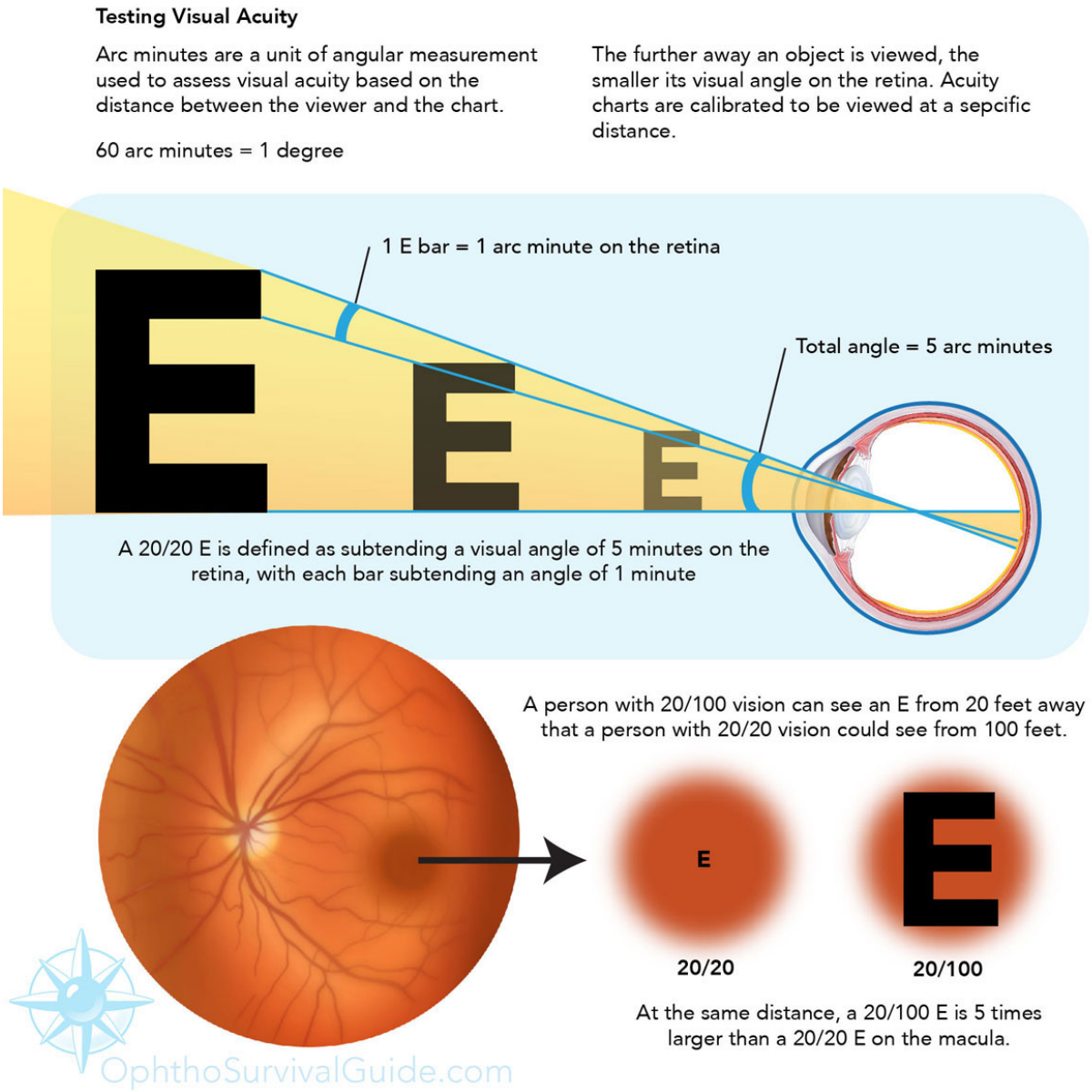
The Ophthalmology Survival Guide

Assessing Vision

Central Vision (Visual Acuity)

The assessment of visual acuity is a cornerstone of the ophthalmic examination, and a critical survival skill. Visual acuity refers to the ability to accurately discriminate objects and their spatial visual details. It is quantified in terms of visual angle, or the minimum angle of resolution (more to come on that in a bit). Any object of regard, including letters or optotypes and their subcomponents (e.g. such as the bars of the E, or the dot over the letter i), will subtend a visual angle on the retina based on its actual size and the distance at which it is viewed. For any such object, the further away it is viewed the smaller its visual angle on the retina, and the harder it is to see. Acuity charts are therefore designed and calibrated to be viewed at very specific viewing distances.

Now, to get a bit technical for a moment, a 20/20 E is defined as subtending a visual angle of 5 minutes on the retina, with each bar subtending an angle of 1 minute (1 minute of angle is equal to 1/60 of a degree). A 20/200 E subtends an angle of 50 minutes, with each bar subtending an angle of 10 minutes. In other words, a 20/200 E is 10 times larger than a 20/20 E. Another way to think about it, or explain it to patients, is that someone with 20/200 vision needs to be 20 feet away from a letter that a person with 20/20 vision could see from 200 feet away. It is also important to note that a person's visual acuity can be better than 20/20. For instance, some people have vision of 20/15, or even 20/10, though that is the uppermost limit physically. A person with 20/10 acuity is able to accurately see a 20/20 optotype calibrated for 20-foot viewing at a distance of 40 feet. In other words, they can accurately see things that are half the size of the smallest object a person with 20/20 vision can see. Pretty incredible.



A quick note about logMAR notation. What is logMAR? LogMAR is shorthand for Logarithm, base 10, of the Minimum Angle of Resolution. Ok, great, can I move on now? In a second. LogMAR notation actually provides a more concrete measure of

acuity than Snellen notation. Remember the 20/20 E? Each bar subtends a visual angle of 1 minute. So the logMAR equivalent is 0, since the $\log_{10}1 = 0$. And for a 20/200 E, where each bar subtends a visual angle of 10 minutes, the logMAR equivalent is 1, since the $\log_{10}10 = 1$. LogMAR notation is commonly used in clinical trials and other types of vision research, so it's good to be familiar with what it is. Not a critical survival skill per se, but good to know.

The macula is the only area of the retina with sufficient density of photoreceptors and associated relay cells to allow for high grade visual acuity (better than 20/200). This is referred to as central vision. The remainder of the retina provides peripheral vision, motion detection, circadian rhythm, and helps to maintain fusion and normal eye alignment. It is also important to note that visual acuity with both eyes working together is generally a bit better than when each eye is measured monocularly, because of binocular summation. Two eyes are better than one and the total is greater than the sum of the parts.

Measuring a patient's visual acuity is sometimes easier said than done and must at times be accomplished in situations in which patients are uncooperative (e.g. children, language barriers) and the environment is less than ideal (e.g. a busy emergency department, a hospital bed). Preferably a quantitative measurement of visual acuity should be obtained from each eye separately, using a standard optotype chart. The results should ideally be reported in a standard format (i.e. Snellen equivalent or logMAR). If this cannot be done, it is still important to document vision, but in a more rudimentary way. One technique is to assess and report the ability of each eye to accurately fixate on, and follow, a visual target, and whether or not one eye appears to function better than the other. It is also sometimes helpful to measure vision binocularly in children as this is less threatening, and then try to measure it monocularly.

While not a survival skill per se, understanding the concept of visual angle, and its relationship to how visual acuity is measured and reported, is very helpful. In patients with nystagmus it is a good practice to also measure binocular visual acuity (i.e., with both eyes open), since covering either eye may exacerbate the nystagmus, causing an artifactual reduction in acuity.

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