SCORING OF FUNCTIONAL VISION

AUTHOR

Hasan Minto: Brien Holden Vision Institute, Pakistan

PEER REVIEWER

Melissa Chun: Jules Stein Eye Institute UCLA

S May Ho: Brien Holden Vision Institute, Australia

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AIMS

This module aims to outline the method of scoring a functional vision assessment of children with low vision via developing a:

- Knowledge base of vision assessment
- Systematic approach to measuring vision
- Protocol for implementing low vision services based on the level of functional vision

LEARNING OUTCOMES

After completing this module, students should be able to:

- Describe the functional acuity score
- Understand the difference between standard visual acuity measures and the functional acuity score
- Recognise the value of functional vision testing
- Apply the use of functional vision scores for the purposes of disability classification

INTRODUCTION

Traditional methods of measuring vision function are based primarily on visual acuity or visual fields using standard test procedures, e.g. Snellen visual acuity. When the visual acuity is less than 6/60, clinicians tend to use finger counting, hand movement or light perception as categories of visual acuity. However, none of these are standardized and the results can vary significantly according to the environmental conditions in which the testing is performed.

The measurement of visual acuity is fundamental in patients with low vision as it provides information on the impact low vision devices make to vision, progression of disease, recovery or deterioration of vision and guides current and future interventions.

The use of the LogMAR visual acuity chart has become a gold standard in the assessment of visual acuity because of its reliability and replicability. Using charts based on a logarithmic progression is a valuable step forward, however, it still does not adequately measure very low levels of vision (rudimentary vision). The vision scores are typically assigned based either on the vision in the better eye or visual field in the better eye.

This system does not take into account the visual acuity or visual field in the weaker eye and neither does it combine the vision scores of both eyes. Combining the visual acuity scores with the visual field scores of both eyes allows for a better prediction of the functional vision level that the individual might be able to use to perform or execute a task.

The issue is further complicated since visual acuity and visual field alone are not good predictors of functional vision which depends on additional factors like contrast sensitivity, colour vision, binocular vision and visual skills like saccadic and pursuit eye movements which determine the level of visual efficiency.

To address this issue, the World Health Organization, the American Medical Association (AMA), and other authoritative bodies have adopted systems for quantifying vision and classifying functional visual abilities. These systems assign scores that provide a rational basis for making rankings and groupings according to visual abilities.

In the AMA system, the results from standardized clinical tests lead to a Functional Acuity Score and a Functional Field Score, and both are scored on a 100 point scale. These two scores are then combined to give a Functional Vision Score.

THE FUNCTIONAL ACUITY SCORE

The visual acuity of the right eye and left eye are measured using standardised procedures. Then the visual acuity is measured with both eyes open. The test charts should have a size sequence that follows a logarithmic (constant ratio) progression, with five target presentations at each size level. Credit is given for each letter read correctly.

The visual acuity will not be designated as a traditional Snellen fraction (such as 6/6, 6/60, etc.), but rather as a Visual Angle Rating (VAR) value.

On the VAR scale, a Snellen 6/6 is equivalent to the VAR = 100, and for 6/60 the VAR = 50, and for 6/600 the VAR = 0. These are the three major benchmarks.

The LogMAR scoring system for visual acuity measurement was introduced by Bailey and Lovie (1976) and this has become the universal standard for acuity measurement in clinical research.

The VAR score is a simple transformation of the LogMAR score:

$$VAR = 100 - 50 \times (LogMAR)$$

Table1 shows conversion of VAR scores into the corresponding Snellen fractions (for 6 meters, 4 meters and 20 feet), with decimal notation.

Table 1. Visual Acuity Rating conversion table.

Snellen			Decimal	logMAR	VAR
20 feet	6 m	4 m			
20/400	6/120	4/80	0.05	1.3	35
20/320	6/95	4/63	0.06	1.2	40
20/250	6/75	4/50	0.08	1.1	45
20/200	6/60	4/40	0.1	1.0	50
20/160	6/48	4/32	0.13	0.9	55
20/125	6/38	4/25	0.16	0.8	60
20/100	6/30	4/20	0.2	0.7	65
20/80	6/24	4/16	0.25	0.6	70
20/60	6/19	4/12.5	0.32	0.5	75
20/50	6/15	4/10	0.4	0.4	80
20/40	6/12	4/8	0.5	0.3	85
20/30	6/9.5	4/6.3	0.63	0.2	90
20/25	6/7.5	4/5	0.8	0.1	95
20/20	6/6	4/4	1	0.0	100
20/16	6/4.8	4/3.2	1.25	-0.1	105
20/12.5	6/3.8	4/2.5	1.58	-0.2	110
20/10	6/3.0	4/2	2	-0.3	115

It is well established that in assigning visual acuity scores, credit should be given for every letter read. If the progression of size on the test charts follows a logarithmic sequence, and if there are five letters (or symbols) at each size level, then each letter will have a VAR value of 1 point.

For example, if a person could read the 6/75 line, they would achieve a VAR score of 45 points. If they were to read 2 extra letters from the next line (6/60), then their score would improve to 47.

The visual acuity testing results should be expressed in VAR units.

FACTORING IN THE VISUAL ACUITY IN THE POORER EYE

In the AMA system, to obtain a Functional Acuity Score (FAS) that factors in the poorer eye, the VAR scores should be measured for the better eye, the poorer eye, and for both eyes together.

Then, the following formula is used to obtain the Functional Acuity Score:

$$FAS = [3 \times VAR\ better + VAR\ poorer + VAR\ both] / 5$$

In the event that the visual acuity was not measured with both eyes open, then the formula should be modified to become:

FAS = [4 x VAR better + VAR poorer] / 5

For some illustrative examples are as follows:

For a person who has a VAR of 50 (i.e. 6/60) in their better eye, and a VAR of 15 (6/300) in the poorer eye along with a VAR of 55 (6/48) when both eyes are used, the Functional Acuity Score would become:

FAS= [3(50) +15+55] / 5 = 220 / 5 = 44

For a person who has a VAR score of 50 (6/60) in the better eye and no measurable visual acuity in the second eye (VAR = 0), the visual acuity should be 50 (6/60) when both eyes are open. The Functional Acuity Score would be:

FAS= [3(50) + 0 +50] / 5 = 200 / 5 = 40

Note the same FAS score of 40 would also be given to a person who had a visual acuity of VAR = 40 (i.e. 6/95) both in the right eye and in the left eye, and also when tested with both eyes open.

THE FUNCTIONAL FIELD SCORE

The AMA uses a simplified method to score visual fields. The AMA system calls for testing of visual fields along 10 different radial meridians - for the right eye, for the left eye, and for both eyes together. They measure fields along 4 radial meridians in the superior field (25, 65, 115, 155 degrees), and along 6 radial meridians in the inferior field (195, 225, 255, 285, 315, 345 degrees).

Along each of these radial meridians there are 11 specified points. Five of these 11 points are within the central 10 degrees (at 1, 3, 5, 7 and 9 degrees) and the other 6 points are in the peripheral field (at 15, 25, 35, 45, 55, and 65 degrees).

The examiner notes how many of these points can be seen along each of the 10 radial meridians, and these are all added together to give a total visual field score. Theoretically, the highest possible score is 110, but the brow, the nose and the bridge of the nose impose limitations that cause the score to become about 100 for an individual with normal visual fields. The AMA system uses scores for visual field from the better eye, from the poorer eye, and from the binocular visual field measured. These three visual field scores are combined using a weighted averaging process.

For practicality, a modified method for scoring the visual fields based on the AMA method is recommended. The visual fields should be measured using a hand held disc perimeter or similar screening method with a 6/300 white target or equivalent, and testing should be done with both eyes open.

The visual field should be tested along five radial meridians only. Two of these radial meridians are in the upper field (45 and 135 degrees) and three are in the lower field (225, 270 and 315 degrees). Along each of these radial meridians, there will be 10 specified points following the same increments used in the AMA system. These are 1, 3, 5, 7, 9, 15, 25, 35, 45, 55 and 65 degrees.

For each of the five radial meridians, the examiner notes at how many of the designated points the target can be seen. The number of points seen along each of the 5 radial directions are added together, and this sum is multiplied by 2 to give the Functional Field Score (FFS). For normal visual fields, the FFS would be about 100 points. Figure 1 shows the functional visual field recording sheet.

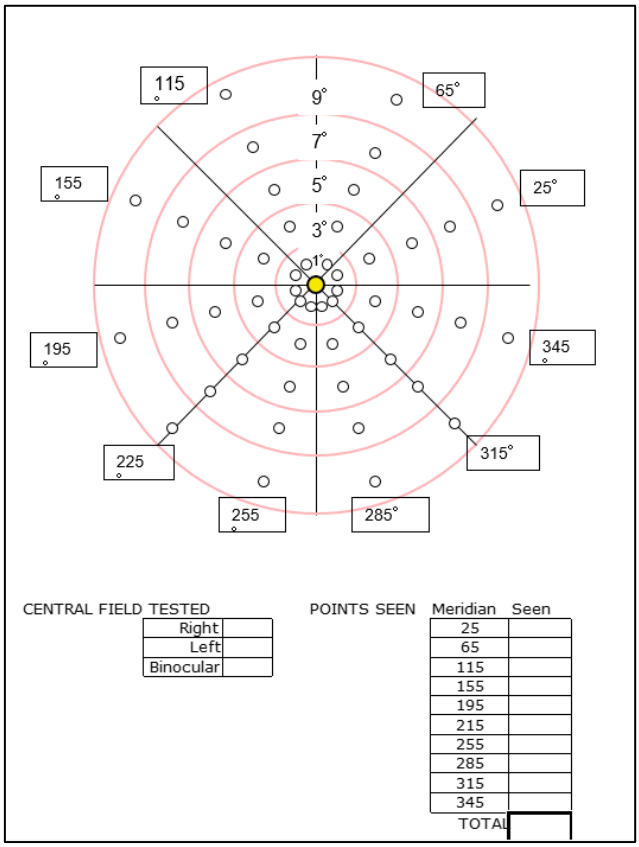

Figure 1. Recording sheet for the modified functional visual field assessment.

As an example, a person whose visual field was constricted to a circle with a 10 degree radius (20 degree diameter) would be able to see 5 points (at 1, 3, 5, 7 and 9 degrees) along each of the 5 radial meridians, so the sum of points seen would be 25. Then the Functional Field Score would be FFS = 2 (25) = 50 points.

A table giving the Functional Field Scores that would be obtained if the visual fields were constricted in a symmetrical or concentric manner is available.

THE FUNCTIONAL VISION SCORE

A Functional Vision Score is obtained by combining the Functional Acuity Score and the Functional Field Score. The formula for combining the Visual Acuity and the Visual Field measures uses simple multiplication.

Functional Vision Score FVS = FAS x FFS / 100

If FAS = 50 and FAS = 50 then FFS = 50 x 50 / 100 = 2500/100 = 25

An alternative way of thinking about this formula is to consider the FAS and the FFS as being on percentage scale. Then a FAS of 50 points is taken as 50%, a FFS of 50 points is also taken as 50% and by multiplying these two percentages together, one obtains a Functional Vision Score in percentage terms. In this example 50% of 50% = 25%.

CONCLUSION

It is important to use functional vision scores for the purposes of disability classification, participation in sports for the visually impaired, and for the purposes of research, where there is a need to relate vision with quality of life.

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