

SMOKING – TRIGGER AND AGRAVATING FACTOR IN DRY EYE DISEASE

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Abstract: The purpose of the study is to analyse the relationship between smoking and dry eye syndrome. The instrumentation consists of the Ocular Surface Disease Index (OSDI) questionnaire, based on 12 questions related to subjective ocular signs and symptoms that appeared during the different activities of daily life, qualitative tests like Schirmer I (without anesthesia) and for assessing the quality of tears the T-BUT and the tears pH was performed. In the study 75 subjects were included with ages between 20-45 years old, smokers and non-smokers, healthy persons with no medication, with no ophthalmic surgery in the last 6 months and not contact lens wearers. Results show the presence of dry eye symptoms more advanced in smokers compared to non-smokers.

INTRODUCTION

Dry eye disease is one of the most common ocular comorbidities and may overlap with other causes of ocular surface disease, such as ocular allergy and meibomian gland dysfunction.(1,2) Dry eye syndrome is a multifactorial disease whose outcome is malfunctioning of the tear film due to insufficient tear production or increased tear film evaporation, with potential damage to the ocular surface.

Prevalence of dry eye syndrome increases with age; studies show a prevalence between 5-30% of the adult population.(3) Dry eye is associated with many risk factors such as environment, lifestyle, age, sex, drug history, and systemic diseases, among which the lifestyle factors may play an important role. Smoking is already known as an important risk factor for many chronic diseases and however is still an unclear risk factor of dry eye.

Smoking represents a major health problem in worldwide and it is the cause of many disease like cardiovascular, respiratory, tobacco-alcoholic amblyopia, dry eye syndrome.(4)

The definition of dry eye was suggested according to tear break-up time (T-BUT) and Schirmer score. Smoking was found to decrease T-BUT in some of the studies.(5) Sayin *et al* found the decreasing of Schirmer score in smokers.(6)

Ocular surface is exposed to chronic oxidative stress: UV radiation, oxygen action in the air, exchange of oxygen pressure during blinking, the action of various environmental factors.

Furthermore, smoking affects the ocular surface homeostasis and is a risk factor that intervenes in the tear film stability by damaging lipid layer.(7,8)

AIM

The purpose of the study was to determine the quality of the tear film and the possible risk of dry eye syndrome in smokers compared to non-smokers.

MATERIALS AND METHODS

In the study, 150 eyes, 75 subjects were included, aged ages between 20-45 years old, smokers and non-smokers, healthy persons with no medication, no ophthalmic surgery in the last 6 months, not contact lens wearers.

Subjective symptoms were evaluated with OSDI questionnaires, qualitative tests like Schirmer I (without anesthesia) and for assessing the quality of tears the T-BUT and the tears pH was performed.

For the Schirmer I test we used the standard test paper strip, inserted in the bottom of the conjunctival sac, without anesthesia; after 5 minutes it was removed and the wet length of the strips was read, the results being noted in millimeters. Normal values of Schirmer I measurements are > 15 mm/5 minutes.

Tear break time (T-BUT) - a drop of fluorescein 0,5% it's applied in of the lower conjunctival fornix. The patient is asked to blink several times and the interval between the last blink and the appearance of the first black spots on the cornea is measured. A normal T-BUT >10 seconds, values <10 sec are considered abnormal and indicate tear film instability.

For the tear pH, we used pH strips of paper inserted into the conjunctival sac and left to soak with tears, then the colour obtained was compared with the colour of the test scale. We noted two groups for tear pH, one with a pH between <7.2-8> and one with PH > 8, associated with eye film instability and the possible occurrence of dry eye syndrome.

RESULTS

Of the 75 patients, the greatest percent, almost 55%, is represented by persons aged between 20 and 30 years old, followed by the age between 31-40 years old with 32 % (figure no. 1).

From all the patients, we found a higher percentage of dry eyes in women, respectively 48 women representing 64% of the total patients and 27 of patients were man (figure no. 2).

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CLINICAL ASPECTS

Figure no. 1. Distribution of patients by age

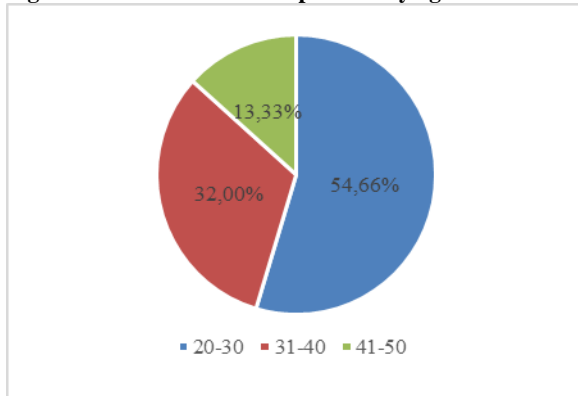
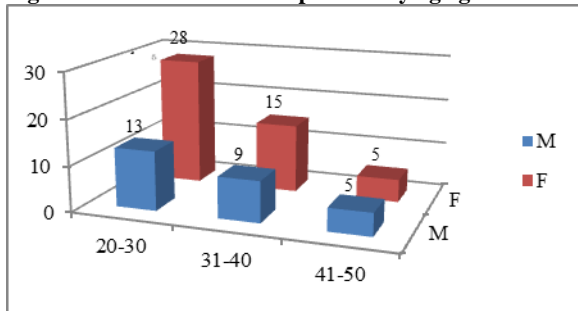


Figure no. 2. Distribution of patients by age/gender



36 of the patients were smokers and 39 were non-smokers (table no. 1).

Table no. 1. Distribution of patients by age/ gender/ smokers/ non-smokers

AGE	MAN - SMO KER	MAN- NON- SMO KER	WOMA N SMO KERS	WOMA N- NON- SMO KE RS	TOT AL
20-30	7	6	11	17	41
31-40	4	5	8	7	24
41-50	4	1	2	3	10
TOTAL	15	12	21	27	75

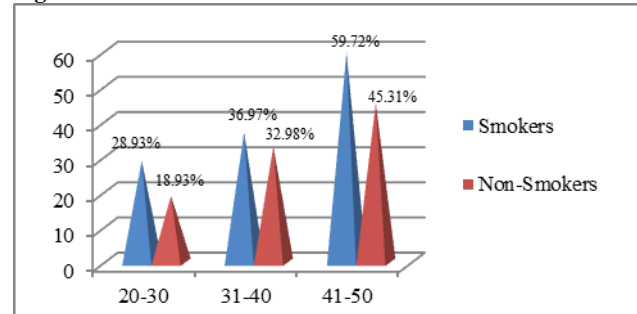
OSDI scores were: OSDI A 5.77 ± 3.11 , OSDI B 5.57 ± 2.49 , OSDI C 3.6 ± 2.37 , OSDI D 14.96 ± 7.53 , OSDI score was 31.13 with a standard deviation of 15.67 (table no. 2). This score corresponds to a mild to moderate dry eye syndrome.

Table no. 2. OSDI scores

	OSDI A	OSDI B	OSDI C	OSDI D	score OSDI
Mean	5.77	5.57	3.6	14.96	31.13
Standard Error	0.35	0.28	0.27	0.86	1.81
Standard Deviation	3.11	2.49	2.37	7.53	15.67
Minimum	0	1	1	2	4.16
Maximum	17	15	10	42	87.5
Sum	433	418	270	1122	2335.41
Count	75	75	75	75	75
Confidence Level (95.0%)	0.716251	0.575102	0.545517	1.733117671	13.607610709

We can see in the graph below (figure no. 3) a higher percentage of the total OSDI score in smokers compared to non-smokers and the highest percentage of the OSDI score is represented by persons in the age group of 41-50 years, respectively 59.72%.

Figure no. 3. OSDI scores in smokers/non-smokers



Schirmer I test is more affected in smokers than non-smokers. The most affected are smokers aged 41-50 years, in which the Schirmer I test is ≤ 5 mm/5 min. We did not find a big difference between right eye and left eye (figure no. 4, figure no. 5).

Figure no. 4. Right eye - Schirmer I test in smokers/ non-smokers

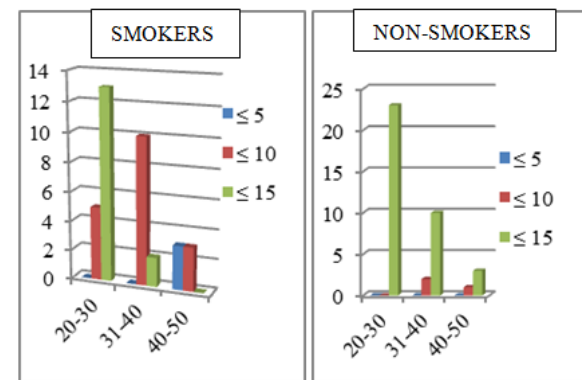
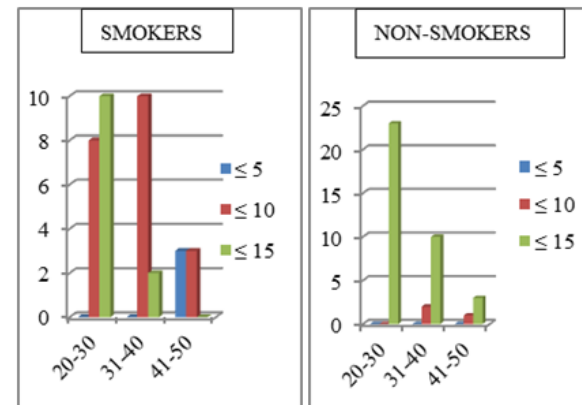


Figure no. 5. Left eye - Schirmer I test in smokers/ non-smokers



Regarding the tear break up time (T-BUT), we can observe that smokers from age group 41-50 years are the most affected (table no. 3), where the T-BUT is less than 5 seconds. The next age group affected is the one between 31-40 years, also smokers being more affected than non-smokers (table no. 4).

Table no. 3. T-BUT in smokers

T-BUT (sec)	5	%	10	%	15	%	Total
20-30	0	3	3.75	15	18.75	18	
31-40	0	9	11.25	3	3.75	12	
41-50	4	3.75	3	3.75	0	6	
Total	4	3.75	14	18.75	18	22.5	36

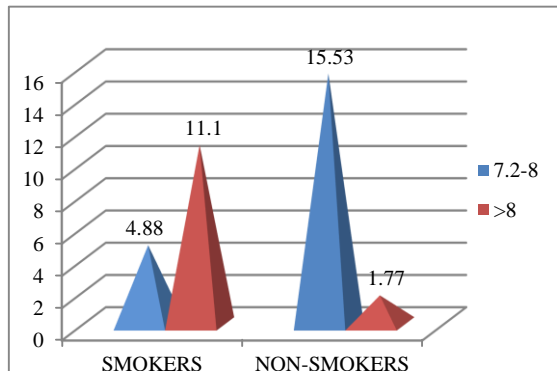
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Table no. 4. T-BUT in non-smokers

T-BUT (sec)	5	%	10	%	15	%	Total
20-30		0	2	2.5	21	26.25	23
31-40		0	3	3.75	9	11.25	12
41-50	1	1.25	1	1.25	2	2.5	4
Total	1	1.25	6	7.5	32	40	39

From the chart below (figure no.6) we can see that smokers have a higher tear pH (> 8) compared to non-smokers, where the pH values in most patients are between <7.2-8>. Values above 8 are found in people with dry eye syndrome.

Figure no. 6. Tear PH in smokers/non-smokers



DISCUSSIONS

Dry eye is one of the most frequent ophthalmic disease, causing complaints of burning, itching, or even dryness.

Cigarette smoke is one of the factors that cause a dysfunctional tear film, resulting in dry eye. In this study, we have shown that smoking has statistically significant negative effects on the tear film and ocular surface.(9)

Frei B. et al. (10) - the effect of lipid peroxidation of the outer layer of the precorneal tear film is one of the most probable cause of tear film breakdown that leads to dry eye symptoms.

Pryor WA (11) - smokers also have higher levels of lipid peroxidation than non-smokers. Cigarette smoke also causes a change in the tear protein patterns of smokers compared with non-smokers.

Grus FH et al. (9) - observed more severe changes in tear proteins in smokers than non-smokers.

Yoon KC et al. (12) - deterioration of ocular surface was related to amount of smoking, which was noted also in our study.

Matsumoto et al. (13) - reported that chronic smoking induced distinctive quantitative and qualitative disturbances of the ocular surface health.

Kjaergard et al (14) - reported a higher degree of ocular irritation among tobacco workers who came in contact with a high concentration of the substance.

In our study - obtained results confirmed and emphasized the fact that chronic smoking does have adverse effects on the tear film and the ocular surface, that gets worse as you increase the duration of smoking years.

CONCLUSIONS

Smoking causes tear film instability, and leads to high values of OSDI score, decreased Schirmer I, T-BUT and increased dry eye symptoms. The results demonstrated that the tear pH of smokers was significantly higher than of non-smokers and tear pH testing should be considered as a tool in evaluating dry eye patients and may be a helpful aide in treatment.

Although smoking cessation programmes focus on cardiovascular and respiratory problems, tear film dysfunction

cause ocular discomfort and affect the quality of life of patients.

The current study brings more evidence for the negative effects of smoking.

In order to control this global health issue, there is a dire need to increase knowledge and provide support and motivation towards cessation of tobacco use.

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