

# Visual symptoms and convergence insufficiency in university teachers

## *Sintomas visuais e insuficiência de convergência em docentes universitários*

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### ABSTRACT

**Objective:** To investigate the prevalence of visual discomfort and convergence failure in professors. **Methods:** A cross-sectional study was done, consisting of 60 teachers of both sexes, of the Centro Universitário FAG, which used the Convergence Insufficiency Symptom Survey, validated for the Brazilian population. **Results:** Of those surveyed 55.0% are female. 48.3% respondents spend less than two hours a day reading, with 40.0% of respondents said they do 30-minute breaks for one hour during reading and 63.3% said they spend between 2-5 hours a day in front of the computer. With regard to research on diseases of the visual system, 25.0% reported having myopia, with 55.0% of individuals use these glasses and 41.7% use it frequently. The research of the prevalence of convergence insufficiency, gave an average of 12.4(1.8) %. **Conclusion:** It was found that most respondents presented with visual discomfort and small percentages were affected by CI.

**Keywords:** Visual acuity; Ocular motility disorders; Vision disorders; Vision, binocular

### RESUMO

**Objetivo:** Investigar a prevalência de desconforto visual e insuficiência de convergência (IC) em docentes universitários. **Métodos:** Tratar-se de um estudo transversal, com 60 docentes de ambos os sexos, tendo sido utilizado o questionário Convergence Insufficiency Symptom Survey, validado para a população brasileira. **Resultados:** Dos docentes entrevistados 55,0% eram do sexo feminino. 48,3% responderam dedicar menos que duas horas por dia à leitura, sendo que 40,0% dos entrevistados disseram que fazem pausas de 30 minutos à uma hora durante a leitura e 63,3% afirmaram passar entre 2 a 5 horas por dia em frente ao computador. Em relação à investigação sobre as doenças do sistema visual, 25,0% relataram apresentar miopia, sendo que 55,0% dos indivíduos usam óculos e destes 41,7% o usam com frequência. Quanto à investigação da prevalência de insuficiência de convergência, obteve-se frequência de (1,8) %. **Conclusão:** Constatou-se que a maioria dos entrevistados se apresentou com desconforto visual e uma pequena porcentagem foram acometidos pela IC.

**Descritores:** Acuidade visual; Transtornos da motilidade ocular; Transtornos da visão; Visão binocular

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## INTRODUCTION

The biological visual systems have a feature called visual attention, which allows us to extract the best information from the environment, besides having the ability to decrease the amount of information caught. <sup>(1,2)</sup> Performance, processing of visual attention, and school learning can be affected by visual attention problems. <sup>(3)</sup>

Among the basic processes of interaction with the environment, we can mention the eye movements, which allow us to locate and observe objects around us. <sup>(4)</sup> Thus, with the simultaneous adduction of the eyes, called convergence, it is possible to visualize near objects located approximately 33 cm apart. The near point of convergence (NPC) is designated as the closest point at which the eyes are able to converge, and it is not common to change with age. <sup>(5)</sup>

When the approach of objects becomes an obstacle preventing the proper binocular alignment of the eyes, we call it convergence insufficiency (CI).<sup>(1,6)</sup> Symptoms are usually influenced by prolonged near-sighted work, by general health and anxiety, which include difficulty concentrating and understanding when performing near-sighted activities, visual discomfort, eye fatigue, blurred or double vision, drowsiness, headache, among others. <sup>(6,7)</sup>

After prolonged near-sighted work such as using the computer and reading, the symptoms of visual discomfort appear, not only in students, but also in the general population.<sup>(8,9)</sup> Due to the high risk of the progression of myopia or its late development as well as changes related to near sight, these individuals become a group of special interest when speaking of convergence insufficiency.<sup>(10)</sup> Research has pointed to several factors contributing to visual discomfort in professions that require near sight (teachers, for example), which may include uncorrected refractive errors, cortical cell hypersensitivities, and oculomotor anomalies.<sup>(9,11)</sup>

According to Tavares <sup>(8)</sup>, when related to health and quality of life, convergence insufficiency can be seen as a negative factor as it contributes to low income at work, poor performance at school and leisure hours. Taking into account that CI interferes with the ability to read, learn and perform near sighted work<sup>(1)</sup>, the present study aimed at investigating the prevalence of visual discomfort and lack of convergence in university teachers.

## METHODS

It is a cross-sectional study selecting a convenience sample of 60 male and female professors from Centro Universitário da Faculdade Assis Gurgacz (FAG), in the city of Cascavel - PR during the year 2016. The research was approved by the Research Ethics Committee by CAAE: 49529715.7.0000.5219. The inclusion criteria were: male and female individuals over 40 years of age who were university professors in full employment and who had a minimum of four working hours a week and who accepted to participate in the research. The consent was obtained by the members of the research through the presentation and signature of the Free and Informed Consent.

For the data collection, a face-to-face interview with the individuals was carried out, and the researchers used a questionnaire validated for the Brazilian population and translated by Tavares.<sup>(8)</sup> The questionnaire Convergence Insufficiency Symptom Survey (CISS) developed by the Convergence Insufficiency Treatment Trial is the first standardized tool that has

been proven valid and reliable for measuring the frequency and type of symptoms before and after a convergence insufficiency therapy or other binocular or accommodative disorder. This questionnaire is divided into 15 items, using a Likert scale with 5 levels of response. Each item focuses on only one symptom, and it has the sensitivity to discriminate which symptom the individual is reporting, having good psychometric properties. The results can be classified as follows: 0 to 10 points: normal binocular vision; 11 to 36 points: suspected CI; and 37 to 60 points: CI.

Afterwards, questions related to visual symptoms were also answered as a questionnaire. The researchers interviewed the teachers during their period of activity interval between classes, in the morning, afternoon and evening shifts. The individuals of the research were interviewed in the teaching rooms of Centro Universitário Assis Gurgacz - FAG.

For statistical analysis, the program Statistical Package for the Social Sciences (SPSS<sup>®</sup>) Version 22.0 was used, where normality distribution tests were performed using the Kolmogorov-Smirnov test, and the central tendency measures for the quantitative data were calculated and the frequency distribution for qualitative data was performed. Quantitative data was presented as average and standard deviation due to presenting normal distribution. The qualitative data was presented in frequency. A significance level of 5% ( $p < 0.05$ ) was considered for the entire study.

## RESULTS

Sixty teachers were interviewed, of which 33 were female (55.0%) and 27 were male (45.0%), with an average age of 45.1 (4.2) years. Regarding residence during class time, 85.0% answered that the address is not the same as the family's, with 30.0% residing at a distance greater than 200 km from the family, and with 26.7% going to their homes only one weekend per month. Regarding the average sleeping hours per night compared to the week searched, an average of 6 to 8 hours (55%) was found.

As to the preference for the study material, paper was predominant with a percentage of 73.3%, but 63.3% of the respondents said they spend between 2 and 5 hours a day on the computer. Regarding the hours devoted to reading, 48.3% answered that they spent less than two hours a day reading, 40.0% of respondents said that they frequently take breaks during reading from 30 minutes to one hour. With regard to general lighting, 83.3% said having good lighting for reading, and 91.7% reported not using additional lighting.

Of the individuals requiring orthoses, fifty-five percent wear glasses, 41.7% of whom report wearing it frequently, and 35% wear contact lens. As to the investigation of the prevalence of convergence insufficiency in university professors, 1.8% of individuals had CI; 51.6% signs of CI, and 46.6% presented normal binocular vision.

The majority of respondents had visual discomforts, with a higher prevalence of tired, aching or uncomfortable eyes, headaches, blurred or double vision, drowsiness, difficulty to concentrate, and problems associated with reading.

Regarding research on visual system diseases, 25.0% reported having myopia, and as for their family history, 23.3% had cataracts as a predominance in visual diseases. Regarding their general health, 10.0% of the individuals reported having arterial hypertension, and 36.7% of their family also had a predominance of this disease.

## DISCUSSION

The convergence insufficiency, the basic exophoria and the excess convergence are the binocular dysfunctions that are most related to altered visual function in students<sup>(12)</sup>, and Scheiman<sup>(4)</sup> states that the most common non-constricting binocular dysfunction is the convergence insufficiency in adults. Jeffrey and Nadine<sup>(13)</sup> state that CI is a common binocular vision disorder associated to some symptoms such as double vision, eye fatigue, headaches, blurred vision, and loss of reading that occur when performing near-sighted work such as reading and viewing the computer, and approximately 5% of the population in the United States are affected by CI.

In the study population composed of 60 university professors, the prevalence values of CI obtained a frequency of 1.8%; 51.6% with signs of CI, and 46.6% presented normal binocular vision. In a pilot study conducted by Tavares<sup>(8)</sup> in a population of university students seeking to identify CI with a sample of 98 individuals aged between 18 and 25 years, it can be seen that 62% present normal binocular vision, 9.2% lack of convergence, 3.1% presented binocular problems, 11.2% accommodative problems, and 14.3% presented non-compensated refractive errors.

The study of Rouse et al.<sup>(14)</sup> in a sample of adults between 19 and 30 years of age, 46 individuals had normal binocular vision, and 46 individuals has CI, whereas Borsting et al.<sup>(15)</sup>, in a population comprising young university students, found 56 individuals with normal binocular vision, and 47 with CI. Therefore, we can observe that the samples used by these authors both in the group of individuals with VBN and in the group of individuals with CI showed very similar results, which is not verified in the sample of the present study, which has 46.6% of individuals with normal binocular vision, and 1.8% with CI.

In relation to the most frequent visual problems and associated symptoms, Estepa et al.<sup>(16)</sup>, with a sample of 53 teachers, concluded that CI and the reduction in the amount of tear produced were the most frequent visual problems associated to symptoms of eye fatigue and dryness related to the excessive use of computers, and 39% of the sample had CI, and they also added that professors reported spending between 1 and 12 hours on the computer, with the most frequent pauses ranging between 3 and 4 hours.

On the other hand, in the study in question on visual system diseases, 25.0% of patients reported myopia. In addition, 63.3% of respondents spend between 2 and 5 hours a day on the computer, and 40.0% of respondents said they pause when reading with a frequency of 30 minutes to 1 hour.

Studies indicate that because CI symptoms are most commonly reported up to the second or third decade of life, CI is not common in children, as young adults often spend more time doing near-sighted work, thus they are more likely to complain of symptoms than children.<sup>(13)</sup> The symptoms found in most CIs are secondary to accommodative abnormalities, according to Marran et al.<sup>(17)</sup>

In our study comparing the results for myopia, the incidence was 25%, and among their families, 23.3% had cataracts as predominance in visual diseases. Moreover, it was possible to observe that regarding general health both of the individuals investigated and their antecedents, arterial hypertension was predominant, being 10.0% and 36.7%, respectively.

The present study showed that, of the individuals requiring orthoses, fifty-five percent wear glasses, 41.7% of whom report wearing it frequently, and 35% wear contact lens. According to the World Health Organization the number of the visually impaired in the global population is 180 million, of which 135 million have low visual acuity and 45 million are blind.<sup>(18)</sup> The International Dry Eye Workshop<sup>(19)</sup> states that contact lens wearers have five times more dry eye symptoms compared to glasses wearers.

In individuals over 40 years of age and after the onset of presbyopia, the prevalence of glasses seems to increase.<sup>(20)</sup> According to Gentil et al.<sup>(21)</sup>, office workers were shown as the population who suffers the most from ocular discomfort, and it is due to the fact that they are chronic wearers of contact lenses.

In this study, regarding their general health, 10.0% of the individuals reported having arterial hypertension, and 36.7% of their family also had a predominance of this disease. According to Oigman<sup>(22)</sup>, headache is the most frequent and specific symptom observed in hypertensive individuals, and hypertensive encephalopathy is characterized by the association between hypertension with drowsiness, mental confusion, visual disturbance, nausea and vomiting. Pinto et al.<sup>(23)</sup> in a study to determine the frequency of headache in employees of a hospital in the State of Goiás, emphasized its association to some chronic disease, in which hypertension was highlighted with 53%.

With regard to general lighting, in the present study 83.3% said having good lighting for reading, and 91.7% reported not using additional lighting. The purpose of lighting in the work environment is to perform the visual task in a comfortable way, as well as to allow this task to be performed without difficulties.<sup>(24)</sup>

According to Peixoto et al.<sup>(25)</sup> good lighting can help an individual with poor vision increase productivity<sup>(26)</sup>, contributing to a sense of well-being<sup>(27)</sup>, and they emphasize that thanks to visual adaptation it is possible to see well with poor lighting. The different light conditions caused by the contrast between the highest luminance and the lowest luminance are responsible for generating the process of visual adaptation, and when it is not possible to achieve this visual adaptation, then visual discomfort occurs due to glare.<sup>(25)</sup>

One of the ways to have comfort vision during reading and which requires less ocular accommodative effort is an environment suitable for such task, also consisting of a good lighting system, even knowing that the vision is able to adapt to insufficient light conditions because some inadequacy in the lighting system can affect not only the visual health of users of the environment causing visual fatigue, causing discomfort and tension, but also worsening existing vision problems, as well as influencing learning, social interaction and in health.<sup>(28,29)</sup>

Gentil et al.<sup>(21)</sup> reported that when it comes to damage to the eyes, it can be said that lighting is one of the factors with significant influence, since the excess of brightness emitted mainly by the monitor results in ocular fatigue, and according to Oliveira<sup>(30)</sup> the most common symptoms are: congested eyes, blurred vision, constant tearing, trouble seeing, and headache. Light has effects on the muscles responsible for the movement and focus of the eyes and the mechanism of vision, and visual fatigue occurs when these muscles attached to the eyeball suffer from a kind of exhaustion.<sup>(31,32)</sup>

In the present study, as to the preference for the study material, paper was predominant with a percentage of 73.3%, but

63.3% of the respondents said they spend between 2 and 5 hours a day on the computer. According to Oliveira<sup>(33)</sup>, after several hours on the computer, it is possible to detect different changes such as eye fatigue, eye pain and burning, and blurred vision. He further states that 50% to 70% of computer users suffer from these symptoms after a day's work where they spent more than 3 hours in front of the screen.

Studies have shown that spending more than 4 hours in front of video leads to binocular changes and accommodation caused by severe visual demands of near vision. In addition to regular pauses, good lighting is recommended so that it does not strain the visual system.<sup>(16)</sup>

However, when the computer screen is higher than the eyes, the accommodative and vergence efforts are greater, leading to enlargement of the palpebral opening spaces, exposing the ocular surface and producing visual fatigue, musculoskeletal discomfort and ocular dryness.<sup>(34,35)</sup> According to Balci et al.<sup>(36)</sup>, to reduce asthmatic symptoms when computer work is frequent, regular breaks should be made, because when the effort is greater than recommended, the extraocular and intraocular muscles that interfere in the convergence and accommodation, respectively, suffer from fatigue or spasm.

In the present study, 48.3% answered that they spent less than two hours a day reading, 40.0% of respondents said that they frequently take breaks during reading from 30 minutes to one hour.

In recent years, eye diseases have become very common among university professors, whose working hours have been increasing, thus increasing the time spent on the computer, which leads to a gradual increase of eye diseases and visual fatigue, and therefore preventive measures are necessary, and it is important to have good habits to protect the health of the eyes.

The practice of eye exercises becomes important for visual health, as they are designed to improve the performance of eye muscles by reducing the negative impact on daily vision, avoid headaches, reduce visual stress, promote improved concentration and, in some aspects of vision, relax the muscles of the eyes; besides, they are beneficial for a variety of eye diseases, related or not with the aging of the eyes, such as: myopia, strabismus, convergence insufficiency, nystagmus, presbyopia, among others.

Further studies shall be proposed, in order to deepen the correlations between visual symptoms and CI in the population under study, as well as preventive measures and health promotion with multiprofessional approaches.

## CONCLUSION

The majority of respondents had visual discomforts, with a higher prevalence of tired, aching or uncomfortable eyes, headaches, blurred or double vision, drowsiness, difficulty to concentrate, and problems associated with reading. Regarding the investigation of the prevalence of convergence insufficiency, a small percentage was identified.

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