American Journal of Bioscience and Clinical Integrity
https://biojournals.us/index.php/AJBCI
ISSN: 2997-7347

The Role of OCT in Determining the Location of Extraocular Muscles!

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Received: 2025, 15, Feb
Accepted: 2025, 21, Mar
Published: 2025, 28, Apr

Annotation: An eye examination can be performed using standard equipment, such as an ophthalmoscope; a more thorough examination requires specialized equipment and a report from a qualified ophthalmologist.

The history includes questions about the location, onset, rate of progression, and duration of current symptoms; the presence and nature of pain, discharge, and redness of the eye; and changes in visual acuity. In addition to vision loss and pain, warning signs may include flashing lights and floaters (both of which may indicate retinal detachment), double vision, and loss of peripheral vision.

Keywords: OCT, methods, modern clinical diagnostics, diagnostics, diagnosis.

Introduction: The first step in an ophthalmologic examination of a patient is to determine visual acuity. However, many patients do not make sufficient effort. Allowing adequate time for the examination and verbally encouraging patients usually leads to more accurate examination results. The patient's visual acuity should be measured both with and without glasses. If the patient does not have glasses, a perforated diaphragm can be used. If you do not have commercial apertures for testing vision, you can easily make several holes of different diameters in a piece of cardboard using an 18-gauge needle. The patient should choose the hole that improves vision. If visual acuity improves significantly with the diaphragm, the problem is refractive error. Using a diaphragm is a quick and effective way to diagnose refractive problems, which are the most common cause of blurred vision. The maximum correction achievable with a diaphragm is usually 20/30 (0.66 according to the Sivtsev-Golovin table), but not 20/20.

To check visual acuity, you need to cover the other eye with a hard object (it is better not to cover the eye with your fingers, its density may change during the test). When checking vision, patients try to read a chart located at a distance of 6 m. If this test is not possible, the patient's vision can be checked using printed text or a special chart located 36 cm from the patient's eye. Normal or abnormal vision is calculated using traditional Snellen signs. The Snellen index of

20/40 (6/12) indicates that the smallest letters that can be read by a person with normal vision at a distance of 12 m must be moved to a distance of 6 m for the patient to recognize them. Visual acuity is determined by the smallest line at which the patient can read half of the letters, even if the letters appear blurry or have to be guessed by their outlines. If the patient cannot read the largest line on the chart at a distance of 6 m, the test should be repeated at a distance of 3 m. If the patient cannot read the lines on the chart even at the closest distance, the following test should be performed: the doctor holds a different number of fingers in front of the patient to see if he can count them accurately. If not, it should be checked whether the patient can perceive the movement of the hand. If not, a light is shone into the patient's eyes to see if he can perceive light.

Near visual acuity is tested at a distance of 36 cm using a standard chart or newspaper; patients over 40 years of age who wear glasses or contact lenses should wear them to test near vision.

Research methods and materials: An approximate estimate of refractive error can be made using a hand-held ophthalmoscope, selecting the lenses necessary to focus the retinal image; To do this, you must use your own lenses to check your vision. This procedure is not a substitute for a comprehensive refractive assessment. Most often, refractive errors are assessed using a standard phoropter or an automated refractometer (a device that measures changes in the reflection of light projected onto the patient's retina). The same devices help to assess the degree of astigmatism (see: Overview of refractive error).

The eyelid margins and periorbital tissues are evaluated under focused light and magnification (e.g., loupe, slit lamp, or ophthalmoscope). If dacryocystitis or canaliculitis is suspected, the lacrimal sac is palpated and its contents are aspirated through the lacrimal canaliculi and puncta. By inverting the eyelid, the conjunctiva of the eyelids, the eyeball, and the conjunctival fornix can be examined for the presence of a foreign body, signs of inflammation (e.g., follicular hypertrophy, presence of exudate, hyperemia, edema), or other abnormalities.

Blurred edges or blurring of the light reflex (the reflection of light from the cornea) is a sign of a violation of the integrity or thickening of the corneal surface, such as corneal erosion or keratitis. Corneal erosions and ulcers can be detected using fluorescent staining. If the patient is experiencing pain or if the cornea or conjunctiva must be touched (for example, to remove a foreign body or measure IOP), the patient may be given local anesthesia with a 0.5% procaine or 0.5% tetracaine solution to facilitate the examination. A sterile fluorescein test strip is moistened with a drop of sterile saline or local anesthetic and applied to the inside of the lower eyelid while the patient is looking upward. The patient then blinks several times to distribute the dye throughout the tear film; the examination is performed under magnification under a cobalt blue lamp. Areas of non-epithelial tissue on the cornea or conjunctiva (due to erosion or ulceration) are stained fluorescent green.

The size and shape of the pupils, as well as the reaction of each eye to light at a distance, are assessed separately. Direct and friendly reactions are tested using the alternating light test. The test is carried out in 3 stages:

A beam of direct light is directed at one of the pupils until it contracts maximally (1-3 seconds).

Results: Normally, the pupil contracts equally when light is directed at it (direct response) and when light is directed at the other eye (consensus response). However, if light perception in one eye is impaired due to damage to the afferent part of the reflex arc (from the optic nerve to the chiasm) or extensive damage to the retina, the consensual response of the affected eye is more pronounced than when looking directly. Thus, in the third stage of the interval light test, when light is directed back to the affected eye, the pupil paradoxically dilates. This is called a relative afferent pupillary defect (RAPD or Marcus-Gun pupil).

Using finger movement or a flashlight, the doctor will ask the patient to look in 8 directions (up, up and right, right, down and right, down, down and left, left, up and left) while assessing the patient for signs such as line of sight deviation, limited eye movement, uncoordinated eye movement, or a combination of these symptoms.

Ophthalmoscopy (examination of the posterior segment of the eye) can be performed using a portable ophthalmoscope or a portable lens in conjunction with a slit-lamp biomicroscope. Indirect ophthalmoscopy can be performed using a head-mounted ophthalmoscope and a hand lens. In direct ophthalmoscopy, the examiner sets the ophthalmoscope to 0 diopters and then increases or decreases the diopter power until the focus is on the fundus. With direct ophthalmoscopy, the retina is limited in view; indirect ophthalmoscopy provides a three-dimensional view and allows for better examination of the area around the retina, where retinal detachments often occur.

The fundus view can be improved by dilating the pupil. Before dilating the pupil, the depth of the anterior chamber is determined, because if the anterior chamber is shallow, mydriasis can lead to an attack of acute angle-closure glaucoma. This examination can be performed with a slit lamp or, less accurately, with a hand light held at the temporal limbus parallel to the plane of the iris. If the medial part of the iris is in shadow, then the anterior chamber is considered shallow and dilation of the pupils should be avoided. Other contraindications to dilating the pupil include head trauma, suspected rupture of the globe, narrow anterior chamber angle, or angle-closure glaucoma.

Pupils are usually dilated with 1 drop of 1% tropicamide and/or 2.5% phenylephrine (repeat after 5-10 minutes if necessary); for a longer effect, tropicamide is replaced with 1% cyclopentolate.

Ophthalmoscopy helps to determine the transparency of the lens and vitreous, assess the ratio of the optic cup / disc diameter, and detect changes in the retina and vessels. The optic disc excavation is a central depression, the optic disc is the entire area of the optic nerve. The normal ratio of the diameters of the eye cup and nerve is from 0 to 0.4. An increase in the ratio of the excavation area to the disc diameter ≥ 0.5 indicates the loss of ganglion cells or the presence of glaucoma.

The slit lamp focuses a beam of light in height and width for precise stereoscopic examination of the eyelids, conjunctiva, cornea, anterior chamber, iris, lens, and anterior vitreous. A portable condenser lens can also be used for detailed examination of the retina and macula. Biomicroscopy is particularly useful for:

Discussion: Visual fields can be altered by damage to any part of the visual pathways from the optic nerves to the occipital lobes of the brain (see Visual Field Alteration Table and the figure "Upper Visual Pathways"). Glaucoma causes loss of peripheral vision. Visual fields can be assessed by direct comparison of the visual fields of the physician and the subject (control study) or by special studies.

In direct comparison, the patient looks intently at the examiner's eye or nose. The examiner moves a small object (such as a match or finger) from the visual periphery to each of the 4 visual quadrants and asks the patient to indicate when he or she first saw the object. By moving the small object slowly, you help the patient identify and locate it. Another way to directly examine the visual field is to hold several fingers in each quadrant and ask the patient how many fingers they can see. Each eye is examined separately. Impairments in object recognition require instrumental examination.

More precise methods include the use of a campimeter, Goldman perimetry, or computerized automated perimetry (in which visual fields are drawn by a computer based on the patient's response to flashing light cues controlled by a standardized computer program). An Amsler grid is used to test central vision. A grid distortion (metamorphopsia) or blind spot (scotoma) may indicate macular damage (e.g., choroidal neovascularization) that occurs in age-related macular degeneration (AMD).

To study color vision, 12- or 24-color Ishihara charts (in Russia, Rabkin charts are used) are usually used with numbers or symbols hidden in a field of colored dots. Patients with impaired color vision or acquired changes in color perception (for example, in optic nerve diseases) cannot see some or all of the hidden numbers. Most congenital color vision disorders involve red or green color blindness; Most acquired disorders (for example, caused by glaucoma or optic nerve diseases) involve the inability to perceive yellow or blue colors

Tonometry is a method of measuring intraocular pressure by measuring the amount of force required to dilate the cornea. Hand-held tonometers are used for screening. Local anesthesia (such as 0.5% proparacaine) is required to perform tonometry. Another hand-held tonometer, the iCare tonometer, measures the return time of a small, lightweight probe and can be used without local anesthesia. It is useful for children and is widely used by non-ophthalmologists in emergency departments. Screening can also be done using non-contact pneumotonometry; this does not require great skill because it is performed without direct contact with the cornea. A more accurate method is Goldmann applanation tonometry, but it requires more experience and is usually performed only by ophthalmologists. Screening tests for glaucoma are not limited to measuring intraocular pressure: the optic nerve should also be examined.

Fluorescein angiography is used to assess perfusion, blood vessel leakage, and neovascularization in diseases such as diabetes, age-related macular degeneration, retinal vascular occlusion, and eye inflammation. It is also useful for evaluating patients before surgery for retinal laser procedures. After intravenous administration of a fluorescein solution, the vessels of the retina, choroid, optic disc, or iris are photographed sequentially.

Indocyanine green angiography is used to visualize the retinal and choroidal vessels of the eye and can sometimes provide more detailed information about the choroidal vessels than fluorescein angiography. It is used to visualize exudative or wet age-related macular degeneration.

Optical coherence tomography (OCT) provides high-resolution images of the structures at the back of the eye, such as the retina (including the retinal pigment epithelium), choroid, posterior vitreous, and optic nerve. Retinal edema can be detected. OCT works similarly to ultrasound, but uses light instead of sound. It does not involve the use of contrast or ionizing radiation and is noninvasive. OCT is used to image macular edema or fibrous proliferation, including retinal lesions that cause age-related macular degeneration, diabetic retinopathy, macular holes, and epiretinal membranes. It is also useful for monitoring the progression of glaucoma and other optic nerve abnormalities.

Conclusion: Electrodes are placed on both the cornea and the skin surrounding the eye and the electrical activity of the retina is recorded. This method allows the assessment of retinal function in patients with retinal degeneration, but does not allow the assessment of visual acuity.

B-mode ultrasound provides two-dimensional structural information even in the presence of corneal and lens opacity that may interfere with direct examination (e.g., ophthalmoscopy). Indications for ultrasound include: evaluation of retinal tumors, detachments, and vitreous hemorrhage; localization of foreign bodies; detection of posterior sclera edema typical of posterior scleritis; B-mode also allows differentiation of choroidal melanoma from metastatic carcinoma and subretinal hemorrhage.

A-mode ultrasound is a one-dimensional ultrasound used to determine the axial length of the eye, a measurement necessary to calculate the power of intraocular lenses before implantation.

Ultrasound pachymetry is the use of ultrasound to determine corneal thickness before refractive surgery (such as laser in situ keratoplasty [LASIK]) and in patients with corneal dystrophy.

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