MANAGEMENT OF DRY EYES IN COMPUTER USERS- 0.5% CARBOXYMETHYL CELLULOSE VERSUS 0.3% HYDROXYPROPYL METHYLCELLULOSE

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ABSTRACT

BACKGROUND

Dry eye is characterised by eye irritation caused by change in the precorneal tear film instability. In modern society, computer usage is almost universal. Computer usage has been identified as one of the risk factor for developing dry eye. Various treatment options have been studied to relieve the symptoms of dry eye.

MATERIALS AND METHODS

A total of 100 computer users were included in this study. Patients were divided into group A and group B. Group A subjects (n=50) were given 0.5% CMC eye drops and Group B (n=50) were given 0.3% HPMC eye drops. Symptoms and signs were assessed at four intervals (2 weeks, 4 weeks, 3 months and 6 months).

RESULTS

Ocular symptoms were dramatically reduced in Group A (0.5% CMC eye drops) when compared to Group B (0.3% HPMC eye drops).

CONCLUSION

Both drugs were found to be effective in the treatment of dry eye. However, 0.5% CMC drops was found to be better in lowering the severity of dry eye symptoms.

KEYWORDS

0.5% Carboxymethyl Cellulose (CMC), 0.3% Hydroxypropyl Methylcellulose (HPMC), Dry Eye and Computer Users.

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BACKGROUND

Computers have become an epitome of modern life being used in every aspect of life from calculating grocery bills, telecommunications, banking work to operations in colleges, universities, offices and homes[1] with the advent of technological revolution, advanced computing cum communication devices have become an integral part of not only professional work, but also of leisure activities.[2,3] There are approximately 6 computers/1000 population with an installation of 18 million Personal Computers (PCs) per year and the number is increasing each passing day.[4] Adding to the influence of technology, these Visual Display Terminals (VDT) have now slipped into the pockets of billions of mobile users in the form of smart phones. With the unprecedented growth of the users of these handheld devices, it is estimated that almost 84% of the world's population will be using these by the end of 2018.[5]

This extensive use of computers made it necessary to conduct studies in an attempt to address questions concerning safety and health issues for VDT users.[6] These studies have shown that VDT usage causes symptoms ranging from somatic disorders, obsessions and musculoskeletal pains to ocular complaints.[7] Eye-related symptoms are the most frequently occurring health problems among computer users.[7,8]

VDTs have certain intrinsic characteristics, which make image processing by the human visual system more taxing. These characteristics include flicker, glare, contrast and the dot matrix. VDT images with their blurred edges stimulate accommodation in a futile attempt to make the dot matrix characteristics more clear. This results in accommodative insufficiency in facility and spasm leading to fatigue of accommodation. A subjective visual symptom or distress resulting from the use of one's eye is called asthenopia. The symptoms of asthenopia are classified as- 1) Visual (blurring); 2) Ocular (pain in the eyes, eye fatigue, burning sensation, irritation and redness); 3) Referral (headache); and 4) Functional (behavioural).[9] The condition of a person experiencing one or more of these ocular complaints as a result of operating a computer and working at a computer

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monitor for a long duration is referred to as Computer Vision Syndrome (CVS).[6]

Due to decrease in blink rate and an increased rate of tear evaporation, dry eyes are the leading cause of ocular fatigue and ocular symptoms such as redness, irritation, gritty sensation and watering among computers users.[10] Dry eye is defined as an ocular surface disease caused by disturbances of the natural function and the protection of the external eye leading to an unstable tear film when the eye is open.[11]

There is an urgent need to understand the dynamics of dry eyes due to computer usage. However, not much data is available in developing countries on the magnitude of this problem. In a study conducted on the information technology professionals in New Delhi, the frequency of computer-related vision problems have been shown to be as high as 76%, of which 55% is attributable to dry eyes.[1] A significant correlation has been found between the frequency of dry eyes and usage of artificial tears suggesting that patients reported less dryness and irritation symptoms by using artificial tears along with the improvement of their working condition and work habits.[12]

The present study was designed to compare the efficacy of 0.5% Carboxymethyl Cellulose (CMC) and 0.3% Hydroxypropyl Methylcellulose (HPMC) in subjects with dry eye due to VDT usage.

Aims and Objectives- To compare the efficacy of 0.5% Carboxymethyl Cellulose (CMC) and 0.3% Hydroxypropyl Methylcellulose (HPMC) in subjects with dry eyes due to computer usage.

MATERIALS AND METHODS

The present study was conducted in the Department of Ophthalmology, Christian Medical College and Hospital, Ludhiana. A total of 100 computer users were included as sample in this study selected randomly from 10 software training centers in Ludhiana city. Only subjects working on the current job for the past six months for a minimum of 15 hours per week or at least 2 hours at a stretch per day in front of a VDT were included. VDT users who were already on treatment for dry eyes or any other ocular condition were excluded from this study.

On the basis of the duration and severity of ocular symptoms and tear film tests, these subjects were diagnosed to have dry eye (mild, moderate and severe) as a result of VDT usage.

These subjects formed the clinical database for this prospective, randomised double-blind trial study for comparing the effect of 0.5% Carboxymethyl Cellulose (CMC) and 0.3% Hydroxypropyl Methylcellulose (HPMC) eye drops in the management of dry eye symptoms. The subjects were divided into two groups of 50 each, Group A subjects (n=50) were given 0.5% CMC eye drops 4 times per day and were evaluated after 2 weeks and then at the end of 4 weeks, 3 months and 6 months. Similarly, group B (n=50) were given 0.3% HPMC eye drops and the same protocol was followed. The ophthalmologists and subjects were unaware of the eye drops as the bottles were masked. Only one investigator kept the details of the composition of the eye drops, subjects and groups, which were revealed during the analysis of the data.

The need for compliance was repeatedly explained to each subject and also mentioned in the informed consent. At baseline, information was recorded for each subject on dry eye symptoms. At each follow up visit, the subjects were asked to fill up the predesigned protocol to grade their ocular symptoms in terms of normal, mild, moderate or severe. A coding was done for each category and a score was maintained. The data was analysed using independent t-test.

At the end of 2 weeks, each subject was requested to grade the relief in ocular symptoms in the pre-designed protocol. The same exercise was followed at the end of 4 weeks, 3 months and 6 months. The subjects also underwent the following tear film tests to study the efficacy of both eye drops- Tear Film Break-Up Time (TFBUT) and rose bengal staining.

Tear Film Break-Up Time (TFBUT)- This test measures the time to the appearance of the first random corneal dry spots following a complete blink. A fluorescein impregnated paper strip was placed on the bulbar conjunctiva for a few moments to allow the dye to completely mix with the tears. The eye of each subject was then viewed under the slit lamp, asking the patient not to blink. The time in seconds was noted at the appearance of the first random corneal dry spots. In a dry eye, the TFBUT is usually less than 10 seconds.

Rose Bengal Staining- This test mainly evaluates the integrity of the mucin layer of the tear film. Negative rose bengal staining is due to the protective function of the preocular tear film.

After anaesthetising the eye with 0.5% proparacaine, 1% rose bengal was instilled into the eye. White light was used to assess the amount of staining. Intensity was scored in 2 exposed conjunctival zones and the cornea with a score of 0-3 for each zone to a maximum score of 9.

RESULTS

100 subjects were analysed for this study. Of these, 50 were in group A who were given 0.5% CMC eye drops and 50 were in Group B (0.3% HPMC eye drops). There were a total of 76 males and 24 females included in this study. The mean age was 25.3 years (SD ± 5.82).

At the start of the study, the subjects were requested to grade the duration and severity of ocular symptoms, which included- eye strain, burning sensation and redness of eyes.

The most commonly occurring symptoms with greatest intensity were redness of eyes and burning sensation.

Observations- The severity of the ocular symptoms reported by subjects of both groups A and B at the start of the study are shown in table 1.

	Group A (CMC)			Group B (HPMC)		
Severity of Symptoms	**R**	**B**	**E**	**R**	**B**	**E**
Severe	46	46	46	47	47	47
Moderate	0	0	0	0	0	0
Mild	0	0	0	0	0	0
Normal	0	0	0	0	0	0
	Total Score = 414			**Total Score = 423**		

Table 1. Ocular Symptoms at Baseline

R = Redness, B = Burning sensation, E = Eye strain.

The subjects were asked to grade their ocular symptoms in terms of normal, mild, moderate or severe at each subsequent visit. The final assessment was made after 6 months, which is shown in Table 2.

	Group A (CMC)			Group B (HPMC)		
Severity of Symptoms	**R**	**B**	**E**	**R**	**B**	**E**
Severe	0	0	0	0	0	0
Moderate	0	0	0	0	0	0
Mild	6	7	31	41	36	14
Normal	40	39	15	6	10	8
	Total Score = 44			**Total Score = 143**		

Table 2. Ocular Symptoms at 6 Months

P = 0.000 at 5%, very significant (independent t-test).

As seen from the table above, after 6 months, ocular symptoms were dramatically reduced in group A (0.5% CMC eye drops) when compared to group B (0.3% HPMC eye drops).

The observations made on the basis on the tear film test on each subject are shown below in the following tables-

	Group A (CMC)	Group B (HPMC)
Time in Seconds	**Number of Individuals**	**Number of Individuals**
>15	7	6
10-15	12	14
5-10	22	20
<5	5	7
	Total Score = 71	**Total Score = 68**

Table 3. Tear Film Test - TFBUT - Baseline Value

The test was repeated after 3 months and final assessment was done at the end of 6 months.

	Group A (CMC)	Group B (HPMC)
Time in Seconds	**Number of Individuals**	**Number of Individuals**
>15	22	27
10-15	23	17
5-10	01	03
<5	00	00
	Total Score=25	**Total Score=23**

Table 4. Tear Film Test - TFBUT - at 6 Months

P = 0.324 at 5%, not significant.

Tear film break-up time (TFBUT) is same with both drugs at the end of 6 months of management of dry eyes as observed from the table above.

	Group A (CMC)	Group B (HPMC)
Staining Pattern	**Number of Individuals**	**Number of Individuals**
Mild	39	38
Normal	7	9
	Total Score = 85	**Total Score = 85**

Table 5. Tear Film Test - Rose Bengal Staining - Baseline Value

The test was repeated at the end of 3 months and final assessment was made on the basis of staining pattern at the end of 6 months, which is shown in Table 6.

	Group A (CMC)	Group B(HPMC)
Staining Pattern	**Number of Individuals**	**Number of Individuals**
Mild	8	16
Normal	38	31
	Total Score = 54	**Total Score = 63**

Table 6. Tear Film Test – Rose Bengal Staining - at 6 Months

P = 0.000 at 5%, very significant.

As seen in Table 6, there is a significant improvement (p=0.000) in the staining pattern observed in subjects of group A who were using 0.5% CMC eye drops.

DISCUSSION

Studies have shown beyond doubt that a relationship exists between the duration of VDT usage and development of dry eye symptoms.[5] Several studies have been conducted to compare the efficacy of various artificial tear drops in the management of dry eye resulting from excessive VDT usage or other aetiologies. It was observed that 0.5% CMC eye drops brought about a major relief to subjects with dry eye complaints.[13] Donshik et al did a study comparing the efficacy of CMC and HPMC eye drops in the management of moderate-to-severe dry eye. They concluded that both these eye drops produced a significant relief in dry eye symptoms.[14]

In another study by Albietz et al, it was suggested that CMC eye drops are more effective than HPMC in reducing dry eye symptoms.[12] There are several possible reasons for the observed superiority of CMC when compared with HPMC. The absence of cytotoxic effects in the formulation of CMC in lactate buffer maybe beneficial for both the ocular surface epithelia and the stroma.[15] Studies have also reported that CMC may promote the recovery of the damaged ocular surface epithelia, increased goblet cell density and reduced dry eye symptoms in patients with tear insufficiency.[13,14,16]

CMC lubricants have been shown to have superior mucoadhesive properties, increased ocular residence time and good shear thinning properties when compared with HPMC.[17] The findings of our study are comparable to the above-mentioned studies in observing the superiority of CMC

eye drops over HPMC in lowering the severity of dry eye symptoms (p = 0.000, very significant) and a decrease in the staining pattern of rose bengal (p = 0.000, very significant).

CONCLUSION

Although, this study was limited to small sample size, results indicate CMC 0.5% superior to HPMC 0.3% in lowering the dry eye symptoms in subjects with dry eye due to computer usage. Both the drugs improved TFBUT and rose bengal staining pattern. Further studies are required, designed to determine the mechanism in which CMC helps in stabilising the tear film and helps in relieving the signs and symptoms in computer users with dry eye.

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