Original Research Report

SODIUM HYALURONATE EYE DROPS FOR COLLEGE STUDENTS WITH COMPUTER VISION SYNDROME IN INDONESIA

Bambang Subakti Zulkarnain[1], Rozalina Loebis[2], Toetik Ariyani[1]
[1]Department of Pharmacy Practice, Faculty of Pharmacy, Universitas Airlangga, Surabaya, Indonesia
[2]Department of Ophthalmology, Faculty of Medicine, Universitas Airlangga; Dr. Soetomo General Academic Hospital, Surabaya, Indonesia

ABSTRACT

The use of computers and mobile devices is increasing. Computers and mobile devices help our daily work or study. However, prolonged use of them may cause computer vision syndrome (CVS). Nowadays, CVS becomes a health problem for everyone working with computers or mobile devices including college students because it causes dry eyes. It may disrupt reading, doing professional work, or using a computer which is important for college students to complete academic tasks. Sodium hyaluronate can be used to overcome the dry eye problem due to CVS. To assess the effectiveness of sodium hyaluronate eyedrops on students suffering from CVS, pre- and post-administration of sodium hyaluronate was measured for two weeks. Inclusion criteria for this study were college students aged 20-35 years, using a computer for >2 hours a day, not using nonsteroidal anti-inflammatory drugs (NSAIDs), not consuming drugs, or having a disease that affects tear production and bearing no pregnancy. Parameters assessed include tear break-up time using the Tear Break-Up Time (TBUT) test, tear production using the Schirmer I test, the number of clinically subjective symptoms, and Ocular Surface Disease Index (OSDI) scores. Data were analyzed using student paired t-tests or Wilcoxon Rank Test. There were statistically significant differences before and after the TBUT (4.4 vs 6.7 seconds; p<0.0001); the Schirmer I Test (4 vs 6 mm; p<0.05), and the number of clinically subjective symptoms (3 vs 0 clinically subjective symptoms; p<0.0001). The OSDI scores did not show statistical differences before and after administration of sodium hyaluronate (27 vs 21; p>0.05), but there was a positive impact from moderate to mild dry eye. Sodium hyaluronate eyedrops can be used as one of the CVS therapy strategies for students suffering from CVS.

Keywords: *Computer vision syndrome; sodium hyaluronate; Tear Break Up Time test, Schirmer I test; clinically subjective symptoms; OSDI score, healthy lifestyle*

Correspondence: Rozalina Loebis, Department of Ophthalmology, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. Email: rozalinaloebis2512@gmail.com

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Highlights:

1. Computer vision syndrome (CVS) that causes dry eyes becomes a health problem for college students.
2. Sodium hyaluronate eyedrops can be used as one of the CVS therapy strategies for students suffering from CVS.

INTRODUCTION

The use of computers is increasingly common in society nowadays. Computers help our daily activities and increase our productivity in workplaces, schools, universities, or elsewhere. However, there are also the negative effects of computers, especially for prolonged use. Computer vision syndrome (CVS) or digital eye strain (DES) can occur because of computer use for more than 2 hours a day. Symptoms include ocular or non-ocular such as asthenopia, tired eyes, irritation, burning, red eyes, dry eyes, blurred eyes, double vision or headache, and neck pain (Blehm et al. 2005, Reddy et al. 2013, Bali et al. 2014, Alamri et al. 2022). Furthermore, although not yet widely investigated, the use of mobile devices such as mobile phones or tablets may cause CVS (Kim et al. 2017, Jaiswal et al. 2019, Altalhi et al. 2020).

Nearly 60 million people suffer from CVS and millions of new CVS cases appear each year (Sen & Richardson 2007, Alatawi et al. 2022, Adane et al. 2022). Worldwide CVS prevalence is estimated at 25%-93%. With the increasingly common use of computers and devices in our daily activities from year to year, there is a potential decrease in work productivity and the quality of life due to CVS. CVS can cause problems in some daily activities such as reading (OR 3.64, 95% CI 2.45-5.40, p<0.0001); doing professional work (OR 3.49, 95% CI 1.72-7.09, p<0.001); using a computer (OR 3.37, 95% CI 2.11-5.38, p<0.0001); watching television (OR 2.84, 95% CI 0.05-7.74, p<0.04); driving during the day (OR 2.80, 95% CI 1.58-4.96, p<0.0001); and driving at night (OR 2.20, 95% CI 1.48-3.28, p<0.0001). CVS also causes poor sleep quality and depression (Miljanović et al. 2007, Patil et al. 2019, Park et al. 2019).

Nowadays, college students rely heavily on computers and smartphones for their academic tasks. Thus, CVS is common among them. In Malaysia, the prevalence of CVS reached almost 90% of college students. Almost similar prevalence was found among students in India and Saudi Arabia. The use of computers for more than 2 hours a day is a risk factor for CVS (Reddy et al. 2013, Logaraj et al. 2014, Al Rashidi & Alhumaidan 2017). The main cause of CVS is dry eye disease (DED). Dry eyes must be treated immediately because if ignored, the degree of dry eyes will continue to be burdensome so that the patient's quality of life will worsened (Gunawan IPFA et al. 2022). The main treatment for DED is artificial tear eyedrops (Blehm et al. 2005, Şimşek et al. 2018, Labetoulle et al. 2022). Sodium hyaluronate plays an important role in tissue development and wound healing and is effective for lubrication. The drug was effective in relieving the symptoms of DED in several studies (Cheema et al. 2012, Maheshwary et al. 2013, Park et al. 2017, Ang et al. 2017). In a small clinical trial, the drug was effective in relieving the symptoms of DED compared to normal saline (Lemp 2008). Previously, CVS was investigated on 150 bank employees in Indonesia (Kusumawaty et al. 2015). Where, this current study investigated CVS in college students in Indonesia and the effectiveness of sodium hyaluronate to ameliorate the symptoms of CVS.

MATERIALS AND METHODS

Pre- and post-studies were carried out to investigate the effectiveness of sodium hyaluronate in college students suffering from CVS. Cross-sectional time-limited sampling was used to obtain samples during August-October 2017. The inclusion criteria for the sample were as follows: college students aged between 20-35 years; using a computer for more than 2 hours a day; currently not taking nonsteroidal anti-inflammatory drugs or drugs that affect tear production; not having an ailment that affects tear production, and bearing no pregnancy at the time of the study. Informed consent was given to each study participant. Those who were diagnosed with CVS were given sodium hyaluronate eyedrop for two weeks. Measurements were carried out to identify tear break time using the Tear Break Up Time (TBUT) test, tear production using the Schirmer I test, as well as the number of clinically subjective symptoms, and Ocular Surface Disease Index (OSDI) score before and after the use of sodium hyaluronate eyedrop. Pre- and post-data were analyzed using SPSS version 17. Normality data were analyzed using the Kolgomorov-Smirnov or Shapiro-Wilk Test. Normal data were then analyzed with the paired t-test, while abnormal data were analyzed using the Wilcoxon Rank Test. The significance value less than 0.05 was considered statistically significant.

RESULTS

This study has obtained the ethical approval of the Medical Research Ethics Committee of Faculty of Medicine, Universitas Airlangga with number 241/EC/KEPK/FKUA2017. There were 78 students attending this study. A total of 66 students were diagnosed with CVS (87%). Their demographic data can be seen in Table 1.

Table 1. Demographic data of students participating in this study

	Characteristics	Number (n)
Sex	Male	8
	Female	58
Age	<25 years old	62
	25-45 years old	4
	>45 years old	0

Most of the participants were female and aged under 25 years old. Participants of young age for this study were selected as they more likely had an evaporative dry eye. Meanwhile, old people were not selected as they had reduced tear production because of hormonal causes.

The measured parameters of the effectiveness of sodium hyaluronate are shown in Figure 1, Figure 2, Figure 3, and Figure 4. Those figures show the analysis of the TBUT test, the Schirmer I test, and the number of clinically subjective symptoms. Those parameters were statistically significant ($p<0.05$). Only the OSDI score was not statistically significant ($p>0.05$). However, there was a trend of declining OSDI scores even though it was not significant statistically.

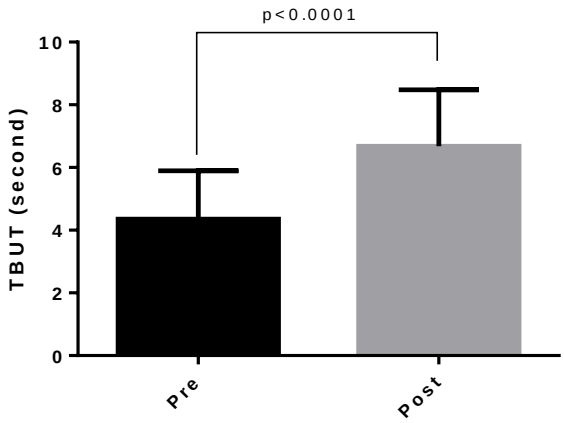

Figure 1. Pre- vs post-TBUT results

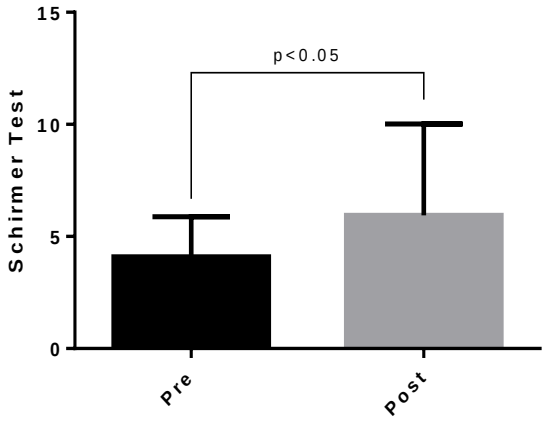

Figure 2. Pre- vs post-Schirmer I test results

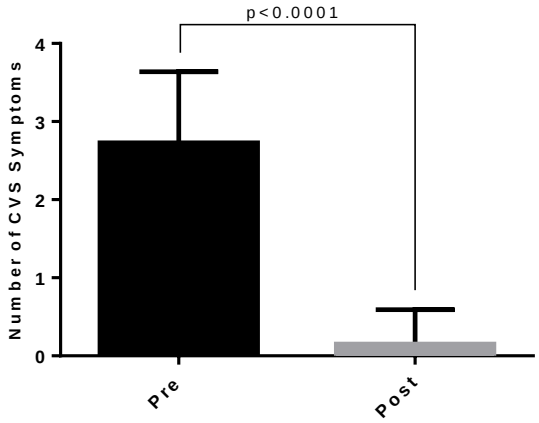

Figure 3. Pre- vs post-number of clinically subjective symptoms

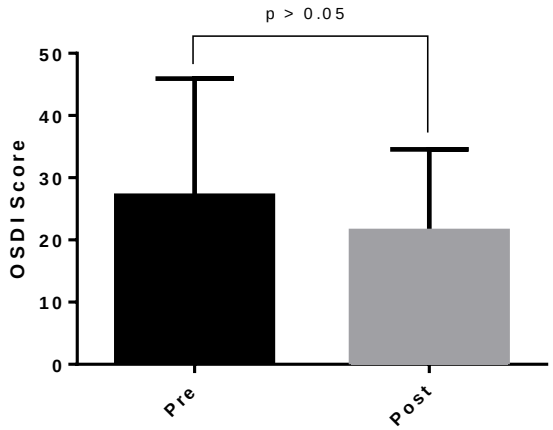

Figure 4. Pre- vs post-OSDI scores

DISCUSSION

The percentage of students suffering from CVS was 87%. This number was almost similar to the prevalence of CVS in college students in Malaysia, India, and Saudi Arabia (Reddy et al. 2013, Logaraj et al. 2014, Al Rashidi & Alhumaidan 2017, Altalhi et al. 2020, Iqbal et al. 2021).

The worldwide prevalence of CVS was estimated at 25%-93%. While there is trending use of computers and devices in our daily activities for something good, there is also a potential problem such as CVS for college students. Such problem may hinder them to complete academic tasks. The main cause of CVS is DED, and the effectiveness of the therapeutic strategy for CVS can be measured using some dry eye parameters. The main treatment of DED is artificial tear eyedrop (Blehm et al. 2005, Şimşek et al. 2018, Labetoulle et al. 2022)

The Tear Break Up Time (TBUT) is a parameter that measures the stability of tear film (Mcmonnies 2018, Hwang et al. 2020). It measures the time of tearing. DED patients have lower TBUT. A normal person has TBUT of >10 seconds. The TBUT before and after sodium hyaluronate administration showed an increase. The initial average before administration of sodium hyaluronate was 4.4 seconds. After two weeks of therapy, the TBUT value increased to an average of 6.7 seconds lower than the normal TBUT, 10 seconds. Longer administration of sodium hyaluronate may be able to return the TBUT value to normal. Another study also proves that sodium hyaluronate is better and faster than carboxymethylcellulose (CMC) (Groß et al. 2018). It is also safe for moderate and severe dry-eye patients (Maheshwary et al. 2013, Park et al. 2017). The efficacy of sodium hyaluronate eye drops was shown also in multi center trial (Cheema et al. 2012).

The Schirmer I test is a test to measure the tear production. The test was carried out by inserting a piece of Whatman filter paper into both eyes for five minutes. The wet paper length was measured in mm. It is considered normal when the result of Schirmer I test >10 mm. A CVS sufferer would show a test result of <10 mm or less for severe dry-eye person. The results of sodium hyaluronate administration are seen in Figure 2. The administration of sodium hyaluronate increased tear production according to the pre-Schirmer I test with average wet paper length of 4 mm and post Schirmer I test with average wet paper length of 6 mm ($p<0.05$). The Dry Eye Workshop (DEWS) dry eye severity grading scheme stated that the Schirmer I test result of <5 mm/5 minutes is categorized as dry eye level 3, whereas Schirmer I test result of <10 mm/5 minutes is categorized as dry eye level 2. This scheme categorizes dry eye levels from 1 (low) to 4 (severe) (McAlinden et al. 2017).

The next parameter for evaluating the effectiveness of sodium hyaluronate before and after administration is the number of clinically subjective symptoms expressed by the patient during the examination. In this study, the participants mentioned intra-ocular symptoms (blurred vision, painful eyes, eye strain,

watery eye, itchy eyes, double vision, tired eyes, and greasy eyes) or nonocular symptoms (headache, shoulders pain, and neck pain). Figure 3 shows a decrease in the number of clinically subjective symptoms of CVS patients after two-week therapy with sodium hyaluronate ($p<0.05$). The initial common clinically subjective symptoms include ocular or nonocular symptoms. After sodium hyaluronate administration, the clinically subjective symptoms reduced to almost zero symptoms.

Furthermore, the OSDI questionnaire is a common diagnostic tool for dry eye. It consists of 12 questions whose total OSDI score can be categorized as severe, moderate, mild, or normal. The score ranges from 0 to 100. The OSDI score of 0-12 is normal, 13-22 is mild, 23-32 is moderate, and >32 is severe. Figure 4 shows the results of administration of sodium hyaluronate in CVS patients by OSDI scores. In this study, the statistical results of the OSDI scores before and after therapy showed no significant difference ($p>0.05$), but the OSDI level of dry eye changed from moderate to mild (OSDI score from 27 to 21). Finally, even though artificial tear, such as sodium hyaluronate, is effective for DED due to CVS, other measures among mobile device users are widely advised, such as the 20-20-20 rule and ergonomic practices (Mowatt et al. 2018). These non-drugs measures are also important in preventing the occurrence of DED due to CVS.

Strength and limitation

This research can be useful for academics because it provides administration of Sodium hyaluronate to CVS by providing CVS therapy strategies. Further studies can be conducted based on the findings of this study to investigate the effect of Sodium hyaluronate among college students who have CVS on a larger scale and to prevent its prevalence .

CONCLUSION

Sodium hyaluronate administration in students suffering from CVS can be used as one of the CVS therapy strategies. The effectiveness of this therapy was measured from four parameters (i.e., TBUT, Schirmer I Test, clinically subjective symptoms, and OSDI Score).

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Conflict of interest

There was no conflict of interest.

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Author contribution

BSZ collected and analyzed the data, and wrote the manuscript. RL collected the data and wrote the manuscript. TA also collected the data and wrote the manuscript.

REFERENCES

Adane F, Alamneh YM, Desta M (2022). Computer vision syndrome and predictors among computer users in Ethiopia: A systematic review and meta-analysis. Trop Med Health 50**,** 26.

Alamri A, Amer KA, Aldosari AA, et al (2022). Computer vision syndrome: Symptoms, risk factors, and practices. J Fam Med Prim Care 11**,** 5110.

Alatawi SK, Allinjawi K, Alzahrani K, et al (2022). Self-reported student awareness and prevalence of computer vision syndrome during COVID-19 pandemic at Al-Baha University. Clin Optom Volume 14**,** 159–72.

Altalhi AA, Khayyat W, Khojah O, et al (2020). Computer vision syndrome among health sciences students in Saudi Arabia: Prevalence and risk factors. Cureus 12**,** 1–6.

Ang BCH, Sng JJ, Wang PXH, et al (2017). Sodium hyaluronate in the treatment of dry eye syndrome: A systematic review and meta-analysis. Sci Rep 7**,** 9013.

Bali J, Neeraj N, Bali R (2014). Computer vision syndrome: A review. J Clin Ophthalmol Res 2**,** 61.

Blehm C, Vishnu S, Khattak A, et al (2005). Computer Vision Syndrome: A Review. Surv Ophthalmol 50**,** 253–62.

Cheema A, Aziz T, Mirza SA, et al (2012). Sodium hyaluronate eye drops in the treatment of dry eye disease: An open label, uncontrolled, multi-centre trial. J Ayub Med Coll Abbottabad-Pakistan 24**,** 14–6.

Groß D, Childs M, Piaton J-M (2018). Comparative study of 0.1% hyaluronic acid versus 0.5% carboxymethylcellulose in patients with dry eye associated with moderate keratitis or keratoconjunctivitis. Clin Ophthalmol Volume 12**,** 1081–8.

Gunawan IPFA, Lidia K, Telussa AS, et al (2022). Correlation between online gaming duration and dry eyes complaints and quality of life using DEQS questionnaire. Vis Sci Eye Heal J 22, 29–33.

Hwang H Bin, Ku YH, Kim EC, et al (2020). Easy and effective test to evaluate tear-film stability for self-diagnosis of dry eye syndrome: blinking tolerance time (BTT). BMC Ophthalmol 20**,** 438.

Iqbal M, Elzembely H, Elmassry A, et al (2021). Computer vision syndrome prevalence and ocular sequelae among medical students: A university-wide study on a marginalized visual security issue. Open Ophthalmol J 15**,** 156–70.

Jaiswal S, Asper L, Long J, et al (2019). Ocular and visual discomfort associated with smartphones, tablets and computers: what we do and do not know. Clin Exp Optom 102**,** 463–77.

Kim DJ, Lim C-Y, Gu N, et al (2017). Visual fatigue induced by viewing a tablet computer with a high-resolution display. Korean J Ophthalmol 31**,** 388.

Kusumawaty S, Syawal S, Sirajuddin J (2015). *Computer vision syndrome pada pegawai pengguna komputer di PT. Bank Negara Indonesia (Persero) Tbk Makassar* (thesis). Universitas Hasanuddin.

Labetoulle M, Benitez-del-Castillo JM, Barabino S, et al (2022). Artificial tears: Biological role of their ingredients in the management of dry eye disease. Int J Mol Sci 23**,** 2434.

Lemp M (2008). Management of dry eye disease. Am J Manag Care 14**,** S88-101.

Logaraj M, Madhupriya V, Hegde S (2014). Computer vision syndrome and associated factors among medical and engineering students in Chennai. Ann Med Health Sci Res 4**,** 179.

Maheshwary N, Saeed N, Qazi Z, et al (2013). Effectiveness of sodium hyaluronate eye gel in patients with dry eye disease: A multi-centre, open label, uncontrolled study. Pakistan J Med Sci 29**,** 1055–8.

McAlinden C, Gao R, Wang Q, et al (2017). Rasch analysis of three dry eye questionnaires and correlates with objective clinical tests. Ocul Surf 15**,** 202–10.

McMonnies CW (2018). Tear instability importance, mechanisms, validity and reliability of assessment. J Optom 11**,** 203–10.

Miljanović B, Dana R, Sullivan DA, et al (2007). Impact of dry eye syndrome on vision-related quality of life. Am J Ophthalmol 143**,** 409–15.

Mowatt L, Gordon C, Santosh ABR, et al (2018). Computer vision syndrome and ergonomic practices among undergraduate university students. Int J Clin Pract 72**,** e13035.

Park S-Y, Yang S, Shin C-S, et al (2019). Long-term symptoms of mobile phone use on mobile phone addiction and depression among Korean adolescents. Int J Environ Res Public Health 16**,** 3584.

Park Y, Song JS, Choi CY, et al (2017). A randomized multicenter study comparing 0.1%, 0.15%, and 0.3% sodium hyaluronate with 0.05% cyclosporine in the treatment of dry eye. J Ocul Pharmacol Ther 33**,** 66–72.

Patil A, Bhavya, Chaudhury S, et al (2019). Eyeing computer vision syndrome: Awareness, knowledge, and its impact on sleep quality among medical students. Ind Psychiatry J 28**,** 68.

Al Rashidi S, Alhumaidan H (2017). Computer vision syndrome prevalence, knowledge and associated factors among Saudi Arabia University Students: Is it a serious problem? Int J Heal Sci 11**,** 17–9.

Reddy SC, Low C, Lim Y, et al (2013). Computer vision syndrome: a study of knowledge and practices in university students. Nepal J Ophthalmol 5**,** 161–8.

Sen A, Richardson S (2007). A study of computer-related upper limb discomfort and computer vision syndrome. J Hum Ergol (Tokyo) 36**,** 45–50.

Şimşek C, Doğru M, Kojima T, et al (2018). Current management and treatment of dry eye disease. Turkish J Ophthalmol 48**,** 309–13.