

Comparison of Efficacy of 0.5% Carboxymethylcellulose Eye Drop Against 0.3% Hydroxypropylmethylcellulose Eye Gel Formulation in Excessive Computer Users Aging Between 20 to 40 Years

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Abstract

Aim: To assess the status of dry eye in population aging between 20 – 40 years, having daily computer exposure of 8 hours and comparative study of their treatment with 0.5% Carboxymethylcellulose eye drop against 0.3 % Hydroxypropylmethylcellulose eye gel formulation.

Design: Prospective, comparative, interventional study.

Materials and Methods: The study included 200 eyes of 100 individuals having daily computer exposure of 8 hours complaining of dry eye symptoms. Quantitative evaluation of dry eye was done by Schirmer-1 test (without topical anesthesia) and Tear Break-Up Time (BUT) while qualitative assessment was carried out by fluorescein staining of cornea. Subsequently all eyes were grouped in two, each with 100 eyes, out of which one set of eyes would be treated with 0.5% Carboxymethylcellulose while other with 0.3 % Hydroxypropyl methylcellulose. All eyes were treated for 12 weeks following which their pre-treatment parameters were re-evaluated. Paired –t test was used to compare groups before and after the treatment.

Results: At baseline, 118/200 eyes (59.0%) had mild dry eye, 64/200 (32.0%) had moderate dry eye, and 18/200 (9.0%) had severe dry eye. In Group A, 64/100 eyes (64.0%) improved after 12 weeks, including 42/68 (61.8%) with mild, 18/26 (69.2%) with moderate, and 4/6 (66.7%) with severe dry eye. In Group B, 68/100 eyes (68.0%) improved, including 32/50 (64.0%) with mild, 28/38 (73.7%) with moderate, and 8/12 (66.7%) with severe dry eye. The reported between-group comparison showed no statistically significant difference in overall treatment outcome.

Conclusion: There is no statistically significant difference between outcomes of treatment with 0.5% Carboxymethylcellulose eye drop and 0.3 % Hydroxypropylmethylcellulose eye gel formulation.

Keywords: Dry Eye, Computer Users, Carboxymethylcellulose, Hydroxypropylmethylcellulose

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Introduction

Dry eye is a multifactorial clinical condition characterized by deficient tear production or excessive tear evaporation resulting in ocular discomfort.¹ Symptoms like gritty sensation, burning, itching or foreign body sensation in eye are suggestive of dry eye. There is a constant risk of ocular surface disorders in these patients. If the appropriate treatment is not given, dry eye can be quite debilitating.

The most common type of dry eye disease is an evaporative type, and most of them belong to the individuals with extensive use of computers and display devices like mobile phones or digital Tablets. Nowadays, increasing number of individuals have to

use computers and display devices every day at work places as well as at home.

Exposure to computers and display devices decreases the number of eye blinks, leading to incomplete blinking, evaporation of tears, and subsequently to dry eye disease. Drying of the ocular surface may be caused by a reduced blink rate, which lengthens the period during which the ocular surface is exposed to water loss before the next blink.² Portello et al. found a negative correlation between the number of blinks and relevant symptoms.³

American Optometry Association has described Computer Vision Syndrome as an eye and vision

problem seen in long-term computer, tablet, and cell phone users.⁴ It includes symptoms like fatigue, headache and dry eyes. Eye dryness is one the most common symptom ophthalmologist has to deal with in this group which affects negatively on their quality of life. Accommodation and vergence functions can also be hampered due to extensive exposure to computer screen.⁵ Computer users more than 4 hours, have found to have convergence insufficiency.⁶

The most common treatment of Computer Vision Syndrome is tears substitutes. Carboxymethylcellulose 0.5 % eye drop and Hydroxypropylmethylcellulose 2% eye gel are among the most common forms of tear substitutes. They increase tear volume, minimize desiccation and lubricate the ocular surface. Artificial tears lubricate the ocular surface, reduce tear osmolarity and protect the ocular surface from desiccation.⁷

Materials and Methods

The present study was prospective, comparative and interventional study conducted in ophthalmology OPD of a medical college. The study included 200 eyes of 100 individuals having daily computer exposure of 8 hours complaining of dry eye symptoms. The study was started after obtaining institutional ethics committee approval. Each individual had been given detailed information of the study along with the investigations which would be carried out during it and included only after getting the written consent. A detailed history of the patient was taken regarding age, sex, personal history, past ocular history, medical and surgical history. Each participant had been given a questionnaire to fill followed by examination of visual acuity and slit lamp examination.

Quantitative evaluation of dry eye was done by Schirmer-1 test (without topical anesthesia) and Tear Break-Up Time (BUT) while qualitative assessment was carried out by fluorescein staining of cornea.

Tear film break-up time (BUT) was noted after putting impregnated fluorescein strip into lower fornix to stain the entire cornea by asking patient to blink several times. Tear film- BUT, which is the interval between patients last blink and appearance of first randomly distributed dry spot on cornea, was examined at the slit-lamp with a broad beam using the cobalt blue filter.

Tear secretion was evaluated by Schirmer-1 test without anesthesia as it measures maximum basic and reflex secretion. It was performed by placing a precut strip of filter paper (Tear Touch-Schirmer strip: Madhu Instruments, New-Delhi). Less than 10 mm of wetting after 5 minutes will be taken abnormal. These tests were performed strictly in this sequence because the Schirmer test can disrupt tear film stability and cause false-positive ocular-surface staining.

Criteria for dry eye was set and it were graded into three types – mild, moderate and severe.

Criteria for the dry eye:

Dry eye was defined as having positive clinical tests as follows:

- 1) Tear film BUT ≤ 10 seconds,
- 2) Schirmer-1 test (without anesthesia) score ≤ 10 mm,
- 3) Positive fluorescein staining of the corneal epithelial surface.

Dry eye was graded into three types – mild, moderate and severe.

Mild dry eye was defined having at least 2 of the 3 criteria satisfied:

- 1) Tear film BUT of 5 - 10 seconds,
- 2) Schirmer-1 test (without anesthesia) of 5-10 mm,
- 3) Less than one quadrant of staining of the corneal epithelial surface.

Moderate dry eye was defined as having at least 2 of the 3 criteria satisfied:

- 1) Tear film BUT of < 5 seconds,
- 2) Schirmer-1 test (without anesthesia) of < 5 mm,
- 3) Punctate staining of more than one quadrant of the corneal epithelial surface.

Severe dry eye was defined as having all of the 3 criteria satisfied:

- 1) Tear film BUT of < 5 seconds,
- 2) Schirmer-1 test (without anesthesia) of < 5 mm,
- 3) Diffuse punctate staining of corneal epithelial surface.

Subsequently all eyes were grouped in two, each with 100 eyes, out of which one set of eyes would be treated with 0.5% Carboxymethylcellulose while other with 0.3 % Hydroxypropylmethylcellulose. All eyes were treated for 12 weeks following which their pre-treatment parameters were re-evaluated and questionnaire responses were noted. Statistical analysis of the treatment efficacy was carried out with similar pre-treatment parameters.

Inclusion Criteria:

All individuals of either sex, aging between 20 – 40 years, having daily computer exposure of 8 hours complaining of dry eye symptoms.

Exclusion Criteria:

1. Patients with ocular diseases and systemic diseases which are known to cause dry eye.
2. Patients with ocular surgeries in the past.
3. Patients which are taking any local or systemic drugs which can affect the tear secretion.
4. Patients who wear contact lenses.

Statistical Analysis:

The obtained data was recorded in SPSS 20.0 (Statistical Package for the Social Sciences, IBM).

Comparison of Efficacy of 0.5% Carboxymethylcellulose Eye Drop Against 0.3% Hydroxypropylmethylcellulose Eye Gel Formulation in Excessive Computer Users Aging Between 20 to 40 Years

The evaluations are to be made within the 95% confidence interval. P value less than 0.05 was considered statistically significant. Paired –t test was used to compare groups before and after the treatment. Null hypothesis was established.

Results

Out of 200 eyes, number of eyes with mild Dry eye syndrome was 118, those with moderate Dry eye syndrome were 64 and those having severe Dry eye syndrome were 18. After randomization, two groups were formed Group A and Group B. Group A consisted of 68 eyes with mild Dry Eye, 26 eyes with moderate Dry Eye and 6 eyes with severe Dry Eye while Group B consisted of 50 eyes with mild Dry Eye, 38 eyes with moderate Dry Eye and 12 eyes with severe Dry Eye. Group A received 0.5 % Carboxymethylcellulose eye drop three times a day and Group B received 0.3 % Hydroxypropylmethylcellulose eye gel at night.

In Group A who received 0.5% Carboxymethylcellulose; out of 68 mild dry eyes 42 (62%) eyes showed no signs of dryness after 12 weeks of treatment while 26 continued to have mild dryness. Out of 26 moderate dry eyes, 6 eyes showed no signs of dryness and 12 eyes had mild dryness while 8 eyes continued to have moderate dryness which accounts for improvement in 18 eyes (69 %). Out of 6 severe dry eyes 4 eyes showed moderate dryness while 2 eyes continued to have severe dryness which accounts for 67 % improvement in this category.

In Group B who received 0.3 % Hydroxypropylmethylcellulose; out of 50 mild dry eyes 32 (64 %) eyes showed no signs of dryness after 12 weeks of treatment while 18 continued to have mild dryness. Out of 38 moderate dry eyes, 8 eyes showed no signs of dryness and 20 eyes had mild dryness while 10 eyes continued to have moderate dryness which accounts for 74 % improvement in 28 eyes (74 %). Out of 12 severe dry eyes 8 eyes showed moderate dryness while 4 eyes continued to have severe dryness which accounts for 67% improvement in this category.

Table 1: Group A (Received 0.5% Carboxymethylcellulose eye drop)

Before Treatment	After 3 months of Treatment				Improved Eyes
	No Dry Eye	Mild Dry Eye	Moderate Dry Eye	Severe Dry Eye	

	Eye	y		Dry Eye	
Mild Dry Eye (68)	42	26	-	-	42
Moderate Dry Eye (26)	6	12	8	-	18
Severe Dry Eye (6)	-	-	4	2	4
(100)	48	38	12	2	64/100

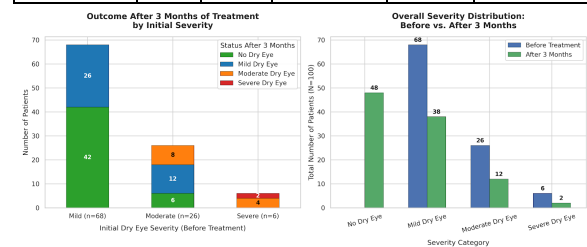


Figure 1

Table 2: Group B (Received 0.3% Hydroxypropylmethylcellulose eye gel)

Before Treatment	After 3 months of Treatment				Improved Eyes
	No Dry Eye	Mild Dry Eye	Moderate Dry Eye	Severe Dry Eye	

Comparison of Efficacy of 0.5% Carboxymethylcellulose Eye Drop Against 0.3% Hydroxypropylmethylcellulose Eye Gel Formulation in Excessive Computer Users Aging Between 20 to 40 Years

Mild Dry Eye (50)	32	18	-	-	32
Moderate Dry Eye (38)	8	20	10	-	28
Severe Dry Eye (12)	-	-	8	4	8
(100)	40	38	18	4	68/100

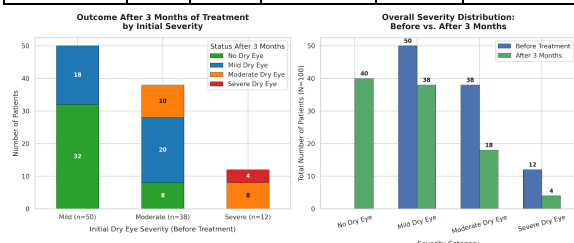


Figure 2

Student's t-test was used in the original analysis to compare treatment outcomes between the two groups. The reported t-value was -0.09988 and the p-value was 0.462624; therefore, the between-group difference was not statistically significant at the 5% level. Thus, although improvement was observed in 64.0% of eyes in the CMC group and 68.0% in the HPMC group, the study did not demonstrate a statistically significant difference in overall treatment outcome between the two formulations.

Discussion

This study assessed the status of dry eyes in extensive computer users daily, which confirmed that some degree of dry eyes was found in every eye. The majority of eyes had mild degree of dry eyes followed by moderate and severe. As shown in previous studies by Sezen Akkaya et al, the dryness caused in these eyes is of evaporative type.⁸

Another objective of our study was to compare between the two ocular lubricants for the relief of dry eyes in these extensive computer users. In one of the previous studies conducted by Anubhav Baveja et al, where 0.5% Carboxymethylcellulose (CMC) eye drop was compared with 0.3 % Hydroxypropylmethylcellulose (HPMC), the results were better with 0.5 % CMC.⁹ With 0.3 %HPMC which was used in our study to assess the outcome regarding dry eye symptoms, there were no difference in the outcome which included relief of symptoms as well as improvement in severity of dry eyes.

Albietz JM et al compared 0.5 % CMC with 0.3% HPMC for dry eye symptoms and ocular surface health in myopic LASIK patients and found out that 0.5 % CMC was more effective than 0.5 % HPMC in the

immediate postoperative period. They concluded these results to have possibly influenced due to the greater muco-adhesive properties of CMC.¹⁰

Rahul M Rajendraprasad et al found in their study that both 0.5 % CMC and 0.3 % HPMC were comparable in treating dry eyes in computer vision syndrome.¹¹

There were studies in past reporting that the recovery of the damaged ocular surface epithelia, increased goblet cell density and reduced dry eye symptoms in patients with tear insufficiency is promoted by CMC.^{12,13,14}

Pasquale Aragona et al in 2007 studied the effects of tear substitutes on conjunctival epithelium of mice and found out that 0.5 % HPMC treated group showed a reduced area of goblet cells with reduced optical density of mucin granules.

As the compliance is an important factor for management of dry eye, once a day application can be a better solution, especially in those individuals where long-term treatment is required. Maintaining frequency of three times a day was a major difficulty in participating individuals.

There were no discomfort, irritation or ocular congestion reported by any of the participant which confirms that both these lubricants can be used safely over the time.

Although, there were 15 out of 50 individuals who used 0.3 % HPMC gel formulation reported sediment deposition in morning which was not accepted well by them. In such patients, 0.5 % CMC would be better option as this issue is less likely to occur with drop formulation.

Conclusion

There is no statistically significant difference between outcomes of treatment with 0.5% Carboxymethylcellulose eye drop and 0.3 % Hydroxypropylmethylcellulose eye gel formulation. The choice of the medication should depend on the compliance as well as preference of the patients.

Recommendations

A long-term follow-up study can give better insights regarding chronic effect of 0.5 % CMC and 0.5 % HPMC on dry eye symptoms. A lubricating medication should be used regularly in individuals having dry eye symptoms with excessive computer users.

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