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ORIGINAL ARTICLE

The impact of daily and monthly contact lenses on dry eye, comfort, and beyond

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Abstract

Purpose: The purpose of this study is to investigate the effects of daily and monthly contact lenses (CLs) over dry eye parameters and comfort in patients using CLs for the first time.

Methods: In this study, 33 myopic individuals intending to wear CLs were divided into two groups: One eye was assigned daily disposable lenses (Nesofilcon A, Bausch and Lomb Biotrue), and the contralateral eye was assigned monthly disposable lenses (Samfilcon A, Bausch and Lomb Ultra). After the initial evaluation, participants had a 1-month follow-up. They were instructed to wear the lenses for 8 h a day during the 1 month, with a 2-h break on the morning of the follow-up. Various clinical measurements, including ocular surface disease index (OSDI), hyperemia assessment, staining evaluation, tear break-up time (TBUT) measurement, Schirmer test, and tear meniscus height (TMH) assessment using optical coherence tomography (OCT), were conducted. Comfort was subjectively assessed with CLs dry eye questionnaire-8 (CLDEQ-8) at the 1-month follow-up, and participants rated end-of-day comfort on a scale from 0 to 100. The study compared comfort levels and examination parameters between daily and monthly lens use.

Results: In the 1-month follow-up examination, there was no significant difference between eyes in terms of OSDI, hyperemia, ocular surface staining, TBUT, Schirmer test, and TMH ($p>0.05$). CLs comfort was higher in those using daily CLs when examined with CLDEQ-8 test (daily CL: 8.93, monthly CL: 4.29, $p=0.04$). However, end-of-the-day comfort was higher in monthly CLs users (daily CL: 89, monthly CL: 95, $p=0.04$).

Conclusion: In the short term, Nesofilcon A was found to be more advantageous in terms of comfort compared to Samfilcon A. However, since end-of the day comfort was higher in Samfilcon A, for patients starting to use CLs during the adaptation phase, it may be preferred over Nesofilcon A.

Keywords: Daily contact lens; dry eye; monthly contact lens; tear meniscus height.

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Contact lenses (CLs) have transformed the world of vision correction, offering convenience and comfort to millions of individuals globally.[1] Numerous factors are taken into consideration, including optical and material characteristics such as polymer type, oxygen transmissibility, water content (WC), material modulus of elasticity, surface wettability, and lubricity during determination of the optimal type of CLs for a prospective wearer.[2]

The clinical efficacy of a soft CLs is mostly influenced by the frequency of lens replacement. A common comparison involves two modes of daily wear lens usage: "daily disposable," where the lens is worn for some or all waking hours of the day and then discarded, and "reusable," where the lens is stored in disinfection solution (typically overnight) between each wearing period and discarded on a 2-weekly or monthly basis.[2] There is limited evidence linking visual performance to the frequency of lens replacement. From a somewhat theoretical and historical standpoint, the occurrence of substantial deposition on the CLs surface over time has been associated with a decline in visual acuity.[3] However, such surface alterations are now seldom observed, given that the majority of soft lenses are prescribed for replacement on a monthly basis or even more frequently.[4,5]

Two significant materials, Samfilcon A and Nesofilcon A, have emerged as leading contenders of soft CLs, each showcasing unique properties and potential advantages.[6] The fitting characteristics of a lens are influenced not only by its materials, total diameter, back optic zone radius, thickness, back surface, and edge profiles but also by its interaction with an individual's ocular surface. Consequently, predicting lens fit based solely on lens parameters is not sufficient. It is crucial to conduct testing of a lens before confirming the final prescribing decision. Even if two lenses have the same parameters, they may not necessarily offer an equivalent fit.[7] Therefore, considering CLs design elements in relation to clinically relevant issues is vital for optimizing CLs designs and enhancing the on-eye performance and wearing experience for the patient.[2]

This study aimed to explore the effects of a daily (Nesofilcon A, Bausch and Lomb Biotrue) and a monthly (Samfilcon A, Bausch and Lomb Ultra) disposable CLs on dry eye symptoms and comfort levels and various other factors crucial to the overall satisfaction of first time CLs wearers.

Materials and Methods

This study adhered to the principles outlined in the Declaration of Helsinki, and it was approved by the local Ethics Committee. This prospective cross-sectional study included 33 myopic individuals within the age range of 18–45 years and exhibit a spherical refractive error ranging from −0.50 to −6.00 D, with a cylindrical refractive error <0.50 D without previous CLs usage. The individuals intending to wear CLs were divided into two groups: One eye was assigned daily disposable lenses (Nesofilcon A, Bausch and Lomb Biotrue), and the contralateral eye was assigned monthly disposable lenses (Samfilcon A, Bausch and Lomb Ultra) (Table 1). Participants with a history of smoking, ocular surgery, other ocular disorders (e.g., dry eye, pterygium, allergy, and atopy), systemic diseases (e.g., diabetes mellitus, rheumatological diseases), and systemic or topical drugs were excluded from the study.

Before the study's initiation, participants underwent a comprehensive ocular examination to ensure eligibility for CLs wear based on ocular health and refractive error. Following this initial evaluation, participants were assigned the specified CLs for each eye, marking the commencement of a 1-month trial period. During this period, participants were instructed to wear the lenses for 8 h daily, with a mandatory 2-h break on the morning of the follow-up. Several clinical measurements, such as Ocular Surface Disease Index (OSDI), Schirmer test, tear break-up time (TBUT) measurement, conjunctival bulbar and limbal hyperemia (Jenvis Grading Score), corneal and conjunctival staining evaluation, and tear meniscus height (TMH) evaluation through anterior segment optical coherence tomography (AS-OCT) were performed at baseline and after 1 month. The order of the examinations was as follows; OSDI, Jenvis Grading Score, AS-OCT, Schirmer test, TBUT, corneal and conjunctival staining. Comfort levels were subjectively evaluated using CLs dry eye questionnaire-8 (CLDEQ-8) during the 1-month follow-up, and participants provided end-of-the-day comfort ratings on a scale from 0 to 100.[8,9]

Table 1. Properties of daily and monthly contact lenses

Material	Nesofilcon A	Samfilcon A
Laboratory	Bausch and Lomb	Bausch and Lomb
Commercial Name	Biotrue 1 day	Ultra
Base curve (mm)	8.6	8.5
Diameter (mm)	14.2	14.2
Oxygen Transmissibility (Dk/t)	42	163
Water content (%)	78	46
Modulus (MPa)	0.49	0.70

The OSDI is a 12-item questionnaire assessing symptoms of eye-related irritation and their impact on visual acuity. The Turkish-validated OSDI questionnaire was employed for evaluation.[10] Each patient's total OSDI score was calculated using the formula: OSDI score = (Total score of all answered questions × 100)/(Total number of questions answered × 4).

The Schirmer I test was administered to the lower third of the lateral bulbar conjunctiva without the use of topical anesthesia. Patients were instructed to divert their gaze from the paper strip and blink naturally. The evaluation involved measuring the length of wetting on the paper strip after a 5-min interval, with results recorded in millimeters (mm).

For the TBUT test, a sodium fluorescein strip was delicately applied to the upper conjunctiva to stain the tear film. Under cobalt blue light and using a slit-lamp biomicroscope, the patient was directed to look straight ahead, blink once, and then refrain from blinking for as long as possible. TBUT was recorded as the time in seconds from the final blink until the appearance of the first break in the fluorescein under cobalt blue illumination. The test was repeated three times, and the average time was recorded.

OCT measurements were conducted using Swept Source OCT (SS-OCT, DRI OCT Triton, Topcon, Tokyo, Japan). The SS-anterior segment OCT single vertical scan mode was utilized for obtaining measurements of lower TMH. During follow-up measurements, the scan targeted the same region of the eyelid just beneath the corneal vertex, centered on the inferior cornea and the lower eyelid. Throughout the imaging procedure, the patient was instructed to blink naturally while focusing on a fixed target within the device. Images were captured within the initial second immediately after a blink. A built-in caliper facilitated the measurement of TMH in micrometers. The TMH was determined as the line where the meniscus intersected with the cornea (superiorly) and the eyelid (inferiorly) (Fig. 1).

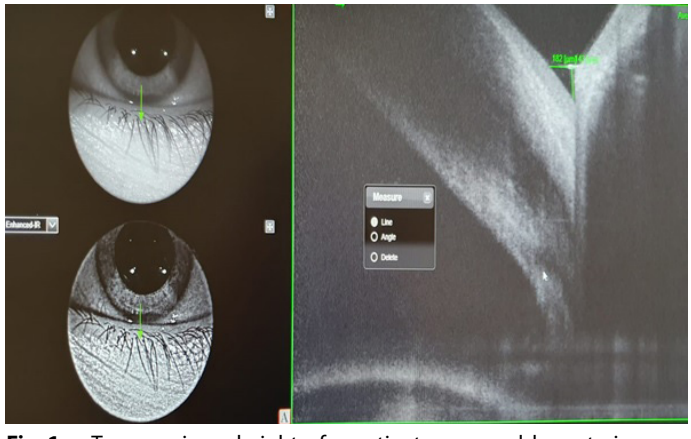

Fig. 1. Tear meniscus height of a patient measured by anterior segment-optical coherence tomography.

Statistical Analysis

Statistical analysis was carried out using SPSS 22.0 software (IBM Inc., Chicago, IL), and the normality of the data was examined through the Shapiro–Wilk test. Descriptive statistics included the presentation of continuous variables as mean±SD or median (min–max), while categorical variables were expressed as the number of cases and percentages. In cases where the data did not follow a normal distribution, the Mann–Whitney U test was employed to determine the significance of group differences. The $p<0.05$ was considered statistically significant.

Results

Sixty-six eyes of 33 patients (20 female, 13 male) were evaluated. The mean age of the participants was 24.7±4.2 years. In the 1-month follow-up examination, no significant differences were observed between the eyes concerning OSDI, hyperemia, ocular surface staining, TBUT, Schirmer test, and TMH (Table 2) ($p>0.05$). On the other hand, a significant difference was identified in terms of CLs comfort. CLs comfort was higher in those using daily CLs when examined with CLDEQ-8 test (daily CL: 8.93, monthly CL: 4.29, p=0.04) (Fig. 2). Besides, end-of-the-day comfort was higher in monthly CLs users (daily CL: 89, monthly CL: 95, p=0.04) (Fig. 3)

Discussion

A stable tear film is essential for clear vision in CLs wearers. CLs use (in those using soft hydrogel and silicone hydrogel lens) may lead to evaporative dry eye by reducing the thickness of the lipid layer in the tear film.[11,12] This leads to reduced tear volume, resulting in discomfort due to friction between the ocular surface and the lid margin.[13] At present, various soft CLs with different wearing patterns are available to enhance the ultimate comfort.

Table 2. The comparison of the clinical parameters between the two eyes at the end of 1 month

Parameters	Nesofilcon A	Samfilcon A	p
OSDI	7.67±6.28	7.5±3.39	0.950
Schirmer I	20±4.18	20±6.12	0.374
TBUT	11.83±1.83	11.33±2.73	0.415
Hyperemia (JGS)	0.43±0.53	0.35±0.36	0.567
OSS	0.20 ±0.41	0.43 ±0.53	0.178
TMH (μm)	208.66±38.13	212.33±6.11	0.701

OSDI: Ocular surface disease index, TBUT: Tear break up time, JGS: Jenvis grading score, OSS: Ocular surface staining, TMH: Tear meniscus height.

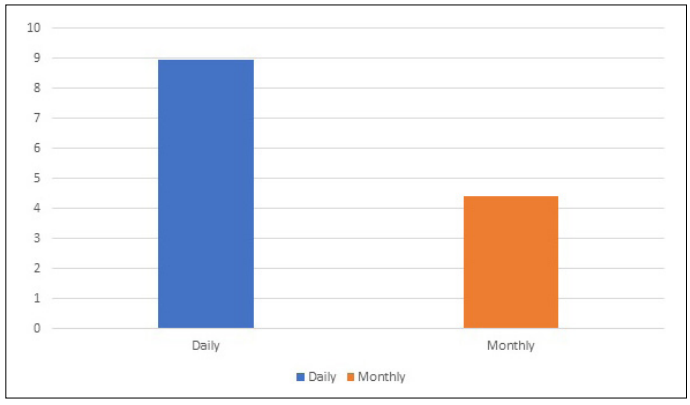

Fig. 2. CLDEQ-8 scores of the groups.

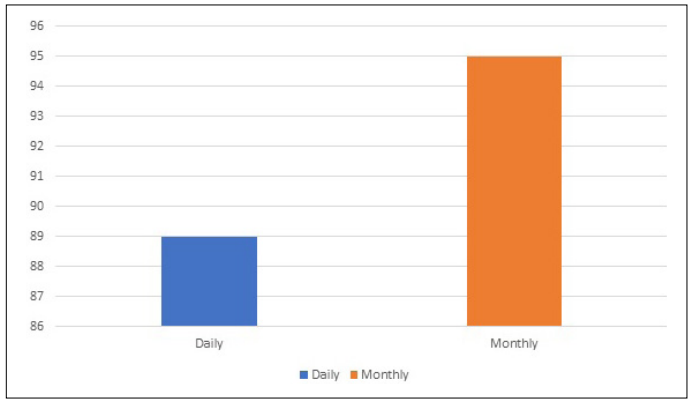

Fig. 3. End of the day comfort scores of the groups.

Samfilcon A, which is a monthly used silicone hydrogel lens, keeps the ocular surface moist all day long with its 46% WC and creates a smooth ocular surface for good, stable vision.[6] On the other hand, Nesofilcon A is a conventional, hydrogel, daily disposable lens with its 78% WC.[14] While Nesofilcon A provides ocular comfort with its high WC, it is also the first choice for many CL users due to its disposable feature.[15] Sapkota et al. investigated the effects of monthly and daily CLs on the ocular surface and reported that limbal hyperemia and comfort varied depending on the lens material. CL specialists were advised to prescribe based on material rather than using modality.[16]

In a clinical study including 341 participants who spent at least 3 h using an electronic device, it was reported that after 2 weeks of daily wear, Samfilcon A was found to be more effective than their habitual lenses in terms of visual quality and comfort.[17] In another study conducted in intense digital device users, Samfilcon A lenses were again given high overall ratings in terms of comfort and vision. Participants also emphasized that they would consider this material in the future.[18] Similar to this result, patients reported a better end-of-the-day comfort with Samfilcon A in our study.

In a comparative study by Schafer et al., it was found that Nesofilcon A preserved its WC after 15 min of wear and it is emphasized that this feature could be related to a smoother vision with less visual aberration.[15,16] In another study by Montani and Martino, it was suggested that Nesofilcon A could be associated with longer NIBUT values, and when compared to other materials, it could provide a higher image quality.[14] In our study: at the end of one month, there was no significant difference between CL materials in terms of BUT values.

In our study, we also examined whether TMH varies with daily and monthly lens use and we did not find any difference between the two groups. Montani and Martino detected that at the end of the 1st week, TMH was significantly reduced after at least 8 h wear of Delefilcon A and Stenfilcon A. However, they found that Nesofilcon A displayed a lower reduction of TMH.[14] In another study, Nagahara et al. reported that TMH was significantly reduced with high a WC CL (69%) compared with a low WC CL (24%).[19]

Another endpoint of our study is that the CLDEQ-8 scores were higher in daily CLs use. In a comparative study by Penbe et al., it was found that the hydrogel Nesofilcon A has higher CLDEQ-8 scores than senofilcon A and verofilcon. Silicone hydrogel lenses may be superior to hydrogel lenses in terms of patient's comfort due to their high oxygen transmissibility.[20]

Conclusion

In our study, after 1-month of follow-up, despite the fact that two distinct materials have similar features in terms of dry eye parameters; we concluded that end-of-the-day comfort could be higher in Samfilcon A. Applying different types of CLs to each patient's eyes may have led the patients to better evaluate the comfort of these two lenses. Although longer follow-up time is required, for patients starting to use CLs during the adaptation phase, Samfilcon A may be preferred over Nesofilcon A.

Ethics Committee Approval: This study was approved by SBU Ankara Numune Local Ethics Commitee (date: 09.05.2019, number: 2710/2019).

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