Research Article

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Impact of Acute Emotional Stress on the Tear Quality of Students from a Medical School in Campina Grande: Paraíba Brazil

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Abstract

Background: Stress acts on the nervous system impairing lachrymal gland function. Thus, one can hypothesize that medical student under academic evaluation, with acute emotional stress, could suffer changes in tear quality, which was the purpose of this study.

Methods: The prospective, longitudinal, observational and analytic study was performed at Faculty of Medical Sciences-Campina Grande, Paraíba, Brazil. It was randomly recruited, 80 (5.8%) students, 42 (52.5%) women and 38 (47.5%) men, with ages ranging from 18 to 42 year-old (22.9 ± 4.9 years), median of 21.5 years. Exclusion criteria include all students who presented with any disease or condition that could affect the tear quality. The BUT was assessed before and after 35 days of academic examination. The continuous parameters were expressed by their mean ± standard deviation. Wilcoxon test was used for assessing difference between means. \( p \leq 0.05 \) was used for rejecting the null hypothesis. The research was approved by the Institutional Ethics Committee.

Results: Stress was present in all students immediately of taking academic evaluation; ranging as follows: mild-15 (18.7%); moderate-41 (51.3%), and severe 24 (30.0%) (How was this stress assessed to arrive at mild, moderate and severe). The mean BUT in the right eye was significantly higher after the 35-day interval (before 8.5 ± 3.1 seconds versus 9.6 ± 3.0 seconds - \( p = 0.0016 \)). Similarly, the mean BUT in the left eye was significantly higher after the 35-day interval (before 8.5 ± 3.1 seconds versus 9.4 ± 2.9 seconds - \( p = 0.0053 \).)

Conclusion: There was a decrease in the BUT immediately before academic evaluation. However, there was no correlation or association with the stressful parameters caused during this period with the BUT measurements, including emotional stress levels, night sleep time before academic examination. It was observed a tendency to return to BUT baseline parameters, later 45 days after knowledge of student performance in the academic examinations.

Keywords: Psychosomatic symptoms, Tear quality, Medical students, Academic evaluation, Tear breakup time

Introduction

Medical education is more intensive and longer compared to other courses, so it is not surprising that these students experience greater risks of anxiety and stress-related comorbidities [1-3]. However, it is not only health consequences that pose a problem, as there are also other health implications that may impact a young person's future, such as academic performance, and may be aggravated in the presence of tear film disorders [4,5].
Tear film stability is threatened when interactions between tear film stabilizing constituents are compromised by: decreased tear secretion; delayed clearance and alteration of film breakage. Eye surface inflammation is a secondary consequence of this dysfunction. Reflex tear secretion is seen as the initial compensatory mechanism, but over time, inflammation accompanying secretor dysfunction and decreased corneal sensitivity eventually compromises the reflex response and results in greater tear film instability. Disruption of the tear function unit plays an important role in ocular surface lubrication [6].

Several tests are used to evaluate the quantity, quality and function of the various layers of tear film. The availability and cost of these tests may restrict their use in studies, but there is simple tests such as Schirmer's, break up time (BUT) testing, easy to perform, commonly used in clinical practice [7,8].

The purpose of the study was to evaluate the relationship between acute emotional stresses and tear quality, using as a target sample, medical students from the Faculty of Medical Sciences in the city of Campina Grande-PB, Brazil.

**Methods**

The prospective, observational and analytical study was performed at the Faculty of Medical Sciences - UNIFACISA University Center.

Medical students who underwent individual institutional performance evaluation were included. All students diagnosed with a tear quality affecting disease or conditions were excluded from the study.

Students enrolled in the investigation were advised in advance of the research to be carried out. They received explanations about the investigation and signed the free and informed consent form. They were approached randomly in the corridors of UNIFACISA test rooms' minutes before the institutional evaluation was performed, when they were presented to the project and invited to participate in the study. They were also asked about a known allergy to 1% sodium fluorescein to exclude study participation if they were.

Students who agreed to be included in the survey answered the dry eye questionnaire, with a brief history including questions about personal history, previous eye treatment, such as contact lens wear, eye drops, previous eye treatment or surgery, treatment. with laser; presence of systemic diseases such as: systemic arterial hypertension, diabetes mellitus, rheumatoid arthritis, lupus, Sjogren's syndrome, or other connective tissue disorders, cognitive or behavioral disorders, medication use, and hormonal changes systemic habits, lifestyle (alcohol and smoking), hours of sleep and use of stimulant substances the night before the assessment, as well as subjective questions about the level of preparation for the test and the level of stress, if they were.

The continuous parameters were expressed by their mean ± standard deviation. Wilcoxon test was used for assessing difference between means. Linear correlation Pearson test was used for assessing relationship between two quantitative parameters. $P \leq 0.05$ was used for rejecting the null hypothesis. The research was approved by the Institutional Ethics Committee.

**Results**

Eighty from a total of 1,380 (5.8%) students were randomly recruited for the investigation. Forty-two (52.5%) women and 38 (47.5%) men, with ages ranging from 18 to 42-year-old (22.9 ± 4.9 years), a median of 21.5 years. A weak negative correlation was observed between increasing age and decreasing break-up time (BUT). Right eye ($r = -0.16$) and left eye ($r = -0.14$) (Table 1).

| Table 1: Baseline characteristics of the study participants. |

|                     | n   | %               |
|---------------------|-----|-----------------|
| Women/men           | 42/38 | 52,2%/47,5%    |
| Ophthalmic diseases | 11  | 13,7%           |
| Others diseases     | 14  | 17,5%           |
| Alcohol use/ tabagism | 35/2 | 43,75%/0,025% |
| First/ second/ third/fourth year of medicine | 25/21/11/23 | 31,3%/26,3%/13, 7%/28,8% |

All students who presented with any disease or condition that could affect the tear quality were excluded.

Twenty-five (31.3%) students were in the first year, 21 (26.3%) were in the second year, 11 (13.7%) were in the third year and 23 (28.8%) were in the fourth year.

Most academics, 66 (82.5%) did not report having any disease. However, six (7.5%) college students reported...
having psychiatric illness, four (5%) reported having hormonal changes, one student reported dysfunction of the central nervous system, another student reported hormonal change and asthma / rhinitis, and another student reported having hemoglobinopathy.

The majority, 69 (86.3%) students reported having no ophthalmic disease past history. However, eight (10.0%) reported using eye lubricant. Eye allergy, eye hypertension and toxoplasmosis were reported by one student respectively.

Forty-four (55.0%) students did not report habits that could interfere with the amount or quality of the tear. However, 34 (42.5%) students made social use of alcohol, and two other students reported: one smoking and the other smoking and alcoholism.

Most students 53 (66.3%) considered themselves prepared to take the test while 27 (33.7%) did not consider themselves prepared for the test. However, this variable was not correlated with BUT before the tests in both eyes ($r \leq 0.2$).

Stress was present in all students at the moment immediately before the academic evaluation, being: mild in 15 (18.7%); moderate intensity in 41 (51.3%) and 24 (30%) high intensity. However, there was no strong correlation between stress level and right and left eye BUT ($r = -0.1343$ - right eye and $r = -0.1261$ - left eye).

The use of stimulant substances was made, on the eve of the test, by 22 (27.5%) students. However, no correlation was observed between stimulant use and BUT in both eyes ($r \leq 0.2$).

The average hour of sleep the night before the academic assessment was 5.1 ± 1.8 hours, ranging from zero to nine hours. The median was five hours. Correlation between sleep time and BUT values prior to academic examination in both eyes was weak ($r \leq 0.2$).

The mean BUT in the right eye was significantly higher after the 35-day interval (before 8.5 ± 3.1 seconds versus 9.6 ± 3.0 seconds - $p = 0.0016$ - Wilcoxon test). Similarly, the mean BUT in the left eye was significantly higher after the 35-day interval (before 8.5 ± 3.1 seconds versus 9.4 ± 2.9 seconds - $p = 0.0053$ - Wilcoxon test).

**Discussion**

Tear quality analysis has been studied under several conditions, among them, acute stress can influence the physiology of this secretion [1,2]. However, studies in this direction still leave undefined the causal relationship and the impact of the emotional state on the inadequate production of ocular surface lubrication.

Thus, the investigation of the stress impact on tear quality in the academic performance is relevant. Additionally, this phenomenon may interfere with the academic performance at the time of taking examinations.

In this study it was observed an increase, in seconds, of breakup time (BUT) after overcoming the stressful event (academic evaluation of the various disciplines of the medical course). Normal BUT can be considered when longer than 10 seconds [6], which is one of the tests to assess the quality of tears and dry eye. Poor tear quality is one of the criteria for classification of dry eye syndrome, and this multifactorial tear and eye surface disease results in symptoms such as discomfort, disturbance and instability of the tear film with potential damage to the ocular surface [6,8].

The severity of dry eye symptoms in young people impact more depressive symptoms compared to other psychosomatic symptoms [9,10], leading to further enhance the verification of BUT and to reflect on the relevance of eye diseases in the health of the individual as a whole, in special medical students under emotional stress.

A high prevalence of dry eye disease has been observed in paramedics, as well as symptomatic dry eye among medical students. Psychological stress was associated with higher risk of dry eye syndrome in both target groups [11]. As health professionals were the target population for research on acute stress, it was expected that stress had been negatively related to BUT, however, although lower BUT was observed in the pre-evaluation, the correlation analysis between sleep time and stress level that preceded the application of academic performance was not strong ($r \leq 0.2$), thus not having clear correlation between the studied variables.

The lack of correlation between sleep time and BUT alteration may have been induced by insufficient information on sleep time by the students involved in the research, since there is a definite association between sleep quality, mood state and characteristics of the ocular surface in patients with dry eye syndrome and by analogy with tear quality [12].
The increase in intraocular pressure observed in university students in Spain was explained by stress due to acute emotion caused by academic examination [13]. Another explanation for this phenomenon could be the induction of the increase of this pressure through the excitation of the limbic system, the amygdala and the hippocampus as a cerebral mediator, initiating the cascade of the ocular response in the form of increased intraocular pressure, placing it as a trigger factor or increasing adaptation [14]. Similarly, as adaptive phenomenon, it was found in the current study that there was a change (significant decrease in BUT) in the academic pre-assessment when compared with this variable after knowledge of the performance of the tests (significant increase). This was the most relevant finding - the tendency to return to baseline (BUT) values, which is an additional argument for the relationship between acute emotion and the change in the tear quality [10].

The relationship between dry eye symptoms and their quantitative and qualitative tear parameters with stressors such as anxiety and depression has shown a significant correlation between these disorders and the negative impact on tear quality and quantity, which can be ameliorated the control of neurovegetative alterations [15,16], an explanation that may support the findings found in the present study.

The research findings regarding emotional stress interfering with the performance of medical students during the evaluation may convey for possible anti-stress measures, which will benefit the mental status and therefore improving tear quality and student performance in academic assessments.

Study limitations

We hypothesized that some variables may represent limitations to the study, such as: the subjective tool used for stress assessment as well as the lack of data reliability by the undergraduate participants enrolled in the investigation. The scale used for stress assessment in the present study was of the analogical type, consisting of a psychometric response, which is capable of measuring subjective characteristics. A scale often used to quantify pain in medical care. However, it is a simple scale, easy to interpret and quick to fill, and was therefore chosen for this study. But, it cannot constitute itself as a quantitative instrument or express itself as a continuous quantitative variable, rather as semi-quantitative.

There may also have been inadequate completion of the questionnaires by the students who focused on the tool they were fulfilling, and they may not have given the importance to the questions and thus filled them out without proper concentration or even responded with unreliable data in their haste to proceed to the academic assessment.

Conclusion

There was a decrease in BUT before academic evaluation. However, there was no correlation or association with the stressful parameters caused during this period. Also it was observed a tendency to return to baseline parameters of BUT after student performance knowledge. This scientific information is of great relevance for the psychological support for the medical students before taking academic evaluation.

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