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# Treatment of contact lens related dry eye with antibacterial honey

Daniel Wong, Julie M. Albietz, Huan Tran, Cimonette Du Toit, Anita Hui Li, Tina Yun, Jee Han, Katrina L. Schmid*

*School of Optometry and Vision Science and Institute of Health and Biomedical Innovation, Faculty of Health, Queensland University of Technology, 60 Musk Avenue, Kelvin Grove, Qld, 4059, Australia*

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ABSTRACT

*Aim:* Contact lens induced dry eye affects approximately 50% of contact lens wearers. The aim was to assess the effects of Manuka (Leptospermum sp.) honey eye drops (Optimel, Melcare, Australia) on dry eye in contact lens wearers. The safety of the honey eye drops in contact lens wear and contact lens wearers' compliance were also evaluated.

*Design:* Prospective, randomised, cross over study, examiner masked, pilot treatment trial.

*Methods:* Twenty-four participants aged 20 to 55 years with contact lens related dry eye were recruited and randomised to two treatment groups; 20 completed the study. One group used Optimel eye drops twice a day for two weeks followed by conventional lubricant (Systane Ultra, Alcon) therapy for two weeks; the other group completed the treatments in the reverse order. Before and after each treatment dry eye symptomology, ocular surface inflammation, and tear quantity and quality were assessed. Participants completed a daily log detailing their usage of treatments and any issues.

*Results:* Dry eye symptoms improved significantly after Optimel treatment. Patients with more severe symptoms at baseline showed a greater improvement in symptoms. No significant differences were observed in the objective signs of dry eye; presumably because of the short treatment duration. Seventy-five% of contact lens wearers reported good adherence to Optimel treatment and 95% reported no issues using this product.

*Conclusions:* Optimel Eye Drops reduce the symptoms of dry eye in contact lens wearers and are safe to use. A longer treatment period to assess the effect on clinical signs of dry eye is required.

## 1. Introduction

Although contact lens wear is generally considered safe, it is not uncommon for patients to develop contact lens related problems. Depending on the study, up to 21% of contact lens wearers will develop a contact lens related complication each year, ranging from mild corneal epitheliopathy to vision threatening microbial keratitis [1]. The most common problem associated with contact lens wear is contact lens related dry eye [2]. The primary reasons for contact lens intolerance are discomfort and dryness, with up to 50% of contact lens wearers reporting dry eye symptoms [3–6]. Studies report that between 12% and 51% of lens wearers "drop out" of contact lens wear, with contact lens discomfort being the primary reason for discontinuation [7]. Contact lens wear disturbs the delicate homeostatic balance of the ocular surface, decreasing tear film stability, increasing tear evaporation, reducing tear film turnover, and probably increasing tear osmolarity, and thus initiating an inflammatory cascade [7].

*Optimel Manuka+ Dry Eye Drops (16% Leptospermum spp. honey,* sodium chloride, benzoic acid; Melcare Biomedical, Australia) (Optimel) has regulatory approval in Australia (ARTG Identifier 199785) and Europe (CE marked). Current approved treatment indications are chronic dry eye, blepharitis, and sore irritated eyes and eyelids. The product contains a unique proprietary mix of honeys from the Australian and New Zealand Leptospermum species (commonly known as Manuka, Tea Tree or Jelly Bush). These honeys are selected for their highest and most consistent level of antibacterial activity, including activity against antibiotic resistant strains such as methicillin resistant *Staphylococcus aureus* and *Pseudomonas aeruginosa,*and other exceptional physicochemical properties such as a high phenolic and flavonoid content [8–11], immunomodulatory effects [12–14], and anti-inflammatory, anti-oxidant and wound healing properties [11,14,15].

Honey has a long history in eye care and wound care [16]. Honey is a supersaturated solution of sugars with an acidic pH, high osmolarity and low water content. These characteristics inhibit the growth of microorganisms, reduce oedema and promote epithelialisation [15,17].

* Corresponding author. Institute of Health and Biomedical Innovation, Queensland University of Technology, 60 Musk Ave, Kelvin Grove, Qld, 4059, Australia.
*E-mail address:* k.schmid@qut.edu.au (K.L. Schmid).

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Honey from a variety of floral sources and geographic locations, and in a range of concentrations, has been reported as an effective adjunctive treatment in the chronic management of ocular surface diseases, including post-operative corneal oedema and bullous keratopathy unsuitable for corneal grafting [18,19], Sjogren's and non-Sjogren's aqueous deficient dry eye [20–22], meibomian gland dysfunction [20,22], herpes zoster-related neurotrophic keratitis [23], vernal keratoconjunctivitis [24], contact lens-related bacterial keratitis [25] and as an antimicrobial prophylaxis for ocular surgery [26]. In animal models, unprocessed honeys were as effective as conventional antibiotic therapies in the management of bacterial conjunctivitis and keratitis caused by *Staphylococcus aureus* and *Pseudomonas aeruginosa* [27–29] and demonstrated efficacy in the management of corneal alkali burns [30] and a corneal abrasion inoculated with *Pseudomonas aeruginosa* toxin to induce immune mediated keratitis [31].

There are few published clinical studies on the efficacy of antibacterial honeys in eye care and none involving contact lens wearers with dry eye. The aim was to evaluate the efficacy of medically regulated antibacterial honey eye drops versus conventional lubricant eye drop therapy for management of dry eye symptoms and signs in symptomatic contact lens wearers. Both the safety of the product and contact lens wearers' compliance with its use were assessed.

## 2. Materials and methods

### 2.1. Participants

Twenty-four soft contact lens wearers aged 20 to 55 years, who reported experiencing symptoms of dryness during contact lens wear, were recruited from the Queensland University of Technology, Optometry Clinic. Soft contact lens wearers who were hypersensitive or allergic to honey or bee products were excluded from participation, as were those using topical or systemic medications. The study complied with the tenets of the Declaration of Helsinki and was approved by the University's Human Research Ethics Committee.

Four patients (17%) did not complete the trial for the following reasons: they acquired adenoviral conjunctivitis (n = 1), they developed contact lens acute red eye associated with increased contact lens wear (n = 1), or they did not complete the lubricant therapy treatment due to stated preference for Optimel Manuka+ (n = 2). Only the data of the 20 participants that completed both treatments were included in the analyses (Table 1). The mean ages of participants were 25.7 ± 9.2 years, 11 were female and 9 were male. All wore soft contact lenses: eleven wore daily disposables, 1 wore fortnightly replacement lenses and 8 used monthly replacement lenses. Most wore their lenses more than 5 h per day (n = 19) on more than 3 days per week (n = 13); some wore their lenses less due to their dry eye problem.

### 2.2. Treatments

Participants were randomised to two treatment groups. One group used Optimel Manuka+ Dry Eye Drops (Optimel Manuka + ) twice a day for two weeks followed by lubricant (Systane Ultra, Alcon, USA) therapy for two weeks; the other group completed the treatments in the reverse order. Systane Ultra (Alcon Laboratories, Texas, USA) was chosen as the comparison due to its known effectiveness in treating contact lens related dry eye [32,33]. Before being given to the participants for at home use, the Optimel Manuka+ eye drops were instilled onto the eye's surface to determine if a sensitivity reaction was likely. Participants were instructed to use the eye drops twice a day; once in the morning at least 10 min before lens insertion and then once at the end of the day after contact lens removal. They were to use the drops daily regardless of whether they had worn contact lenses that day or not.

It was not possible to mask the participants as to which treatment they were using as the Optimel Manuka+ eye drops have a unique look, smell and taste with nasolacrimal drainage. Before and after each treatment period dry eye symptomology, ocular surface inflammation, and tear quantity and quality were assessed. The researchers taking the measurements were masked as to which of the two treatments had been used. During each treatment period participants completed a log detailing their usage of treatments and any issues experienced.

**Table 1**
Participant characteristics at baseline.

| VARIABLE | PARTICIPANTS (n = 20) |
|---|---|
| Age (year) | 25.7 ± 9.2 |
| Gender (no. male/female) | 9/11 |
| Contact Lens Type (no. wearing daily/fortnightly/monthly) | 11/1/8 |
| Duration of Lens Wear per Day (no. wearing < 5/5-10/ > 10hours) | 1/14/5 |
| Wearing Schedule Days per Week (no. wearing < 3/3-5/ > 5 days) | 7/5/8 |

### 2.3. Measurements

Participants attended three measurement sessions (baseline, after lubricants, after honey treatment). Validated dry eye questionnaires used to assess ocular symptoms included the Ocular Surface Disease Index (OSDI) [34] and Ocular Comfort Index (OCI) [35]. The scores of these questionnaires exhibit a positive correlation with each other with a high validity, reliability, specificity and sensitivity [34,36]. They were also asked to report their compliance with the Optimel Manuka+ eye drop treatment. The questionnaire had four choices Excellent (two drops per day nearly every day as recommended), Good (one or two drops per day most days), Fair (one drop per day most days), and Poor compliance (one or two drops when needed only), the participant chose one option.

Assessment of the tear film and ocular surface were performed using the Keratograph5 M (OCULUS Optikgeräte GmbH, Wetzlar, Germany). These assessments included limbal and bulbar conjunctival redness [37], non-invasive tear break up time (NIBUT) [38], and tear meniscus height [39]. The Schirmer 1 test of secretion [41] was also performed. All participants also underwent an anterior eye slit lamp examination. The presence of papillae upon lid eversion was graded using the Efron Scale [42]. Conjunctival fluorescein staining was graded using the Oxford Scale [43].

### 2.4. Data analysis

The data of the participant's most symptomatic dry eye at baseline was selected for data analysis. Descriptive data have been presented as mean ± standard deviations. Statistical analyses were performed using SPSS 17.0 for Windows (SPSS Inc, Chicago, Illinois, USA). Analysis of potential confounders showed that there was no impact of treatment order on the data and thus the data was collapsed to one group for analysis. A repeated measures analysis of variance (repeat measure ANOVA) was used for statistical analysis of crossover and treatment effects. Data of the participants with a baseline OSDI score of > 12 were also analysed separately; i.e. the sub-group with the more severe dry eye symptoms [36]. Pearson correlation analysis was performed to evaluate the relationship between Optimel Manuka+ treatment and clinical measures. P values < 0.05 were considered statistically significant.

## 3. Results

Compliance with Optimel Manuka+ treatment was excellent in 40%, good in 35%, fair in 20% and poor in 5% of participants (Fig. 1).