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Original Research Article

Assessment of dry eye in pediatric population along with ocular surface disorder and visual display terminal

Namrata Srivastava[1], P. N. Dwivedi[2]*, Nitesh Srivastava[3]

[1]Department of Optometry ERA University of Allied Health Science, Lucknow, Uttar Pradesh, India
[2]Department of Ophthalmology, [3]Department of Optometry, Satya Eye Hospital and Research Institute, Kanpur, Uttar Pradesh, India

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***Correspondence:**
Dr. P. N. Dwivedi,
E-mail: optometry.cnb@gmail.com

ABSTRACT

Background: Dry eye is a disease condition wherein the ocular surface is either not uniformly or not completely lubricated by tear film. Dry eye is less prevalent in children, but if observed it may be a manifestation of conditions like Steven Jonson syndrome, Sjogren's syndrome, blepharitis, MGD or VKC. Therefore, evaluation of dry eye may aid in effective and timely treatment of other life-threatening diseases in children. Aim of current study was determination of dry eye in pediatrics and to investigate its association with ocular surface disorders like MGD, VKC and VDT.
Methods: A prospective observational study was conducted on 400 patients. All patients were screened for OSDI and patients having index score >11 were investigated for dry eye disease, based on inter blink interval and tear-film breakup time determined using slit lamp and through Schirmer's test. Dry eye patients were further investigated to determine type and causative factors for dry eye.
Results: 25 patients exhibited bilateral dry eye with >12 score. Children of age group 7-18 years were commonly affected. Diseases commonly observed to be associated with dry eye in children were VKC, MGD, or visual display terminal caused due to over use of smart phone and digital screen.
Conclusions: The evaporative dry eye due to MGD and VDT is more common in pediatric age group in comparison to aqueous deficiency dry eye. Overuse of smart phones, tablets or computers increases the prevalence of dry eye which inturn affect their outdoor activity, studies and over all development of children.

Keywords: Dry eye, Vernal kerato-conjunctivitis, Meibomian gland dysfunction, Visual display terminal

INTRODUCTION

Dry eye is a common disease usually characterized by loss of homeostasis of the tear film to lubricate ocular surface.[1] There are multiple causative factors leading to dry eye disease including multifactorial diseases of ocular surface leading to tear film instability and hyperosmolarity, ocular surface inflammation or neurosensory abnormalities.[1-3] Dry eye symptoms may also be a manifestation of systematic disease, therefore timely evaluation of dry eye may aid in early diagnosis and effective treatment of life-threatening disease.[3]

In pediatric population, dry eye disease is less prevalent and its epidemiology in children below the age of 18 years is very rare.[4] However dry eye signs and symptoms like excessive blinking or rubbing of eyes during study or watching television are observed in children, should be taken seriously as it may be a manifestation of several other disease conditions or causes.[5] Many cases of dry eye in children exhibited the presence of systemic conditions like Steven Jonson syndrome, Sjogren's syndrome, juvenile rheumatoid arthritis.[4-8] In children dry eye may also be a result of increased visual tasking activity like overuse of computer and mobile phones for

long duration as children tend to stare at the screen without eye blinking when they are using the computer or playing video games.[6-8] Use of video display terminals and learning (reading and writing) for a long hour has been associated with maximum blink interval, so there is development of dry eye symptoms.[7-9] In children it is more likely that dry eye is exacerbated by blepharitis, ocular rosacea, Meibomian gland dysfunction (MGD), even infection apart from allergy or Vitamin A deficiency.[6-9] There are multiple causes behind the symptoms, so finding the specific cause and the efficacious treatment for dry eye disease is difficult. Moreover, diagnosis and treatment of dry eye in pediatric patients is different and difficult than in adults as children cannot usually understand and reveal the symptoms.[5-9]

Aims and objectives

The aim and objectives of current study was to determine the prevalence of symptom of ocular surface disease and visual terminal display as risk factors for dry eye among pediatrics population.

METHODS

Study design, location and duration

Current study was a prospective, interventional study conducted at J. L. Rohatagi Hospital and Dr. Jawaharlal Rohtagi Smarak Netra Chikitsalaya, Kanpur Nager, Uttar Pradesh from 2017 to 2019. Total 400 patients (800 eyes) were screened. Out of which 25 patients (50 eyes) with bilateral presentation were included.

Inclusion criteria

Patients less than 18 years of age visiting the outpatient department at the J. L. Rohatagi Hospital and Dr. Jawaharlal Rohtagi Smarak Netra Chikitsalaya, civil hospital, Kanpur, Uttar Pradesh were included in the study.

Exclusion criteria

Patients more than 18 years of age and having the past history of surgery, patients who had nocturnal lagophthalmos, patients who had eyelid problems like trachoma, trichiasis, distichiasis or epiblepharon, patients who had allergic conjunctivitis with the use of antihistaminic drugs, contact lens wearers and patients who had any congenital, endocrine or auto-immune disease were excluded from the study.

Procedure

All patients with the chief complaints of redness itching, watering and foreign body sensation were screened for ocular surface disease index (OSDI). Of those, patients having OSDI score >11 were further evaluated for the dry eye tests including inter blink interval (IBI) and tear-film breakup time (TBUT) using split lamp and Schirmer's test (ST). Out of 400 patients who were evaluated, 25 patients (50 eyes) were selected and studied for investigating the type and causative factors for dry eye disease.

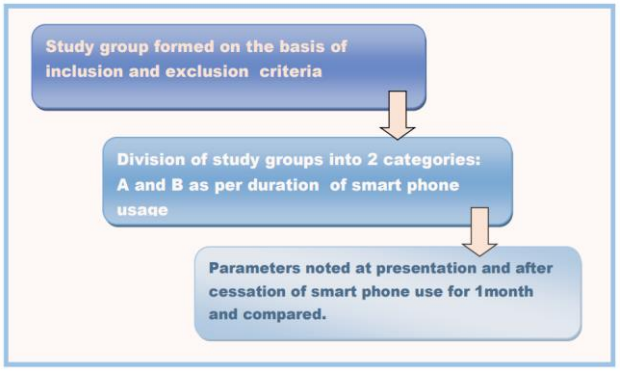

Figure 1: Study procedure.

Statistical analysis

Clinical information, including complete ophthalmic examination along with demographic details, was entered into the spreadsheets in Microsoft Excel. The statistical analysis was done using SPSS software, version 16.0 (SPSS Inc., Chicago, Illinois, USA). Student's t-test was used to compare group mean, p value >0.05 was considered significant.

RESULTS

Total 50 eyes of 25 patients were included in current study, out of which 8 (31.25%) were female and 17 (68.75%) were male. Children were divided in three age groups, out of which 6 (23.33%) children were in 1-6 years age group, 13 (53.34%) were in 7-12 years age group and 6 (23.33%) were in 13-18 years age group. The prevalence of the dry eye was observed to be 6% (50 out of 800 eyes) in current study. The prevalence of dry eyes was highest in age group of 7-12 years (53.34%), while 23.33% in both age groups of 1-6 years and 13-18 years.

The distribution of risk factors of dry eyes among the age groups is depicted in (Table 1). In risk factor association, the MGD (Meibomian gland dysfunction) was observed in 10 eyes of 7-12 years of age, and all 10 (100%) eyes were having dry eyes. The 50 eyes were found to have vernal keratoconjunctivitis (VKC). Among these 50 eyes, 28 (55.76%) eyes showed the evidence of dry eyes. The 50 eyes were found to have prolonged exposure to computer screen and history of smartphone use. Among these 50 eyes, 27 (53.84%) eyes exhibited dry eye disease (Table 2). The average tear film breaks up time was 8 seconds in both 1-6 years and 13-18 years of age groups, while 6 seconds in 7-12 years. Vernal keratoconjunctivitis, Meibomian gland dysfunction and visual display terminal (VDT) were observed as ocular surface disorders due to over use of smart phones and digital screens.

Table 1: Distribution of risk factor among age group.

Age group (years)	Total no. of affected eyes (n=50)	Risk factors distribution			
	N (%)	VKC N (%)	Mobile users N (%)	Computer users N (%)	MGD N (%)
1-6	12 (23.33)	12 (100)	5 (43)	5 (43)	0 (0)
7-12	26 (53.34)	18 (75)	26 (100)	26 (100)	9 (34)
13-18	12 (23.33)	12 (100)	12 (100)	12 (100)	0 (0)

Table 2: Association of risk factor with dry eye.

Risk Factor	Total eyes affected	Dry eye preset	Dry eye (%)
Meibomian gland dysfunction	9	9	100
Vernal Kerato conjunctivitis	42	23	55.79
Computer and smart phone user	43	23	53.84

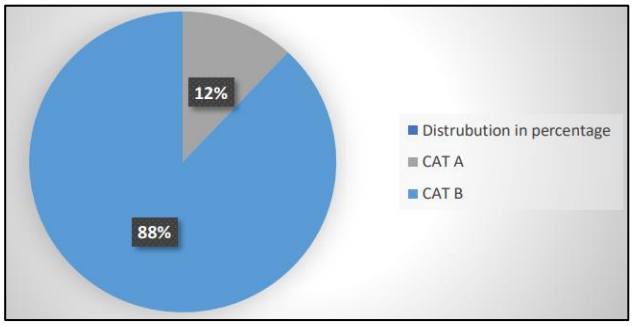

Figure 2: Distribution of dry eye disease (DED) patients into two categories.

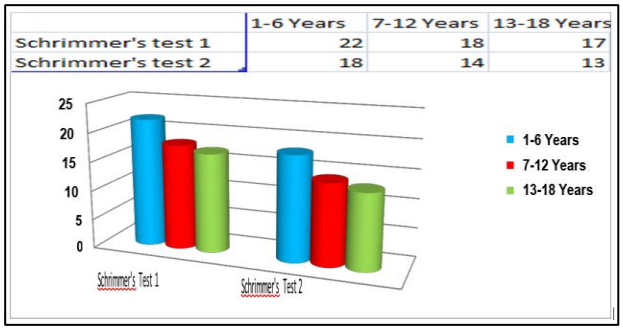

Figure 3: Mean value of Schrimmer's test among the age groups.

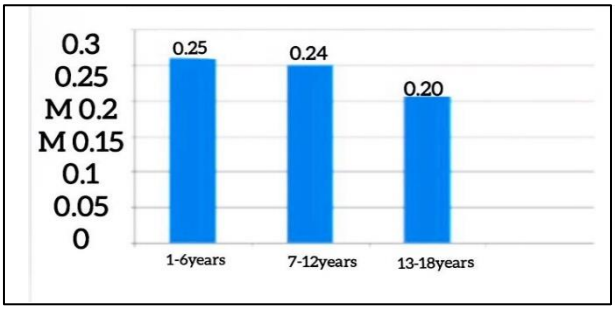

Figure 4: Mean tear meniscus height vs. age group distribution.

Table 3: Change in mean OSDI scores in both the categories.

Mean OSDI scores	Category A (%)	Category B (%)
Before	34.76	29.45
After	15.63	11.53
Change (%)	54.7	60.2

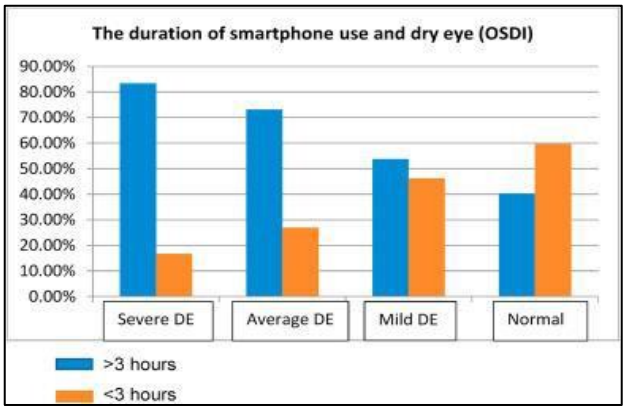

Figure 5: The duration of smartphone vs. prevalence rate of dry eye.

Out of 50 total 38 eyes were found to have prolonged exposure to computer screen or with history of prolonged smart phone usage. Among these 38 eyes; 88.4% eyes belonged to category A and 11.6% belonged to category B. Mean IBI in category A was observed to be 2.89 seconds and in category B it was observed to be 4.32 seconds. Mean TBUT was observed to be 8.87 seconds and 9 seconds in both the categories respectively, and a Schirmmer's value of <10 mm was observed without anaesthesia in both the categories. After stopping the usage of smart phones for 4 weeks in the DED group; both subjective symptoms and objective signs were observed to be improved.

The mean value of Schrimmer's test among the age groups is depicted in (Figure 3). The mean tear meniscus

height was observed to be 0.26 mm in 1-6 years, 0.25 mm in 7-12 years and 0.21mm in 13-18 years of age group (Figure 4).

OSDI scores showed significant improved results in favor of smart phone cessation. There was 54.7% decrease in mean OSDI score in category-A ($p<0.001$) and 60.2% decrease in mean OSDI score in category-B ($p<0.004$), statistical significance calculated by independent t-test.

DISCUSSION

Many studies have earlier been carried out to establish a correlation between the clinical condition of visual display syndrome and ocular surface disorders.[10-12] The most common risk factors for dry eye disease were observed to be VKC, mobile game playing and use of computer screen for prolonged period of time.[13,14] A single-center, prospective, case control study conducted by Moon et al including 35 children of 3-6 years of age with seasonal allergic conjunctivitis or perennial allergic conjunctivitis and undergoing medical healthy examination reported that VKC was found in 42 eyes, among which 23 (55.79%) eyes showed the evidence of dry eyes with mild symptoms.[15,16] A study conducted by Johnston et al reported the mean tear film break-up time of 6.54±1.48 seconds in the patients of dry eye disease.[17] Comparable to the study conducted by Tsubota et al current study results revealed that among children having allergic conjunctivitis, 45% eyes were diagnosed with dry eye disease.[18] Current study shows that all the children of 7-12 years and 13-18 years age group who had the history of mobile game playing and prolonged computer screen watching showed the sign and symptoms of dry eyes. The findings of the current study were similar and comparable to reports published by Kozeis et al and Akkaya et al who reported that long duration of computer use, and a short duration of outdoor activity time increased the incidence of dry eye disease.[19,20] Similar to current study findings reports published by Choi et al and Al-Marri et al revealed that usage of smartphones for a prolonged period of time may also increase the incidence of dry eyes.[21,22] Thus results of current study reveals that Overuse of smart phones, tablets or computers increases the prevalence of dry eye which inturn affect their outdoor activity, studies and over all development of children.

CONCLUSION

Results of current study revealed that in the pediatric age group, the aqueous deficiency is least likely to occur. There is decreased tear film break up time in dry eyes as revealed by Schirmmer's test and tear meniscus height. The prevalence of dry eye was observed to be highest in children of age group 7 to 12 years. In children of 1-6 years of age group vernal kerato conjunctivitis was observed to be a most common risk factor causing dry eye, while in children of 7-12 years of age groups and in teenagers the mobile game playing and prolonged use of computer screen resulted in dry eyes. The results revealed that smart phone usage is an important causative factor for dry eye disease. Thus it was concluded that increased use of smart phones is a serious issue that can result in ocular surface symptoms, especially in paediatric age population, and its continuous use is found to be more detrimental than intermittent use or judicious use with enough breaks to avoid ocular fatigue. Close observation and caution regarding video display terminal use, especially smart phones usage are thus recommended for children to prevent dry eyes.

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