Original Article

Relationship between Time Length of Digital Device Usage and Dry Eye in Pterygium Patients

Phrueksaudomchai P, MD[1], Tangpakasit W, MD[1], Kanchanaranya N, MD[1]

[1] Department of Ophthalmology, Faculty of Medicine, Thammasat University, Pathumthani, Thailand

Objective: To study the relationship between time length of digital devices usage and dry eye conditions in pterygium patients.

Materials and Methods: This is a retrospective study at Thammasat University Hospital. Consequently, information regarding demographic characteristics, characteristic and related data of pterygium, time spent on using digital devices and Ocular Surface Disease Index (OSDI) were collected. The quantitative data was analyzed to determine the mean and relationships by using statistical tools of ANOVA, simple linear regression and Pearson correlation.

Results: In total, 328 samples were collected which comprised of 314 patients with primary pterygium (95.7 percent) and 14 of recurrent pterygium (4.3 percent). An average of 3.73 hours was the time spent on using digital devices per day. There were 249 patients (75.91 percent) which reported a history of using digital devices. The studies revealed that time spent on digital devices had no influence on pterygium size but the duration more than or equal 2 hours per day were statistically significant affected to the OSDI scores. Relationship between the duration of the digital device usage and the eye pain ($R^2 = 0.026$), blurred vision ($R^2 = 0.014$) and the OSDI scores ($R^2 = 0.014$) were found to be related in the same way.

Conclusion: Patients with pterygium were found to have the history of digital devices usage (75.91 percent). Moreover, the time spent using digital devices more than or equal 2 hours per day were statistically significant affected to the OSDI scores. The correlation between time spent using digital devices, eye pain, blurred vision, and the severity level of the OSDI scores were found to be related.

Keywords: Time length, Digital device usage, Dry eye, Pterygium

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Technological developments in the modern era increase the roles of digital equipment in our daily life. According to population surveys, electronic tools were ones of the factors that cause eye disorders among office workers, particularly dry eye symptoms[1]. However, ocular disorders caused by the use of digital tools have been defined in a broad term as digital eye strain or computer vision syndrome, a group of symptoms associated with dry eye conditions. The prevalence of these disorders was found in more than 50 percent of users[2]. According to a summary report from the Dry Eye Workshop (DEWS II), dry eye has been defined as a disease of the ocular surface which caused by variety of pathogenic origins. The disease disrupted homeostasis of tear film which appears in conjunction with ocular symptoms associated with the tear film instability, inflammation of the eye surface, and loss of sensory perception of the eyes. Dry eye disease occurrence is found in diverse range of population who share a significant risk factor relating to the use of digital devices. Dry eye disease may lead to economic suffering, affect the vision, quality of life, work efficiency, as well as physical and mental suffering[3]. According to study report regarding the prevalence of dry eye disease in Bangkok, 34 percent of 555 patients who had abnormal ocular surface were found to have the dry eye condition. More than half of these patients also had pterygium[4].

The researcher intended to study the relationship between the use of such technology and dry eye conditions due to; widespread use of digital tools and the trend is anticipated to rise unceasingly, and there is research data signifying the relationship between pterygium and dry eye conditions.

Materials and Methods

The retrospective study was approved by the Research Ethics committee 1, the Faculty of Medicine, Thammasat University and collected the data from Thammasat Hospital's Pterygium Screening Project on 30th March 2018. The inclusion criteria is primary and secondary pterygium aged between 15 to 80 years of age and exclude patients who were not mentally capable.

Data collection included the following information; age, gender, education, occupation, time spent on using digital devices (average number of hours/days) by patients subjective

Correspondence to:

Phrueksaudomchai P.

Department of Ophthalmology, Faculty of Medicine, Thammasat University, 95 Paholyotin Road, Klongnueng, Klongluang, Pathumthani 12120, Thailand.

Phone: +66-87-6898604

E-mail: makorn273@gmail.com

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data, time spent outdoors (average number of hours/days) by patients subjective data, Moreover, severity levels of symptoms and signs on the ocular surface such as eye pain, eye irritation, teary eye, blurred vision, red eye, level of disturbances in daily life, horizontal size (measured by slit lamp) and type of pterygium, OSDI scores[5] were also collected. The quantitative data was displayed as frequency unit numbers which was subsequently analyzed to obtain percentages and mean by using ANOVA and Regression analysis (for correlation analysis, Pearson correlation coefficient was used). The results were considered statistically significant at $p \leq 0.05$. Statistical analysis was performed using the SPSS software version 22.0 (SPSS Inc, Chicago, IL).

The data was reviewed from the questionnaire that was collected on the 30th March 2018 at Thammasat University hospital. The questionnaire had been prepared to obtain patient's information and was tested by the simple content validity method by two ophthalmologists who are specialized in cornea and glaucoma. Administrative staffs also helped to verify the questionnaire's linguistic accuracy. Prior to the actual usage the questionnaire. This research has been approved by the Research Ethics committee 1, the Faculty of Medicine, Thammasat University.

Results

According to the collected data, 328 patients out of the entire population of 800 met the research criteria. In 328 patients who were included which subsequently divided into 314 cases of primary pterygium (95.7 percent) and 14 cases of recurrent pterygium (4.3 percent). The majority age group was 51 to 60 years of age which was represented by 105 patients (32.0 percent) followed by 41 to 50 years of age whose 73 members was accounted for 22.3 percent whereas those who were 70 years of age or older were numbered at 15 or 4.6 percent. The average age was 51.2 years. Male participants were more populous (217 individuals or 66.2 percent), 102 patients or 31.1 percent graduated from primary education, Day laborers were the most represented group with 97 patients or 29.6 percent (Table 1).

According to the horizontal size of pterygium, an average size of 2.72 millimeter. The average time of using digital devices was 3.73 hours/day. In all patients with pterygium, 249 of the population or 75.91 percent reported the history of using the digital devices. In addition, 75.48 percent or 237 individuals who had primary pterygium reported the device usage and 85.71 percent or 12 individuals who had recurrent pterygium reported the use. The average outdoors time was 4.39 hours, which was longer than the number of hours spent on digital equipment. The severity of the OSDI scores was observed when the symptom started to appear which was found in 79 percent of the population. Moderate level symptoms were found in 34.8 percent of the

Table 1. Demographic data of patients (n = 328)

Characteristics	Type of pterygium		
	Primary, n = 314 n (%)	Recurrent, n = 14 n (%)	Total, n = 328 n (%)
Age (years)			
<30	16 (5.1)	0 (0.0)	16 (4.9)
30 to 40	53 (16.9)	4 (28.6)	57 (14.7)
41 to 50	71 (22.6)	2 (14.3)	73 (22.3)
51 to 60	99 (35.1)	6 (42.9)	105 (32.0)
61 to 70	61 (19.4)	1 (7.1)	62 (18.9)
>70	14 (4.5)	1 (7.1)	15 (4.6)
Mean age	51.21	50.9	51.2
Gender			
Female	105 (33.4)	6 (42.9)	111 (33.8)
Male	209 (66.6)	8 (57.1)	217 (66.2)
Education			
Uneducated	36 (11.5)	4 (28.6)	36 (11.0)
Primary education graduates	98 (31.2)	1 (7.1)	102 (31.1)
High school graduates	72 (22.9)	7 (50.0)	73 (22.3)
Bachelor's degree graduates	75 (23.9)	2 (14.3)	82 (25.0)
Vocational education graduates	33 (10.5)	0 (0%)	35 (10.7)
Occupation			
Unemployed	76 (24.2)	1 (7.1)	77 (23.5)
General labor	93 (29.6)	4 (28.6)	97 (29.6)
Officer	28 (8.9)	3 (21.4)	31 (9.5)
Farmer	41 (13.1)	2 (14.3)	43 (13.1)
Officialdom	27 (8.6)	1 (7.1)	28 (8.5)
Private business owners	13 (4.1)	2 (14.3)	15 (4.6)
Merchant	36 (11.5)	1 (7.1)	37 (11.3)

patients (Table 2). Upon considering 5 symptoms of the ocular surface, scores of symptoms and signs for blurred vision was the highest at 5.83 points, followed by that of red-eye, eye irritation, teary eye, and eye pain at 5.71, 5.61, 4.50, and 3.83 points respectively (Table 3).

Pearson correlation coefficients and Simple linear regression were used to ascertain the relationship between the time length of digital devices usage and time spent outdoors and pterygium size. The study revealed that an increased usage of digital devices had no influence on the size of the pterygium, however, had influence on the OSDI scores (p-value = 0.043, R^2 = 0.013) as show in Fugure 1.

Likewise, the time spent outdoors influenced the increase in size of pterygium (p-value = 0.034, R^2 = 0.014) and the OSDI scores (p-value = 0.035, R^2 = 0.014). The results revealed that spending more time on digital devices influenced the severity of eye pain and blurred vision (p-value = 0.003, 0.032 and R^2 = 0.026, R^2 = 0.014). In term of time length of digital devices usage, the results these the group which are less than or equal 2 hours per day and more than 2 hours per day were statistically significant affected to The OSDI scores (p-value = 0.044), but did not affected to size of pterygium. Similarly, Time spent outdoors, the results these the group which are less than or equal 2 hours per day and more than 2 hours per day were statistically significant affected to size of pterygium (p-value = 0.034), likeness the group which are less than or equal 3 hours per day and more than 3 hours per day were statistically significant affected to The OSDI scores (p-value = 0.004) as show in Table 4.

Discussion

Data that was collected by Thammasat University Hospital's Eye Center on the 30th March 2018, involved more than 800 patients. The project provided general population with an opportunity to attend screening for pterygium at hospital. Simple sampling technique resulted in

Table 2. Pterygium clinical data of patients (n=328)

Characteristics	Type of pterygium		
	Primary n = 314, n (%)	Recurrent n = 14, n (%)	Total n = 328, n (%)
Size of pterygium (mm)			
Mean	2.68	3.86	2.72
<1.5	65 (20.7)	1 (7.1)	66 (20.1)
1.5 to 4.0	215 (68.5)	7 (50.0)	222 (67.7)
>4.0	34 (10.8)	6 (42.9)	40 (12.2)
The time spent on using digital devices (hours/days)			
Mean	3.64	5.79	3.73
<1	77 (24.5)	2 (14.3)	79 (24.1)
1	32 (10.2)	0 (0.0)	32 (9.8)
2	43 (13.7)	0 (0.0)	43 (13.1)
3	29 (9.2)	1 (7.1)	30 (9.1)
4	32 (10.2)	3 (21.4)	35 (10.7)
5	18 (5.7)	1 (7.1)	19 (5.8)
6	22 (7.0)	2 (14.3)	24 (7.3)
7	6 (1.9)	1 (7.1)	7 (2.1)
8	24 (7.6)	1 (7.1)	25 (7.6)
>8	31 (9.9)	3 (21.4)	34 (10.4)
Time spent outdoors (hours/days)			
Mean	3.46	5.0	4.39
<1	20 (6.4)	0 (0.0)	20 (6.1)
1	31 (9.9)	1 (7.1)	32 (9.8)
2	50 (15.9)	4 (28.6)	54 (16.5)
3	41 (13.1)	1 (7.1)	42 (12.8)
4	42 (13.4)	2 (14.3)	44 (13.4)
5	25 (8.0)	1 (7.1)	26 (7.9)
6	40 (12.7)	1 (7.1)	41 (12.5)
7	6 (19.9)	0 (0.0)	6 (1.8)
8	34 (10.8)	2 (14.3)	36 (11.0)
>8	25 (8.0)	2 (14.3)	27 (8.2)
The ocular surface disease index (OSDI) level			
No symptoms (0 to 12)	67(21.3)	2 (14.3)	69 (21.0)
Mild (13 to 22)	98 (31.2)	3 (21.4)	101 (30.8)
Moderate (23 to 32)	107 (34.1)	7 (50/0)	114 (34.8)
Severe (≥33)	42 (13.4)	2 (14.3)	44 (13.4)

Table 3. Scores of symptom and signs on ocular surface

Data	primary scores n = 314, n (%)	Recurrent scores n = 14, n (%)	Total scores n = 328, n (%)
Total scores (C) (60)			
Mean	31.9	31.6	31.9
Eye pain (C1) (10)			
Mean	3.8	3.9	3.8
Eye irritated (C2) (10)			
Mean	5.6	5.6	5.6
Eye teary (C3) (10)			
Mean	4.5	4.9	4.5
Blurred vision (C4) (10)			
Mean	5.6	5.4	5.8
Eye redness (C5) (10)			
Mean	5.6	6.5	5.7
Disturb daily life (C6) (10)			
Mean	6.4	5.5	6.4

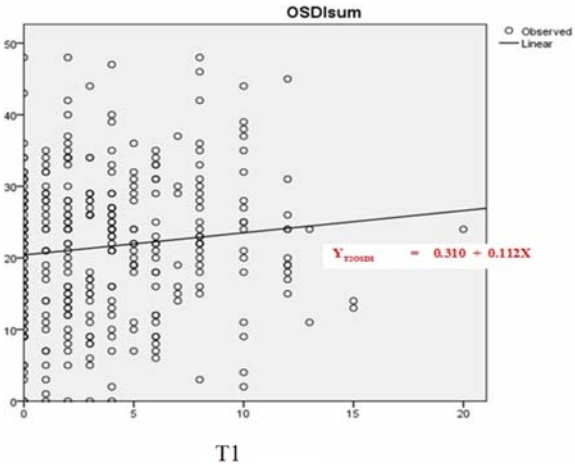

Figure 1. The relationship between the time length of digital devices usage (T1) and the severity of OSDI scores.

328 patients.

In all patients with pterygium, 249 of the population or 75.9 percent reported the history of using the digital devices. According to the previous studies concerning office workers, the prevalence of the device usage was reported at only 60 percent. Thus, the discovery in this report is relatively high compared to the general population[6]. The average outdoors time was 4.39 hours, which was longer than the number of hours spent on digital equipment. Of all patients with pterygium, 308 patients or 93.9 percent were reported to spend time outdoors. Therefore, pterygium patients spent more time outdoors than using the digital device. Based on previous research reviews which studied risk factors associated with time periods spent outdoors and activities that were at risk of developing pterygium, this research report appears to support the former findings and is similar to the population in different regions[7-12]. Upon considering the relationship between the time period spent on digital devices and the sizes of pterygium, the results indicated no influence of the time period on the size of pterygium and vice versa. However, the increased duration of outdoors time was found to be related with the increase in size of pterygium which corresponded to the previously reviewed research[7-12].

As for the relationships between the time spent on using the digital devices, the duration of time spent outdoors, severity of the symptoms and signs that were shown on ocular surface, and the level of disturbances in daily life, the results revealed that the time spent on digital device usage, the severity of the eye pain, and the blurred vision concordantly influenced each other. In the previous studies regarding general population who use the digital devices regularly, approximately 50 percent of the eye abnormalities associated with abnormal vision and eye pain were reported[13]. The result was conducted in reference to pterygium patients and the obtained results suggested that patients who spent more time on digital devices experienced eye disorders, similar to the results found in general population.

As for the relationship between the duration of digital equipment usage, the duration of time spent outdoors, and the of the OSDI, the results indicated that these factors concordantly influenced each other. In patients with pterygium, the time spent using digital devices and the duration of time spent outdoors influenced severity of the OSDI, an index that signifies the dry eye syndrome. According to previous studies in the general population of a foreign country, the results suggested that the time spent using digital devices affected dry eye conditions[11-13].

There are limitations associated with this research which stemmed from data collection methods and we don't have timing of pterygium data which may related. As this is a retrospective research which was focused on the information

Table 4. The relationship between time length of digital devices usage, spent outdoors and dry eye conditions in pterygium patients

Data	Size of pterygium		The ocular surface disease index (OSDI) scores		Scores of symptoms and signs on ocular surface					
	(p-value[1])	(p-value[2])	(p-value[1])	(p-value[2])	Eye pain (p-value[2])	Eye irritated (p-value[2])	Eye teary (p-value[2])	Blurred vision (p-value[2])	Eye redness (p-value[2])	Disturb daily life (p-value[2])
Time length of digital devices usage		0.133		0.043* (R^2 = 0.013)	0.003* (R^2 = 0.026)	0.179	0.740	0.032* (R^2 = 0.014)	0.115	0.322
Duration ≤2, >2 hrs/d	0.792		0.044*							
Duration ≤3, >3 hrs/d	0.726		0.038*							
Duration ≤4, >4 hrs/d	0.475		0.031*							
Duration ≤5, >5 hrs/d	0.389		0.030*							
Time spent outdoors		0.034* (0.014)		0.035* (R^2 = 0.014)	0.053	0.428	0.187	0.141	0.241	0.182
Duration ≤2, >2 hrs/d	0.034*		0.747							
Duration ≤3, >3 hrs/d	0.002*		0.004*							
Duration ≤4, >4 hrs/d	0.011*		0.018*							
Duration ≤5, >5 hrs/d	0.124		0.032*							

[1] Analyzed to obtain percentages and mean by using ANOVA
[2] Regression analysis (for correlation analysis, Pearson correlation coefficient was used)

stored in the past, incomplete collection of information may occur. However, the obtained information may be beneficial for future research.

Conclusion

Patients with pterygium were found to have the history of digital devices usage (75.91 percent). Moreover, the time spent using digital devices more than or equal 2 hours per day were statistically significant affected to the OSDI scores. The correlation between time spent using digital devices, eye pain, blurred vision, and the severity level of the OSDI scores were found to be related.

What is already known on this topic?

According to previous studies in the general population of a foreign country, the results suggested that the time spent using digital devices affected dry eye conditions. Thai population particularly the patients with pterygium, remained limitation of data.

What is this study adds?

The relationship between time length of digital devices usage and the OSDI scores, scores of symptoms and signs on ocular surface, size of pterygium in Thai pterygium patients.

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Potential conflicts of interest

The authors declare no conflict of interest.

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ความสัมพันธ์ระหว่างระยะเวลาการใช้อุปกรณ์ดิจิตอลและภาวะตาแห้งในผู้ป่วยต้อเนื้อ

ปกรณ์กิจ พฤกษาอุดมชัย, วิมลวรรณ ตั้งปกาศิต, ณวพล กาญจนารัณย์

วัตถุประสงค์: ศึกษาความสัมพันธ์ระหว่างระยะเวลาการใช้อุปกรณ์ดิจิตอลและภาวะตาแห้งในผู้ป่วยต้อเนื้อ

วัสดุและวิธีการ: เป็นการศึกษาเก็บข้อมูลย้อนหลัง (Retrospective study) เก็บข้อมูลลักษณะพื้นฐานประชากร ระยะเวลาที่ใช้อุปกรณ์ดิจิตอลระยะเวลาระยะเวลาอยู่ในที่กลางแจ้ง ระดับความรุนแรงอาการและอาการแสดงทางพื้นผิวดวงตา ขนาดของต้อเนื้อ ชนิดของต้อเนื้อ และคะแนนประเมินความรุนแรงของภาวะตาแห้ง Ocular Surface Disease Index (OSDI) แสดงข้อมูลเชิงปริมาณเป็นความถี่หน่วยตัวเลข วิเคราะห์ผลเป็นค่าเฉลี่ยและหาความสัมพันธ์โดยใช้สถิติ ANOVA, simple linear regression และ Pearson correlation

ผลการศึกษา: รวบรวมข้อมูลได้จำนวน 328 คน แบ่งเป็นชนิดปฐมมิ 314 คน (95.7%) และชนิดเป็นซ้ำ 14 คน (4.3%) ระยะเวลาที่ใช้อุปกรณ์ดิจิตอลเฉลี่ย 3.73 ชั่วโมงต่อวัน มีประวัติใช้อุปกรณ์ดิจิตอลมากถึง 249 คน (75.91%) พบว่าระยะเวลาที่ใช้อุปกรณ์ดิจิตอลต่อขนาดต้อเนื้อไม่มีอิทธิพลต่อกัน ส่วนระยะเวลาที่ใช้อุปกรณ์ดิจิตอลที่มากกว่าหรือเท่ากับ 2 ชั่วโมงมีผลต่อความรุนแรงของภาวะตาแห้ง (OSDI) ต่างกันอย่างมีนัยสำคัญ (p = 0.044) พบความสัมพันธ์ระหว่างระยะเวลาที่ใช้อุปกรณ์ดิจิตอลต่อความรู้สึกปวดตา (R^2 = 0.026) ความรู้สึกตามัว (C4) (R^2 = 0.014) และความรุนแรงของภาวะตาแห้ง (OSDI) (R^2= 0.014)

สรุป: ผู้ป่วยต้อเนื้อมีประวัติการใช้อุปกรณ์ดิจิตอลมากถึงร้อยละ 75.91 ระยะเวลาที่ใช้อุปกรณ์ดิจิตอลที่มากกว่าหรือเท่ากับ 2 ชั่วโมงพบว่ามีผลต่อความรุนแรงของภาวะตาแห้ง พบความสัมพันธ์ระหว่างระยะเวลาที่ใช้อุปกรณ์ดิจิตอลที่มากขึ้นกับอาการปวดตา ตามัวและระดับคะแนนความรุนแรงของของภาวะตาแห้ง (OSDI) เป็นไปในทิศทางเดียวกัน