Proposal Title:

A Comparative Study on Functional Vision and Digital Device Usage in Astigmatic Patients: DAILIES TOTAL1 Toric Contact Lenses vs. Spherical Equivalent Contact Lenses in Asian Eyes

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Background:

In today's digital age, individuals spend a significant amount of time using digital devices [1]. This is notably challenging for individuals with astigmatism, a condition that can impair visual acuity when using these devices [2]. Despite the prevalence of astigmatism, toric contact lens technology, which can potentially improve visual acuity for these individuals, remains underused [3][4]. Many eye care practitioners opt for spherical lenses due to perceived complexities of fitting and considerations of cost-effectiveness [5][6].

DAILIES TOTAL1® for Astigmatism contact lenses, the first and only daily disposable Water Gradient toric contact lenses, can potentially address this issue. These lenses represent a significant innovation in toric contact lens technology, offering a unique combination of breathability and exceptional comfort. The lenses utilize Water Gradient Technology, creating a gradual transition in water content from the core to the surface of the lens, with the water content approaching 100% at the lens surface. This technology enables these lenses to offer a combination of high breathability and exceptional comfort.

Unmet Medical Need:

Although toric lenses, including DAILIES TOTAL1® for Astigmatism, have been shown to improve visual acuity in astigmatic patients, their impact on real-world visual performance, particularly when using digital devices, is less understood [1]. Additionally, while many practitioners gravitate towards spherical lenses, astigmatic patients could greatly benefit from the comfort and visual acuity provided by DAILIES TOTAL1® for Astigmatism contact lenses.

Gaining insights into the real-world visual performance of astigmatic patients when using DAILIES TOTAL1® for Astigmatism contact lenses could provide valuable information to eye care practitioners and patients. This could potentially encourage the broader adoption of DAILIES TOTAL1® for Astigmatism contact lenses, improving the visual experience for astigmatic patients and addressing an unmet medical need.

Scientific Rationale:

Previous clinical studies have demonstrated the benefits of toric contact lenses in improving visual acuity in astigmatic patients[5]. However, these studies primarily used traditional high-contrast, high-luminance visual acuity testing, which may not accurately reflect the visual demands of real-world tasks, especially those involving digital devices [7][8].

DAILIES TOTAL1® for Astigmatism contact lenses stand out due to their unique Water Gradient Technology and Precision Balance 8|4® Lens Design. The gradual transition in water content from the core to the surface of the lens, with the water content approaching 100% at the lens surface, enables a combination of high breathability and exceptional comfort. The lens design ensures a quick and stable fit, with 99% first-lens fit success. Additionally, these lenses feature SmarTears® Technology, which releases an ingredient found naturally in tears to stabilize the lipid layer of the tear film, further promoting comfort for the wearer.

This study seeks to extend previous findings by evaluating the impact of DAILIES TOTAL1® for Astigmatism Contact Lenses on subjective and objective visual performance outcomes in astigmatic patients using digital devices [9]. This will involve the use of advanced digital real-world and patient-reported outcome tools, providing a comprehensive evaluation of vision beyond acuity alone. The goal is to ascertain whether the unique benefits of DAILIES TOTAL1® for Astigmatism Contact Lenses translate to improved functional vision and overall satisfaction for astigmatic patients.

Objective:

This study aims to assess the impact of DAILIES TOTAL1® for Astigmatism Contact Lenses on the functional vision of astigmatic patients as compared to DAILIES TOTAL1® Spherical Contact Lenses, using digital real-world and patient-reported outcome tools in Asian Eyes.

Hypothesis:

DAILIES TOTAL1® for Astigmatism Contact Lenses will improve both subjective and objective visual performance in astigmatic patients using digital devices compared to DAILIES TOTAL1® Spherical Contact Lenses in Asian Eyes.

Methodology

Recruitment and Enrolment

The study will involve adult participants aged between 18 and 39 years with -0.75 to -1.50 D of astigmatism. Potential participants will initially be screened for study eligibility by phone or in-person discussion. All subjects will consent before enrolment in the study.

Inclusion Criteria:

1. Asian (self-report and be confirmed by PI observation)
2. Ages between 18 and 39 years
3. Vertexed corrected sphere power between -0.50 and -6.00 D
4. Vertexed refractive cylinder power between -0.75 and -1.50 D
5. Best corrected acuity of 20/25 or better in each eye
6. Habitual soft contact lens wearers at least 6 months (who should be successfully fitted with both DT1 Spherical and Toric contact lens)

Exclusion Criteria:

1. History of ocular pathology or surgery
2. Active ocular infection or clinically significant ocular inflammation
3. Any significant binocular vision abnormalities
4. Wearers of gas-permeable lenses for at least 3 months prior to the study
5. Pregnant or lactating individuals (by self-report)

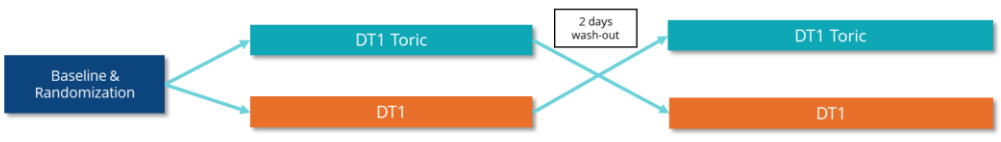
Study Design:

This study will follow a double-masked randomized crossover design [10], where participants will be fitted with DAILIES TOTAL1® for Astigmatism and DAILIES TOTAL1® Spherical Contact Lenses in a randomized order. Each participant will use both types of lenses over different periods. The study will be composed of five visits:

	Visit 1 (Baseline and fitting for lens 1)	Visit 2 (D2±1 lens 1 follow-up)	Visit 3 (D4 ±1 Outcomes for lens 1 and fitting for lens 2)	Visit 4 (D6 ±1 lens 2 follow-up)	Visit 5 (D8 ±1 Outcomes for lens 2)
Inclusion/Exclusion Criteria Screening	X				
Fitting	X		X		
NAVQ test	X		X		X
high-contrast, high-luminance and low-contrast, high-luminance visual acuity at 40 cm and 6 m (logMAR) by EyeChart PRO and E-ETDRS (NIDEK SC-2000)			X		X
MNREAD reading performance test	X		X		X
Slit lamp assessment & over-refraction	X	X	X	X	X

The assessments will be conducted following the sequence in this table

Timeline:



Each lens pair will be measured three times: Fitting, follow-up and outcome measurement

Visit 1 - Baseline Evaluation and Fitting for Lens 1

1. Obtain informed consent.
2. Collect subject demographics, medical and ocular health, and information on concomitant medications.
3. Measure binocular near logMAR visual acuity with the participant's habitual correction.
4. Administer the Near Activity Visual Questionnaire (NAVQ) to gauge the participant's subjective experience of near vision function. [11]
5. Evaluate the participant's reading performance, speed, and functionality with the MNREAD app. This will involve:
    i. Reading Acuity: Determine the smallest print size so that the participant can accurately read without making significant errors. The app will present sentences in various print sizes, starting from larger to smaller.
    ii. Critical Print Size: Identify the smallest print size that the participant can read at their fastest speed. This will be determined by observing the smallest print size read at the maximum speed by the participant.
    iii. Maximum Reading Speed: Assess by presenting sentences in a print size comfortable for the participant, then timing how long it takes for them to read these sentences. The reading speed will be computed in words per minute.
    iv. Reading Accessibility Index: Calculate this single-value measure, which represents a person's visual access to commonly encountered printed material, using data from the previous steps.
6. Conduct manifest refraction using maximum plus to best visual acuity.
7. Assess accommodation and binocular vision.
8. Measure pupil size in dim and bright light settings.
9. Complete an anterior segment slit lamp examination.
10. After confirming eligibility, randomize and fit the subject with the first pair of contact lenses.
11. Allow the contact lenses to settle for 10 minutes before evaluating the fit.
12. Perform an over-refraction and adjust the lens power if necessary.

Visit 2 - Contact Lens Follow-up 1

1. Assess the subject who should be wearing the assigned study contact lenses for at least 2 hours before the appointment.
2. Perform an over-refraction and adjust the lens power if necessary.
3. Conduct a slit lamp examination including ocular surface evaluation with sodium fluorescein after the contact lenses are removed.

Visit 3 - Outcome Measures for Lens 1 and Fitting for Lens 2

1. Have the subject report to the visit wearing their assigned study contact lenses for at least 2 hours before their appointment.
2. Administer the NAVQ.
3. Conduct high-contrast, high-luminance visual acuity at 40 cm & 6 m and low-contrast, high-luminance visual acuity at 6m
4. Evaluate the participant's reading performance, speed, and functionality with the MNREAD app

5. Perform a slit lamp examination including sodium fluorescein after removing the study contact lenses.
6. Fit the subject with the second pair of contact lenses based on the randomization schedule.
7. Allow the contact lenses to settle for 10 minutes before evaluating.
8. Perform an overrefraction and adjust the power of the alternate lenses if necessary.

Visits 4 and 5 - Contact Lens Follow-up 2 and Outcome Measures for Lens 2

1. Repeat the procedures from Visits 2 and 3 respectively for the second pair of lenses.

Randomization:

- Create a computer-generated list with 39 elements, each representing a type of lens (label "A" for DAILIES TOTAL1® for Astigmatism and "B" for DAILIES TOTAL1® Spherical Contact Lenses).
- Shuffle the elements of the list to ensure random assignment.
- Attach a coded sticker to each lens' blister packaging, corresponding to the codes in the computer-generated list.

  Note: Only a designated unmasked examiner, who does not interact directly with the participants or influence the data collection, interpretation, or analysis, will have access to the decoding key for these stickers.

Visit 1:

- After confirming eligibility, the unmasked examiner consults the randomization list and selects the appropriately coded package for the participant.
- The unmasked examiner hands off the coded package to the masked examiner.
- The masked examiner fits the subject with the first pair of lenses, without knowing the type of lens they are administering.

Visit 3:

- Repeat the process from Visit 1: the unmasked examiner, based on the randomization list, selects the second pair of lenses for the participant.
- The unmasked examiner hands off the coded package to the masked examiner.
- The masked examiner fits the subject with the second pair of lenses, maintaining the blindness of the study.

End of Study:

- At the end of the study, the unmasked examiner references the coding key to reveal the order in which the lenses were administered to each participant, allowing the research team to analyze the results accordingly.
- This point form process ensures a robust double-blind crossover design, where the participants and the majority of the research team are not aware of the lens type being used at any point, reducing potential biases.

Endpoints:

Primary Endpoints:

1. Evaluate near (40cm) high-contrast visual acuity in logMAR by i-Pad-based applications – EyeChart PRO

Secondary Endpoints:

1. Evaluate participant's reading acuity, critical print size, maximum reading speed, and reading accessibility index using the MNREAD app. Specifically:
    i. Reading Acuity: Identify the smallest print size that can be accurately read by the participant without significant errors. This is done by presenting sentences in decreasing print sizes.
    ii. Critical Print Size: Determine the smallest print size that the participant can read at their fastest reading speed.
    iii. Maximum Reading Speed: Measure by timing how long the participant takes to read sentences presented in a comfortable print size. The speed is calculated as words per minute.
    iv. Reading Accessibility Index: Compute this single-value metric, indicative of a person's visual access to commonly encountered printed text, using data from the previous steps.
2. Evaluate the near visual function with the Near Activity Visual Questionnaire
3. Distance high-low contrast visual acuity in logMAR by using E-ETDRS (NIDEK SC-2000)

Sample size justification

1. The sample size for this study was calculated based on the results of a similar study [12] that assessed improvements in near high- and low-contrast visual acuity among astigmatic patients using toric contact lenses versus spherical contact lenses.

2. The primary endpoint for our study is like the referenced study, and we expect a 1-line treatment benefit (0.1 logMAR) as the minimum clinically important difference. The within-subject standard deviation of the outcome measure is also anticipated to be a line (0.1 logMAR) based on the referenced study.

3. To ensure adequate power for our study, set the significance level (α) at 0.05 (2-sided) and the power ($1-\beta$) at 0.80. Using these parameters and the formula for sample size calculation in a crossover design, we estimated a sample size of 35 participants.

4. A dropout rate of approximately 10%. To ensure sufficient power to detect a statistically and clinically significant difference in our primary outcome, we plan to enrol 39 participants in this clinical trial.

Statical Analysis:

The treatment effects will be analyzed using the Grizzle model for the two-period, two-treatment crossover trial [10]. The data will first be tested for the presence of a carryover effect according to the sequence of randomization, that is, sphere or toric, during the first period at the critical level of 0.10. Then, the treatment effect will be estimated using a linear mixed model in the presence of period and sequence effects to obtain unbiased effect sizes [10].

Reference:

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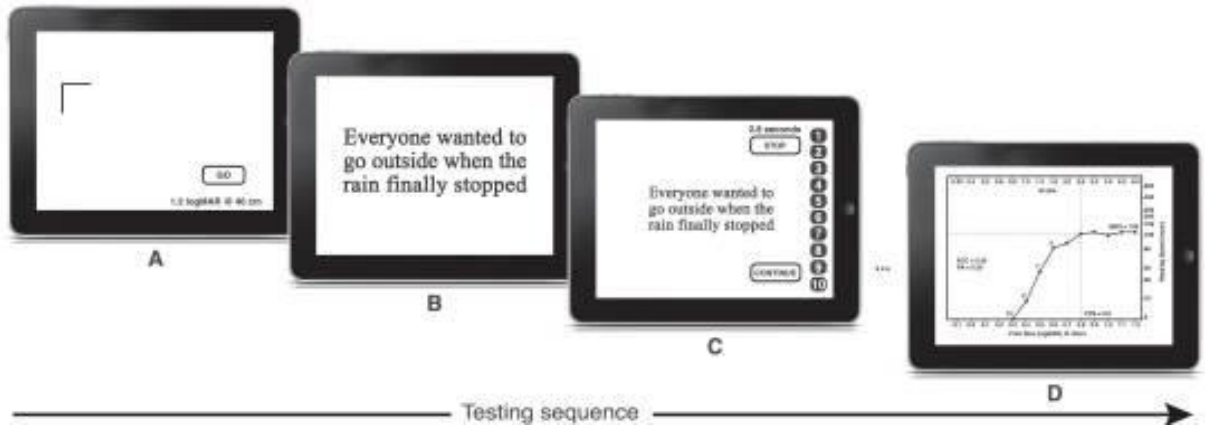
Appendix 1: MNREAD testing sequence using the iPad app.

(A) Preparation screen displayed before each sentence;

(B) After the experimenter clicks the “GO” button, the first sentence is displayed in the center of the screen, launching the time recording;

(C) Once the participant is done reading, a simple click will stop the trial and record the reading time. A score screen appears, allowing the experimenter to enter the number of errors and launch the next trial;

(D) When reading becomes impossible, the test is stopped and the app displays the MNREAD data plot and parameter estimates.



Appendix 2: Near Activity Visual Questionnaire.

THE NEAR ACTIVITY VISUAL QUESTIONNAIRE (NAVQ)

Name: _____ DOB: ___/___/____ Gender: Male/Female Date: _____

Please answer ALL questions for the situation IF/WHEN YOU DO THE DESCRIBED ACTIVITY WITHOUT EXTRA READING SPECTACLES.

Circle the relevant option.

If you do not do the described activity or you have stopped for reasons that are not related to your vision then please circle the 'N/A' option.

How much difficulty do you have:	**N/A or stopped for non-visual reasons**	**No Difficulty**	**A little difficulty**	**Moderate difficulty**	**Extreme Difficulty**
1. Reading small print, such as: newspaper articles, items on a menu, telephone dire ctories?	x	0	1	2	3
2. Reading labels/ instructions/ ingredients/ prices such as on: medicine bottles, food packaging?	x	0	1	2	3
3. Reading your post/ mail, such as: electric bill, greeting cards, bank statements, letters from friends & family?	x	0	1	2	3
4. Writing and reading your own writing, such as: greeting cards, notes, letters, filling in forms, checks, signing your name?	x	0	1	2	3
5. Seeing the display & keyboard on a computer or calculator?	x	0	1	2	3
6. Seeing the display & keyboard on a mobile or fixed telephone?	x	0	1	2	3
7. Seeing objects close to you and engaging in your hobbies, such as: playing card games, gardening, seeing photographs?	x	0	1	2	3
8. Seeing objects close to you in poor or dim light?	x	0	1	2	3
9. Maintaining focus for prolonged near work?	x	0	1	2	3
10. Conducting near work?	x	0	1	2	3

OVERALL	Completely Satisfied	Very Satisfied	Moderately Satisfied	A little satisfied	Completely Unsatisfied
How satisfied are you with your near vision?	0	1	2	3	4