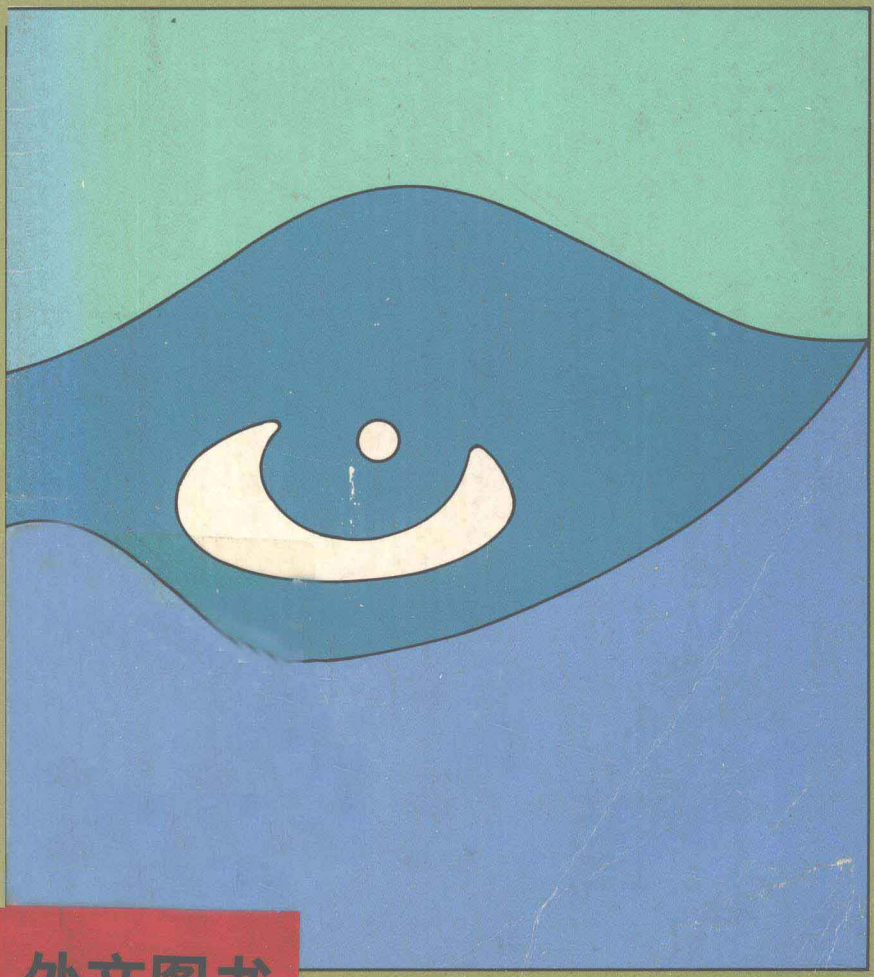
Manual of Ocular Diagnosis and Therapy

Edited by Deborah Pavan-Langston, M.D.



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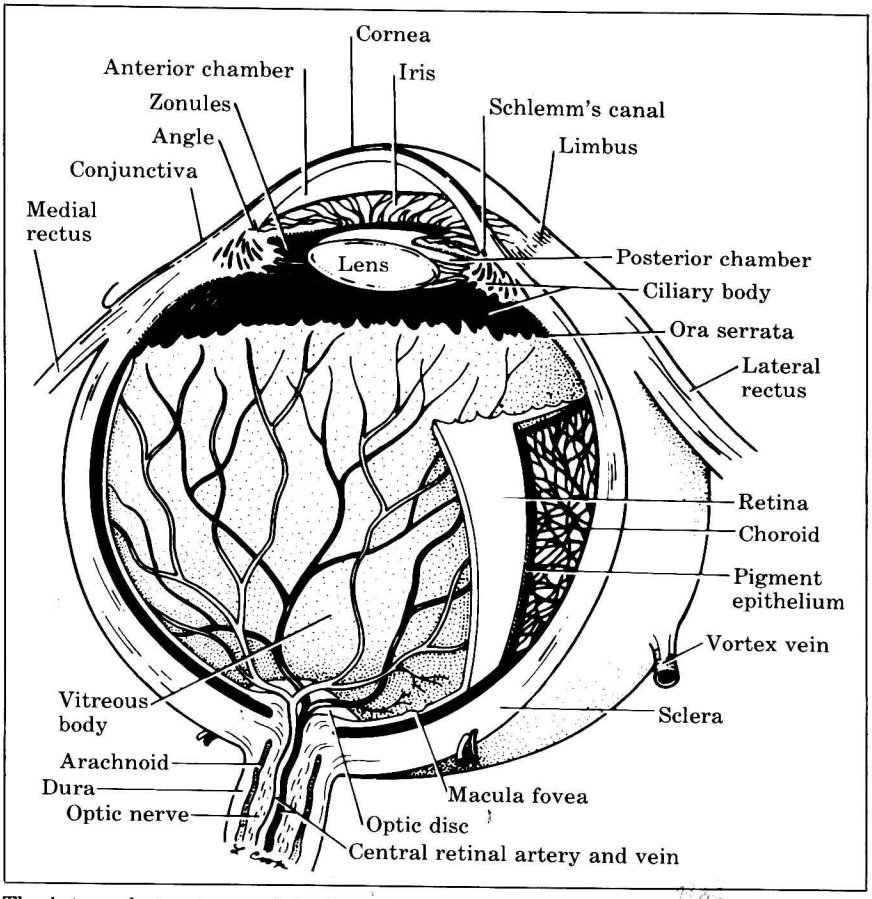

The internal structures of the human eye. Adapted from the original drawing by Mr. Paul Peck, *Anatomy of the Eye*. Courtesy of Lederle Laboratories, Pearl River, N.Y.

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Preface

The object of this exercise was to put together a detailed but highly practical manual on ocular diagnosis and therapy that would be of use to the doctor "up front"; the one sitting face to face with a patient. This book is written for the widest possible audience: the practicing ophthalmologist, the emergency room physician, the internist, the family practitioner, the pediatrician, the neurologist, house officers in any discipline, and medical students. It is for anyone involved in decisions concerning either care of the eyes or what the eyes can tell us about other care needed by the patient.

Each section covers the clinical findings of given ocular problems, diagnostic tests, differential diagnosis, and treatment. The subject matter varies widely, including such topics as the simple removal of corneal foreign bodies to management of chemical burns, antibiotics and infections, use of corticosteroids and immunosuppressive agents, extraocular muscle imbalance, and neuroophthalmic problems. The ocular findings in systemic disease and the ocular toxicities of systemic drugs are thoroughly tabulated by disease or drug for easy reference. The straightforward outline form of the text, the index, the drug formulary, drawings, and tables are all designed such that information can be rapidly located and a pertinent review brought quickly to hand.

Each author was selected primarily for his or her skill as a practicing physician or surgeon with expertise in the area covered. All are knowledgeable in clinical and laboratory research as well and are, therefore, up to date or new developments in the field. I am indebted to these fine physicians for their contributions to this book.

Ms. Kathleen O'Brien of Little, Brown and Company has been an encouraging and helpful editor. I acknowledge also the excellent drawings of Ms. Laurel Cook and Mr. Peter Mallen and am most appreciative of the assistance given me by Ms. Patricia Geary, Ms. Mary Lou Moar, and Ms. Denise Brown. Without the help of all these people, and countless others too numerous to mention by name, this book might never have been published.

D. P.-L.

Notice

The indications and dosages of all drugs in this book have been recommended in the medical literature and conform to the practices of the general medical community. The medications described do not necessarily have specific approval by the Food and Drug Administration for use in the diseases and dosages for which they are recommended. The package insert for each drug should be consulted for use and dosage as approved by the FDA. Because standards for usage change, it is advisable to keep abreast of revised recommendations, particularly those concerning new drugs.

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Ocular Examination Techniques and Diagnostic Tests

Deborah Pavan-Langston

I. General principles

A. Physical examination and evaluation of the ocular system is greatly facilitated by a number of techniques that may be performed in the office using equipment readily available through any optical or medical supply house. Some of the more complicated techniques, however, must be performed by a specialist in a hospital setting. These are discussed with a view to their indications, how they are done, so that the referring examiner can explain to a patient what might be expected, and, finally, what information will be forthcoming to aid the examiner in his management of the patient.

B. Order of exam. Examination of the eye and its surrounding tissues with and without special aids may yield valuable information for the diagnosis and treatment of primary ocular disease or disease secondary to systemic problems. So that nothing is overlooked, a systematic routine should be adopted and particular attention given to those factors that brought the patient to testing in the first place. With time and increased experience, an exam that initially may take a somewhat prolonged period of time can be shortened significantly with no loss of accuracy and frequently with increased accuracy of perception. Individual chapters should be referred to for related detail.

C. The general order for nonemergency exam is as follows:

1. **History.** Present complaints, previous eye disorders, family eye problems, present and past general illnesses, medications, and allergies.
2. **Visual acuity.** Distant and near without and with glasses, if used, and with pinhole if less than 20/30 is obtained.
3. **Extraocular muscle function.** Range of action in all fields of gaze, stereopsis testing, screening for strabismus and diplopia.
4. **Color vision testing**
5. **Anterior segment examination** under some magnification if possible (loupe or slit lamp), with and without fluorescein or rose bengal dyes.
6. **Intraocular pressures**
7. **Ophthalmoscopy** of the fundi
8. **Confrontation or other field testing**
9. **Other tests** as indicated by history and prior exam
   a. Tear film adequacy
   b. Corneal sensation
   c. Transillumination
   d. Exophthalmometry

e. Keratoscopy

f. Keratometry

g. Tonography

h. Gonioscopy

i. Ultrasonography

j. Fluorescein angiography

k. Electroretinography and electroculography

l. Radiology

Procedures **f** through **k** are done by specialists in eye care and referral should be made if such testing is indicated.

II. Routine office examination techniques

A. Visual acuity. Determination of visual acuity is a test of macular function and should be part of any eye examination regardless of symptomatology or lack thereof.

1. Distant visual acuity. Visual acuity is examined one eye at a time, the other eye being occluded. Pressure on the occluded eye should be avoided so that there will be no distortion of the image when that eye is tested subsequently. If the patient normally wears glasses, the test should be made both with and without his corrected lenses and recorded as "uncorrected" (sc) and "corrected" (cc).

a. The chart most commonly used for distance vision with literate patients is the Snellen chart, which is situated 20 feet (approximately 6 meters) away from the patient and diffusely illuminated without glare. At this distance the rays of light from the object in view are almost parallel and no effort of accommodation (focusing) is necessary for the normal eye to see the subject clearly. The Snellen chart is made up of letters of graduated sizes with the distance at which each size subtends an angle of 5 minutes indicated along the side of the chart. The farther one is from an object, the smaller the retinal image. By combining the two factors of size and distance it is possible to determine the minimal visual angle, i.e., the smallest retinal image that can be seen by a given eye. A normal visual system can identify an entire letter subtending an angle of 5 minutes of arc and any components of the letter subtending 1 minute of arc at a distance of 20 feet. Some patients, however, may resolve letters subtending even smaller visual angles. The vision of a normal eye is recorded as 20/20, or 6/6 in metric measurement. If the patient is able to read down only to the 20/30 line the vision is recorded as 20/30. If he is unable to read even the large E at the top, which subtends an arc of 400', the patient may be moved closer so that the distance measurement is changed. The visual acuity may then be recorded as 10/400, for instance, if the patient is able to read this letter at 10 feet from the chart.

b. Pinhole vision is tested if the patient is unable to read the 20/30 line. A pinhole aperture is placed in front of the eye to ascertain any improvement in acuity. The use of a pinhole will correct for any uncorrected refractive error such as nearsightedness, farsightedness, and astigmatism (regular or irregular from corneal surface abnormalities) without the need for lenses. Through the pinhole a patient with a refractive error should read close to 20/20. If the pinhole fails to improve his visual acuity score the examiner must suspect another cause for the reduced vision, such as opacities in the ocular media or macular or optic nerve disease.

c. **Preschool children** or **patients who are unable to read** should be shown the Illiterate E chart, which is made up entirely of the letter E facing in different directions. The patient is instructed to point his finger in the direction of the bars of the E. Children as young as 3 years of age may be able to cooperate in this testing. Another form of testing is with Allen cards, which are small cards with test pictures printed on each one such that at a distance of 20 feet a visual acuity of 20/30 may be tested. If the patient is unable to identify the pictures at that distance, the distance at which the picture is identified is recorded, e.g., 10/30, 5/30, and so on.

d. **If a patient is unable to identify any letter** on the chart at any distance, visual acuity is recorded as counting fingers (CF) at whatever distance the patient is able to perform this function, e.g., CF 3. Vision less than counting fingers is recorded as hand motion (HM) or light perception (LP). If an eye is unable to perceive light the examiner should record no light perception (NLP) rather than the misleading term *blind*.

e. **Tests of light projection** may demonstrate normal retinal function when vision is extremely poor and the **examiner is unable to see the retina,** as in the presence of mature cataract or severe corneal scarring. This is done by covering the other eye completely and holding a light source in four different quadrants in front of the eye in question. The patient is asked to identify the direction from which the light is approaching the eye. A red lens is then held in front of the light and the patient is asked to differentiate the red from the white light. If all answers are correct the examiner may be reasonably certain the retinal function is normal. It is important to note that normal retinal and macular function may be present despite abnormal light perception due to unusually dense anterior segment disease, which prevents light sufficient to give the retina proper stimulation from reaching it.

f. **Macular photostress test.** Very early macular dysfunction, whether from spontaneous or toxic degeneration, may be detected by the macular photostress test. The patient looks at a flashlight held 2 cm from the eye for 10 seconds. The time it takes for visual recovery to one line less than the visual acuity determined prior to this test is measured. Normal time is about 55 seconds. Recovery taking longer than this indicates macular dysfunction even though the area may appear anatomically normal.

g. **Macular function** may be tested in the presence of **opaque media** by gently massaging the globe through closed lids with the lighted end of a small flashlight. If the macula is functioning normally the patient will usually see a red central area surrounded by retinal blood vessels. If macular function is abnormal the central area will be dark rather than red and no blood vessels will be seen.

h. **Legal blindness.** Visual acuity correctable by glasses or contact lenses to 20/200 or less in both eyes or visual fields of less than 10° centrally constitutes legal blindness in the United States. Its presence requires that the patient be reported to the Commission for the Blind in the patient's home state. Report forms are short and readily available from the Commission.

2. **Close visual acuity.** Close visual acuity is usually measured using a multipurpose reading card such as the Rosenbaum Pocket Vision Screener or the Lebensohn Chart. The patient holds the chart approximately 14 inches from the eye and reading separately with each eye with and without glasses reads the smallest print he is able to identify. This may then be recorded directly from the chart as 20/30, 20/25, or as Jaeger

equivalents J-1, J-2. In patients older than the late 30s the examiner should suspect uncorrected presbyopia if the patient is unable to read a normal visual acuity at 14 inches but is able to read it completely or at least better if the card is held further away. Abnormally low close vision in an elderly patient without reading glasses is meaningless per se except for comparative purposes in serial exams of the severely ill.

B. Extraocular muscle function. The movement of the eyes in all fields of gaze should be examined. **(See Chap. 11, I, XI.)**

1. In the **primary position of gaze,** i.e., straight ahead, the straightness, or orthophoria, of the eyes may be ascertained by observing the reflection of light on the central corneas. The patient is asked to look directly at a flashlight held 1 foot in front of the eye. Normally the light reflection is symmetrical and central in both corneas. The asymmetric positioning of a light reflex in one eye will indicate deviation of that eye. Location of the reflex on the nasal side of the central cornea indicates that the eye is aimed outward or exotropic; location of the reflex temporal to the central cornea indicates that the eye is deviated inward or esotropic. Each millimeter of deviation is equivalent to 7° or 15 diopters of turn. A paretic or paralytic extraocular muscle would be the cause of such ocular deviation. Vertical deviation may be determined by noting the location of a light reflex above or below the central cornea. In some patients the light reflex will be slightly inside or outside the central cornea due to a normal difference between the visual axis and the anatomic axis between central cornea and the fovea. This angle is referred to as the **angle kappa** and is positive if the eye appears to be deviating outward, negative if the eye appears to be deviating inward.

2. **Cardinal positions of gaze.** The patient is asked to look in the six cardinal positions of gaze, i.e., left, right, up and right, up and left, down and right, down and left. **Congruity** (parallelism) of gaze between the two eyes should be noted as well as the extent of the excursion. The examiner should check for restriction of gaze in any direction or for double vision in any field of gaze due to restriction of one eye. Occasionally, involuntary movement may occur in normal patients at the extremes of gaze; this is referred to as end-gaze or physiologic nystagmus. **Nystagmus** is a short excursion, back and forward movement of the eye that may be fine or coarse, slow or rapid. Occasionally, fine rotational nystagmus may also be observed. Except in end-gaze nystagmus this rotational nystagmus may bear further investigation. **(See Chap. 11, XI.)**

3. **The near point of conversion (NPC)** is the point closest to the patient at which both eyes converge on an object as it is brought toward the eyes. This is normally 50 to 70 mm in front of the eye. The moment one eye begins to deviate outward, the limit of conversion has been reached. An NPC greater than 10 cm is considered abnormal and may result in excessive tiring of the eyes on close work such as reading or sewing.

4. **Stereopsis** is tested grossly by having the patient touch the end of his finger to the tip of the examiner's finger coming in horizontally end to end. Past pointing may indicate lack of depth perception in the absence of central nervous system disease. More refined testing is done using the Wirt Test fly, circle, and animal figures with 3-D glasses. Stereopsis may be graded from the equivalent of 20/400 (large fly) to 20/20 (nine circle depth perception) using this commercially available test. Simultaneous perception of four red and green lights while wearing glasses with a red lens over one eye (eye sees only red) and a green over the other (eye sees only green) indicates a more gross but significant form of fusion. This test is the Worth Four Dot Test and is also available commercially.

C. Color vision testing

1. **Purpose.** Demonstration of adequate color vision is mandatory for certain jobs in a number of states and for obtaining a driver's license. Jobs affected are armed services trainees, transportation workers, and others whose occupations require accurate color perception. Color vision may be disturbed in early macular disease, whether toxic or idiopathic degenerative, and in optic nerve disease, particularly in nutritional deficiencies such as avitaminosis A. Some of the earliest and reversible drug toxicities, such as that from chloroquine, are detected by repeated color vision testing; regression and progression may also be documented. These tests are designed for:

   a. **Screening defective color vision from normal**

   b. **Qualitative classification** as to type of defect. Protans and deutans are red-green deficient and found in 4.0% of all males and 0.4% of all females; tritans and tetartans are very rare and blue-yellow deficient.

   c. **Quantitative analysis** of degree of deficiency. Mild, medium, marked.

2. **Technique.** The most commonly used tests are the polychromatic plates of Ishihara, Stilling, or Hardy-Rand-Ritler. The progressively more subtle and difficult plates are made up of dots of primary colors printed on a background of similar dots in a confusion of colors or grays. These dots are set in patterns, shapes, numbers, or letters that would be recognized by a normal individual but not perceived by those with color perception defects. Patients are shown a series of plates, the number of correct answers totaled in various color test areas, and the type and severity of any deficiency thus defined.

D. Anterior segment examination (See Frontispiece.)

1. **Magnifying loupes.** The external examination of the eye itself is greatly facilitated by the use of a bright light source such as a flashlight or transilluminator and a magnifying loupe. There are many different kinds of loupes available but basically they may be divided into two categories. One form is worn as a spectacle loupe and has magnification ranging from 2× to 5× with working distances ranging between 8 and 14 in. These magnifying spectacles may be mounted on the normal prescription glasses if these are worn by the examining physician. The second form of loupe is a headband loupe, which can range in power from 1.75× to 5.25× with working distances ranging between 8 and 20 in. Loupes are of great help in evaluating not only local tissue changes and location of corneal abrasions and staining but in minor surgical procedures and the removal of corneal foreign bodies. Hand-held magnifiers do not leave both hands free for other purposes.

2. **Eyelids and palpebral fissures.** Under good lighting conditions the lashes and eyebrows should be inspected for the presence of inflammation, scaling, or dandruff, and the lashes also for orientation, i.e., being turned in or out, misdirected, missing, or present as more than one row. Focal changes in pigmentation are also important to note. The observer should note the general appearance of the lid margins as to color, texture, swelling, position, and motility. Note should be made of signs of inflammation, pouting of the meibomian gland openings, rash, unusual vascularity, or old scars. The normal lid margins should overlie the corneal limbus by 1 to 2 mm above and below with no exposure of sclera. Voluntary lid closure should be complete with no inferior exposure. Involuntary blinking should occur every 3 to 6 seconds with complete closure of the lids. Both upper lids should elevate well on upward gaze

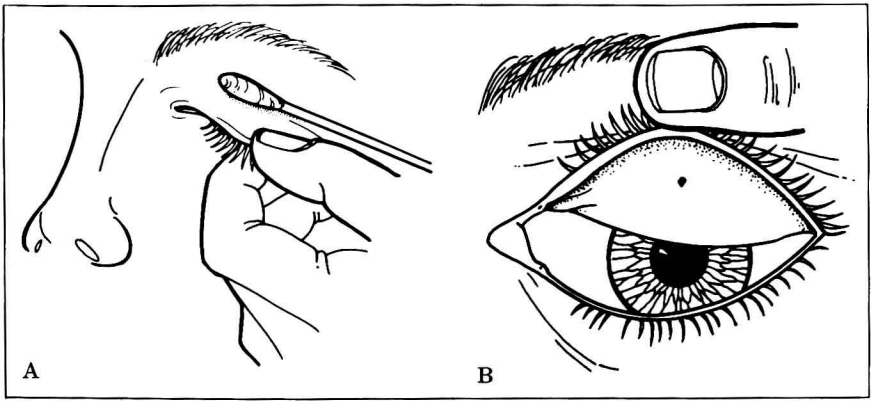

Fig. 1-1. A. Technique of lid eversion. **B.** Foreign body easily located with everted lid held against upper orbital rim.

and drop on downward gaze. The space between the upper and lower lid margin ranges normally between 9 and 13 mm. This measurement is not so critical as is a disparity in the size of this measurement between the two eyes in a given patient. The lid margins should follow the globe synchronously on downward and upward gaze without evidence of lid lag. The borders should have good anatomic apposition to the globe with the tear puncta (upper and lower punctal openings are located 2 to 4 mm temporal to the medial canthus in contact with the tear film which they drain).

3. **Lid eversion.** The upper lid may easily be everted for inspection of the palpebral conjunctiva by having the patient look down while the examiner grasps the lashes with one hand, pulling out and down, pressing on the lid with a cotton-tip applicator stick 1 cm above the edge of the lid margin, i.e., at the superior border of the tarsal plate, and flipping the lid over the stick (Fig. 1-1 A and B). In the presence of pain a topical anesthetic may assist in this part of the examination. To restore the everted upper lid the examiner simply asks the patient to look up and simultaneously pulls the lashes gently down. The lower palpebral conjunctiva is easily seen by pressing down over the bony maxilla to pull the lid down with a finger and asking the patient to look up.

4. **The main lacrimal gland** is situated at the superior temporal quadrant of the orbit. It may be seen as a globulated pink mass under the upper eyelid when the patient is asked to look down and nasally and traction is placed on the upper outer eyelid. Tears are carried from this gland as well as the accessory lacrimal glands in the conjunctiva from the supero-temporal quadrant of the eye down toward the infranasal area where tears pass through the lacrimal canaliculi via the puncta and down into the lacrimal sac. From there they enter the nasolacrimal duct opening under the inferior turbinate of the nose. Tears flow down the back of the throat, thereby occasionally giving patients the taste of medication instilled into the conjunctival cul-de-sac.

5. **The bulbar (eyeball) conjunctiva** is examined by gentle separation of the lids and asking the patient to look in all directions of gaze—up, down, right, and left. The normal conjunctiva is a thin membrane almost entirely transparent and appearing white, although a few patients may