SIXTH EDITION

Jack J

Kanski

Clinical Ophthalmology

A SYSTEMATIC APPROACH

BUTTERWORTH
HEINEMANN
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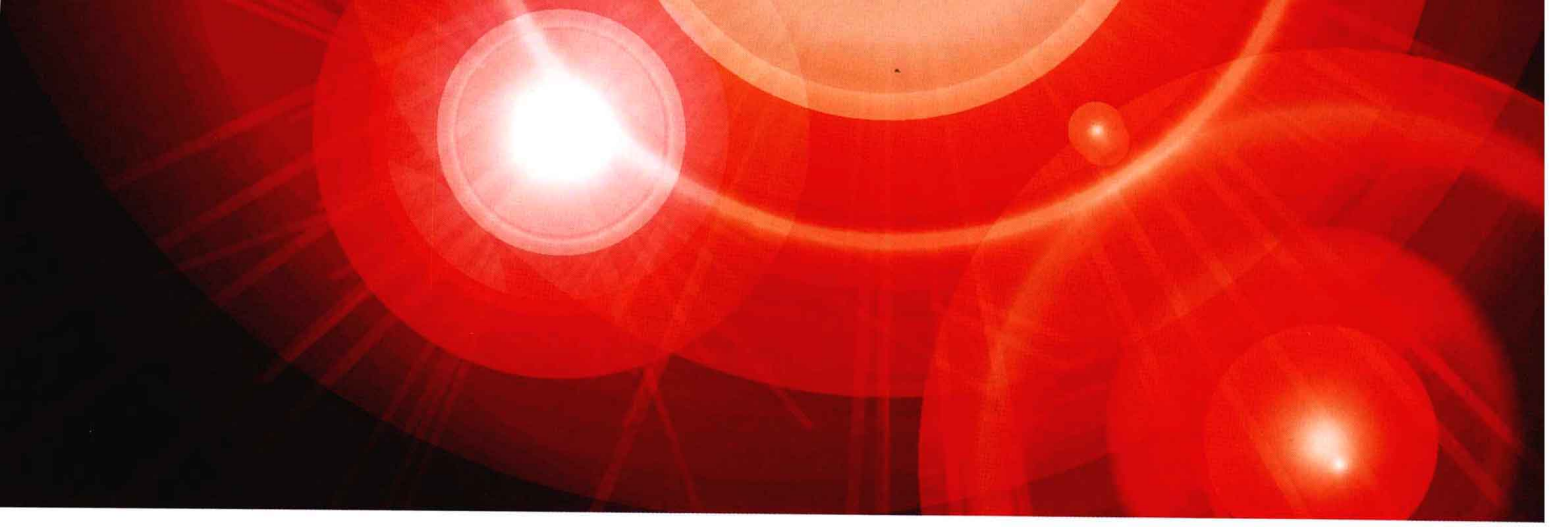

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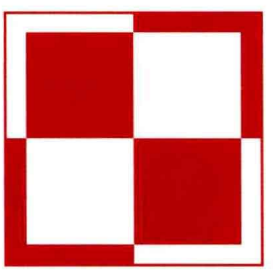
Clinical Ophthalmology

A SYSTEMATIC APPROACH

Dedication

To the valiant Polish fighter pilots in the Battle of Britain.



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Preface to the sixth edition

Four years have elapsed since the publication of the fifth edition of *Clinical Ophthalmology*. Since then many advances have occurred in the speciality including the discovery of new disease processes as well as treatment modalities and diagnostic methods. This edition has therefore been completely revised and expanded to include much new material. The number of illustrations has been considerably increased so that the vast majority of clinical conditions are illustrated. The number of chapters has been increased from 20 to 24 with new chapters on examination, imaging techniques, congenital anomalies and drug-induced conditions. Emphasis is placed on understanding pathogenesis of disease processes and for the first time descriptions of histology have been included.

The aim of this book is not to replace the many excellent encyclopaedic multi-author texts and exhaustive bibliographies that are readily available in other publications but to provide the trainee with a systematic, concisely written, well-illustrated and easily assimilated single-volume text that provides basic knowledge and acts as a stepping-stone from which the reader can further expand his knowledge of ophthalmology.

JJK
Windsor 2007

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Contents

CHAPTER 1

OCULAR EXAMINATION TECHNIQUES

SLIT-LAMP BIOMICROSCOPY OF THE ANTERIOR SEGMENT

The purpose of slit-lamp examination of the cornea and anterior segment is to determine the position, depth and size of any abnormalities (Fig. 1.1).

Direct illumination

Direct illumination with diffuse light is used to detect gross abnormalities:

a. A narrow obliquely directed slit-beam is used to visualize a cross-section of the cornea.
b. Further narrowing of the beam to a very thin optical section moved across the cornea can determine the depth of a lesion.
c. The height of the coaxial beam can be adjusted to measure the horizontal and vertical size of a lesion or associated epithelial defect.
d. The use of a red-free filter makes red objects appear black, thereby increasing contrast when observing vascular structures or rose bengal staining. A cobalt blue filter is normally used in conjunction with fluorescein.

Scleral scatter

Scleral scatter involves decentring the slit beam laterally so that the light is incident on the limbus with the microscope focused centrally. Light is then transmitted within the cornea by total internal reflection. A corneal stromal lesion will become illuminated because of forward light scatter. This technique is especially useful to detect subtle stromal haze, or cellular or lipid infiltration.

Retroillumination

Retroillumination uses reflected light from the iris or fundus after pupil dilation to illuminate the cornea. This allows the

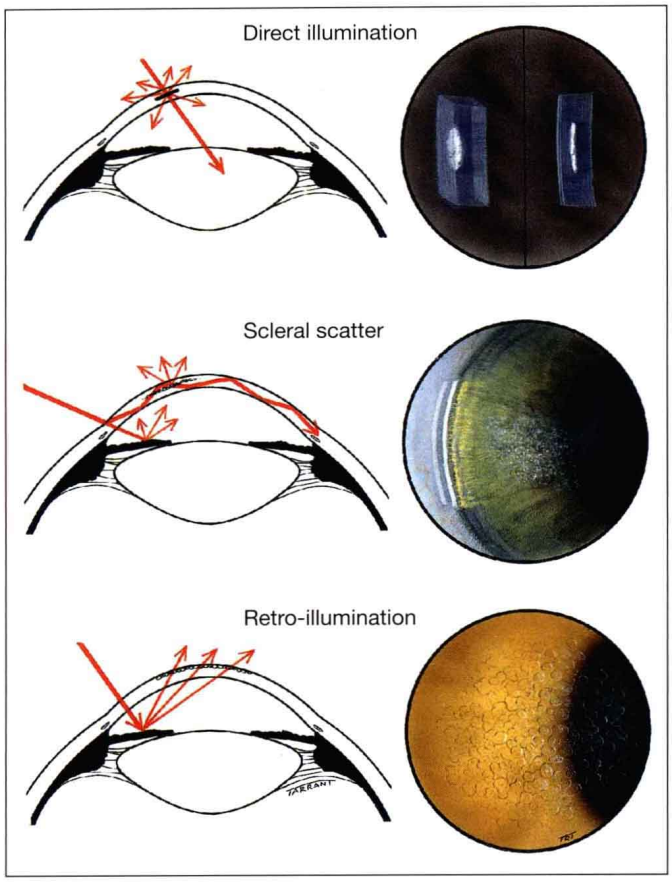

Fig. 1.1
Technique of slit-lamp biomicroscopy of the anterior segment

detection of fine epithelial and endothelial changes, such as epithelial cysts, keratic precipitates and small blood vessels.

Specular reflection

Specular reflection shows abnormalities of the endothelium such as reduced cell density and guttata. Pseudoguttata (dark events) probably represent reversible endothelial cell oedema and inflammatory cells beneath the endothelial cell layer.

FUNDUS EXAMINATION

Slit-lamp biomicroscopy

Indirect ophthalmoscopy

Indirect ophthalmoscopy utilizes high power convex lenses designed to obtain a wide field of view of the fundus (Fig. 1.2); the image is vertically inverted and laterally reversed. The technique is as follows:

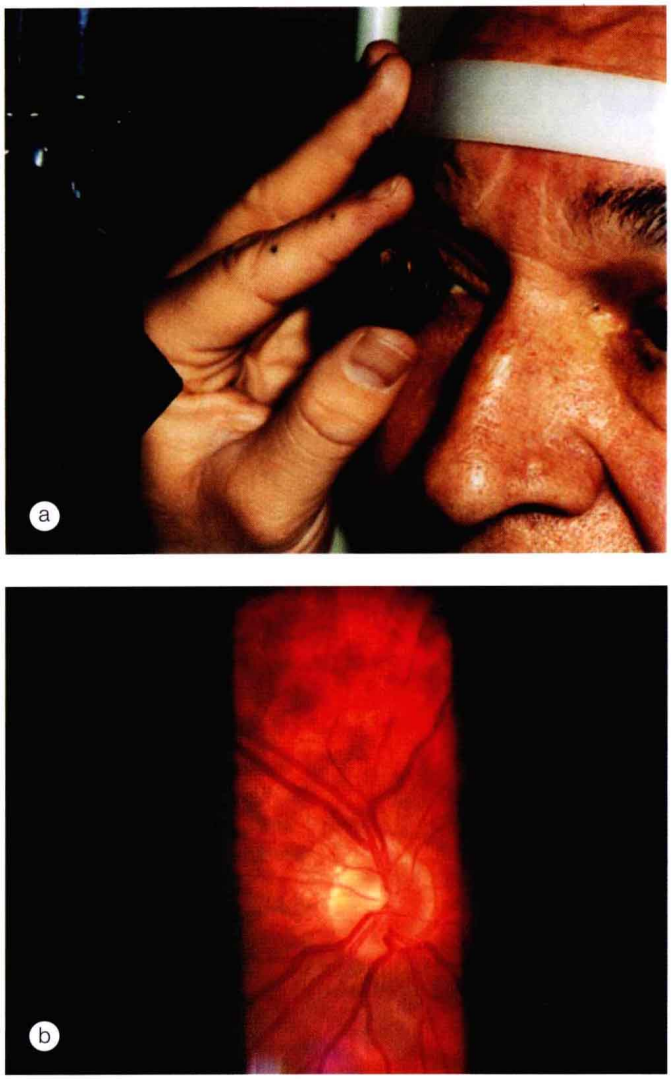

Fig. 1.2
(a) Indirect slit-lamp biomicroscopy; **(b)** fundus view (Courtesy of B Tompkins)

a. The slit beam is adjusted to a width about ¼ of its full round diameter.
b. The illumination is set at an angle coaxial with the slit-lamp viewing system.
c. The magnification and light intensity are adjusted to the lowest settings.
d. The light beam should be centred to pass directly through the patient's pupil.
e. The lens is held directly in front of the cornea just clearing the lashes so that the light beam passes through its centre.
f. The fundus is examined by moving the joystick and vertical adjustment mechanism of the slit-lamp whilst keeping the lens still.
g. Magnification is increased to show greater detail as necessary.
h. To view the peripheral retina the patient should be instructed to direct gaze accordingly.

Goldmann three-mirror examination

1. **Goldmann lens** consists of a central part and three mirrors set at different angles. Because the curvature of the contact surface of the lens is steeper than that of the cornea a viscous coupling substance with the same refractive index as the cornea is required to bridge the gap between the cornea and the goniolens. It is important to be familiar with each part of the lens as follows (Fig. 1.3):
   - The central part provides a 30° upright view of the posterior pole.
   - The equatorial mirror (largest and oblong shaped) enables visualization from 30° to the equator.
   - The peripheral mirror (intermediate in size and square shaped) enables visualization between the equator and the ora serrata.
   - The gonioscopy mirror (smallest and dome-shaped) may be used for visualizing the extreme periphery and pars plana. It is therefore apparent that the smaller the mirror the more peripheral the view obtained.
2. **Mirror positioning**
   - The mirror should be positioned opposite the area of the fundus to be examined; to examine the 12 o'clock position the mirror should be at 6 o'clock.
   - When viewing the vertical meridian, the image is upside down but not laterally reversed, as with indirect ophthalmoscopy, so that lesions located to the left of 12 o'clock in the retina will also appear in the mirror on the left-hand side (Fig. 1.4).
   - When viewing the horizontal meridian, the image is laterally reversed.
3. **Technique**
   a. The pupils are dilated.
   b. The locking screw is unlocked (Fig. 1.5a) to allow side tilting of the illumination column (Fig. 1.5b).
   c. Anaesthetic drops are instilled.
   d. Coupling fluid (high viscosity methylcellulose or equivalent) is inserted into the cup of the contact lens; it should be no more than half full.
   e. The patient is asked to look up; the inferior rim of the lens is inserted into the lower fornix (Fig. 1.6a) and pressed quickly against the cornea so that the coupling fluid has no time to escape (Fig. 1.6b).
   f. The illumination column should always be tilted except when viewing the 12 o'clock position in the fundus (i.e. with the mirror at 6 o'clock).
   g. When viewing horizontal meridians (i.e. 3 and 9 o'clock positions in the fundus) the column should be kept central.
   h. When viewing the vertical meridians (i.e. 6 and 12 o'clock positions) the column can be positioned left or right of centre (Fig. 1.7).
   i. When viewing oblique meridians (i.e. 1.30 and 7.30 o'clock) the column is kept right of centre, and vice versa when viewing the 10.30 and 4.30 o'clock positions.
   j. When viewing different positions of the peripheral retina the axis of the beam is rotated so that it is always at right angles to the mirror.
   k. To visualize the entire fundus the lens is rotated for 360°, using first the equatorial mirror and then the peripheral mirrors.

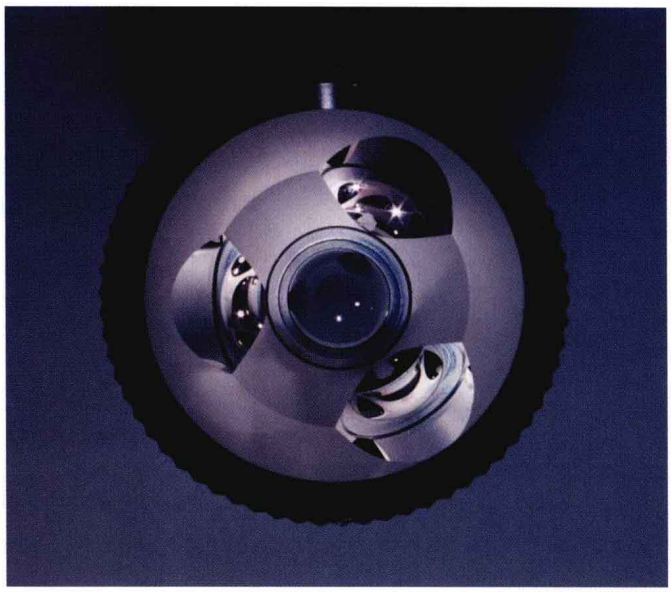

Fig. 1.3
Goldmann three-mirror lens

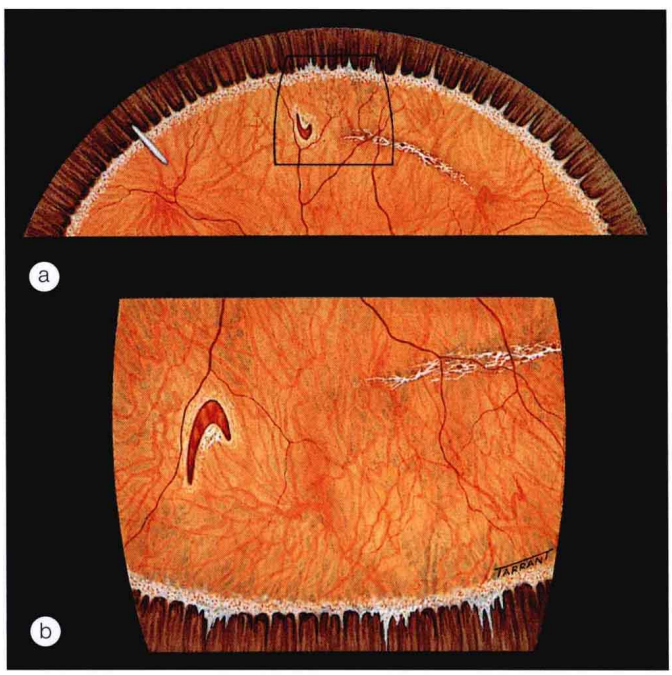

Fig. 1.4
(a) U-tear left of 12 o'clock and an island of lattice degeneration right of 12 o'clock; **(b)** the same lesions seen with the triple mirror positioned at 6 o'clock

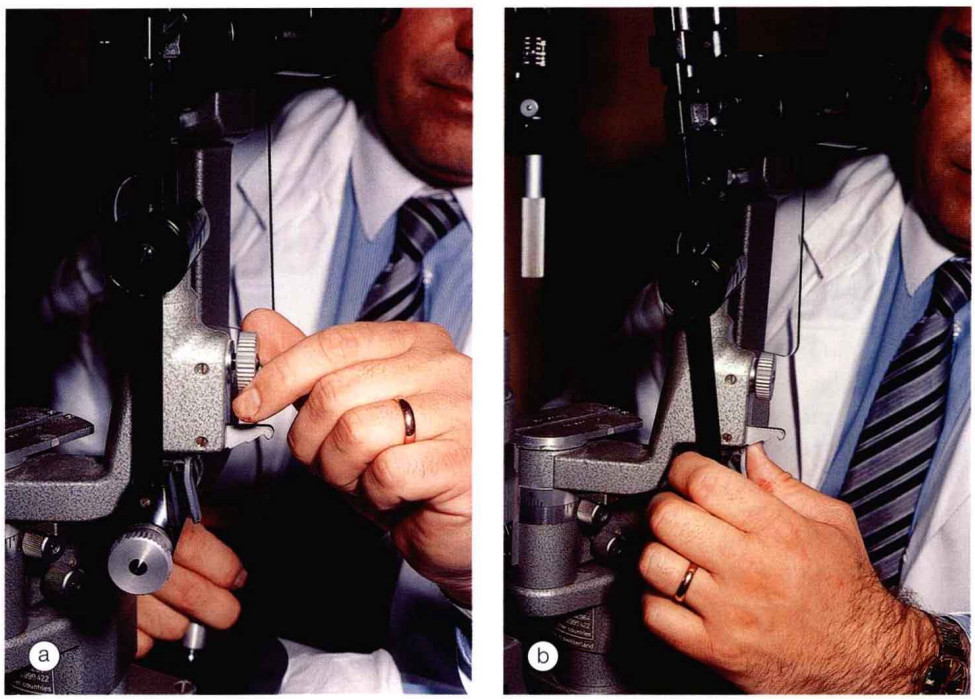

Fig. 1.5
Preparation of the slit-lamp for fundus examination. **(a)** Unlocking the screw; **(b)** tilting of the illumination column

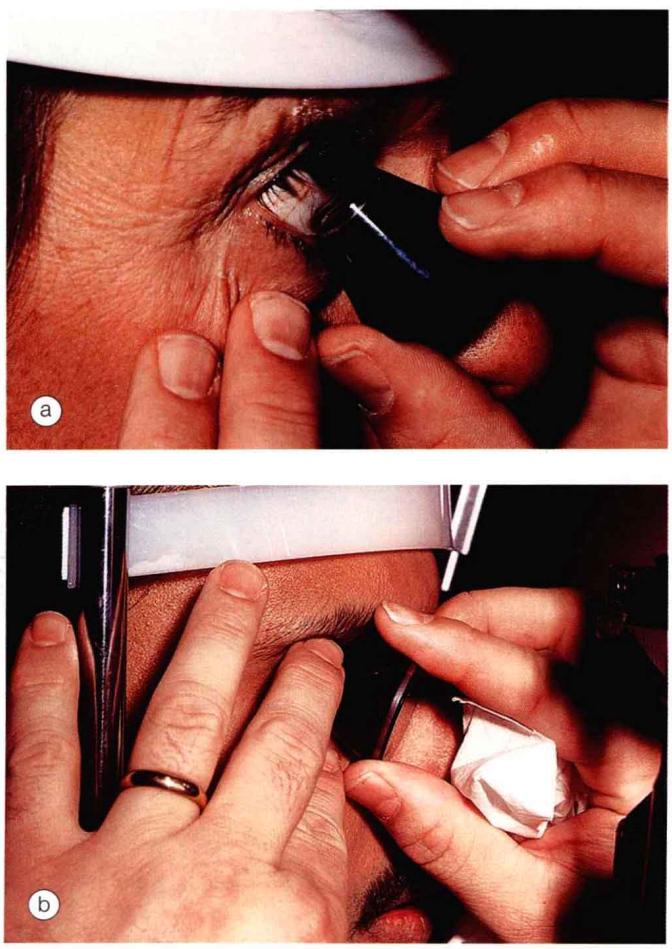

Fig. 1.6
(a) Insertion of the triple-mirror lens into the lower fornix with the patient looking up; **(b)** triple-mirror in position

Fig. 1.7
Illumination column tilted and positioned right of centre to view the oblique meridians at 1.30 and 7.30 o'clock

l. To obtain a more peripheral view the lens is tilted to the opposite side asking the patient to move the eyes to the same side. For example, to obtain a more peripheral view of 12 o'clock (with mirrors at 6 o'clock) tilt the lens down and ask the patient to look up.
m. The vitreous cavity is examined with the central lens using both a horizontal and a vertical slit beam.
n. The posterior pole is examined.

Indirect ophthalmoscopy

Principles

Indirect ophthalmoscopy provides a stereoscopic view of the fundus. The light emitted from the instrument is transmitted to the fundus through a condensing lens, held at the focal point of the eye, which provides an inverted and laterally reversed image of the fundus (Fig. 1.8a). This image is viewed through a special viewing system in the ophthalmoscope. As the power of the condensing lens decreases, the working distance and the magnification are increased but the field of view is reduced, and vice versa.

Condensing lenses

The following condensing lenses of various powers and diameters are available for indirect ophthalmoscopy (Fig. 1.8b).

- 15D (magnifies ×4; field about 40°) is used for examination of the posterior pole.
- 20D (magnifies ×3; field about 45°) is the most commonly used for general examination of the fundus.
- 25D (magnifies ×2.5; field is about 50°).
- 30D (magnifies ×2; field is 60°) has a shorter working distance and is useful when examining patients with small pupils.
- 40D (magnifies ×1.5; field is about 65°) is used mainly to examine small children.
- Panretinal 2.2 (magnifies ×3; field is about 55°).

Technique

a. Both pupils are dilated with 1% tropicamide and, if necessary, phenylephrine 10% so that they will not constrict when exposed to a bright light during examination.

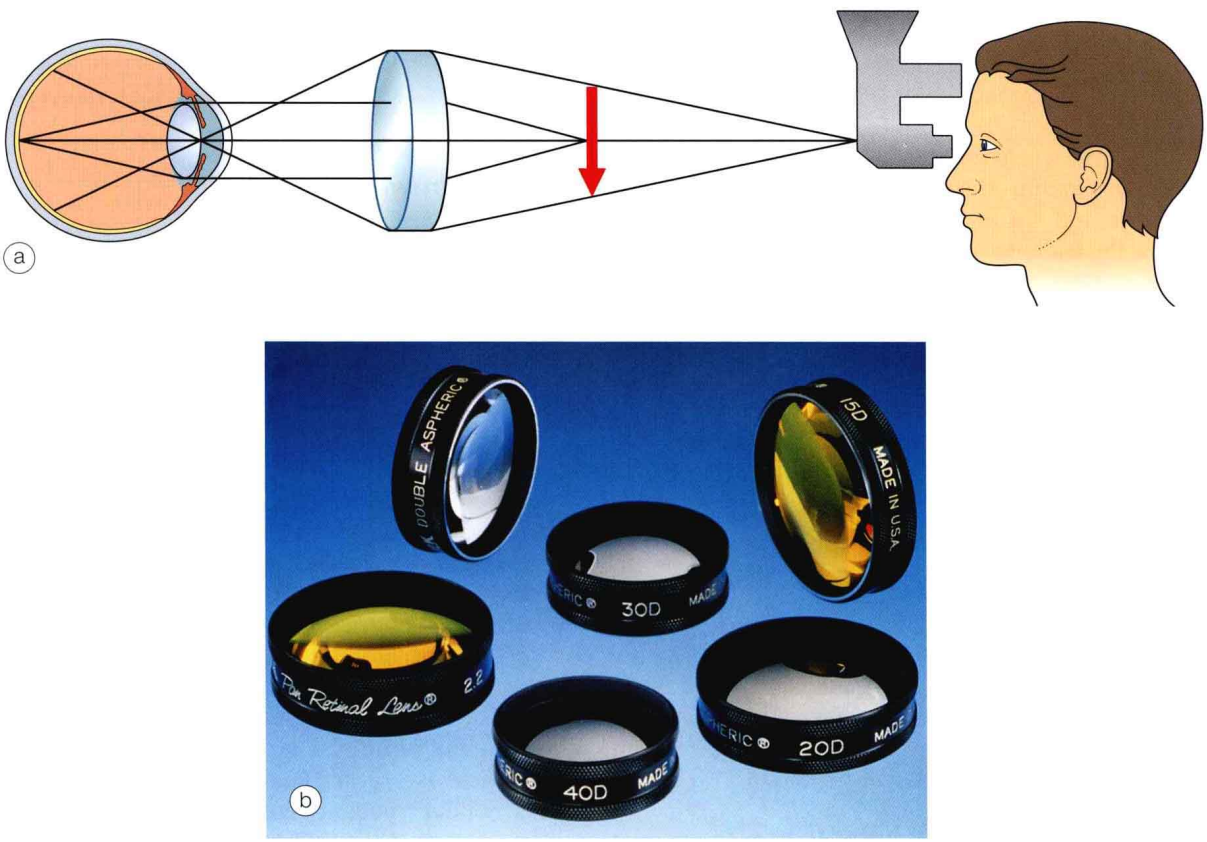

Fig. 1.8
(a) Principles of indirect ophthalmoscopy; **(b)** condensing lenses

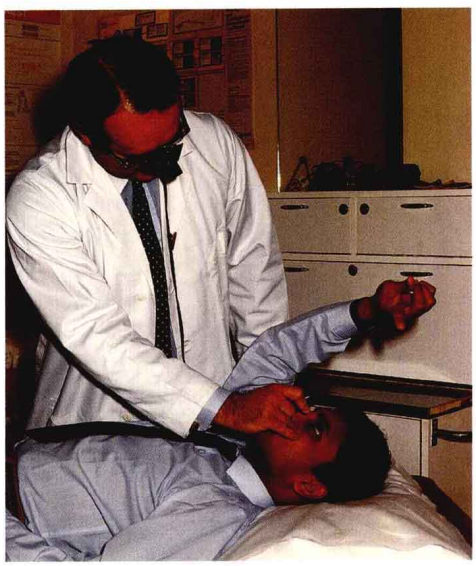

Fig. 1.9
Position of the patient during indirect ophthalmoscopy

b. The patient should be in the supine position, with one pillow, on a bed (Fig. 1.9), reclining chair or couch, and not sitting upright in a chair.
c. The examination room is darkened.
d. The eyepieces are set at the correct interpupillary distance and the beam aligned so that it is located in the centre of the viewing frame.
e. The patient is instructed to keep both eyes open at all times.
f. The lens is taken into one hand with the flat surface facing the patient and throughout the examination is kept parallel to the patient's iris plane.
g. If necessary, the patient's eyelids are gently separated with the fingers.
h. In order to enable the patient to get used to the light he should be asked to look up so that the superior peripheral fundus is examined first.
i. The patient is asked to move the eyes and head into optimal positions for examination. For example, when examining the extreme retinal periphery, ask the patient to look away from you.

Scleral indentation

1. **Purposes.** Scleral indentation should be attempted only after the art of indirect ophthalmoscopy has been mastered. Its main function is to enhance visualization of the peripheral retina anterior to the equator (Fig. 1.10); it also permits a kinetic evaluation of the retina.
2. **Technique**
   a. To view the ora serrata at 12 o'clock, the patient is asked to look down and the scleral indenter is applied to the outside of the upper eyelid at the margin of the tarsal plate (Fig. 1.11a).
   b. With the indenter in place, the patient is asked to look up; at the same time the indenter is advanced into the anterior orbit parallel with the globe (Fig. 1.11b).
   c. The examiner's eyes are aligned with the condensing lens and indenter.
   d. Gentle pressure is exerted so that a mound is created (Fig. 1.11c) and then the indenter is moved to an adjacent part of the fundus.

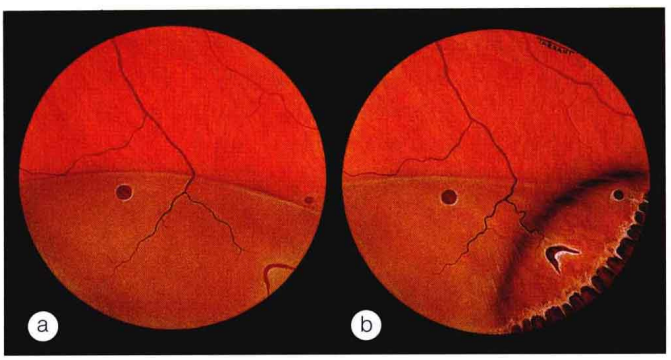

Fig. 1.10
Appearance of retinal breaks in detached retina. **(a)** Without scleral indentation; **(b)** with indentation

NB The indenter should be kept tangential to the globe at all times, as perpendicular indentation will cause pain.

Fundus drawing

1. **Technique.** The image seen with the indirect ophthalmoscope is vertically inverted and laterally reversed. This phenomenon can be used to advantage when drawing the fundus if the top of the chart is placed towards the patient's feet (i.e. upside down). In this way the inverted position of the chart in relation to the patient's eye corresponds to the image of the fundus obtained by the observer. For example, a U-tear at 11 o'clock in the patient's right eye will correspond to the 11 o'clock position on the chart; the same applies to the area of lattice degeneration between 1 o'clock and 2 o'clock (Fig. 1.12a).
2. **Colour code** (Fig. 1.12b)
   a. The boundaries of the RD are drawn by starting at the optic nerve and then extending to the periphery.
   b. Detached retina is shaded blue and flat retina in red.
   c. The course of retinal veins is indicated with blue. Retinal arterioles are not usually drawn unless they serve as a special guide to an important lesion.
   d. Retinal breaks are drawn in red with blue outlines; the flat part of a retinal tear is also drawn in blue.
   e. Thin retina is indicated by red hatchings outlined in blue; lattice degeneration is shown as blue hatchings outlined in blue; retinal pigment is black; retinal exudates yellow; and vitreous opacities green.

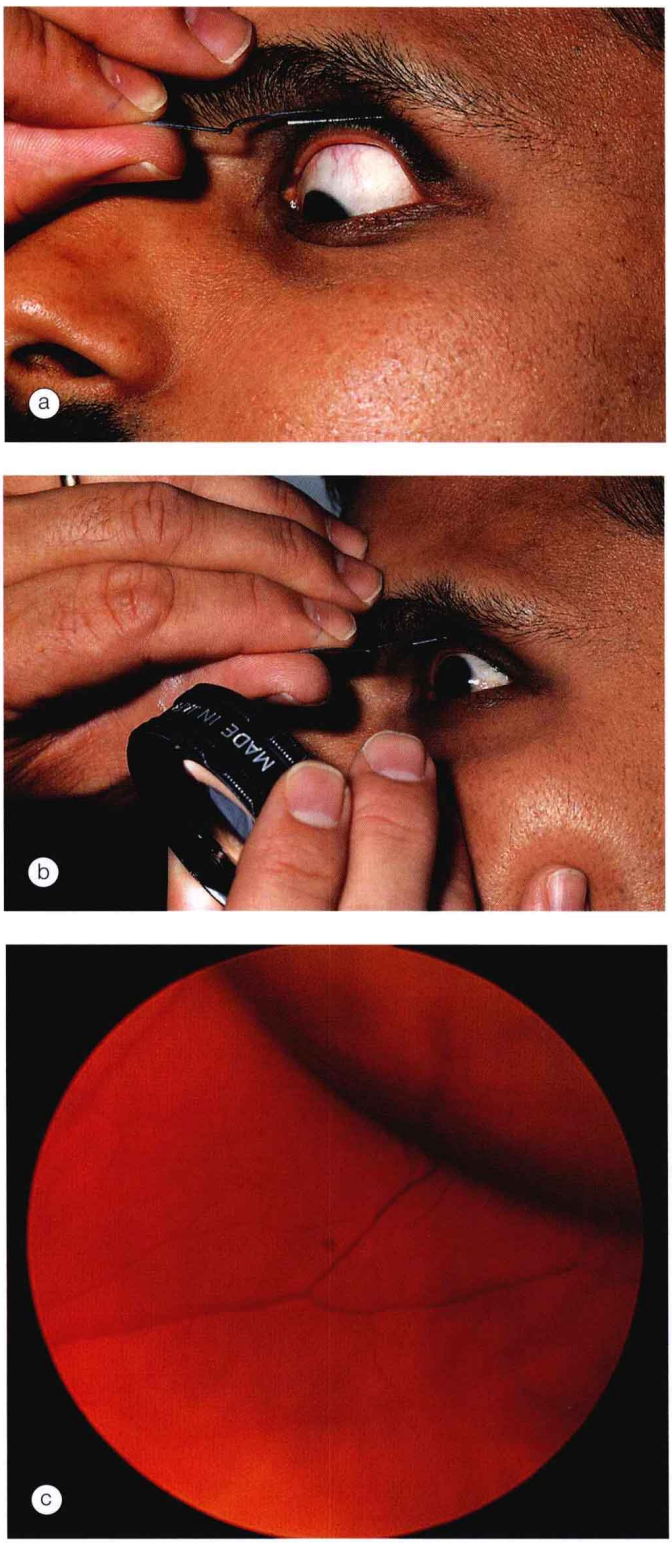

Fig. 1.11
Sclera indentation; **(a)** Insertion of indenter; **(b)** indentation; **(c)** mound created by indentation
(Courtesy of N E Byer, from *The Peripheral Retina in Profile, a Stereoscopic Atlas*, Criterion Press, Torrence California, 1982 – fig. c)

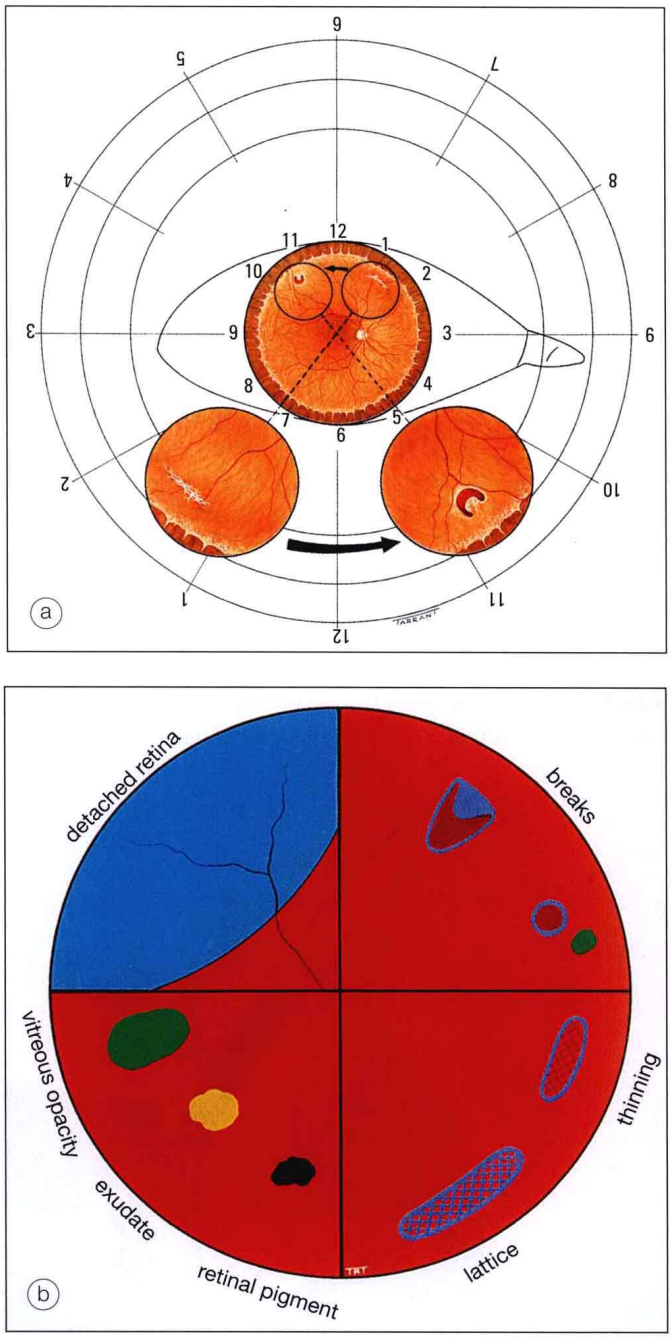

Fig. 1.12
Technique of drawing retinal lesions. **(a)** Position of chart in relation to the eye; **(b)** colour code for documenting retinal lesions