Evaluation of Prevalence and Associated Factors of Dry Eye Syndrome among Medical Students Exposed to Visual Display Terminal in Health Campus, Universiti Sains Malaysia

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DISCLAIMER

I hereby certify that the work in this dissertation is my own except for the quotations and summaries which have been duly acknowledged. I declare that I have no financial interest in the instruments in this study.

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ABSTRAK

Pengenalan

Sindrom mata kering (DES) telah menjadi kebimbangan kesihatan awam, terutamanya semasa pandemik COVID-19. Pelajar perubatan sarjana muda memounyai risiko DES disebabkan peningkatan pendedahan kepada terminal paparan visual (VDT) memandangkan peralihan kepada kuliah dalam talian sepenuh masa. Ini disebabkan oleh, kehadiran kadar kelipan berkurangan dan ketidakstabilan filem titisan mata dalam pengguna VDT menyebabkan peningkatan dalam penyejatan titisan air mata yang membawa kepada gejala DES. Kajian ini membantu kita untuk mengetahui tentang faktor-faktor yang berkaitan dengan penggunaan VDT dan DES dalam kalangan generasi muda.

Objektif

Matlamat kajian ini adalah untuk menentukan prevalens dan faktor berkaitan DES dalam kalangan pelajar perubatan yang terdedah kepada VDT di kampus kesihatan, Universiti Sains Malaysia (USM).

Kaedah

Kajian keratan rentas melibatkan 140 pelajar perubatan sarjana muda berumur 22 hingga 29 tahun yang merupakan pengguna VDT. Faktor dianalisa adalah umur, jantina, bangsa dan tempoh pengunaan VDT. Pengumpulan data termasuk penilaian subjektif DES (soal selidik OSDI) dan penilaian objektif DES (ujian TBUT dan Schirmer). Analisis statistik dilakukan menggunakan Statistical Package for the Social Science (SPSS Inc Version 24). Keputusan dianalisis menggunakan analisis Deskriptif dan regresi Logistik Multivariate.

Keputusan

Kebanyakan kohort pelajar perubatan adalah perempuan dan Melayu. Kebanyakan pelajar menggunakan VDT kurang daripada 8 jam. Insiden DES yang tinggi dicatatkan dalam kalangan pelajar perubatan (92.1%). Tiada satu pun daripada faktor menunjukkan perkaitan yang signifikan dengan penemuan positif DES oleh penilaian subjektif dan objektif dan tempoh penggunaan VDT.

Kesimpulan

DES adalah perkara biasa di kalangan pengguna VDT. Kajian ini menunjukkan prevalens DES yang tinggi dalam kalangan pelajar perubatan di USM. Faktor yang dianalisa dalam kajian ini tidak menunjukkan perkaitan yang signifikan dengan penemuan positif DES oleh penilaian subjektif dan objektif dan tempoh penggunaan VDT. Dapatan kajian ini akan membantu mengenali masalah dan akan meningkatkan kesedaran tentang amalan harian mereka dan melaksanakan langkah-langkah pencegahan untuk mengelakkan DES berkaitan VDT.

ABSTRACT

Introduction

Dry eye syndrome (DES) has become a public health concern, especially during the COVID-19 pandemic. Medical students are at risk due to an increase in visual display terminal (VDT) exposure given the transition to full-time online lectures. Presence of reduced blink rate and tear film instability in VDT users causes an increase in tear evaporation leading to symptoms of DES. This study helps us to learn about the associated factors of VDT use and DES among the young generation.

Objectives

This study aims to determine the prevalence and associated factors of DES among medical students exposed to VDT in health campus, Universiti Sains Malaysia (USM).

Patients and Methods

A cross-sectional study involving 140 undergraduate medical students aged 22 to 29 years old who were VDT users. Factors analysed are age, gender, race and duration of VDT usage. Data collection included both subjective assessment (OSDI questionnaire) and objective assessment (TBUT and Schirmer's test). Statistical analysis was done using Statistical Package for the Social Science (SPSS Inc Version 24). Results were analysed using Descriptive analysis and Multivariate Logistic regression.

Results

Most of the medical student cohort was female and Malay. Most of the students use VDT for less than 8 hours. A high incidence of DES was noted among medical students (92.1%). None

of the factors showed significant association with positive findings DES by subjective and objective assessment and duration of VDT usage.

Conclusion

DES is common among VDT users. This study showed a high prevalence of DES among the medical students in USM. The factors analysed did not show a significant association with DES and duration of VDT usage. This study may help to recognize the problem and will raise awareness of their daily practice and implement preventive measures to avoid VDT related DES.

CHAPTER 1
INTRODUCTION

1. Introduction

Dry eye syndrome (DES) has become a public health worriment initiating ocular signs and symptoms that may cause a visual disturbance that impedes daily activities. It is one of the most prevailing ocular surface diseases in the universe.[1] DES comprises about 20 million in the United States.[2] In Malaysia, a study conducted by Mohd-Ali et al in Kuala Lumpur estimated that around 15% of the sample population in Kuala Lumpur has dry eyes.[1] The prevalence of DES among medical students during the Covid pandemic was 70.8%.[3] DES is a symptomatic disorder which may present with several levels of severity that can interfere with daily activities. Clinical symptoms of DES include burning sensation, itching, tearing, foreign-body sensation, discharge, frequent blinking, redness, blurring of vision, fluctuating vision, light sensitivity, eye pain, eyelid fatigue and or headache.[2] These clinical symptoms are made worse when reading, computer, watching television, driving, or playing video games.[2]

The pathophysiology involves, a breakdown in the tear film which coats in front of the eye. In normal condition, this layer of tears is a stable, homogenous layer which consists of electrolytes, anti-inflammatory elements and enzymes that helps in the maintenance of healthy cornea and conjunctiva.[2] The tear film may be affected by an autoimmune disease such as Rheumatoid arthritis, Systemic Lupus erythematous or Sjogren syndrome.[4] Apart from that, it is postulated that the pathogenetic triggering mechanism stress to the ocular surface environmental factors also contributes to DES, such as due to infection, endogenous stress, antigens and genetic factors.[4] Proinflammatory cytokines, chemokines, and matrix metalloproteinases lead to the expansion of T helper cells which infiltrate the ocular surface and lacrimal gland (Figure 1).[4] The result is a vicious circle of damage to the ocular surface and inflammation leading to damage to the tear film and dry eye symptoms.

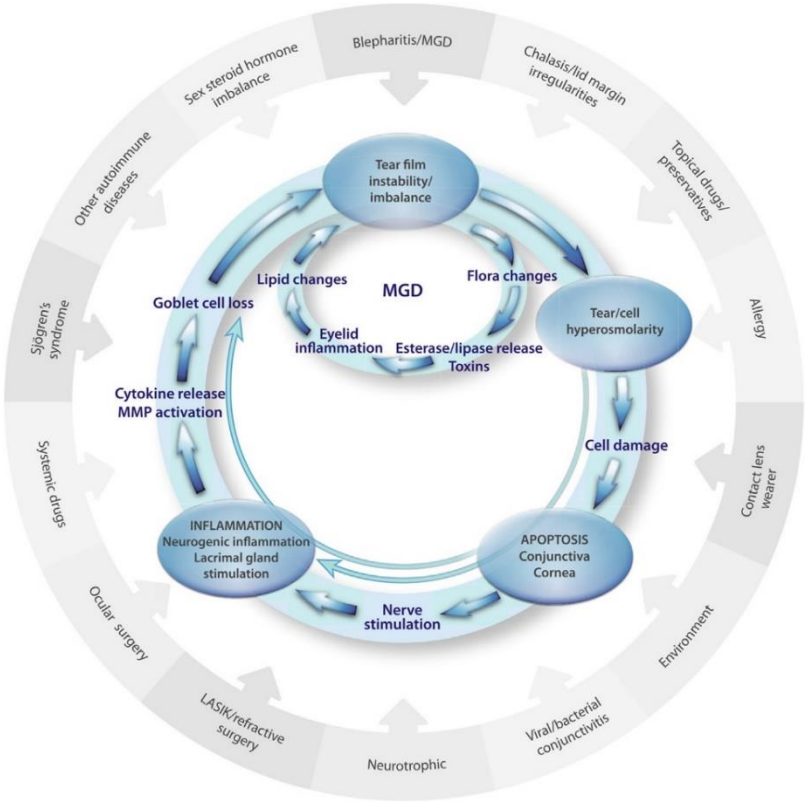

Figure 1: Proposed schema of the vicious circle theory for DED pathology, adapted from Baudouin et al, 2007. (MMP: matrix metalloproteinase. LPS: lipopolysaccharide. MGD: meibomian gland dysfunction)

There are various questionnaires have been produced to aid in epidemiological and clinical research for screening and diagnosing purposes. Examples of questionnaires available are the Ocular Surface Disease Index (OSDI), the Dry Eye Questionnaire (DEQ), and the McMonnies Dry Eye Questionnaire (MDEQ). The treatment of DES depends on the causes. Treatment modalities include lubricants such as artificial tears eye drops and longer-acting agents such as artificial tear gel and ointments. Tear conserving treatments such as puncta plugs, warm compression and eyelid hygiene.[2]

1.1 Tear film

The tear film is a transparent fluid layer that covers the cornea and the conjunctiva. It has several major roles to serve the well-being of the cornea and conjunctiva epithelium. Some of the roles are to keep the cornea moist, maintain the refractive power of the cornea, helping to defend against eye infection, allow gas exchange between the atmosphere and cornea, and be responsible for cornea transparency to maintain cornea dehydration.[5] The tear film needs to be of sufficient quantity and quality to fulfil the requirements outlined above. Tear volume is crucial to provide lubrication to the eye. Apart from that, tear film stability is also a crucial requirement to maintain adequate coverage of the ocular surface.

The tear film is a complex structure however it can be simplified with 3 layers (Figure 2). The innermost layer of the tear film is known as the mucin layer. Overlying which there is an aqueous layer. The outermost layer is the lipid layer. The tear film has an estimated thickness of around 4um to 6um.[5] The lipid layer is about 0.1um in thickness.[5] It is produced by the meibomian glands, that open onto the eyelid margins. This layer helps to prevent overflow of the tear fluid and limit evaporation from the ocular surface.[5] The aqueous layer is measured to be around 7um thick.[5] It is the thickest layer of the tear film. This layer is produced by the main and accessory lacrimal glands. The main lacrimal gland secretion is under neuronal control which plays role in balancing the tear production according to the need of the ocular surface.[5] The role of this layer is to wash away foreign material, nourish the corneal and conjunctival epithelium and provide nutrients to the ocular surface.[5] The mucin layer is composed mainly of mucins in complex with water, lipids, enzymes, proteins, carbohydrates and electrolytes.[5] It is produced by the goblet cells of the conjunctiva, glands of Manz and the crypts of Henlé.[5] The role of this layer is to maintain the viscosity of the tear film. This will help to maintain tear

film stability. It gives physical protection to the ocular surface and helps to prevent the invasion of bacteria to the cornea surface.[5]

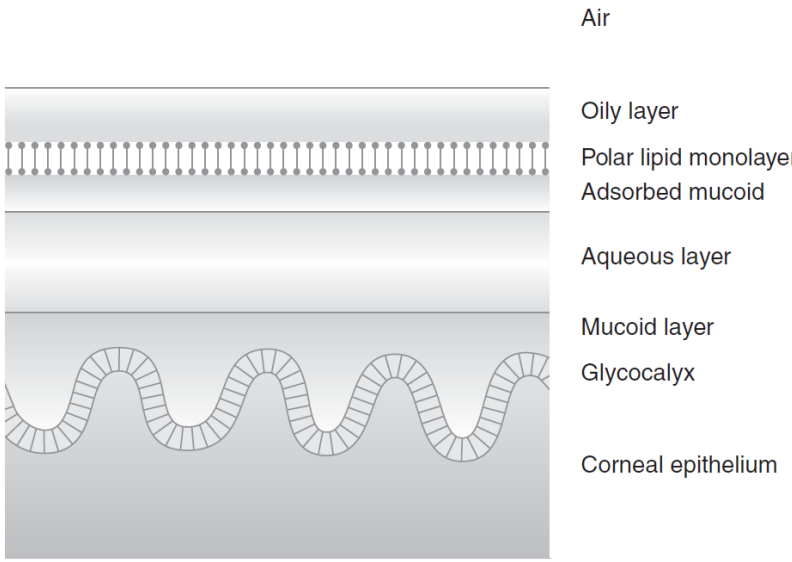

Figure 2: Tiffany's Model of the Tear Film (Tiffany, 1988). From air to the glycocalyx covering the microvilli of the corneal epithelium.

1.2 Classifications of Dry Eye Syndrome Tear film

The National Eye Institute Workshop has classified Dry eye syndrome based on the aetiology of tear deficiency or tear evaporation. (Figure 3)

1.2.1 Aqueous Deficient Dry Eye

As discussed, earlier, the aqueous layer contributes 98% to the tear film layer. Abnormalities in this layer can cause a great impact on the ocular surface. It can be caused by a disease-causing abnormality in the lacrimal gland production, such as Sjogren syndrome. It can also be caused by lacrimal gland abnormality itself.[5] Sjögren syndrome is an autoimmune condition

causing chronic inflammation of the lacrimal and salivary glands. Epithelial cells of the lacrimal gland function to produce immune mediators for the secretory function of the lacrimal gland.[5] Abnormalities in this condition lead to impairment in tear production. Sjögren syndrome may be primary or secondary. Primary Sjogren syndrome mainly affects exocrine glands such as salivary and lacrimal, causing dry mouth and dry eyes. Secondary Sjögren syndrome occurs in association with other autoimmune connective tissue disorders such as rheumatoid arthritis being the most common, systemic lupus erythematosus and scleroderma.[5] Non-Sjögren Syndromes occur in the absence of an autoimmune disease. It can be due to lacrimal gland dysfunction primarily due to an unknown reason or congenital alacrimia.[5] Secondarily it can be due to age-related changes to the lacrimal gland causing a decrease in tear production. The most common form of non-Sjögren dry eye is a primary lacrimal deficiency.[5]

1.2.2 Evaporative Dry Eye

Evaporative dry eye occurs due to a deficiency in the lipid layer tear film which leads to an increase in tear evaporation.[6] Usually, the lacrimal gland function is normal, and the volume of lacrimal fluid is adequate.[7] The aetiology of this condition is commonly due to meibomian gland dysfunction, blepharitis, and other lid margin inflammation.[6] A decrease in lipid secretion from the meibomian gland will cause an insufficient lipid tear film layer. This causes an increase in the hyperosmolarity of the tear film leading to tearing evaporation.[5]

Apart from lid abnormalities, the use of contact lenses contributes to evaporative dry eyes by disrupting the tear film stability. Prolong contact lens wear may cause sensory loss leading to a decrease in lacrimal secretion due to interference of the reflex arc.[5] Blinking disorders also

may contribute to evaporative dry eyes. This condition is closely related to this study. Blinking is a neuronal reflex to mechanically spread the tear film on the ocular surface. The blinking reflex helps to protect the ocular surface from physical insult and assists in washing away foreign debris from the ocular surface. Under normal conditions, an individual blinks 12 to 18 times per minute.[5] Conditions that may lead to decreased blinking are among visual display terminal users, Parkinson's disease or medication-related such as antipsychotics.[5]

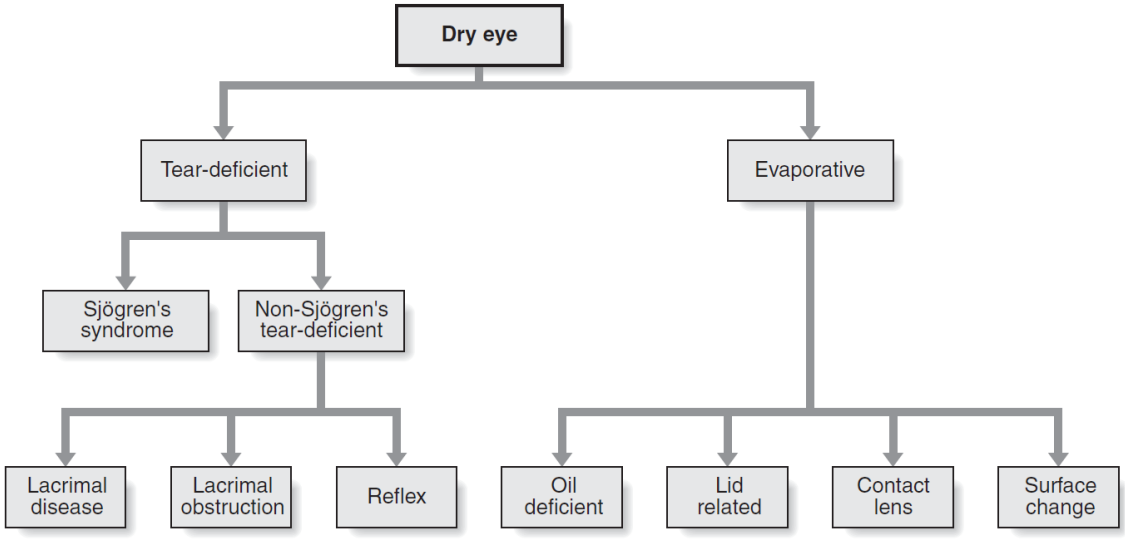

Figure 3: Dry eye classification after Lemp (1995).

1.3 Factors Contributing to DES

Increasing age is associated with decreased in androgen levels.[6] Down regulation of androgen levels leads to decrease in meibomian function.[6] This impedes the lipid function in in tear film developing DES. Female gender is the most consistently identified risk factor, with the prevalence in women being almost double that in men.[6] Women are more likely to develop dry eyes due to hormonal changes caused by pregnancy, the use of oral contraceptives and menopause.[6] Consumption of Certain medicines, including antihistamines, decongestants,

blood pressure medications, and antidepressants, can reduce tear production leading to DES.[2] Medical conditions such as rheumatoid arthritis, diabetes, and thyroid problems are more likely to have symptoms of dry eyes.[2] Apart from that, eyelid abnormalities such as blepharitis, entropion, trichiasis can cause dry eyes to develop.[2] Refractive eye surgeries, such as LASIK, can decrease tear production and contribute to dry eyes.[2] Environmental conditions also play an important role. Exposure to smoke, wind and dry climates can increase tear evaporation resulting in dry eye symptoms.[2]

Additionally, people with stress have emotional dysregulation, lack of confidence, and social support.[8] These alterations generate a state of psychological stress that through the release of inflammatory cytokines such as IL-1β, IL-6 and IL-8 generate the instability of the tear film, as well as the suppression of tear production leading to DES.[8] Wang et al. have reported that patients with DED were more likely to have depression.[9] The main explanations for this phenomenon are that dry eye symptoms may increase depression symptoms or antidepressant medications affect anticholinergic activity.[9] This study showed that stress is an important risk factor for DED.

1.4 Clinical Evaluation of Dry Eye Syndrome

Dry eyes can be diagnosed by the ocular symptoms and several tear film evaluation tests. These tests are easily done and readily available.

1.4.1 Schirmer's Test

The Schirmer test is a common, non-invasive, and easy bedside clinical test to measure tear production. There are two types of Schirmer tests, done without topical anaesthetic or with an anaesthetic.[10] Schirmer with topical anaesthesia (Schirmer I) measures the basal aqueous tear production and Schirmer without anaesthesia (Schirmer II) additionally measures reflex tearing.[10] It is done by placing a strip of Whatman #41 paper at the junction of the middle and lateral thirds of the lower eyelid of each eye to minimize irritation to the cornea.[10] After 5 minutes, the strip is removed and the length of the tear wetting is measured in millimetres.[10] A measurement of 10 mm or greater is considered the cut-off for a normal value for both tests.[10] An abnormal finding is highly suggestive of aqueous deficient dry eye.[10] For the Schirmer I, less than 5 mm is diagnostic of aqueous tear deficiency and 5 to 10 mm is suggestive.[5] For Schirmer II, wetting of less than 15 mm after 5 minutes is associated with a defect in reflex secretion.[5] This test has variable repeatability and a wide range of sensitivity and specificity values. However, the accuracy seems to increase as the severity of the disease increases.[10]

1.4.2 Tear Break -up Time

Tear break-up time (TBUT) is very common, cheap, and easy to perform at the slip lamp test. The purpose is to determine tear film stability. It is performed by wetting a fluorescein strip with saline and placed in the inferior cul-de-sac. The surface of the cornea is observed with a cobalt blue filter and diffuse illumination at the slit lamp. The time is measured in seconds between a blink and the appearance of a dark spot in the fluorescein. A normal result is taken as ten seconds or greater. Less than 10 seconds can occur in evaporative and aqueous deficient forms of dry eye.[10]

1.4.3 Evaluating the OSDI Score

The OSDI is an established questionnaire which is easily available online. It is assessed on a scale of 0 to 100, with a greater number of scores representing greater disability. The index can demonstrate sensitivity and specificity in distinguishing between normal subjects and patients with dry eye syndrome. OSDI is a valid and reliable instrument for measuring dry eye syndrome in terms of normal, mild to moderate, and severe classification. It is also able to evaluate the effect on vision-related function.[11]

1.5 General Effects of VDT Exposure

In this era, we are surrounded by technological products. Technology has been evolving and has become an important part of life. It has been proven to have a positive and negative impact on education, the workplace and quality of life. A video display terminal is defined as a computer terminal consisting of a screen on which data or graphics can be displayed.[12] For example, a flat panel display, computer, mobile terminal, game devices, and portable game displays.[12] Usage of VDT has cause impacts such as ocular symptoms, musculoskeletal, dermatological as well as psychological adverse effects.[13] Though VDT use is associated with large number of extraocular symptoms, the eye symptoms are the most frequently encountered complaint among its users.

Asthenopia and visual disturbances among VDT users occurs due to loss of accommodative amplitude and vergence. When operating prolonged near work, there will be a sustained accommodative effort. In view of reduced amplitude due to accommodative fatigue demands, increased accommodative innervation and onset of subjective visual fatigue occurs. Extended

duration of VDT usage may require prolonged accommodation of the eye hence transient myopic occurs.[14] A study done by Luberto et al on a group of female VDT operators noted a transient myopic shift of about 0.12 Dioptres to 1.3 Diopters.[14] Vasudevan et al concluded in their study that near work-related transient myopia may lead to the development of permanent myopic changes in adults.[15]

Musculoskeletal symptoms like neck pain, back pain, and shoulder pain are frequently reported with use of computer. Hales et al. found tendon related disorders (15%) and hand or wrist area (12%) as most common disorder and most common affected area respectively.[16] Prolonged period of sitting, uncomfortable postures, and mouse use have been linked to musculoskeletal symptoms. Psychosocial factors also influence musculoskeletal discomfort. Prolonged VDT usage for work, studies and research work has caused an impact on psychological health. Khin et al studied prolonged VDT use and the health of office workers over 30 years old.[17] The study concluded moderate VDT users have reduced psychological distress whereas VDT use for more than ten hours per day is associated with poor health and severe psychological distress. Therefore, they advised that prolonged VDT use should be prevented.[9]

1.6 Visual Display Terminal and Dry eye Syndrome

University students including medical students are spending more time staring at the screen for studying, research work and entertainment purposes. There have been several studies reporting an increased prevalence of VDT among users, specifically medical students. Hence, during the COVID-19 pandemic, medical students are at risk due to an increase in both digital screen time for online lectures and stress.[3] A study done in America reported over 2000 American children between 8 and 18 years of age, spend approximately 7.5 hours using entertainment media in a

day.[17] Lockdown during the COVID-19 pandemic has shown a great impact in an increase in screen time in many countries. Majumdar et al studied the use of cell phones and computers among office workers and students before and during the lockdown period.[19] They found the significant result of greater duration of time on VDT usage approximately 9 hours per day before and 11 hours during the lockdown.[19]

People experience eye discomfort and disturbance in vision problems when viewing digital screens for extended periods. The level of discomfort appears to increase with the amount of digital screen use.[20] Uchino et al stated that the major cause of ocular symptoms related to viewing electronic screens is dry eye.[20] Several factors may contribute to dry eyes in relation to VDT use. Device related factors is closely related to VDT usage habits. Such as increased corneal exposure due to the viewing angle of the visual display screen.[21] Usually, VDT screens are placed at or just below eye level therefore a larger area of the cornea is exposed as to reading a hard copy of text held below a horizontal plane.[21] This leads to an increase in tear evaporation leading to symptoms of dry eye.[21] Higher the viewing angle more is the anisotropic effect and lesser performance. The recommended placement of monitor between 60 and 100 cm and vertically downward about 40 degree below horizontal eye level.[21]

Environmental and work factors play an important role in VDT users. The multiple light sources from the surrounding have a direct influence on visual symptoms of VDT users. Light from a point or a diffuse source over a VDT reduces the contrast of the text or display on VDT producing annoyance and ocular fatigue. Studies on colour of ambient light, red and green colored lights are found to produce more visual fatigue when compared to white- and blue-coloured lights.[22] Reflections on-screen during VDT use also contribute to visual disturbances. This is caused by the reflection from surrounding objects that produce images on the screen.[13]

These reflections confuse leading to difficulty to focus and defocus.[13] Diffuse light reflecting from the VDT can be prevented by using protective ware such as antiglare coating which helps to increase the comfort of the viewing screen.[23] Other impact of VDT is the effect of long working hour practices which has been found in various studies. Toomingas et al. and Shimai et al. confirmed the fact that long working hours on VDT leads to more visual complaints.[24,25]

The visual symptom of asthenopia has been found significantly more among VDT workers group who worked more than four hours. Less than one hour of single spell of work and work-rest schedule with breaks frequenting at every 15 min followed by microbreaks or at 30 min followed by 5 min breaks has been found to significantly increase work efficiency, reduce eye symptoms and prevent musculoskeletal strain.[25] Microenvironment also contributes to the effects of VDT usage. Factors such as low relative humidity less than 40%, high temperature and air draft do increase the evaporative disruption of precorneal tear film, producing hyperosmolarity and ocular discomfort. Other factors that may influence or aggravate ocular symptoms in an indoor workplace include dust, pollens, aerosols, combustion products or irritating chemical compounds namely oxidation mixtures formed by interaction between ozone and alkenes at low relative humidity.[26]

There is a presence of reduced blink rate in visual display terminal users which causes an increase in tear evaporation leading to symptoms of dry eye.[26] Spontaneous blinking are mandatory to maintain the physiology of the tear on the ocular surface along with its mechanical tear smearing or spreading action. Increase of cognitive demand and attention to a visual task commonly seen with VDT use lead decrease blink rate. Muniraju et al reported that when viewing electronic material, the blink will reduce to 5 to 6 times per minute due to continuous staring at a screen.[27] This will lead to an increase in tear evaporation and cause Dry

eye syndrome.[27] Use of lubricating eye drops is found to regularize interblink interval and provides a significant subjective relief in CVS symptoms however has no effect on basal blink rate.[27]

Ocular surface disorder plays an important role towards VDT related DES. Meibomian gland secretions, contributing toward lipid layer of the tear film, are mandatory for deterring evaporative influence on it by ambient air.[28] Wu et al. studied the effect of meibomian gland dysfunction (MGD) on severity of dry eye disorder in VDT users found that lid margin abnormality, meibum expression and meibomian gland dropout were positively correlated with VDT working time of more than 4 h per day.[28] The effect of contact lens wear together with VDT use has been identified to have an additive effect on the development of dry eye condition and ocular symptoms.[29] Tauste et al. reviewed 114 articles and found contact lens users are 4 times more susceptible to develop dry eyes. Contact lens users were also found associated with meibomian gland atrophy, tear film instability and decreased cornea sensation leading to decrease in the reflex arc to secrete tears contributing to the dry eye condition. Making the "20-20-20" rule a habit, which recommends that every 20 minutes, an individual should take a 20-second break and focus their eyes on something at least 20 feet away.[27] To practice limited screen time every day. Evaluation of tear film status should be regularly performed on all VDT users. Management with ocular lubricants can improve ocular discomfort and improve both qualities of life and productivity.

1.7 Rationale

Usage of VDT has become very influential in our daily lives. Especially during the COVID-19 pandemic, medical students are at risk due to an increase in VDT exposure given the

transition to full-time online lectures. Exposure to VDT has been known to cause reduction in blink rate, visual disturbance due to bright light from screen, increased cornea exposure due to increased viewing angle of screen, stress and transient myopia. This has encouraged us to study the effects of the duration of VDT usage and DES among the young generation. These parameters may guide us ophthalmology team for detection of undiagnosed DES among VDT users. Undiagnosed DES may lead to severe ocular surface disease. This study may elucidate the requirement for routine eye assessment and further improvise our management and prevention of VDT related DES.

1.8 References

1. Mohd-Ali, B., Fee, L.S., Abdul-Mutalib, H. and Mohidin, N., 2011. Incidence of dry eye in a sample population in Kuala Lumpur. International Journal of Collaborative Research on Internal Medicine & Public Health, 3(11), pp.839-845.
2. https://www.aao.org/eye-health/diseases/what-is-dry-eye
3. Tangmonkongvoragul C, Chokesuwattanaskul S, Khankaeo C, Punyasevee R, Nakkara L, Moolsan S, Unruan O. Prevalence of symptomatic dry eye disease with associated risk factors among medical students at Chiang Mai University due to increased screen time and stress during COVID-19 pandemic. PloS one. 2022 Mar 23;17(3):e0265733.
4. Baudouin C, Aragona P, Messmer EM, Tomlinson A, Calonge M, Boboridis KG, Akova YA, Geerling G, Labetoulle M, Rolando M. Role of hyperosmolarity in the pathogenesis and management of dry eye disease: proceedings of the OCEAN group meeting. The ocular surface. 2013 Oct 1;11(4):246-58

5. Peters, E. and Colby, K., 2006. The tear film. Foundation Volume 2: Physiology of the Eye and Visual System.

6. Findlay, Q., & Reid, K. (2018). Dry eye disease: when to treat and when to refer. Australian prescriber, 41(5), 160-163. https://doi.org/10.18773/austprescr.2018.048

7. Lemp, A., 1995. Report of the National Eye Institute/Industry workshop on clinical trials in dry eyes. Eye & contact lens, 21(4), pp.221-232.

8. Condori-Meza IB, Dávila-Cabanillas LA, Challapa-Mamani MR, Pinedo-Soria A, Torres RR, Yalle J, Rojas-Humpire R, Huancahuire-Vega S. Problematic Internet Use Associated with Symptomatic Dry Eye Disease in Medical Students from Peru. Clinical Ophthalmology (Auckland, NZ). 2021;15:4357.

9. Wang TJ, Wang IJ, Hu CC, Lin HC. Comorbidities of dry eye disease: a nationwide population-based study. Acta ophthalmologica. 2012 Nov;90(7):663-8.)

10. Wood, S.D. and Mian, S.I., Diagnostic Tools for Dry Eye Disease. Journal-Diagnostic Tools for Dry Eye Disease.

11. Bron, A.J., Abelson, M.B., Ousler, G., Pearce, E., Tomlinson, A., Yokoi, N., Smith, J.A., Begley, C., Caffery, B., Nichols, K. and Schaumberg, D., 2007. Methodologies to diagnose and monitor dry eye disease: report of the Diagnostic Methodology Subcommittee of the International Dry Eye WorkShop (2007). Ocular Surface, 5(2), pp.108-152.

12. Dictionary, R.H.U., copyright 1997, by Random House, Inc., on Infoplease. Intensiometer (http://www. Infoplease. com/dictionary/intensity

13. Parihar JK, Jain VK, Chaturvedi P, Kaushik J, Jain G, Parihar AK. Computer and visual display terminals (VDT) vision syndrome (CVDTS). Medical Journal Armed Forces India. 2016 Jul 1;72(3):270-6

14. Luberto F, Gobba F, Broglia A. Temporary myopia and subjective symptoms in video display terminal operators. La Medicina del lavoro. 1989 Mar 1;80(2):155-63.

15. Vasudevan B, Ciuffreda KJ. Additivity of near work-induced transient myopia and its decay characteristics in different refractive groups. Investigative ophthalmology & visual science. 2008 Feb 1;49(2):836-41.

16. Hales TR, Sauter SL, Peterson MR, Fine LJ, Putz-Anderson V, Schleifer LR, Ochs TT, Bernard BP. Musculoskeletal disorders among visual display terminal users in a telecommunications company. Ergonomics. 1994 Oct 1;37(10):1603-21.

17. Khin YP, Matsuyama Y, Tabuchi T, Fujiwara T. Association of Visual Display Terminal Usage with Self-Rated Health and Psychological Distress among Japanese Office Workers during the COVID-19 Pandemic. International Journal of Environmental Research and Public Health. 2021 Jan;18(17):9406.

18. Rideout VJ, Foehr UG & Roberts DF. Generation M2. Media in the Lives of 8- to 18-Year Olds. A Kaiser Family Foundation Study. The Henry J. Kaiser Family Foundation: Menlo Park, CA, 2010

19. Majumdar P, Biswas A, Sahu S. COVID-19 pandemic and lockdown: cause of sleep disruption, depression, somatic pain, and increased screen exposure of office workers and students of India. Chronobiology international. 2020 Aug 2;37(8):1191-200.

20. Uchino M, Schaumberg DA, Dogru M et al. Prevalence of dry eye disease among Japanese visual display terminal users. Ophthalmology 2008; 115: 1982–1998

21. Thomson, W.D., 1998. Eye problems and visual display terminals—the facts and the fallacies. Ophthalmic and physiological optics, 18(2), pp.111-119.)

22. Janosik E, Grzesik J. Influence of different lighting levels at workstations with video display terminals on operators' work efficiency. Medycyna Pracy. 2003 Jan 1;54(2):123

23. Flynn MJ, Badano A. Image quality degradation by light scattering in display devices. Journal of Digital Imaging. 1999 May;12(2):50-9.

24. Toomingas A, Hagberg M, Heiden M, Richter H, Westergren KE, Tornqvist EW. Risk factors, incidence and persistence of symptoms from the eyes among professional computer users. Work. 2014 Jan 1;47(3):291-301.

25. WATANABE S, TORII J, SHINKAI S, WATANABE T. Relationships between health status and working conditions and personalities among VDT workers. InNeurobehavioral Methods and Effects in Occupational and Environmental Health 1994 Jan 1 (pp. 657-664). Academic Press.

26. Tsubota K & Nakamori K. Dry eyes and video display terminals. New Eng J Med 1993; 328: 584–585).

27. Muniraju, N.K., Amarnath, H.K. and Ashwini, M.J., 2018. A review on effects of electronic Gadgets on the eye. Journal of Ayurveda Physicians & Surgeons (JAPS)(EISSN 2394-6350), 5(1).

28. Wu H, Wang Y, Dong N, Yang F, Lin Z, Shang X, Li C. Meibomian gland dysfunction determines the severity of the dry eye conditions in visual display terminal workers. PloS one. 2014 Aug 21;9(8):e105575.

29. Tauste A, Ronda E, Baste V, Bråtveit M, Moen BE, Seguí Crespo MD. Ocular surface and tear film status among contact lens wearers and non-wearers who use VDT at work: comparing three different lens types. International Archives of Occupational and Environmental Health. 2018 Apr;91(3):327-35.

CHAPTER 2
OBJECTIVES OF THE STUDY

2.1 General Objective

i. To determine the prevalence and associated factors of dry eye syndrome among medical students exposed to visual display terminal in health campus, USM.

2.2 Specific Objectives

i. To determine the prevalence of dry eye syndrome among medical students exposed to visual display terminal in health campus, USM.

ii. To determine factors affecting dry eye syndrome among medical students exposed to visual display terminal in health campus, USM.

CHAPTER 3
MANUSCRIPT

Evaluation of Prevalence and Associated Factors of Dry Eye Syndrome among Medical Students Exposed to Visual Display Terminal in Health Campus, Universiti Sains Malaysia

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3.1 Abstract

Introduction

Dry eye syndrome (DES) has become a public health concern, especially during the COVID-19 pandemic. Medical students are at risk due to an increase in visual display terminal (VDT) exposure given the transition to full-time online lectures. Presence of reduced blink rate and tear film instability in VDT users causes an increase in tear evaporation leading to symptoms of DES. This study helps us to learn about the associated factors of VDT use and DES among the young generation.

Objectives

This study aims to determine the prevalence and associated factors of DES among medical students exposed to VDT in health campus, Universiti Sains Malaysia (USM).

Patients and Methods

A cross-sectional study involving 140 undergraduate medical students aged 22 to 29 years old who were VDT users. Factors studied are age, gender, race and duration of VDT use. Data collection included both subjective assessment (OSDI questionnaire) and objective assessment (TBUT and Schirmer's test). Statistical analysis was done using Statistical Package for the Social Science (SPSS Inc Version 24). Results were analysed using Descriptive analysis and Multivariate Logistic regression.

Results

Most of the medical student cohort was female and Malay. Majority used VDT for less than 8 hours (53.6%). A high incidence of DES was noted among medical students (92.1%). None of

the factors showed significant association with positive findings DES by subjective and objective assessment and duration of VDT usage.

Conclusion

DES is common among VDT users. This study showed a high prevalence of DES among the medical students in USM. All the factors did not show a significant association with positive findings DES and duration of VDT usage. This study may help recognize the problem and will raise awareness of their daily practice and implement preventive measures to avoid VDT related DES.

Keywords

Dry Eye Syndrome, Visual Display terminal, medical student

3.2 Introduction

Dry eye syndrome (DES) has become a public health worriment initiating ocular signs and symptoms that may cause a visual disturbance that impedes daily activities. It is one of the most prevailing ocular surface diseases in the universe.[1] DES comprises about 20 million in the United States.[2] In Malaysia, a study conducted in Kuala Lumpur by Mohd-Ali et al estimated that around 15% of the sample population in Kuala Lumpur has dry eyes.[1] The prevalence of DES among medical students during the Covid pandemic was 70.8%.[3] Apart from DES, technology has been evolving and has become an important part of life. It has been proven to have a positive and negative impact on education, the workplace and quality of life.