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CLINICAL TRIAL REPORT

Performance of a Toric, Monthly, Soft Contact Lens in Digital Device Users

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Purpose: To determine the performance of TOTAL30 for Astigmatism (T30fA; Alcon; Fort Worth, TX, USA) contact lenses (CLs) in existing CL wearers who are also frequent digital device users.

Methods: This 1-month, 3-visit study recruited adult, 18- to 40-year-old subjects who were required to use daily digital devices for at least 8 hours per day. All subjects were refit into T30fA CLs. A text message visual analog scale (VAS) (±50 scale; positive being comfortable) evaluate at-home eye comfort across the day at 1 day, 1 week, and 1 month. Subjects were evaluated at 1 month with the Computer Vision Syndrome Questionnaire (CVS-Q), Impact of Dry Eye on Everyday Life (IDEEL) Quality of Life questionnaire, and a custom questionnaire.

Results: A total 48 subjects were analyzed (mean age = 28.8 ± 6.3 years; 75% female). At 1 month, IDEEL daily activities, feelings, and work domains scores were 96.7 ± 6.6, 96.4 ± 6.2, and 94.8 ± 8.6, respectively. CVS-Q scores were 3.48 ± 3.73. Most of the subjects indicated that they were satisfied with the overall performance of the study CLs (81.3%) and with their level of eye strain with the study CLs (87.3%). When evaluating CL comfort with the VAS, comfort did not differ across the month at each time point (all p-value ≥ 0.16), yet CL comfort did decrease minimally across the wear day (all p-value < 0.001).

Conclusion: These data suggest that the monthly study CLs can provide an excellent wearing experience for those with frequent digital device use.

Keywords: contact lens, astigmatism, comfort, digital eye strain, quality of life

Introduction

Modern society is plagued by digital eye strain with its prevalence reported in up to 91% of the North American population depending on who is being evaluated,[1] and its severity has been found to rise with increased digital device time.[2,3] Digital eye strain is a condition where patients develop bothersome symptoms and/or signs associated with digital device use.[1,4] Digital eye strain symptoms include burning, itching, foreign body sensation, tearing, excessive blinking, ocular redness, ocular pain, heavy eyelids, dryness, blurry vision, double vision, difficulty focusing for near vision, photophobia, colored halos around objects, worsening of vision, headache, and neck and shoulder pain,[3,5,6] and these symptoms may also result in decreased quality of life.[7] While the discomfort and dryness symptoms associated with digital eye strain are likely multifactorial, much of these symptoms are likely attributable to increased tear film evaporation secondary to decreased blink frequency.[3]

Patients habitually blink about 15 times per minute when viewing distance scenes, yet when patients are focused on near tasks, such as work on a tablet, blink frequency dramatically decreases to about 6 blinks per minute.[8,9] Since the typical tear break up time is usually faster than the inter-blink-interval of a patients who are focused on a near task, the ocular surface of these patients likely experiences intermittent patches of dryness and excessive tear evaporation, which secondarily may promote tear hyperosmolarity.[10] Tear hyperosmolarity is well known to induce ocular surface

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inflammation, which likely causes dryness symptoms associated with digital device use.[10] It is also known that contact lenses can further destabilize the tear film by dividing it and/or absorbing its dissolved molecules,[11,12] which in theory may make it challenging for some subjects to be able to successfully wear contact lens for a full day, particularly, given the frequent amount of digital device use nowadays.

Since digital eye strain may be an issue for some contact lens wearers and since contact lens discomfort is consistently the top reason why established contact wearers permanently cease wearing of contact lenses,[13,14] a better understanding of digital eye strain and ocular comfort in patients who are refit into a new contact lens is warranted.[11] The community specifically lacks an understanding of how ocular symptoms may vary over the first month of wearing toric, monthly contact lenses in frequent device users. Maintaining ocular comfort with satisfactory contact lens performance is key to contact lens success; thus, the purpose of this work was to determine how subjects perform during the first month of contact lens wear when they were refit into a new, monthly, toric, soft contact lens.

Methods

Subjects

This 1-month, 3-visit study was conducted at the Southern College of Optometry (Memphis, TN, USA), Coldwater Vision Center (Coldwater, MS), and Kannarr Eye Care (Pittsburg, KS). The study was approved by the Institutional Review Board (IRB) of the Southern College of Optometry, conformed to the tenets of the Declaration of Helsinki, and it was registered on ClinicalTrials.gov (NCT06266728). Subjects were recruited via clinic records, emails, and fliers. Adult, 18–40-year-old, contact lens wearers who had 0.00 logarithm of the minimum angle of resolution (LogMAR) visual acuities or better in their habitual contact lenses or by manifest refraction in both eyes were recruited. Subjects were required to use a digital device daily for at least 8 hours per day. To ensure a diverse population of previous habitual lens wear, no more than 50% of the subjects previously wore lenses from the same manufacturer, and no more than 20% habitually wore lenses from the same material/brand of contact lens. Subjects were required to be able to wear TOTAL 30® Astigmatism Contact Lenses (lehfilcon A; Alcon; Fort Worth, TX, USA), and they were required to have a smart phone with text messaging capabilities. The study contact lens brand was concealed from the subjects. All subjects were required to wear the study contact lenses on a daily wear basis and to use CLEAR CARE® PLUS (Alcon; Fort Worth, TX, USA) for nightly disinfection. Subjects were required to be willing to start wearing their contact lenses between 6:00 AM and 8:00 AM and wear their contact lenses until at least 9:00 PM each day text message data was collected. This timing requirement helped ensure accurate text message delivery to the subjects. Table 1 lists a full list of inclusion and exclusion criteria used in the study. Clinical measurements were obtained from both eyes and tested in the below order. The testing order was designed to be sequentially administered with the least invasive to most invasive test to help ensure that a previous procedure would have a minimal effect on all subsequent assessments.[15] Subjects were asked to report to the visit wearing their habitual contact lenses. Upon arrival, subject eligibility was confirmed. All relevant patient demographics were collected via a questionnaire developed by the investigators. Non-eligible subjects were dismissed at this time or rescheduled depending upon the reason for ineligibility. Eligible subjects were enrolled, consented, and requested to sign a privacy document.

Visual acuities were measured with a high-contrast LogMAR visual acuity chart. Habitual contact lenses were then removed, and the investigator then determined the subject's refractive error with a phoropter. A binocular balance was performed if best-corrected visual acuity was equal between the eyes. The investigator then used a slit-lamp biomicroscope to document normal and/or remarkable findings of the anterior eye structures: eyelashes, eyelids, conjunctiva, and cornea. Subjects were then fitted with the study contact lenses based upon the investigator's preferred soft contact lens fitting method. The contact lenses were evaluated for centration, movement, coverage, and contact lens power adjustments were only made if it improved the LogMAR visual acuity. Final contact lens visual acuities were then measured with a high-contrast LogMAR visual acuity chart. Subjects were given a 1-month supply of CLEAR CARE® PLUS contact lens solution, and they were educated on how to use it. The subjects were also given take-home instructions on how to use the contact lens care system.

Table 1 Study Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
• Willing and able to provide informed consent • Adults 18–40-year-old • 0.00 logarithm of the minimum angle of resolution visual acuity or better in habitual contact lenses or by manifest refraction in both eyes • Smart phone with text messaging capabilities • Existing wearers of soft, frequent replacement toric contact lenses within past 6 months • Frequent digital device user (eg, phone, iPad, computer, social media, video streaming, etc) defined as at least 8 hours of usage per day • Willing to follow the required wear schedule • Astigmatism ranging from 0.75 D to 2.50 D in each eye • Willing to wear study contact lenses at least 13 hours/day	• Have a known systemic health condition that is thought to alter tear film physiology (eg, Sjögren's syndrome) • Have a known history of being diagnosed with dry eye disease • Have a history of ocular surgery within the past 12 months • Have a history of severe ocular trauma, active ocular infection, or active ocular inflammation • Have a history of viral eye disease • Currently using isotretinoin-derivatives or ocular medications • Currently using a dry eye treatment including but not limited to artificial tears • Currently using rewetting drops daily or occasionally • Currently pregnant or breast feeding • Need for spectacle add power of any amount (presbyopic) • Wearing TOTAL30 for Astigmatism Contact Lenses prior to enrollment • Have a history of wearing hard contact lenses • Subjects who show excessive lens oscillation with TOTAL30 for Astigmatism contact lenses during the fitting process yet show 0.00 logarithm of the minimum angle of resolution acuity • Willing to not use any artificial tears or dry eye treatments during the study • Willing to not use rewetting drops during the study

All subjects were encouraged to wear their contact lenses for at least 13 hours per day and to start wearing their contact lenses between 6:00 AM and 8:00 AM on days that they would be completing text message surveys. Subjects were educated that they would be required to complete Research Electronic Data Capture (REDCap) surveys on their phone.[16,17] Subjects were asked to complete a test text message survey before they left the first study visit to make sure that the REDCap system was compatible with their phone. This measure was also an evaluation of initial contact lens comfort. The text message surveys asked subjects about their eye comfort with a visual analog scale (±50 scale with positive scores being comfortable and negative scores being uncomfortable; scores of 0 were neutral comfort) before contact lens application, directly after contact lens application, after 8 hours and 13 hours of contact lens use, directly before contact lens removal, and after contact lens removal on the first full day of contact lens wear.[18] This same system was used to monitor how many hours the subjects wore their contact lenses each day. Subjects were also asked to complete these surveys on day 14 and 1 day prior to their 1-month visit (1 month) to help better understand comfort over the life of the contact lens. Subjects were called the day before the 1-week and 1-month surveys to remind them about these surveys. Subjects were allowed to schedule their 1-week and 1-month surveys within 3 days of these time points to allow for better compliance.

Subjects were asked to return to the office after 1 week of contact lens wear. Visual acuity while wearing the study contact lenses was again measured with a LogMAR high-contrast visual acuity chart. The investigator used a slit-lamp biomicroscope to document normal and/or remarkable findings of the anterior eye structures. The investigator then evaluated the subject's contact lenses for centration, movement, and coverage, and contact lens power adjustments were only made if it improved the LogMAR visual acuities. If a refractive error adjustment of ±0.25 D sphere and/or ±0.50-cylinder change was made, the subject was given a new set of contact lenses. The subjects were then asked to return for a 1-month visit. Subjects were asked at the 1-month visit to complete the Impact of Dry Eye on Everyday Life (IDEEL) quality of life (Daily Activities, Feelings, and Work Domains) questionnaire to evaluate visual quality of life,[19] the Computer Vision Syndrome Questionnaire (CVS-Q) to evaluate digital eye strain symptoms,[5] and an investigator-designed survey to better understand the contact lens wearing experience. Contact lens visual acuities were then evaluated. A slit-lamp biomicroscope exam was performed, and the study contact lenses were evaluated again. After testing, the subjects were released from the study.

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Sample Size and Statistical Analysis

This was a prospective study to understand contact lens comfort throughout the day in monthly, toric, soft contact lens wearers. The primary endpoint was the proportion of subjects who have comfortable visual analog scale scores (scores ≥0) at the end of the study at the end of the study; thus, no comparison with the primary endpoint occurred and no formal sample size calculation could be performed. Nevertheless, we estimated that 48 subjects were enough to gain a general understanding of ocular comfort after a month's worth of contact lens wear based upon past research (40 subjects + 8 subjects to account for missing data).[20–22]

All data were collected via REDCap and were analyzed with Stata/BE 18 (StataCorp LLC; TX, USA). The primary endpoint was simply analyzed as the proportion of subjects who had a comfortable visual analog scale score (scores ≥0) at the end of the study. Comfort visual analog scale scores for the at-home questionnaires were analyzed with an analysis of variance (ANOVA) by time of day to determine if scores changed over the course of the study. IDEEL and CVS-Q scores were reported based upon their standard calculation methods. Likert questionnaire results are presented as the percentage of subjects who identify with each response option. Values were considered significant if $p < 0.05$ was achieved.

Results

This study enrolled 51 subjects. Two subjects dropped out because they were lost to follow up, and one subject was excluded from the analysis because they required a contact lens change at the 1-week visit to improve their vision; thus, a total 48 subjects were included in the analysis. The evaluated subjects had a mean ± standard deviation age of 28.8 ± 6.3 years, and 75% of the subjects were female. Only 4.3% of the subjects were Hispanic with 6.3%, 6.3%, 81.3%, 4.2%, and 2.1% of the subjects identifying as Asian, Black or African American, White, more than one race, or unknown or not reported, respectively. The subjects had a right eye sphere and cylinder power of −2.05 ± 2.14 D and −1.39 ± 0.52 D, respectively, on manifest refraction at the baseline visit, while the subjects had a left eye sphere and cylinder power of −2.07 ± 2.36 D and −1.46 ± 0.52 D, respectively, on manifest refraction at that same visit. Best-corrected visual acuities at the baseline visit were −0.02 ± 0.04 logMAR in the right eye while they were −0.02 ± 0.06 logMAR in the left eye. The subjects' mean sphere and cylinder contact lens powers in their right eyes were −1.95 ± 2.11 D and −1.31 ± 0.51 D while they were −1.92 ± 2.28 D and −1.37 ± 0.53 D in their left eyes. The subjects had a mean logMAR visual acuity of −0.02 ± 0.05 in their right eye at the baseline visit while wearing the study contact lenses, and they had a mean logMAR visual acuity of −0.02 ± 0.05 in their left eye at the same visit while wearing the study contact lenses. The subjects' visual acuities did not significantly differ in either eye across visits (all $p \geq 0.36$). No self-reported adverse events were noted, and no adverse events were detected via slit-lamp biomicroscopy exam during any study visit.

The subject's wearing experience was evaluated in several ways during the 1-month visit. When considering the subject's quality of life as evaluated with the IDEEL questionnaire, the subjects rated their quality of life as high, which was signified by having IDEEL daily activities, feelings, and work domains scores of 96.7 ± 6.6, 96.4 ± 6.2, and 94.8 ± 8.6, respectively. Most subjects similarly displayed asymptomatic CVS-Q scores with the mean group score being 3.48 ± 3.73 and only 17% of the subjects having digital eye strain. The investigators furthermore developed a series of questions aimed at better understanding the subject's contact lens wearing experience (Table 2). The majority of the subjects indicated that they were either very satisfied or satisfied with the overall performance of the study contact lenses (81.3%), their level of eye tiredness while wearing the study contact lenses (87.5%), their level of eye strain while wearing the study contact lenses (87.3%), the comfort of the study contact lenses after using a digital device for ≥8 hours (77.1%), their vision while wearing the study contact lenses after using a digital device for ≥8 hours (83.3%), their level of eye strain while wearing the study contact lenses when using a digital device for ≥ 8 hours (87.5%), and their level of eye fatigue while wearing the study contact lenses after using a digital device for ≥8 hours (76.1%). The subjects also strongly agreed or agreed that they did not experience blurred vision while wearing the study contact lenses when using a digital device for ≥8 hours (73.0%), the study contact lenses provided good performance when using a digital device for ≥8 hours (87.5%), and that they would recommend the study contact lenses to a friend (73.0%). The subjects were furthermore asked three visual analog scale questions during the final visit regarding a typical day over the past week while wearing the study contact lenses. Subjects indicated positive/good scores with regards to overall end-of-day

Table 2 Investigator-Developed Patient Reported Outcomes Questionnaire

Question	Response
Overall, how satisfied are you with the performance of the study contact lenses?	Very Satisfied: 43.8% Satisfied: 37.5% Indifferent: 14.6% Unsatisfied: 4.2% Very Unsatisfied: 0.0%
Overall, how satisfied are with your level of eye tiredness while wearing the study contact lenses?	Very Satisfied: 39.6% Satisfied: 47.9% Indifferent: 10.4% Unsatisfied: 0.0% Very Unsatisfied: 2.1%
Overall, how satisfied are with your level of eye strain while wearing the study contact lenses?	Very Satisfied: 44.7% Satisfied: 42.6% Indifferent: 6.4% Unsatisfied: 6.4% Very Unsatisfied: 0.0%
Overall, how satisfied are with the comfort of the study contact lenses provided when using a digital device for ≥8 hours?	Very Satisfied: 37.5% Satisfied: 39.6% Indifferent: 12.5% Unsatisfied: 10.4% Very Unsatisfied: 0.0%
Overall, how satisfied are with the vision of the study contact lenses provided when using a digital device for ≥8 hours?	Very Satisfied: 45.8% Satisfied: 37.5% Indifferent: 6.3% Unsatisfied: 10.4% Very Unsatisfied: 0.0%
Overall, how satisfied are you with your level of eye strain while wearing the study contact lenses provided when using a digital device use for ≥8 hours?	Very Satisfied: 50.0% Satisfied: 37.5% Indifferent: 6.3% Unsatisfied: 6.3% Very Unsatisfied: 0.0%
Overall, how satisfied are you with your level of eye fatigue (eye tiredness) while wearing the study contact lenses provided when using a digital device for ≥8 hours?	Very Satisfied: 34.8% Satisfied: 41.3% Indifferent: 19.6% Unsatisfied: 4.4% Very Unsatisfied: 0.0%
Overall, I did not experience blurred vision while wearing the study CLs provided when using a digital device for ≥8 hours.	Strongly Agree: 31.3% Agree: 41.7% Neither Agree nor Disagree: 8.3% Disagree: 12.5% Strongly Disagree: 6.3%
Overall, the study contact lenses provided good performance when using a digital device for ≥ 8 hours.	Strongly Agree: 45.8% Agree: 41.7% Neither Agree nor Disagree: 6.3% Disagree: 6.3% Strongly Disagree: 0.0%

(*Continued*)

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Table 2 (Continued).

Question	Response
Overall, I would recommend the study contact lenses to a friend.	Strongly Agree: 43.8% Agree: 29.2% Neither Agree nor Disagree: 16.7% Disagree: 8.3% Strongly Disagree: 2.1%

comfort after about 13 hours of contact lens wear (25.6 ± 24.1), overall eye dryness after about 13 hours of contact lens wearer (23.7 ± 26.2), and overall clarity of vision after about 13 hours of contact lens wear (34.5 ± 18.9).

The subject's contact lens comfort was likewise evaluated by sending the subjects visual analog scale comfort inquires via text message. This study had high compliance with 860 out of 864 of the potential at-home visual analog scales being completed (>99%), and of all the visual analog scales completed, only 7.8% were negative/uncomfortable scores. The subjects' initial in office mean contact lens comfort score was 36.3 ± 19.5. The subjects had a mean number of contact lens wear hours of 14.3 ± 2.0, 14.4 ± 2.3, and 13.9 ± 2.7 on day 1, 1 week, and 1 month, respectively. The subjects' contact wear times did not significantly differ across the three study visits ($p = 0.55$). When evaluating contact lens comfort by a time point, comfort did not differ across the study visits (eg, comfort before contact lens removal; all p-value ≥ 0.16; Table 3). However, contact lens comfort decreased across the wear day when considering comfort at the time of waking until after contact lens removal (all p-value < 0.001), and contact lens comfort also decreased across the wear day when only considering times when the contact lenses were being worn (all p-value < 0.001).

Discussion

This study is one of the first to evaluate the performance of a modern, toric, monthly soft contact lens in a group of subjects who regularly use digital devices for at least 8 hours per day. This study furthermore is one of the first to evaluate ocular comfort throughout the day via text messages over the life of a monthly, toric, contact lens. This study found that subjects overwhelmingly found that the study contact lenses resulted in comfortable contact lens wear across the wear day and for the life of the contact lens. The subjects likewise found the study contact lens to provide an overall high quality of life and minimal digital eye strain symptoms while wearing study contact lenses.

Tauste et al have previously evaluated digital eye strain in 426 office workers who did and did not wear contact lenses.[23] The authors found that when evaluating these subjects with the CVS-Q, the overall frequency of digital eye strain was 53% with this frequency not significantly differing between the contact lens and non-contact lens wearing groups. The current study found a mean CVS-Q scores of 3.48 ± 3.73, which suggests that the average subject in the current study did not have digital eye strain given that a score ≥6 is considered to be symptomatic enough to have digital

Table 3 Eye Comfort Visual Analog Scale (VAS) Scores by Event

Day of Wear	Comfort at Waking	Comfort at Application	Comfort at Hour 8	Comfort at Hour 13	Comfort Before Removal	Comfort After Removal
	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)	(Mean ± SD)
1 Day	39.3 ± 19.9	37.1 ± 20.3	38.2 ± 18.5	34.0 ± 20.5	30.5 ± 24.5	41.3 ± 25.5
1 week	40.9 ± 16.6	34.6 ± 20.7	35.1 ± 18.3	31.3 ± 22.8	27.6 ± 23.6	36.8 ± 14.9
1 Month	41.6 ± 13.5	39.5 ± 14.5	36.0 ± 18.4	29.2 ± 24.5	24.5 ± 27.8	33.5 ± 17.4
P-value	0.79	0.43	0.70	0.58	0.51	0.16
Negative Scores	0.81%	0.81%	1.04%	1.97%	2.55%	0.46%

eye strain. Also, when further evaluating the current study, only 8 subjects had symptoms that reached the threshold of a digital eye strain diagnosis, which suggests that the study subjects were able to comfortably perform digital tasks across the work day.[5] The likely reason for the lower frequency of digital eye strain in the current study compared to Tauste et al is that Tauste et al allowed any type of contact lens, while the current study limited subjects to TOTAL30 for Astigmatism contact lenses.[23]

Talens-Estarelles et al have since evaluated digital eye strain symptoms in a group of healthy subjects (n = 34) who were daily disposable, spherical contact lens (Dailies Total One) wearers who were asked to read for 20 minutes on a computer or smartphone under 3 different conditions (without correction, with contact lens wear, and contact lens wear with artificial tears).[24] The authors of this study found that daily disposable contact lens wear had no additive effects on signs (tear meniscus height, tear break up time) or symptoms (Ocular Surface Disease Index, Dry Eye Questionnaire-5) of dry eye when using digital devices for short periods; the authors also found that application of artificial tears was an effective strategy for reducing the impact of display use in contact lens wearers.[24] Meyer et al have furthermore conducted a survey of contact lens (n = 602) and non-contact lens (n = 127) wearers with the authors determining with their investigator-developed survey that in general the two groups had similar symptomatology though the contact lens wearers experience more frequent dryness symptoms than the non-contact lens wearers.[25] Ucakhan et al lastly fit neophytes (n = 102) or senofilcon A (n = 77) or lotrafilcon B (n = 53) contact lens wearers into samfilcon A contact lenses and evaluated them after 1 month of wear with an investigator developed survey, and the authors found that 90.2% of the subjects agreed that the study lens provided clear vision during long-digital device use.[26] The above studies also corroborate the current study's investigator-developed survey with the current study finding that the vast majority of subjects were satisfied with the performance, level of eye tiredness, level of eye strain, vision, and comfort of the study contact lens with extended digital use.

Another aspect of the current study is that it evaluated eye comfort with an electronic visual analog scale via text messaging during the first day of wear and then again after 1 week and 1 month of contact lens wear. Santodomingo et al (2010) were likely the first investigators to employ text message surveys for evaluating contact lens comfort.[27] Santodomingo et al specifically evaluated soft and hard contact lens wearers and non-contact lens wearers by sending them text messages in the morning, afternoon, and night with the authors finding ocular comfort was reduced at night compared to the morning with greater reduced comfort occurring in the soft contact lens wearers compared to hard contact lens and non-contact lens wearers. Others such as Fogt and Patton have used text message surveys to evaluate the ocular comfort of spherical and toric daily disposable contact lens wearers;[28,29] however, Call et al may be the only other published report evaluating the real-time comfort of monthly soft contact lenses.[18] With Call et al's study, they refit current contact lens wearers into spherical TOTAL30® monthly contact lenses, and they sent their subjects the same ±50 visual analog scale used in the current study. The authors evaluated ocular comfort at waking and then after 8, 10, 12, 14, and 16 hours of contact lens wear and after contact lens removal, and they sent these messages after 1, 2, 3, 4, and 5 days, 2 weeks, and 30 days of wear. The authors overall found that while contact lens comfort decreased across a given wear day, contact lens comfort was stable at any given time point over the course of the wear month. Although the current study evaluated fewer wear days and fewer time points within a given day than the Call et al study, the current study came to the same conclusion, which is that most subjects find the study contact lenses to be comfortable all day and that the study contact lenses maintain their comfort over a month. Nevertheless, one difference to note is that Call et al evaluated spherical contact lenses while the current study evaluated toric contact lenses, which indicates that subjects who require astigmatic correction can also maintain good comfort for the first month of contact lens wear.

While this study has several strengths such as collecting real-time patient reported outcomes data, high survey completion rates, using a variety of patient-reported outcomes instruments, and using a single type of contact lens to standardize the wear experience while evaluating ocular comfort in astigmatic contact lens wearers, this study is not without limitations. The primary study limitation is that a single type of toric contact lens was evaluated. A single type of contact lens was evaluated to help avoid confounding factors that may influence ocular comfort. While this design factor is a key strength of the study, claims about how other toric, monthly contact lenses cannot be made, and additional studies evaluating other types of contact lenses are needed. Nevertheless, the past work noted above suggests that a contact lens has minimal additional impact in subjects performing extended digital device tasks;[23–26] thus, it is not expected that alterative conclusions would be reached upon further testing. Relatedly, no control lens was used in this

study, and the examiners were not masked to the contact lens under investigation. With the focus of this study being on how the subject's perception of the study contact lenses change over the course of the study, these limitations likely had a limited impact on the study results given that the subjects were masked to the brand of contact lens being evaluated and given that subjects were being asked to rate their experience with the same contact lens over the course of the study. It is likewise unlikely that the unmasked investigators influenced the outcomes of this study given that they were not the ones measuring the primary outcome of this study. A similar limitation is that the study contact lenses were only evaluated for a single month, and additional work should be performed to evaluate the long-term success rate of subjects who are refit into the study lens, especially given that a small percentage of subjects who is a dropout of contact lenses may do so after completing one month of wear.[30]

Conclusions

This project is one of the first to monitor the real-time ocular comfort of monthly, toric, contact lens wearers who frequently use digital devices. The data from this study suggests that monthly, toric, contact lens users who are also frequent digital device users can still be successful contact lens wearers. The data also suggests that the study contact lens is durable in that while subject comfort does decrease throughout the wear day, it does not typically deteriorate to the point of being uncomfortable, and it indicates that contact lens comfort at any given time during the day is stable across the month, which suggests that the comfort of the study lens on the day of the fit is a good estimate of what the comfort of the contact lens will be after wearing it for about 1 month. These data are important for not only evaluating a patient's contact lens options but also for educating them about their wearing experience. While these data are applicable to the contact lens being evaluated in this study, more work is needed to evaluate the study contact lens beyond one month's worth of wear, and more work is needed to determine if the results of this study are generalizable to other monthly, toric, contact lenses.

Data Sharing Statement

The authors, upon request, will share all deidentified participant data for two years after publishing date. Data will be shared electronically after contacting the corresponding author.

Ethics

Research was approved by Southern College of Optometry Institutional Review Board (IRB00006753/FWA00013872).

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Disclosure

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