



Clinical application of the tear film prism

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To the Editor:

Although the prolate cornea has a reduced refractive power towards the periphery, direct gonioscopy without scleral indentation is only possible if there is gross corneal ectasia (e.g. keratoglobus) [1]. For direct gonioscopy, the power of the anterior corneal surface can be neutralised by a contact lens (e.g. Koeppe or Barkan) and the image viewed from the side. For indirect gonioscopy at the slit lamp, a contact lens is also used to neutralise the effect of the anterior corneal surface, with a mirror used to view the image from the front [2]. In this report we describe how the meniscus of the precorneal tear film can act as a base-down prism to refract light from the periphery of the anterior chamber. We also show how this natural prism can be used to help identify pathology.

A 53-year-old individual was referred with suspected left microbial keratitis. There was a central corneal infiltrate with feathered margins, an anterior uveitis and keratic precipitates (Fig. 1a). A hypopyon was not initially noticed but was identified through the lower lid tear film (Fig. 1b, c, Supplementary Video). In this case, the presence of hypopyon helped us make a presumed diagnosis of fungal keratitis, which responded to topical medical therapy.

The air-water interface of the tear film prism will refract the light towards the base of the prism. The posterior surface of the tear meniscus neutralises the refractive power of the anterior corneal surface. However, the added prismatic effect, combined with the negative refractive

power of the posterior corneal surface, produces a divergent light path (Fig. 2). This effect is enhanced if there is an increased meniscus height from epiphora, or if the lower lid moves the meniscus directly across the lower limbus. This can increase the view of the inferior anterior chamber to help identify pathology such as a small hypopyon or hypheama, when contact gonioscope may be relatively contraindicated.

To the best of our knowledge, this effect of the tear film prism has not been described in the literature as an aid for clinical assessment. However, there is debate over the role of the tear meniscus in post-iridotomy dysphotopsia, when light is refracted peripherally towards the iris defect [3]. Published moderate-low Grading of Recommendations, Assessment, Development and Evaluation (GRADE) randomised control trials comparing the effect of superior or temporal placement of a peripheral iridotomy on the risk of dysphotopsia report conflicting results [4, 5], potentially due to the variability of the position of the upper eye lid.

In conclusion, this case illustrates a clinical application of the tear film prism to visualise pathology in the peripheral anterior chamber, such as hypheama or hypopyon, when gonioscopy would not normally be performed. The technique can be enhanced by instilling a drop of saline to increase the height of the meniscus and by manipulating the position of the lid. Although the technique is quick and easy to perform, the view of the periphery of the anterior chamber is not as extensive as can be obtained by contact lens-assisted gonioscopy.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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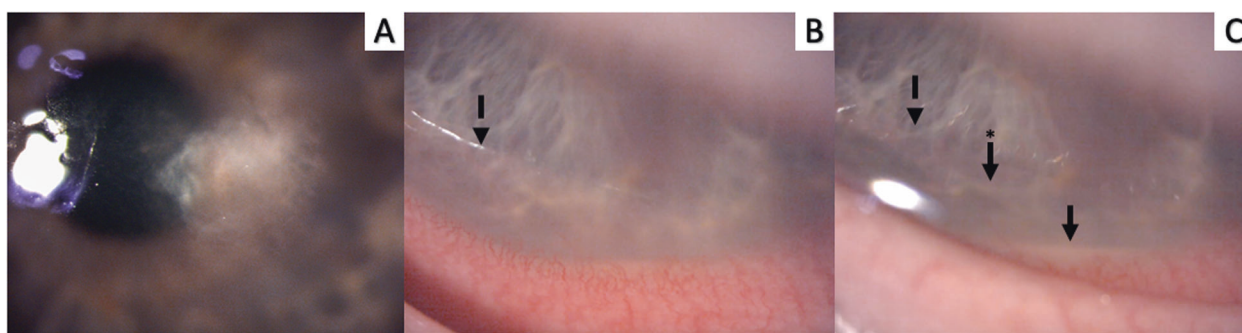


Fig. 1 In vivo slit lamp photographs of the tear film prism. Slit lamp photograph of the corneal ulcer (a). Images b and c are taken from the supplementary video clip. The lid margin reflected on the cornea (dashed black arrow) (b). Moving the meniscus upward by

raised the lower lid highlights the hypopyon (solid black arrow) (c). The lid margin reflection (dashed black arrow) and upper border of the meniscus (asterisk black arrow) are also visible.

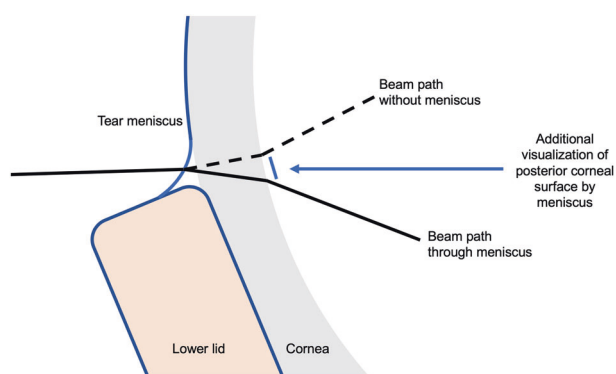


Fig. 2 Schematic of the optical effects of the tear meniscus (not to scale). The tear meniscus and the anterior corneal surface forms a base-down prism. When this is combined with neutralisation of the power of the anterior corneal surface and the negative power of the posterior corneal surface there is increased visualisation of the periphery of the anterior chamber. For a small angle of $<5^\circ$, deviation can be calculated with the formula, angle $b = (n - 1)/\text{angle } a$. Where angle b is the angle of deviation, n is the refractive index of the prism (tear film) and angle a is the apical angle of the prism.

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