Visual Test and Demonstrations

Introduction:

Normal vision results when light rays from objects in the external environment are refracted by the cornea and lens of the eye and are focused onto the photoreceptors of the retina. If a person has a condition of nearsightedness (myopia) the image focuses in front of the retina as the eyeball is too long. If a person has a condition of farsightedness (hyperopia) the image focuses behind the retina as the eyeball is too short; distant objects are blurred. A concave lens is required to correct vision for nearsightedness; a convex lens is required to correct vision for farsightedness. If a defect occurs in the curvature of the cornea or lens, a condition known as astigmatism results. Focusing in different planes cannot occur simultaneously. Corrective cylindrical lenses will allow proper refraction of light onto the retina to compensate for the unequal curvatures.

As part of the natural aging process, the lens’s elasticity decrease, which degrades our ability to focus on nearby objects. The near point of accommodation test is used to determine the ability to accommodate. Often a person will use “reading glasses” to compensate for this condition. Hereditary defects in color vision result from lack of certain cones necessary to absorb certain wavelengths of light. Special color test plates are used to diagnose a condition of colorblindness.

If you wear corrective lenses, perform the tests with and without your lenses. If you wear contact lenses it is not necessary to run the tests under both conditions, however indicate in the laboratory report that all tests were performed with contact lenses in place.

**Materials:**

## Snellen Eye Chart

## 3 x 5 card plain

## 3 x 5 card with the work “+” and “.” 10cm apart

## Astigmatism chart

## Meter stick

## Metric ruler

## Pen flashlight

## Computer access for online colorblind test

Procedure:

Before you begin your tests, write a purpose and hypothesis for the lab on the sheet provided. Your hypothesis should predict what you expect the results of your visual tests should be and why.

(If…then…because….)

**Part A: Visual Tests**

Perform the following visual tests for both you and your lab partner. Each of you should record your own data. If your partner usually wears glasses, test each eye with and without the glasses.

* 1. **Visual acuity test.** Visual acuity (sharpness of vision) can be measure by using a Snellen Eye chart. This chart consists of several sets of letters in different sizes printed on a white chart. An acuity value in the form of a fraction is next to each set of letters. One set is marked 20/20. The normal eye can clearly see these letters from the standard distance of 20 feet and thus is said to have 20/20 vision. The letter at the top of the chart is marked 20/200. The normal eye can read letters this size from a distance of 200 feet. Thus an eye able to read only the top letter of the chart from a distance of 20 feet is said to have 20/200 vision. This person has less than normal vision. A line of letters near the bottom of the chart is marker 20/15. The normal eye can read letters of this size from a distance of 15 feet, but a person might be able to read it from 20 feet. This person had better vision than normal. To conduct these tests:
     1. Hang the Snellen Eye chart on a well illuminated wall at eye level
     2. Stand 20 feet in front of the chart and cover the left eye with the blank notecard and read the smallest set of letters possible with your right eye. Record your visual acuity.
     3. Repeat the procedure covering your right eye. Record your visual acuity in the data table.

1. **Astigmatism test.** This is a condition that results from a defect in the curvature of the cornea or lens. As a consequence some portions of the image projected on the retina are sharply focused and other portions are blurred. Astigmatism can be evaluated using an astigmatism chart. This consists of sets of black lines radiating from a central spot like the spokes of a wheel. To a normal eye, these lines appear sharply focused and equally dark; however, if the eye has an astigmatism, some sets of lines appear sharply focused and dark, while others are blurred and less dark. To conduct the astigmatism test, follow these steps:
   * 1. Hang the astigmatism chart on a well illuminated wall at eye level.
     2. Stand 20 feet in front of the chart and cover the left eye with the blank notecard. Using your right eye focus on the spot in the center of the radiating lines and report which lines, if any, appear more sharply focused and darker.
     3. Repeat the procedure using the left eye.
     4. Record your results.
2. **Accommodation test.** Accommodation is the changing of the shape of the lens that occurs when the normal eye is focused for close vision. It involved a reflex in which muscles of the ciliary body are stimulated to contract, releasing tension on the suspensory ligaments fastened to the lens. This allows the capsule of the lens to rebound elastically, causing the surface of the lens to become more convex. The ability to accommodate is likely to decrease with age because the tissues involved tend to lose their elasticity. To evaluate the ability to accommodate, follow these steps:
   * 1. Hold the end of a meter stick against your partner’s chin so that the stick extends outward at a right angle to the plane of the face.
     2. Have your partner close the left eye.
     3. Hold the notecard with the work **eyeball** on it in the center at the distal end of the meter stick.
     4. Slide the card along the stick toward your partners open right eye, and locate the point closest to the eye where your partner can still see the letters of the word sharply focused. This distance is called the near point of accommodation, and it tends to increase with age. See the table below.

|  |  |
| --- | --- |
| **Age (years)** | **Average Near point (cm)** |
| 10 | 7 |
| 20 | 10 |
| 30 | 13 |
| 40 | 20 |
| 50 | 45 |
| 60 | 90 |

* + 1. Repeat the procedure with the right eye closed.
    2. Record the results

1. **Color Vision.** Some people exhibit defective color vision because they lack certain cones, usually those sensitive to the reds or greens. This is an X linked inheritance s the condition is more prevalent in males than in females. People who lack or possess decreased sensitivity to the red-sensitive cones possess protanopia colorblindness; those who lack or possess decreased sensitivity to green-sensitive cones possess deuteranopia colorblindness. To conduct the color blind test go to the following website on the open computers in the classroom:

[**http://www.colour-blindness.com/colour-blindness-tests/ishihara-colour-test-plates/**](http://www.colour-blindness.com/colour-blindness-tests/ishihara-colour-test-plates/)

* + 1. Follow the directions online.
    2. Go through the series of slides to determine if you are colorblind**.**
    3. If you are colorblind based indicate if you have protanopia or deutranopia.
    4. Record your results on the handout and the white board at the front of the room.

**Part B-Visual Demonstrations**

1. **Blind spot demonstration.** Where the optic nerve leaves the back of the eye there are no photoreceptors. This area is called the blind spot.
   1. Close your left eye and hold the notecard with the + and the 10 apart

about 35 cm from your face and stare at the + sign in the figure with your right eye.

* 1. Move the figure closer to your face as you continue to stare at the + sign until the dot on the figure suddenly disappears. This happens when the image of the dot is focused on the optic disc. Measure the right eye distance using a metric ruler or meter stick.
  2. Repeat the procedure with the right eye closed. Measure the distance.
  3. Record your results.

1. **Photopupillary reflex.** The smooth muscles of the iris control the size of the pupil. When the intensity of light entering the eye increase, the muscles of the iris are stimulated to contract and the pupil opening decreases. To demonstrate the following:
   1. Cover your eyes for 2 minutes.
   2. Have your partner position the pen light close to one your eyes and have them shine the light on one of your hands. Remove one hand and open that eye. Have your partner observe the pupil, note any changes.
   3. Then remove the other hand and open the eye. Have them compare the two pupils and note any difference.