, a high number of potential patients had passed away before they could be

interviewed. Also, a considerable proportion of our patients were found to suffer from cognitive impairment, blocking their participation in the study. Another limitation is that this is a subjective study based on questionnaires. Even though a self-assessment questionnaire is not the golden standard for assessment of the sleeping position, it is widely used and is an acceptable and useful method [2,3,6,27,28]. Another issue is the retrospective nature of the study, which has its own limitations, including relying on patient recall.

CONCLUSION

Our study firstly demonstrates the association between sleep position preference and the risk of developing an ectropion. This evidence is supported by other studies indicating a possible link between sleep position and ocular and periocular diseases. Further studies are needed to examine this association and its possible pathophysiology.

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