

## MEDIA FACT SHEET ON THEA PROJECT

### ***About Ocular Surface Diseases***

- Common ocular surface diseases (OSD) include corneal edema<sup>1</sup>, corneal opacity<sup>2</sup>, and dry eye disease. Currently, there are no clinical tools to objectively assess the **severity of corneal edema, corneal scar density** and **corneal hydration level**<sup>3</sup>. Objective evaluation of the ocular surface is especially crucial for the timely and accurate diagnosis of OSD and monitoring of the disease progression, which facilitates early treatment and intervention.

### ***Evaluating Ocular Surface Diseases using Terahertz Imaging***

- To address this, a team of clinician innovators and healthcare researchers from SingHealth's Singapore National Eye Centre (SNEC) and Singapore Eye Research Institute (SERI), and A\*STAR's Institute of Materials Research and Engineering (IMRE) are studying the use of a Terahertz (THz) imaging system in the evaluation of OSD. The team is working alongside industry partners to develop **THEA (Terahertz High Definition Eye Analysis)**, a clinical tool for the ocular surface that uses THz imaging. This includes a software that enables clinicians to evaluate ocular surface dynamics objectively, as well as assess the severity and progression of OSD from the THz images.
- Typically, THz imaging is used in industrial settings or for surveillance purposes, such as security screening. The use of THz imaging is novel to ophthalmology. The team has successfully completed preclinical investigations and established that it is biologically safe for use on ocular tissue.

### ***Potential Benefits of THz Imaging for the Evaluation of OSD***

1. Improve evaluation of corneal hydration level:
  - **Managing dry eye disease:** Objective evaluation of corneal hydration levels in dry eye disease helps clinicians to **better monitor the disease progression** and **evaluate treatment effects** for better clinical outcomes.

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<sup>1</sup>Corneal edema refers to swelling of the cornea, which is affected by the corneal hydration level.

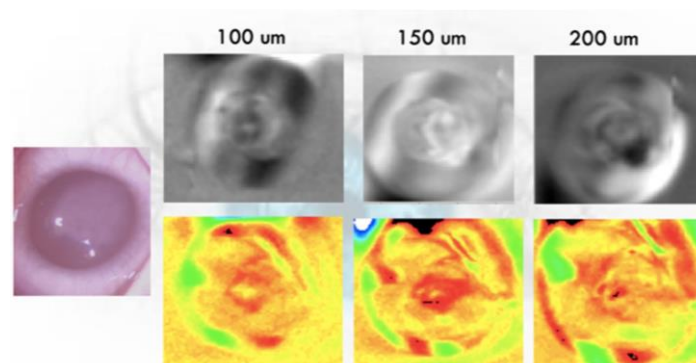
<sup>2</sup>Common causes of corneal opacity include corneal edema and corneal scarring.

<sup>3</sup>Water content of the cornea.

- **Better efficacy of refractive surgery:** During refractive surgery, corneal hydration levels can significantly affect treatment efficacy. Currently, surgeons judge a patient's corneal hydration level subjectively by sight during surgery. THEA could offer a novel clinical tool that allows **real-time monitoring** of the corneal hydration level in refractive surgery, so that surgeons can maintain its optimal level for better surgical outcomes.
- **Objective evaluation of corneal edema:** Currently, corneal edema is subjectively graded by using corneal thickness as an indirect indicator. THEA potentially offers a novel tool to directly measure corneal hydration level, which enables clinicians to objectively evaluate of the **progression of corneal edema**.

2. Allows for quantitative measurements of corneal scar density:

- **Preventing corneal opacity:** The management and surgical options for corneal scarring depend on the depth, size and density of the scar. Current assessment tools only provide information on the scar's surface area without providing quantitative information on scar density. THEA potentially provides a quantitative clinical tool to measure corneal scar density, enabling clinicians to better assess and monitor corneal scars for **earlier intervention** with **less invasive techniques** to prevent corneal opacity.



*Fig. 1 The THz scanning system can generate colour mapping demonstrating the area, size and density of the corneal opacity. Warmer colours represent the areas with denser opacities.*

- When implemented successfully, THEA will facilitate early diagnosis and better management of OSD in the hope of preventing the disease from progressing to an irreversible stage that requires advanced surgical intervention. This will, in turn, lead to greater optimisation of healthcare resources and enhance value-driven care for patients.