

Community Eye Health *Journal*

A number of common eye conditions can be detected using a torch. **INDIA**
DR. SHIVAM MAINI, OPERATION EYESIGHT



Examining the eye



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All health workers should be able to carry out a good eye examination of the front of the eye. In this issue, we explain how this can be done with limited resources.

Most patients with vision or eye problems will first be seen by a health worker who is not an ophthalmologist. In high-resource countries, this may be a general physician or an optometrist, and in low-resource settings it is more likely to be a community or primary health care worker. These health workers, who have to be able to assess any medical condition, often have limited knowledge and experience with regards to eye diseases, as well as limited equipment with which to examine the eye. This may result in health workers feeling disempowered and unable to help anyone with an eye condition. In practice, a number of common eye diseases can be diagnosed by examination of the eye with a torch and assessment of vision using a visual acuity chart, both of which are inexpensive and easy to use.

The aim of this issue is to support non-specialists to confidently carry out an eye examination.

The first step is to take a history. The presentation of common eye diseases can be usefully divided into four main groups of symptoms:

- 1 Red, sore, painful eye or eyes (including injury to the eye).
- 2 Decreased distance vision in one or both eyes, whether sudden or gradual.
- 3 A reduced ability to read small print or see near objects after the age of 40 years.
- 4 Any other specific eye symptom, such as double vision, swelling of an eyelid, watering or squint.

Continues overleaf ►





About this issue

A number of common eye diseases can be detected by examining the eye with a torch and assessing vision using a visual acuity chart, both of which are relatively inexpensive and easy to find. Carrying out a good eye examination is a skill that is worth practising and doing well, and in this issue we will show you how.

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Deciding which of these main groups of symptoms a patient is complaining of enables us to start thinking about possible different diagnoses.

The second step is to measure the vision in each eye. This is described on page 46 for distance vision and on page 47 for those with difficulties to see for reading. Note: The severity of vision loss is an indicator of how serious the eye condition is.

The third step is to examine the front of the eye using a torch (p. 48). Ask:

- Are the eyes straight? Are the eyelids normal, and do they open and close? Are the eyelashes in place? Any swelling or redness?
- Is the white of the eye white? Any redness, discharge or swelling?
- Is the window of the eye (cornea), clear? Are there any grey or white areas?
- Is the pupil black and round, and does it become smaller in bright light? Is the red reflex present?

If the answer to these questions is 'No', then this can lead to a suspected diagnosis which may be treatable (such as conjunctivitis), or require referral (such as cataract).

There are other examinations that can also be performed with non-expensive equipment, including:

- Examining the optic nerve and retina using the Arclight (p. 49)
- Testing the red reflex (p. 53)
- Measuring intraocular pressure (p. 54)
- Examining visual fields (p. 56)
- Assessing eye alignment and movement (p. 58).

Not every health worker will have the knowledge, experience and equipment to perform all these further examinations; however we hope that this issue of the *Community Eye Health Journal* will provide *all* health workers with the knowledge of how to take an eye history, measure visual acuity and perform a good examination of the external eye with a torch. We hope that this issue will provide you with the knowledge you need to feel confident in your work.

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Putting patients first: how to carry out a patient-centred eye examination



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We can provide better care if we focus on our patients as human beings, not just on their eyes.¹

1 Consider the person as a whole

From when you first meet your patients, notice how they use their vision. Are they able to walk around by themselves? Is there any evidence of pain? What other health conditions or disabilities do they have?

2 Establish a good relationship

Greet the person warmly. Introduce yourself by name and explain your role in everyday language, e.g.: "I am here to look at your eye(s) so we can find out what is wrong and how to help you." Speak in a respectful, kind and compassionate manner, and take time to get to know the person as an individual.

3 Listen

When you are taking a history, it is very important to listen very carefully; do not interrupt the patient or jump to conclusions. Ask how symptoms affect patients' daily living, and whether they have any concerns or fears, such as a fear of blindness or having eye surgery. Find out what their expectations are about the outcomes of treatment.

4 Make the patient comfortable and tell them what you are doing

Before measuring visual acuity or carrying out an examination, tell patients what you will be doing and explain what you would like them to do, e.g., point in the direction of the letters on a tumbling E chart. If it is a longer procedure, talk them through



Explaining visual acuity testing to a patient. PAPUA NEW GUINEA

Theresa Gende, Fred Hollows Foundation New Zealand (VISIONFIRST/COMPETITION) CC BY-NC-SA 2.0

the steps, particularly if they cannot see what you are doing. Ensure patients are positioned comfortably and encourage them to tell you if they experience pain or discomfort. Some patients may not feel able to tell you, so check their face periodically for any visible signs of pain and make adjustments as needed.

5 Talk about what comes next

Explain whether any further tests are necessary, or whether a referral to a specialist is needed. Tell patients what treatment they might require, including where to get medicine and how to use it. Ask them if they have any questions and ensure that they and their carers/relatives (if appropriate) have all the information they need, such as the address and clinic times if they are referred.

Reference

- 1 Du Toit R. How to do a person-centred eye health consultation. *Comm Eye Health J* 2015;28(90):36.

Before carrying out any eye procedure

Wash your hands (and afterwards too)

Use gloves if indicated (e.g., for an invasive procedure or if an eye appears infectious)

Clean or disinfect equipment

Ensure that lighting is appropriate

Clearly explain what you are going to do

Position the patient comfortably.

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How to take a complete eye history

Taking a good history not only helps you to make a diagnosis, it can also help you to understand the impact of the condition on the patient and identify any obstacles to treatment.

It is impossible to over-emphasise the importance of taking a careful history when assessing an eye patient. Taking a good history can help to focus your examination and indicate what investigations are needed. It can also help you to understand the impact of the condition on the patient and pinpoint any difficulties they may have adhering to treatment.

This is also your opportunity to focus on the patient as a person and to form a relationship of trust, respect and mutual understanding.

How to structure history taking

To ensure you don't miss anything important, structure your history taking carefully. Ask about:

- Personal and demographic data
- Reason for visit or presenting complaint
- History of presenting complaint
- Past eye history
- General medical history
- Family eye history
- Medication history
- Allergy history
- Social history

Each of these is discussed in more detail below.

Tip: You can use this bulleted list as a checklist. Copy and keep it where you can see it during history taking to help you to stay on track and ensure that you will not miss anything important.

Top tips for taking a good history

- Introduce yourself to the patient – this creates a friendly environment.
- Respect the patient's privacy and confidentiality while taking the history
- Ask questions that are direct, simple and clear. Avoid using medical terms and explain things in ordinary language as much as possible.
- Be a good listener. Avoid interrupting or rushing the patient. Show them that you are listening and paying attention: make eye contact as appropriate and ask if you are not sure about something they said. It is often useful to use open questions (e.g., how are you?) and closed questions (e.g., yes/no answers) to help focus the discussion.
- Try to see things from the patient's point of view and make an effort to understand them and their circumstances, especially when these are very different from your own.
- Be aware that patients who are older, or who have disabilities (including hearing impairment, speech difficulties or a learning disability) may need a bit more time or may struggle to express themselves. This may cause them some anxiety, so remain patient and reassure them that you are there to listen.



Make careful notes when you take a history. SOUTH SUDAN

Personal and demographic data

Ask the patient's personal details:

- Name, for identification, filing and patient follow-up
- Address and mobile phone number, for follow-up and to identify patients from areas with endemic diseases
- Age and gender, for noting down and ruling out any diseases associated with different age groups and/or sex
- Language
- Disability
- Patient's occupation, daily tasks and hobbies.

Understanding a patient's occupation, daily tasks (e.g., looking after grandchildren) and hobbies is helpful for finding out a patient's visual needs and understanding any eye manifestations or symptoms as a result of occupational hazards.

Recording the age, gender, language and disability status of patients allows you to monitor who is, and is not, coming to your eye clinic or hospital. Compare these figures with the population to identify groups that are under-represented, e.g., girls with other disabilities, and plan ways to reach out to them.

Reason for visit/Presenting complaint

Ask the main reason why the patient has come to seek an eye examination.

Record the main presenting symptoms in the patient's own words and in a chronological order. The four main groups of symptoms are:

- 1 Red, sore, painful eye or eyes (including injury to the eye)
- 2 Decreased distance vision in one or both eyes, whether suddenly or gradually
- 3 A reduced ability to read small print or see near objects after the age of 40 years
- 4 Any other specific eye symptom, such as double vision, swelling of an eyelid, watering or squint.

History of presenting complaint

This is an elaboration of the presenting complaint and provides more detail. The patient should be encouraged to explain their complaint in detail and the person taking history should be a patient listener. While taking a history of the presenting complaint, it is important to have potential diagnoses in mind. For each complaint, ask about:

- Onset (sudden or gradual)
- Course (how it has progressed)
- Duration (how long)
- Severity
- Location (involving one or both eyes)
- Any relevant associated symptoms
- Any similar problems in the past
- Previous medical advice and any current medication.

Past eye history

Ask for detail about any previous eye problems

- **History of similar eye complaints** in the past. This is important in recurrent conditions such as herpes simplex keratitis, allergic conjunctivitis, uveitis and recurrent corneal erosions
- **History of similar complaints in the other eye** is important in bilateral conditions such as uveitis, cataract
- **History of past trauma to the eye** may explain occurrence of conditions such as cataract and retinal detachment
- **History of eye surgery.** It is important to ask about any ocular surgery in the past such as cataract extraction, muscle surgery, glaucoma, or retinal surgery
- **Other symptoms.** Ask whether the patient has any other specific eye symptoms.

General medical history

Ask about any current and past medical conditions. These include conditions such as diabetes, hypertension, arthritis, HIV, asthma and eczema.

Family eye history

It is important to ask the patient whether any other member of the family has a similar condition or another eye disease. This can help to establish familial predisposition of inheritable ocular disorders like glaucoma, retinoblastoma or congenital eye diseases, diabetes and hypertension.

Medication history

Ask about present and past medications for both ocular and medical conditions. Don't overlook any medications that the patient may have stopped taking some time ago. Some medications are important in the etiology of ocular conditions.

It is also helpful to ask whether the patient has been able to use the medication as prescribed (their compliance). If a medication is ineffective, you want to know whether the patient is actually using the medication as prescribed, for example glaucoma medications.

Using your own discretion, it is helpful to find out whether access to medication prescribed is a problem. This helps to ascertain whether cost or other concerns are a potential reason for non-compliance. There could also be practical issues, such as difficulty instilling eyedrops or forgetting to do so.

Do not forget to ask in a non-judgmental way about traditional/herbal medication use.

Allergies

Ask about any allergies to medications or other substances.

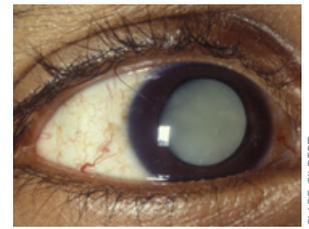
Social history

- Smoking (amount, duration and type)
- Alcohol (amount, duration and type)

Birth and immunisation history

For children, the birth history (prematurity) and immunisation status can be important.

Figure 1 Case scenarios with different presenting complaints



CLARE GILBERT

A case of age-related cataract (history of gradual loss of vision)



P. VIJAYAKSHMI

A case of red eye due to bacterial conjunctivitis



MURRAY MCGAVIN

A case of ophthalmia neonatorum (history of purulent discharge in a newborn)

Letter to the editor



When something goes wrong

Thank you so much for your courageous coverage of medical error in the most recent issue of the *Community Eye Health Journal*. Inadvertent harm in health care settings can be devastating for patients and caregivers alike. Not too long ago, when I was trained in medicine, disclosure of medical error and apology were discouraged because of the potential for lawsuits. Such an approach disrespected patients and morally harmed caregivers. It was therefore tremendously encouraging to learn that, at least in clinical eye care, disclosure of error and apology are being practiced in hospitals and clinics around the world. A recent account in the Huffington Post by a gynaecologist (<http://bit.ly/Huff-apology>) complements your reporting and highlights the positive impact of disclosing medical error.

When something goes wrong in public health, or global health, offering an apology can be even more difficult. Responsibility is diffuse and causal pathways

are more difficult to discern. There may be fear that acknowledging inadvertent harm could threaten public health programmes that deliver substantial benefits. Consequently, as described in a recent article (<http://bit.ly/glob-apol>), apology in public health is less often the norm. We in public health can be inspired and challenged by the progress made by eye health in acknowledging unintended harm.

Your remarkable coverage of this topic in the *Community Eye Health Journal* has done us all a great service. Indeed, this issue can serve as a model for other fields within health care and across global health. Thank you for so positively advancing the conversation, with extraordinary clarity and forthrightness.

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Hennely ML. How to detect myopia in the eye clinic. *Comm Eye Health J* 2019;32(105):15-16.

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How to measure distance visual acuity

Visual acuity is a measure of the ability of the eye to distinguish the details of objects.

Visual acuity testing is part of every eye examination. It is important that it is done well, and accurately, as an incorrect measurement can lead to inappropriate decisions and management.

It is important to assess visual acuity in a consistent way in order to detect any changes in vision. One eye is tested at a time.

Equipment

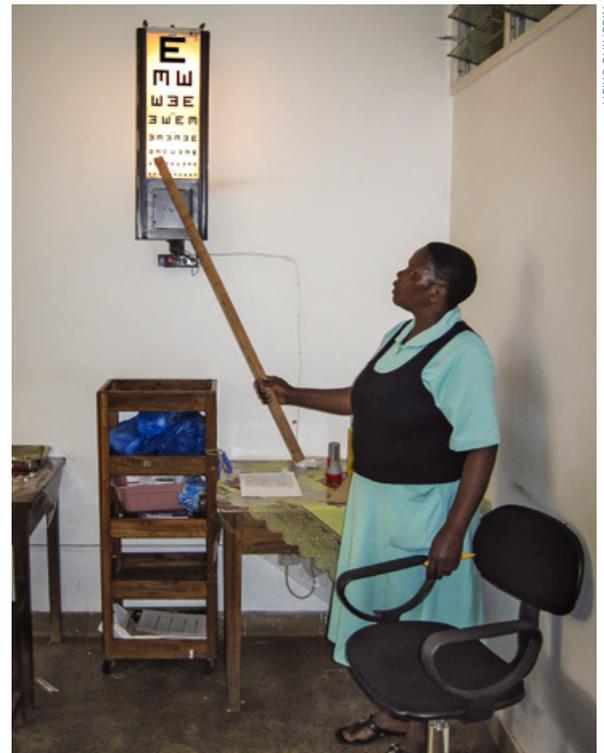
- Multi-letter Snellen chart or tumbling E (or C) chart
- Plain occluder, card or tissue
- Pinhole occluder
- Patient's documentation

Preparation

- Ensure good natural light or illumination on the chart.
- Explain the test to the patient.
- Tell the patient it is not a test that they have to pass. Tell them not to guess if they cannot see.
- Position the patient, sitting or standing, six metres away from the 6-metre Snellen or tumbling E chart (or 3 metres away from the 3-metre Snellen or E chart).

Testing and recording visual acuity

- Test the eyes one at a time, usually starting with the right eye, without any spectacles.
- Ask the patient to cover the left eye with the plain occluder, card or tissue.
- Ask the patient to read from the top of the chart and from left to right. For children or adults who cannot read the letters, use a tumbling E or C chart and ask them to point in the direction that the 'legs' of the E (or the opening in the C) are facing. There is a one in four chance that the patient can guess the direction; the patient should therefore correctly indicate the orientation of **most** letters of the same size, e.g., three out of four.
- Record the visual acuity for the examined eye. Visual acuity is expressed as a fraction e.g. 6/18. The top number is the distance the patient is from the chart in metres (6). The bottom number is the **smallest** line on the chart the person can read accurately. For example the 18 line (6/18), or the 6 line (6/6).



HEIKO PHILIPPIN

Visual acuity should be measured from a standard distance, using a standard chart. **TANZANIA**

- Incomplete lines can be added to the last complete line. e.g. 6/12+3, indicating that the patient read the '12' line at 6 metres and three of the letters on the '9' line.

If the patient cannot read the largest (top) letter at 6 metres, either:

- move them closer to the chart, 1 metre at a time, until the top letter can be seen – the VA will then be recorded as 5/60 or 4/60, etc. or
- hold up your fingers at varying distances (5 metres, 4 metres etc. and record the vision as counting fingers (CF) at the maximum distance they can see between 5 and 1 metre, i.e. **VA = CF 5m or VA = CF 1m.**

If the patient cannot count fingers at 1 metre, wave your hand and check if he/she can see this. This is recorded as hand movements (HM): **VA = HM.**

If the patient cannot see hand movements, shine a torch in the eye and ask if they can see the light. If they can, record 'perception of light': **VA = PL.** If they cannot see the light, record 'no perception of light': **VA = NPL.**

- After testing and recording the VA for the right eye repeat now for the left eye.
- If the patient wears spectacles for distance vision, now test the VA in each eye with the spectacles on.
- If the visual acuity in either eye is less than 6/6, one can measure the visual acuity with a pin hole (see panel).
- The VA is recorded for each eye in the patient's notes. For example:

Right VA = 6/18 without spectacles
Right VA = 6/6 with spectacles
Left VA = HM without spectacles
Left VA = HM with spectacles

The pinhole test

Using a pinhole reduces the need to focus the light that enters the eye, and people with a refractive error, such as myopia, can usually see better with the pinhole than without it.

Steps

- Position the patient 6 metres from the chart.
- Ask the patient to cover one eye with the occluder.
- Position the pin hole over the eye to be tested so they can see the chart through the pinhole.
- Test one eye at a time by following the same procedure used to test visual acuity.

If the person can read more letters with the pinhole than without, they are likely to have a refractive error, such as myopia. All patients (adults and children) whose acuity improves with a pinhole should undergo a full refraction to see whether they require spectacles, and of what power.



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How to prescribe spectacles for near vision

Many people aged 40 years and above need near vision spectacles for reading and other essential daily tasks.

As we grow older, the lens loses the ability to focus at close distances. Starting around the age of 40, near vision will slowly become worse, but distance vision will not be affected; this is known as presbyopia.

Indications

People with presbyopia usually say that their near vision has slowly become worse.

You will need

- Distance and near vision charts with letters, Es or shapes
- Pinhole (optional)
- A trial set of lenses or a selection of ready-made spectacles (RMS). Most people with presbyopia do not need spectacles with powers of less than +1.00 or more than +3.00. See Table 1 for suggested powers.

History

Before prescribing spectacles for presbyopia, take a careful history (pp. 44–45) and carry out a comprehensive eye examination to make sure there is nothing else wrong with the person's eyes.

Examination

1 Measure the distance vision in each eye

- If the presenting vision is 6/12 or worse in either eye, find out the cause of poor distance vision before prescribing spectacles for near vision.
- If the distance vision is 6/9 or better in each eye then one can proceed with checking near vision.

2 Assess working distance

- The correct power of spectacles for presbyopia depends on the person's age, the distance at which they want to see for near work, and how well they can see.
- Find out the person's working distance; this is the distance at which they would like to do most of their near work (see Figure 1a).
- Ask him or her to hold a near vision chart at the distance they do most near tasks. Around 40 cm is a comfortable distance for most people.

3 Measure near vision

- Ask the person to hold the chart at the distance they want to see clearly (the desired working distance) with both eyes open. Ask them to read the smallest line or show the smallest shapes they can see clearly. Write this down as their near visual acuity (e.g., N6 or J6).

- If the person already has spectacles for presbyopia, measure their near vision with these being worn. Write this down as 'near visual acuity with spectacles'
- If the person is able to see N6 or better without any spectacles, they might not need spectacles for presbyopia. If they can see N6 or better with their old spectacles, they might not need new spectacles.

4 Identify the correct lens power

- Use the person's age as an idea for what power of near lens they may need. Table 2.

Table 2 Suggested lens power for different ages

| Person's age | Lens power |
|--------------|-----------------|
| 35 to 45 | +1.00 |
| 46 to 50 | +1.50 |
| 51 to 55 | +2.00 |
| Over 55 | +2.50 or higher |

- While the person wears spectacles with the selected power (or trial lenses of the same number), give them the near chart again and ask them to hold it at the desired working distance (Figure 1a). If the person cannot see at least the N6 line, try again with the next stronger power until they can see the N6 line.
- Ask the person to look at the smallest line they can see on the near chart with the near lenses, and then bring the chart closer until the letters become blurred. Hold one hand to mark the nearest distance (Figure 1b), then ask the person to move the chart further away until the letters become blurred. Mark the furthest distance (Figure 1c). This is the range of clear vision available to the person while wearing the selected lens power.
- Ask the person again to hold the chart at their desired working distance. If the range is correct, the working distance should be in the middle of this range, for example at about 40 cm (Figure 1d). This means that a person will be able to see clearly for the same distance in front and behind their working distance.

5 Prescribe and dispense spectacles

- Prescribe and give the reading spectacles.
- Ensure that the patient understands they are only for reading and not for seeing in the distance.
- Advise the patient that a good reading light will help to improve their near vision.

Table 1 Suggested lens powers for correction of presbyopia

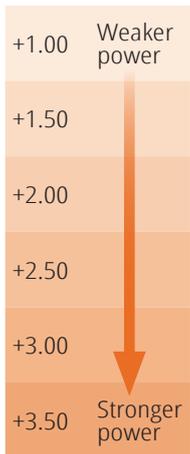


Figure 1 Finding the right prescription for presbyopia



1a A woman demonstrates her desired working distance

1b The nearest distance at which the woman can read the smallest line

1c The furthest distance at which the woman can read the smallest line

1d The desired working distance is in the middle of this range.



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How to examine the front of the eye

A number of common eye diseases can be diagnosed by examining the front of the eye using a torch.

Basic eye examination using a torch

It is important that all health care workers know how to examine the eyes. Use of a slit lamp microscope is a gold-standard method of examining the eye but a basic examination of the front of the eye can be carried out with a torch; if a magnifying loupe is attached to the torch this is helpful but not essential.

A +20 DS lens, if available, can also be used to magnify the anterior eye used in conjunction with the torch.

Figure 1 shows a healthy eye. There are four key parts to examine:

- The eyelids
- The conjunctiva
- The cornea
- The pupil

Only some common conditions, that can be seen using the above basic examination, are discussed below. All signs should be linked to the history of symptoms as this will aid the differential diagnosis. Management of specific conditions is beyond the scope of this article.

The eyelids - do they look normal?

When examining the eyelids, check that they move normally, are in the correct position, and that there are no swellings or lumps.

Check that:

- The eyelids open and close normally. Ptosis is a term used to describe drooping of the eyelids, and if they

cannot close completely it is called lagophthalmos. If the eyelids cannot close, the patient is at risk of damage to the cornea.

- Neither eye is further forward than the other. When one eye protrudes further forward this is known as proptosis, which is usually a serious condition.
- The eyelashes point away from the eyeball; if they turn in on the eye this is abnormal and is called trichiasis (Figure 2). This can cause corneal scarring and blindness.
- There are no swellings or lumps on the eyelids. A swelling on the eyelid margin can be due to a cyst, called a chalazion (Figure 3), or an infection of an eyelash is called a sty.
- There is no redness or discharge at the eyelid margin, termed blepharitis.

The conjunctiva - does the white of the eye look white?

The conjunctiva is a transparent layer which extends from the outer edge of the cornea, across the sclera (the white part of the eye) and along the insides of both eyelids. The conjunctiva contains blood vessels and, when there is a problem, the eye will often appear red.



Figure 1 A healthy eye. The pupil is black, the white of the eye is white (not red), the eyelashes point outwards and the cornea and conjunctiva are clear.

Figure 2 Trichiasis

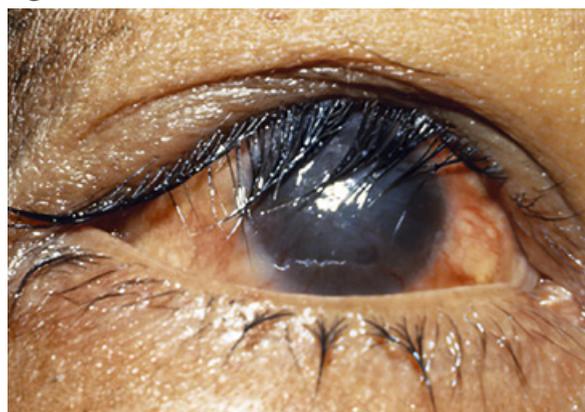
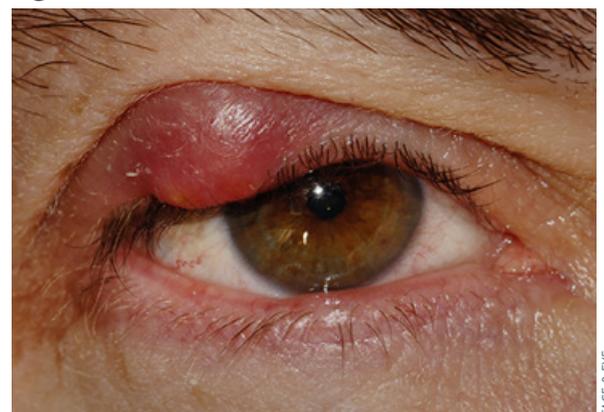


Figure 3 Chalazion



Look for:

- Redness of the conjunctiva (conjunctivitis); this might be due to infection; or allergy.
- Growths or raised fleshy areas, for example a pterygium (Figure 4) which is usually bilateral, involving the cornea; or a tumour (conjunctival carcinoma – see Figure 5);
- Foreign bodies causing irritation and often redness; it may be necessary to invert the eyelid as occasionally a foreign body is under the eyelid.

The cornea – is it clear?

The cornea is the clear part of the front of the eye. It acts like a window and allows light to get into the eye. To examine the cornea, shine the light from the side. If there is a problem, the cornea may appear cloudy or hazy.

Check that:

- There is no foreign body on the cornea; this is usually unilateral accompanied by pain or discomfort (Figure 6).
- There are no white or grey areas on the cornea; a white or grey area in a red or painful eye is likely to be a corneal ulcer (Figure 7); a white or grey area in a white, non-painful eye is likely to be a corneal scar.

The pupil – is the pupil black and does it react to bright light?

The pupil is a round opening found in the centre of the iris, which is the coloured ring-like structure inside the eye, behind the cornea. The iris gives the eye its colour.

The pupil regulates the amount of light that goes into the eye; it is small in bright light and large in a dark room.

The swinging torch test

If the torch is moved from one pupil to another and back again (the swinging torch test), each pupil should become small when the light is shone at it. If this does not happen (i.e., a pupil dilates when the light is swung towards it), this may indicate a relative afferent pupillary defect (RAPD) in that eye. When RAPD is present, this suggests disease of the retina or optic nerve.

Check:

- The colour of the pupil: it should be black. A white or grey pupil may be due to cataract (opacity of the lens).
- The shape of the pupil: it should be circular. An irregular-shaped pupil may be due to injury or inflammation inside the eye (called iritis).
- That the pupil becomes small when a bright light is shone into the eye in a dark room; this indicates that the optic nerve at the back of the eye is working; if the pupil does not become small with a bright light it may be due to damage of the nerve.
- The pupils' reaction to the swinging torch test (see panel above).
- The red reflex – see p. 54.

A careful examination of the front of the eye, using a torch, can help the eye health worker identify abnormalities which can lead to a diagnosis and assist in deciding the best management for the patient.

Figure 4 Pterygium

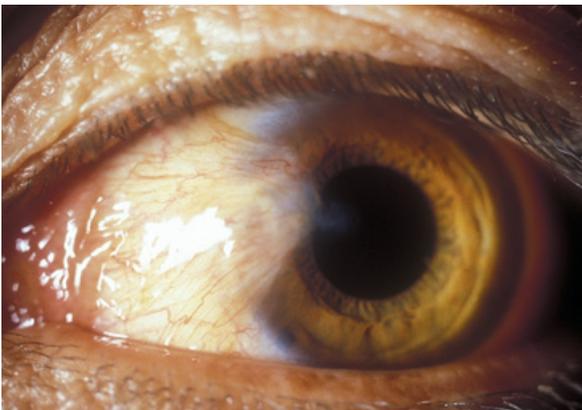


Figure 5 A cancerous growth on the conjunctiva

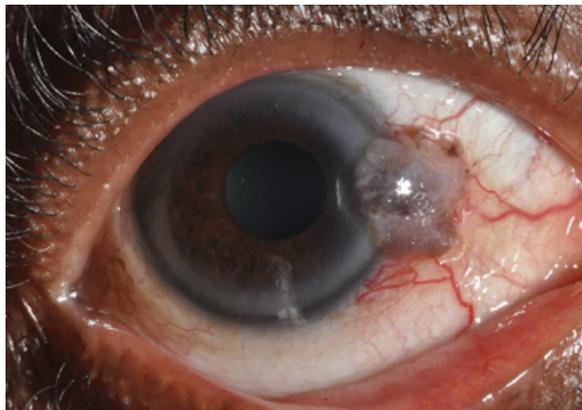


Figure 6 A foreign body on the cornea

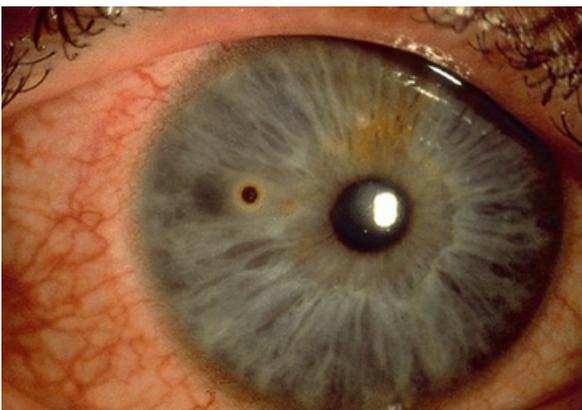
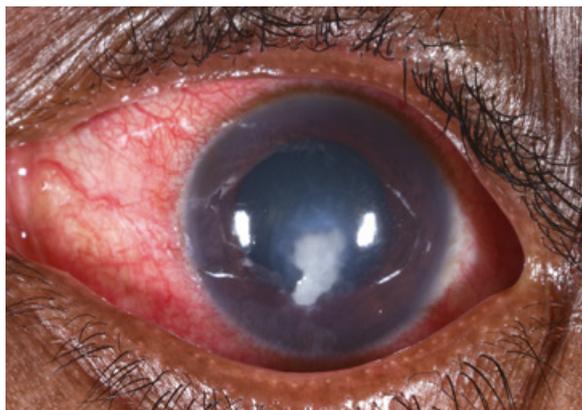


Figure 7 Corneal ulcer



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The Arclight and how to use it

With hands-on training, mentorship and regular practice the latest Arclight package can be used by primary, mid-level and advanced eye care practitioners to perform comprehensive ophthalmic examinations.

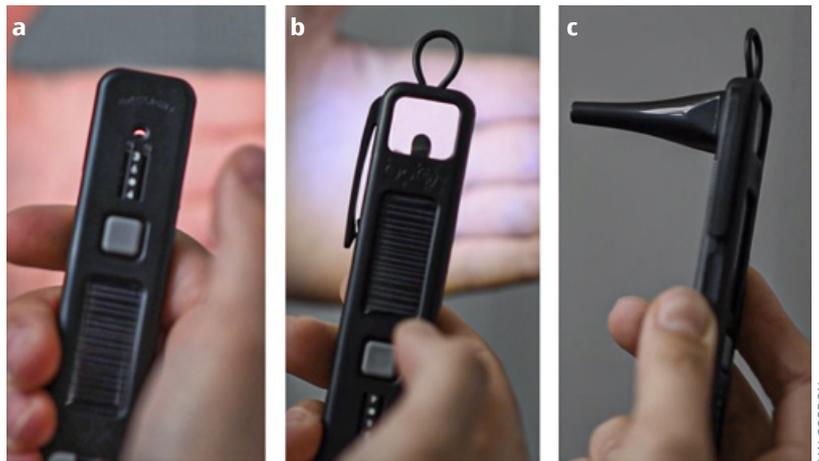


Figure 1 Direct ophthalmoscope (a), anterior segment loupe (b) and otoscope (c).

Additional information

The Arclight is available via the IAPB Standard list. Visit <https://iapb.standardlist.org/the-products/arclight-mk3-5-ophthalmoscope-otoscope/>

The manufacturer's website is www.arclightscope.com

For training videos and information, visit <http://med.st-andrews.ac.uk/arclight/training/>

The Arclight is a multi-purpose medical diagnostic tool combining direct ophthalmoscopy, anterior segment loupe and otoscope (Figure 1). It was developed to overcome barriers to ownership in low-resource settings¹ and is solar powered, uses long-lasting light-emitting diodes and costs users in low-resource regions around £10 per unit. With hands-on training (Figure 2) and ongoing mentored practice, all the major causes of treatable and preventable blindness can be reliably diagnosed.^{2,3} As the Arclight can also be used to examine ears⁴ and skin, the device can act as a catalyst to inter-professional education, enabling integration of eye care into universal health coverage.^{1,5}

Anterior segment examination

Using the internally lit 14 dioptre lens, the lids, conjunctiva, cornea and anterior chamber can be examined. The blue light highlights fluorescein staining, which enables epithelial loss and the activity of ulcers to be seen clearly (Figure 3). The headband allows you to conduct a hands-free examination, which simplifies the removal of foreign bodies and aids trachoma tarsal plate examination.⁶ Precise differentiation of corneal scarring from cataract can also be achieved, avoiding needless referrals to distant cataract surgery centres.

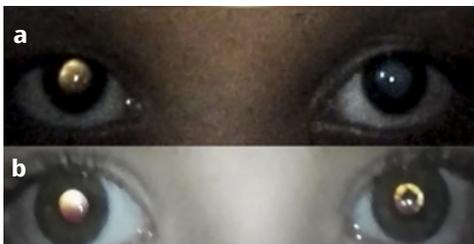
The red reflex

In children with darker skin and a pigmented fundus, the so-called 'red' reflex appears paler. The reflex can be observed using the direct ophthalmoscope (Figure 4). Media opacity, due to cataract or retinoblastoma,

can be reliably screened for in babies as well as adults.⁷ Hold the device at arm's length and illuminate both eyes at the same time (select the brightest light). The examination is best performed in a dimly lit room or, even better, under a black-out cloth. With experience, squint and refractive error can also be identified,⁸ which can improve the quality of referral to paediatric services.

Figure 4

- a) Right eye: normal reflex.
Left eye: no reflex due to complete cataract
b) Right eye: normal reflex.
Left eye: posterior polar cataract



OBAID KOUSHA

Figure 2 Hands-on training with simulation tools



IAN GORDON

GLEN KENNEDY

Figure 3 Anterior segment loupe: blue light & fluorescein to highlight ulcers



TERRY COOPER

Direct ophthalmoscopy

After placing your feet next to the patient in the position you aim to finish, lean back and follow the red reflex in towards the patient's eye on the horizontal plane at 15 degrees temporal (Figure 5). Use the right hand and right eye to examine the patient's right eye and vice versa. This 'flight path' should bring the disc into view. If the disc is not seen, follow the 'arrows' created by the branches of retinal vessels as they point towards the disc.

Assessing the margin, the colour of the neuro-retinal rim and the cup to disc ratio can help to identify raised intraocular pressure, glaucoma and optic atrophy (Figure 6). After examining the four major retinal vessel branches and the surrounding retina, ask the patient to

look at the light. This will bring the central macula (fovea) into view. Macular disease due to infection, diabetes and ageing can now be seen.

Binocular indirect ophthalmoscopy

Quick and simple binocular indirect ophthalmoscopy can be performed on well dilated patients. By placing the light source of the direct ophthalmoscope directly between the user's eyes, a wide field view of the fundus can be achieved with the addition of a standard condensing lens.

Mobile phone camera clip

Where diagnostic uncertainty occurs, you can take video by attaching the ophthalmoscope, loupe or otoscope to a mobile phone camera (Figure 6) using a universal clip.⁹ This offers the opportunity for a remote second opinion or for documenting clinical signs for later comparison.

Other tools

To complete a comprehensive ophthalmic examination, the Arclight package comes with several other tools, including a distance/near visual acuity chart and matching card, an engaging 'bird' near target and flashing white-blue 'lure' for children, a red desaturation square and a white target for visual field assessment as well as a ruler, pupilometer and cup to disc ratio gauge.

Figure 5 Direct ophthalmoscopy: approach from 15 degrees temporal on the horizontal plane to see the optic nerve



PHILLIDSTONE



KIM ALLAN

Figure 6 Optic nerve examination and imaging with mobile phone clip

References

- 1 Blaikie A, Sandford-Smith J, Tuteja SY, Williams CD, O'Callaghan C. Arclight: A pocket ophthalmoscope for the 21st century. *BMJ (Online)*. 2016
- 2 Lowe J, Cleland CR, Mgaya E, Furahini G, Gilbert CE, Burton MJ, et al. The Arclight Ophthalmoscope: A Reliable Low-Cost Alternative to the Standard Direct Ophthalmoscope. *J Ophthalmol*. 2015
- 3 Blundell R, Roberts D, Fioratou E, Abraham C, Msosa J, Chirambo T, et al. Comparative evaluation of a novel solar powered low-cost ophthalmoscope (Arclight) by eye healthcare workers in Malawi. *BMJ Innov*. 2018
- 4 Hey SY, Buckley JC, Shahsavari S, Kousha O, Haddow KA, Blaikie A, et al. A mixed methods comparative evaluation of a low cost otoscope (Arclight) with a traditional device in twenty-one clinicians. *Clin Otolaryngol*. 2019
- 5 World Health Organization. Framework for action on interprofessional education and collaborative practice [Internet]. 2010. Available from: https://www.who.int/hrh/resources/framework_action/en/
- 6 Solomon AW, Le Mesurier RT, Williams WJ. A diagnostic instrument to help field graders evaluate active trachoma. *Ophthalmic Epidemiol*. 2018
- 7 Blaikie a. J, Dutton GN. How to assess eyes and vision in infants and preschool children. *Bmj* [Internet]. 2015;350(may07 27):h1716–h1716. Available from: <http://www.bmj.com/cgi/doi/10.1136/bmj.h1716>
- 8 Roe LD, Guyton DL. The light that leaks: Brückner and the red reflex. *Surv Ophthalmol*. 1984
- 9 Viquez KDC, Arandjelović O, Blaikie A, Hwang IA. Synthesising Wider Field Images from Narrow-Field Retinal Video Acquired Using a Low-Cost Direct Ophthalmoscope (Arclight) Attached to a Smartphone. In: *Proceedings – 2017 IEEE International Conference on Computer Vision Workshops, ICCVW 2017*. 2018.

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Dr. Ijilmurun, Ulaanbaatar, Mongolia



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Tips for assessing vision in a baby or child

In babies and young children, early intervention can prevent decades of visual impairment. This article gives tips and advice for a successful eye examination and explains what responses to expect from a healthy baby.



An eye care worker checks a baby's fixation. The baby is looking at her face, which is a reassuring sign.

CLARE GILBERT

Assessing vision in a baby (0-1 year)

There is no need to be anxious about examining a baby. If the baby is awake and attentive, there is a lot you can find out by asking the parents and simply observing the baby's reactions.

- First ask the parents what they think about their baby's vision.
- Notice how the baby looks at things in the room, such as the window or any lights.
- Watch for eye contact between the baby and parents.
- Does the baby look when someone comes into the room?
- Does the baby respond to silent smiles or to raised eyebrows?
- Do you get eye contact?

You should have realistic expectations about what a baby should be able to do by a certain age. Table 1 shows

when a baby is too young to show a visual response, when the response is likely to develop, and at what age you should be worried if a baby does NOT show the expected response. You can ask the mother or check the baby's responses yourself.

For example, if a baby of about three weeks old does not turn to a diffuse light, such as light coming from a window, you would not necessarily be worried – although you would still believe the parents if they are concerned. On the other hand, if a baby is eight weeks old and does not eventually turn to a diffuse light, then there may be a problem and you should investigate further.

Bear in mind that there can be a lot of variation in babies' development; however, this table should be a helpful guide.

Table 1 Normal visual functioning for a baby

| Behaviour | Age Neonate | Age 6 weeks | Age 3 months | Age 4 months | Age 5 months + |
|--|--|--|--|--|--|
| Blinks when a light is flashed in their eyes? | Healthy babies will do this. If not, suspect a problem | | | | |
| Turns to a diffuse light, such a light coming from a window? | May do it | Healthy babies will do this. If not, suspect a problem | | | |
| Looks at your face when 10-20 cm away (less than 1 foot)? Any response to silent smiles or eyebrow raising? | Too young | May do it | Healthy babies will do this. If not, suspect a problem | | |
| Eyes fix on, and follow, a dangling ball or toy? | Too young | May do it | Healthy babies will do this. If not, suspect a problem | | |
| Watches an adult at 1.5 metres (5 feet)? | Too young | May do it | | Healthy babies will do this. If not, suspect a problem | |
| Converges accurately? (If you move a toy closer and further away, do the eyes focus on the toy and line up properly?) | Too young | May do it | | Healthy babies will do this. If not, suspect a problem | |
| Blinks in response to a threat? (Any silent, sudden movement close to the face which causes no breeze, e.g., opening your fist very suddenly.) | Too young | Too young | Too young | May do it | Healthy babies will do this. If not, suspect a problem |

Tips for examining a baby

- Try to carry out as much of the examination as possible without touching the baby. Children often resist having their eyes held open, for example.
- Have many toys available. For each new toy, the baby will momentarily hold their eyes steady, allowing a quick examination. If available, use toys which are bright and can flash on and off. A good rule to remember is: "one toy, one look", as babies can quickly lose interest.
- Don't be embarrassed about making funny noises! These help to attract the baby's attention and keep them interested and calm. Look for good fixation, e.g. on your face.
- In order to perform a more detailed examination of an infant, examine the child while she or he is being bottle fed or breast fed.
- If you are struggling, ask the parent's permission to wrap the baby; the pressure can help babies to feel safe and secure while keeping their hands away from your equipment! To do this, place the baby on a blanket or sheet, hold the arms to the side and the legs straight, and wrap the blanket around the body and arms (Figure 1). Ask the parent to hold the baby. Ask the parent, or a helper, to open one eye at a time by placing a finger very gently on the upper eyelid and easing it upwards; first demonstrate how to do this, using your own eye. Praise and reassure the parents – this may be a very stressful experience for them and their child.

Assessing vision in a young child (1-5 years)

Children in this age group should have steady eyes, no squint (p. 55), no history of sight difficulties and, if in a good mood, show interest in colourful or interesting objects in the room. They should respond to silent smiles, eyebrow raising, and winking.

Children in this age group should also be able to see objects presented in their peripheral visual field by a colleague while you draw their attention to your face, perhaps by making a funny noise. Cover one eye at a

Figure 1 Wrapping a baby for an eye examination. This baby found it very comforting and fell asleep!



Figure 2 Be playful and make a game of the examination



time if the child will allow it and ask them to identify different sized objects or, with older children, letters. Make it a game.

Many children can accurately name colours by the age of three, but many cannot do this until they are older; it is reassuring if they can.

After the age of three, most children can participate in accurate visual acuity, visual field, and colour vision testing when done by someone trained and with age-appropriate equipment.

If you do not have that equipment, or have not been trained to use it, you can still test a child's functional vision using everyday objects, as described above.

Tips for examining a young child

The tips for examining a baby (above) apply equally well to young children.

In addition:

- Be playful and make a game of the examination (Figure 2). For example, shine a light into the mother's eye first, or pretend you are playing 'hide and seek' or 'peekaboo' when covering one eye.
- Observe children when they don't know they are being observed, for example while you are talking to the mother or taking a history.
- The tip about wrapping up a baby will work for a younger child, but it may be more difficult in an older child. If examination is proving difficult, ask the parents what they think would be appropriate or would work best. For example, parents could hold the child on their lap and wrap their arms around their child in a hug, thereby gently restraining the child's arms.

“Observe children when they don't know they are being observed, for example while you are talking to the mother or taking a history.”

Adapted from:

Baiyeraju A, Bowman R, Gilbert C, Taylor D. Managing eye health in young children. *Comm Eye Health J* 2010;23(72):4-11



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Testing the red reflex

A red reflex test can detect cataract and retinoblastoma. Both conditions require urgent referral.

Why is it important to test the red reflex?

The 'red' reflex (which appears paler in children with darker skin and a pigmented fundus) can reveal problems in the cornea, the lens, the vitreous, and the retina. It is particularly useful in young children who are too young to complain of not seeing.

The possible causes of an abnormal red reflex are:

- Cataract
- Retinoblastoma
- Other uncommon diseases of the vitreous or retina.

When to test the red reflex for retinoblastoma

It is important to test the red reflex after birth, at the age of six weeks, during routine consultations, or when parents are concerned about the child's vision or the appearance of her or his eyes.

How to test the red reflex

- The red reflex is much easier to see in a darkened room, so switch off the lights and draw the curtains, or ask the parents and child to go with you into a darkened room.
- Use a direct ophthalmoscope (e.g., an Arclight) with the lens power set at '0'. Make sure the batteries are charged.
- Sit about half a metre (50 cm) away. Hold the ophthalmoscope close to your eyes.
- Encourage the child to look at the light source and direct the light at the child's eyes. You should see an equal and bright reflex from each pupil.
- Pay attention to the colour and brightness of the reflex. It should be identical in both eyes (Figure 1). An absence of a reflex, a difference between the eyes, or an abnormal colour in the pupil (Figures 2–4) may indicate retinoblastoma or another serious eye condition.

To determine whether the red reflex is normal, comparison with the red reflex of a parent may be helpful. If you are not sure whether the reflex is normal, dilate the pupil for a complete examination. **If you are unable to dilate the pupil, refer the child to a specialist.**

What to do if the red reflex is abnormal

If possible, ask another colleague to check too. If the reflex is abnormal, explain to the parents or carers that their baby/child may have an eye disease that will need to be treated. **Avoid mentioning cancer or removal of the eye.**

Refer the child to a specialist for a complete eye examination. If possible, speak to the eye specialist by phone or text message (SMS) to explain the situation and confirm clinic times and dates.

Refer the baby/child to an eye specialist with an accompanying letter or note. Make sure the parents know where to go and when. Emphasise that they must go in the next few days at the latest.



The red reflex is easier to see in a darkened room. TANZANIA

Figure 1 The normal red reflex



Figure 2 Right eye: the normal red reflex. Left eye: the absence of a red reflex is abnormal and could indicate a serious condition. Refer the child to a specialist.



Figure 3 Right eye: the normal red reflex. Left eye: the wrong colour in a red reflex (here white) could indicate a serious condition. The child in this image has a cataract in the left eye. Refer the child to a specialist.



Figure 4 Right eye: the normal red reflex. Left eye: the wrong colour in a red reflex (here yellow-white) could indicate a serious condition. The child in this image may have retinoblastoma in the left eye. Refer the child to a specialist urgently.



Figure 5 Right eye: the normal red reflex. Left eye: the red reflex is less bright and the corneal reflection (white spot on the cornea) is not centred. This is a squint, which may be the result of a serious underlying condition. Refer the child to a specialist.



Adapted from the poster: 'See RED' produced by JR Ainsworth, UK National Retinoblastoma Service, Birmingham, UK and the Childhood Eye Cancer Trust. www.chect.org.uk. First published in the *Community Eye Health Journal* French edition, Issue 8, 2011.



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How to check eye alignment and movement

If a child's eyes are not lined up correctly, then the vision in the deviated eye may be reduced permanently. Early detection and referral is essential.

In order to achieve normal binocular vision, the eyes must see well, be aligned (i.e., look in the same direction), and be focused on the same object. To maintain alignment, the eyes must also move in a coordinated manner.

Misalignment of the eyes is called **strabismus** (or **squint**). Misalignment means that the eyes are not lined up to look at the same thing. In strabismus or misalignment, one eye is fixed on what the person intends to look at (the fixing eye) and the other eye is looking at something else (the deviated eye). In young children the brain tends to suppress the image in the deviated eye, while in adults a new squint (misalignment) can cause double vision. If a child has strabismus from a young age and is not treated, the vision in the deviated eye can become permanently reduced; this is called **amblyopia** or 'lazy eye'.

It is therefore very important to detect strabismus as early as possible and to refer the patient to an ophthalmologist or other relevant eye care professional.

Step 1. Check ocular alignment using a torch

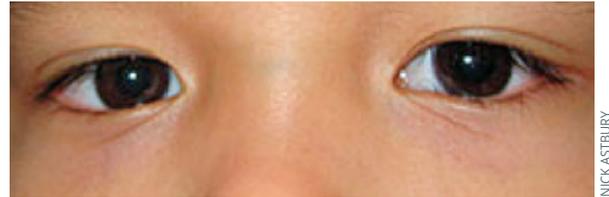
Check the alignment of the eyes. This is performed by comparing the light reflex from the cornea of both eyes. Hold a torch 1 metre in front of the eyes and look for the light reflex on the cornea (Hirschberg test). In the primary gaze (looking straight ahead at the torch light), the light reflexes should be in a symmetrical position on each cornea (Figure 1).

If one eye is turning **out**, this is called exotropia (Figure 2), whereas if the eye is turning **in** it is called esotropia (Figure 3).

Step 2. Check for abnormal head posture

Look at the patient and see if they hold their head in an abnormal position. In some instances, the person with a strabismus assumes an abnormal position of the head to try to keep the eyes aligned. For example, the child or adult will turn their head or raise or lower the chin to help the eyes to become aligned with what they are looking at.

Figure 1 Straight eyes. The light reflex is seen in the centre of the pupils in both eyes. Although this boy's eyes tend to look crossed (because he is looking slightly to the left and the bridge of his nose is broad), the light reflexes in the centre of his pupils confirm that his eyes are straight and aligned.



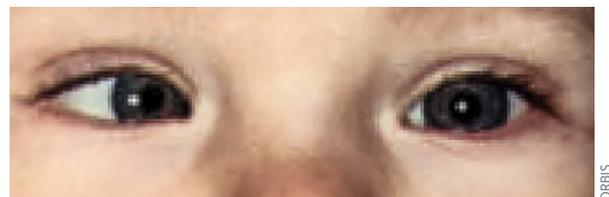
NICK ASTBURY

Figure 2 Exotropia in the left eye. The light reflex is central in the right eye and over the iris in the left eye.



ORBIS

Figure 3 Esotropia in the right eye. The light reflex is central in the left eye and over the iris in the right eye.



ORBIS

Step 3. Do the cover test

If you find that an eye is misaligned, use the cover test to confirm this. For example, say that you have observed the right eye turning in when the patient looks straight ahead (as in Figure 3). If you then cover the left eye (the normal eye), you should see the right eye (the deviated eye) turn towards the front. This confirms that the right eye was not aligned with the left eye when both eyes were open.

Step 4. Check ocular movements and double vision

When checking a person for strabismus, it is necessary to confirm that the eyes can move freely in all directions. There are nine possible positions of gaze, as shown in Figure 4. Check eye movements by holding the patient's head still and asking him or her to follow your finger or a light as you move it from looking in front to each of the nine positions in turn. Note any limitation of movement of one or both eyes.

If a patient complains of double vision (diplopia) then while checking ocular movements, ask the patient if they see one or two torch images in each position of gaze. The gaze of maximal double vision can help identify which muscle and nerve is not working.

Adapted from:

Helveston EM. Understanding, detecting and managing strabismus. *Comm Eye Health* 2010;23(72):12-14.

Moodley A. Basic clinical examination of a patient with neuro-ophthalmology symptoms. *Comm Eye Health* 2016;29(96):66-67.

Figure 4 The nine positions of gaze in someone with healthy eyes



ICEH

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Measuring intraocular pressure

High intraocular pressure (IOP) is an important warning sign. Left untreated, it can result in irreversible damage to the optic nerve. Patients with suspected high IOP must be referred to an ophthalmologist for a detailed and comprehensive eye examination.



Figure 1 Palpating the eye carefully can help to identify very high intraocular pressure, a possible sign of glaucoma. TANZANIA

Normal intraocular pressure (IOP) ranges from 12–22 mmHg, on average, but it may be higher if patients have glaucoma, use medication (e.g. steroids) or have recently undergone eye surgery.

The International Agency for the Prevention of Blindness (IAPB) recommends that trained ophthalmic personnel measure IOP using either a Perkins tonometer (used for applanation tonometry) or new technologies such as puff tonometers or the Tonopen.¹

If these are not available, and if the patient's history or symptoms suggest that the IOP may be high, there are two screening tests that may be useful:

- 1 The fingertip test (digital palpation)
- 2 Schiötz tonometry

1. The fingertip test

It is possible to detect very high IOP using your fingertips. The accuracy is better if the examiner is familiar with this examination method, so take time to practice it: first on yourself and then on your colleagues (with their permission).

Note: If you do not detect anything abnormal, the eye pressure may still be dangerously high. If the history or symptoms suggest glaucoma, or if the patient is using steroid medication or has recently undergone eye surgery, you must refer them to a centre where their IOP can be accurately assessed.

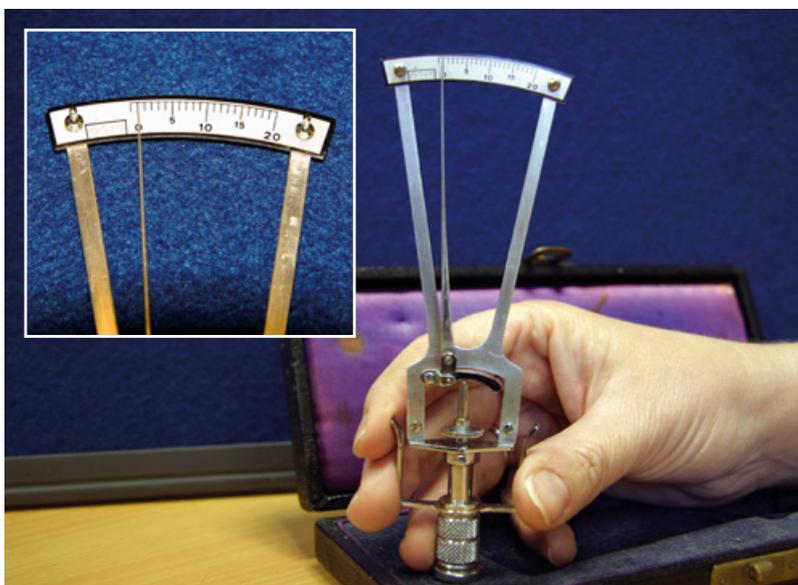
Method²

- Ask the patient to close her or his eyes and look down.
- Place the tips of both index fingers on the closed upper eyelid. Keeping both fingertips in contact with the upper eyelid, apply gentle pressure through the closed eyelid, first gently pressing on the eye with the right index finger, then with the left, and then with the right again (Figure 1).
- Repeat on the other eye.
- A normal eye should feel a bit like a tomato that is just ripe: not solid, nor very soft.
- It is important to compare the two eyes with one other. An eye with very high IOP will feel abnormally hard and solid.³

2. Schiötz tonometry⁴

Schiötz tonometry is a more accurate screening test. If Schiötz tonometry indicates a high IOP, the patient should be referred to an ophthalmologist who will be able to confirm the result (using applanation tonometry or equivalent) and begin appropriate management.

Figure 2 Schiötz tonometer. The pointer should be at '0' when using the 5.5 g weight



NICK ASTBURY

Figure 3 Position yourself behind the patient with your hands at the same level as their head. The patient is looking at his finger, which is directly above his eyes.



Figure 4 Gently place the plunger of the Schiötz tonometer on the central cornea



You will need

- Schiötz tonometer, weights, and scale card
- Local anaesthetic drops
- Clean cotton wool or gauze swabs
- Isopropyl alcohol (70%), methylated spirit or ready-to-use alcohol wipes

Preparation

- Test the tonometer using the spherical mould in the box and the 5.5 g weight. The pointer should swing to '0' immediately (Figure 2).
- Clean the plunger and disc of the tonometer with a gauze or cotton wool swab and the isopropyl alcohol, methylated spirit or alcohol wipes. Wipe dry with a clean dry gauze or cotton wool swab.
- Lie the patient flat with her or his head supported on a pillow.

Method

- Wash and dry your hands.
- Position yourself correctly: stand upright, behind the head of the patient, with your hands level with the patient's head. Note the health worker's good posture in Figure 3. Bad posture can affect the reading.
- Instil local anaesthetic eye drops and wait about 30 seconds.
- Ask the patient to look at a fixed object directly above the eyes. The patient's own thumb or finger held directly in front of his or her eyes) and to keep absolutely still.
- With the thumb and index finger of one hand, gently hold open the patient's eyelids, taking care not to put any pressure on the eye (see Figure 4).
- With the other hand, hold the tonometer (with the 5.5 g weight) between the thumb and index finger and place the plunger on the central cornea (see Figure 4).
- Allow the disc to lower gently onto the corneal surface.
- Note the scale reading.

- If the scale reading is '2' or less, remove the tonometer, replace the 5 g weight with the 7.5 g weight and repeat the procedure.
- Note the scale reading again and remove the tonometer.
- Tell the patient not to rub the eye – the anaesthetic will last for about five minutes.
- Clean and dry the tonometer head.
- Repeat the whole procedure for the other eye.
- Clean and dry the tonometer again and store it safely in the box.
- Using the scale card, convert the noted scale readings and record the pressure in the patient's records.

References

- 1 IABP Essential List: Glaucoma. <https://iabp.standardlist.org/essential-lists/essential-list-glaucoma/>
- 2 Philippin H, Shah P, Burton M. Detecting possible glaucoma with only limited equipment: a crucial first step. *Comm Eye Health* Vol. 25 No. 79 & 80 2012 pp 48 - 49. <https://cehjournal.org/article/detecting-possible-glaucoma-with-only-limited-equipment-a-crucial-first-step/>
- 3 Baum J, Chaturvedi N, Netland PA, Dreyer EB. Assessment of intraocular pressure by palpation. *Am J Ophthalmol* 1995;119(5):650–1.
- 4 Stevens S. How to measure intraocular pressure: Schiötz tonometry. *Comm Eye Health J* 2008;21(66):44. <https://cehjournal.org/article/how-to-measure-intraocular-pressure-schiotz-tonometry/>

Table 1 Scale card for ocular pressure

| Scale reading | Ocular pressure, mm HG | | |
|---------------|------------------------|--------------|---------------|
| | 5.5 g weight | 7.5 g weight | 10.0 g weight |
| 3.0 | 24.4 | 35.8 | 50.6 |
| 4.0 | 20.6 | 30.4 | 43.4 |
| 5.0 | 17.3 | 25.8 | 37.2 |
| 6.0 | 14.6 | 21.9 | 31.8 |
| 7.0 | 12.2 | 18.5 | 27.2 |
| 8.0 | 10.2 | 15.6 | 23.1 |
| 9.0 | 8.5 | 13.1 | 19.6 |
| 10.0 | 7.1 | 10.9 | 16.5 |



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Examining visual fields

Basic visual field testing only takes a few minutes, but can help to detect glaucoma and macular disease.

Examining visual fields is important for the detection of glaucoma, macular disease and neurological conditions such as stroke, and is an integral part of a full ophthalmic evaluation. In this article, we describe how to detect visual field defects using confrontation visual field testing and an Amsler Grid, neither of which requires expensive equipment.

Early (or even moderate) visual field defects often go unnoticed, particularly if only one eye is affected. The images in Figure 2 represent what a scene may look like to someone with different visual field defects in each eye. The left eye has inferior field loss, and the right eye has superior field loss. Because the defects do not overlap, the field defects will not be apparent when the scene is viewed with both eyes together.

Useful questions to ask are:

- Have you noticed if any part of your vision is missing in either eye?
- Have you noticed any gaps in your vision?
- If you close each eye in turn, does what you see differ from one eye to the other?

In addition, it is essential to enquire about past ophthalmic and medical history, concentrating on family history and whether there are any additional ophthalmic or neurological symptoms.

Confrontation visual field testing

Confrontation visual field testing only takes a few minutes and can provide useful information. Prepare



Figure 1 Testing visual fields to confrontation. The examiner's left eye is closed, so he can compare the field of his right eye with the field of the patient's left eye.

by testing yourself first so that you can become familiar with the range and limitations of your own field of vision and locate your blind spot in each eye. A defect is detected when you show a target and the patient does not react, even though it is at the same distance from you and the patient. The assumption is that you, as the examiner, have normal visual fields. This is another reason why you should undergo visual field testing yourself first.

During the examination, first test the binocular visual field (with both eyes open) and then test each eye separately. You will need a target: this can be a finger that waves, or curls and uncurls, or a pen with a red top.

Confrontation testing with both eyes

Ask the patient to stare directly and steadily into your eyes. Staring can cause embarrassment or awkwardness, so allow the patient to rest and try again if they find it difficult to look at you directly. Check that the patient can look steadily at your eyes while you look steadily at theirs. Ask the patient whether any part of your face is missing or indistinct.

Figure 2 The left eye has inferior field loss (a), and the right eye has superior field loss (b). Because the defects do not overlap, they will not be apparent when the scene is viewed with both eyes together (c).



- 1 Check the patient's left hemi-field by making a fist with your right hand and holding it in their left hemi-field, at eye level, just to the right of your face. Making sure that the patient is still holding your gaze, raise one to four fingers and ask how many fingers can be seen. To test the upper and lower quadrants, move your hand up and to the right, and down and to the right, repeating the test at various points. This simple finger-counting test is particularly useful for detecting visual field loss due to neurological problems (such as strokes), but is only useful for patients with glaucoma when the visual field loss is severe.
- 2 To test the patient's right hemi-field and upper and lower quadrants, repeat the finger-counting test using your left hand, starting just to the left of your face and moving up and left and then down and left.

Testing each eye to confrontation

- 1 Ask the patient to cover their own eye with the palm of their hand (not their fingers, as it is easy to peep between fingers). Remember that you should close your eyes in turn too, so that you are comparing the field in your right eye with the field of the patient's left eye, for example (Figure 1).
- 2 Do the finger counting test first (static testing). Be sure to test on both the left and the right for **each eye tested**.
- 3 Next, bring your target finger from the far periphery in towards the central region (kinetic testing).

Ask the patient to say when they first see the target. Repeat from several different directions, ensuring that the full 360° for each eye is tested. The examiner should remember to perform kinetic testing at a speed appropriate for the patient's responses.

- 4 Next, test the peripheral (outer) field preferably with a white target (this can be a pin or eye drop bottle lid) and then test the central (inner) field with a red target (eye drop bottle lid or the top of a pen). Testing with these targets gives more accurate results than testing with fingers and can detect earlier visual field loss. In addition, red-headed targets can be used to test for red-desaturation. A sign of early optic nerve disease.

Amsler chart testing

A printed grid, known as an Amsler grid (Figure 3) can be used to detect abnormalities in the central field as well as paracentral defects (fairly common in patients with glaucoma).

Test one eye at a time, correcting for any near refractive errors. Ask patients to hold the chart at a comfortable reading distance from their uncovered eye, and stare at the central spot of the grid. Ask them to identify and then point to any areas where the grid is missing or distorted. Missing areas may suggest paracentral glaucomatous visual field loss, whereas distortion is more common with macular disorders.

Figure 3 Amsler grid, used to check distortion of central vision

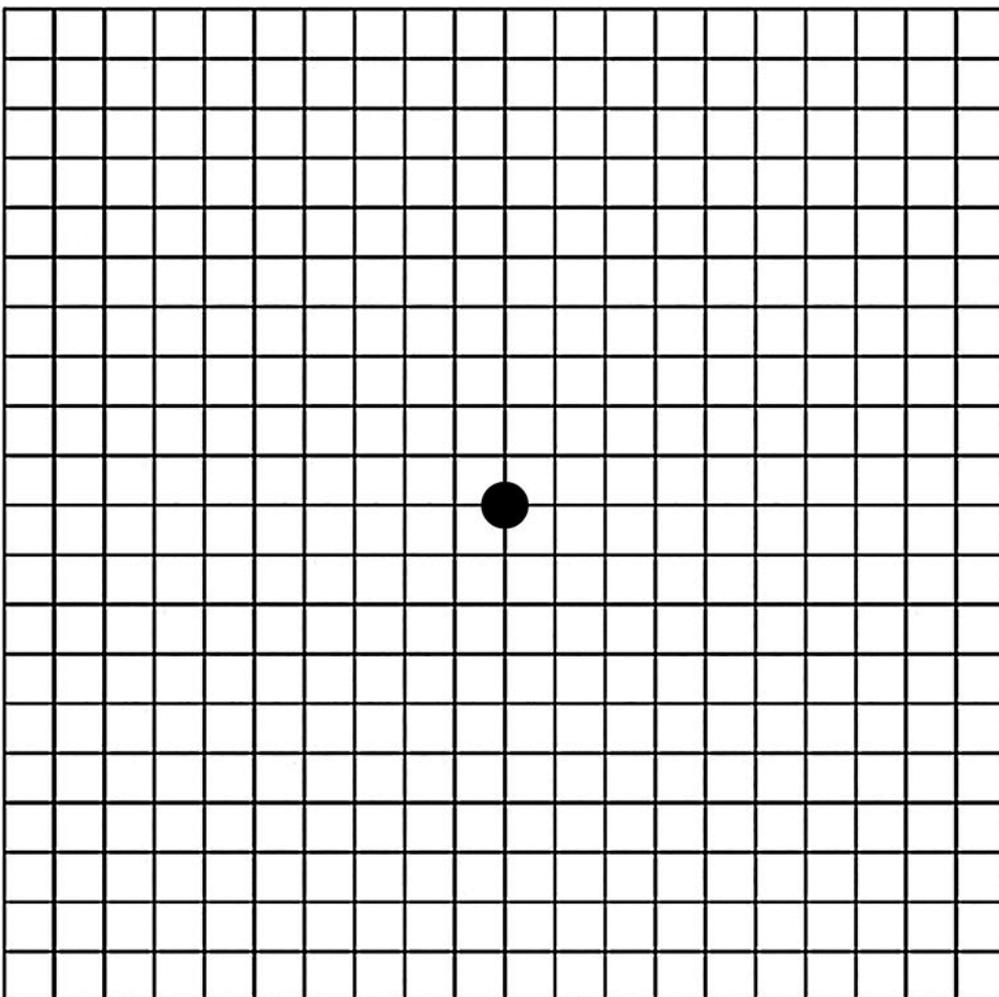
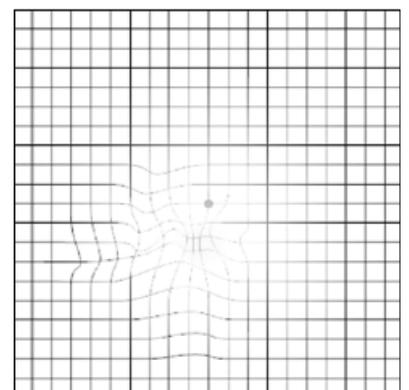
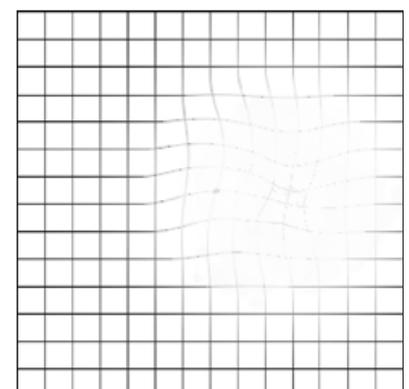


Figure 4 Amsler grid when viewed by someone with a problem with their central visual field (a and b)



4a Small scotoma (defect within a field of vision) below central fixation, with surrounding distortion



4b Large scotoma encroaching on central fixation with some distortion

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Beyond VISION 2020: universal eye health coverage and the elimination of trachoma

The WHO World Report on Vision provides a strategic path to achieve sustainable eye health systems and universal eye health coverage.

On 18 February 1999, the World Health Organization (WHO) and the International Agency for the Prevention of Blindness (IAPB) launched **VISION 2020: The Right to Sight**. This global initiative was created to eliminate causes of avoidable blindness by the year 2020.

VISION 2020 aims to build comprehensive and sustainable eye health systems by integrating existing health services and ensuring high quality universal eye care. VISION 2020 has three key objectives: 1) the control of diseases that affect eye health; 2) the development of human resources; and 3) the provision of appropriate technology and infrastructure.

Trachoma, the world's leading infectious cause of blindness, is one of the priority diseases targeted by VISION 2020. There has been significant advancement towards elimination since the launch of VISION 2020. In June 2019, **WHO announced a 91% global reduction** in the number of people at risk of trachoma, from 1.5 billion in 2002 to 142.2 million today. During the same period, the number of people requiring surgery for trachomatous trichiasis (TT), the late blinding stage of trachoma, reduced from 7.6 million to 2.5 million – a 68% reduction. Nine countries across all endemic WHO regions have also been validated for achieving elimination.

Progress towards VISION 2020's mission and objectives include:

1. Raising support for comprehensive and sustainable eye health systems

VISION 2020 has led several initiatives that have raised the profile of avoidable blindness. Four World Health Assembly (WHA) resolutions have been adopted since 2003, including WHA resolution 66.4 **Universal Eye Health: A global action plan 2014 – 2019**, which have reinforced WHA Resolution 51:11 calling for the global elimination of trachoma. WHA resolutions aim to support UN member states to achieve global vision targets, including universal access to comprehensive eye care services.

2. Robust evidence to support disease elimination efforts

International commitments and increased investment led to the largest ever infectious disease survey – the **Global Trachoma Mapping Project (GTMP)**. From 2012–2016, GTMP screened over 2.6 million people for trachoma across 29 countries and identified areas



Women in Napak, Uganda, after trichiasis surgery at a camp set up by the local health department in collaboration with Sightsavers as part of The Queen Elizabeth Diamond Jubilee Trust Trachoma Initiative, with support from UK Aid.

where interventions needed to be scaled up. Since 2016, **Tropical Data** has supported health ministries through the full survey process - from planning and protocol development to application of the survey outputs. Data collected by GTMP and Tropical Data have mobilised resources to scale up all components of the WHO-endorsed SAFE strategy (surgery, antibiotics, facial cleanliness, environmental improvements) and have contributed to **over 566 million doses of antibiotics being distributed and nearly 1.5 million TT operations being conducted** since 2011.

3. Improved human resources, infrastructure and technology for eye health

In recent years, programmes have included strategies to **effectively use limited human resources** in resource-poor settings.¹ In Kenya, Tanzania and Chad, national programmes are upskilling ophthalmic nurses and ophthalmic clinical officers to carry out and manage TT operations. In Ethiopia, **which accounts for 44% of the global burden of trachoma**, the national programme is training general health workers to provide eye care services, including TT surgery, in order to improve coverage rates. Furthermore, new innovations, such as the TT tracker, is **helping national programmes to track surgical performance** for individual surgeons, so supervisors know when enhanced supervision or additional training is needed.²

Conclusion

With VISION 2020 coming to an end next year, the eye health sector can celebrate advancements towards building sustainable eye health systems. The WHO World Report on Vision, published in October 2019, provides a strategic path to progress towards objectives set by VISION 2020. However, to achieve targets, trachoma interventions must be included in national eye health care plans and health systems must be equipped to deliver comprehensive eye health care for entire populations, including people with disabilities and other hard to reach populations.

References

- Courtright P, Jesudason T, Lewellan S. Achieving universal eye health coverage: planning and human resource lessons from trachoma. *Comm Eye Health* Vol. 31 No. 102 2018 pp 54.
- Bartlett S, Jensen K, Jesudason T. TT Tracker app aims to improve surgical outcomes and patient care. *Comm Eye Health* Vol. 31 No.104 2019 pp 93



Elmien

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Editor: *Community Eye Health Journal*, International Centre for Eye Health, London School of Hygiene & Tropical Medicine, UK.

Thank you

to Tijssen Foundation and the Peek Vision Foundation (www.peekvision.org) for funding the development of the *Community Eye Health Journal* app.

Ophthalmologists from Kenya and India studying at the London School of Hygiene & Tropical Medicine.

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- Look in the **Topic** tab for articles related to common keywords.
- Use the **search tool** (the magnifying glass, top right on most screens) to find something specific.
- Move between the articles in an issue using the **PREV** (previous) and **NEXT** buttons at the top of each article.
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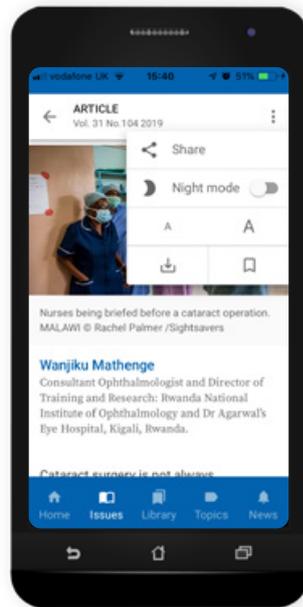


Figure 1 The three dots top right open up a menu where you can share, improve visibility and download or bookmark articles.

To save any image to your camera roll, tap and hold the image until the option appears.

Library

Here you can create and name your own folders to organise your content, e.g. for outreach visits, teaching or patient education. To access your library, you will be asked to create a free and secure account using an email address and a password of your own choosing. Everything you have downloaded and organised in your folders will always be accessible, even if you change devices or lose a device. You can also log into your library account on multiple devices, including your mobile, tablet or computer.

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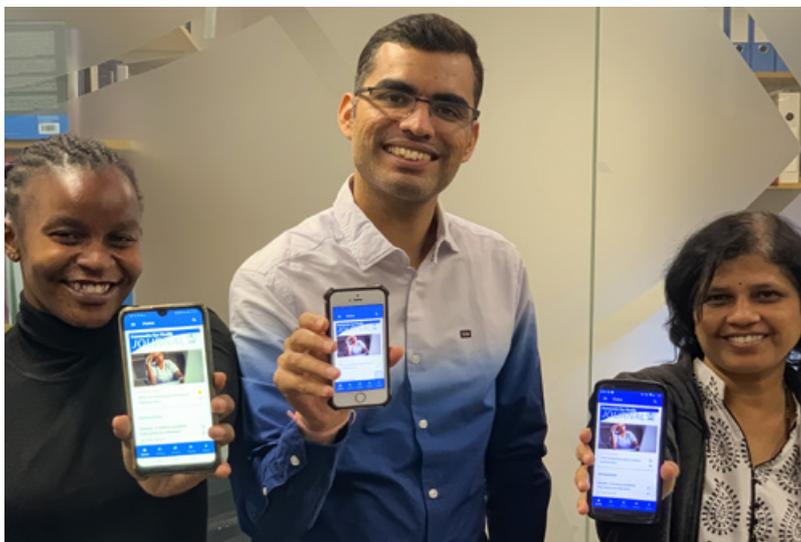
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ROWULO FABUNAN, ICEH

Test your knowledge and understanding

This page is designed to help you to test your own understanding of the concepts covered in this issue, and to reflect on what you have learnt.



NIRANJAN GAIRE, CHHANDA (KALE-BABU) NARAYANI EYE HOSPITAL

You can detect many eye conditions using a simple torch. **NEPAL**

We hope that you will also discuss the questions with your colleagues and other members of the eye care team, perhaps in a journal club. To complete the activities online – and get instant feedback – please visit www.cehjournal.org

Answer TRUE or FALSE for every part of all questions.

Question 1

The following eye examinations can be performed by a trained eye health worker (who is not a doctor) who has suitable equipment:

- a. Measurement of visual acuity
- b. Indirect ophthalmoscopy
- c. Refraction for presbyopia
- d. Measurement of intraocular pressure using a Schiötz tonometer
- e. Examination of the visual fields

Question 2

The following can be performed using a torch:

- a. Examination of the pupil light reflex
- b. Examination of the conjunctiva
- c. Diagnosis of trichiasis
- d. Examination of the optic disc
- e. Examination of the cornea for a foreign body

Question 3

The Arclight:

- a. Requires batteries
- b. Costs about £30
- c. Can be used to examine the optic disc
- d. Can only be used by doctors
- e. Can be used to examine the ears

Question 4

Which of the following statements are TRUE ?

- a. A baby with a white pupil should be referred immediately
- b. Reading glasses can be given to a 50-year-old patient with 6/60 vision in both eyes
- c. A 50-year-old patient who has an in-turned eye on cover test and complains of double vision probably has a squint from childhood
- d. A patient who complains of sudden unilateral painless loss of vision should have their pupil reactions tested and fundi examined following dilation of the pupils
- e. Community health workers must refer all eye patients to a specialist

ANSWERS

1. a, c, d and e are TRUE. Indirect ophthalmoscopy is usually done by ophthalmologists.
 2. d, is FALSE. a, b, c and e are TRUE.
 3. c and e are TRUE. a, b and d are FALSE. It is solar powered and costs about £10 (US \$13). It can be used by any trained health worker.
 4. a. TRUE. It may be cataract or retinoblastoma, both of which require urgent specialist attention. b. FALSE. The cause of poor distance vision needs to be found before considering giving reading glasses. c. FALSE. Double vision implies a recent muscle or nerve problem, e.g. sixth nerve palsy. d. TRUE. Sudden vision loss in a non-painful eye may be due to diseases of the retina or optic nerve. e. FALSE. A community health worker can be trained to carry out a basic eye examination and diagnose and treat common eye conditions such as conjunctivitis.

Picture quiz



ICEH

Question 1

What do you notice about each of the following?

- a. Eyelids
- b. Conjunctiva
- c. Cornea
- d. Pupil

Note: the dense white oval mark at 12 o'clock on the pupil margin is a reflex from the flash of the camera.

Question 2

What is the diagnosis?

Question 3

What disease is likely to cause this?

Question 4

What is the name of the public health strategy to eliminate blindness from this disease?

ANSWERS

1. What can you see?
a) Eyelids: turning in of the upper eyelashes
b) Conjunctiva: it is red
c) Cornea: there is a small grey-white opacity at 4 o'clock near the pupil edge; the rest of the visible cornea is clear
d) Pupil: it looks normal.
2. What is the diagnosis? Trichiasis.
3. What disease is likely to cause this? Trachoma.
4. What is the name of the public health strategy to eliminate blindness from this disease? The SAFE strategy (S for surgery to treat trichiasis, A for antibiotics to clear infection, F for facial cleanliness and hand hygiene to help reduce transmission and E for environmental improvement (for access to water and sanitation).

Inaugural World Ophthalmic Nursing Forum



The World Ophthalmic Nursing Forum will offer nurses the opportunity to meet and network with a wide range of colleagues from across globe. It is free for nurses who register to attend the IAPB Global Assembly in Singapore from 12-14 October 2020. Find out more: email communications@iapb.org or visit IAPB.org/GA2020

Egypt carries out first trachoma intervention since 2001

Egypt distributes antibiotics to over 300,000 people to prevent and treat trachoma. Egypt has conducted its first mass drug administration (MDA) since 2001, giving it to over 300,000 people to prevent and treat trachoma. Read more at www.cehjournal.org/NAME-OF-ARTICLE

Cataract surgeons needed

Are you a practicing ophthalmologist cataract surgeon interested in improving cataract surgical outcomes? The BOOST app will help you to capture key cataract outcome data and produce simple, engaging reports that can help you improve outcomes. To help us test the app, email BOOST@hollows.org or read more at www.cehjournal.org/NAME-OF-ARTICLE. The deadline is **30 December**.



Paediatric cataract surgery video now online

Highly respected paediatric ophthalmologist Albrecht Hennig has made a valuable teaching video about cataract surgery in children, based on technique he perfected while working in Nepal and performing cataract surgery on thousands of children. Watch it on YouTube: <https://youtu.be/exYK409KgL8>

Courses

MSc Public Health for Eye Care, London School of Hygiene & Tropical Medicine, London, UK

Fully funded scholarships are available for Commonwealth country nationals. For more information visit www.lshtm.ac.uk/study/masters/mscphec.html or email romulo.fabunan@lshtm.ac.uk

Small Incision Cataract Surgery Training at Lions Medical Training Centre in Nairobi, Kenya

Courses begin every six weeks and cost US \$1,000 for training and approximately US \$1,000 for accommodation. Email training@lionsloresho.org or call/message +254 728 970 601 or +254 733 619 191.

Free online courses

The ICEH Open Education for eye care programme offers a series of online courses in key topics in public health eye care. All the courses are free to access. More free courses coming! Certification also available. For more information visit <http://iceh.lshtm.ac.uk/oer/>

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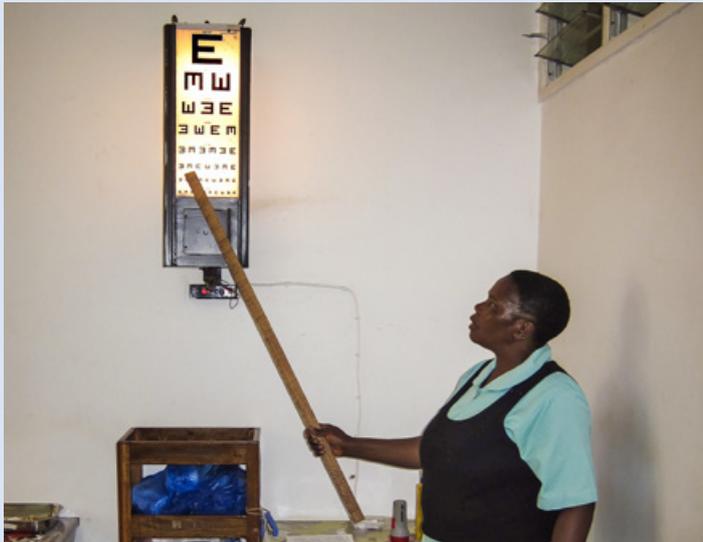
Next issue



ALLEN FOSTER

The next issue is on the theme **Viral infections and the eye** and it will be available on our app and online only

Key community eye health messages



HEIKO PHILIPPIN

The visual acuity should be measured in each eye for all patients complaining of eye problems



DR. SHIVAM MAINI, OPERATION EYESIGHT

How to examine the eyelids, conjunctiva, cornea and pupils with a torch should be taught to all health workers



TERRY COOPER

The Arclight costs about £10, is solar powered and is very useful for examining the front of the eye, optic disc and central retina

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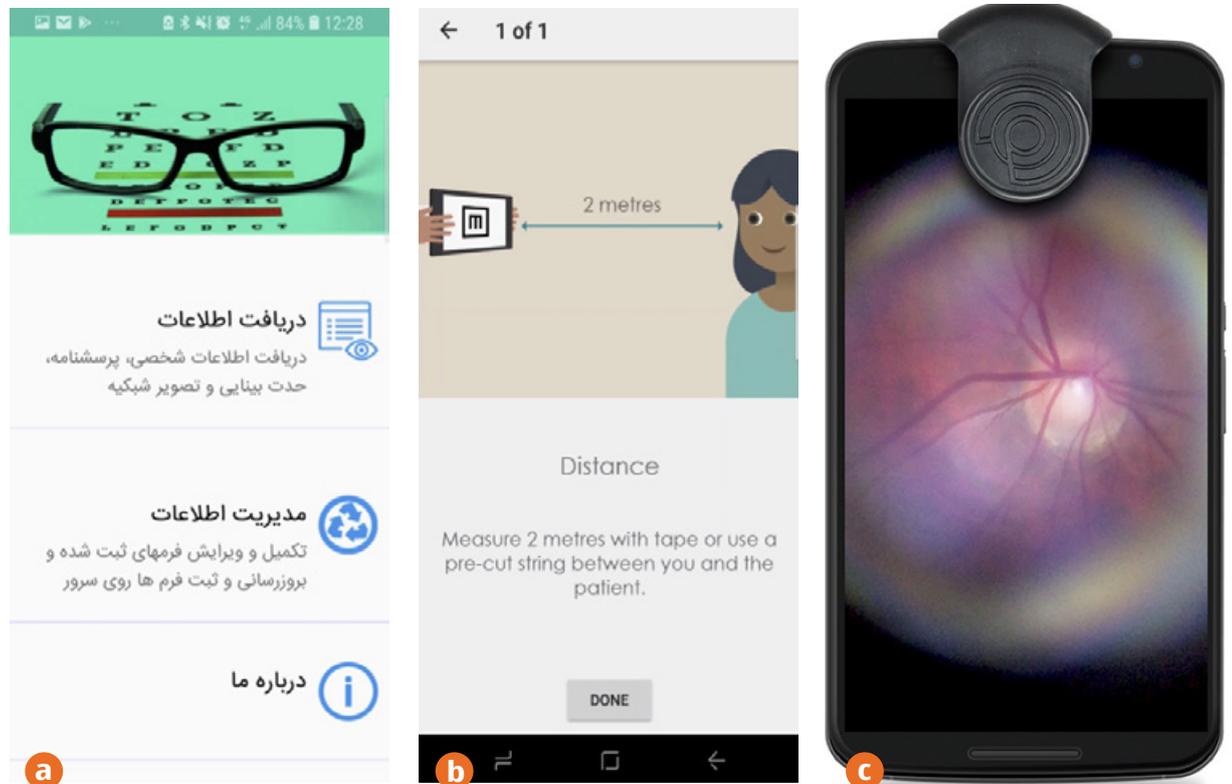
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Using mHealth to improve eye care in remote areas of Iran

Primary health workers are using a new digital mHealth tool to support eye health screening and management in Iran.



Primary health care workers use the three integrated apps in turn to: a) capture demographic data and needs assessment, b) measure visual acuity using Peek Acuity and c) take a photograph of the retina using Peek Retina.

Mobile communication technology in health (mHealth) offers opportunities to improve prevention and care for non-communicable diseases (NCDs).¹ Most evidence comes from high-income countries;² however, recent studies show that this technology is also effective at community level in low- and middle-income countries (LMICs).^{3,4} It is possible to enhance health care through mobile technology, both on- and offline, in different settings.⁵

In Iran there is one ophthalmologist and one optometrist per 40,000 and 45,000 people, respectively. Although this meets the World Health Organization's recommendations, the distribution in the country is uneven.⁶ Recent population-based studies showed that the proportion of avoidable eye disorders is high even in areas with available human resources and infrastructure due to inadequate prevention.^{7,8}

mHealth, also known as telemedicine, may facilitate cost-effective use of available resources and decrease unnecessary workload on referral centres. To enable early detection and better management and monitoring of vision-threatening conditions, provide timely follow-up and prevent ocular morbidity, we designed a community-based mHealth screening, management and monitoring tool to be integrated into the national health care system. With this tool, primary health care (PHC) workers

– the community health providers known as Behvarz in Iran – have the opportunity to screen the population in remote areas, upload data and digitally consult with an ophthalmologist in an urban referral centre.

How does it work?

The tool has two components: a mobile application and web-based software. The mobile application consists of digital survey forms, an integrated software application (Peek Acuity) for obtaining visual acuity (VA),⁹ integrated hardware for optimizing retinal imaging (Peek Retina),¹⁰ and a management system for the PHC workers.

The forms and screening tests were developed based on focus group discussions with professionals and health providers.¹¹

There are four steps:

- 1 The PHC workers use the mobile application to enter each patient's demographic and eye health history data, visual acuity and retinal images.
- 2 The information is uploaded to the customised web-based system.
- 3 An ophthalmologist in a reading centre reviews the information on the web-based system and provides a management plan.
- 4 Participants receive their results and follow-up advice, if needed, using an automated SMS (text message) system.

Testing the mHealth tool

An intervention trial on community members was carried out to test the effectiveness and acceptability of the tool. A representative sample of 50+ residents from 27 enumeration areas were enrolled through door-to-door visits of the households with a random and compact segment sampling method. Ethical approval was granted by Shahid Beheshti University of Medical Sciences in Tehran.

The study had three arms:

- 1 mHealth intervention: using mobile application for data collection and screening tests.
- 2 Conventional intervention: using paper-based forms, Snellen chart for measuring VA and fundus photography equipment for fundus imaging.
- 3 Control arm: using paper-based forms, no further intervention.

Participants with presenting $VA \leq 20/40$ in either eye were referred to an ophthalmologist for further evaluation. An ophthalmic assistant conducted retinal imaging, using Peek Retina, at the local PHC units. Retina specialists in a central reading centre reviewed retinal images and, if necessary, made further referral plans.

Results

Over 3,000 residents were enrolled, with 92.1% in the control, 78.4% in the mHealth and 57.7% in the conventional group agreeing to participate..

Of 1,508 participants in vision screening (mHealth = 873), (conventional = 635), 608 (40.3%, 95%CI: 37.8-42.8) had $\leq 20/40$ vision in at least one eye and were therefore referred for evaluation (referral rate 35.9% in conventional vs. 43.5% in the mHealth arm, not significant after adjusting for age and need for eye care).

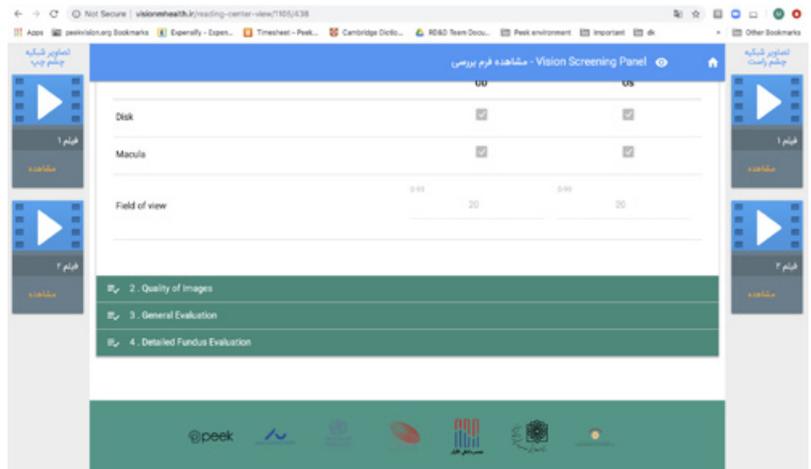
Fundus evaluation was performed in 756 participants with $>20/40$ presenting visual acuity. Of the 756, 45 (0.6%) had poor quality images (20 [0.5%] in conventional and 25 [0.75%] mHealth arms). Of 711 people with fundus evaluation, 173 (24.3%) had abnormal images (79 [19.6%] in conventional and 94 [26.9%] mHealth arms).

Implications

The findings show a high level of eye care need in the study population. PHC workers were able to examine the eye and transmit images for expert assessment using the mHealth tool.

Making a definite diagnosis and grading of disorders were beyond the objectives of the study; nevertheless, in those who were referred based on fundus imaging, the following abnormalities were found: diabetic retinopathy, age-related macular degeneration, glaucoma, high myopia, chorio-retinal scar, myopic fundus with chorio-retinal atrophy, retinal scars and hyperpigmentation.

Geographic location and socioeconomic status are factors that may inhibit service provision, use and continuity of care. Appropriate mHealth solutions may provide access to specialist consultation services and early interventions. This mHealth eye-care approach



delivers health care to populations that have limited access to specialist services and improves the health care where there are only partial services.

Many advantages of this mHealth solution were identified, including improved resource use, early intervention, avoidance of unnecessary transportation, community-based delivery and engagement, combined medical education and research, cost efficiency, improved medical record documentation and an increased coverage of care.

The mHealth tool is being updated following feedback from different users.

Acknowledgement: The authors would like to express their sincere gratitude to the Peek Vision team in the UK for their great contribution to developing the mHealth tool in this project. We also express our sincere gratitude to Ardeshir Montaseri, the CEO, and the IT team at the Asre Danesh Afzar Co. who adopted and managed this mHealth tool.

References

- 1 Payne HE, Lister C, West JH, Bernhardt JM. Behavioral functionality of mobile apps in health interventions: a systematic review of the literature. *JMIR mHealth uHealth* 2015 Feb;3(1): e20.
- 2 Free C, Phillips G, Galli L, Watson L, Felix L, Edwards P, et al. The Effectiveness of Mobile-Health Technology-Based Health Behaviour Change or Disease Management Interventions for Health Care Consumers: A Systematic Review. *Cornford T, editor. PLoS Med* 2013 Jan;10(1): e1001362.
- 3 Xavier D, Gupta R, Kamath D, Sigamani A, Devereaux PJ, George N, et al. Community health worker-based intervention for adherence to drugs and lifestyle change after acute coronary syndrome: a multicentre, open, randomised controlled trial. *Lancet Diabetes Endocrinol* 2016 Mar;4(3): 244–53.
- 4 Rubinstein A, Miranda JJ, Beratarrechea A, Diez-Canseco F, Kanter R, Gutierrez L, et al. Effectiveness of an mHealth intervention to improve the cardiometabolic profile of people with prehypertension in low-resource urban settings in Latin America: a randomised controlled trial. *Lancet Diabetes Endocrinol* 2016 Jan;4(1): 52–63.
- 5 Royston G, Hagar C, Long L-A, McMahon D, Pakenham-Walsh N, Wadhvani N, et al. Mobile health-care information for all: a global challenge. *Lancet Glob Heal* 2015 Jul;3(7): e356–7.
- 6 Mohammadi S-F, Lashay M-R, Ashrafi E, Haghdoost A-A, Alinia C, Lashay A-R, et al. Distribution of ophthalmologists and optometrists in Islamic Republic of Iran and their associated factors. *East Mediterr Health J* 2017 Feb;22(12): 880–6.
- 7 Rajavi Z, Katibeh M, Ziaei H, Fardesmaeilpour N, Sehat M, Ahmadi H, et al. Rapid assessment of avoidable blindness in Iran. *Ophthalmology* 2011 Sep;118(9): 1812–8.
- 8 Katibeh M, Blanchet K, Akbarian S, Hosseini S, Ahmadi H, Burton MJ. 'Planning eye health services in Varamin district, Iran: a cross-sectional study'. *BMC Health Serv Res* 2015 Apr;15(1): 140.
- 9 Bastawrous A, Rono HK, Livingstone IAT, Weiss HA, Jordan S, Kuper H, Burton MJ. Development and Validation of a Smartphone-Based Visual Acuity Test (Peek Acuity) for Clinical Practice and Community-Based Fieldwork. *JAMA Ophthalmol.* 2015;133(8):930.
- 10 Bastawrous A, Giardini ME, Bolster NM, Shah N, Livingstone IA, Weiss HA, et al. Clinical Validation of a Smartphone-Based Adapter for Optic Disc Imaging in Kenya. *JAMA Ophthalmol.* 2016;134(2):151-158.
- 11 Katibeh M, Kalantarion M, Sabbaghi H, Mousavi B, Schriver M, Nikkha H, et al. Designing a screening program for prevention of avoidable blindness in Iran through a participatory action approach. *J Ophthalmic Vis Res.* 2019;14(1):52.

Ophthalmologist receive information through the online system and evaluate patients' records. The screening results and follow-up advice, if needed, are sent to patients via SMS (text message).



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Comprehensive eye examination: what does it mean?

A routine comprehensive eye examination helps to screen for and diagnose common eye diseases.

As an eye health professional, it is important to talk to patients and the public about:

- consulting an ophthalmologist early when experiencing eye or vision-related problems and
- regular, periodic eye examination for early detection and treatment of eye diseases

In addition, it is a good practice to talk about basic measures for prevention of common eye diseases.¹⁻³ A routine CEE presents a good opportunity to fulfil the above objectives. It helps to screen and diagnose common eye diseases, thus helping to reduce morbidity and the costs associated with eye diseases. A CEE is done when a patient with ocular symptoms seeks medical advice and also when a simple routine eye check-up is sought. This article explains what a CEE includes.

A CEE consists of a series of tests that assess the different aspects of eye health. Ideally, a CEE should be done not just for patients seeking medical advice but also for individuals above the age of 40 as a yearly check-up.

Table 1
Components of a comprehensive eye examination

| Components | Tools |
|--|--|
| External ocular examination | • Torch light |
| Visual acuity test | • Snellen's chart • Near vision charts |
| Visual fields test* | • Central 30-2 full threshold Humphrey visual field analyser • Frequency doubling perimeter • Goldmann kinetic perimeter |
| Colour vision test* | • Ishihara test |
| Binocular vision* | • Bagolini's striated glasses • Worth four dot test • Red filter test |
| Stereopsis* | • Random dot stereoacuity test • TNO and Lang's stereo test |
| Refraction | • Self-illuminated/mirror retinoscope • Trial frame • Set of trial lenses • Cycloplegic drugs • Jackson cross cylinder • Automated refractometers |
| Anterior segment and pupillary examination | • Torch light • Slit lamp biomicroscope |
| Gonioscopy* | • Goniolens (Goldmann two, three and four mirror) |
| Intraocular pressure | • Tonometer (Goldmann, Tono-pen, Perkins, Shiotz) |
| Fundus evaluation | • Direct and indirect ophthalmoscope • +90D/+78D lens |

*Required if clinically indicated based on history and examination



A patient getting checked for refraction. INDIA

In case, a routine annual review is not possible for the entire population, it should be recommended for those with:

- a known chronic eye disease
- a family history of glaucoma or
- a systemic disease known to affect the eyes such as diabetes mellitus

Do note, that these tests may vary depending upon the population examined and the infrastructure available at a clinic. (Table 1 lists various tests in a CEE).

History

A detailed medical and treatment history is essential before beginning a CEE. Make a note of:

- family history of illnesses and working and living conditions to get an idea of the symptoms
- systemic illnesses like diabetes, hypertension, thyroid or inherited disorders. Such illnesses may affect the eyes and need appropriate investigations

Visual acuity (VA) is a measure of the eye's ability to distinguish shapes and the details of objects at a given distance. To measure VA, ask your patient to read letters on Snellen (Figure 1) or an E chart. Note the type of correction (spectacles/contact lenses) used by the patient. Any reduction in VA can show an underlying pathology. Write the results of the VA test as a fraction (20/40). The top number in the fraction is the standard distance at which a patient stands/ sits (20 feet). The bottom number is the smallest line of letter-size that the patient can read. Normal distance VA is 20/20. A pinhole test can distinguish if the reduced vision is due to refractive errors or other causes. Record the best corrected VA after you identify full correction of refractive error.

In young children, use Tellers and Cardiff acuity cards or optokinetic nystagmus. Measure the presenting and corrected near visual acuity with hand-held test cards by placing them at a distance of 40 cm.

Visual field can be tested using a simple procedure known as confrontation test. A confrontation test checks the peripheral and central visual fields (VF) and is the most used VF test done during a CEE. Each eye



Figure 1 Snellen's visual acuity chart

is tested for all four quadrants (upper and lower, temporal and nasal). In the confrontation test the eye examiner moves a target (usually a finger) from the periphery towards the centre and asks the patient when they see the target.

Perimetry tests are used for a more detailed and systematic evaluation of VF. Amsler grid is a useful tool for macular disorders with central field defect (age-related macular degeneration). Testing the visual field is useful in the management of patients with glaucoma, neuro-ophthalmic and retinal disorders.

Contrast sensitivity is the measure of the eye's ability to detect an

object against its background. A Pelli Robson chart is used to test for contrast sensitivity. The Pelli Robson chart consists of horizontal lines of capital letters in contrast of one colour. Glaucoma, diabetic eye disease, and cataracts have shown to reduce contrast sensitivity in patients.

Colour vision deficiency is the inability to distinguish between certain shades of colour. It is a genetic disorder more common in men. Red-green deficiency is most common. Conditions like diabetes, glaucoma, optic neuritis and use of certain drugs (chlorpromazine, thioridazine, ethambutol) may lead to colour vision deficiencies. Many patients are unaware of their deficiency unless tested. We recommend use of colour vision charts for screening and detecting specific types of colour blindness.

Binocular vision is the vision achieved by the coordinated use of both eyes together. Simultaneous perception, fusion, and stereopsis are the three grades of binocular vision. Binocular vision can be tested using Bagolini's striated glasses, Worth four dot test and red filter test.



Figure 2 A trial frame. INDIA

Refraction is a test that determines the type (myopia, hypermetropia, and astigmatism) and the amount of refractive error (RE). It also tells us the required lens power needed to

compensate for it. For a correct estimate of RE, the patient's accommodation should be minimal. Accommodation is the ability of the eye to change focus from distant to near images. Dry retinoscopy is the technique of refraction done without using cycloplegics. Here you can control the accommodation by asking the patient to fixate at a distant target. In wet retinoscopy, cycloplegic drugs are used to paralyse the ciliary body and remove the influence of accommodation during the test. Use a self-illuminated or mirror retinoscope to measure refractive error by placing a series of lenses in trial frames (Figure 2) in front of the eyes. You can also use automated

refractometers for an initial estimate of RE. You can fine-tune your estimates using Jackson cross-cylinder and lenses to help the patient gain clearest vision.

We recommend cycloplegic refraction followed by a post-mydriatic test for adequate assessment of RE in infants and young children. For correction of presbyopia, we prescribe adding a plus lens over the patient's distance refractive correction.

Torchlight external eye exam

An external torchlight examination helps to inspect:

- alignment and position of the eyes, eyelids, adnexa, conjunctiva, sclera, cornea, iris, pupils and extraocular movements
- palpebral symmetry, lid abnormalities, redness or growths on the conjunctiva and presence of any discharge (see Table 2)
- cornea for any abnormalities
- pupils for their size, shape, location, and reactivity

You can test the eye movements (versions and ductions) by asking the patient to look in nine cardinal positions of gaze. Use cover/uncover test to look for underlying heterophoria. Prism bar alternate cover test measures the total amount of deviation. In cases where prism bar can't measure the deviation, you can use Hirschberg and modified Krimsky tests.

Slit-lamp biomicroscopy for anterior segment

A slit-lamp (Figure 3) examines the anterior and posterior segment of the eye, which includes conjunctiva, cornea, anterior chamber, pupil, lens and retrolental space (see Table 2). Gonioscopy is the technique of visualising anterior chamber angle structures at the SL. Findings from gonioscopy include the width of angle, presence of peripheral synechiae, goniosynechiae, hyperpigmentation, and neovascularisation.

Intraocular pressure

Tonometry is used to measure intraocular pressures (IOP) and to evaluate patients with or at risk of glaucoma. Different types of tonometers include:

- applanation tonometry (Goldmann and Perkins applanation tonometry, non-contact tonometry, ocular response analyser)
- indentation tonometry (Schiotz tonometer, pneumotonometer, tono-pen)
- rebound tonometry
- Pascal dynamic contour tonometer

Preliminary assessment of the posterior segment with distant direct ophthalmoscopy

Distant direct ophthalmoscopy (DDO) is performed routinely before a dilated fundus examination. DDO helps in diagnosing media opacities. Use a self-illuminating retinoscope or ophthalmoscope in a semi-dark room at a distance of 20-25 cm from the patient's eye. Note the features of red glow in the pupillary area. You may see abnormal greyish pupillary reflex in cases of cataract or some retinal detachments.



Figure 3: Slit-lamp biomicroscope. INDIA

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References

1 Michaud L, Forcier P. Prevalence of asymptomatic ocular conditions in subjects with refractive-based symptoms. *Journal of optometry*. 2014 Jul 1;7(3):153-60.

2 Robinson B. Prevalence of asymptomatic eye disease. *Canadian Journal of Optometry*. 2003;65(5):177-86.

3 Wang F, Ford D, Tielsch JM, Quigley HA, Whelton PK. Undetected eye disease in a primary care clinic population. *Archives of internal medicine*. 1994 Aug 22;154(16):1821-8.

Detailed fundus exam with a direct, and indirect ophthalmoscope and slit lamp biomicroscopy

Direct ophthalmoscopy provides an upright and monocular image of the retina. It is very useful for examining optic disc changes and foveal pathologies at higher magnification. A dilated fundus evaluation using a binocular indirect ophthalmoscope or SL biomicroscope with a +90Dioptres (D)/+78D lens is essential to record pathologies affecting the peripheral retina. Limited field of view is one limitation of direct ophthalmoscopy.

A dilated fundus examination helps to rule out diseases like diabetic retinopathy (DR) which have a high prevalence. Non-mydratic fundus cameras are also available for peripheral centre-based screening of DR.

After a CEE, consider the results of the examination to determine a diagnosis. Sometimes more investigation may be needed to confirm or rule out the suspected diagnosis and to develop a treatment plan. Make appropriate referrals if your patient needs specialist consultations.

Table 2 Ocular structures and related disorders to look for during a comprehensive eye examination

| Ocular structures | Disorders |
|---------------------------|--|
| Eye brows | <ul style="list-style-type: none"> • Madarosis (Leprosy, Myxedema) |
| Eye lids | <ul style="list-style-type: none"> • Ptosis • Lid retraction • Lagophthalmos • Entropion • Ectropion • Trichiasis • Distichiasis • Blepharitis • Chalazion • Sty |
| Palpebral aperture | <ul style="list-style-type: none"> • Blepharophimosis • Ankyloblepharon |
| Lacrimal apparatus | <ul style="list-style-type: none"> • Fistula • Punctual stenosis • Regurgitation |
| Eye balls | <ul style="list-style-type: none"> • Proptosis • Anophthalmos • Enophthalmos • Heterotropias |
| Conjunctiva | <ul style="list-style-type: none"> • Discolouration • Conjunctivitis • Chemosis • Circumcorneal congestion • Pterygium • Pinguecula • Follicles • Papillae • Symblepharon • Foreign body |
| Sclera | <ul style="list-style-type: none"> • Discolouration • Episcleritis • Scleritis • Staphyloma • Perforations |

| Ocular structures | Disorders |
|----------------------------|--|
| Cornea | <ul style="list-style-type: none"> • Microcornea • Megalocornea • Keratoconus • Keratoglobus • Cornea plana • Dry Eyes • Edema • Scarring • Degenerations • Ulceration • Vascularisation • Guttae • Keratic precipitates • Keratitis |
| Anterior chamber | <ul style="list-style-type: none"> • Shallow/irregular depth • Aqueous cells/flare • Hypopyon |
| Iris | <ul style="list-style-type: none"> • Heterochromia • Synechiae • Iridodonesis • Rubeosis iridis • Transillumination defects |
| Pupil | <ul style="list-style-type: none"> • Shape (festooned pupil) size (anisocoria, traumatic mydriasis), • Colour (leucocoria, greyish reflex) • RAPD (swinging torch light test) • Correctopia |
| Lens | <ul style="list-style-type: none"> • Dislocation • Subluxation • Cataract |
| Optic disc | <ul style="list-style-type: none"> • Glaucoma • Papilledema • Papillitis • Optic atrophy |
| Macula | <ul style="list-style-type: none"> • Macular hole • Haemorrhage • Cherry red spot • Oedema • Hard and soft exudates • ARMD |
| Retinal vasculature | <ul style="list-style-type: none"> • Diabetic and hypertensive retinopathy • CRVO • CRAO • Vasculitis |



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Advances in anterior segment examination

Corneal imaging techniques are used to assess the structure and function of the cornea and anterior segment. They are crucial for diagnosing and treating a wide variety of ocular diseases.

Corneal and ocular surface imaging is an ever-advancing field in ophthalmology. There have been several innovations in imaging technologies, such as rotating Scheimpflug, anterior segment optical coherence tomography (ASOCT) and confocal microscopy. Investigative technologies like ocular surface analysers have helped to understand and manage anterior segment diseases in newer ways. In this article, we discuss various techniques, their advantages, and their limitations.

Corneal topography and tomography

The growing popularity of refractive surgeries has prompted rapid advancements in corneal imaging. Corneal topography helps to map the shape and features of the corneal surface. Placido's disc-based and slit-scanning system are two common technologies in use today. Tomographers, generate 3D images of the anterior segment of a cornea which gives information about its thickness. Scheimpflug imaging and optical coherence tomography (OCT), are two examples of tomography.¹

Placido disc-based keratometry

Placido's disc-based videokeratometry (Figure 1) is a common and easy-to-perform topography technique to study the anterior corneal surface. It provides information on cornea's shape (central power, simulated keratometry, corneal asphericity) and aberrometry. It is useful in the diagnosis of corneal ectatic disorders like keratoconus and while fitting contact lenses. It also helps in intraocular lens power calculation for cataract surgery in patients with irregular corneas, follow-up, and management of post-keratoplasty (corneal transplantation) astigmatism and dry eye assessment (with non-invasive tear break up time).

A limitation with this technique is that it covers a limited corneal surface area (about 60 per cent). It does not provide information about the posterior corneal surface, which is important in the early diagnosis of ectasia.

Slit-scanning

Slit-scanning elevation topography combines projection of a slit of light with Placido's disc keratometry to get anterior and posterior corneal curvature measurements. The final image represents a 3D topography that includes various colour-coded maps (curvature, elevation, pachymetry) of the entire



Figure 1 Placido disk with alternate light and dark concentric rings

corneal surface. It also provides data on anterior chamber depth, the corneal white-to-white diameter, and data from the anterior surface of the iris and lens. These devices are useful for diagnosis, follow-up, and management of corneal ectasia.

One needs to keep in mind that the representation of the posterior corneal surface may not be accurate as posterior elevation maps are derivatives and not the actual measurements.

Scheimpflug imaging

Pentacam is a device that uses a rotating Scheimpflug camera to generate a 3D model of the anterior segment. It provides information, such as corneal and lens densitometry for opacification, keratometry, colour-coded maps for corneal thickness, elevation, curvature, or refractive power (or four maps refractive), pupil diameter and anterior chamber analysis. A popular feature, known as Belin-Ambrósio enhanced ectasia display (BAD) helps in detecting early cases of ectasia and is useful in screening candidates for refractive surgery.

Pentacam also helps in patients with previous refractive surgery and cataract, and in determining corneal aberrations. Galilei is a newer device that uses a dual Scheimpflug camera and incorporates Placido disc technology to improve curvature information on the central cornea.

The advantages of these devices are their accuracy, ease of use, repeatability, speed, quality and holistic anterior segment analysis.

The initial steep learning curve for data and image interpretation is a limitation for using Scheimpflug imaging. Image resolution, visualisation of iris and

References

- 1 Fan R, Chan TC, Prakash G, Jhanji V. Applications of corneal topography and tomography: a review. *Clinical & experimental ophthalmology*. 2018 Mar;46(2):133-46.
- 2 Venkateswaran N, Galor A, Wang J, Karp CL. Optical coherence tomography for ocular surface and corneal diseases: a review. *Eye and Vision*. 2018 Dec;5(1):13.
- 3 Villani E, Baudouin C, Efron N, Hamrah P, Kojima T, Patel SV, et al. In vivo confocal microscopy of the ocular surface: from bench to bedside. *Current eye research*. 2014 Mar 1;39(3):213-31.
- 4 Giannaccare G, Vigo L, Pellegrini M, Sebastiani S, Carones F. Ocular surface workup with automated non-invasive measurements for the diagnosis of meibomian gland dysfunction. *Cornea*. 2018 Jun 1;37(6):740-5.

anterior chamber details may be better with ultra-high-resolution OCT. Pentacam's accuracy in the case of corneal scars is limited, in which case ultrasound bio-microscopy (UBM) may be a better option to visualise the anterior segment structures.

Optical coherence tomography (OCT)

Anterior segment OCT (ASCOT) captures dynamic high-resolution cross-sectional images of the ocular surface and anterior segment in a non-invasive manner.² OCT captures images with ease and interpretation of the images is not difficult. OCT is used for several investigations such as:

- Ocular surface disorder and dry eye disease: tear meniscus height and meibomian gland assessment
- Assessment of corneal opacities: endothelial gutta, depth of scarring, corneal thickness
- Keratoplasty workup and follow-up: assessment of corneal thickness and opacity, especially for lamellar/partial thickness surgeries
- Keratoconus: evaluation of focal corneal thinning and asymmetry; epithelial thickness measurement; visualisation of depth of demarcation line after collagen cross-linking; diagnosis and management of hydrops in keratoconus
- Corneal infections: assessment of depth of infiltrates, areas of necrosis, endothelial plaque
- Refractive surgery: assessment of flap thickness, interface details; workup for phakic intraocular lens for myopia
- Anterior segment tumours: ocular surface squamous neoplasia, stromal iris cysts and conjunctival nevi
- Others: corneal deposits (Kayser–Fleischer ring, drug deposits) and intracameral foreign body
- Intra-operative OCT: integration with operating microscope helps in lamellar keratoplasty and ocular surface reconstruction (Figure 2A and B)

Confocal microscopy

In vivo confocal microscopy (IVCM) is a minimally-invasive bio-imaging technique that allows high-resolution analysis of corneal microstructure and function.³ IVCM is useful in:

- diagnosing and managing acanthamoeba and fungal keratitis
- detecting deep-seated infections thereby preventing corneal scraping for microbiological diagnosis
- diagnosing corneal dystrophies and deposits

- gaining a better understanding of dry eye disease
- studying long-term changes in corneal backscatter, corneal nerves, and cellularity

Confocal microscopy has provided more insights into visual quality after lamellar keratoplasty, excimer kerato-refractive surgery and corneal alterations after contact lens wear.

Ultrasound biomicroscopy (UBM)

UBM is a high-frequency ultrasound used to capture images of the anterior segment. The procedure involves placing a fluid-filled eyecup over the eye and immersing the probe into the fluid to visualise the anterior segment. It allows deeper penetration and imaging through corneal opacities, dynamic view of the anterior segment structures and visualisation of the ciliary body, which, may not be possible with an OCT examination.

UBM is a contact procedure, it requires patient cooperation, and a highly-skilled operator to get good quality images which might sometimes be a challenge.

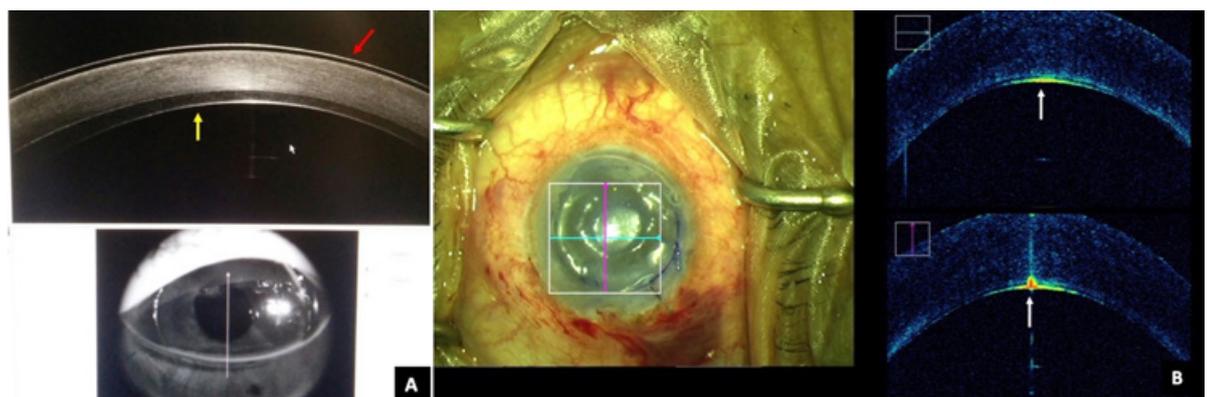
Ocular surface analyser

Ocular surface analyser (OSA) is a new addition to the plethora of imaging devices. It helps in non-invasive analysis of tear film, enables quick and detailed structural research of the tear composition and tear film layers.⁴ It also helps to identify the type of dry eye disease and determine targeted treatment for individual layers. OSA is helpful in several investigations such as:

- interferometry- measurement of tear film stability, thickness, and pattern of the lipid layer
- tear meniscus- helps to check its height, regularity, and shape
- non-invasive break up time(NIBUT)- using grids projected onto the cornea, it measures, the stability of the mucin layer and the entire tear film
- meibography- images the shape of the meibomian gland through transillumination of the eyelid with infrared light, helps in picking up drop-out areas, and diagnosis of the meibomian gland dysfunction
- others- ocular redness classification, blink rate, pupillometry (scotopic, mesopic, and photopic)

While we have come a long way with the available investigative modalities, a thorough clinical examination is crucial for correlation and appropriate management.

Figure 2A RTVue ASOCT image showing well attached DSAEK graft (yellow arrow) with a contact lens in situ (red arrow)
Figure 2B Intraoperative OCT image with a well attached DMEK graft (white arrow) at the end of surgery.





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Diagnosing glaucoma

Glaucoma is a condition that can lead to severe vision loss if not detected on time. Opportunistic screening is one way to screen for glaucoma.

Glaucoma is a disease that damages the eye's optic nerve. It is often a chronic, progressive and degenerative disease that can lead to visual defects. There may also be an acute presentation with redness, pain, tearing and photophobia due to acute raised intraocular pressure (IOP) in cases with angle closure.^{1,2} The damage caused by glaucoma is irreversible. This is why it is important to diagnose the disease early to prevent further vision loss.

You can suspect glaucoma in a patient if the patient has:

- family history of the condition
- high refractive errors
- diabetes
- symptoms like coloured halos and/or pain,
- frequent change of glasses
- raised intraocular pressure
- occludable angles
- signs of optic nerve head damage

India is a country of nearly 1380 million people of which about 345 million people (25 per cent) are aged 40 years and above. This age group is eligible for opportunistic screening for glaucoma.

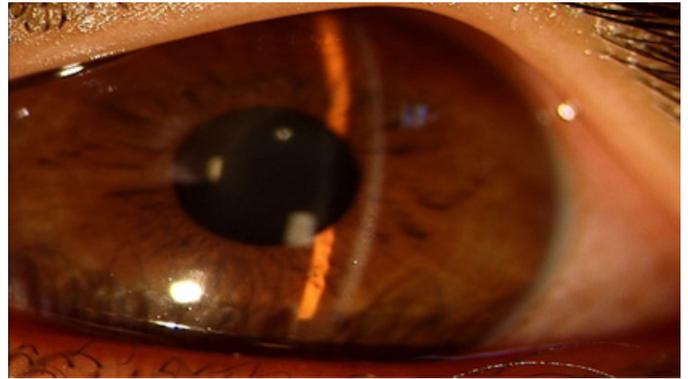
Opportunistic screening for glaucoma

Opportunistic screening involves checking those at risk for glaucoma when they present themselves for any eye examination. It can be done in outreach camps, vision centres and ophthalmology clinics. Opportunistic screening for glaucoma includes:

- checking for family history of glaucoma
- measuring IOP
- examining the anterior segment with torchlight, including relative afferent pupil defect (RAPD)
- evaluating the optic disc with direct ophthalmoscope

If available it can also include obtaining an image of the optic disc with smart phone photography.

Eye trained staff at outreach camps, vision centres and eye clinics can examine those at risk of glaucoma (anyone aged 40 years and over); this includes patients who may present with presbyopia, refractive errors or cataract. Proper family history, measurement of intraocular pressure, torchlight examination and optic nerve head assessment is recommended for all patients for opportunistic screening of glaucoma.



Shallow anterior chamber seen with a torchlight. INDIA

MADHU BHADURIA

Comprehensive ocular examination for glaucoma

Slit-lamp evaluation for glaucoma

Van Herick technique is used to evaluate anterior chamber depth with a slit-lamp to look for:

- pseudo exfoliation
- neovascularisation of iris
- iris atrophy
- presence of peripheral iridotomy
- blebs
- pigments of corneal endothelium (Kruckenberg spindle)
- pigments on the anterior surface of the lens

Tonometry

Do remember to measure IOP of all patients above 40 years at every visit. Applanation tonometer is ideal but rebound or non-contact tonometer can also be used. Corrected IOP according to corneal thickness is useful in suspected cases of ocular hypertension and normal-tension glaucoma.

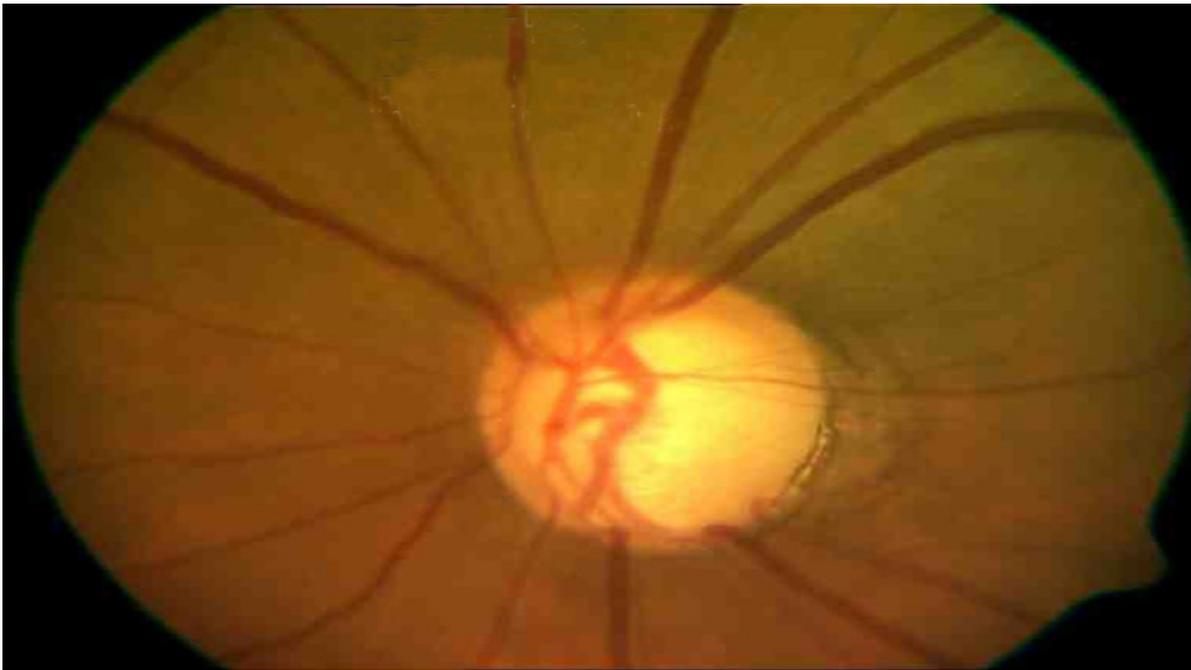
Gonioscopy

Gonioscopy is essential for all patients suspected of glaucoma. It examines the angle of the anterior chamber. It is best performed using four-mirror indentation gonioscope. The ophthalmologist should assess the angle as occludable or open as the treatment will depend on the assessment. An angle is occludable when posterior trabecular meshwork is not seen in 180 degrees of angle and more.

Dynamic or manipulative gonioscopy assesses if angle closure is only appositional or if peripheral anterior synechiae are formed. Evidence of blotchy pigments, neovascularisation, excessive pigments on trabecular mesh with wide open angle and concave iris are signs of pigmentary glaucoma.

Disc evaluation

The best way to evaluate a disc is with a 78 or 90 Dioptre non-contact fundus lens on a slit lamp. It gives a stereoscopic view of the disc to assess optic disc size, cup and rim delineation. In patients suspected of glaucoma important signs to note are: cup size and depth, loss of rim, notches, slopes, and disc



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haemorrhage. A point to remember is that the margin of cup is where vessels bend and not the area of pallor.

The disc suspected for glaucoma may include:

- a vertical cup to disc ratio of more than 0.5
- asymmetric cups (that is a cup disc ratio between both the eyes of more than 0.2)
- notching of the neuro retinal rim and
- splinter haemorrhages at the disc

Disc damage likelihood score (DDLS) is a tool that can help to classify optic discs of different sizes as normal, disc at risk, glaucoma damage and glaucoma disability.

Visual field analysis

All the patients who are glaucoma suspects need perimetry to check for glaucomatous field loss.

Imaging in glaucoma

Visual field defects begin to be obvious after a loss of about 40 per cent of retinal ganglion cells. Hence structure imaging tools that can pick up abnormalities earlier have become popular. These tools include optic disc and retinal nerve fibre layer (RNFL) imaging for disc documentation and RNFL loss. The most popular technique is optical coherence tomography (OCT). OCT is a non-invasive test that provides images of disc, RNFL and ganglion cell count of macula. These are useful for early detection and to track progression.

Progression of glaucoma

Family history, refractive errors, and age are risk factors for progression of glaucoma.³ Progression is tracked using IOP, visual fields, disc photos and/or OCT. Optic disc progression can be seen as neuro-retinal rim thinning, enlargement of the cup/ disc ratio and increased area of parapapillary atrophy. Visual field progression is assessed by increasing mean deviation and pattern standard deviation, enlargement of scotoma or increased depth of scotoma. OCT gives numeric values of disc parameters and RNFL thickness; a reduction of ten per cent or more from a previous visit is considered progression. Visual fields and OCT both have built-in progression analysis package called GPA that is capable of giving trend and event analysis.

References

- 1 Bathija R, Gupta N, Zangwill L, Weinreb RN. Changing definition of glaucoma. *Journal of glaucoma*. 1998 Jun 1;7:165-9.
- 2 Van Buskirk EM, Cioffi GA. Glaucomatous optic neuropathy. *Am J Ophthalmol*. 1992 Apr 15. 113(4):447-52
- 3 Rao HL, Kumar AU, Babu JG, Senthil S, Garudadri CS. Relationship between severity of visual field loss at presentation and rate of visual field progression in glaucoma. *Ophthalmology*. 2011 Feb. 118(2):249-53



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Recent advances in retinal imaging and diagnostics

New imaging technologies like artificial intelligence and deep learning systems show a potential to screen populations at risk of retinal diseases at a large scale in a resource constrained setting.

Retinal disorders are emerging as important causes of blindness in middle-income countries. In a recent rapid assessment of avoidable blindness plus diabetic retinopathy (RAAB plus DR) survey in western India, posterior segment disorders (PSD) were responsible for nearly 39 per cent of blindness next only to cataract (45 per cent).¹ Diabetic retinopathy (DR), retinopathy of prematurity (ROP) and age-related macular degeneration (ARMD) are the important retinal diseases of public health significance.

Challenges in screening for retinal diseases

Challenges to provision of screening in resource poor regions such as Asia include lack of specialists and lack of equipment. Of the limited specialists, most practise in urban areas, whereas a large population resides in remote rural areas. Retinal imaging devices and telemedicine can help address the 'rural-urban gap',² as non-ophthalmologists can screen for retinal diseases to save the precious time of specialists.

Types of retinal imaging

Several types of cameras can image the retina or optic nerve. Imaging a retina allows one to:

- screen various diseases
- photo document pathological lesions
- track disease process
- see response to therapy overtime

Fundus photography has transformed from electronic flashes to smart phone-based cameras to more recent portable eye examination kit (PEEK). PEEK is a smart phone-based application for comprehensive eye examination (www.peekvision.org). The advantage of these cameras is that a non-ophthalmologist can take pictures and, with some training, grade them as well.

We discuss various types of imaging systems below:

Mydriatic camera

This is the most used and sophisticated imaging system available in the market. By asking patients to move their eyes in different directions, one can take



Figure 1 Retinal dialysis imaged with an ultra-wide field camera. **INDIA**

images of posterior pole as well as the periphery of retina. Pupillary dilatation and bright flash lights make this system less patient friendly. The bulky size of a mydriatic camera makes it unsuitable for use in outreach/high volume screening.

Non-mydriatic camera

Low cost and less weight makes a non-mydriatic camera ideal for screening. It also appeals to patients as you can image without pupillary dilatation and use low intensity flash light.

Hand-held cameras

The big advantage of a hand-held camera system is its small size. This system does not need to be mounted on a table top unlike the mydriatic and non-mydriatic cameras. Its portable size and low cost make this a good option for high volume screening programmes. One important disadvantage with this camera is that, it is difficult to get good quality images if cataract or other media haze are present. Hand-held cameras cannot be used for special investigations such as FFA.

Smart phone-based camera systems

Special adaptors make it possible to use smart phones as fundus cameras. This is the cheapest way to image a retina. In several studies, a smart phone-based retinal camera has shown similar results to a desktop fundus camera.³

Most cameras we mention above provide a field of view between 30 and 45 degrees. This is suitable to identify diseases that affect posterior pole like diabetic retinopathy (DR) or age-related macular degeneration (ARMD). However, there is a possibility of missing lesions in the retinal periphery.

Ultra-wide field (UWF) camera

UWF camera helps to take images of peripheral retinal lesions like vein occlusions, vasculitis, posterior uveitis, breaks and detachments. UWF cameras provide



Figure 2 ROP screening with a portable camera with probe resting on neonate's eye.

INDIA

a field of view of 200 degrees which is approximately 82 per cent of retina surface. Fundus fluorescein angiography (FFA) with such cameras helps to detect peripheral vascular lesions

which are otherwise missed in a standard FFA. Figure 1 shows the ultra-wide field image of a giant retinal tear which may have missed with standard photography. Disadvantages of UWF imaging system are high cost and bulky size.

Ocular angiography

Angiography of the retina and choroid shows vascular diseases and inflammatory pathologies. FFA provides useful information on diabetic retinopathy, retinal vein occlusions and retinal vasculitis. For choroidal pathologies such as ARMD, the ICG angiography is a better tool. Areas where there is hypoperfusion, leakage or staining, show the anatomical location and pathological process. This helps to arrive at a conclusive diagnosis and plan for future management of a case.

Fundus autofluorescence

Fundus autofluorescence (FAF) is non-invasive and a quick method to assess the function of retinal pigment epithelium (RPE). FAF aids in diagnosis of optic nerve head drusen, Best's disease and hereditary macular dystrophies.

Paediatric retinal imaging

The cameras we mention above need a person to sit in front of a camera aperture and fix their gaze on a target. This is impossible in a neonate or an infant. Certain wide field imaging systems like Retcam and Forus Neo help in such cases. Some of these cameras are portable and have a probe which resembles an ultrasound transducer. Paediatric retinal imaging is a contact technique and images up to the ora serrata can be taken under topical anaesthesia. Portability makes these tools an excellent choice for screening retinopathy of prematurity (ROP) and retinoblastoma.

Optical coherence tomography

Optical coherence tomography (OCT) is equal to a histopathological section of a tissue. One can study individual layers of retinal cells and pathological lesions in them. OCT diagnoses many subtle pathologies which may be missed during a clinical examination. Figure 3 shows an OCT image of a neurosensory detachment secondary to central serous retinopathy. OCT is performed on an undilated pupil. Newer OCT machines can capture good quality images even through dense cataracts. Recent addition of OCT angiography allows dyeless visualisation of retinal vessels in macula.

Artificial intelligence in diagnosis of retinal conditions

Artificial intelligence (AI) and deep learning system (DLS) have the potential to improve screening coverage in resource constrained settings. In DLS, neural networks read labels of images with normal and abnormal findings. It then starts to recognise patterns and groups similar images of a particular diagnosis. More the number of image sets, higher the precision and accuracy.

In a study done in Singapore, researchers used AI and DLS to screen and identify DR and other eye diseases. The results of the study showed a very high sensitivity to vision threatening DR but a low sensitivity for diabetic macular oedema. Which makes it, one of the major limitations in a DR screening programme. However the study showed a high sensitivity and specificity for detection of glaucoma and ARMD.⁴ Further research may establish the validity of DLS in making a difference at a large scale. AI and DLS show the potential in screening programmes. They can reduce the burden on trained human resources and enable specialists to focus on treatment of these conditions.

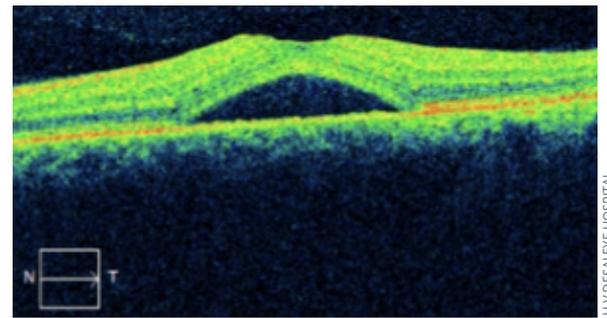


Figure 3 OCT scan of macula showing a neurosensory detachment. INDIA

Conclusion

Advances in retinal imaging have led to a paradigm change in diagnosis and management of retinal diseases. In future, use of new technologies like AI and DLS in screening programmes is likely to help identify several blinding retinal conditions and treat them at an early stage.

References

- 1 Kulkarni S, Kondalkar S, Mactaggart I, Shamanna BR, Lodhi A, Mendke R, Kharat J, Kapse R, Dole K, Deshpande M. Estimating the magnitude of diabetes mellitus and diabetic retinopathy in an older age urban population in Pune, western India. *BMJ open ophthalmology*. 2019 Feb 1;4(1):e000201.
- 2 Vinekar A, Gilbert C, Dogra M, Kurian M, Shainesh G, Shetty B, Bauer N. The KIDROP model of combining strategies for providing retinopathy of prematurity screening in underserved areas in India using wide-field imaging, tele-medicine, non-physician graders and smart phone reporting. *Indian journal of ophthalmology*. 2014 Jan;62(1):41.
- 3 Vilela MA, Valença FM, Barreto PK, Amaral CE, Pellanda LC. Agreement between retinal images obtained via smartphones and images obtained with retinal cameras or fundoscopic exams—systematic review and meta-analysis. *Clinical Ophthalmology (Auckland, NZ)*. 2018;12:2581.
- 4 Ting DS, Cheung CY, Lim G, Tan GS, Quang ND, Gan A, Hamzah H, Garcia-Franco R, San Yeo IY, Lee SY, Wong EY. Development and validation of a deep learning system for diabetic retinopathy and related eye diseases using retinal images from multiethnic populations with diabetes. *Jama*. 2017 Dec 12;318(22):2211-23.



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Managing demand generation with evidence

Generating and managing demand for eye care services must be based on evidence. We discuss what this evidence includes and how it can be effectively used to start eye care programmes to reach underserved populations.



Evidence is needed to generate and manage demand for eye care services. INDIA

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An estimated 1.3 billion people worldwide live with some form of distance or near vision impairment. Uncorrected refractive errors and cataracts are the leading causes of vision impairment. They are also avoidable.¹ The WHO estimates that globally only about a quarter of people with eye problems use eye care services.²

Studies conducted in rural India and Nepal show the levels of uptake of eye services and cataract surgery range from seven per cent to 35 per cent. In another study in 52 countries only 18 per cent of people over 60 years got their eyes examined within the last one year; 38 per cent reported never having an eye exam.³

Appropriate demand generation strategies can address this unmet need in the community. With large eye care providers based in urban areas, there is a need to reach the rural population. Community outreach programmes are a viable strategy to generate demand in rural populations. These programmes have an indirect or snowball effect on the patients who come to a base hospital.⁴ Another strategy is setting up primary eye care centres in rural areas. Primary eye care centres can enable access and refer those who need further interventions to a base hospital.

Outreach

Outreach can be either at a community screening or at vision centre or at primary eye care centre. An eye care provider can generate demand for outreach activities by gaining a good understanding of the region, and ensuring good frequency of visits. While walk-in patients can visit a hospital anytime, their visits depend on:

- their level of awareness
- the priority they accord to eye care and
- the level of trust in the service provider

We need to plan activities and track them with appropriate evidence to ensure that our efforts in delivering eye care are effective.

Estimating the demand potential

While evidence exists for prevalence or backlog, it is a challenge to estimate the demand for, let's say,

cataract surgeries or spectacles, from a particular area in a certain period. Yet, one can make reasonable estimates based on existing trends, comparing with other similar regions, and the need in the community. Such estimates can also be made for a country or state.

Setting targets for an eye hospital

Besides, estimating the demand potential, eye hospitals need to set targets which requires us to understand the current level of eye care in the service area to arrive at the unmet demand potential. Targets combined with the hospital's own capacity can help derive the annual goals for the hospital.

Setting targets for an outreach event

An outreach event covers a circle of eight to ten kilometres radius around the camp and is influenced by the access time to reach the eye camp site. The population covered and the intensity of promotion are the main drivers of the event. Past experiences help to refine the estimates for expected outpatients, surgery or spectacles.

Why are such targets important?

At the national level such targets are critical for advocacy and to build capacity of human resources and facilities. This applies to the hospital level as well. For outreach events such targets guide adequate staffing. Technology like geographic information system (GIS) can help to set realistic targets for served or underserved areas.

Ensuring effectiveness of the programme

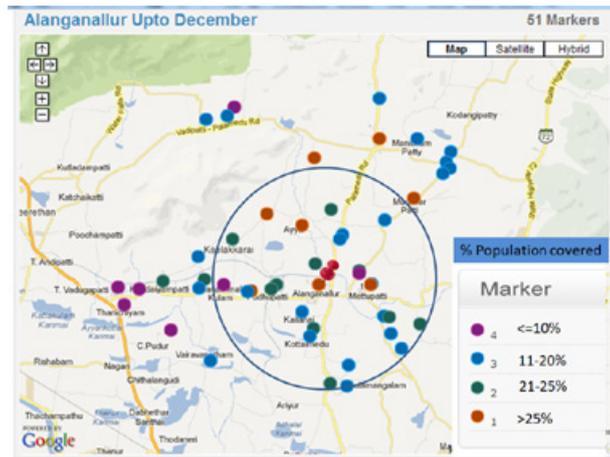
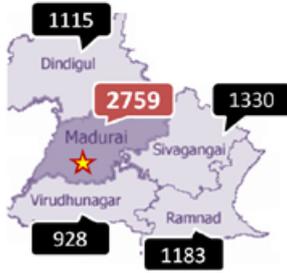
Several factors influence the effectiveness of our efforts or deployment of resources. Having evidence helps to develop the right interventions to enhance the effectiveness. Such factors are:

Compliance refers to whether or not patients follow their physicians instructions. It is important to understand how many patients comply with the prescribed surgery, spectacles or treatment. All the diagnostic or outreach efforts on those who don't

References

- 1 World Health Organization. Blindness and vision impairment fact sheet. <https://www.who.int/news-room/fact-sheets/detail/blindness-and-visual-impairment>: (accessed on 31 December 2018).
- 2 Donoghue M. People who don't use eye services: 'making the invisible visible'. *Community Eye Health*. 1999;12(31):36.
- 3 Vela C, Samson E, Zunzunegui MV, Haddad S, Aubin MJ, Freeman EE. Eye care utilisation by older adults in low, middle, and high income countries. *BMC ophthalmology*. 2012 Dec;12(1):5.
- 4 Gupta S, Palsule-Desai OD, Gnanasekaran C, Ravilla T. Spillover effects of mission activities on revenues in nonprofit health care: the case of Aravind Eye Hospitals, India. *Journal of marketing research*. 2018 Dec;55(6):884-99.

Variation in Access: New patients per lakh population



A geographical analysis can tell where patients come from.
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comply, is essentially wasted. Plus without the treatment, there is no impact on the problem. So it is important to track the prescriptions and their compliance. Understanding the barriers to non-compliance helps to plan appropriate strategies to improve compliance.

Cataract surgery acceptance rate is the number of cataract patients accepting a surgery among the total number of patients prescribed. Setting a target for the surgery acceptance rate helps to measure the gap and plan for increased productivity and cost effectiveness. You may find that transport, counselling and costs are also facilitators for improving effectiveness.

Cataract conversion rate is the number of cataract surgeries done per hundred outpatients served. We use this when calculating cataract surgery acceptance rate is not possible due to lack of data. The rate varies across the regions as per the prevalence of cataract and the type of services available. Comparing the rate with similar organisations ensures that we do not miss the patients needing cataract surgery. The rate can suggest refinements to clinical protocol and counselling process.

Diagnostic profile of outpatients gives an insight into the patients' condition. We must take appropriate action if patients are not visiting the hospital for certain conditions. For instance, if very few patients with diabetes are getting their eyes examined, focused awareness campaigns at the community level can address this and reduce the risk of diabetic retinopathy.

A **geographic analysis** of where patients come from can help to identify areas of low coverage. This, in turn, helps to frame appropriate strategies to reach patients from all locations.

It is a common phenomenon in many regions to see seasonal variations in **patient load**. This can be due to several reasons, including changes in the weather. Such variations lead to underutilising resources during lean periods and stretching in peak periods. Both scenarios are undesirable. So, knowing the variations would help managers to smooth the seasonality.

Sustaining the demand

Sustaining and growing the demand is largely driven by word of mouth and trust in the hospital. Therefore the evidence for quality of services, patient satisfaction and retention requires constant improvement.

Post-operative visual outcome:

Satisfied patients usually become the ambassadors of the hospital. It is important to minimise operative complications

and ensure that the patient gets the best possible vision. The WHO recommends that over 90 per cent of the cataract surgical patients should gain a best corrected vision of 6/18 or better. It is heartening that very good outcome of better or equal to 6/12 is a step in the right direction for quality vision.

Patient experience:

This is another major influence on demand. It includes both clinical and non-clinical services. Apart from clinical outcomes, patients should be happy with other services you offer like short waiting time, support services, food and quality of communication. A simple way to know what patients want is by placing a suggestion box or through feedback surveys.

Tracking patients with chronic conditions:

Patients with conditions like glaucoma or diabetes need to be monitored regularly to preserve their vision. A patient register to track such patients and sending reminders via SMS or WhatsApp may be useful. You can track the effectiveness of such interventions through compliance to periodic follow-up.

Benchmarking:

Any evidence by itself in isolation does not give much insight. Looking at historical data or a comparison with other providers can give rich insight. For example, an indicator of quality of surgery is when a hospital reports that 80 per cent of cataract patients gained best corrected visual acuity (BCVA) 6/18 or better. When you compare this with WHO standards of 90 per cent you can find the gap and opportunities for improvement.

Monitoring system:

For excelling in operations, monitoring should be an integral part of a hospital teams work. Periodic systematic review of what went well or what didn't, can pave the way for continuous improvement of existing systems and processes.

Conclusion

Managing demand has two facets and each has a different orientation. Looking at the current demand for services that is, those who come and have their need met by your services. All providers, regardless of whether you are programme manager or running a hospital, should also be concerned with those in the catchment area you are not reaching, the unmet need. Coverage is the percentage of those who have their need met out of all those who have a need. This needs to be based on good evidence generated through ongoing monitoring and population based studies.