



Prevalence of Dry Eye in Korean Adults who have and have not Undergone Refractive Surgery: The Korea National Health and Nutrition Examination Survey (KNHANES), 2010-2011

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Purpose: To determine the adjusted prevalence of dry eye using a dry eye questionnaire in a general Korean population comprising individuals who have and have not undergone refractive surgery (RS and NRS groups, respectively). **Methods:** This population-based cross-sectional study evaluated 6,003 adults (age 20–49 years) who participated in the fifth Korea National Health and Nutrition Examination Survey (2010–2011). Clinically diagnosed dry eye disease (DED) and subjective dry eye symptoms were assessed using questionnaires. Participants were investigated for education level, thyroid disease, stress status, history of other eye surgeries, sleep duration, and hypercholesterolemia as risk factors for DED. Data were then analyzed to determine the prevalence of DED and subjective dry eye symptoms after adjusting for DED-related risk factors. **Results:** In the RS and NRS groups, the prevalence of DED was 23.21% and 6.72%, respectively (adjusted $p < 0.05$), and the prevalence of subjective dry eye symptoms was 31.71% and 12.68%, respectively (adjusted $p < 0.05$) after controlling for DED-related factors. In the NRS group, the adjusted prevalence of DED was 2.97% in men and 10.78% in women. In the RS group, the adjusted prevalence of DED was 18.90% in men and 25.56% in women. In particular, the adjusted prevalence of subjective dry eye symptoms for men aged 20–29 years was significantly different between the RS (34.72%) and NRS (8.96%) groups. **Conclusions:** The prevalence of DED, as assessed using a dry eye questionnaire, among Koreans was higher in the RS group than in the NRS group. For young men, dry eye symptoms were more prominent in the RS group than in the NRS group.

Key words: Dry eye disease, Refractive surgery, LASIK

INTRODUCTION

Dry eye is a growing public health problem,^[1] which is a multifactorial disease of the tear ducts and ocular surface, which is accompanied by increased osmolality of the tear film and inflammation of the ocular surface.^[2] The prevalence of dry eye disease (DED) among middle-aged and elderly persons ranges from 7–34%,^[3] and dry eye syndrome is currently one of the most common ophthalmic diseases.^[4]

Furthermore, DED results in severe discomfort, mild ocular irritation, fatigue, visual disturbance, photophobia, and tear film instability, which can potentially damage the ocular surface.^[2,5-6] DED can also affect a person's daily activi-

ties, including the ability to drive a car,^[7] and decrease their productivity at work.^[8] Therefore, DED is a serious health problem,^[6] and it can place a significant financial burden on the health care system.^[9,10]

The risk factors for DED are old age, female sex, smoking, contact lens wear, systemic medications, video display use, and a history of ocular surgery.^[3,7,11-14] In particular, individuals who have undergone refractive surgery are more likely to experience dry eye, than those who have not undergone eye surgery.^[11] Refractive surgery is a common procedure for correcting refractive error, and >1 million patients undergo the laser in situ keratomileusis (LASIK) procedure in the United States each year.^[15] However, DED is one of the most common complications after LASIK.^[15]

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Although previous studies have reported the incidence of DED among patients who underwent LASIK surgery, there is limited literature regarding the prevalence of DED in the general population. Therefore, in the present study of a representative sample of Korean adults, we attempted to determine the adjusted prevalence of DED and subjective dry eye symptoms using a dry eye questionnaire among individuals who have and have not undergone refractive surgery.

SUBJECTS AND METHODS

1. Study population

The Korean National Health and Nutrition Examination Survey (KNHANES) is a nationwide population-based cross-sectional health examination and survey conducted regularly by the Korea Centers for Disease Control and Prevention under the Ministry of Health and Welfare. Participants in the survey undergo a health interview; health examinations, including ophthalmologic examinations, i.e., visual acuity testing, auto refraction, and slit-lamp examinations; and a nutrition survey. The ophthalmologic survey aims to determine the vision status and prevalence of common eye diseases in the Korean population. A stratified, multistage probability sampling design is used for the selection of household units that participate in the survey, which ensures that each year's survey results represent the entire general population of South Korea.

In 2010–2011, ophthalmologic interviews specifically addressed dry eye, to evaluate its risk factors. The present cross-sectional study evaluated 6,003 participants (age 20–49 years) in the 2010–2011 KNHANES. We excluded participants aged ≥ 50 years, because it is unlikely that they would have undergone refractive surgery, given its relatively novel nature. This study adhered to the tenets of the Declaration of Helsinki, and ethical approval was obtained from the institutional review board of the Korea Centers for Disease Control and Prevention. Written informed consent was obtained from each participant.

2. Questionnaire

DED was defined as dry eye diagnosed by a physician who referred to a dry eye questionnaire used in previous studies.^[11,16] A questionnaire related to DED was distributed, which comprised the following questions: (1) “Have

you ever been diagnosed with DED by a physician?” (Participants were asked the aforementioned question with an emphasis on “by a physician.”) and (2) “Do your eyes tend to be dry, have a foreign body sensation with itching, and a burning or sandy feeling?” Participants were also asked to assess subjective dry eye symptoms. These questions could be answered as “yes” or “no”. Participants who “did not know” were excluded from the analysis. A previous study reported that clinically diagnosed DED is associated with older age, female sex, a high education level, thyroid disease, extreme stress, and a history of eye surgery among the Korean population.^[11] In addition, sleep duration and hypercholesterolemia affects the subjective symptoms of DED.^[11] Therefore, we adjusted for these variables to evaluate the prevalence of DED post-refractive surgery.

Education levels were classified as elementary school, middle school, high school, or university or higher. Thyroid disease was categorized as present or absent. Participants' stress status was classified as not stressed, moderately stressed, or extremely stressed. A history of eye surgery included all other ocular surgeries, except refractive surgery. Sleep duration was classified as <6 h/day, 6–8 h/day, or >8 h/day. Hypercholesterolemia was classified as present or absent.^[11]

3. Statistical analysis

The prevalence of DED was expressed as percentage of the study population with 95% confidence intervals (CI). Participants were classified as having undergone refractive surgery (RS group) or not having undergone refractive surgery (NRS group), and the prevalence of DED were calculated for each group. We also performed sub-analyses according to age groups (20–29 years, 30–39 years, and 40–49 years) and sex. The prevalence of DED was also calculated after adjusting for a high education level, the presence of thyroid disease, extreme stress, and a history of eye surgery. For the prevalence of subjective dry eye symptoms, we also adjusted for sleep duration and the presence of hypercholesterolemia. Participants who answered “I do not know” were excluded from the analysis. In addition, all missing responses for each question were excluded from the statistical analysis. As the KNHANES is weighted to compensate for the complex sampling design and to allow for approximation of the Korean population, we performed weighted analyses using SAS software (version 9.3; SAS Institute, Cary, NC, USA). The SAS tool PROC SUR-

VEYFREQ was used to estimate the prevalence rates and 95% CI between the RS and NRS groups, and between the 20–29-year-old and 40–49-year-old groups. The SURVEYREG procedure performs regression analysis for survey data. For adjusted prevalence,^[17,18] a multivariate model using the SURVEYREG procedure was fitted to control for variables that were shown to be independently associated with dry eye (i.e., the education level, thyroid disease, stress status, and history of other eye surgeries). A p -value <0.05 was considered statistically significant.

RESULTS AND DISCUSSIONS

This study included 6,003 participants (2,556 men and 3,447 women) aged 20–49 years. Table 1 shows the distributions according to age, sex, education level, the presence of thyroid disease, stress status, sleep duration, and the presence of hypercholesterolemia. Three hundred and sixty-five participants had undergone refractive surgery, and 481 and 799 participants reported having clinically diagnosed DED or subjective dry eye symptoms, respectively.

1. Prevalence of clinically diagnosed DED

Table 2 presents the prevalence of clinically diagnosed DED using a dry eye questionnaire according to age and sex. There was a significant difference in the prevalence of clinically diagnosed DED in the RS (24.80%) and NRS groups (6.69%) (adjusted $p = 0.001$). In the subanalyses according to sex, the prevalence of clinically diagnosed DED was higher among men in the RS group (20.19%) than among men in the NRS group (3.04%) (adjusted $p = 0.002$), and among women in the RS group (26.71%) than among women in the NRS group (10.71%) (adjusted $p = 0.001$).

The difference in the trends of prevalence of DED between the RS and NRS groups remained after adjusting for the risk factors of DED. Table 3 shows the prevalence of clinically diagnosed DED using a dry eye questionnaire according to age and sex after adjusting for the education level, thyroid disease, stress status, and history of other eye surgeries. The overall prevalence of clinically diagnosed DED, after adjusting for these risk factors, was 3.5-fold higher in the RS group than in the NRS group (adjusted $p = 0.001$). Among men, the prevalence of clinically diagnosed DED were 18.90% in the RS group and

Table 1. Characteristics of the study population

	n	Weighted % (SE)
Age, years		
20–29	1345	29.4 (1.1)
30–39	2286	34.5 (1.0)
40–49	2272	36.1 (0.9)
Gender		
Male	2556	51.4 (0.6)
Female	3447	48.6 (0.6)
Education level		
Elementary or lower	115	2.5 (0.3)
Middle school	256	5.1 (0.4)
High school	2510	45.9 (1.0)
University or higher	2993	46.5 (1.0)
Thyroid disease		
Yes	191	2.6 (0.2)
No	5683	97.4 (0.2)
Stress status		
Least stressful	502	8.4 (0.8)
Moderately stressful	3538	60.4 (0.8)
Extremely stressful	1849	31.2 (0.4)
Sleep duration		
6–8 h/day	4939	83.2 (0.6)
<6 h/day	509	9.2 (0.5)
>8 h/day	440	7.6 (0.4)
Hypercholesterolemia		
Yes	391	6.8 (0.4)
No	5167	93.2 (0.4)
Refractive surgery		
Yes	365	5.2 (0.4)
No	5263	94.8 (0.4)
Clinically diagnosed dry eye disease		
Yes	481	7.7 (0.4)
No	5122	92.3 (0.4)
Symptoms of dry eye		
Yes	799	18.9 (0.8)
No	4515	86.1 (0.8)

SE: standard error

2.97% in the NRS group (adjusted $p = 0.003$). Among women in the RS and NRS groups, the prevalence rates were 25.56% and 10.78%, respectively (adjusted $p = 0.001$). In the

Table 2. Prevalence of clinically diagnosed dry eye disease using a dry eye questionnaire according to age and sex in the refractive and non-refractive surgery groups

<i>Male</i>			
	RS	NRS	P value
Age, y	% (95% CI)	% (95% CI)	
20-29	21.35 (2.69-40.01)	2.58 (1.01-4.14)	0.150
30-39	18.99 (4.85-33.12)	3.13 (1.76-4.48)	0.088
40-49	20.31 (3.56-44.12)	3.32 (2.09-4.55)	0.487
*P value	0.945	0.436	
Total	20.19 (9.33-31.06)	3.04 (2.19-3.88)	0.002
<i>Female</i>			
	RS	NRS	P value
Age, y	% (95% CI)	% (95% CI)	
20-29	22.45 (13.33-31.57)	12.41 (9.28-15.53)	0.131
30-39	27.50 (18.68-36.31)	10.11 (7.71-12.51)	0.001
40-49	34.72 (17.93-51.50)	9.99 (7.96-12.02)	0.014
*P value	0.190	0.212	
Total	26.71 (20.60-32.82)	10.71 (9.23-12.19)	0.001
<i>Total</i>			
	RS	NRS	P value
Age, y	% (95% CI)	% (95% CI)	
20-29	22.11 (13.47-30.74)	7.14 (5.36-8.92)	0.003
30-39	25.13 (17.61-32.66)	6.44 (4.99-7.88)	0.001
40-49	30.74 (16.30-45.18)	6.57 (5.37-7.77)	0.004
*P value	0.302	0.610	
Total subjects	24.80 (19.24-30.36)	6.69 (5.81-7.56)	0.001

Prevalence is expressed as an estimated percentage with 95% confidence interval (CI).

RS: refractive surgery group, NRS: non-refractive surgery group. P values were calculated using SAS PROC SURVEYREG between refractive surgery and non-refractive surgery groups. *P values were calculated using SAS PROC SURVEYREG between 20-29-year-old and 40-49-year-old groups.

sub-analyses according to age groups, the adjusted prevalence of DED for men according to a history of RS was not significantly different. Although men aged 20-29 years in the RS group had a higher prevalence of DED than NRS, as shown in Tables 2 and 3, there was no significant difference between the two groups. The wide confidence interval in men than in women or total participants may affect these results. However, for women, a significant difference was found in the 30-39-year-old and 40-49-year-old groups (RS: 27.59% and NRS: 10.34%; RS:

Table 3. Adjusted prevalence of clinically diagnosed dry eye disease using a dry eye questionnaire according to age and sex in the refractive and non-refractive surgery groups

<i>Male</i>			
	RS	NRS	Adj-P value
Age, y	% (95% CI)	% (95% CI)	
20-29	21.41 (3.18-39.65)	2.39 (1.13-4.25)	0.136
30-39	18.59 (4.43-32.76)	2.83 (1.52-4.13)	0.092
40-49	11.63 (5.16-28.43)	3.32 (2.10-39.65)	0.994
*P value	0.429	0.499	
Total	18.90 (8.34-29.46)	2.97 (2.12-3.80)	0.003
<i>Female</i>			
	RS	NRS	Adj-P value
Age, y	% (95% CI)	% (95% CI)	
20-29	19.59 (11.56-27.61)	12.9 (9.76-16.03)	0.393
30-39	27.59 (18.51-36.67)	10.34 (7.86-12.83)	0.001
40-49	33.89 (17.71-50.07)	9.56 (7.39-11.73)	0.012
*P value	0.109	0.095	
Total	25.56 (19.55-31.58)	10.78 (9.28-12.26)	0.001
<i>Total</i>			
	RS	NRS	Adj-P value
Age, y	% (95% CI)	% (95% CI)	
20-29	19.76 (11.61-27.91)	7.46 (5.70-9.21)	0.013
30-39	24.70 (17.02-32.38)	6.51 (5.01-8.02)	0.001
40-49	27.55 (13.92-41.18)	6.33 (5.10-7.56)	0.007
*P value	0.333	0.302	
Total subjects	23.21 (17.72-28.70)	6.72 (5.83-7.60)	0.001

Prevalence adjusted for education level, thyroid disease, stress status, and history of other eye surgery is expressed as an estimated percentage with 95% confidence interval (CI).

RS: refractive surgery group, NRS: non-refractive surgery. Adj-P values were calculated using SAS PROC SURVEYREG between refractive surgery and non-refractive surgery groups. Adj-P value <0.05 was considered to be statistically significant. *P values were calculated using SAS PROC SURVEYREG between 20-29-year-old and 40-49-year-old groups.

33.89% and NRS: 9.56%, respectively).

2. Prevalence of subjective dry eye symptoms

As shown in Table 4, 32.68% of participants in the RS group had symptoms of dry eye according to a dry eye questionnaire, whereas 12.71% of participants in the NRS group (adjusted p = 0.001). Among men, the prevalence of dry eye symptoms in the RS and NRS groups were 28.64%

Table 4. Prevalence of subjective dry eye symptoms using a dry eye questionnaire according to age and sex in the refractive and non-refractive surgery groups

Male	RS		NRS		P value
	Age, y	% (95% CI)	Age, y	% (95% CI)	
	20-29	35.49 (16.78-54.20)	8.66 (5.97-11.35)		0.019
	30-39	20.17 (7.09-33.24)	9.24 (6.82-11.65)		0.318
	40-49	33.68 (18.34-75.72)	8.51 (6.16-10.85)		0.720
	*P value	0.940	0.926		
	Total	28.64 (17.10-40.17)	8.80 (7.16-10.45)		0.001
Female					
Female	RS		NRS		P value
	Age, y	% (95% CI)	Age, y	% (95% CI)	
	20-29	30.74 (19.05-42.43)	19.78 (15.95-23.61)		0.236
	30-39	33.72 (25.24-42.21)	16.34 (13.49-19.20)		0.001
	40-49	44.90 (25.75-64.05)	15.57 (12.65-42.43)		0.010
	*P value	0.215	0.047		
	Total	34.36 (27.57-41.15)	17.02 (14.86-19.17)		0.001
Total					
Total	RS		NRS		P value
	Age, y	% (95% CI)	Age, y	% (95% CI)	
	20-29	32.28 (22.60-41.96)	13.80 (11.24-16.36)		0.001
	30-39	29.98 (22.67-37.29)	12.63 (10.58-14.69)		0.001
	40-49	41.96 (24.47-59.44)	11.93 (9.85-14.01)		0.003
	*P value	0.342	0.208		
	Total subjects	32.68 (26.82-38.55)	12.71 (11.18-14.25)		0.001

Prevalence is expressed as an estimated percentage with 95% confidence interval (CI).

RS: refractive surgery group, NRS: non-refractive surgery group. P values were calculated using SAS PROC SURVEYREG between refractive surgery and non-refractive surgery groups. *P values were calculated using SAS PROC SURVEYREG between 20-29-year-old and 40-49-year-old groups.

and 8.80%, respectively (adjusted $p = 0.001$). Among women, the prevalence of dry eye symptoms in the RS and NRS groups were 34.36% and 17.02% (adjusted $p = 0.001$), respectively. The difference in the prevalence of dry eye symptoms between the RS and NRS groups was more prominent for men aged 20–29 years (35.49% vs. 8.66%; adjusted $p = 0.019$).

Table 5 shows the prevalence of dry eye symptoms using a dry eye questionnaire according to age and sex after adjusting for dry eye-related risk factors (e.g., educa-

Table 5. Adjusted prevalence of subjective dry eye symptoms using a dry eye questionnaire according to age and sex in the refractive and non-refractive surgery groups

Male	RS		NRS		Adj-P value
	Age, y	% (95% CI)	Age, y	% (95% CI)	
	20-29	34.72 (15.47-53.97)	8.96 (6.14-11.79)		0.032
	30-39	19.10 (5.86-32.34)	8.09 (5.72-10.46)		0.322
	40-49	38.29 (16.99-86.56)	8.53 (6.10-10.96)		0.592
	*P value	0.889	0.808		
	Total	28.12 (16.36-39.88)	8.51 (6.89-10.13)		0.001
Female					
Female	RS		NRS		Adj-P value
	Age, y	% (95% CI)	Age, y	% (95% CI)	
	20-29	28.37 (16.52-40.22)	19.79 (16.06-23.52)		0.528
	30-39	34.5 (25.82-43.18)	16.53 (13.58-19.49)		0.001
	40-49	45.11 (25.75-64.46)	15.66 (12.61-18.71)		0.010
	*P value	0.145	0.074		
	Total	33.76 (26.83-40.68)	17.15 (15.07-19.23)		0.001
Total					
Total	RS		NRS		Adj-P value
	Age, y	% (95% CI)	Age, y	% (95% CI)	
	20-29	29.98 (20.32-39.64)	14.00 (11.49-16.52)		0.006
	30-39	29.75 (22.21-37.29)	12.30 (10.19-14.42)		0.001
	40-49	42.76 (24.50-61.02)	11.98 (9.93-14.04)		0.003
	*P value	0.222	0.185		
	Total subjects	31.71 (25.62-37.80)	12.68 (11.18-14.18)		0.001

Prevalence adjusted for education level, thyroid disease, stress status, history of other eye surgery, sleep duration, and hypercholesterolemia is expressed as an estimated percentage with 95% confidence interval (CI).

RS: refractive surgery group, NRS: non-refractive surgery group. Adj-P values were calculated using SAS PROC SURVEYREG between refractive surgery and non-refractive surgery groups. Adj-P value <0.05 was considered to be statistically significant. *P values were calculated using SAS PROC SURVEYREG between 20-29-year-old and 40-49-year-old groups.

tion level, presence of thyroid disease, stress status, history of other eye surgeries, sleep duration, and the presence of hypercholesterolemia). The adjusted prevalence of dry eye symptoms was 31.71% in the RS group and 12.68% in the NRS group. A significant difference in the adjusted prevalence of dry eye symptoms was observed for 20–29-year-old men in the RS and NRS groups (34.72% vs. 8.96%; adjusted $p = 0.011$). No significant difference in the preva-

lence of dry eye symptoms was observed for 20–29-year-old women in the RS and NRS groups. However, significant differences in the prevalence of dry eye symptoms were observed between 30–39-year-old and 40–49 year-old women in the RS and NRS groups.

In the present population-based study, the prevalence of clinically diagnosed DED using a dry eye questionnaire after adjusting for the risk factors of DED was 3.5-fold higher in the RS group than in the NRS group among individuals aged 20–49 years (23.21% vs. 6.72%). In particular, the adjusted prevalence of subjective dry eye symptoms using a dry eye questionnaire among 20–29-year-old men in the RS group was 34.72%, which was remarkably higher than that in the corresponding NRS group (8.96%) or that among women (28.37%).

Dry eye has traditionally been considered an age-related dysfunction of the lacrimal gland.^[19] Jeon YW et al.^[20] investigated DED in Korean adults aged 19 years or older in 2012 and found a prevalence of 13.5%. In addition, the number of patients with DED visiting the hospital increased by 26.7% over 5 years from 2009 to 2013 in Korea.^[21] Young adults may undergo refractive surgery and subsequently experience normal age-related changes that may cause dry eye. Therefore, a previous study suggested that further research is needed to identify the risk factors for dry eye after refractive surgery.^[22] Furthermore, a 2001 survey of members of the American Society of Cataract and Refractive Surgeons found that the most common complication of LASIK was dry eye.^[13,23] Therefore, we need to carefully monitor DED after performing LASIK. Most studies have reported the prevalence and typical risk factors for DED, including age, sex, smoking, alcohol consumption, contact lens wear, systemic medications, video display use, and a history of ocular surgery.^[3,7,11–14] However, epidemiological studies have been performed in a variety of patient populations, and variations in the prevalence of dry eye and the risk factors are likely related to different subjective and objective criteria used to define dry eye. In the previous studies, the possible bias due to other risk factors for DED was not definitively excluded.^[3,7,11–14] The present study is the first to calculate the prevalence of DED post-refractive surgery after adjusting for the risk factors of DED and using epidemiological data.

Ocular surgeries such as cataract and refractive or ptosis surgery can result in dry eye.^[24–26] A previous Korean

population-based study^[11] reported that refractive surgery is related to a higher prevalence of DED (diagnosed DED group, odds ratio: 3.4 [2.4–4.8]; DED symptoms group, odds ratio: 2.6 [2.0–3.5]). DED is a primary reason for patient dissatisfaction after LASIK surgery,^[5] and Shoja and Besharati^[27] reported that 20% of LASIK-treated eyes were diagnosed with chronic dry eye persisting for ≥ 6 months after LASIK. LASIK is a common procedure for correcting refractive error, and numerous LASIK procedures are performed annually. Unfortunately, patients often experience dryness, irritation, and soreness after LASIK, and LASIK has been reported to perturb the ocular surface, reduce tear production, destabilize the tear film, and decrease corneal sensitivity.^[5] Therefore, it is likely that the increase in the number of these procedures will significantly increase the prevalence of DED due to surgery.^[19] Donnenfeld ED *et al.*^[25] evaluated patients who underwent LASIK using a microkeratome with 160- μm -thick flaps and compared the effect of hinge position on corneal sensation. They found a significant reduction in corneal sensation after LASIK and it persisted at 6 months. In the conventional LASIK patients, decreased corneal sensation can lead to dry eye. In addition, they reported that the loss of dry eye symptoms was greater in eyes with a superior-hinge flap than in eyes with a nasal-hinge flap. Hence, instruments and skills related to refractive surgery are being developed to prevent corneal nerve injury. A previous study evaluated the use of a femtosecond laser for flap creation, and the authors found that the incidence of dry eye symptoms and signs was significantly lower in the laser group.^[27]

Dry eye causes ocular discomfort, fatigue, and visual disturbance, which affect quality of life by decreasing a person's ability to read, use a computer, and drive.^[7] Furthermore, the chronic and unremitting nature of dry eye syndrome can lead to despair, depression, decreased productivity, and permanent job disability in some cases.^[8,28] In a study by Miljanovic et al.^[29] patients with DED were approximately 3-fold more likely to report difficulty performing common activities (after controlling for age, diabetes, hypertension, and other factors), compared to patients without dry eye symptoms. Therefore, the authors suggested that these results emphasize the fact that dry eye symptoms is a significant public health problem that deserves attention in the clinic.^[29] Paulsen et al.^[30] have also reported that individuals with DED had lower scores

in health-related quality of life. Furthermore, van der Vaart et al.^[28] have recently described a statistically significant association between DED and depression or anxiety in their large single-center population-based study. Moreover, Na et al.^[16] have reported that Korean women with a DED diagnosis have a higher likelihood of experiencing severe psychological stress, depressive mood, anxiety/depression, and a history of psychological counseling. Therefore, DED negatively affects individuals' physical and mental functioning, and increasingly severe DED symptoms can also affect their perceptions of health, physical function, social function, and role/emotional perception.^[2] Patel *et al.*^[9] have compared work productivity loss between patients with mild-to-moderate and severe DED symptoms, and suggested that DED severity was correlated with reduction in work productivity. Furthermore, dry eye can increase the economic burden that these patients bear.^[16]

The current study had several limitations. First, data regarding DED did not evaluate the objective tests for dry eye. Second, given the cross-sectional design, we could not determine whether participants had dry eye symptoms before they had undergone refractive surgery. Third, we did not consider the severity of dry eye symptoms and other potential causes of dry eye such as contact lens or medication use. Fourth, we were unable to categorize participants according to the type of refractive surgery that they underwent, and the time between refractive surgery and the evaluation of dry eye symptoms. Nevertheless, this is the first study to evaluate the prevalence of DED, after controlling for risk factors, among patients who did and did not undergo refractive surgery in a large population-based study.

CONCLUSIONS

In summary, after adjusting for risk factors of DED, patients who underwent refractive surgery had a higher prevalence of DED according to a dry eye questionnaire than those who did not undergo refractive surgery. Among men, the adjusted prevalence of dry eye was 21.41% (20–29 years), 18.59% (30–39 years), and 11.63% (40–49 years). Therefore, additional studies are needed to identify methods to reduce the prevalence of DED after refractive surgery. Furthermore, when planning for refractive surgery, it may be appropriate to consider the patient's risk factors for

DED, in order to improve patient satisfaction.

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한국 성인에서 굴절교정수술에 따른 건성안의 유병률 조사: 국민건강영양조사 2010-2011

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목적: 한국 성인에서 안구건조 설문지를 이용하여 굴절교정수술을 받은 경우와 그렇지 않은 경우에 발생한 건성안의 유병률을 조사하고자 하였다. **방법:** 본 인구기반 단면연구는 제5기 국민건강영양조사(2010-2011)를 완료한 20-49세의 6,003명을 대상으로 하였다. 건성안으로 진단을 받은 경우와 안구건조 자각증상에 대해 질문하였다. 모든 대상자들은 건성안의 관련인자로 교육정도, 갑상선질환, 스트레스 정도, 기타 안구수술, 일일 수면시간, 그리고 고콜레스테롤 혈중에 대해 조사되었다. 건성안 관련인자들을 모두 보정한 후에, 건성안 유병률과 안구건조 증상에 대해 분석하였다. **결과:** 굴절교정수술을 받은 그룹과 그렇지 않은 그룹에서 건성안 관련인자를 보정한 후에 건성안 유병률은 각각 23.21%와 6.72%였고(adjusted $p < 0.05$), 안구건조 자각증상은 각각 31.71%와 12.68% 였다(adjusted $p < 0.05$). 굴절교정수술을 받지 않은 그룹에서 건성안 유병률은 남자에게서 2.97%, 여자에게서 10.78%였다. 굴절교정수술을 받은 그룹에서 건성안 유병률은 남자가 18.90% 여자가 25.56%였다. 특히, 20대 남자에게서 굴절교정수술을 받은 그룹에서 안구건조 증상은 34.72%로 수술을 받지 않은 그룹의 8.96% 보다 높은 유병률을 보였다. **결론:** 한국 성인에서 굴절교정수술을 받은 그룹에서 건성안 유병률은 그렇지 않은 그룹보다 높았다. 젊은 남자에게서 안구건조 증상은 굴절교정수술을 받은 그룹에서 수술을 받지 않은 그룹보다 크게 높았다.

주제어: 건성안, 굴절교정수술, 라식