

Simulated keratometry using microscope-integrated optical coherence tomography



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PURPOSE

- Intraoperative **simulated keratometry** has the potential to have a positive impact on anterior segment surgeries.
- Microscope-integrated **Optical Coherence Tomography (OCT)** can be employed for that purpose.
- In this study we compare **astigmatism** measurements by a gold standard method and measurements by an ophthalmic surgical microscope with a modified OCT engine performing simulated keratometry in a **porcine wet lab**.

METHODS

- A **Lumera 700 microscope with RESCAN 700** (Zeiss, Oberkochen, Germany) is modified and equipped with an automated algorithm to carry out simulated keratometry.
- The process starts with centering the OCT acquisition region to the detected **corneal vertex**.
- Then, an **OCT volume** covering 6mm in width, 6mm in height and 2mm in depth is captured from ex-vivo porcine eyes.
- Additional B-scans are captured and used for the **correction of motions** induced by environmental effects.
- The algorithm then **segments** the cornea in the motion-corrected volume.
- To measure the astigmatism of the corneal surface, **anterior axial power map** is calculated and the simulated keratometry values of the **flattest and the steepest meridians** are extracted.
- The difference between the two k-readings is considered as the measured **astigmatism**.
- The corneal topography and astigmatism of each porcine eye is also measured using an **ATLAS 9000** corneal topography system (Zeiss, Dublin, USA).

RESULTS

- **20 porcine eyes** are tested for the purpose of this study.
- To eliminate measurement inaccuracies, each eye is **tested 5 times** with each method and the median is used
- 5 eyes were rejected due to inconsistent measurements.
- The calculated central astigmatism in each eye is compared to the reference measurements by ATLAS 9000
- The readings have a **correlation coefficient of 0.67**.
- The observed deviation between the values by the proposed method and the reference method has a **mean of 0.62**, a **standard deviation of 0.41**, and a **median of 0.57** (all in diopters).

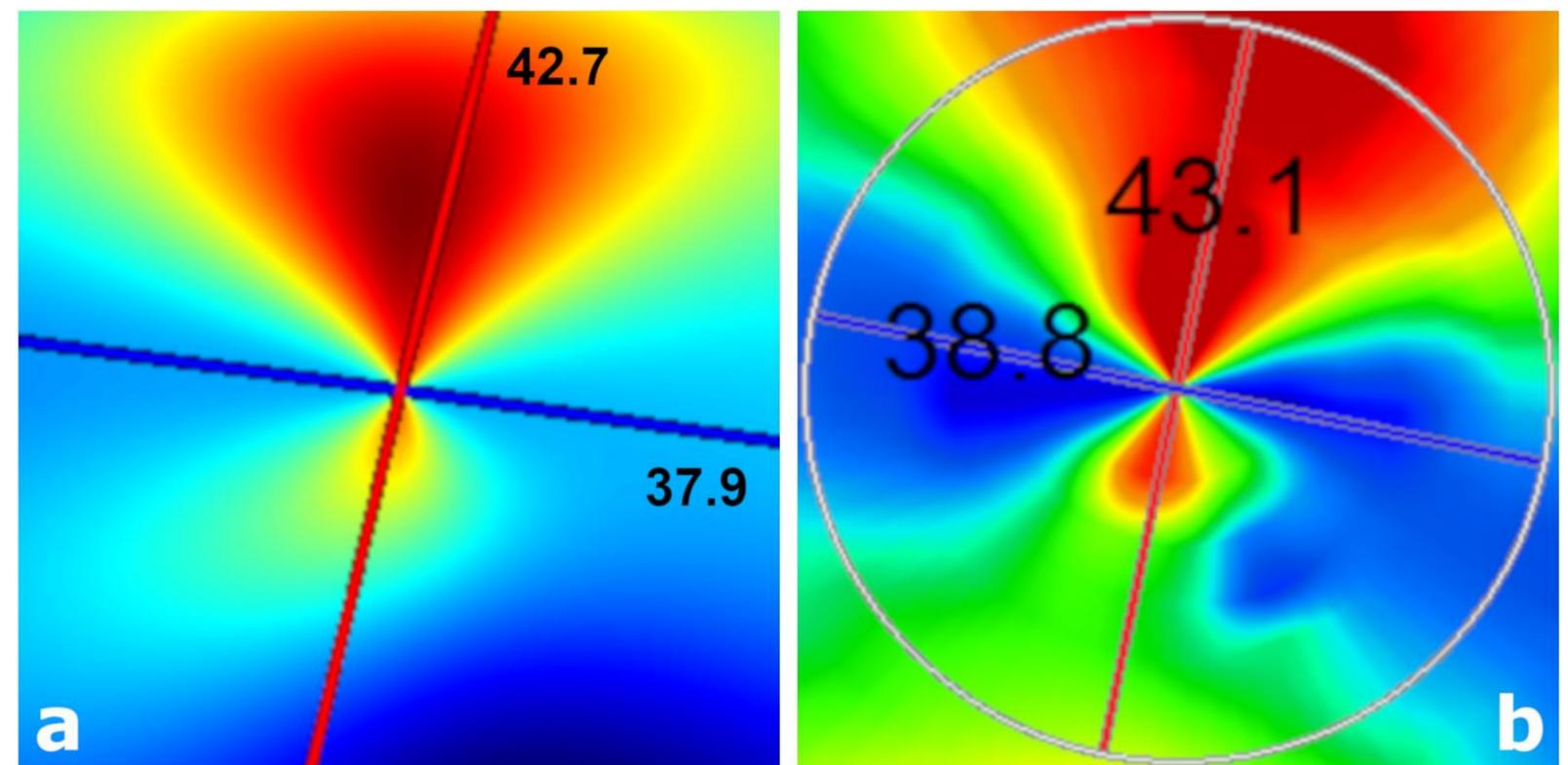


Figure 1. Anterior axial power maps of an ex-vivo porcine eye calculated by the proposed method (a) and the gold standard method (b). Red and blue lines indicate the steepest and flattest meridians respectively.

CONCLUSIONS

- Our results show that astigmatism measurements using microscope-integrated OCT is **comparable** to the measurements using the gold standard method.
- Further research is needed to examine the **repeatability** of measurements using the proposed method.