Simple Clinical Photokeratoscopy

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Abstract

A simple photokeratoscope can be clinically useful for the quantification of corneal configuration in keratoconus, for determining the presence or absence of large corneal cylinders in infants and non-communicative patients and for recording post-operative corneal topography.

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Un photokératoscope peut servir dans un environnement clinique pour évaluer quantitivement la configuration de la cornée dans des cas de keratocône; pour déterminer la présence ou non d'un astigmatisme cornéen outré chez les bébés ou les personnes incapables de communiquer; pour conserver un record de la topograhie cornéene post chirurgicale.

Gullstrand is credited with introducing the technique of photokeratoscopy in 1896 (1). Numerous developments and improvements have been reported since then. These include: the use of hemispherical or cyclindrical target surfaces, flash photography, stereophotography, autocollimation and the telecentric stop (2-6). Despite the obvious advantages, such as providing an objective record of corneal topography, photokeratoscopy is rarely used in clinical practice.

The Wesley-Jessen System 2000 photokeratoscope (7) and the Corneascope (International Diagnostic Instruments) appear to be the only commercially available photokeratoscopes. Both are relatively expensive and cumbersome instruments used as aids in the fitting of contact lenses.

The Keeler-Klein keratoscope is a commercially available self-luminous Placido disc. The simple photokeratoscope described here (Fig. 1) consists of the head of a Keeler-Klein keratoscope mounted on a single lens reflex camera (8). This is accomplished with a simple adapter and a camera filter ring. The normal battery powered illumination system of the keratoscope is used for alignment and focussing while the photograph is taken with a regular electronic flash, the surface of which is covered with a removable baffle. The light flash is carried to the keratoscope head with a fiber optic cable, one end of which is inserted into a hole in the baffle and the other into the side of the keratoscope.

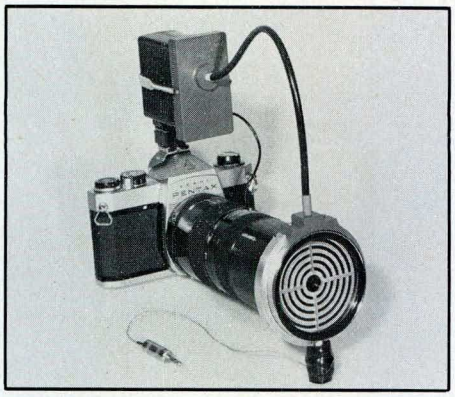

Fig. 1. Photography of a simple photokeratoscope consisting of the head of a Keeler-Klein keratoscope mounted on a macro lens. The photograph is taken with an electronic flash which is carried to the keratoscope head by means of a fibre optic cable.

The camera optics used can be varied depending on available attachments and the extent of corneal coverage desired. Limbus to limbus coverage is not absolutely necessary. A regular 50 mm lens and bellows or a 100 mm macro lens are adequate to account for the topography of the central 30-40% of the cornea; sufficient to cover the entrance pupil of the eye in photopic and most mesopic conditions. Regular high speed film such as Kodak Tri-X is adequate.

The simple photokeratoscopic described here was originally developed for research in animal vision. A simple, easy to use, and compact instrument was needed to measure corneal curvature of the eyes of various animals (Fig. 1). Corneal radius of curvature was estimated by comparison with photographs of spheres of known diameter. While an instrument of this nature cannot compete with the accuracy of sophisticated photokeratoscopes, the examples which follow will demonstrate a number of clinical uses.

Because of mire distortion as well as corneal steepening beyond the range of keratometers, most practitioners must guess at the severity of keratoconus by visual inspection of the corneal profile. Figures 2 and 3 are photokeratogrammes of a patient with one keratoconic and one normal cornea. Aside from the evident distortion at the apex of the keratoconic cornea, the keratoscope rings are approximately one-half the diameter of those reflected by the normal (42.00 D) cornea. Thus the refractive contribution of the abnormal cornea is approximately twice as much (80 D) as it should be.

Fig. 2. Photokeratogramme of a keratoconic cornea.

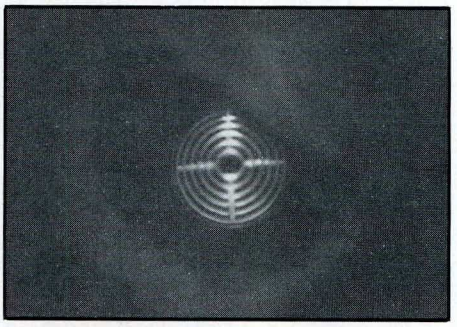

Fig. 3. Photokeratogramme of a normal cornea from the same patient as figure 2.

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The following pair of figures (4 and 5) are photographs of reflections from the corneas of a young mentally retarded patient with nystagmus. Keratometry was not possible in this case. The right cornea (Fig. 3) appears to be normal although a relatively small (1.5-2.0 D) amount of corneal astigmatism is indicated along an axis of 105°. The photokeratogramme of the left eye

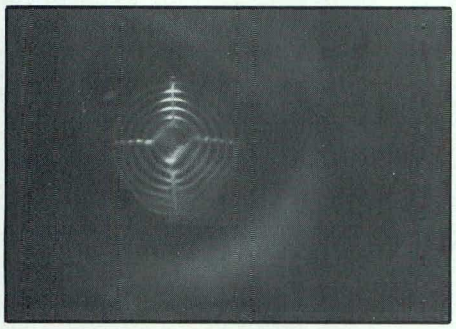

Fig. 4. Photokeratogramme of the right eye of a young mentally retarded patient indicating corneal distortion.

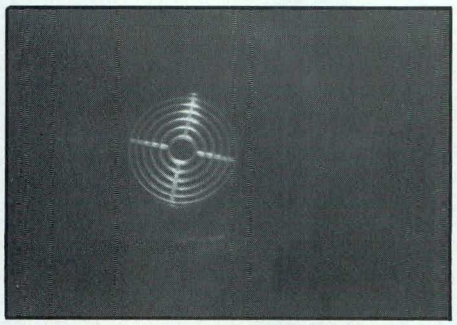

Fig. 5. Left cornea of the same patient as figure 4. A small cylinder (approx. 1.5D) is indicated at 105°.

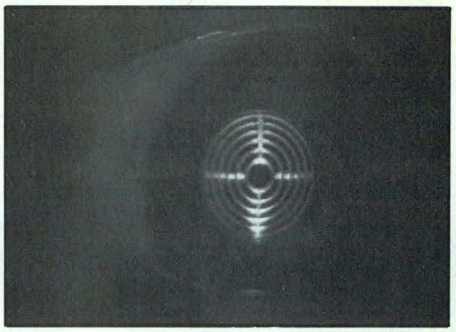

Fig. 6. Cornea following intra-ocular lens transplant surgery. A 4 D against the rule cylinder is indicated.

indicates that the central cornea is severely distorted (Fig. 4).

Figure 6 is a photograph of keratoscope rings reflected by the cornea of a patient who has had an intraocular lens implant. An against-the-rule cylinder of 4.00 D is indicated. The final figure (7) highlights a peripheral corneal depression caused by a chemical burn. Attempts to stain this area with fluorescein for biomicroscopy were unsuccessful.

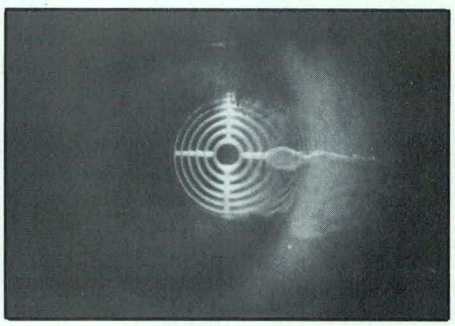

Fig. 7. Photograph from a cornea with a peripheral chemical burn.

In summary, a simple photokeratoscope can be a valuable instrument for the quantification of corneal configuration in keratoconus, for determining the presence or absence of large amounts of corneal astigmatism in infants and non-communicative patients, and for recording post-operative corneal topography. It has been particularly useful in the Low Vision Clinic at the University of Waterloo.

References

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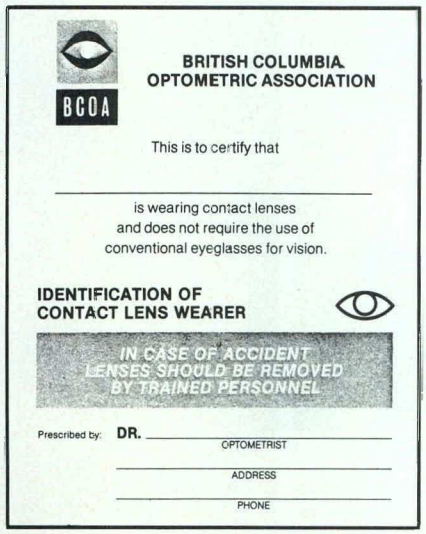
B.C.O.A. Contact Lens Wearer's I.D. Card



The British Columbia Optometric Association has recently produced a Contact Lens Wearer's I.D. Card.

Designed for use in the industrial environment, the card (both front and back are shown at left) is being promoted by the B.C.O.A. to the Workers' Compensation Board in that province.

Tom Little, Program Director for the B.C.O.A., referred specifically to the distinctive red alert logo (to the right of the words "Contact Lens Wearer") as the focal point of B.C.'s present promotion of the card. "The potential exists," he said, "for a valuable symbol to be used nationally."

Among the uses being advocated by the B.C.O.A. is the symbol's development as a decal for construction hard hats.