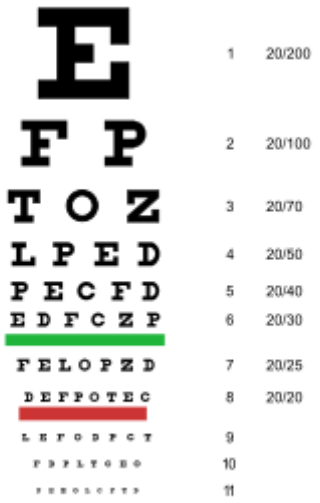
Eye chart

An **eye chart**, or **opotype**, is a chart used to measure visual acuity. Eye charts are often used by health care professionals, such as optometrists, physicians or nurses, to screen persons for vision impairment. Ophthalmologists, physicians who specialize in the eye, also use eye charts to monitor the visual acuity of their patients in response to various therapies such as medications or surgery.

The chart is placed at a standardized distance away from the person whose vision is being tested. The person then attempts to identify the symbols on the chart, starting with the larger symbols and continuing with progressively smaller symbols until the person cannot identify the symbols. The smallest symbols that can be reliably identified is considered the person's visual acuity.

The Snellen chart is the most widely used. Alternative types of eye charts include the logMAR chart, Landolt C, E chart, Lea test, Golovin–Sivtsev table, the Rosenbaum chart, and the Jaeger chart. As previously mentioned, eye charts measure visual acuity. Eye charts do not provide doctors with information on eye diseases such as glaucoma, problems with the retina, or loss of peripheral vision. [1]

Eye chart



Snellen chart used for visual testing.

Uses	Vision testing
Related items	Snellen chart Landolt C Lea test logMAR chart

Procedure

Charts display several rows of optotypes, which are standardized symbols for testing vision. Optotypes are usually letters, numbers, or geometric symbols. Each row of the chart depicts optotypes of a different size. Typically the largest optotypes are in the top row. The optotypes become progressively smaller towards the bottom of the chart.

The person removes any glasses or contact lenses, and stands or sits a standardized distance from the chart (e.g., 20 feet for the Snellen chart).[2] The person is then asked to identify the optotypes on the chart, starting with large rows and continuing to smaller rows until the optotypes cannot be reliably identified any more. The row in which the person can reliably identify symbols defines the visual acuity.

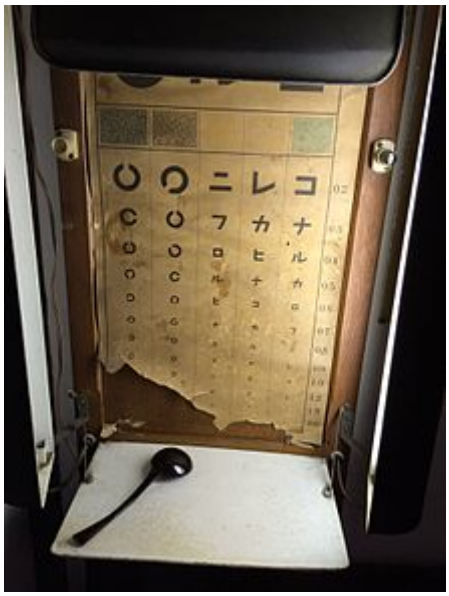
One eye is tested at a time. Practically, this is accomplished by covering the other eye with a hand, piece of paper, or a small paddle. After testing without glasses or contact lenses, testing is repeated while the person wears them, if applicable. Often, the use of such refractive lenses will correct visual acuity to normal. Refractive error can be corrected using a pinhole occluder. If the visual acuity improves with the use of pinholes, refractive lenses can be utilized to improve visual acuity. Squinting can achieve the same effect as a pinhole occluder.

With the Snellen chart, the visual acuity is recorded as a fraction with 20 in the numerator (top number) and values ranging from 10 to 600 in the denominator (bottom number). The denominator indicates the distance in feet at which a person with normal vision could stand to correctly identify the same symbols identified by the person tested. For example, a visual acuity of 20/20 is considered normal.

Variations

Numerous types of eye charts exist and are used in various situations. For example, the Snellen chart is designed for use at 6 meters or 20 feet, and is thus appropriate for testing distance vision, while the ETDRS chart is designed for use at 4 meters.[3] There is often also a need to test a subject's vision at near or occupational tasks (such as reading or computer use). For these situations, a Rosenbaum chart or Jaeger chart can be used.[4]

While the Snellen chart remains the default, some authors have argued that the logMAR chart is superior.[5] The logMAR chart presents the same number of symbols on each line, uses a typeface with letters that are equally legible at various sizes, and by varying the symbol size logarithmically, it is easier to use at nonstandard distances. As a consequence of these improvements, the logMAR chart has been proposed as a more reliable tool for measuring visual acuity. However, the logMAR chart has not yet been widely adopted.



An example of the Landolt C eye chart (also known as the Japanese eye chart.)

It can be difficult to measure visual acuity in infants, young children, and illiterate adults. Special eye charts such as Lea Symbols can be used. One version uses simple pictures or patterns. Others are printed with the block letter "E" turned in different orientations, the so-called Tumbling E. The patient simply indicates which direction each "E" is facing. The Landolt C chart is similar: rows have circles with different segments missing, and the test-taker describes where each broken piece is located. The last two kinds of charts also reduce the possibility of the patient guessing the images.[6]

Parents and caregivers may test their child's eyesight from home to identify potential vision problems that require an eye care professional. Testing a child age three and older can be accomplished using the Tumbling E chart to play the "pointing game". For this test, the child sits in a chair 10 feet from the chart, gently holding an eye cover over one eye. The parent or caregiver points to each E, starting with the largest E. The child then points in the direction the E is facing (up, down, left, right). The smallest line with Es identified by the child can be recorded. The various directions the E can face should be reviewed with the child prior to home testing. Home tests are not as accurate as exams conducted by professional ophthalmologists. At home eye tests should not replace a visit to a professional eye care physician.[7][8]

Alternatives

Computer-based alternatives to the eye chart have been developed, but are not very common prior to smart phones with high display resolution and DPI becoming popular. They have several potential advantages, such as a more precise measurement, less examiner-induced bias and randomized optotypes.

If the person, particularly a young child, is unable to cooperate with visual acuity testing via an eye chart, practitioners can be alerted to possible deficits in visual acuity by asking parents whether the child appears to see well. A clue is that the child may hold objects close to the face when attempting to focus.[9] Refractive error can be estimated via photography, a technique called photoscreening.[10]

Technical details

Optotype Crowding

Research has shown that optotype "crowding" reduces visual acuity at the fovea (as opposed to *eccentric* visual acuity) once the optotype characters are closer than 4.4 bar widths apart.[11] This is referred to as the "critical spacing" for optotype letters at the fovea. For periphery visual acuity, the critical spacing is much greater, such that optotype characters closer than 15-20 bar widths apart negatively affect visual acuity.[12]

See also

- Golovin–Sivtsev table
- Landolt C
- Lea test
- Monoyer chart
- Snellen chart

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