STUDY OF OSTEOPOROTIC FRACTURES (V2)

Vision Tests Protocol

Illumination: It is important that all of the vision tests be performed in areas of UNIFORM illumination; i.e., no abrupt changes in illumination or shadows when moving a few feet or changing orientation. Diffuse natural light, flourescent light or a combination of the two is best. The chart luminance should be between 50 and 70 foot Lamberts for each of the three tests. The light meter included in the VCTS will be used to standardize chart luminance. If natural light levels vary considerably from day to day you should check luminance levels daily. The spatial relation of the targets to the subject should be such as to minimize glare on target surfaces. Determine the optimal positioning through trial and error under a range of naturally varying light conditions, if any.

Distance: Two of the tests are administered with the participant seated at either 10 or 5 feet from the target. These distances should be marked on the floor with tape. Measure from the target to the middle of the chair.

Glasses: Contrast sensitivity, acuity and distance depth perception are tested with correction for distance vision. Near depth perception is tested with correction for near vision.

Before testing, ask the subject if she normally wears glasses all the time, wears them for distance vision only, wears glasses for reading only, wears bifocals, or if she does not wear glasses. (Probes: "Do you wear glasses to see things far away, like when you go to a movie theater or when you drive a car?"). If she answers that she has glasses for distance but sees better without them, distance tests should be performed with glasses on.

I. Contrast Sensitivity

1. Introduction:

Vision is generally measured by acuity tests that determine the smallest detail, such as black letters on a white background, that can be seen. However, our everyday visual world contains objects that have varying levels of contrast (the level of black and white parts of an object and background) and a range of sizes. Those objects must often be seen under visually degraded conditions such as nighttime, fog, or rain. Contrast sensitivity measurements are needed to determine an observer's ability to see a wide range of everyday objects under normal and visually degraded conditions. Because any object can be decomposed into a combination of simple patterns, called sine waves, contrast sensitivity to sine wave gratings provides a generalized measure of visual sensitivity to everyday objects.

2. Equipment: VISTECH VCTS 6500 wall chart and light meter. Mark the right and left hand sides of chart with a large R and L, clearly visible to the participant.

The VISTECH contrast sensitivity test system, Model 6500, uses highly controlled photographic and printing techniques to present a series of sine wave gratings at calibrated

levels of contrast. In a manner similar to reading the typical acuity chart, the observer simply reports whether or not a grating is visible; and if visible, at what orientation of all grating sizes. At the 10 foot distance, the spatial frequencies tested are 1.5, 3, 6, 12, and 18 cycles per degree. The range of spatial frequencies tested can be made higher or lower by simply changing viewing distance.

Illumination: The VCTS is designed so that it can accurately measure contrast sensitivity under normal room illumination corresponding to a chart luminance of 30-70 ft-Lamberts.

However, since we are working with an older population we will restrict the chart luminance range to 50-70 ft-Lamberts. For consistent measurement of contrast sensitivity, luminance must be kept constant from one area of the chart to another, and from one test to the next.

Light meter instructions:

a) With the dial facing up, hold the light meter two inches from and perpendicular to the upper right corner of the chart. Be sure you are not casting a shadow on the chart as you measure luminance.

b) Note the position of the pointer. It should be in the upper 50% of the green area (between about 14 and 20 degrees).

c) Repeat the measurement holding the meter two inches from the lower left corner of the chart.

d) For consistent repeated measurements, the readings from one area of the chart to another or from one test to the next should be within five degrees of pointer movement.

e) If your test area has significant natural light, evaluate chart luminance under a variety of naturally varying conditions to determine if additional artificial light will sometimes be needed.

3. Measurement Procedures:

a) Place chart system in an area where it receives uniform lighting. Shadows or glare on the chart can affect contrast sensitivity measurement. To minimize glare, the chart should not be facing a window or have a window directly behind it. Measure chart luminance to insure lighting conditions are within desirable limits (see Light Meter Instructions). HAVE A POINTER HANDY.

b) The subject should be seated 10 feet from the chart, with the middle of the chart around eye level. TEST WITH GLASSES ON IF SHE WEARS GLASSES FOR DISTANCE.

c) Tell the subject:

"This test measures your contrast sensitivity, or how well you are able to see differences in shades of dark and light. (Optional: We test this by seeing how well you are able to see the fuzzy bars on this chart.

Your ability to see these bars relates to how well you see everyday objects.)"

Continue, pointing to the upper left hand patch (A1).

"Each of the circular patches on the chart contain bars that vary in contrast. Can you see the light and dark bars on this patch?"

If "no", point to C1 and ask again. If unable to see the bars on C1, then follow instructions for low vision.) Then point up and down the first column (1).

"Each row contains a different size bar pattern. The patches on the far left of each row are high contrast sample patches which show the size bars you will be looking for in that row."

"The four patches on the bottom of the chart show the three ways the bars may be pointed and a blank. The bars will be slanted slightly up to the left, slanted slightly up to the right, and straight up. Some patches are blank."

"Your task is to read across each row, starting with Row A, Patch 1, and call out whether the patch is pointing to the left, right, straight up and down or blank. I will record your responses. Some of the patches are very low in contrast and you may not see any bars in these patches. If this is the case, simply answer 'blank'. However, if you do see something in a patch but you are not sure which direction the bars are pointing, you are allowed to guess."

d) Record the subject's response for each patch in the appropriate place on the scoring sheet by drawing a line through those called out incorrectly. CIRCLE THE PATCH NUMBER JUST BEFORE THE FIRST INCORRECT ONE ON EACH LINE. This is the score for that line.

Point at each circle. Ask about every circle don't stop. Cross out the first one missed, then circle the one just before that. Score each row before going on to the next.

e) <u>Low Vision</u>: If the subject cannot see the bars in patch C1, mark the box for low vision on the scoring sheet and test at 5 feet.

For low vision, a quantitative measure of the subject's visual capability in terms of contrast sensitivity is accurately obtained. The low vision subjects can be tested by simply moving her closer to the chart. The spatial frequencies change in direct proportion to distance. (for example, at a 5 ft. viewing distance, the spatial frequencies become .75, 1.5, 3, 6, and 9 cycles per degree.)

II. Focal Acuity

1. Introduction:

The Bailey-Lovie visual acuity letter charts incorporate the following features:

> a) geometric progression of letter size;
>
> b) near equal legibility of all letters in the chart;
>
> c) each row has the same number of letters (5);
>
> d) between row spacing is equal to the height of the letters in the smaller row;
>
> e) letter spacing is equal to one letter width.

These features ensure that the visual acuity task is essentially the same for all letter sizes so that the angular size of the letter is the only parameter which determines the visual acuity score. This, combined with letter size progression on a uniform logarithmic scale, allows for acuity testing at optional non-standard distances determined by the progression of letter sizes. We are assessing acuity at the optional distance of 10 feet. The size of the chart is reduced to produce standard scores at this critical viewing distance. (See Bailey IL, Lovie JE. New design principles for visual acuity letter charts. Am J. Optom Physiol Optics 53 (11): 740-745, 1976.)

2. Equipment:

Bailey-Lovie letter charts.

<u>Illumination:</u> Use the same standards and procedures as contrast sensitivity.

3. Measurement Procedures:

> a) The target should be placed at approximately the eye level of seated subjects. Seat subject on straight-backed chair, 10 feet from the midline of the body to the target. Use a pointer to indicate rows on the chart.

b) If the participant wears glasses (bifocals or regular glasses) for distance viewing, such as driving, walking or at a theater, test with her glasses on. If she only wears glasses (bifocals or regular) when she reads, test without glasses. Test contact lens wearers with lenses in.

c) Ask the subject to start reading the letters on the chart starting with the row with the double bar, proceeding down the chart toward the smaller letters. Say

" I'd like you to read aloud the letters on this chart. Don't squint and don't lean forward. Start at the row with the double bar and read down as far as you can and then say 'That's all'. Read from left to right. Now, can you easily read the row with the double bar?"

If she says yes or reads the row without error, then say:

"OK (begin/continue)."

If she says no or reads it with one or more errors, then say:

"How about the top row? Can you easily read that one?"

If she says no or reads it with error, then test at 5 feet (low vision distance) using the same procedure. Be sure to record that you are testing at 5 feet.

d).As the subject reads, keep a running tally of the total number of letters missed by drawing a line over those read correctly and drawing a line through the incorrect ones.

e) When it is apparent that the subject is struggling (i.e., misses 3 or 4 letters on a row or goes very slowly) then point to the next row and say,

"I want you to try reading the next row even if you just have to guess".

Note the errors on that row, then stop. If she misses all 5 letters on a row, add those to your tally and then stop. If she says "That's all." in the middle of a row, have her guess at the rest of the row and then stop. Draw a line through the first row not attempted.

f).RECORD THE NUMBER CORRECT. The number next to each line on the score sheet is the number of letters from the top row to that row, inclusive. So, if a subject attempted to read up to the line marked 40, she read a total of 40 letters. Compute the number of letters she read correctly by subtracting the number of letters crossed off from the number on the last line read e.g. 40 - 5 crossed off = 35 correct.

For your information: The logarithm of minutes of arc (Log MAR) is computed according to the formula Log MAR = 1.1-((70-n).02), where n = total letters missed. Snellen fraction equivalents can be obtained from the Log MAR scale. They can also be obtained directly from the number of errors and the testing distance. These conversions will be printed on the scoring form so you can tell the participants their acuity score in a form they will understand.

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Bailey-Lovie Letter Chart

<u>Rationale for using a non-standard testing distance</u>. Acuity is usually measured at 16 inches for near and 20 feet for distance. However, for this study we are interested in acuity at viewing distances representative of fall situations, or mid-distances. Acuity at near may not be representative of acuity at 10 feet, especially in the elderly. Elderly with glasses may be out of focus at near distances. Very restricted pupils could affect acuity differently at different distances, as could light scatter due to cataracts. Reduced focussing flexibility in the elderly could also cause focus error across different distances. These problems are not likely to contribute to any significant differences in the result at 10 feet versus 20 feet. So we could test at 20 feet, but a larger room would be required. So we chose 10 feet.

III. Depth Perception: Randot Circles

1. Introduction:

Depth perception, or stereopsis, is the ability to binocularly discern the difference in distance from the observer of two static objects. This test creates a visual depth effect on a flat surface and provides a finely graded sequence test. It is designed for use at near distances - 16 inches; though some variation in distance should have little effect on the score. The stereopsis levels discriminated by the test range from 400 to 20 seconds of arc at 16 inches.

2. Equipment: Randot stereo acuity targets and polarized glasses. Within each of ten rectangular targets are three circles. Only one of the circles has crossed disparity, which when seen binocularly through polarized viewers should appear to stand forward of the other two. Mark the right and left side of the target with R and L.

Illumination: The standards and procedures for chart luminance are the same as for contrast sensitivity. Since this target surface has less reflectance than the other targets, an over the shoulder light source may be needed to bring the reading within range. This is appropriate since the dark glasses considerably reduce effective chart luminance. Glare will vary depending on how the examiner holds the target. A dark area or curtain behind the subject helps reduce glare.

3. Measurement Procedures:

a) The subject should be seated next to the examiner. Say:

"This is a test of how well you are able to judge distances. For example, how far down is the first step or the last step on a stairway? For this test I want you to wear your glasses, even if you only use them for reading, and wear these dark glasses over them."

b) Have the subject put on the polarized glasses. If subject wears glasses, even for reading, place the polarized glasses over her regular glasses. For the bifocal wearer, you will have to position the glasses and target properly for near-point viewing.

c) Point to Box 10.

"There are ten boxes on this page, each containing three circles. When you put on these special dark glasses, one of the circles may appear closer than the others or stand out from the others. I want you to tell me which of the circles in each box appears closer than the others or stands out from the others. It gets more difficult to see the differences as we go from box to box, so you may not be able to tell for all the boxes."

Note: In some subjects vision may be so poor that she will not be able to see the plate well enough to complete this test. If the subject complains of not being able to

see the circles at all, record her as being unable. A subject who cannot read any of the letters on the letter chart at 5 feet may be unable to see the circles.

d) Sit next to the seated subject. Hold the target about 16 inches from their face at about chest level. Ask the her to hold her head straight and still, not tilting it from side to side. The target must be held upright to maintain the proper axis of polarization.

e) Start with the first box and ask:

"Now which circle in box appears to stand out from the others, or appears closer to you. It should look like 3D".

Let each subject look at the first box for 30 seconds. (It sometimes takes 30 seconds for the depth illusion to develop.)

f) Scoring: Use the key on the scoring sheet to determine if subject chooses the correct circle in each box. If subject chooses incorrectly, go back to the preceding box and ask again, "Which circle stands out or appears closer?" If she gets that one wrong, go back to the box before that, etc., until she gets one correct. The score is the highest number box for which the subject chooses the correct circle twice. If no boxes are assessed correctly, the score is zero.