

## Effect of lens care system on silicone hydrogel contact lens wettability



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### ARTICLE INFO

#### Article history:

Received 3 February 2015

Received in revised form 23 June 2015

Accepted 29 June 2015

#### Keywords:

Silicone hydrogel

Wettability

Contact lens

Care system

### ABSTRACT

**Purpose:** The purpose was to compare the effect of the repeated usage of two care systems (one hydrogen peroxide cleaning and disinfecting system and one polyaminopropyl biguanide (PHMB) containing multi-purpose system) with silicone hydrogel contact lenses worn for three months on a daily wear modality. A specific aspect of interest was of the effect of the care systems on contact lens wettability. **Methods:** Seventy-four symptomatic contact lens wearers, habitually wearing either ACUVUE<sup>®</sup> OASYS<sup>®</sup> ( $n = 37$ ) or PureVision<sup>™</sup> ( $n = 37$ ), constituted the study population. The study was a two-arm prospective, investigator-masked, bilateral study of three-month duration to evaluate the effects of CLEAR CARE<sup>®</sup> compared with renu<sup>®</sup> fresh<sup>™</sup>. The subjects were randomized to one of the two lens care systems. Contact lens wettability and surface cleanliness were assessed with the Tearscope and reported in terms of pre-lens non-invasive break-up time (PL-NIBUT) and visible deposits. Baseline assessments at enrollment were with the subjects' own contact lenses worn for at least 6 h when using their habitual PHMB-preserved care system and at the dispensing visit with new contact lenses. At the follow-up visits, the contact lenses were worn for at least 6 h, and were at least 11 days old for ACUVUE<sup>®</sup> OASYS<sup>®</sup> and 25 days old for PureVision<sup>™</sup>.

**Results:** The results obtained showed that: (i) with CLEAR CARE<sup>®</sup>, a significant improvement in contact lens wettability was recorded compared with the habitual care system at the three-month follow-up visit (mean median PL-NIBUT 5.8 vs. 4.0 s,  $p < 0.001$ ). Further, with this same lens care system a significant increase in wettability was observed at the three-month follow-up visit compared with dispensing (mean median PL-NIBUT 5.8 vs. 4.5 s,  $p = 0.022$ ). (ii) Whereas no difference in contact lens wettability was observed at dispensing between the two lens care groups (mean PL-NIBUT: 4.5 vs. 4.2 s,  $p = 0.518$ ), a significantly more stable pre-lens tear film was observed with CLEAR CARE<sup>®</sup> than with renu<sup>®</sup> fresh<sup>™</sup> at both the two-month (mean PL-NIBUT: 4.6 vs. 3.7 s,  $p = 0.005$ ) and three-month (mean PL-NIBUT: 5.8 vs. 4.2 s,  $p = 0.028$ ) visits. iii. With renu<sup>®</sup> fresh<sup>™</sup>, no significant differences were observed at the end of three months of use compared with either the habitual care system or the new contact lens solution (mean PL-NIBUT: 3 M 4.2 vs. Disp 4.2 s ( $p = 0.420$ ) vs. enrolment habitual care solution 5.1 s ( $p = 0.734$ )). iv. With CLEAR CARE<sup>®</sup> significant increases in the incidence of surfaces free of both mucus (3 month 95% vs. habitual solution 82% enrolment;  $p = 0.005$ ) and lipid (3 month 87% vs. habitual solution 72% enrolment;  $p = 0.009$ ) were observed.

**Conclusion:** Significantly better contact lens wettability and surface cleanliness were achieved for ACUVUE<sup>®</sup> OASYS<sup>®</sup> and PureVision<sup>™</sup> with CLEAR CARE<sup>®</sup> than with renu<sup>®</sup> fresh<sup>™</sup> at the end of three months of use.

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### 1. Introduction

The introduction of silicone hydrogel contact lenses has created challenges for contact lens care systems beyond disinfection and

good compatibility with lens materials. Additional challenges are, in particular, the efficient removal of deposits, mainly from tear film lipids, and the lubrication of contact lens materials containing hydrophobic silicone based components. Consequently, a large number of studies have examined the influence of lens care systems on the performance of silicone hydrogel contact lenses. However, whereas most studies have assessed the effect of lens care on comfort [1–5], very few studies have quantified the effect of lens care on lipid deposits or on-eye contact lens wettability,

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which are other relevant clinical endpoints [6–8]. Nichols studied the effect of four lens care systems on lipid deposition with galyfilcon A silicone hydrogel contact lenses and concluded that whereas small differences between lens care systems existed, the main factor that affected lipid deposits was the incorporation of a digital rub in the lens care regimen [7]. Young et al., assessed a PHMB-preserved and a polyquad-preserved lens care system on the wettability of group IV hydrogel and silicone hydrogel contact lenses and were able to detect a difference in subjective classification of wettability between the two lens care systems in combination with the hydrogel contact lenses, but not the silicone hydrogel contact lenses [8]. Lorentz et al., analysed the effect of *in vitro* lipid doping on lens wettability of conventional hydrogel and silicone hydrogel contact lenses using sessile drop contact angle measurement and determined that exposure to lipids may improve the wettability of certain contact lens materials, especially silicone hydrogel materials that are surface treated [6].

Among the various lens care systems, those utilizing a hydrogen peroxide disinfectant seem to perform well with silicone hydrogel contact lenses. In particular the hydrogen peroxide systems have been associated with a very low level of corneal staining, (significantly lower than PHMB-containing MPS) [9,10]. Additionally, palpebral changes have been observed with the use of some PHMB systems [8,11]. Clear Care<sup>®</sup>, a hydrogen peroxide system, has also been reported to provide effective cleaning [12,13]. As such, it may favorably impact the interaction between silicone hydrogel contact lenses and the eyelid tissue, [12,14,15] and contribute to better cleaning and wetting of the contact lens surface by the tear film.

The purpose of this study was to evaluate the effect on eye of two different lens care systems (one hydrogen peroxide system and one PHMB multi-purpose system) on contact lens wettability and cleanliness of silicone hydrogel contact lenses worn on a daily wear basis for three months.

## 2. Materials and methods

### 2.1. Study products

The test product was CLEAR CARE<sup>®</sup> (AOSept<sup>®</sup> Plus in the UK) hydrogen peroxide cleaning and disinfecting solution (Alcon Laboratories, Inc., Fort Worth, TX, USA). The control product was

renu<sup>®</sup> fresh<sup>™</sup> (Renu<sup>®</sup> MultiPlus Fresh<sup>™</sup> in the UK) multi-purpose solution (Bausch & Lomb Inc., Rochester, NY, USA). Both products were used according to the manufacturers instructions (*i.e.* the multi-purpose users were instructed to rub and rinse their lenses after removal and the hydrogen peroxide users were instructed to rinse their lenses while on the domed lens holders of the case).

The subjects were also issued Minims<sup>®</sup> unpreserved single dose saline (Laboratories Chauvin) to use as needed as a contact lens re-wetting drop. No recommended use schedule was imposed, but the re-wetting drop usage was monitored and recorded at the follow-up visits.

### 2.2. Study population

The study was carried out at a single site (OCULAR TECHNOLOGY GROUP—International). The target population was symptomatic daily wear silicone hydrogel contact lens wearers, wearing either ACUVUE<sup>®</sup> OASYS<sup>®</sup> (senofilcon A) replaced every two weeks or PureVision<sup>™</sup> (balafilcon A) replaced monthly, and caring for their contact lenses with a PHMB-preserved lens care system.

To identify a symptomatic contact lens wearing population, only participants who reported wearing their contact lenses less than 10 h a day or experiencing at least 2 h of uncomfortable wearing were enrolled. This inclusion criteria was assessed towards the end of their contact lens wearing period. The end of the wear period was taken as contact lenses 11–17 days old for the two week replacement contact lenses and 25–35 days old for the monthly replacement contact lenses.

### 2.3. Experimental method

This was a two-arm, prospective, interventional, bilateral, investigator-masked study. Upon enrolment, the subjects were randomly allocated (1:1 randomization) to use one of the two lens care systems for the three month duration of the study (Fig. 1). Each lens care system was assessed for the change between the data collected at enrolment (recorded for the subjects' habitual lens care system) and the data recorded at the follow-up visits. The data recorded at the follow-up visits was also compared to that recorded at the dispensing visit (with new contact lenses inserted from the blister pack).

The experimental protocol was reviewed and approved by an independent ethics committee in the UK. The study complied with

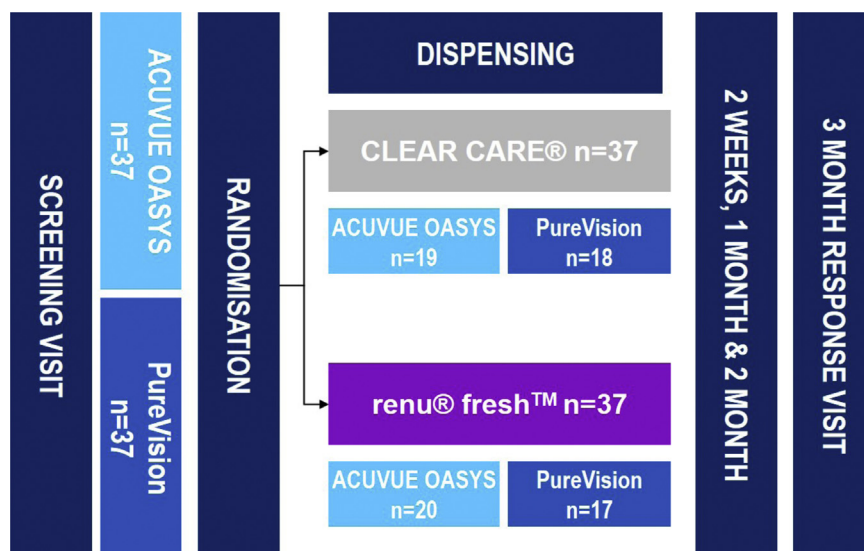


Fig. 1. Summary of study design and study visits.

the requirements of the Declaration of Helsinki and the Data Protection Act in the UK. All subjects were given written information about the study and signed the consent form at the enrolment visit, prior to any assessment being carried out.

During the study, the subjects were required to continue wearing their habitual contact lens brand lenses either ACUVUE<sup>®</sup> OASYS<sup>®</sup> or PureVision<sup>™</sup>, replacing them every two weeks or monthly, as applicable, and to exclusively use the lens care system they had been randomized to use.

The experimental routine involved one enrolment visit during which the subjects were assessed for inclusion in the study. Eligible participants were enrolled and scheduled to attend a dispensing visit and four follow-up visits.

The subjects were required to attend the enrolment visit wearing their habitual silicone hydrogel contact lenses. The enrolment visit was scheduled so that the subjects' habitual contact lenses were at least  $14 \pm 3$  days old for the subjects replacing their lenses every two weeks and at least  $30 \pm 5$  days old for those replacing their lenses monthly. The subjects attended the enrolment visit having worn their contact lenses for at least 6 h on the day of the visit. The subjects continued wearing their habitual contact lenses and using their habitual lens care system until the dispensing visit.

At the dispensing visit, the subjects were dispensed a new pair of their habitual contact lens brand to be used according to the manufacturers recommended replacement schedule. The new pair of silicone hydrogel contact lenses (identical to the habitual contact lens brand) were used in conjunction with the randomized and dispensed study lens care product. Measurements were carried out with the new contact lenses and the participants were instructed to wear the dispensed contact lenses for a minimum of 6 h per day, and a minimum of 5 days per week for the duration of the study if possible.

The subjects were then scheduled to attend four follow-up visits respectively, at two weeks, one, two and three months. Contact lens replacement was scheduled to ensure that contact lenses were  $14 + 0/-3$  days old at all follow-up visits for the contact lenses replaced every two weeks and  $30 + 0/-5$  days for the contact lenses replaced monthly. The subjects were required to have worn the study contact lenses at least 6 h when attending all the follow-up visits.

#### 2.4. Measurement procedures

Contact lens wettability was assessed using a non-invasive measurement technique. The Tearscope lighting system, providing a wide, diffuse cold light source, attached to a Nidek SLD7 biomicroscope set at 25X magnification was used as the observation system (Fig. 2). The pre-lens non-invasive break-up time (PL-NIBUT) was measured; it is defined as the time elapsed between eye opening after a blink, and the appearance of the first break (dark spot) within the tear film over the lens when observed with the Tearscope or when a blink occurs if it precedes a visible break. Three successive measurements of the PL-NIBUT were recorded at each visit; the median value (median PL-NIBUT was used for statistical analysis).

Contact lens surface contamination, observed with the Tearscope, was recorded separately on five point scales for lipid and mucus contaminations as follows: (i) mucus film: 0 = none or very slight mucus spot contamination; 1 = slight mucus spot contamination; 2 = mild mucus film contamination; 3 = moderate mucus film strand contamination; 4 = severe mucus film strand contamination; (ii) lipid contamination: 0 = none or very slight lipidic film; 1 = slight lipidic film; 2 = mild lipidic film; 3 = moderate lipidic film; 4 = severe thick lipidic film.



Fig. 2. Tearscope & biomicroscope examination set up.

The measurement of Snellen visual acuity, the observation of the ocular tissues by slit lamp biomicroscopy, and the monitoring of any adverse events were the procedures in place for the safe management of the subjects.

#### 2.5. Statistical method

The data analysis was carried out using SPSS 19.0 (IBM UK Ltd.). The data gathered at the enrolment visit, with habitual contact lenses and lens care systems and at the dispensing visit, with a new pair of lenses, are the reference data used to measure the effect of the study lens care systems. For each measurement of interest, comparative statistics were carried out between enrolment and dispensing visits by paired sample t-test for continuous data and Wilcoxon signed rank test for categorical data. In both instances, a 0.050 significance level was taken to test the alternate hypothesis that the changes observed between the two time points were significant. Further, the data gathered at each visit with the test lens care system (CLEAR CARE<sup>®</sup>) was compared to the data gathered at each visit with the control lens care system (renu<sup>®</sup> fresh<sup>™</sup>) to measure the relative performance of the two lens care systems by independent samples test. For continuous data, when the data was not normally distributed, the parameters were transformed prior to analysis (e.g. log transformation).

### 3. Results

#### 3.1. Study population

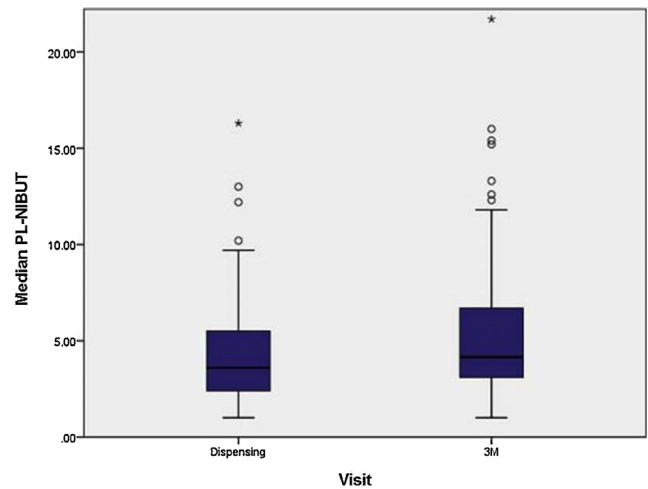
A total of 74 subjects who consented to take part and fulfilled the study inclusion/exclusion criteria were successfully enrolled and completed the study as per the protocol. The enrolled subjects were randomized in an equal number ( $n = 37$ ) to the CLEAR CARE<sup>®</sup> and the renu<sup>®</sup> fresh<sup>™</sup> arms of the study. The two study groups were well matched for age and gender. The subjects in the CLEAR CARE<sup>®</sup> group were between 22 and 56 years of age (mean age =  $34.8 \pm 9.8$  years) with a slight predominance of females ( $n = 21$ ; 57%) over males ( $n = 16$ ; 43%). The subjects in the renu<sup>®</sup> fresh<sup>™</sup> group were between 20 and 67 years of age (mean age =  $35.5 \pm 10.5$  years) with a slightly more marked predominance of females ( $n = 25$ ; 68%) over males ( $n = 12$ ; 32%).

**Table 1**  
CLEAR CARE® & renu® fresh™ median PL-NIBUT descriptive statistics and t-test group comparison at dispensing and follow-up visits.

Median PL-NIBUT (seconds)					
	Dispense	2 Weeks	1 Month	2 Months	3 Months
<b>CLEAR CARE®</b> (Mean ± SD)	<b>4.46 ± 2.90</b>	<b>4.84 ± 5.50</b>	<b>4.36 ± 2.74</b>	<b>4.65 ± 2.33</b>	<b>5.76 ± 4.50</b>
Percentiles					
25	2.40	2.30	2.38	3.03	3.08
50	3.60	3.80	3.60	4.15	4.15
75	5.50	5.40	5.80	5.85	6.80
<b>renu® fresh™</b> (Mean ± SD)	<b>4.19 ± 2.54</b>	<b>4.60 ± 3.13</b>	<b>4.06 ± 1.94</b>	<b>3.68 ± 2.04</b>	<b>4.22 ± 2.14</b>
Percentiles					
25	2.15	2.30	2.43	2.05	2.90
50	3.40	3.50	3.75	2.90	3.80
75	5.58	6.00	5.38	5.35	5.08
p value	0.518	0.975	0.797	<b>0.005</b>	<b>0.028</b>

In accordance with the study inclusion criteria, the subjects were all either ACUVUE® OASYS® or PureVision™ silicone hydrogel soft contact lens wearers at the time of enrolment in the study. In each solution group, the distribution of lens brands was close to 1:1 with only slightly more ACUVUE® OASYS® wearers (CLEAR CARE® n = 19; 51%; renu® fresh™ n = 20; 54%). Further, the average wear times were similar for the participants enrolled in the two groups (Mean: CLEAR CARE® = 11.5 h; renu® fresh™ = 11.4 h), as were the average comfortable wear times reported at enrolment (mean: CLEAR CARE® = 8.0 h; renu® fresh™ = 8.5 h).

Two subjects (one prior to randomization and the other in the renu® fresh™ group) were prematurely discontinued for non-study product related reasons. Sixteen adverse events were recorded throughout the investigation. Six events were non-ocular, of which two were serious adverse events, and ten were ocular, of which seven were study product related: Six were in the CLEAR CARE® group (four toxic reaction and two bacterial conjunctivitis) and one in the renu® fresh™ group (corneal erosion).



**Fig. 4.** Median PL-NIBUT (pre-lens non-invasive break-up time) for CLEAR CARE® users: boxplot showing 3 month follow-up (3M) vs. dispensing with new contact lenses (mean, standard deviation & 95% confidence interval).

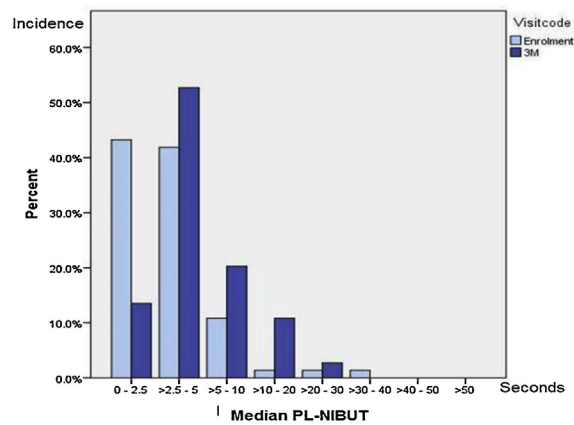
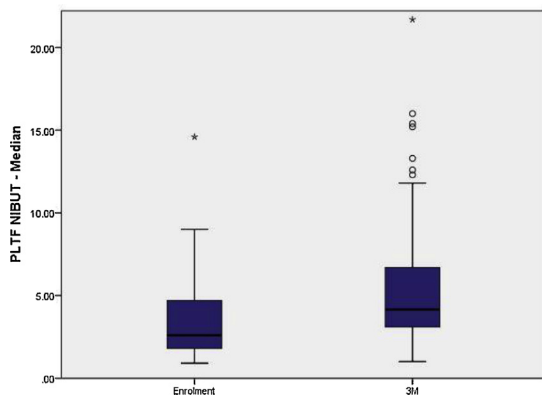
3.2. Product usage & study protocol compliance

The daily contact lens wear time for both lens care groups was similar and remained unchanged throughout the study period. The mean number of days that the contact lenses were worn each week varied between 6.0 and 6.4 days per week and the mean daily wear time ranged from 11.6 to 12.0 h per day. The contact lens age at the time of the visits demonstrated an excellent compliance with the study protocol. In the ACUVUE® OASYS® group, for which planned replacement was every two weeks, the mean lens age varied between 12.9 and 13.6 days at the follow up visits. For the PureVision™ contact lens wearers whose planned replacement was monthly, the mean lens age varied between 27.4 and 28.7 days at the follow-up visits, except for the two week visit.

3.3. Individual lens care product effects on PL-NIBUT and surface deposition

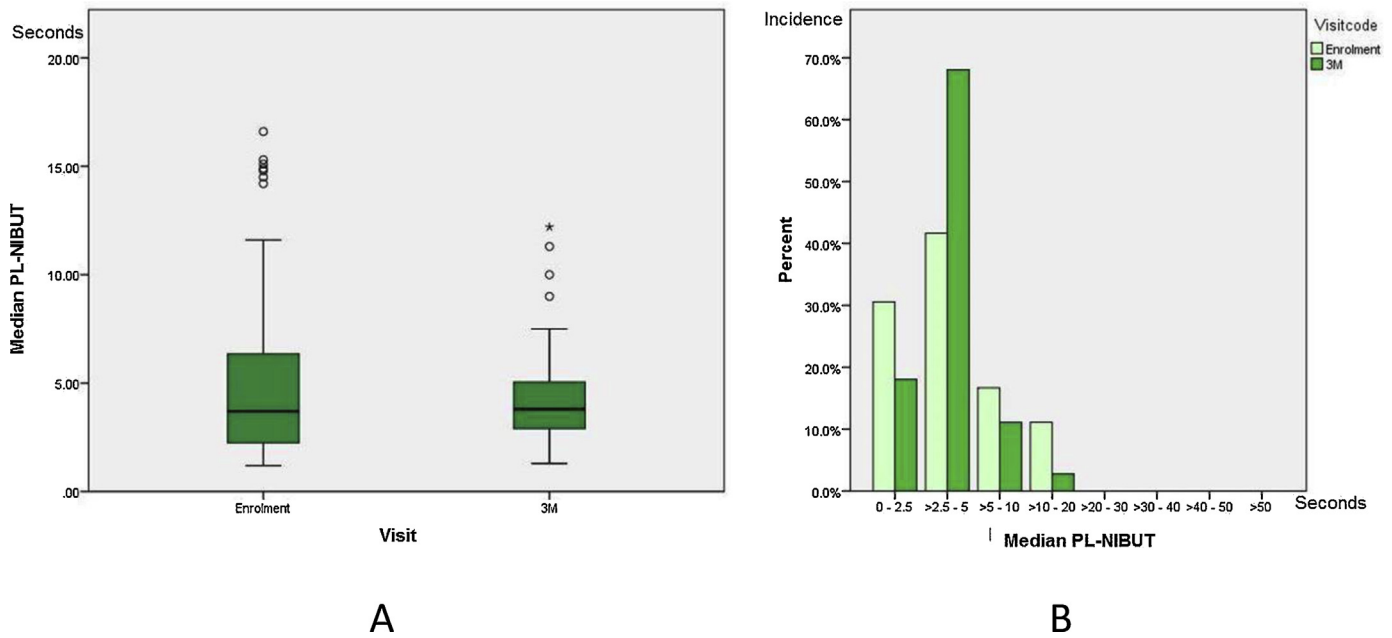
3.3.1. Definition

The effect of each lens care system individually was determined by comparing, within each lens care group, the *in vivo* wettability expressed by the PL-NIBUT and surface contamination judged with



**Fig. 3.** Median PL-NIBUT (pre-lens non-invasive break-up time) for CLEAR CARE® users: 3 month follow-up (3M) vs. enrolment with own lens care (enrolment): (A) boxplot (mean, standard deviation & 95% confidence interval), (B) distribution according to median PL-NIBUT.





**Fig. 5.** Median PL-NIBUT (pre-lens non-invasive break-up time) for renu<sup>®</sup> fresh<sup>™</sup> users: 3 month follow-up (3M) vs. enrolment with own lens care (enrolment): (A) boxplot (mean, standard deviation & 95% confidence interval), (B) distribution according to median PL-NIBUT

the Tearscope at the three month follow-up visit with: (i) the PL-NIBUT and surface contamination at enrolment with the subjects' own contact lenses and lens care system (Effect vs. habitual PHMB-preserved care system); (ii) the PL-NIBUT and surface contamination of the new contact lenses at dispensing (Wettability Maintenance Effect) (Table 1).

#### 3.4. Clear care<sup>®</sup>

PL-NIBUT data at the three month follow-up visit compared with data at enrolment (Fig. 3A&B) and dispensing visits after 30 min of wear (Fig. 4) revealed a significant improvement in the surface wettability of the contact lenses cared for with CLEAR CARE<sup>®</sup>. The PL-NIBUT at the three month follow-up visit was significantly longer ( $p < 0.001$ ) than the PL-NIBUT at enrolment, with a mean increase in median PL-NIBUT of 45% (5.8 s vs. 4.0 s). The difference in average PL-NIBUT was associated with an overall shift in the distribution of the individual median PL-NIBUT recordings toward better overall tear film stability at the three month visit as compared to the enrolment visit (most common distribution: 2.5–5.0 s vs. 0.0–2.5 s; incidence PL-NIBUT > 5 s 33.8% vs. 15.0%). Similarly, the PL-NIBUT at the three month follow-up visit was significantly longer ( $p = 0.022$ ) than the PL-NIBUT of the new contact lenses at the dispensing visit, with a mean improvement of 29% (5.8 s vs. 4.5 s).

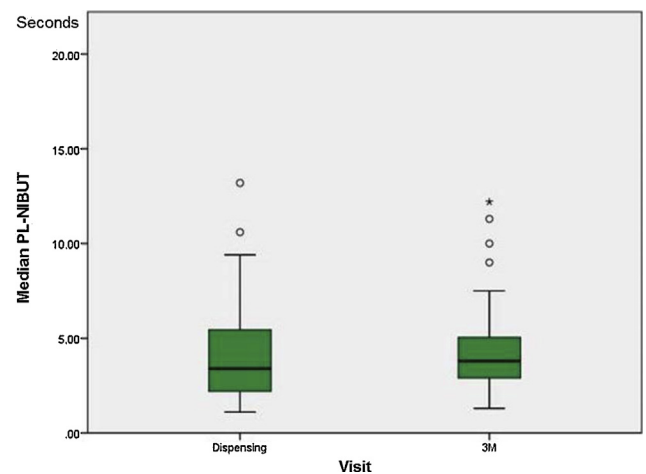
The contact lens surface deposition at the three month follow-up visit showed that CLEAR CARE<sup>®</sup> maintained a cleaner contact lens surface than the subjects' habitual care system. At the follow-up visit, both the mucus ( $p = 0.005$ ) and lipid ( $p = 0.009$ ) deposits were significantly less than at enrolment; the statistical differences were associated with an increase in the incidence of clean/deposit free surfaces, grade 0 (mucus 95% vs. 82%; lipids 87% vs. 72%).

##### 3.4.1. renu<sup>®</sup> fresh<sup>™</sup>

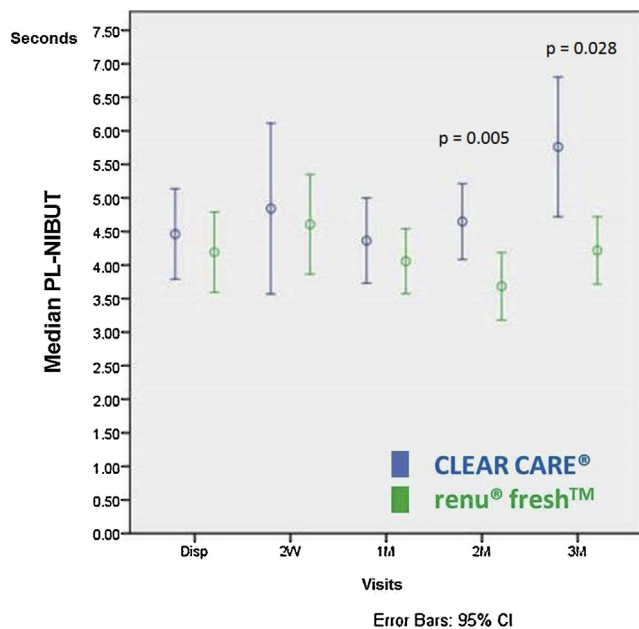
PL-NIBUT data at the three month follow-up visit compared with enrolment (Fig. 5A&B) and dispensing visits after 30 min of wear (Fig. 6) did not reveal any change in the contact lenses for on eye wettability when using renu<sup>®</sup> fresh<sup>™</sup>. The PL-NIBUT at the three month follow-up visit was not significantly different

( $p = 0.734$ ) from that recorded with the subjects' habitual lens care system (4.2 s vs. 5.1 s). The distribution however, revealed a trend towards a slightly more homogeneous on-eye wettability among subjects at the three month follow-up visit after using renu<sup>®</sup> fresh<sup>™</sup> (PL-NIBUT > 2.5 s – 5.0 s 68.1%) than with the subjects' habitual lens care systems at enrolment (PL-NIBUT 0.0 s – 2.5 s 33%; PL-NIBUT > 2.5 s – 5.0 s 39%; PL-NIBUT > 5.0 s – 10.0 s 17%) The PL-NIBUT at the three month follow-up visit was also not different ( $p = 0.420$ ) from the dispensing visit (mean: 4.2 s vs. 4.2 s).

The contact lens surface deposition at the three month follow-up visit with renu<sup>®</sup> fresh<sup>™</sup> and at the enrolment visit with the subjects habitual lens care system were similarly low with a preponderance of incidence of clean/deposit free surfaces for both mucus (86% vs. 78%;  $p = 0.201$ ) and lipids (87% vs. 78%;  $p = 0.128$ ).



**Fig. 6.** Median PL-NIBUT (pre-lens non-invasive break-up time) for renu<sup>®</sup> fresh<sup>™</sup> users: boxplot showing 3 month follow-up (3M) vs. dispensing with new contact lenses: median PL-NIBUT boxplot (mean, standard deviation & 95% confidence interval).



**Fig. 7.** Comparative PL-NIBUT (pre-lens non-invasive break-up time) at dispensing (Disp) and 2-week (2W), 1-month (1M), 2-months (2M) and 3-months (3M) follow-up visits for CLEAR CARE® vs. renu® fresh™ (mean, standard deviation).

### 3.5. Lens care regimen comparison of PL-NIBUT

The PL-NIBUT recorded at each visit with the two lens care systems (Table 1 and Fig. 7) clearly demonstrated the positive effect of the repeated use of CLEAR CARE® on contact lens wettability. At the dispensing visit, with new contact lenses prior to any lens care usage, the PL-NIBUT was not clinically or statistically significantly different (mean: CLEAR CARE® group – 4.5 s vs. renu® fresh™ group – 4.2 s;  $p = 0.518$ ) indicating that the intrinsic contact lens wettability was similar for the two groups. At the two-week visit, no difference in mean PL-NIBUT was recorded (CLEAR CARE® 4.8 s – renu® fresh™ 4.6 s;  $p = 0.975$ ). In contrast, upon further adaptation, the benefit of the lens care system was apparent. CLEAR CARE® achieved significantly longer median PL-NIBUT at both the two-month (mean 4.7 s vs. 3.7 s;  $p < 0.005$ ) and three-month follow-up visits (5.8 s vs. 4.2 s;  $p = 0.028$ ), with 27% and 36% longer times for the group using CLEAR CARE® compared to the group using renu® fresh™.

## 4. Discussion

The objective of the investigation was to assess whether changing the lens care system from PHMB-preserved MPS systems to a hydrogen peroxide system could have a beneficial effect on the wettability and cleanliness of silicone hydrogel contact lenses for a population of symptomatic contact wearers. In order to test for the effect due to lens care alone, the subjects used their habitual contact lenses at their usually prescribed replacement frequency. Further, to control for placebo effect, a control arm using a PHMB lens care system was included. Bias was also avoided by testing the contact lenses at the end of their wearing period (14 + 0/–3 days for the two-week replacement; 30 + 0/–5 days for the monthly replacement), after at least 6 h of wear on the day of the visit and the investigators carrying out the measurements and observations were masked. Finally, two-week (ACUVUE® OASYS®) and monthly (PureVision™) replacement contact lenses were included in equal number in each of the study groups.

Changing the lens care system from a PHMB MPS to hydrogen peroxide based solution resulted in a significant improvement in

contact lens wettability, demonstrated by a remarkable 45% increase in pre-lens tear film stability, as assessed by the measurement of NITBUT, after three months of use. The association between the change in lens care and the improvement in on-eye lens wettability was supported by the absence of change in wettability recorded in the control arm that used a PHMB system during the same three month period. An average improvement in pre-lens tear film stability close to 50% is clinically significant; the improvement is particularly remarkable as it is produced solely by a change in lens care system. To our knowledge this is the first time that such a large improvement in pre-lens tear film stability is reported for a change in lens care system. The implication of the current findings is that a significant improvement of the contact lens surface can be achieved in changing lens care regimen for symptomatic contact lens wearers using silicone hydrogel contact lenses. Therefore, this should be the recommended first step when managing such patients as it achieves improvement without the need for refitting.

Measurements of the contact lens wettability at the various follow-up visits seem to indicate that the beneficial effect is progressive and significant after three months of use. The improvement over time could appear surprising, as contact lenses are typically changed at least monthly. However, contact lens wettability during the inter blink period is in part dependent on the friction that takes place between the contact lens front surface and the eyelids. So, whereas at least every month a new contact lens is used, it may take some time for the eyelid structure, with changes such as papillary changes leading to increased surface roughness, to recover following the use of a PHMB lens care system [15].

Another objective was to assess how well the hydrogen peroxide system maintained a wettable surface throughout the contact lens life. The findings showed that even for a population of symptomatic wearers, not only was the wettability of the contact lenses maintained, but in fact it improved by 29% compared with that of new contact lenses. In contrast the use of PHMB MPS did not produce any improvement in wettability compared with that of new contact lenses. Whereas wettability similar to new contact lenses could be considered good, in the case of silicone hydrogels, the authors' clinical experience reveals that initial tear stability often represents a compromise rather than an optimal situation with some wearers taking some significant time to establish a functional biofilm that maintains a stable pre-lens tear film.

Intuitively, one would expect that a lens care system that achieves a superior contact lens surface wettability would also maintain cleaner surfaces. The results confirmed that CLEAR CARE® provided a decrease in surface mucus and lipid deposition compared with the subjects' own habitual PHMB lens care system. In contrast, no reduction in surface contamination was recorded between the subjects' own lens care system and renu® fresh™. Deposition is highly subject and time dependent, even for the same contact lens care system combination, and presence of deposits is associated with decreased comfort and/or decrease in tear film stability [16]. Therefore, achieving a decrease in deposits at the end of the wearing period has significant beneficial effects that can impact long term successful wear.

## 5. Conclusion

The use of CLEAR CARE®, a hydrogen peroxide lens care system, by symptomatic silicone hydrogel contact lens wearers habitually using PHMB care systems, resulted in a significant improvement in the contact lens on eye wettability, with a 45% increase in tear film stability and an improvement in contact lens surface cleanliness, demonstrated by a higher incidence of contact lenses free of mucus and lipid deposition. Further, CLEAR CARE® not only maintained good contact lens wettability throughout the period of use, but also

improved pre-lens tear film stability by 29% compared with the wettability of a new contact lens of the same brand.

### Acknowledgement

This study was supported by Alcon Research, Ltd., Fort Worth, TX, USA.

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