**Expert Review**  Examination of Visual Acuity

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Abstract  Examination of visual acuity is an essential part of the clinical examination. This article reviews the salient features of the examination, the necessity of standardisation, and the relative merits of the different types of visual acuity chart. Suggestions are consistent with The Principles of Clinical Examination [1]. It should provide a useful resource for both the novice medical student and the more experienced clinician. **Word count**: 1,533 (excluding abstract and references).

Key words: Visual acuity, vision, examination, Snellen, logMAR.

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**Introduction**

Visual acuity (VA) is determined by the smallest object that can be clearly seen and distinguished at distance, or alternatively when testing near. VA is, along with visual field, the most important determinate of visual function. It is commonly assessed in both a general practice and hospital setting. The examination should proceed as summarised in Table 1.

VA can be disturbed by pathology at three main levels: the sharpness of retinal focus, the sensitivity of the components of the visual pathway, or the interpretative faculty of the brain [2]. Although loss of VA is most commonly caused by a correctable refractive error, it can signify a wide range of pathology—from glaucoma and cataract, to stroke.

**Principles of the Examination of Visual Acuity**

Some general principles will be discussed first.

**The Charts**  VA is assessed using standardised charts, which display lines of visual stimuli, arranged by size, so that the examiner can determine the smallest size of visual stimuli that the patient can distinguish accurately at distance.

The fully functioning adult visual system can easily distinguish two points separated by an angle to the eye as small as 1 minute. By convention, this ability to distinguish an angle of 1 minute is arbitrarily

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<table>
<thead>
<tr>
<th>Table 1  Examination check list.</th>
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</thead>
<tbody>
<tr>
<td><strong>Introduction</strong></td>
</tr>
<tr>
<td>Ask for consent to the examination</td>
</tr>
<tr>
<td>Wash hands using alcohol gel</td>
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<tr>
<td>Ask if the patient is comfortable</td>
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<tr>
<td><strong>Preparation</strong></td>
</tr>
<tr>
<td>Ensure the chart is at the correct distance with adequate illumination</td>
</tr>
<tr>
<td>Ask the patient to wear distance glasses or contact lenses (consider pinhole test to rule out refractive error)</td>
</tr>
<tr>
<td>Cover non-examined eye with occluder</td>
</tr>
<tr>
<td><strong>Examination</strong></td>
</tr>
<tr>
<td>Instruct patient to keep examind eye open</td>
</tr>
<tr>
<td>Ask patient to read chart</td>
</tr>
<tr>
<td>Advise ‘guess’ if unsure</td>
</tr>
<tr>
<td>Record smallest line that the patient can read (or progress to further tests if patient cannot read largest type)</td>
</tr>
<tr>
<td>Repeat for the other eye (take measures to ensure the patient is reading the chart, not recalling answers from test of previous eye i.e. read from right to left rather than left to right).</td>
</tr>
<tr>
<td>Thank the patient and make sure they are comfortable</td>
</tr>
</tbody>
</table>

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considered the correlate of 'normal' VA. Therefore, most VA charts will have sections that subtend 1 minute of arc (6/6 lines), and actually most will include even smaller stimuli (most include 6/5 lines and many include 6/4 lines). The patient is asked to read the chart (e.g. Snellen chart), or to perform a task that depends on being able to see the chart (e.g. Landolt C chart).

**Corrective lenses** The optician is interested in measuring refractive error, whereas the physician is usually more interested in any recent change in visual acuity. Therefore, the patient will be asked to wear his/her distance glasses or contact lenses – as these usually compensate for any long-standing refractive error. It should be documented in the notes that the patient was wearing corrective lenses during the VA test.

**Covering the eye** It is important to measure each eye independently, as otherwise a unilateral loss of visual acuity may be overlooked, and also because binocular VA is usually slightly better than monocular VA. Care should be taken to ensure that the eye that is not being tested is covered completely, so it is advised that the examiner should cover the patient’s eye with an occluder.

**Standardisation** The reliability of visual acuity measurements under a standard protocol is high – over 98% in one major study [3]. Without precautions to ensure adequate standardisation, the test of VA can become far less reliable; one study found that 53 per cent of in-school VA results were either one line better or one line worse than the VA measured in the controlled conditions of an orthoptic clinic, whilst 27 per cent of the measurements had an even greater difference [4]. There is an obvious necessity to employ standardised protocol.

The charts must be viewed from a set distance. The chart should be attached to a wall with no visual distractions, and away from any windows that could cause glare. One study suggests that very few GP practices measure and mark the set distance with appropriate accuracy [8].

Charts that are proportionately reduced in size can compensate for rooms too small to allow the standard set distance. It is preferable to use the standard 6 metre charts, as 6 metres is said to be close enough to ‘optical infinity’ to make lens accommodation negligible. At 3 metres, the amount of accommodation of the lens is significant. Mirrors can be utilised with reversed VA charts to increase the virtual viewing distance in a small exam room (Figure 1).

**Figure 1** Snellen chart (above right) and reversed logMAR chart (left).

The illumination of the room should be no less than one-fifth that of the chart. For externally illuminated charts, the minimum lighting requirement is 480 lx [6]. Again it is likely that many GP practices fall short of this requirement, hence underestimating the patient’s VA [6].

The patient should be encouraged to ‘guess’ letters if they are uncertain. This measure should minimise variation caused by the psychological factor of whether an uncertain patient is reluctant or willing to give a response.

The patient must keep the examined eye wide open, as lid squeezing can increase VA in the patient with elements of refractive error (see ‘pinhole test’ later).

**Recording VA** The examiner determines which is the smallest line that the patient can see. Beside this line, on the VA chart, should be a notation that gives the VA result numerically.

VA results are expressed as fractions; the numerator denotes the patient’s distance from the chart, and the denominator denotes the distance from the chart at which a normal person can see that particular line. In the UK distances are given in metres, and most standard charts have a viewing distance of 6 metres, so that normal vision is regarded as 6/6 (the USA uses feet, where 20/20 is equivalent).

For example, if the VA is 6/60, the patient can read from 6 metres the line that normal people can read from 60 metres (i.e. visual acuity is poor).

**Further tests** Patients with severely impaired vision may not be able to read even the largest type on the
VA chart (the 6/60 line). In this case, the patient may advance closer to the chart, until he/she can see it. VA is recorded as x/60, where x is the distance from the chart where the patient can see the 6/60 line.

If the 6/60 line cannot be seen even from close, the distance at which the patient can count the number of fingers that the examiner is holding up (counting fingers or CF vision), or can see hand movements (HM vision) should be tested. Failing this, the examiner should darken the room and shine a torch light into the eye. A patient who can identify the direction of light or at least the presence of light has ‘light projection’ or ‘light perception’ (LP), respectively. Otherwise, the patient is recorded as ‘no perception of light’ (NPL).

**The pinhole test**  
The commonest cause of decreased VA is poor focusing (a refractive error). To distinguish refractive error from other causes of decreased VA, the patient should re-read the VA chart when looking through a pinhole disk. This device filters out all but a narrow beam of light that runs along the visual axis, hence removing the need to focus and therefore correcting for refractive error. If VA remains poor despite use of the pinhole disk, the cause is something other than a refractive error.

**Types of VA Charts**

**Snellen chart**  
In the United Kingdom, visual acuity is most commonly assessed with a standard Snellen chart at 6 metres. The first line consists of one very large letter, whilst subsequent rows have increasing numbers of letters of decreasing size (Figure 1).

The Snellen chart is criticised, in that the lines with bigger letters have fewer letters on each line. This makes the big lines inherently easier to read, as there is less crowding. This is especially important in patients with amblyopia – who find it far easier to see isolated figures. In addition, patients may be able to memorise those lines with fewer letters.

**logMAR chart**  
This chart incorporates recommendations of the Committee on Vision of the American National Academy of Sciences – National Research Council [7]. Unlike the Snellen chart, the test task is the same at each size level on the chart. There are the same number of letter on each row, with uniform between-letter and between-row spacing. In addition, the exact letters on the chart are chosen to be of equal legibility between rows (Figure 1).

The logMAR chart is thought to have greater accuracy and sensitivity than the Snellen chart [8], and is widely used in the research world. However, it is not widely used in a clinical setting, presumably because of its increased cost, size and time taken to test. Efforts have been made to develop an abbreviated version of the logMAR chart [9], but uptake remains low.

**Landolt’s broken-ring chart**  
Illiterate persons and young children may use a different chart such as Landolt’s broken-ring chart. The patient is asked to identify in which direction the break in the ring is pointing (Figure 2).

![Figure 2 Landolt’s broken ring chart.](image)
Figure 3 Standardised book of types.

Summary
The test of VA is an essential part of the clinical examination. When approached correctly, it can be an accurate and useful test. However, particular care must be taken to standardise the test. Whilst the Snellen chart is the most commonly used VA chart, one might anticipate a movement towards the increased uptake of the logMAR chart.

References

Conflicts of interest
None declared

Acknowledgements
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