A DISSERTATION REPORT ON

“Prevalence of dry eye in Digital screen users of >6hour with those of <6hour of screen time by comparing Schirmer Score. ”

SUBMITTED BY

Sabiha Aafreen

In partial fulfillment for the award of the degree of

BACHELOR IN CLINICAL OPTOMETRY

IN AFFILIATION WITH

Year 2018-2022

A DISSERTATION REPORT ON

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A DISSERTATION SUBMITTED TO THE BACHELOR OF CLINICAL OPTOMETRY,

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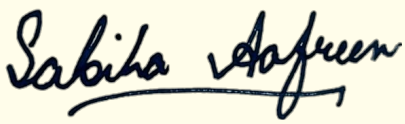
BY

Sabiha Aafreen



CERTIFICATE BY THE GUIDE

This is to Certify that the project titled **"Prevalence of dry eye in Digital screen users of >6hour with those of <6hour of screen time by comparing Schirmer Score."** is a bonafide work of Sabiha Aafreen under the guidance of my supervision . In fulfillment of the requirement for the degree of Bachelors in Clinical optometry.

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CERTIFICATE

THIS IS TO CERTIFY THAT SABIHA AAFREEN FINAL SEMESTER STUDENT OF BACHELOR OF CLINICAL OPTOMETRY FOR THE SESSION 2018-2022, HAS COMPLETED THE STUDY PROJECT ON,

"Prevalence of dry eye status in patients having screen time >6hr with those of < 6 hour of screen time by schirmer score"

PROJECT GUIDE

OPTOM SURBHI SHARMA

CO-GUIDE

Mr Chodup Thinley

SIGNATURE OF EXTERNAL EXAMINER

Signature of the Programme Coordinator
Program Co-ordinator
Department of Optometry
School of Health & Allied Science
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UNDERTAKING

I CONFIRM THAT THIS CLINICAL RECORD DRAWN-UP BY ME IS AN ACCURATE RECORD OF THE WORK I HAVE UNDERTAKEN.

STUDENT: SABIHA AAFREEN DATE: 10 -05 -2022

I CONFIRM THAT I HAVE EXAMINED THE PLACEMENT RECORD AND APPROVED AS BEING AN ACCURATE RECORD, TO THE BEST OF MY KNOWLEDGE.

DATE: 10-05-2022

Dr. Mariya Doctor

L. V. Prasad Eye institute, Sircilla

I CONFIRM THAT I HAVE EXAMINED THE RECORD AND APPROVED,

OPTOM SURBHI SHARMA

DATE: 10-05-2022

SUPERVISOR

ACKNOWLEDGEMENT

I Am thankful to Dr. Mariya for the expert guidance and suggestions throughout my project and for encouraging me at every point of my project.

I am thankful to Optom. Chodup Thinley for supporting and guiding me throughout the project.

I am also thankful to Optom. Surbhi Sharma for constantly inspiring me throughout my project.

I would like to thank for giving me this opportunity to do this project on the following topic.

Finally I would like to thank the participation of all the subjects without whom this study would not have been possible.

TABLE OF CONTENT

ABSTRACT

AIM : The aim of the study is to look for prevalence of dry eye in patients using digital screen for longer duration (>6 hour) with those having lesser screen time (<6 hour) by comparing Schirmer score.

OBJECTIVE:

To know the effect of screen time on schirmer test scores in mainly two groups, one that uses the screen for more than 6 hours and the one which has less than 6 hours of screen time.

MATERIALS AND METHODS:

This study included 100 eyes of 50 patients who visited L V Prasad eye institute, Sircilla, Telangana from March 2022 to April 2022 for routine eye check-up falling in inclusion criteria of study underwent schirmer's test 1 and 2 respectively.

The participants were divided into 2 groups. Case group:- had those with screen time of more than 6 hours like Software engineer, receptionist, PG Students working on System, gamers etc.

Control group:- had those with less than 6 hour of screen work like Construction managers, chef, housemaid, surgeon, tattoo artists, shopkeepers etc.

RESULT

50 patients that are 100 eyes were undertaken to check schirmer value with and without anesthesia under case and control group. Schirmer score is found to be less in cases as compared to control groups who use screens for more than 6 hours a day. This study found 12 out of 25 patients under the case group had mild to moderate dry eye on the basis of schirmer score. Whereas only 08 out of 25 have mild- moderate dry eye in the control group which is comparatively lower and at less risk of developing dry eye in later life to those of case group.

Conclusion

Routine dry eye objective tests are found to be affected in patients with prolonged digital screens exposure. There is no defined minimum duration of exposure that will have adverse effects as both case and control group has a number of subjects falling into the category of mild to moderate range in schirmer .

INTRODUCTION

1.1. OUTLINE OF THE REPORT

The study will be presented with an introduction, literature review, methodology, results, the discussion and the conclusion. Thereafter, the references used in the study will be listed.

1.2. INTRODUCTION

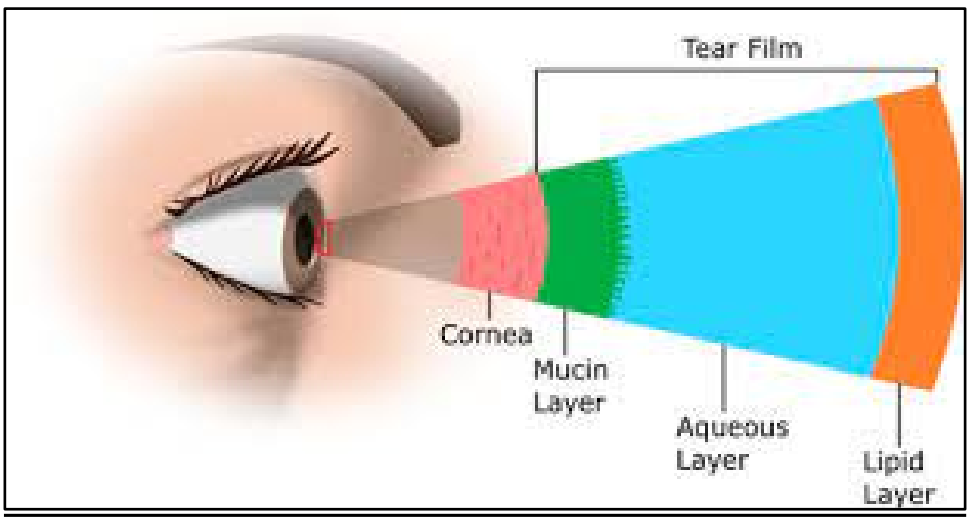
India being one of the major economic centers of the world has a very high population of young professionals who work on the digital screens. Government itself has encouraged the use of computers and other multimedia devices for faster and better performance at work. It is known that screen usage can lead to various adverse effects which are termed as digital strain. Its features are dry eye syndrome (DES), low back pain, tension headaches, psychosocial stress etc. Many studies have reported the association between prolonged computer use and adverse effects. Most of them mainly focused on western adult subjects. However, very little work has been done on the effect of computer use on the Indian population.
Thus the present study was conducted to assess the effects of digital exposure on schirmer score more of tear production.
Prolonged and continuous daily use of digital screens has become the norm in occupational, educational, and recreational settings. An increased global dependence on screen has led to a rise in associated visual complaints, including eye strain, ocular dryness, burning, blurred vision, and irritation, to name a few. This study focuses on the schirmer value in order to evaluate the status of dryness in digital screen users and comparing it with those of no or less hour of screen users. Several mechanisms have been implicated in VDT-associated DE, including blink anomalies, damaging light emission from modern devices, and inflammatory changes.

The study will focus on awareness of using digital screens and their impact on schirmer score which will give the idea of dry eye status by comparing the results in two groups.

CVS, or digital eye strain, refers to a spectrum of clinical vision-related and muscular symptoms perceivably resulting from prolonged and continuous use of visual displays , such as computers, smartphones, televisions, and tablets. Different display device types are associated with unique profiles of visual effects, possibly due to differences in viewing positioning (distance and angle), patterns of use, screen resolution and contrast, image refresh rates, screen glare, color spectra, and other digital features.

Common visual symptoms in CVS include dryness and irritation, sensations of burning, asthenopia, epiphora, hyperemia, blurred vision, diplopia, glare sensitivity, and transient deceptions in color perception. Other extraocular complaints associated with CVS frequently include musculoskeletal pain in the neck, back, and shoulders, carpal tunnel syndrome, and venous thromboembolism, and a higher prevalence for developing dermatologic conditions (ie, eczema, rosacea, seborrheic dermatitis). Given the global burden of screen-induced visual discomfort, identifying and managing its underlying causes can help improve physical wellbeing and workplace productivity.

INTRODUCTION TO TEAR FILM

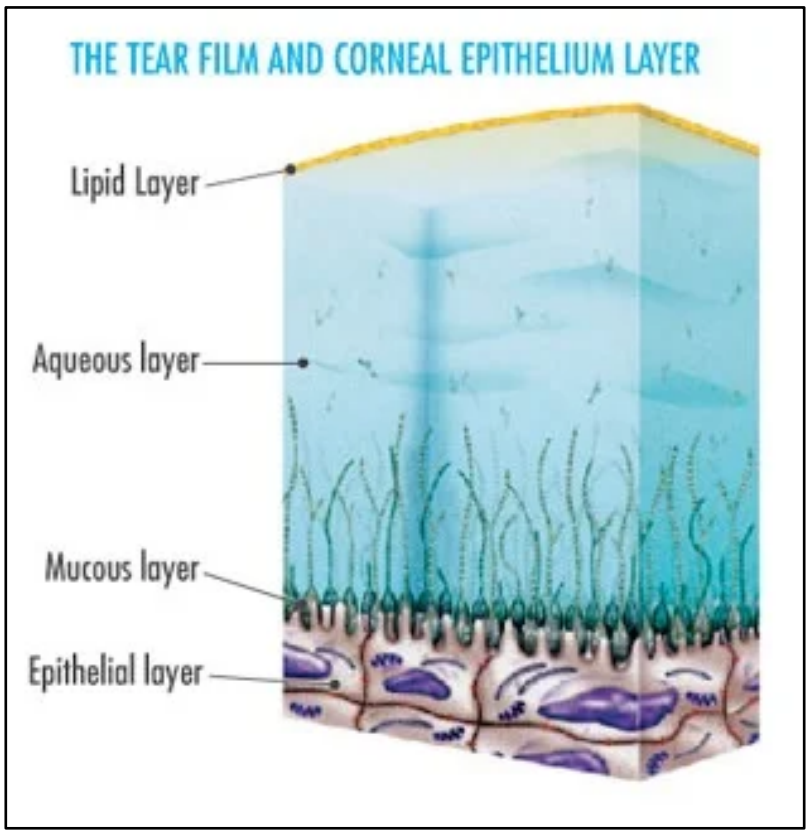


Picture by- Jahmunah Vicnesh ,Shu Lih Oh, Joel En Wei Koh
https://www.researchgate.net/figure/Layers-of-the-tear-film_fig1_339784412

The outer portion of the eye consists of a number of structures, each of which has a specific function. The ocular surface, tear film, lacrimal glands, and eyelids act as a functional unit to preserve the quality of the refractive surface of the eye; to resist injury and to protect the eye against changing bodily and environmental conditions.

The tear film plays a vital role in nourishing, lubricating and protecting the ocular surface. Dry eye is often a consequence of tear film anomaly.

NORMAL TEAR FILM



Picture by Collins street optometrists
https://www.collinsoptometrists.com.au/dry-eye-clinic/understanding-the-tear-film-and-dry-eye/

The traditional description of the tear film is a three-layered structure: superficial-oily, middle - aqueous and mucous layer at the base .

The outermost oily or lipid layer is produced by meibomian glands of eyelids, sebaceous glands of eyelid margin and lashes (zeis and moll)

-Form the outer layer of the tear film.

-Minimize the evaporation of water from the eye surface

-Isolate ocular surface from the environment

-Improve the stability of tear film

-Provide smooth refracting surface

-Limit contamination of ocular surface from dust and microorganisms

-Prevent tear contamination by skin lipids

-Limit aqueous layer surface tension

-Counteract tears overflowing onto the skin

The middle aqueous layer is secreted by the main lacrimal glands and accessory lacrimal glands of Krause and Wolfring produce the remainder. It is normally 7 micrometer thick. Constitutes roughly 90% of the tear film volume

-Lubricate the ocular surface

-Wash away foreign bodies and contaminations

-Nourish the avascular cornea (oxygen, proteins, inorganic salts)

-Include proteins (lysozyme, lactoferrin, lipocalin), immunoglobulins, and

-glycoproteins responsible for antimicrobial activity

-Include growth factors, vitamins and electrolytes necessary for ocular surface

-health and epithelial integrity

-Realign corneal micro irregularities (refractive properties)

The innermost layer mucin is 0.2micrometer thick and is secreted by conjunctival goblet cells and glands of manz.

- Form a glycocalyx over the ocular epithelium that prevents pathogen adhesion
- Bind water to hydrate and lubricate the ocular surface.
- Reduce friction during blinking
- Clear the surface of pathogens and debris
- Contribute to tear stability
- Take part in regulation of epithelial growth

Test to calculate tear production

There are several tests done to assess dry eye by checking tear film stability (TBUT, TMH, Phenol red thread etc.) out of all Schirmer is the commonest test which is being followed in most of the clinics in assessment of tear production.

Basal tears are secreted and spread continuously by the eyes. They moisten the eyes.

Emotional tears made when one is overcome with emotions

Reflex tears are those which are produced by external stimuli or foreign bodies. They are made in Lacrimal gland

SCHIRMER TEST

The clinical diagnosis of dry eye is confirmed by a suitable test of tear production. The technique commonly used is the Schirmer test, being considered one of the most useful in detecting the severest, most tear deficient dry eye (Kallarackal etal, 2002). It was first described by Schirmer in 1903 and is still the method most commonly used clinically to evaluate aqueous tear production (Schirmer, 1903;Kashkouli et al, 2010). The Schirmer procedure was modified by De Roetth in 1953 when he changed the paper to Whatman standard No.41 filter paper. In 1961 standardized Schirmer test strips were introduced for the first time by Halberg and Behrens (Halberg and Behrens, 1961.

Furthermore, it was stated that all the study participants preferred the shorter duration citing the unpleasant test procedure as their reason. Bawazeer and Hodge (2003) investigated performing a one-minute Schirmer 2 test. An acceptable correlation between the results for the five minute and one minute test was discussed. While the study recommended that reducing the test time is clinically acceptable, the five minute testing time is still used.

There has been much discussion whether a closed or open eye state should be maintained during the test. Nelson (1982) and Pandher et al (1985) did not place any emphasis on this issue. Other authors (Doughman 1973; Shapiro and Merin 1979; Clinch et al 1983) suggest that the patient should continue to blink normally throughout the procedure. Also, Loran et al (1987) did not find any differences in the test results when the eyes were open or closed. However, Serruya et al (2009) found a statistical difference in the results when the eye was kept open and when it was closed. In agreement with these authors, Serin et al (2007) suggested that conducting the Schirmer's test with closed eyes produces less variable results and more repeatability. Kashkouli et al (2010) are in agreement that the closed eye state is advantageous in maintaining more stable and uniform test+ conditions as it eliminates the influence of external factors such as temperature, evaporation and humidity.

The Schirmer test is used to assess and estimate tear secretion and can be performed with or without a local anesthetic. The presence of the anesthetic eliminates reflex tearing and is indicative of the basal secretion of tears (Schirmer 2). If the test is performed without the anesthetic (Schirmer 1), the results yielded would be indicative of both reflex and basal tears.

SCHIRMER TEST 1:

The Schirmer test 1 is performed using a sterile strip of Whatman no 41 filter paper of 5 mm width and 35 mm long.

It is folded 5 mm from one end and the patient is asked to look slightly above the horizon at a distant target and then a strip is inserted into the lower conjunctival sac at the junction of the lateral and middle thirds, avoiding touching the cornea and asking the patient to keep the eyes closed.

The amount of wetting caused by tear fluid is measured after 5 minutes.

The value less than 10 mm is considered abnormal.

The Schirmer 1 test measures both basic and reflex tearing and does not determine the relative contribution of each of these two components.

SCHIRMER TEST 2(WITH ANESTHESIA):

The reduction in the potential for reflex tearing could be achieved by applying a topical anesthesia before inserting a fresh, dry strip. It tests only basic secretion.

The strip is placed in the same way after topical anesthetic application, removal of excess with a tissue. Basic hyposecretion is present when less than 10 mm of wetting occurs in 5 mm considering 10 mm as a threshold between abnormal and normal.

Because the anesthetic eliminates reflex tearing and allows for a more pure measurement of basic tearing, the basic secretion test is the most common and more reliable test of this series applied clinically.

REVIEW OF LITERATURE

A lot of reviews have been made in order to prove involvement of digital screens in dryness.

One such study name **The Relationship Between Dry Eye Disease and Digital Screen Use by** Zaina Al-Mohtaseb 1, Scott Schachter 2, Bridgitte Shen Lee 3, Jaclyn Garlich 4, William Trattler 5 Was done indicating ocular problems associated with digital screen .

Impact of Prolonged Digital Screens Exposure On Ocular Surface published in Delhi journal of ophthalmology by Upma Awasthi Maheshwari Clinics, Sukhdev Vihar, New Delhi, India. In this prospective cohort study, patients were enrolled on the basis of history of prolonged digital exposure (>2hrs/day).

Dry eye evaluation was done by Schirmer's with anesthesia, Fluorescein-Tear film Break-up Time (F-BUT) and corneal and conjunctival fluorescein staining. Patients were categorized as per severity based grading based on objective tests.

As a result Routine dry eye objective tests are affected in patients with prolonged digital screens exposure. There is no defined minimum duration of exposure that will have adverse effects on the ocular surface. New grading system may serve as a common guideline for the treatment of digital strain in future. The study indicated.

Several other large cross-sectional studies have demonstrated a relationship between digital screen use and dry eye . In a large study of office workers, severe symptoms of dry eye were more prevalent among those who used digital screens for >6 hours per day.
However, no significant relationship was found between duration of screen work and clinically diagnosed DED in any study.

Notably, the position of the screen relative to the individual's eyes and use of a glare filter on the screen were not found to affect the risk of severe symptoms of dry eye or clinically diagnosed DED.

Similarly, a large study using crowdsourcing data found an association between >8 hours of screen use per day and symptomatic dry eye compared to <4 hours per day.
Evidence also supports a relationship between duration of digital screen use and

diagnosed DED.

The OSAKA study demonstrated that office workers who used digital screens for >8 hours per day had a higher risk of definite or probable DED
Furthermore, the JPHC-NEXT study found that greater digital screen use was associated with a higher risk of clinically diagnosed DED and severe symptoms of dry eye.

When risk factors for aqueous deficient DED and evaporative DED were examined among a group of 1125 individuals, greater digital screen exposure was found to be a predictor of evaporative DED

Although a relationship between screen use and diagnosed DED has been found, this relationship was not found when only individuals who had symptomatic dry eye were examined.

Overall, these findings established a relationship between DED and digital screen use. The association between digital screen use and DED has also been found in school-age children, specifically smartphone use. Among a group of 288 children in Korea (age range=10–12 years), the prevalence of smartphones.

In this study, the prevalence of dry eye on the basis of schirmer score in two different groups by calculating tear production and comparison will be made in order to give an idea of tear production.

METHODOLOGY:-

Here, the study population, how the study sample was selected, the inclusion and exclusion criteria, the research tools and methods, and how the data was managed and analyzed is discussed.

RESEARCH DESIGN

Institutional prospective study.

STUDY POPULATION:

The study population was PG students, patients and reception staff at the L V Prasad eye Institute, Sircilla and Hyderabad campus. The participants were recruited in March 2022 to April 2022 using personal invitations and clinical patients visiting L V Prasad eye institute (Hyderabad and Sircilla)during the course of study.

STUDY SAMPLE

Potential participants were recruited between March 2022 and April 2022 and were checked against the inclusion and exclusion criteria. To achieve a 95% confidence, the minimum sample size of 100 participants was decided.
However, in anticipation of some volunteers not meeting the inclusion criteria it was decided to secure the participation of 50 participants.

The study included 50 patients aged 25-40 years from the patients, PG students and staff of LVPEI working on the system.

The sample should consist of 100 (50%) males and 100 (50%) females but equal gender distribution wasn't possible.

PG students and system staff who volunteered to participate were screened and then included in the study if the inclusion criteria were met.

CASE SELECTION:

1. INCLUSION CRITERIA:

1. Patient of either sex.
2. Patient of age 25-40 years.
3. Patients with screen time at least more than 6 hour for case group and <6 hour of screen time in a day for control group
4. Patients experiencing symptoms like pricking sensation and dryness.

2. EXCLUSION CRITERIA:

1. Did not meet any of the inclusion criteria
2. wearing contact lenses
3. Patient with active corneal pathology.
4. Patient with traumatic condition
5. Operative/operated patients

DATA COLLECTION TOOLS AND VARIABLES

The instruments and materials used in the study to gather data were Schirmer test strips and a stopwatch. A general Dry questionnaire forms were prepared to record the results of the test.

The following information was obtained:

- Demographic details: (age and gender)
- Duration of exposure to Screen
- Schirmer 1 and Schirmer 2 score

DATA COLLECTION PROCESS

The study was conducted from March 2022 to April 2022.

All the patients in OPD were examined by an optometrist with the following procedures-

Pre-tear tests procedures

1. A thorough history taking.
2. Refraction.
3. A slit lamp examination was performed to rule out any obvious ocular disease.
4. A self administered questionnaire was used to collect socio-demographic data, ocular symptoms , details of computer usage and potential risk factors. Question follows:-

- What do you do?

- what is your overall screen time?

- any eye drop if you are/were using.

- Do you have any systemic illness?

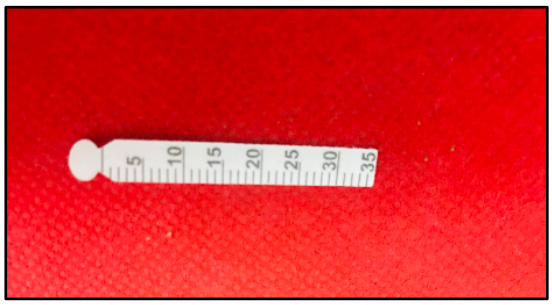
- Any ocular surgery in the past?

- any symptoms like dryness, pricking sensation?

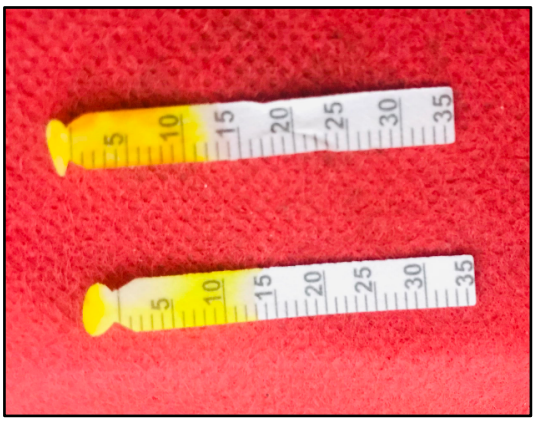
Tear tests procedure

- The participant was seated comfortably in a clinical air conditioned room and the test procedure was explained to them.

- Without previously instilling anesthetic drops, the schirmer strips were inserted into the lower conjunctival sac at the junction of the lateral and middle thirds, avoiding touching the cornea, and the length of wetting strips in millimeters was recorded after 5 minutes


5
10
15
20
25
30
35

The picture of one of the subjects taken while performing the test. The use of fluorescein stain was done for photo purposes to show wetting of the strip clearly.



The picture of a wet Schirmer tear strip.

1 minutes later, strips were placed over the same point in the same person again for 5 minutes, after topical anesthesia with 0.5% proparacaine hydrochloride eye drops twice at 1 minute interval, and then the length of wetting was read. All patients were seated at rest with their eyes closed, and the lower cul-de-sac was gently dried with a cotton applicator before the placement of strips

DATA MANAGEMENT (STORAGE AND ACCESS)

Data was first captured onto the record forms from where it was captured into th computer.

At no stage were any of the participants' names or personal details noted as institutional criteria.

5. And the results were recorded on the pre-prepared sheet.

After recording schirmer value

- Considering standard approach by Jennifer P. Craig, Laura E. Downie, in Conta Lenses (Sixth Edition), 2019 (Schirmer 1)

Schirmer 1 –

- 0 to 5 mm of wetting- severe dry eyes.
- 5 to 10 mm of wetting- moderately dry eyes.
- 10 to 15 mm of wetting- mildly dry eyes and
- >15 mm of wetting- normal tear function.

Schirmer 2 -

- ScienceDirect topics (schirmer 2)
- >16mm of wetting normal
- 10-20mm borderline
- <5mm dry eye

DATA ANALYSIS

The data was analyzed as mean results of the Schirmer 1 and 2 test.

ETHICAL CONSIDERATIONS

Approval to conduct this study was obtained from the Doctor and consultant at L V Prasad Eye Institute, Sircilla.
Participants were fairly selected, with each person being informed of the procedure. Data was maintained and none of the participants were identified in the results. Each subject was informed that participation was voluntary and he or she was free to withdraw from the study if he or she so wished. The study was Self-funded.

RESULTS

The results of this study are in the following order:
demographic details, the results of the screening test, the results of and the Schirmer test.

DETAILS

The population sample consisted 50 participants, 23males (46%) and 27 females (54%), resulting in 100 eyes being examined. The ages of the participants ranged from 25-40 years of

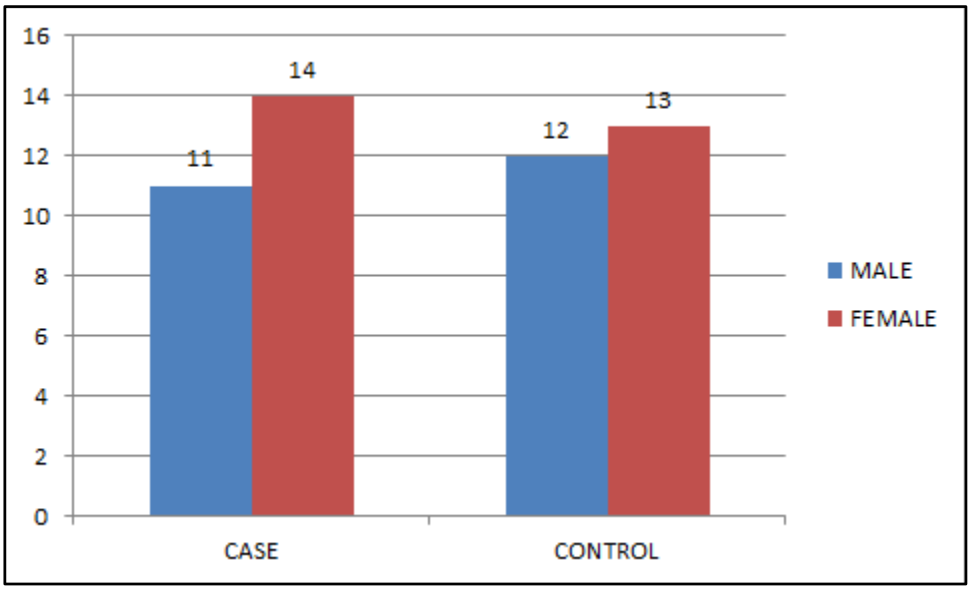
TABLE - 1

1.	No. of patients	25 (CASE) 25 (Control)
2.	No. of Eyes	100 eyes of 50 patients
3.	Age range	25-40years
4.	Mean of age	Case 31.76 ±1.853 (±5.83%) Control 33.32 ±1.92 (±5.76%)
5.	Gender Male	Case 11 Control 12
	Female	Case 14 Control 13
6.	Mean Score - Schirmer 1 Case	RE- 15.56 ±1.63 (±10.47%) LE- 15.68 ±1.858 (±11.85%)
-	Schirmer 1 Control	RE- 19.04 ±2.108 (±11.07%) LE- 19.56 ±2.281 (±11.66%)
-	Schirmer 2 Case	RE- 13.32 ±1.47 (±11.03%) LE- 13.24 ±1.768 (±13.35%
-	Schirmer 2 Control	RE- 15.12 ±1.391 (±9.20%) LE- 15.44 ±1.433 (±9.28%)

TABLE 1 shows number of male and female participants, no. of eyes enrolled, age range, mean of age and mean value of schirmer 1 and 2 in case and control group.

Graph 1

The number of male and female participants in the case and control group is shown below.



GRAPH 1 The X axis shows case and control group, Y axis shows the number of participants the Blue bar shows male participants and Red shows female participants. The Case group had 11 Male and 14 Female whereas the Control group had 12 Male and 13 Female participants.

Table 2

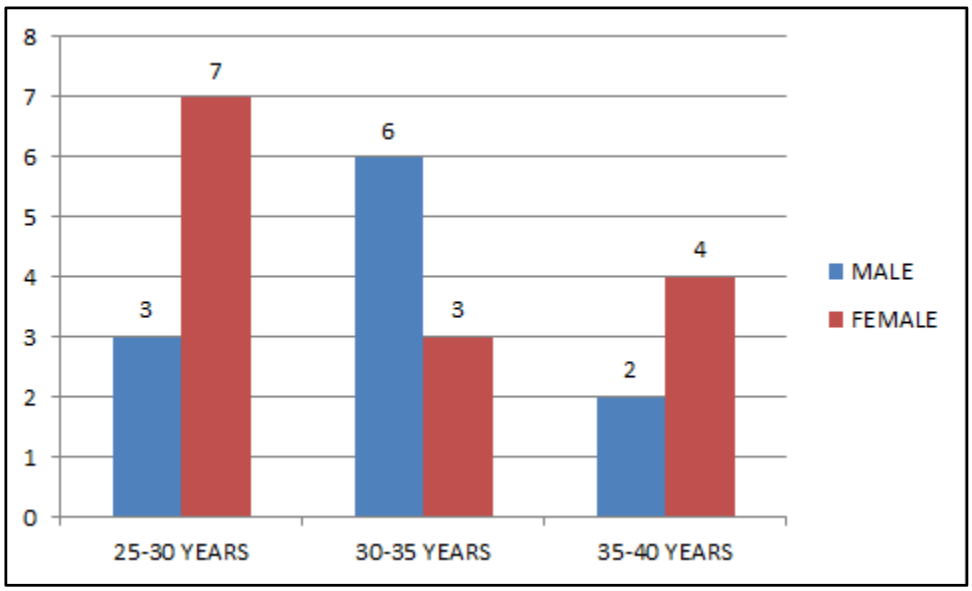
Age- wise gender distribution

Age Group In years	Gender distribution Male	Gender distribution Female
25-30years	Case- 03 Control- 04	Case- 07 Control- 03
30-35 years	Case-06 Control- 05	Case- 03 Control- 03
35-40 years	Case- 02 Control- 03	Case- 04 Control - 07

Table 2 shows age wise gender distribution in case and control group. As per table, a total of 17 participants were of 25-30 years, 17 of 30-40 years and 16 of 30-40 years.

Graph 2

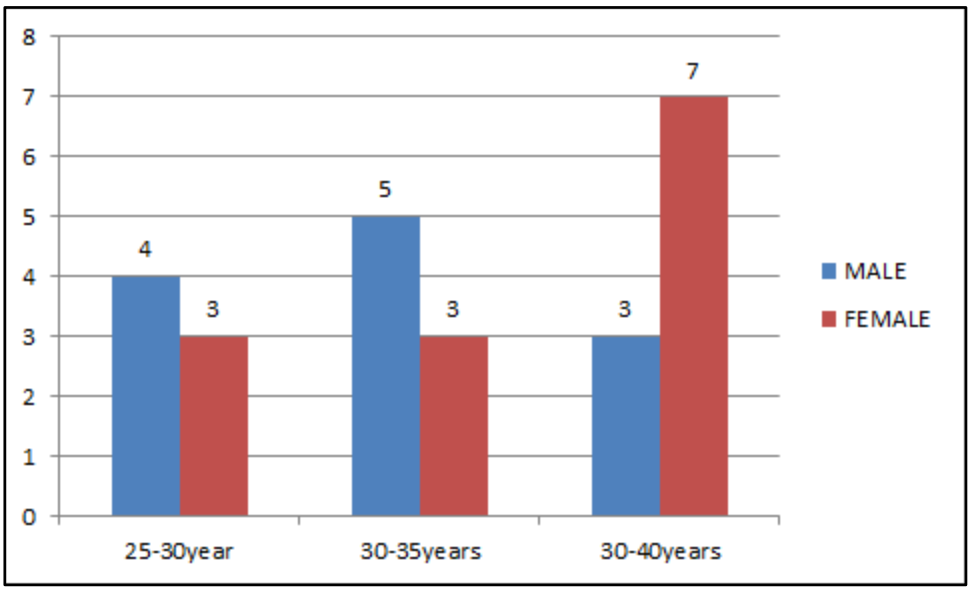
Age wise distribution of male and female in Case group.



GRAPH 2 shows the number of male and female participants of different age groups in Case Group. X axis shows the age distribution i.e., 25-30, 30-35 and 35-40 years, Y axis shows age in year and the blue bar shows no. of Male and red bar shows no. of female participants in different age groups. The total of 10 participants were of 25-30 years, 9 of 30-40 years and 06 in 30-40 years of age in case group

Graph 3

Age wise distribution of male and female in the Control group.



GRAPH 3 shows the number of male and female participants of different age groups in the Control Group. X axis shows the number age distribution i.e., 25-30, 30-35 and 35-40years, Y axis shows age in year and the blue bar shows no. of Male and red bar shows no. of female participants in different age groups. The total of 07 Participants of 25-30 years, 08 of 30-35 years and 10 of 30-40 years of age in the control group.

Table 3

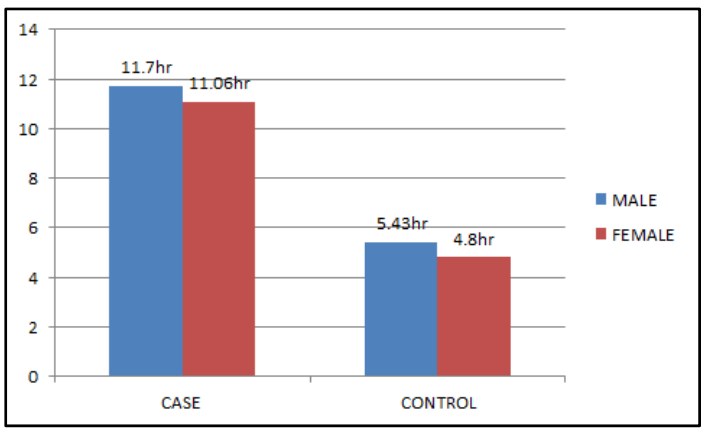
Mean duration of exposure in female and male of different age groups in case and control group.

Age Range	Exposure duration in hours Male	Exposure duration in hours Female
5-30years	Case-9.33±1.41hr Control-5.5 ±0.49	Case-11.4286 ±1.364 Control- 4.33±1.41
0-35 years	Case-12.166±2.67 Control- 5.2±0.656	Case-10.6667 ±0.533 Control- 5.333±0.53
5-40 years	Case-14 ±1.386 Control-5.66±0.53	Case- 11.25 ±2.005 Control- 4.857±0.61

TABLE 3 shows the mean duration of exposure to screen for male and female of case and control group. Male of 35-40 years of age group in Case have comparatively high duration of exposure to screen as compared to other age groups. Whereas in females the 25-30years of age group in Case has higher mean duration of exposure to screen than other age groups.

GRAPH 4

Mean exposure duration of male and female in case and control group



Graph 4 X axis shows Case and control group in which blue bar shows male and red bar indicates female, Y axis shows no. of hours. The total mean duration of exposure

to screen is 11.7 hours in male case group and lowest in the female of the control group being 4.8 hours. Graph shows Male of either group used relatively longer hours compared to females.

TABLE 4

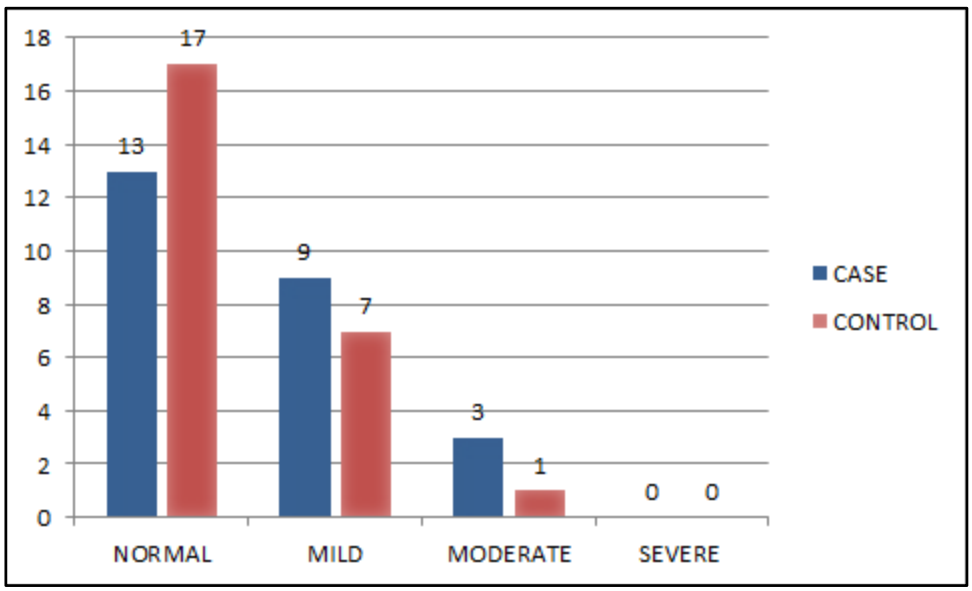
Number of patients/subjects, percentage with a normal,mild,moderate and severe dry eye by schirmer score.

	CASE N=25	%	CONTROL N=25	%
NORMAL	13	52%	17	68%
MILD	09	36%	07	28%
MODERATE	03	12%	01	4%
SEVERE	00	0%	00	0%

TABLE 4 Normal, mild, moderate and severe schirmer value in case and control group. As shown 13 (52%) of 25 (100%) subjects had wetting of more than 10mm in the case group whereas 17 (68%) of 25 (100%) in the control group. About 36% of subjects in the case and 28% in the control group were in the mild range. No subjects were in severe range.

GRAPH 5

Normal, Mild, moderate and severe wetting of tear strip.



In Graph 5, X-axis shows Normal , mild, moderate and severe range of score, Y- axis shows the number of participants. The blue bar shows Case population and red shows Control population. The Case group has a total of 12 subjects with mild- moderate dry eye score whereas the control group has 08. The incidence of dry eye occurrence is more in Case group

TABLE5

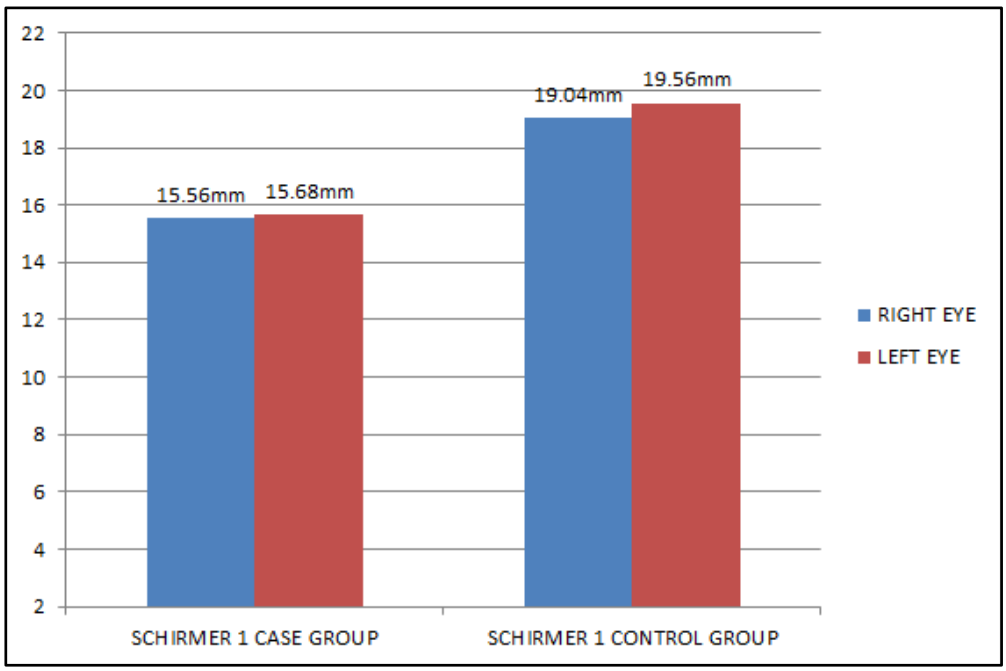
Table 5 shows the mean of wetting height and standard deviation of both eyes in case and control group participants.

EYE	CASE MEAN	STANDARD DEVIATION	CONTROL MEAN	STANDAR DEVIATIO
SCHIRMER 1				
RIGHT EYE	15.56 ±1.63	4.75	19.04 ±2.108	4.37
LEFT EYE	15.68 ±1.858	4.15	19.56 ±2.281	5.81
P- VALUE	P = 0.9748		P = 0.7222	
SCHIRMER 2				
RIGHT EYE	13.32 ±1.47	3.74	15.12 ±1.391	3.54
LEFT EYE	13.24 ±1.768	4.51	15.44 ±1.433	3.65
P- VALUE	P = 0.9459		P = 0.7540	

TABLE 5 shows Mean wetting height of schirmer 1 and 2 in case group is lower as compared to control group which says case group has lower schirmer value and more probability of getting dry eye.

GRAPH 6

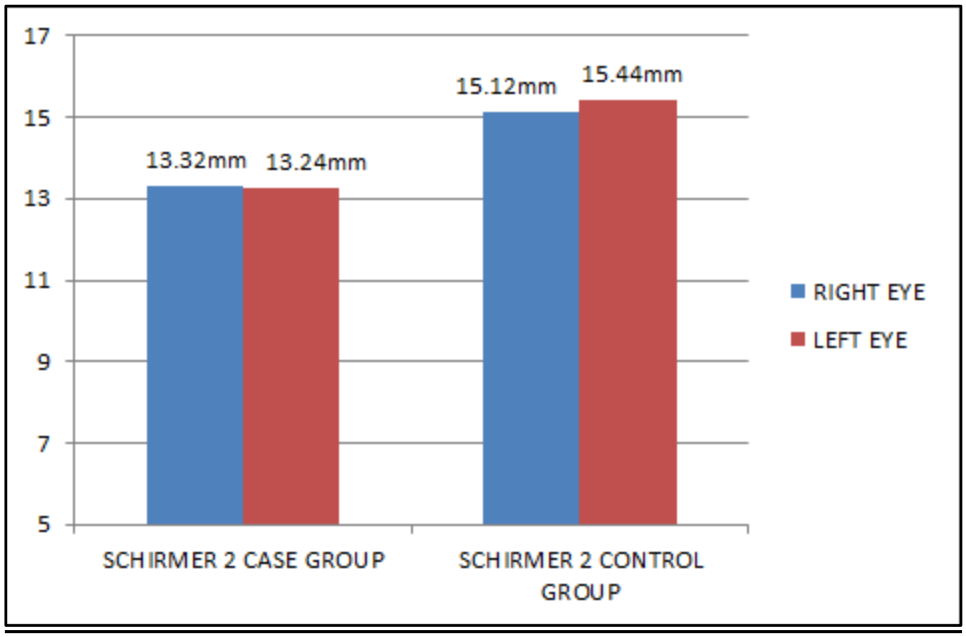
The Schirmer 1 Score in Case and control group.



In graph 6, X-axis represents Schirmer 1 in case and control group, Y- axis shows wetting height in mm and the blue bar is for Right eye and red for left eye mean value. As clearly shown, higher wetting height in the control group and low in the case group. Which again gives us an idea and probability of score and dry eye state.

GRAPH 7

The Schirmer 2 Score in Case and control group



In graph 7, X- axis represents Schirmer 2 in case and control group, Y- axis shows wetting height in mm and the blue bar is for Right eye and red for left eye mean value. As clearly shown, higher wetting height in the control group and low in the case group.

By Results we can say that screen time does affect tear production.

Case group has less wetting height in the Schirmer test with those of the control group.

The graphic representation shows the difference in schirmer value in case and control group.

The participants of the control group also have a number of participants having mild-moderate wetting height but they are likely to be because of the working environment or living lifestyle .

This falls into limitation of study:-

Some receptionists work under normal tempered rooms and some in Air conditioned rooms which were included in both case and control group according to the facility of their working lifestyle. This creates an error in data and falls under limitations of the study.

Working conditions may also affect patients' blink rate which respectively changes the schirmer score.

DISCUSSION

This study was done to evaluate schirmer score in digital screen users with routine objective tests which include Schirmer. Total of 50 patients (100 eyes) were tested for Schirmer score of which 50 eyes were of the case group and 50 of the control group. The number of male and females were unequal in either group.

The number of female participants was more than male in the study. Total of 23 male and 27 females were included in the study.

Mean exposure duration was highest in the 35-40 years age group that was 14 hours . This can be explained by the lesser number of patients in other age groups.

Symptoms related to digital screens were classified by Porcar et al in 2016 and they reported that asthenopia is the most common presentation in such a case group. Though in the study symptoms were not given priority but if considered the participants of the case group will have asthenopic symptoms due to longer screen hours. Such as Neck pain, pulling sensation in eye, eye fatigue.

The mean schirmer score for Schirmer 1 in Case group was 15.56mm,15.68 mm which is lower than Control group of 19.04mm,19.56mm . Here the mean shows the wetting height of the schirmer strip in case and control group.

Whereas same for Schirmer 2 value which was 13.36mm, 13.24mm for case group followed by 15.12mm, 15.44mm for control group.

The mean value of both Schirmer 1 and Schirmer 2 says patients with screen time of more than 6 hours have a lesser tear production.

We have found that even exposure duration of 3 hours can cause a decrease in tear production.

Previous studies reported continuous exposure as long as 1 hour can cause symptoms of DES and the minimum exposure duration in our study was 3 hours and that too of just one patient. It may also be because of small sample size and unequal distribution of patients in different sub-groups. There is no other study that has reported this analysis before and there is no minimum safe exposure duration defined.

Schirmer's 1 test was more than 10mm in 22 (88%) out of 25 patients of the case group and 24 (96%) out of 25 patients in the control group. Lucca et al[17] and Farris et al[18] reported low sensitivity of Schirmer's tests in their studies. DEWS 2 also reported high variability in sensitivity, specificity and repeatability of Schirmer's. And they do not mention Schirmer's in their proposed diagnostic test battery. Despite having low sensitivity, Schirmer's test can be explained by the reflex epiphora. This may be because of ineffective anesthesia. It is a flaw in our study; we should have repeated Schirmer's after re-anesthetizing eyes.

Classification as per exposure duration analysis showed that there is damage in both groups.But patients with higher exposure duration were more symptomatic, and have less wetting height as their mean values were lower. . Even our severity based grading showed that 48% of Case group patients were in mild- moderate grade while 32% of control group were in the same phase.

DETAILS

Sample size

A total of 50 participants (100 eyes) were used in this study, this being lower than decided by us. A small sample size resulted in a low probability of detecting a statistically significant result. Statistically significant means that there exists a genuine difference between the two groups.

This does not necessarily mean that this difference is clinically significant, as the difference between the groups may be so small that it is clinically of little importance. The number of participants should be high enough to detect an effect of clinical importance but not so large that effects too small to be of interest are detected. So due to small sample size this is one of the major limitations of the study conducted.

Age

Participants aged 25-40 years were chosen for this study because they were considered to use screens for longer hours for case groups whereas it was difficult to look for patients/participants who use no or less hours on screen.

The ages of participants in this study are variable to some other studies.

Gender

The unequal number of males and females used in the current study is another major limitation because an equal number or nearly equal number of participants from each gender is important since it helps to draw accurate comparisons, patterns or differences between the genders when analyzing and discussing the results.

It was difficult to calculate and create assumptions on gender basis because of unequal gender distribution.

The Schirmer Value

The schirmer value of all the participants of the case and control group varied with the time of exposure to the screen.

We found that Case group has lower wetting height due to longer duration to screen exposure in comparison with Control group that had relatively more wetting height when the mean of Right and left eye of both case and control group were measured.

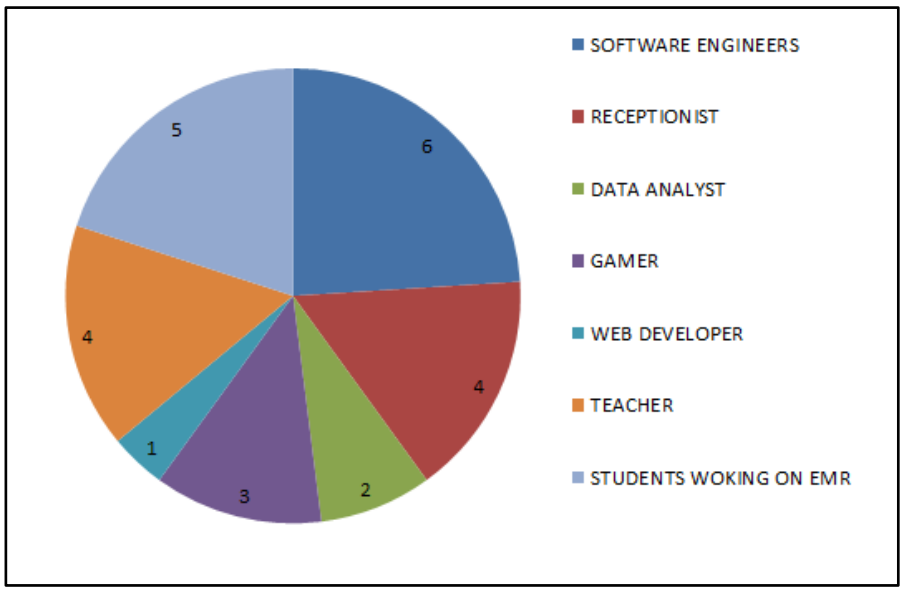
Also the mean exposure duration was higher in male of 35-40 years of case group.

As per the grading subject, using screen for more than 6 hours has higher chance of getting tear film and tear production variability in upcoming years due to prolonged and continuous use of screen as compared to participants of control group who had higher wetting height. Although participants of the control group are also under a mild, moderate range of dry eye, this can be justified by their working condition or error of reading and according to previous studies even use of screen for 1 hour has serious effect on tear production parallel with other factors mentioned above.

There are few strong points also in our study. We have compared two groups separately irrespective of gender, this atleast gave us an idea for estimating the result of case and control group on the basis of exposure duration and schirmer score.

But our study results should be interpreted with caution because of small sample size thus sub -group analysis could have been skewed. Furthermore, we have included only digital screen users and excluded all other causes and confounding factors thus cannot comment on the effect on other causes. Patients presented to us could have been exposed to different environmental conditions. This could have resulted in over or underestimation of the test. In addition to this point:-

PIE CHART -1 Different profession of Participants of Case Group.



This pie chart was made as a rough estimate of different professions of participants of the case group. Total of 25 participants who appeared for the Schirmer test (case group) had a different professions. 6 were Software engineers, 4 receptionist, 2 data analyst, 3 gamers, 1 web developers, 4 were teachers and 5 were Students of LVPEI, who were researchers and works on Electronic Medical Record more than 6 hours a day. By this data we can estimate that working conditions might not be the same for all professions here. Some Software engineers might be working in the office, some may be at home, some under air conditioned rooms or may be some under normal room temperature. Considering those who were working under AC. As our eyes need a certain level of moisture from the air around us to produce tears. Gets suppressed by AC as it reduces the level of humidity in air which causes our eyes to feel uncomfortable and also causes evaporation of tears more quickly which in process disturbes our blink rate this both thing together will disturb the tear production anyhow.

The environment, working conditions and other such factors may also be responsib for changes in Schirmer value.

LIMITATIONS

Few limitations of the study are listed below:-

- Small sample size
- Unequal gender distribution
- Different environmental conditions the patient traveled/lived in.
- Not including working environment as part of distribution

- No systemic examination done while considering patients into inclusion criteria.

CONCLUSION

With this study, it can be concluded that digital screens are causing damage to tear production. There is no defined minimum duration of exposure that will have adverse effects as both case and control group has a number of subjects falling into the category of mild to moderate range in schirmer 1 and 2.

Previous studies showed screen usage of even 1 hour has an adverse effect on tear production. In this study it was 2 hours and that too of just 1 patient.

So, As an optometrist we can counsel patients about the effect of using screen time. Also we can explain the 20-20-20 rule in order to maintain the blinking rate.

The justice to the study can be given by using large sample size and equal distribution in sub groups and keeping the traveling and working environment as a add on to the study.

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9. Microsoft Excel 2010 for making graph
10. Google Documents for editing the file and table formation.
11. MedCalc easy to use statistical calculator for p value

CASE GROUP

S. R No.	Gender	Age	Schirmer 1	Schirmer1	Schirmer 2	Schirmer 2	Exposure duration
			RIGHT EYE	LEFT EYE	RIGHT EYE	LEFT EYE	
1.	M	25	17mm	17mm	16mm	15mm	8hr
2.	F	29	11mm	11mm	10mm	10mm	10hr
3.	M	26	20mm	18mm	17mm	16mm	09hr
4.	M	33	10mm	10mm	08mm	09mm	15hr
5.	M	36	22mm	23mm	20mm	20mm	13hr
6.	M	32	09mm	10mm	08mm	08mm	14hr
7.	M	34	18mm	21mm	15mm	17mm	08hr
8.	F	25	16mm	16mm	14mm	13mm	12hr
9.	F	26	14mm	14mm	13mm	13mm	11hr
10.	F	28	21mm	19mm	19mm	17mm	08hr
11.	M	30	14mm	14mm	12mm	11mm	11hr
12.	M	35	19mm	22mm	16mm	19mm	07hr
13.	F	36	19mm	23mm	17mm	19mm	13hr
14.	F	38	12mm	14mm	10mm	11mm	11hr
15.	F	39	12mm	12mm	10mm	10mm	08hr
16.	M	34	25mm	26mm	21mm	21mm	14hr
17.	F	40	12mm	11mm	10mm	09mm	13hr
18.	F	32	17mm	17mm	15mm	15mm	10hr
19.	M	31	09mm	09mm	08mm	08mm	15hr
20.	F	25	20mm	18mm	16mm	16mm	13hr
21	F	33	13mm	12mm	10mm	10mm	11hr
22.	M	39	15mm	19mm	11mm	15mm	15hr

23.	F	34	14mm	14mm	11mm	12mm	11hr
24.	F	25	13mm	13mm	11mm	12mm	14hr
25.	F	29	17mm	19mm	15mm	15mm	12hr

CONTROL GROUP

S. R No.	Age	Gender	Schirmer 1	Schirmer 1	Schirmer 2	Schirmer 2	Exposure duration
			RIGHT EYE	LEFT EYE	RIGHT EYE	LEFT EYE	
1.	26	M	23mm	24mm	17mm	17mm	6hr
2.	32	M	14mm	15mm	14mm	12mm	5hr
3.	40	M	16mm	16mm	15mm	15mm	5hr
4.	29	F	14mm	12mm	11mm	13mm	4hr
5.	37	M	21mm	20mm	17mm	17mm	6hr
6.	38	F	13mm	11mm	10mm	10mm	6hr
7.	30	M	17mm	17mm	15mm	15mm	5hr
8.	36	F	15mm	14mm	11mm	12mm	5hr
9.	37	M	29mm	30mm	24mm	26mm	6hr
10.	35	M	21mm	26mm	17mm	16mm	5hr
11.	33	M	14mm	15mm	13mm	13mm	4hr
12.	40	F	19mm	18mm	15mm	15mm	4hr
13.	25	M	11mm	13mm	10mm	10mm	5hr
14.	32	F	20mm	23mm	16mm	17mm	5hr
15.	34	F	13mm	14mm	11mm	11mm	6hr
16.	33	F	21mm	22mm	18mm	19mm	5hr
17.	37	F	32mm	29mm	18mm	16mm	5hr
18.	34	M	21mm	19mm	16mm	16mm	6hr
19.	26	M	17mm	17mm	15mm	15mm	6hr
20.	39	F	23mm	24mm	19mm	19mm	4hr
21.	38	F	25mm	26mm	19mm	18mm	4hr
22.	31	M	25mm	29mm	14mm	18mm	6hr
23.	26	F	10mm	10mm	08mm	09mm	3hr
24.	40	F	21mm	21mm	19mm	18mm	6hr

25.	25	F	21mm	24mm	16mm	19mm	6hr

LV.PRASAD EYE INSTITUTE

(A Hyderabad Eye Institute Organization)

Hyderabad Road, Beside RDO Office, Sircilla, Rajanna Sircilla Dist

GENERAL OP-CONSENT FOR TREATMENT

(The Contents of this form been explained to me in my spoken language)

Patient Name Age

Gender

Consultant

Consent is hereby given to the staff of **L.V. Prasad Eye Institute** to conduct any examination of my eyes/my child eyes and my general system, to perform any diagnostic tests, to administer or prescribe any medication that is applied to the eye or taken orally or by injection, as deemed fit by the treating clinician in person or by teleconsultation. The consent is also given for the use of the information contained in my/my child's medical record for the purpose of research into eye health and factors associated with it, with the assurance that my/my child's personal details and identity will not be revealed.

నా కళ్ళు/నా బిడ్డ కళ్ళపై మరియు నా సాధారణ వ్యవస్థపై చికిత్స చేస్తున్న డాక్టర్ స్వయంగాగానీ లేదా టెలీకన్సల్టేషన్ ద్వారాగానీ యుక్తమని భావించిన ఏ పరీక్షలనైనా చేయడానికి, ఏ రోగనిర్ధారణ పరీక్షలు చేయడానికి, కంటికి పూసే లేదా నోటిద్వారా లేదా ఇంజెక్షన్ ద్వారా తీసుకునే ఏ మందునైనా ఇవ్వడానికి లేదా సూచించడానికి ఎల్ వి ప్రసాద్ నేత్ర వైద్య విజ్ఞాన సంస్థ సిబ్బందికి నేను ఇందుమూలంగా సమ్మతిని ఇస్తున్నాను. కంటి ఆరోగ్యం మరియు దాని సంబంధిత కారకాలలో పరిశోధనకొరకు నా/నా బిడ్డ వైద్య రికార్డులో ఉన్న సమాచారం ఉపయోగించడానికికూడా ఈ సమ్మతి ఇవ్వబడుతున్నది, నా / నా పిల్లల వ్యక్తిగత వివరాలు మరియు గుర్తింపు బయటపడవని హామీతో.

(Signature - Patient)

Date:

LV.PRASAD EYE INSTITUTE

(A Hyderabad Eye Institute Organization)

Hyderabad Road, Beside RDO Office, Sircilla, Rajanna Sircilla Dist

GENERAL OP-CONSENT FOR TREATMENT

(The Contents of this form been explained to me in my spoken language)

Patient Name Age

Gender

Consultant

Consent is hereby given to the staff of L.V. Prasad Eye institute to conduct any examination of my eyes/my child eyes and my general system, to perform any diagnostic tests, to administer or prescribe any medication that is applied to the eye or taken orally or by injection, as deemed fit by the treating clinician in person or by teleconsultation. The consent is also given for the use of the information contained in my/my child's medical record for the purpose of research into eye health and factors associated with it, with the assurance that my/my child's personal details and identity will not be revealed.

मैं सहमति देता हूं एलवी प्रसाद के संगत कर्मचारी को मेरी आंखें / मेरे बच्चे की आंखों और मेरी सामान्य प्रणाली की किसी भी परीक्षा का संचालन करने के लिए किसी भी आंखों का परीक्षण करने केलिए किसी भी दवा को देना या निर्धारित करने के लिए जो आंख पर लगाया जाता है या मुंह से या इंजेक्शन के रूप में लिया जाता है, जैसा कि चिकित्सक समझता है स्वयं या टेली परामर्श द्वारा कर सकता है । आँख के स्वास्थ्य और इसके साथ जुड़े कारकों में अनुसंधान के उद्देश्य से मेरे / मेरे बच्चे के मेडिकल रिकॉर्ड में निहित जानकारी के उपयोग के लिए भी मैं सहमति देता हूं, इस आश्वासन के साथ कि मेरे / मेरे बच्चे के व्यक्तिगत विवरण और पहचान का खुलासा नहीं किया जाएगा।.

(Signature - Patient)

Date: