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**Ibragimova S. N.****THE IMPACT OF WORKING CONDITIONS ON THE OCCURRENCE OF CONJUNCTIVAL AND CORNEAL DISEASES IN MODERN OIL INDUSTRY**

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*The problem of the development of eye diseases in people employed in hazardous industries, including the oil industry, remains relevant in Azerbaijan, as the health protection of the working population is a priority. This paper presents the results of a study on the impact of the severity of working conditions in the modern oil industry of Azerbaijan on the occurrence of conjunctival and cornea diseases. The objective of the study is to assess the working environment at the enterprises of oil and gas production profile of the State Oil Company of the Azerbaijan Republic (SOCAR) in terms of their impact on the occurrence of eye diseases. In total, 1852 employees from 13 SOCAR enterprises, who are willing to voluntarily participate in the study, were selected by random systematic sampling. The research was conducted in 2018-2019. According to the obtained data, 55.5% of workplaces in the enterprises belong to class A (optimal working conditions). However, in such industries as "Oil Rocks" and "Siyazan Oil", on average, 30% of workplaces belong to a high hazard class C. Conjunctival and corneal pathologies were detected in 33% of all workers during the study. There was a statistically significant difference in the character of the conjunctival and corneal diseases, depending on the severity of working conditions. The percentage of occurrence of dry eye syndrome was significant in all conditions of labour severity and ranged from 65 to 79%. The majority of participants employed in the production group of "Class C – heavy working conditions" had a high incidence of conjunctivitis of various aetiologies (18%). To reduce the occurrence of conjunctival and corneal diseases, it is recommended to adhere to preventive measures for employees working in difficult working environment.*

Key words: diseases of the conjunctiva and cornea, oil industry, Azerbaijan.

**Introduction**

Given the predominance of the working population in the overall structure of the population, WHO pays much attention to the health of the working population and associates the solution of all problems directly to the improvement of working environment [1]. According to the scientific literature, in the structure of the pathology of the eye diseases in oil industry workers, conjunctival and cornea diseases had the highest frequency rate in recent years [2, 3]. Moreover, the course of disease can be complicated by the developing dry eye syndrome (DES) resulting from irreversible damage of pre-corneal film stability [4, 5]. It is known that the disturbance of pre-corneal film stability is caused by the decreased tear fluid secretion and the disturbance of corneal and conjunctival epithelial membrane integrity [6]. The novelty of this study is a comprehensive approach covering all types of industries in the modern oil sector.

The purpose of this research was to study the impact of the severity of working environment in the modern oil industry on the occurrence of conjunctival and cornea diseases.

**Material and methods**

Organizations and subdivisions of the oil and gas production profile of the State Oil Company of the Republic of Azerbaijan (SOCAR) have been selected as the object of scientific analysis and study. In total, 1852 employees from 13 SOCAR enterprises, who are willing to voluntarily participate in the study, were selected by random systematic sampling. The research was conducted in 2018-2019. The criteria for inclusion in the cross-sectional study were the following: being an employee of the enterprises of SOCAR, regardless of

age, length of service and severity of work. The severity of labour was assessed according to the HESME ("Health, Environment and Social Capital Management in Enterprises") principle [5, 7] and there were identified three groups: "class A" – optimal conditions, "class B" – acceptable conditions and "class C" – harmful working conditions. The distribution of employees by age showed that highest proportion (52.0%) was made up by the individuals aged 46 to 59 years. The mean age of workers was 48 years (min=19; max=67; median Me=50; moda Mo=56).

A general clinical study on assessment of the ophthalmological status of workers employed in the modern oil industry was conducted at the workplace using a mobile clinic operating under Academician Zarifa Aliyeva National Centre for Ophthalmology (NCO) provided by the NCO. The following methods of complex ophthalmological examination were used: to diagnose dry eye syndrome, we used Schirmer's test (evaluation of total tear production); the assessment of corneal and conjunctival epithelium changes using dyes was performed to determine the time of tear film rupture and dry foci on the cornea. Appropriate laboratory tests were used to differentiate conjunctivitis.

Studied diagnoses classified according to ICD-10 by nosological group of ophthalmic pathologies "Conjunctival and corneal diseases": dry eye syndrome (DES) (H04.1), blepharoconjunctivitis (H01.0), chronic blepharoconjunctivitis (H01.0), bacterial conjunctivitis (H10), viral conjunctivitis (Herpes zoster) (H.22.0 (B00.5), allergic conjunctivitis (H10.8), electrophthalmia (H18.8), cornea opacification (H17), keratoconus (H18.6), Arcus senilis (H.13.0).

Data analysis was carried out using the variance

of generally accepted methods of variation statistics technique, with the calculation of the exact criterion  $\chi^2$  (Fisher's criterion) to identify significant differences between categorical groups. For many indicators, minimum and maximum values (min; max); median (Me); moda (Mo) were calculated [8]. The calculations were performed by using the MSO Excel package.

### Results and discussion

According to the manual [7], the working conditions of the employees in our study we identified 3 groups:

– Class A” – optimal conditions. This category does not harm to working ability and health of the employee. Industrial factors do not have a negative impact on working ability. In addition, it provides support for the necessary level of comfort for the worker; this category makes it possible to engage in work activities without harming the health and vitality of the employee. Industrial factors do not have a

negative impact on the individual's ability to work. Special attention is paid to maintaining the necessary level of comfort for the workers.

– Class B” – acceptable conditions mean the fact that the effect of harmful or hazardous substances does not go beyond existing standards, and that employees reach full recovery by the new shift;

–“Class C” – harmful conditions. The influence of negative industrial factors within the working environment, which lead to changes in the general condition of the worker's organism, is outside the norm. Worker needs longer recovery after shift. Changes in the functional state of the organism during work activities are possible, including disorders of the organ of vision.

The results of studied working conditions of each worker employed in modern oil production are presented in the Table 1.

**Table 1**  
Working conditions of employees in modern oil production

| Name of enterprises                                                | Total number | Hazard class (absolute number, %) |            |           |
|--------------------------------------------------------------------|--------------|-----------------------------------|------------|-----------|
|                                                                    |              | A                                 | B          | C         |
| Oil refinery named after H. Aliyev                                 | 375          | 89 (23.7)                         | 262 (69.9) | 24 (6.4)  |
| SOCAR head office                                                  | 264          | 195 (73.9)                        | 69 (26.1)  | 0         |
| Oil refinery "Azneft" "                                            | 254          | 141 (55.5)                        | 91 (35.8)  | 22 (8.7)  |
| "Oil Rocks"                                                        | 211          | 60 (28.4)                         | 120 (56.9) | 31 (14.7) |
| Gas production department "Absheron"                               | 193          | 134 (74.1)                        | 34 (17.6)  | 16 (8.3)  |
| Oil and gas production plant "Siyazan-neft"                        | 97           | 33 (34.0)                         | 34 (35.0)  | 30 (31.0) |
| Karadag gas processing plant                                       | 88           | 36 (40.9)                         | 25 (28.4)  | 27 (30.7) |
| Management of oil and gas production, named after N. Narimanov     | 82           | 79 (96.3)                         | 3 (3.7)    | 0         |
| Bibi-Heybat Department of Oil and Gas Production                   | 71           | 71 (100)                          | 0          | 0         |
| Management of oil and gas production, named after Amirov           | 69           | 60 (87.9)                         | 4 (5.8)    | 5 (7.3)   |
| Department of oil and gas production "28 <sup>th</sup> May"        | 52           | 25 (48.1)                         | 23 (44.2)  | 4 (7.7)   |
| Educational and Methodological Department of Certification "SOCAR" | 49           | 49 (100)                          | 0          | 0         |
| Production Association "Azneft"                                    | 47           | 47 (100)                          | 0          | 0         |
| TOTAL                                                              | 1852         | 1028 (55.5)                       | 665 (35.9) | 159 (8.6) |

As shown in Table 1, 55.5% of work places out of all enterprises belong to the production group of "Class A". However, there are differences in enterprises; thus, enterprises of the modern oil industry with good working conditions include departments (Bibi-Heybat, SOCAR head office, N. Narimanov oil and gas production department, "Azneft" production association and SOCAR educational and methodological certification department). On average, 30% of work places belong to the highly harmful group of "Class C" ("Oil Rocks" and Siyazan-Oil).

In general, pathologies of the conjunctiva and cornea were diagnosed in 33% of all studied workers in the modern oil industry. There were found 435 cases out of this nosology, the number of cases of lesions in both eyes was 423 (22.8% of all examined); in the right eye – 4 (0.2% of all examined) and in the left eye – 8 (0.4% of all examined).

The incidence of the conjunctival and corneal lesions in both eyes in the employees of modern oil industry, depending on the severity of production, is presented in Table 2.

Table 2 shows that the percentage of detected conjunctival and corneal diseases is significantly higher in workers from the production group of "Class C" (harmful working conditions) and makes  $37.1 \pm 1.7\%$  among all those employed in this group of production severity ( $P < 0.05$ ). The lowest statistically significant percentage ( $16.7 \pm 0.57\%$ ) of conjunctival and corneal diseases was observed among the employees whose working conditions were optimal. The character of the conjunctival and corneal diseases differed depending on the severity of working conditions. In the production group of "Class A" there were 118 cases (65% of workers in this group) of DES detected in both eyes. Allergic conjunctivitis was observed in 40 workers (22%). Chronic blepharoconjunctivitis was found in 7 people (4%), other diseases accounted for 1-2% of all workers in optimal working conditions ("Class A") (Figure 1).

Table 2  
The occurrence of the conjunctival and corneal diseases among workers of the modern oil industry by groups of severity of production

|       | Total number (N=1852) |      | Production severity groups |      |             |      |             |      |
|-------|-----------------------|------|----------------------------|------|-------------|------|-------------|------|
|       |                       |      | A (n=1028)                 |      | B (n=665)   |      | C (n=159)   |      |
|       | abs. Number           |      | abs. number                |      | abs. number |      | abs. number |      |
|       | %                     | ±    | %                          | ±    | %           | ±    | %           | ±    |
| OU    | 423                   |      | 167                        |      | 201         |      | 55          |      |
|       | 22.8                  | 2.72 | 16.2                       | 2.54 | 30.2        | 2.51 | 34.6        | 1.5  |
| OD    | 4                     |      | 2                          |      | 1           |      | 1           |      |
|       | 0.2                   | 0.01 | 50.0                       | 3.23 | 25.0        | 1.04 | 25.0        | 1.04 |
| OS    | 8                     |      | 3                          |      | 2           |      | 3           |      |
|       | 0.4                   | 0.01 | 37.5                       | 2.13 | 25.0        | 1.04 | 37.5        | 2.13 |
| Total | 435                   |      | 172                        |      | 204         |      | 59          |      |
|       | 33.2                  | 3.01 | 16.7                       | 0.57 | 30.7        | 2.69 | 37.1        | 1.7  |

Notes: \* - P < 0.05 data are statistically significant compared to group C;  
\*\* - P < 0.05 data are statistically significant compared to group B

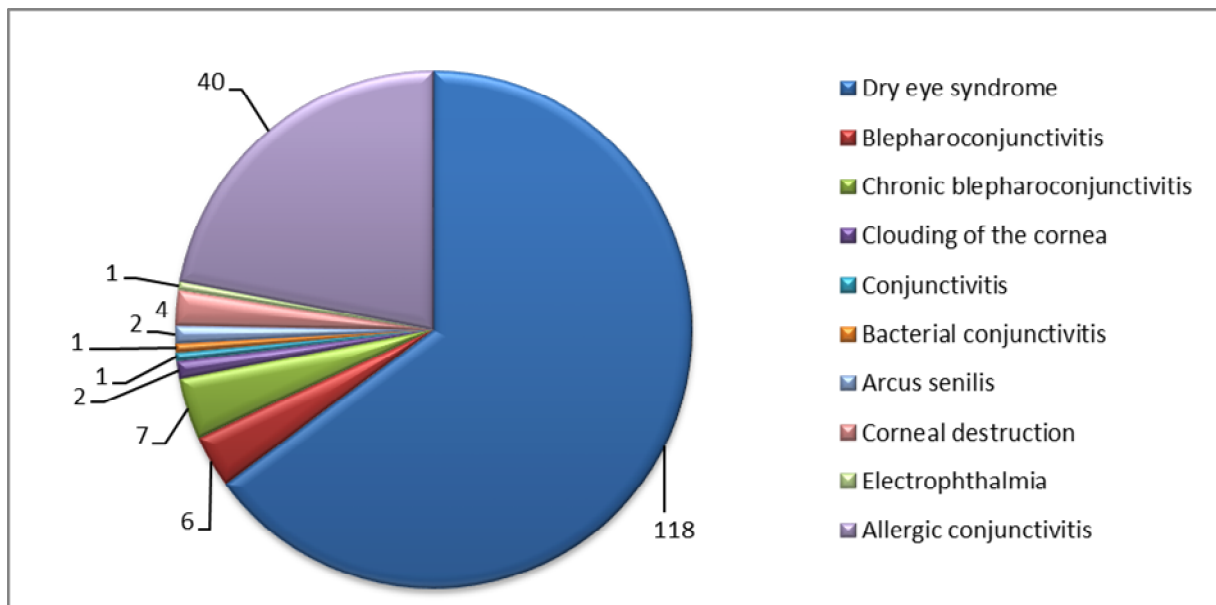


Fig. 1. Structure and nature of diseases of the conjunctiva and cornea in the production group of "Class A"

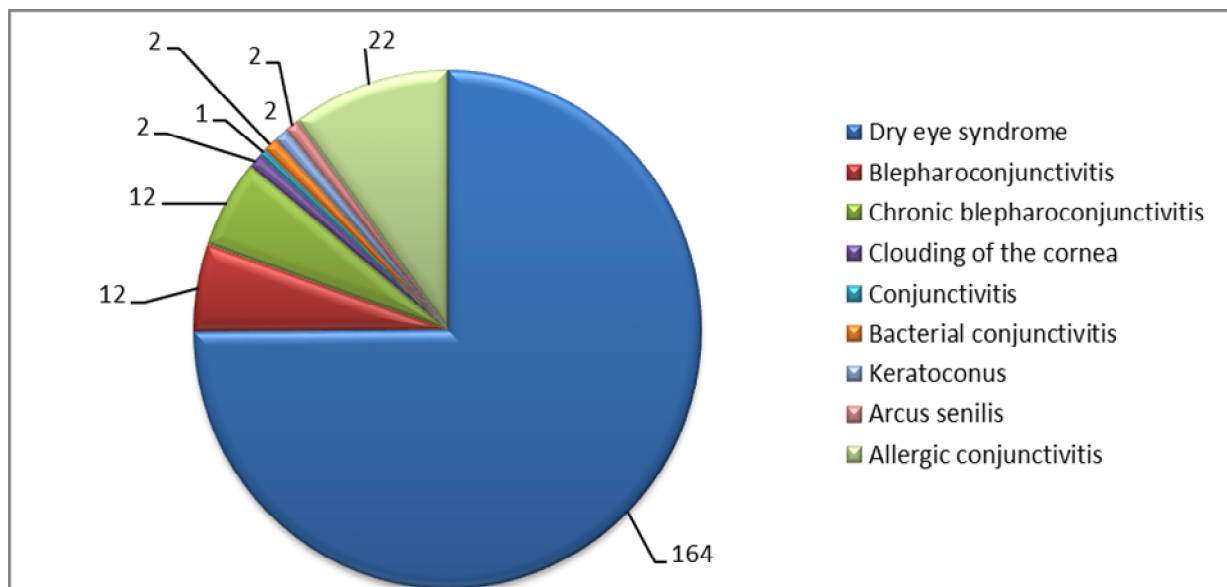


Fig. 2. Structure and nature of diseases of the conjunctiva and cornea in the production group of "Class B"

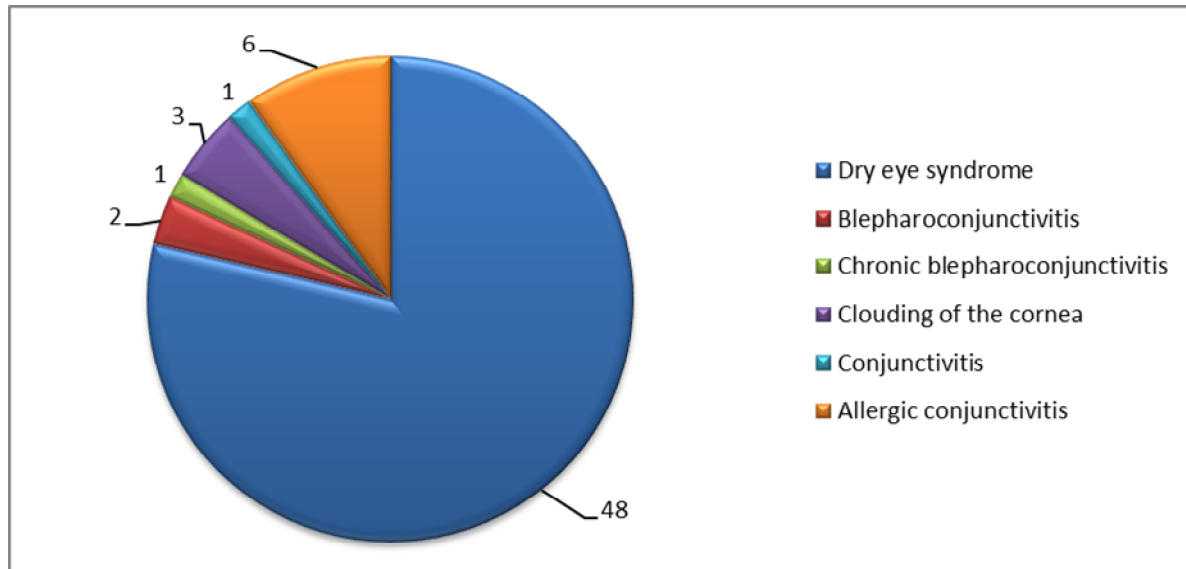


Fig. 3. Structure and nature of diseases of the conjunctiva and cornea in the production group of "Class C"

In the production group of "Class B", there were 164 cases (75% of workers in this group) of DES detected in both eyes. Allergic conjunctivitis was observed in 22 workers (10%). Blepharoconjunctivitis and chronic blepharoconjunctivitis each account for 12% of all employees in the production group of "Class B". Other diseases of this nosology achieved for 1-2% of all workers in acceptable working conditions ("Class B") (Figure 2).

In the production group of "Class C", 48 cases (79% of workers in this group) were diagnosed with DES for both eyes. Allergic conjunctivitis was observed in 6 workers (10%). Three people had clouding of the lens (5%). Conjunctivitis, including blepharoconjunctivitis, accounts for 1-2% of all workers in hazardous working conditions ("Class C") (Figure 3).

It should be noted that in the medical history of people having DES, there were no systemic diseases and long-term medication that could cause this syndrome.

Thus, our study has revealed a significant proportion of pathologies of the conjunctiva and cornea, which accounted for a third of all examined workers in the modern oil industry. Under all conditions of severity of labour, the percentage of occurrence of dry eye syndrome is also significant within 65-79%. The majority of examined employees in the production group of "Class C" (harmful conditions) had a high incidence of conjunctivitis of various aetiologies (18%). The adverse effect of harmful and dangerous working conditions on the eye has been proven earlier by many authors. [2, 9, 10]. In the oil and gas production we are studying, this can be an increase in the concentration of various chemicals in the air, and the impact of various types of radiation (thermal, ionizing, non-ionizing), the severity of labour, noise, vibration. Moreover, it has been

proven that difficult working conditions contribute not only to the occurrence of eye pathologies, but also to the aggravation of the course of already diagnosed eye diseases [6]. The results of our study confirmed the fact of the influence of severity conditions on the development of conjunctiva and cornea diseases. Our study has showed that 46.5% (861 people) of respondents have direct contact with harmful chemicals and oil while working. Moreover, 30.5% of respondents noted the presence of indirect contact with harmful substances. Of all surveyed employees, 23% reported no contact with harmful chemicals.

To reduce the occurrence of the conjunctival and corneal diseases, employees at the modern oil industry enterprises are recommended to strictly follow the preventive measures.

### Conclusion

1. According to the results of the study, 330 (75.9% of all examined individuals with eyelid, conjunctival and corneal pathology) employees of the modern oil industry enterprises were diagnosed with dry eye syndrome of varying severity.

2. In all production groups of labour severity, the percentage of dry eye syndrome occurrence was statistically high, reaching from 65 to 79%.

3. The frequency of conjunctivitis of various aetiologies was registered in the majority of participants (18%) in the production group of "Class C – difficult working conditions".

Prospects for further research may include the investigation of the influence of the severity of working conditions on the health of employees in the modern oil industry, with taking into consideration their length of service, age and ophthalmological status.

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## Реферат

ВПЛИВ УМОВ ПРАЦІ НА ЗАХВОРЮВАННЯ КОН'ЮНКТИВИ ТА РОГІВКИ В СУЧАСНІЙ НАФТОВІЙ ПРОМИСЛОВOSTІ  
Ібрагімова Сона Назим кизи

Ключові слова: захворювання кон'юнктиви та рогівки, нафтова промисловість, Азербайджан.

Проблема розвитку захворювань органу зору в осіб, зайнятих на шкідливих виробництвах, у тому числі в нафтовій галузі, залишається актуальною в Азербайджані, оскільки охорона здоров'я працездатного населення є пріоритетним завданням. Метою роботи було вивчення впливу тяжкості умов праці працівників, зайнятих у сучасній нафтовій промисловості Азербайджану, на виникнення у них захворювань кон'юнктиви та рогівки. Об'єкт та методи дослідження. Об'єктом спостереження та аналізу обрано організації та підрозділи нафтогазовидобувного профілю Державної нафтової компанії Азербайджанської Республіки. В дослідженні шляхом систематичної випадкової вибірки прийняли участь 1852 працівників з 13 підприємств Державної нафтової компанії Азербайджанської Республіки. Дослідження проводились в 2018-2019 роки. Результати та висновки. Згідно з отриманими даними, 55.5% робочих місць загалом на підприємствах належать до класу А (оптимальні умови праці). Проте, на таких виробництвах як «Нафтове каміння» і «Сіязань-нафта» загалом 30% робочих місць відносяться до високого класу небезпеки 3. Патологія кон'юнктиви та рогівки була виявлена у 33% усіх обстежених працівників сучасної нафтової промисловості. Встановлено статистично значущу відмінність у структурі та характері захворювань кон'юнктиви та рогівки залежно від тяжкості умов праці. Відсоток розвитку синдрому сухого ока був значним за всіх умов тяжкості праці, і коливався від 65 до 79%. У більшості обстежених працівників, зайнятих у виробничій групі класу 3 – важкі умови виробництва, зареєстрована висока частота кон'юнктивітів різної етіології (18%). Для зниження виникнення захворювань кон'юнктиви та рогівки працівникам, задіяним у важких умовах праці, рекомендовано дотримуватись профілактичних заходів.