disorders. Nystagmus may be horizontal, vertical or torsional.

- ***Nystagmoid jerks:*** When the vision is impaired in infancy, the eyes often move arrhythmically and show searching movements.

2. Lids

- ***Mongoloid obliquity of the palpebral aperture:*** Normally, in the configuration of palpebral fissure, the level of medial and lateral canthi is more or less same, but in Mongolians the lateral canthus is at a higher level than the medial.
- ***Antimongoloid obliquity of the palpebral aperture:*** It is seen in Crouzon's disease wherein the outer canthus is at a considerably lower level than the medial.
- ***Epicanthus:*** A semilunar fold of skin runs over the inner canthus resulting in a pseudostrabismic appearance. It is usually congenital, bilateral and associated with ptosis. Epicanthus is a racial characteristic of Mongolians.
- ***Telecanthus:*** It is an abnormally increased intercanthal distance although the interpupillary distance remains normal. The condition is developmental and seen in Waardenburg syndrome.
- ***Blepharophimosis:*** The palpebral aperture may be all around narrow and is seen as a congenital anomaly.
- ***Ptosis:*** Ptosis is drooping of the upper lid. It is often seen as congenital anomaly or may be acquired due to trauma or CNS disorders (*Refer* 9.1 and 10.7).
- ***Retraction of the upper lid:*** Usually, the upper lid covers the upper one-sixth of the cornea. The upper limbus is visible due to contraction of the upper lid seen in thyrotoxicosis or sympathetic overactivity.
- ***Distichiasis:*** Distichiasis is a congenital anomaly of eyelashes marked by the presence of an additional posterior row of eyelashes which often cause irritation.
- ***Trichiasis:*** The eyelashes are directed forward and laterally. An inward misdirection of a solitary eyelash or a few eyelashes is known as trichiasis. It causes FB sensation and watering.
- ***Entropion:*** A complete in rolling of the upper or lower lid margin is called entropion, it is easy to diagnose (*Refer* 9.3).
- ***Ectropion:*** Ectropion is a mild sagging of the lower lid margin is commonly seen in old age. It induces annoying epiphora owing to the loss of contact of the lower punctum with the lacus lacrimalis (*Refer* 9.4).
- ***Coloboma of lid:*** A notch is found at the junction of medial-third and middle-third of the upper lid as a developmental defect associated with dermoid seen in Goldenhar syndrome.
- ***Edema of the lid:*** Edema of lid is common because of looseness of its skin. It may be caused by inflammatory conditions of lid, conjunctiva, lacrimal sac and orbit. Passive edema of lid may be found in cavernous sinus thrombosis, nephrotic syndrome, CCF, hypoproteinemia, etc.
- ***Lid signs of Graves' disease***
  - Dalrymple sign: Unilateral or bilateral upper eyelid retraction is the most common (90%)
  - von Graefe: Upper eyelid lags on down gaze
  - Gifford sign: Eversion of upper eyelid is difficult
  - Stellwag sign: Infrequent and incomplete blinking
  - Kocher sign: Spasmatic retraction of upper lid during fixation
  - Rosenbach sign: On gentle closure or taping, tremors of eyelids may be evident

6. Visual acuity in children older than 3 years can be tested by Tumbling E test, HOTV test and Allen cards.

2.2 COLOR VISION TESTING

1. Various methods are available to assess the color vision in an individual. Color vision testing is essential before recruitment in certain jobs such as railway, navy, air force, etc.
2. Ishihara pseudoisochromatic plate test (Fig. 2.2) is commonly used to assess the color status of a patient. The test is based on the principle of color confusion. Other tests developed based on this principle include American optical company plates, Hardy-Rand-Rittler plates, Tritan plate and Dvorine booklet.
3. Some tests have been developed on the basis of color matching. They are Sloan achromatopsia test, Nagel's spectral matching test and Pickford-Nicolson anomaloscope.
4. Edridge-Green lantern, Farnsworth lantern test (Falant) and Homes-Wright lantern tests measure the proficiency of a person to recognize the color signals but do not grade the color vision defects.
5. Farnsworth-Munsell 100 hue test assesses the individual's ability to discriminate hues of color. It is an arrangement test consisting of 85 color chips of different hues. Patients with color deficiency make error in arranging the chips in each row in 2 minutes. Scores of knob/caps are plotted on a circular graph. The test can detect all types of color deficiencies.
6. Farnsworth D-15 test has only 15 color chips and is a more rapid than the 100 hue test.

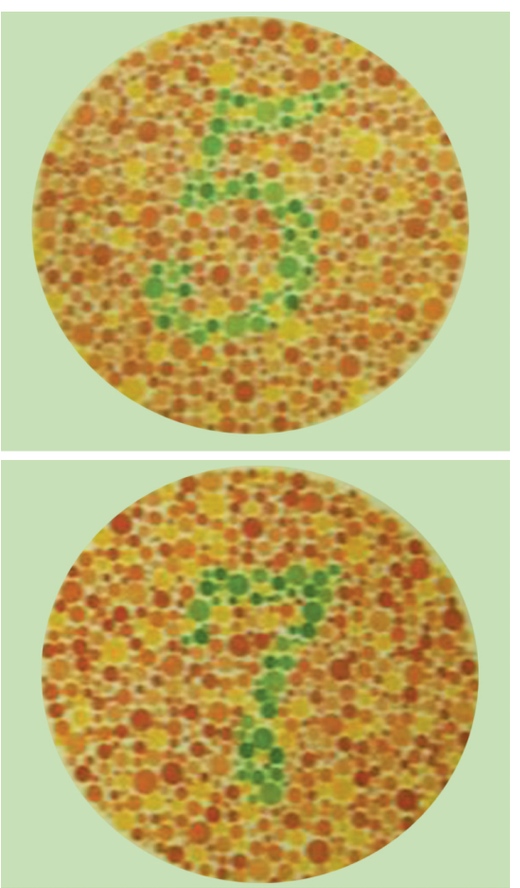

Fig. 2.2: Ishihara color vision plates

2.3 SLIT-LAMP EXAMINATION

Slit-lamp examination (Fig. 2.3) is the most important procedure in diagnosing diseases

Fig. 2.3: Slit-lamp examination

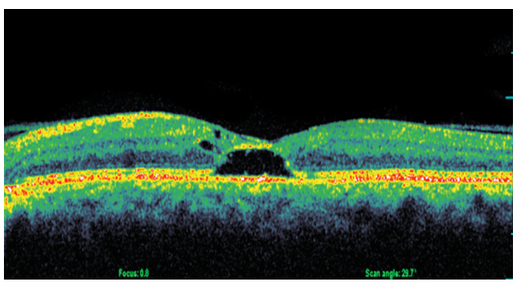

Fig. 2.11: Optical coherence tomography showing impending macular hole

edema (CME), serous RPE detachment, drusen, retinal detachment, optic neuropathy, optic neuritis and papilledema.

4. Measurement of retinal nerve fiber thickness and optic disk cup, volume and rim characteristic may help in the early diagnosis of glaucoma.

2.17 FLUORESCEIN ANGIOGRAPHY

1. Fundus fluorescein angiography is of a useful diagnostic procedure for diseases of retina and optic nerve.
2. Serial photographs of fundus are taken after IV injection of 3 mL 25% sterile sodium fluorescein.
3. There are six phases in FFA:
   - Prearterial phase
   - Arterial phase
   - Arteriovenous phase
   - Venous phase
   - Recirculation phase
   - Late phase
4. The RPE and the endothelium of the retinal vessels act as barriers to fluorescein and thus the dye remains confined to the intravascular space.
5. Figure 2.12 shows an angiogram. The fluorescein in retinal disorders may either show hyperfluorescence or hypofluorescence.
6. Hyperfluorescence manifests in the form of leakage, pooling, staining, window defects, and autofluorescence.

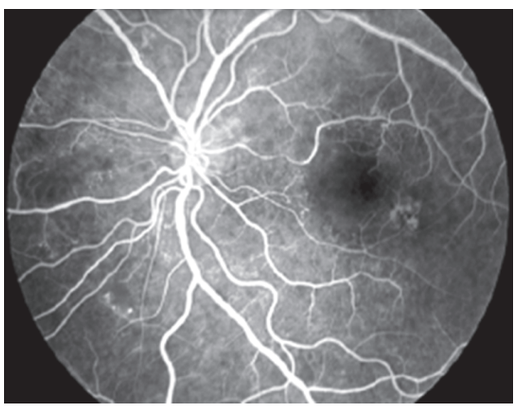

Fig. 2.12: Fluorescein angiogram

7. Leakage is found in neovascularization of retina, proliferative diabetic retinopathy, AMD, papilledema, central serous choroidopathy and CME.
8. Pooling of fluorescein can be seen in REP detachment and central serous choroidopathy.
9. Staining may be found in retinal scar and drusen.
10. Window defects are seen in areas of RPE atrophy and laser scars.
11. Autofluorescence of optic nerve drusen can be recorded before the FFA.
12. Hypofluorescence occurs in central retinal vessel occlusion, and capillary nonperfusion. Retinal hemorrhages and pigmentation mask the fluorescein and lesions look hypofluorescent.

2.18 INDOCYANINE GREEN ANGIOGRAPHY

1. Indocyanine green angiography (ICGA) is an invaluable imaging technique used for studying the choroidal circulation and lesions. The indocyanine green is not absorbed by hemoglobin, melanin and exudates.
2. The ICG angiography shows much better choroidal circulation and subretinal vascularization than FA.
3. ICGA is used in the diagnosis of occult choroidal neovascularization (CNV),

- Tear meniscus height is reduced.
- Tear breakup: Put a drop of fluorescein and examined the eye on slit lamp. Ask the patient to blink. The time taken between the last blink and development of first dry spot on the cornea is known as tear breakup time (Fig. 2.21). The normal breakup time ranges between 15 and 35 seconds. A time of less than 10 seconds or less indicates dry eye.
- Schirmer test: The aqueous production is measured with the help of a 5 × 35 mm Whatman paper strip. About 5 mm of the bent strip is kept in the lower fornix and wetting of the strip from the bent part is measured after 5 min. A secretion of less than 5 mm suggests dry eye.
- Rose Bengal staining: It detects damaged and dead epithelial cells. A staining of bulbar conjunctiva is diagnostic of keratoconjunctivitis sicca.
- Fluorescein staining: It may show diffuse staining of cornea with filaments in the dry eye.
- Lissamine green B: It detects dead or degenerated cells and causes less irritation than rose Bengal.
- Fluorescein clearance test: The dye is instilled in the conjunctiva and the color of the lower tear meniscus is compared with the standardized scale.
- Tear film osmolarity: It has great sensitivity and specificity and considered a gold standard test for the diagnosis of dry eye disease.
- Tear ferning: Ferning pattern of conjunctival scraping under microscope is a quantitative test for mucin deficiency.
- Conjunctival impression cytology: It allows the evaluation of conjunctival epithelium and goblet cells of the ocular surface. A decrease in the density of goblet cells and metaplastic change in the epithelium indicate mucous deficiency and tear film instability.
- Lysozyme and lactoferrin assays: Lysozyme and lactoferrin concentrations are low in dry eyes.
- Serum autoantibodies: Antibodies (anti-Ro or anti-La) have been detected in Sjögren's syndrome.

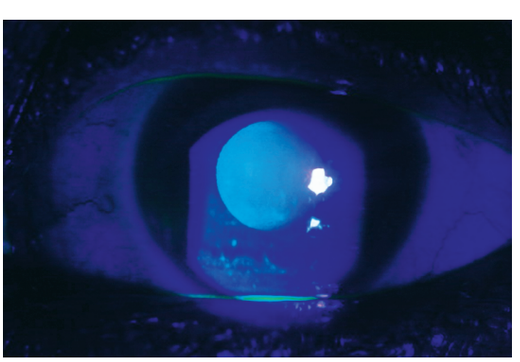

Fig. 2.21: Measurement of tear break-up time (BUT)

2.32 DIAGNOSTIC PROCEDURES FOR INFECTIOUS KERATITIS

1. Infectious keratitis is caused by bacteria, fungi, parasite and viruses.
2. Different protocols are usually followed for diagnosis of these etiological agents.
3. Basic investigative procedures include characteristic clinical picture, examination of smear, culture on specific media and sensitivity test, corneal biopsy, immunology and molecular biology based tests.
   - Corneal scrapings for smear should be collected by using platinum spatula or disposable blade after topical anesthesia. The collected material is spread over a small area on glass slides. The smears are fixed with KOH and stained with Gram for light microscopy (Fig. 2.22). Smear stained with calcoflur white or acridine need fluorescent microscopic examination.
   - Organisms identified during smear examination provide basis for provisional diagnosis. Gram-positive bacteria, fungi and *Acanthamoeba* can be easily recognized by Gram staining. Fungal hyphe