

EXTENDED MEASURED AREA TEAR FILM STABILITY ASSESSMENT METHOD BY CORNEAL REFLEX IMAGE DEGRADATION

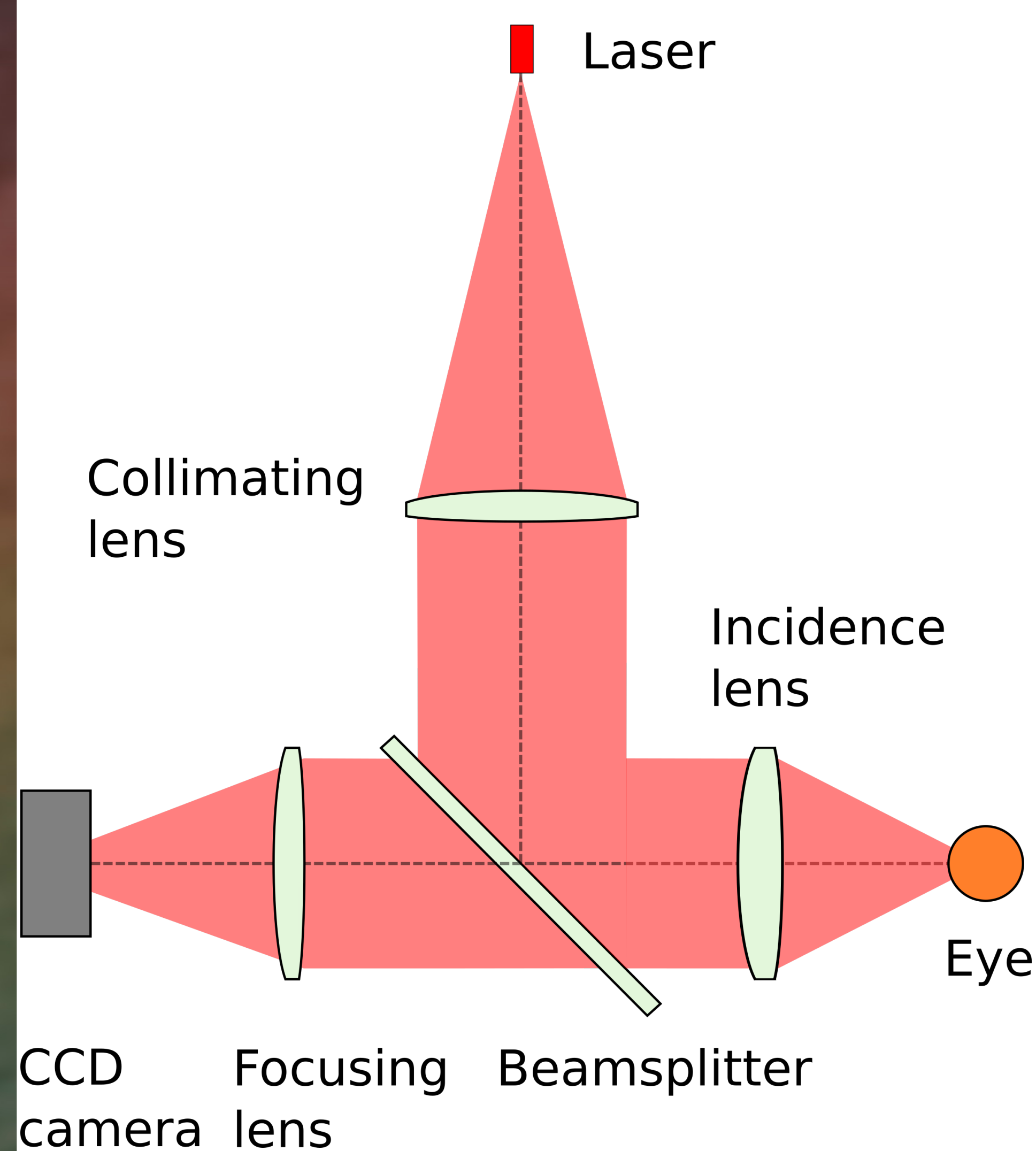
Mikel ALDABA, Fernando DÍAZ-DOUTON, Jaume PUJOL

Centre for Sensors, Instruments and Systems Development (CD6). , Universitat Politècnica de Catalunya, Barcelona, Spain.

PURPOSE:

Recently a new method for the tear film stability measurement based on the corneal reflex image degradation has been proposed¹. The method on its original version is simple, objective, and non-invasive, but has a main limitation: the reduced measured area (3.70mm in diameter). We present a modified version of the method that extends the measured area.

MATERIAL AND METHODS



Setup:

The setup consists of a system to record the corneal reflex image or first Purkinje image, as shown in the figure. An infrared laser diode (λ 780 nm) illuminates the patient's cornea (tear film) after being collimated, reflected in a beamsplitter and passing through an incidence lens with its focal plane at the center of curvature of the cornea so that the incident beam is normal to the tear surface. The light reflected is recorded using a CCD camera after passing through the beamsplitter and a focusing lens.

Four different incidence lenses (see table) were tested.

Measurements:

- The optical quality of the system was evaluated for each incidence lens when using an ophthalmic lens as artificial cornea (PMMA material and radius of curvature 8mm).
- The incidence beam diameter at corneal plane was measured recording an image at this plane and counting the number of pixels that form the beam.

Lens	Manufacturer	Model	Design	\varnothing (mm)	f'(mm)	BFL (mm)	Material
1	Edmund Optics	32-978	Double-Convex spheric	50.0	50.0	45.3	N-SF11
2	Edmund Optics	66-316	Double-Convex aspheric	50.0	50.0	38.3	L-BAL35
3	Knight Optical	LAP3536	Double-Convex aspheric	35.0	32.2	35.7	Acrylic
4	Knight Optical	LAP5150	Double-Convex aspheric	51.0	49.8	39.9	Acrylic

RESULTS

Recorded corneal reflex image, its optical quality measured as the full width at half maximum (FWHM) and the incidence beam diameter (\varnothing) at corneal plane for the different incidence lenses :

	Lens #1	Lens #2	Lens #3	Lens #4
FWHM (pixels)	8	4	5	20
\varnothing (mm)	1.79	7.72	3.36	7.04

CONCLUSIONS

- An optical design for tear film break up measurement method based on corneal reflex image degradation has been presented.
- The method is based on the normal incidence of the incident beam on the cornea.
- Four lenses of different materials and designs were tested.
- Three lenses (#1, #3 and #4) were discarded due to insufficient optical quality or small measuring area.
- The final setup permitted tear film stability assessment with a measuring area of 7.72 mm of diameter.

1- Aldaba, M., Mira-Agudelo, A., Ramírez, J. F. B., García-Guerra, C. E., & Pujol, J. (2019). Tear film stability assessment by corneal reflex image degradation. JOSAA, 36(4), B110-B115.

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