Heidi Expressions Test Game (#254500)

Heidi Expressions Test Game has been developed to improve early evaluation of vision for communication. Among the usually impaired children there are some who cannot see expressions and do not recognize people by their faces. These children may have nearly normal results in routine vision tests (large visual field and normal or near normal visual acuity). Other visually impaired children may have this deficit in visual recognition as a part of more extensive loss of visual functions.

Many children have Cerebral Palsy, which, however, may be so mild that it has no required special treatment. If the child's difficulties are not known and understood, his/her behavior may cause misunderstandings and needless negative experiences in social interactions. Therefore, testing of a child's ability to see differences between different facial expressions is an important part of functional visual assessment. Visually impaired children have two different kinds of problems in learning to recognize faces and to interpret facial expressions:

1. They do not see expressions well enough to interpret them (pathway problem) or
2. They have brain damage in the area of face recognition and therefore do not recognize differences in people's faces and may also have difficulties in interpreting expressions (=cognitive visual processing).

It is possible to observe which type of problem the child has during the Heidi Expressions test game. In some cases the child may have poor quality of image and poor facial recognition.

Play situation:
The Heidi Expressions Test Game can be used from the age of 30-36 months when teaching the child how people look when they have the different expressions. The tester and the child may make the expressions themselves.

1. When the child seems to understand the six different basic expressions, the cards can be matched. First only six cards are chosen, for example, the smiling Heidis and the weeping Heidis. If the child does not have cognitive visual functions for facial recognition, he/she may match the faces with the bow as equal. This needs to be discussed with the child by showing once more on the tester's face the different expressions look. The child may be able to see the expressions in a real life situation although they are too difficult to be recognized in a picture.

2. When the child has matched the cards printed with full contrast, the 10% contrast pictures and later the 2.5% contrast pictures can be used in the play situation.

3. If the child can match the high contrast pictures but not the 10% or 2.5% pictures, contrast sensitivity needs to be measured and the central visual field examined if the child is old enough for testing. It is also advisable to discuss with the child the structure of the image whether there are distortions of lines or spotty loss of the image (contrast). When the child can see the expressions only at 100% contrast, all picture materials in testing the child’s abilities should be analyzed. Regular test materials may be too difficult to be seen by the child and therefore the tests may give a wrong impression on the child’s cognitive abilities. Psychological tests and reading test materials may need to be enlarged and printed at high contrast. Sometimes a closed circuit TV reading device needs to be used.

By combining the information gathered in the different play situations we learn a lot about the child's ability to see and interpret facial features and expressions. Then we can support his/her learning in this area which is central in every day social interactions.

If a child is found not to recognize faces and/or facial expressions in these black & white cards, testing is continued using color photographs and real life situations. Each child who has deviations from normal behavior in interaction with peers and family members needs a thorough assessment of vision for communication. In a group of children the behavior may need an interpreter/intermediary because in that situation (s)he may be functionally blind even if (s)he functions normally in other visual tasks. Without help the play situation in a group of children may be so stressful and confusing that the child prefers to withdraw and may be diagnosed as having autistic behaviors.

Summary
Assessment of visual function at low contrast adds an important dimension in the evaluation of a person’s capabilities. It should be a part of evaluation of vision in occupational health and in low vision services as well as in all diagnostic work. With the easy-to-use ophthometric tests, it is possible to assess a child's low contrast details. A person's ability to see low contrast lines requires grating tests, which presently are under construction.

Contrast sensitivity only assesses the ability to see details at low contrast levels. Visual information at low contrast levels is particularly important:

1. In communication, since the faint shadows on our faces carry the visual information related to facial expressions;

2. In orientation and mobility, where we need to see such critical low contrast forms as the curb, faint shadows, and stairs when walking down the road. In traffic, the demanding situations are at low contrast levels, for example, seeing in dark, rain, fog, snow fall, and at night;

Lea Contrast Sensitivity Test

Introduction
Measurement of contrast sensitivity has been used in experimental and clinical research for several decades, in some places also in routine examinations of patients with different vision problems.

The clinical tests that have been developed by Lea-Test have been useful in many cases. Contrasts of thousands of patients revealing changes in visual function undetectable with the usual high contrast visual acuity tests. Because low contrast vision is not yet covered in all teaching programs, some basic issues, like the definition of contrast and recommendations on illumination, are included in this text.

Since contrast sensitivity tests have not been routinely used, the values measured with the different tests may not depict the quality of visual function when one starts to use the tests. The same was true when high contrast visual acuity tests began to be used.

The combination of high and low contrast visual acuity values defines the location of the slope of the contrast sensitivity curve but quantitatively the most important feature is any change over time.

We have been taught that 1.0 (20/20, 6/6) is “normal” visual acuity although actually it is at the lower end of the range of normal vision: between 0.8 (20/25, 6/9) and 2.5 (20/8, 6/2.5). Similarly, a rather common low contrast visual acuity value is 0.5 (20/40, 6/12) or 2.5% contrast when a person has normal sight. However, the variation of visual acuity at low contrast is nearly five-six lines, similar to variation at high contrast.

Now it is easy to measure, record and detect changes in the transfer of visual information when the change only affects visual acuity at low contrast levels. Repeated measurements and observation of changes in visual functioning will increase our understanding of how the measured values depict visual impairment. Other visual functions need to be assessed as well for classification of visual impairment. In the simple visual acuity measurements at different contrast levels give us an easy start.

What is Contrast Sensitivity?
Contrast sensitivity measures the ability to see details at low contrast levels. Visual information at low contrast levels is particularly important:

1. In communication, since the faint shadows on our faces carry the visual information related to facial expressions;

2. In orientation and mobility, where we need to see such critical low contrast forms as the curb, faint shadows, and stairs when walking down the road. In traffic, the demanding situations are at low contrast levels, for example, seeing in dark, rain, fog, snow fall, and at night;

Lea Contrast Sensitivity Tests

Contrast Sensitivity Tests

Contrast Sensitivity Tests

There are also the Weber definition of contrast:

$$ L_o / e - L_{max} = \text{Contrast} $$

$$ L_o \: \text{Luminance on the lighter surface} $$

$$ \text{Contrast} \: \text{Luminance on the darker surface} $$

$$ L_{max} \: \text{Luminance of the visual acuity charts are close to the maximum contrast. If the lowest contrast perceived is 5%, contrast sensitivity is 100/5=20. If the lowest contrast perceived by a person is 0.6%, contrast sensitivity is 100/0.6=1670. $$

There is no international recommendation on how contrast of visual acuity charts should be defined. Therefore there are differences in the contrast of tests of different manufacturers.
Contrast Sensitivity Tests

An international recommendation does not exist on the luminance level for contrast sensitivity testing, but there is a recommendation for visual acuity testing. It recommends a luminance level equal or higher than 85 candelas per square meter.

In the United States and in a number of other countries, measurement of visual acuity for research purposes is done by using the back illuminated ETDRS light box with the luminance level adjustable from 2.20 to less than 1 cd/m² by using layers of filters. In the small light box the maximum luminance level is 125 cd/m².

Measurement of Contrast Sensitivity

Measurement of contrast sensitivity resembles audiometry: a pure tone audiogram depicting the weakest pure tones at different frequencies that the person can hear. Contrast Sensitivity Curve or visionigram shows the faintest contrasts perceived by the person. If the stimulus is a sine wave grating, then the curve depicts similar function as does the pure tone audiogram. If the stimuli are optotypes (letters, numbers or pediatric symbols), recognition is required and the test resembles speech audiometry. As in audiometry, the result of the contrast sensitivity measurement is not one single value but a diagram.

Test Procedure When Using Low Contrast Visual Acuity Charts

Testing is identical to the measurement of visual acuity at high contrast level, i.e., we measure the smallest size of the optotypes that the person can recognize. The threshold is defined as the line on which at least 50% out of the 5 optotypes are correctly recognized. The 2.5% test is the most practical test in clinical use. The ruling threshold point on the curve is far enough from the high contrast value so that the declination of the slope of the curve can be defined. In severe low vision, the test must be quite slow, which may require use of reading lamps.

Move quickly down the chart and ask the person to identify the first or the last symbol on each line. When the person hesitates or makes an error, record one line and ask the person to read the entire line. To record the result carefully, record the number of optotypes read correctly, i.e., if on the 2.5% chart one of the symbols was read incorrectly on line 20/63 (6/18, 0.3) read 20/63 (6/18, 0.3) read correctly, one line and ask the person to read the entire line. To record the result carefully, record the number of optotypes read correctly, i.e., if on the 2.5% chart one of the symbols was read incorrectly on line 20/63 (6/18, 0.3) read correctly.

Contrast Sensitivity Measured By Using Low Contrast Visual Acuity Charts

Test results are marked on the recording sheet at the level used. See example before going along that level toward the right until the visual acuity value, measured at that contrast (A at 1.2%, B at 2.5%), is reached. If the person's visual acuity was 20/20 (6/6, 1.0), the line connecting A and X, depicts the slope of the contrast sensitivity curve of this person. Results are plotted as 20/50 (6/15, 0.4) at 2.5% and 20/100 (6/30, 0.2) at 1.2%.

Test Procedure When Using Low Contrast Visual Acuity Charts with One Symbol Size

In this test type the 10M size is convenient because at the most common testing distance of 1 meter, it corresponds to visual acuity 0.1 (20/200, 6/00), at 2 meters to 0.2 (20/100, 6/30), at 4 meters 0.4 (20/50, 6/35) and at 0.3 meter distance 0.03 (20/60).

Visual communication is the most important way of communicating during the first year of life. Expressions on faces are mediated by fast shadows and changes of the contour of the mouth and eyes. Most facial expressions on faces are perceived, so an infant’s reactions to the Heidi-Hedi Low Contrast Cards offers useful information. The cards can be used with multidisciplined people.

If an infant only responds to high contrasts, the people in his or her life should be aware of this problem and make their faces more colorful. This can be done by wearing lippy and eye liners, bright lipstick and eyeglasses with dark frames.

Intructions

Even though “infant” is referenced in the following instructions, the directions apply for children and multidisciplined people.

1. Stack the Heidi-Hedi Low Contrast Cards sequentially with the 2.5%, 10% and 100% faces downward, in that order. Since the 25%, 5% and 1.25% faces are on the opposite side, they will be presented last.

2. Position the infant so that he or she faces the examiner and in the optimal position for best visual performance. Support his or her head so involuntary movements least affect the infant’s performance. The infant can look over the parent’s shoulder while being held, sit on its lap or on the child’s buggy. Consider the infant’s most comfortable position. If possible, select the best time of day when the infant is most alert. Note any differences in performance when not taking the above into consideration.

3. Before observation of the infant’s responses to the Heidi-Hedi faces, familiarize yourself with the infant’s usual response pattern and face the head toward an interesting visual object, eye widening, breathing, quivering, eye brows arching, smiling, babbling or to reaching for an object. This will help detect if there are various particular infant reactions on the Heidi-Hedi faces. Familiarize and prepare the infant for locating Heidi-Hedi in whatever way is appropriate to his or her level.

4. During your communication with the infant, notice how far you can back away from the infant without losing his or her attention to your face. Present the face cards, one at a time, with the blank card in front of the face card. Encourage the infant to look toward the midline by talking to him or her about the eyes. You can do this with the blank card in front of your face in an attempt to get the infant’s attention.

5. Leave the stack of cards within your reach, out of the infant’s reach. When presenting the cards, place them in front of your chest. Present the face cards, one at a time, with the blank card in front of the face card. Encourage the infant to look toward the midline by talking to him or her about the eyes. You can do this with the blank card in front of your face in an attempt to get the infant’s attention.

6. Use two cards for each presentation. One card is always the blank card, the other, one of the six Heidi-Hedi faces. Hide the stimulus card and show only the blank card. Then ask the child “Where did the picture disappear to?” while moving the blank card off to one side and the stimulus card off to the other side. Both cards should leave the midline at the same speed. Stimulus cards should be moved to the right and/or left in a random order.

The cards are presented in the following order: 100%, 10%, 2.5% and 1.25%. If the infant does not react to the 100% card, present the 25% card. If the infant then reacts to the 25% card, proceed with the 10% and then the 2.5% card until a threshold level is reached. If the infant does not react to the 2.5% card, present the 5% and other cards, as above, until a threshold level is reached. If the child responds to the 1.25% face, the contrast threshold at that distance is below 1.25%. Record that as <1.25%.

If the purpose of this test is to diagnostically find the infant’s contrast threshold as quickly and as accurately as possible, avoid repeated presentation of the same stimulus card, as this causes habituation.

The tester may notice that an infant does not follow the movement of the Heidi-picture with eye movement or with combined eye-head movements but he merely fixates in the gaze when it stops. Another child may follow the movement but looks puzzled when the movement stops and looks at the tester as if asking “Where did the picture disappear to?” These observations need to be reported to the child’s ophthalmologist because they may mean that the child has problems in motion perception (< perception of movement or perception of objects that stand still).

In the examination of older children the child may prefer waving to Heidi’s “bye-bye” instead of simply pointing. Also, the presentation may be varied by letting the parents show the cards. They hold the cards behind their back while moving to the testing distance. There they present the face card and the blank card at the same time and ask “Who has the Heidi picture?”.

7. If the infant does not respond to the low contrast cards, bring them closer. Note the distance. If the infant still does not respond to a horizontal presentation of the face cards, slide the cards in a vertical presentation.

8. Initially present the cards in usual illumination level (average room lighting). If the infant does not respond, increase or decrease the luminance level by utilizing a lamp with controlling light that allows you to vary the luminance level. Record the optimal luminance level for communication repeatedly during the first year of life.

9. Since infants rely on near and far visual communication, try to obtain at least two separate thresholds. First, measure at the near communication distance, using the method described above: record the distance from the child to the cards, the luminance level, and the contrast threshold level reached.

If the infant responds to low contrast face stimulus at near distance, use one of the cards with higher contrast and the blank card, backing away from the infant to the distance where he or she lost his or her attention to your face. Record this distance, the luminance level and the threshold contrast level reached. This will make the contrast sensitivity curve more accurate. The threshold curves with two exactly identical cards and on a third card which has one additional feature, a bow on Heidi’s hair. In this picture are the set of three cards depicting smiling Heidi and sad Heidi.
Contrast Sensitivity Tests

Contrast sensitivity is a measure of the ability to perceive contrast between two culturally understood coexisting visual elements. Contrast sensitivity tests are used to evaluate the visual function of a healthy child at the same luminance level is demonstrated, it is important not to force children to function at their threshold. If the threshold is not reached, move to a lower contrast level. If the child can see the Heidi card, help planning information for intervention and provides a basis for the visually impaired child’s communication.

Contrast sensitivity needs to be assessed in children and adults who are unable to respond verbally or by pointing. If the person can follow a moving target or shift gaze to or turn head to peripheral perceived visual stimuli, preferential looking test situations can be used when testing with Hiding Heidi pictures.

Visual Acuity/Grating Acuity

Contrast sensitivity tests are used to assess the visual function of children and adults who are unable to respond verbally or by pointing. If the person can follow a moving target or shift gaze to or turn head to peripheral perceived visual stimuli, preferential looking test situations can be used when testing with Hiding Heidi pictures.

The result can be marked on the diagram by locating the test distance on the upper border of the recording form (top scale) and marking the number of correct answers with a cross (1.6m) and the line of the number of the correct answers corresponding to the distance used when testing. In this case the result would then be 18 correct at 3m (marked M) and 23 correct at 1.6m (marked S). Line S-M-X depicts the slope of the contrast sensitivity.

After having used the test for a while, you will not need the recording form any more, except for reporting your results to someone who is not accustomed to using the test. You will have a mental image of where the threshold is located on the form. You will mark down the name of the test, the number of correct answers and the distance at which you measured. These three numbers carry the necessary information for follow-up.

When both optotypes and grating measurements are made, it is interesting to mark the chart (see page 23) at the point where the line of the test distance (1.0m) and the line of the number of the correct answers cross each other. This point is marked with S in the diagram. In the diagram, it is easy to calculate that the result can also be written as 0.6% (1.60 = 20/125 or 6/38). The number of correct answers is read on the left vertical axis and the cross is placed corresponding to the distance used when testing. In this case the result would then be 18 correct at 3m (marked M) and 23 correct at 1.6m (marked S). Line S-M-X depicts the slope of the contrast sensitivity.

The result can be marked on the diagram by locating the test distance on the upper border of the recording form (top scale) and marking the number of correct answers with a cross (1.6m) and the line of the number of the correct answers corresponding to the distance used when testing. In this case the result would then be 18 correct at 3m (marked M) and 23 correct at 1.6m (marked S). Line S-M-X depicts the slope of the contrast sensitivity.

After having used the test for a while, you will not need the recording form any more, except for reporting your results to someone who is not accustomed to using the test. You will have a mental image of where the threshold is located on the form. You will mark down the name of the test, the number of correct answers and the distance at which you measured. These three numbers carry the necessary information for follow-up.

When both optotypes and grating measurements are made, it is interesting to mark the chart (see page 23) at the point where the line of the test distance (1.0m) and the line of the number of the correct answers cross each other. This point is marked with S in the diagram. In the diagram, it is easy to calculate that the result can also be written as 0.6% (1.60 = 20/125 or 6/38). The number of correct answers is read on the left vertical axis and the cross is placed corresponding to the distance used when testing. In this case the result would then be 18 correct at 3m (marked M) and 23 correct at 1.6m (marked S). Line S-M-X depicts the slope of the contrast sensitivity.

After having used the test for a while, you will not need the recording form any more, except for reporting your results to someone who is not accustomed to using the test. You will have a mental image of where the threshold is located on the form. You will mark down the name of the test, the number of correct answers and the distance at which you measured. These three numbers carry the necessary information for follow-up.

When both optotypes and grating measurements are made, it is interesting to mark the chart (see page 23) at the point where the line of the test distance (1.0m) and the line of the number of the correct answers cross each other. This point is marked with S in the diagram. In the diagram, it is easy to calculate that the result can also be written as 0.6% (1.60 = 20/125 or 6/38). The number of correct answers is read on the left vertical axis and the cross is placed corresponding to the distance used when testing. In this case the result would then be 18 correct at 3m (marked M) and 23 correct at 1.6m (marked S). Line S-M-X depicts the slope of the contrast sensitivity.

After having used the test for a while, you will not need the recording form any more, except for reporting your results to someone who is not accustomed to using the test. You will have a mental image of where the threshold is located on the form. You will mark down the name of the test, the number of correct answers and the distance at which you measured. These three numbers carry the necessary information for follow-up.

When both optotypes and grating measurements are made, it is interesting to mark the chart (see page 23) at the point where the line of the test distance (1.0m) and the line of the number of the correct answers cross each other. This point is marked with S in the diagram. In the diagram, it is easy to calculate that the result can also be written as 0.6% (1.60 = 20/125 or 6/38). The number of correct answers is read on the left vertical axis and the cross is placed corresponding to the distance used when testing. In this case the result would then be 18 correct at 3m (marked M) and 23 correct at 1.6m (marked S). Line S-M-X depicts the slope of the contrast sensitivity.

After having used the test for a while, you will not need the recording form any more, except for reporting your results to someone who is not accustomed to using the test. You will have a mental image of where the threshold is located on the form. You will mark down the name of the test, the number of correct answers and the distance at which you measured. These three numbers carry the necessary information for follow-up.
Contrast Sensitivity Tests

60’s. These computer controlled grating tests have not become widely used in clinical medicine because they are expensive and require an experienced technician to use them. However, studies with them have revealed some important principles in measurement of contrast sensitivity in cases of low vision. The most important finding is that contrast sensitivity values in nearly all cases of low vision are different when measured with gratings of different sizes: the larger the grating, the higher the contrast sensitivity value. This is particularly common in cases of central scotoma that are in part of the stimulus and thus the effective stimulus is smaller than the physical stimulus.

Small grating stimuli would often give a misleading picture of visual function at low contrast. Therefore it is wise to make one measurement with a large grating stimulus to learn about the subject’s ability to see low contrast information. On the other hand, it is interesting to evaluate the function of the fixation area by using a smaller stimulus. This is possible by covering the grating stimulus with a grey filter that leaves either one fourth or one tenth of the stimulus visible.

Lea Low Contrast Gratings

Grating Acuity Test at Low Contrast Levels

Grating tests have been used to measure contrast sensitivity since the 60’s. These computer controlled grating tests have not become widely used in clinical medicine because they are expensive and require an experienced technician to use them. However, studies with them have revealed some important principles in measurement of contrast sensitivity in cases of low vision. The most important finding is that contrast sensitivity values in nearly all cases of low vision are different when measured with gratings of different sizes: the larger the grating, the higher the contrast sensitivity value. This is particularly common in cases of central scotoma that are in part of the stimulus and thus the effective stimulus is smaller than the physical stimulus.

Small grating stimuli would often give a misleading picture of visual function at low contrast. Therefore it is wise to make one measurement with a large grating stimulus to learn about the subject’s ability to see low contrast information. On the other hand, it is interesting to evaluate the function of the fixation area by using a smaller stimulus. This is possible by covering the grating stimulus with a grey filter that leaves either one fourth or one tenth of the stimulus visible.

Lea Low Contrast Gratings

Contrast sensitivity curves in case of macular degeneration, L = the normal left eye, R = the right eye with dry macular degeneration. Contrast sensitivity measured with 10 degree stimulus is nearly as good as in the normal left eye, whereas when measured with 5 degree stimulus it is one fifth of the maximum value of the 10 degree maximum and when measured with 2.5 degree stimulus the maximum value is only one twentieth of the 10 degree maximum.

Contrast sensitivity curves for a person with optic atrophy in both eyes. The 0.1 c/deg grating was not seen at 2.5m distance, which corresponds to 10dp (F). The 10% contrast 80pcm grating was seen at 110m distance, which corresponds to 10dp (G). The 2.5% contrast 2pcm grating was seen at 174cm distance, which corresponds to 60dp (H). The line H-G-F depicts the slope of the contrast sensitivity curve, It is Type II curve.

Contrast sensitivity curves for a person with optic atrophy in both eyes. The 0.1 c/deg grating was not seen at 2.5m distance, which corresponds to 10dp (F). The 10% contrast 80pcm grating was seen at 110m distance, which corresponds to 10dp (G). The 2.5% contrast 2pcm grating was seen at 174cm distance, which corresponds to 60dp (H). The line H-G-F depicts the slope of the contrast sensitivity curve, It is Type II curve.

Contrast sensitivity curves in case of macular degeneration, L = the normal left eye, R = the right eye with dry macular degeneration. Contrast sensitivity measured with 10 degree stimulus is nearly as good as in the normal left eye, whereas when measured with 5 degree stimulus it is one fifth of the maximum value of the 10 degree maximum and when measured with 2.5 degree stimulus the maximum value is only one twentieth of the 10 degree maximum.

Contrast sensitivity curves for a person with optic atrophy in both eyes. The 0.1 c/deg grating was not seen at 2.5m distance, which corresponds to 10dp (F). The 10% contrast 80pcm grating was seen at 110m distance, which corresponds to 10dp (G). The 2.5% contrast 2pcm grating was seen at 174cm distance, which corresponds to 60dp (H). The line H-G-F depicts the slope of the contrast sensitivity curve, It is Type II curve.
Contrast sensitivity tests have been used to measure contrast sensitivity since the 1960s. These computer controlled grating tests have not become widely used in clinical medicine because they are expensive and require an experienced technician to use them. However, studies with them have revealed some important principles in measurement of contrast sensitivity in cases of low vision. The most important finding is that contrast sensitivity values in nearly all cases of low vision are different when measured with gratings of different sizes: the larger the grating, the higher the contrast sensitivity value. This is particularly common in cases of central scotoma that “robs” some of the stimulus and thus the effective stimulus is smaller than the physical stimulus.

Small grating stimuli would often give a misleading picture of visual function at low contrast. Therefore it is wise to make one measurement with a large grating stimulus to learn about the subject’s ability to see low contrast information. On the other hand, it is interesting to evaluate the function of the fixation area by using a smaller stimulus. This is possible by covering the grating stimulus with a grey folder that leaves either one fourth or one tenth of the stimulus visible.

Lea Low Contrast Gratings
Grating Acuity Test at Low Contrast Levels

Grating tests have been used to measure contrast sensitivity since the 1960s. These computer controlled grating tests have not become widely used in clinical medicine because they are expensive and require an experienced technician to use them. However, studies with them have revealed some important principles in measurement of contrast sensitivity in cases of low vision. The most important finding is that contrast sensitivity values in nearly all cases of low vision are different when measured with gratings of different sizes: the larger the grating, the higher the contrast sensitivity value. This is particularly common in cases of central scotoma that “robs” some of the stimulus and thus the effective stimulus is smaller than the physical stimulus.

Small grating stimuli would often give a misleading picture of visual function at low contrast. Therefore it is wise to make one measurement with a large grating stimulus to learn about the subject’s ability to see low contrast information. On the other hand, it is interesting to evaluate the function of the fixation area by using a smaller stimulus. This is possible by covering the grating stimulus with a grey folder that leaves either one fourth or one tenth of the stimulus visible.

Contrast sensitivity curves in case of macular degeneration, L: the normal left eye, R: the right eye with dry macular degeneration. Contrast sensitivity measured with 10 degree stimulus is nearly as good as in the normal left eye, whereas when measured with 5 degree stimulus it is one fifth of the maximum value of the 10 degree maximum and when measured with 2.5 degree stimulus the maximum value is only one twentieth of the 10 degree maximum.

Instructs
Start with the high contrast grating. Show the gratings at a distance of 2.5m staying with the 0.5cpcm grating. Turn the gratings in different orientations before exposing them from behind the grey cover. Do not move the gratings when presenting it. Ask the person to respond by showing the orientation of the lines with his/hers hand or with the ruler that is included in the test. Threshold value is reached when three out of five presentations lead to correct response.

If the broadest lines could not be seen at 2.5m distance, move closer until they are seen. Stop back a little, turn the grating behind the cover and present it again. If a person has uncorrected astigmatism, grating will be seen at different distances when presented in different orientations. Thus you learn about the person’s refractive error while measuring grating acuity.

If the broadest lines were seen at a distance of 2.3m, starting with the 0.5cpcm grating and present it again. If a person has uncorrected astigmatism, grating is only one twentieth of the 10 degree stimulus and thus the effective stimulus is nearly as good as in the normal.

The Range of Normal Contrast Sensitivity
Among the normally sighted people, both visual acuity and contrast sensitivity have a wide range of variation. In visual acuity, 20/25 (6/7.5) is a low normal value; the highest normal values are three times higher, 20/16 (6/5). Similarly, the range of normal variation in contrast sensitivity values is great. Therefore, a value within the range of normal may or may not mean that particular person has normal contrast sensitivity. If his or her contrast sensitivity was previously high, it may decrease to less than one-half or one-third of its original value and still be “normal.”

Deciding the location of the slope in normal subjects. The range of normal variation in both visual acuity values (horizontal arrow) and in contrast sensitivity (vertical arrow) is great. If a person’s contrast sensitivity was previously normal and then decreases to two times his original value, it is still within the range of normal values but is highly pathologic to this person.

A change in contrast sensitivity is the diagnostically important feature that will be watched in the future. Because of the large variation in the normal values, we need to have an older value to compare with to notice a change.

Ideally, contrast sensitivity and visual acuity should be measured when children leave their high school/secondary school or in young adulthood. These values should be recorded and saved as part of the basic information related to each person’s health. A change warrants an examination to find out the cause of the change. Although the most common cause would be a small change in the refractive power of the eye, which is a benign finding, repeating the measurement of contrast sensitivity would be beneficial as a part of routine health examinations to rule out changes in the visual pathways.

Measurement of contrast sensitivity would also help us to better understand the complaints of a person whose visual acuity at high contrast has not changed but whose vision has decreased at low contrast levels. Then we would not annoy him/her by saying that his/her vision is as good as before, a situation which is now experienced by all too many patients/clients.

If occupational tasks require good visual function at low contrast levels, visual acuity alone does not select the most suitable persons for that particular task. For example, if the task is to notice airplanes approaching with radar, these planes are best seen by a person with good visual acuity in the contrast range of 1-5%. Since the declination of the slope varies in normal individuals, it is possible that a person with lower visual acuity at high contrast has better function at the lower contrast levels than a person who has higher visual acuity at high contrast. This is important to remember in all such occupational tasks that require exceptionally good visual function at low contrast levels.
Usual loss of visual function is roughly equal at high and at low contrast levels. However, the ability of the testee to perform a test is largely dependent on visual acuity alone does not select the most suitable persons for that type of task. Several lines, yet in the low contrast vision there is slight or no loss (Type II). Type III change in the transfer of visual information is characterized by moderate to no loss of visual acuity at high contrast and a greater loss of visual function at low contrast. This is often caused by diabetic retinopathy, cataract, glaucoma, or optic neuritis, to mention only some of the most common causes. Clinically, it is well known that there can be three people with different types of contrast sensitivity curves, even when they have similar visual fields and visual acuity values. They can have very different functional vision. The three people whose contrast sensitivity curves are in figure all have visual acuity of 20/53 (6/16, 0.3). Person A has high normal function at high contrasts and functions like a normally sighted person. Person B has somewhat decreased low contrast function and the typical behavior of a person with low vision (beigning texts closer and moving slightly slower on stairs, etc.). Person C has lost visual function at low contrast levels and is severely visually impaired. Of these three people with the same visual acuity, one is normally sighted, one has low vision and one is severely visually impaired.

Lower Visual Acuity May Mean Better Vision

If occupational tasks require good visual function at low contrast levels, visual acuity alone does not select the most suitable persons for such particular task. For example, the task is to notice airplanes approaching within the low clouds, these planes are best seen by a person with good visual acuity in the contrast range of 1.5%. Since the decline of the slope varies even in normal individuals, it is possible that a person with lower visual acuity at high contrast has better function at the lower contrast levels than a person who has higher visual acuity at high contrast. This is important to remember in all such occupational tasks that require exceptionally good visual function at low contrast levels.

Contrast sensitivity needs to be assessed in children and adult persons who are unable to respond verbally or by pointing. If the person can follow a moving target or shift gaze to or turn head to physiologically presented visual stimuli, preferential looking test situations can be used when testing with Hiding Heidi pictures. Present the test within the distance within which the person visually responds using the highest contrast(100%) first. If you expect normal function in a baby, you may shorten the test situation by showing test the 2.5% picture and then the 1.2% picture. If you do not get a response to the 2.5% picture, show the 25% or 10% picture next and then the 5% picture. The picture is presented by moving both the picture and the white card with the same speed, usually horizontally. If the person has horizontal nystagmus, the pictures are best presented vertically.

The visibility of facial features can be tested also in older children by using the Hiding Heidi test. Then it is more fun to ask the child to point to Heidi when she becomes visible. In testing of difficult-to-test children we have sometimes used the following technique: the test is on a table. One of the two persons testing takes the picture of Heidi, the other one takes the blank card. Then person moves to the testing distance and asks "who has the Heidi card?". Some children like to wave "bye-bye" to Heidi.

When contrast sensitivity has decreased, it is advisable to measure visibility of facial features at different distances. Surprises are common. Since the area of the Heidi picture - and that of a face - is so much larger than the area of take a drawing stimulus, the low contrast pictures may be discernible at unexpectedly long distances. However, it is important not to force children to function at their threshold. If the function of a healthy child at the same luminance level is demonstrated, the teachers and therapists will better understand the requirements of the visually impaired child's communication.

The ability to detect objects of low contrast is an important component of the visual system. Determining the levels of contrast that an infant can detect, helps planning information for intervention and provides a baseline to evaluate future changes. Deviations from normal behavior may indicate disorders that leave vision at high contrast levels unaffected.
Contrast Sensitivity Tests

An international recommendation does not exist on the luminance level for contrast sensitivity testing, but there is a recommendation for visual acuity testing. It recommends a luminance level equal or higher than 85 candela per square meter.

In the United States and in a number of other countries, measurement of visual acuity for research purposes is done by using the back illuminated ETDRS light box with the luminance level adjustable from 2.5 to less than 1 cd/m² by using layers of filters. In the small light box the maximum luminance level is 12 cd/m².

Measurement of Contrast Sensitivity

Measurement of contrast sensitivity resembles audiometry: a pure tone audiogram depicting the weakest pure tones at different frequencies that the person can hear. Contrast Sensitivity Curve or visogram shows the faintest contrasts perceived by the person. If the stimulus is a sine wave grating, then the curve depicts similar function as does the pure tone audiogram. If the stimuli are optotypes (letters, numbers or pediatric symbols), recognition is required and the test resembles speech audiometry. As in audiometry, the result of the contrast sensitivity measurement is not one single value but a diagram.

Test Procedure When Using Low Contrast Visual Acuity Charts

Testing is identical to the measurement of visual acuity at high contrast level, i.e., we measure the smallest size of the optotypes that the person can recognize. The threshold is defined as the line on which at least 50% of the 5 optotypes are correctly recognized. The 2.5% is tested in the ETDRS test in clinical use. The resulting threshold point on the curve is far enough from the high contrast value so that the declination of the slope of the curve can be defined. In severe low vision, the test must be quite slow, which may require use of reading lenses.

Move quickly down the chart and ask the person to identify the first or the last symbol on each line. When the person hesitates or makes an error, record one line and ask the person to read the entire line. To record the result carefully, record the number of optotypes read correctly, i.e., if on the 2.5% chart one of the optotypes was read incorrectly on line 20/63 (6/18, 0.3) read the chart from line 20/60 (6/15, 0.4) to 20/100 (6/30, 0.2) at 2.5%.

Contrast Sensitivity Measured By Using Low Contrast Visual Acuity Charts

Test results are marked on the recording sheet at the level used (see example below) going along that level toward the right until the visual acuity value, measured at that contrast level (A at 1.2%, B at 2.5%), is reached. If the visual acuity was 20/20 (6/6, 1.0), the line connecting the point on the visual acuity chart was 20/20/63 (6/18, 0.3), the line connecting the point at 2.5% threshold was 20/50 (6/15, 0.4) at 2.5% and 20/100 (6/30, 0.2) at 1.2%.

The threshold values can be measured with two different techniques when using optotypes:

1. By using low contrast visual acuity charts, or
2. By using tests with one symbol size and several contrast levels.

Visual communication is the most important way of communicating during the first year of life. Expressions on faces are mediated by faint changes and shadows of the contours of the mouth and eyes. Most facial expressions are in low contrast, so an infant’s reaction to the Heidi/Heidi Low Contrast Cardset offers useful information. The cards can be used by wearing lip and eye liners, bright lipstick and eyeglasses with dark frames. Even though “infant” is referenced in the following instructions, the procedures can be done by wearing lip and eye liners, bright lipstick and eyeglasses with dark frames. The cards can be used by wearing lip and eye liners, bright lipstick and eyeglasses with dark frames. The cards can be used by wearing lip and eye liners, bright lipstick and eyeglasses with dark frames. The cards can be used by wearing lip and eye liners, bright lipstick and eyeglasses with dark frames.
Heidi Expressions Test Game (#254500)

Heidi Expressions Test Game has been developed to improve early evaluation of vision for communication. Among the visually impaired children there are some who cannot see expressions and do not recognize people by their faces. These children may have nearly normal results in routine vision tests (large visual field and normal or near normal visual acuity). Other visually impaired children may have this deficit in visual recognition as a part of more extensive loss of visual functions.

Many children have Cerebral Palsy, which, however, may be so mild that it has not required special treatment. If the child's difficulties are not known and understood, his/her behavior may cause misunderstandings and needlessly negative experiences in social interactions. Therefore, testing of a child's ability to see differences between different facial expressions is an important part of functional visual assessment.

Visually impaired children have two different kinds of problems in learning to recognize faces and to interpret facial expressions:

1. They do not see expressions well enough to interpret them (pathway problem) or
2. They have brain damage in the area of face recognition and therefore do not recognize differences in people's faces and may also have difficulties in interpreting expressions (-cognitive visual processing problem).

It is possible to observe which type of problem the child has during the Heidi Expressions test game. In some cases the child may have poor quality of image and poor facial recognition.

Play situation:

The Heidi Expressions Test Game can be used from the age of 30-36 months. It is advisable to test the child for visual functioning at low/intermediate contrast levels.

Depending on the child's age and communicative development level the matching game is varied. First the cards can be looked at and the expressions discussed. The tester and the child may make the expressions themselves. With an older child it is possible to reflect upon the causes why Heidi might be sad, sad, serious or weeping.

During this discussion it is possible to observe whether the child has to look very close on the cards and the tester's face to see the expressions or whether the child seems to have difficulties in understanding the concept of facial expressions. In the latter case tactile information is used as additional information. It may be that the child needs to feel the facial features to perceive the expression and to recognize them.

Drawing pictures of faces can be combined to the Heidi Expressions Test Game. Draw the circle and the eyes and ask the child "Which expression does Heidi have this time?" The child may draw the mouth or the tears assisted by the tester when needed. This is another effective way to make the child aware of the structure of expressions. At the same time it can be used to create picture perception as such, to teach the child to understand how a picture represents an object. The expressions can also be created by using pipe cleaners for the mouth and buttons for the eyes glued on a small paper plate as an activity in nursery or kindergarten. The child's creations can be used to observe which features the child uses in the recognition of her/their picture.

When the child seems to understand the six different basic expressions, the cards can be matched. First only six cards are chosen, for example, the smiling Heidi and the weeping Heidi. If the child does not have cognitive visual functions for facial recognition, he/she may match the faces with the box as equal. This needs to be discussed with the child by showing once more on the tester's face each of the different expressions look. The child may be able to see the expressions in a real life situation although they are too difficult to be recognized in a picture.

When the child has matched the cards printed with full contrast, the 10% contrast pictures and later the 2.5% contrast pictures can be used in the play situation.

If the child can match the high contrast pictures but not the 10% or 2.5% pictures, contrast sensitivity needs to be measured and the central visual field examined if the child is old enough for testing. It is also advisable to discuss with the child the structure of the image: whether there are distortions of lines or spotty loss of the image (scotoma).

When a child can see the expressions only at 100% contrast, all picture materials in testing the child's abilities should be analyzed. Regular test materials may be too difficult to be seen by the child and therefore the tests may give a wrong impression on the child's cognitive abilities. Psychological tests and reading test materials may need to be enlarged and printed at high contrast. Sometimes a closed circuit TV reading device needs to be used.

By combining the information gathered in the different play situations we learn a lot about the child's ability to see and interpret facial features and expressions. Then we can support his/her learning in this area which is central in every day social interactions.

If a child is found not to recognize faces and/or facial expressions in these black & white cards, testing is continued using color photographs and real life situations. Each child who has deviations from normal behavior in interaction with peers and family members needs a thorough assessment of vision for communicati-on. In a group of children the behavior may need an intervention/intervener because in that situation (s)he may be functioning well in other visual tasks. Without help the play-strain in a group of children may be so stressful and confusing that the child prefers to withdraw and may be diagnosed as having ‘autistic behaviors’.

Summary

Assessment of visual function at low contrast adds an important dimension in the evaluation of a person's capabilities. It should be a part of evaluation in occupational and health care as well as in all diagnostic work. With the easy-to-use optotype tests, it is possible to assess visibility of low contrast details. A person's ability to see low contrast lines requires grating tests, which presently are under construction.

Contrast sensitivity measures the ability to see details at low contrast levels. Visual information at low contrast levels is particularly important:

1. In communication, since the faint shadows on our faces carry the visual (information related to facial expressions);
2. In orientation and mobility, where we need to see such critical low-contrast forms as the curb, faint shadows, and stairs when walking down the street, traffic signals are at low contrast levels, for example, seeing in dusk, rain, fog, snow fall, and at night;
3. In everyday tasks like reading and writing, if the information is at low contrast as in poor quality copies or in a barely readable imitation, etc.;
4. In near vision tasks like reading and writing, if the information is at low contrast as in poor quality copies or in a barely readable imitation.

Contrast sensitivity is the reciprocal of the contrast at threshold, i.e., one divided by the lowest contrast at which forms or lines can be recognized.

If a person can see details at very low contrast, his or her contrast sensi-tivity is high and vice versa. Depending on the structure of the stimulus used in the measurement – other gratings of different size or symbols - contrast sensitivity of a person gets different values.

What is Contrast?

Contrast is created by the difference in luminance, the amount of reflected light, reflected from two adjacent surfaces. It can be defined in slightly different ways. In clinical work, we usually use the Michelson formula:

\[
\text{Contrast} = \frac{I_{\text{max}} - I_{\text{min}}}{I_{\text{max}}} \times 100\% 
\]

There is also the Weber definition of contrast:

\[
\text{Contrast} = \frac{I_{\text{max}} - I_{\text{min}}}{I_{\text{max}}} 
\]

Luminance = Luminance on the lighter surface
Luminance = Luminance on the darker surface

When the darker surface is black and reflects no light, the ratio is 1. Contrast is usually expressed as percent, then the ratio is multiplied by 100. The maximum contrast is thus 100% contrast. The symbols of the visual acuity charts are close to the maximum contrast. If the lowest contrast perceived is 5%, contrast sensitivity is 100/5 = 20. If the lowest contrast perceived by a person is 0.6%, contrast sensitivity is 100/0.6 = 1670.

There is no international recommendation on how contrast of visual acuity charts should be defined. Therefore there are differences in the contrast of tests of different manufacturers.