

STUDY OF OSTEOPOROTIC FRACTURES (V4)

V4 Performance Cohort

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, fluorescent light or a combination of the two is best. The chart luminance should be between 50 and 70 foot Lamberts for each of the two tests. The light meter from the vision contrast sensitivity test (or a similar one) should 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: Acuity and distance depth perception are tested with correction for distance 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.

All three vision questions are independent questions, thus if a participant refuses one of the tests then she should still be asked to perform / answer the others.

I. 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.

Light meter. Ideally, the VISTECH VCTS 6500 light meter used with the contrast sensitivity will be used to test illumination.

Illumination: The VCTS is designed so that it can accurately measure acuity 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) 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. Measure chart luminance to insure lighting conditions are within desirable limits. 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. If a participant says that she wears glasses but sees better without them, test WITH THEM (her "normal" state).

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 $\text{Log MAR} = 1.1 - ((70 - n) / 0.2)$, 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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II Howard-Dolman apparatus

Equipment and Description:

This device consists of two rods suspended within an enclosed housing which contains its own lighting system to provide uniformly diffused illumination. The rods are adjusted back and forth by means of a cord set attached to the rod guides. The unit has been constructed such that external depth cues are eliminated, requiring that a subject make depth discriminations on the basis of binocular vision cues alone.

The unit is designed to test acuity of depth perception, and has had a long history of development. Its earliest appearance is found in the famous three needle experiment designed by Helmholtz (1856-1866). Howard, in 1919, revised the design by using only two rods instead of three, making each rod moveable and allowing the subject to adjust the rod as designated by the comparison. These two rods are seen through an aperture to eliminate extraneous cues. This apparatus became known as the Howard-Dolman Apparatus, and was used to screen aviation candidates for poor stereopsis. The present apparatus has been further refined by completely enclosing the rods within a housing and providing a uniform and diffused lighting system. The rods have been connected such that the subject moves both rods simultaneously in opposite directions. The scale on top of the housing is graduated in centimeters. The pointer gives the distance each rod has moved away from center; therefore, to obtain the total distance between rods it is necessary to double the indicated value.

Administration:

- a. The unit should be connected to any standard 115V AC outlet. Tilt the box up so that the bottom and top on the inside are not visible to the seated subject.
- b. First let the subject look into the box from a few feet away as you show her how it works. Let her pull on the strings. Point out how the rods move. Say:

"This is a test of your ability to judge differences in the distance of two objects. As I said before this is called 'depth perception'.

- c. The subject should be seated approximately 10 feet from the front edge of the unit. Seat the subject with her back against a wall and head resting against the wall. Test with correction for distance vision.

"For this test it is important that you keep your head still. Do not move it from side to side. Try to keep your head in the same position on the wall behind you."

- d. Place the two control strings in the subject's hands; one in each hand. The arms should be held out far enough from the body so that the strings do not obscure the view of the aperture. Show the subject how she can move the rods in the box by pulling on the strings.

- e. Say:

"Now, the object of this test is for you to pull the strings until it looks to you as if the two rods appear to be the same distance from you. When it looks like the rods are about the same distance from you, or right next to each other (demonstrate with two pencils), then stop and say O.K. I will record the score and then move the rods apart and we'll try again. I'm going to ask you to do this 6 times. Your score will be the average of these tries so don't spend too much time making sure the rods are exactly the same distance from you."

"Now remember, don't move your head from side to side."

The starting positions are as follows:

Trial	1	- 6
Trial	2	+ 7
Trial	3	- 2
Trial	4	+ 3

Reset the pointer to the starting positions by pulling on the strings. **DO NOT RESET BY PULLING ON THE POINTER.** Ask the subject to let the strings slide through her fingers. Starting position can be marked on a piece of masking tape on the top of the box.

f. **Scoring:** After each trial, record the number and sign indicated by the pointer on the unit scale, to the nearest tenth of a centimeter.

For your interest: The computed depth preception error is equal to the standard deviation of 2 times the 4 recorded scores (or the actual errors in centimeters since the actual separation between the rods is twice the read distance). So, if a subject is off by +1 centimeter on all 4 trials, they have an error score of 0, or a perfect score. However, if they're off by +1 centimeter on 2 trials and -1 centimeter on 2 trials then her error score is 1cm, or the standard deviation of the errors.