



International Journal of Medical and Health Research

ISSN: 2454-9142

Received: 22-11-2018; Accepted: 24-12-2018

www.medicalsciencejournal.com

Volume 5; Issue 1; January 2019; Page No. 196-198

Comparison of carboxymethylcellulose versus polyethylene glycol as tear substitutes for the treatment of dry eye

Neha Shilpy¹, Dhaval Bhartkumar Patel²

¹ Senior Resident Ophthalmology, C.H. Nagri Eye Hospital, Ahmedabad, Gujarat, India

² Consultant Ophthalmology, Sadbhaav Eye & Dental Clinic, Ahmedabad, Gujarat, India

Abstract

Purpose: To compare the efficacy of carboxymethylcellulose (CMC) and polyethylene glycol (PEG) as tear substitutes for treatment of dry eye.

Methods: A prospective randomized control study was conducted with a total of 100 dry eye patients divided into two groups. Group I was started on CMC 1% eye drops and group II on PEG containing eye drops (PEG 400 0.4%, propylene glycol 0.3%). Ocular Surface Disease Index (OSDI) scoring, tear break-up time, corneal and conjunctival staining scoring and Schirmer Test (ST) was done at baseline and then at 4 weeks and 6 weeks.

Results: OSDI score and corneal staining score were significantly better in group II compared to group I at 6 weeks. Group II also showed early improvement in OSDI score and conjunctival staining score from baseline to 1 week follow up. TBUT, conjunctival staining score and ST did not show any significant difference between the two groups.

Conclusion: PEG containing eye drops provide quicker and better subjective improvement and better corneal staining scores compared to CMC 1% eye drops. However, other clinical parameters tested don't show a significant difference between the two treatment options.

Keywords: carboxymethylcellulose, polyethylene glycol, propylene glycol, dry eye

1. Introduction

Dry eye disease poses a huge socio-economic burden on the society. It decreases the productivity and affects the quality of life^[1]. The condition can result either from insufficient tear production or excessive evaporation of tears^[2]. International Dry Eye Workshop II (DEWS II) have recognized the multifactorial nature of this disease that can be due to problems with tear film, ocular surface, or neurosensory abnormalities resulting in alteration in tear film osmolarity and inflammation of the ocular surface^[2]. The symptoms can be ocular discomfort related, like burning, irritation and grittiness, or vision related^[2]. Basic clinical assessment comprises of tests for tear production, tear stability and ocular surface damage^[3]. The treatment depends on severity, with mild cases responding to tear substitutes alone, while severe cases need other medical or surgical interventions^[4-6]. The artificial tear substitutes replenish the deficient aqueous layer and dissolve the inflammatory cytokines^[7]. The two most commonly used tear substitutes are carboxymethylcellulose (CMC) and polyethylene glycol (PEG). However, not many studies have compared the clinical efficacy of these two classes. We conducted a prospective study to compare the efficacy of CMC vs PEG containing eye drops as tear substitutes for treatment of dry eye.

2. Material & Methods

This was a prospective randomized control study done at Sadbhaav eye & dental clinic, Ahmedabad, India from April 2018 to September 2018. Patients above 18 yrs of age with best corrected visual acuity of 6/9 or better in both eyes, who had complaints of dry eye with an Ocular Surface Disease

Index (OSDI) score > 12 were included in the study. Patients already on dry eye treatment, any other ocular illness including allergy, infection or any condition that required other topical medications, patients who had undergone any ocular surgery or those with intolerance /hypersensitivity to any material used in the study were excluded. Patients with any systemic illness likely to be associated with dry eye were also excluded.

At presentation, detail history was taken and those who had complaints of dry eye were given the OSDI questionnaire to fill up. Through clinical examination including vision, intraocular pressure, slit lamp examination for anterior segment and fundus examination was done for all patients. Dry eye specific work up included Tear Break-Up Time (TBUT), corneal staining using sodium fluorescein 1%, conjunctival staining using lissamine green and Schirmer's Test (ST). Corneal and conjunctival staining score was calculated using the National eye institute grading scale according to which, cornea is divided into five zones and conjunctiva into six zones with a score from 0-3, where 0 specifies no stain^[8]. The worse affected eye of each patient, or the right eye in case of equally affected eyes, was included in the study.

Patients were divided into two groups based on simple random sampling. In group I, patients were prescribed CMC 1% QID and in group II, PEG containing drops QID ((PEG 400 0.4%, propylene glycol 0.3%). Follow up was done at 1 week and then at 6 weeks. OSDI scoring, TBUT, corneal staining, conjunctival staining and ST was repeated at both follow-ups. Statistical analysis was done using SPSS software version 20.0. Qualitative data was analysed using

chi square test. Quantitative data was analysed using independent sample t-test. Alpha error of $P < 0.05$ was considered significant.

3. Results

A total of 100 patients were included in the study. The mean age of all patients was 55.31 years with 34 males and 66 females. The patients were randomly divided into two groups, with 50 patients in each group. The mean age of patients in group I was 55.88 ± 14.46 years while in group II was 54.74 ± 14.52 years ($P = 0.69$). In group I, there were 18 males (36%) and 32 females (64%) while in group II, there were 16 males (32%) and 34 females (68%) ($P = 0.67$).

All the parameters evaluated, i.e. OSDI score, TBUT, corneal staining score, conjunctival staining score and ST, were comparable at baseline between the two groups ($P = 0.47$, $P = 0.95$, $P = 0.81$, $P = 0.80$, $P = 0.85$ respectively). At 1 week,

there was no statistically significant difference between the two groups in any of the parameters. At 6 weeks, OSDI score and corneal staining score were significantly better in group II than group I ($P = 0.001$ and $P = 0.01$ respectively). TBUT, conjunctival staining score and ST did not show any significant difference between the two groups ($P = 0.34$, $P = 0.25$ and $P = 0.37$ respectively) (Table 1)

Comparison within the groups showed that in group I, between day 0 to week 1, none of the parameters showed significant improvement. But when the comparison was done between day 0 to week 6, all the parameters except ST showed significant improvement (Table 2)

In group II, between day 0 to week 1, OSDI score and conjunctival staining score showed significant improvement ($P = 0.002$ and $P = 0.02$ respectively). Other parameters did not improve significantly. Between day 0 to week 6, all the parameters except ST showed a significant improvement (Table 2).

Table 1: Comparison of dry eye parameters between patients treated with CMC 1% (group I) and PEG containing drops (group II)

Parameters	Day 0			Week 1			Week 6		
	Group I	Group II	P value	Group I	Group II	P value	Group I	Group II	P value
OSDI Score	32.52 ± 12.58	34.40 ± 13.76	0.47	28.20 ± 11.54	26.60 ± 10.56	0.47	20.20 ± 10.68	14.40 ± 5.64	0.001
TBUT	6.34 ± 3.06	6.30 ± 3.34	0.95	6.80 ± 3.20	7.00 ± 3.52	0.77	7.80 ± 3.55	8.50 ± 3.68	0.34
Corneal staining score	4.80 ± 2.10	4.70 ± 2.08	0.81	4.30 ± 2.42	3.90 ± 2.06	0.38	3.40 ± 1.98	2.40 ± 1.86	0.01
Conjunctival staining score	1.99 ± 1.00	1.94 ± 0.98	0.80	1.67 ± 0.80	1.53 ± 0.74	0.37	1.42 ± 0.66	1.28 ± 0.54	0.25
ST	15.54 ± 9.21	15.89 ± 9.54	0.85	16.45 ± 9.52	16.92 ± 9.48	0.80	17.12 ± 9.77	18.84 ± 9.45	0.37

Table 2: Change in dry eye parameters in terms of P value between baseline and 1 week and baseline 6 weeks after starting treatment with CMC 1% (group I) and PEG containing drops (group II)

Parameters	Group I		Group II	
	Day 0-Week 1	Day 0-Week 6	Day 0-Week 1	Day 0-Week 6
OSDI Score	0.07	<0.0001	0.002	<0.0001
TBUT	0.46	0.03	0.31	0.002
Corneal staining score	0.27	0.0009	0.06	<0.0001
Conjunctival staining score	0.08	0.001	0.02	0.001
ST	0.63	0.41	0.59	0.12

4. Discussion

Dry eye disease is more prevalent in elderly and females^[9-11]. Other risk factors include extreme weather conditions, low humidity, use of air conditioners, use of digital screens, contact lens wear, ocular surgery, smoking, systemic illness like arthritis, diabetes and autoimmune diseases^[10-12]. In our study, the mean age of patients was 55.31 years with male: female ratio of almost 1:2 (34 males, 66 females).

OSDI is a validated questionnaire used to grade the disease based on patients' symptoms^[13]. The symptoms and clinical signs do not correlate many of the times^[14]. So, a wide variety of clinical tests have been proposed that range from traditional ones like tear film break-up time, schirmer's test and ocular surface staining to the newer ones like measurement of tear film osmolarity, interferometry and confocal microscopy^[15]. Here we used the OSDI score and basic clinical tests to monitor and compare the response to treatment.

Artificial tear substitutes are the most commonly prescribed treatment for dry eyes. Studies have shown that they increase tear film stability, reduce stress of the ocular surface, improve contrast sensitivity and the optical quality and ultimately

improve the quality of life^[5]. The various tear substitutes are CMC, hydroxypropyl methylcellulose, PEG, propylene glycol, hydroxypropyl-guar and sodium hyaluronate^[7].

In our study, we found that both CMC 1% and PEG containing eye drops were effective in the treatment of dry eye with improvement in clinical signs and symptoms. However, patient response to PEG containing eye drops was Quicker as OSDI score improved significantly from baseline to week 1 follow up. At 6 weeks, improvement in OSDI score and corneal staining score was significantly better in PEG group compared to CMC group. But improvement in other parameters like TBUT, conjunctival staining score and ST was not statistically different between the two groups. This implies that PEG containing eye drops are better for patient satisfaction and ocular surface. However, since dry eye is a multifactorial disease, so the two drops may not be different in terms of other factors and so improvement in other clinical signs is similar between the two groups. Cohen et al have done a similar study and they also found that corneal staining score was better with PEG containing eye drops compared to CMC 1% eye drops^[16]. They did not find difference in any other parameter and found both treatments to be well tolerated. Maharana et al. have compared CMC 0.5%, hydroxypropyl- guar containing PEG and hydroxypropyl methylcellulose (HPMC) 0.3% and found PEG and HPMC to be better than CMC 0.5% in terms of improvement in OSDI scoring, TBUT and ST^[17].

The limitation of our study is that we did the comparison based on traditional clinical tests. Newer methods of dry eye evaluation like tear osmolarity, interferometry and confocal microscopy can be done to compare the two treatments.

5. Conclusion

PEG containing eye drops provide quicker and better

subjective improvement and better corneal staining scores compared to CMC 1% eye drops. However, other clinical parameters tested don't show a significant difference between the two treatment options.

6. References

1. Buchholz P, Steeds CS, Stern LS, Wiederkehr DP, Doyle JJ, Katz LM, Figueiredo FC. Utility assessment to measure the impact of dry eye disease. *Ocul Surf.* 2006; 4(3):155-61.
2. Research in dry eye. Report of the Research Subcommittee of the International Dry Eye WorkShop. *Ocul Surf.* 2007; 5(2):179-93.
3. McGinnigle S, Naroo SA, Eperjesi F. Evaluation of dry eye. *Surv Ophthalmol.* 2012; 57(4):293-316.
4. Drug and Therapeutics Bulletin. The management of dry eye. *BMJ.* 2016; 4:353:i2333.
5. Messmer EM. The pathophysiology, diagnosis, and treatment of dry eye disease. *Dtsch Arztebl Int.* 2015; 112(5):71-81.
6. Lemp MA. Management of dry eye disease. *Am J Manag Care.* 2008; 14(3):S88-101.
7. Moshirfar M, Pierson K, Hanamaikai K, Santiago-Caban L, Muthappan V, Passi SF. Artificial tears potpourri: a literature review. *Clin Ophthalmol.* 2014; 8:1419-33.
8. Lemp MA. Report of the National Eye Institute/Industry workshop on Clinical Trials in Dry Eyes. *CLAO J.* 1995; 21(4):221-32.
9. Schaumberg DA, Sullivan DA, Buring JE, et al. Prevalence of dry eye syndrome among US women. *Am J Ophthalmol.* 2003; 136:318-326.
10. Gayton JL. Etiology, prevalence, and treatment of dry eye disease. *Clin Ophthalmol.* 2009; 3:405-12.
11. Moss SE, Klein R, Klein BE. Prevalence of and risk factors for dry eye syndrome. *Arch Ophthalmol.* 2000; 118:1264-1268.
12. Sendekca M, Baryluk A, Polz-Dacewicz M. [Prevalence and risk factors of dry eye syndrome]. *Przegl Epidemiol.* 2004; 58(1):227-33.
13. Schiffman RM, Christianson MD, Jacobsen G, Hirsch JD, Reis BL. Reliability and Validity of the Ocular Surface Disease Index. *Arch Ophthalmol.* 2000; 118(5):615-621.
14. Nichols KK, Nichols JJ, Mitchell GL. The lack of association between signs and symptoms in patients with dry eye disease. *Cornea.* 2004; 23(8):762-70.
15. Lin H, Yiu SC. Dry eye disease: A review of diagnostic approaches and treatments. *Saudi J Ophthalmol.* 2014 ; 28(3):173-81.
16. Cohen S, Martin A, Sall K. Evaluation of clinical outcomes in patients with dry eye disease using lubricant eye drops containing polyethylene glycol or carboxymethylcellulose. *Clin Ophthalmol.* 2014; 8:157-64.
17. Maharana PK, Raghuwanshi S, Chauhan AK, Rai VG, Pattebahadur R. Comparison of the Efficacy of Carboxymethylcellulose 0.5%, Hydroxypropyl-guar Containing Polyethylene Glycol 400/Propylene Glycol, and Hydroxypropyl Methyl Cellulose 0.3% Tear Substitutes in Improving Ocular Surface Disease Index in Cases of Dry Eye. *Middle East Afr J Ophthalmol.* 2017; 24(4):202-206.