FUNCTIONAL VISION ASSESSMENT FOR CHILDREN WITH LOW VISION

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CHAPTER CONTENTS

INTRODUCTION 2
FUNCTIONAL VISION ASSESSMENT 3
FUNCTIONAL VISION ASSESSMENT REPORT 7
CONCLUSION 7

AIMS

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

- Understanding of the difference between a clinical vision exam and a functional vision assessment
- Systematic approach to selecting the most appropriate testing procedures

LEARNING OUTCOMES

After completing this module, students should be able to:

- Develop a method to implement a functional vision assessment
- Select the most appropriate low vision assessment techniques for a given child
- Provide a report covering the basic areas of the functional vision assessment to parents and teachers for use in the visual habilitation of the child

INTRODUCTION

Despite overall increases in school participation over the past decade, some groups of children continue to be left behind, particularly children with disabilities. One third of the 72 million children currently out of school have at least one disability, and 90 per cent of children with disabilities in developing countries do not go to school.[1]

Disability has more impact on participation in education than gender, rural residence or household economic status.[2] Research in southern Africa suggests access to education is particularly limited for children with sensory disabilities, including those with visual impairments. Making education more responsive to the needs of children with disabilities is now one of the most pressing concerns if the Millennium Development Goals (MDG 2) of universal primary education by 2015 and the Dakar Declaration of Education for All (EFA) by 2015 are to be met.

The education of children with disabilities is also an essential driver for poverty alleviation and human development. People with disabilities constitute an estimated 20% of the world's poorest.[3] Exclusion from education is a significant factor in the high levels of poverty often experienced by people with disabilities and their families. Denying children with disabilities access to a quality education greatly constrains their opportunities to gain independence and skills, often leaving them isolated and unable to contribute to their own self-fulfilment or their communities' drive for development. Yet, with access to education, children with disabilities have the chance to become active and engaged citizens.

Globally, there are 124 million people with low vision. Approximately 65 million of these people have irreversible low vision and require low vision services. Most of those with low vision are older people and the numbers will double over the next 20-30 years because of the aging population. Whilst the number of children is small, the burden in life years with low vision is significant.

Children learn most about the world by what they see. Vision is an organising sense that allows us to perceive objects at a distance and to make connections between these objects. When a child is vision impaired, the amount of visual information they receive can be limited and it can often be interpreted inaccurately. Because of this, it is important for children with visual impairment to directly experience as much of their world as possible and to receive augmented instruction in making connections between objects and processes.

In very young (pre-school) children, it is often difficult and sometimes impossible to assess and quantify the various visual functions through the conventional testing methods. Although special tests exist for the quantitative assessment of vision in children, these are often difficult to administer and require a certain set of advanced skills which most clinicians do not routinely practice. There is also growing evidence that visual acuity score cannot accurately predict the functional performance of an individual, which relates more closely to the levels of visual efficiency including the ability to fixate, scan and track.

Children with special educational needs can be difficult to assess in the clinical setting. A satisfactory result is particularly hard to achieve when a child has significant learning and communication issues. Many children associate the hospital clinic with previous unpleasant experiences. Many children with learning disabilities are unable to manage the standardised tests used to test visual acuity and other vision assessments.

Another issue is the translation of the results of the clinical findings by the education and rehabilitation team into their planning for the individual child. For example, a visual acuity score of 20/200 does not really help a teacher understand how far the child needs to sit from the writing board.

Assessment for children with visual impairment includes comprehensive evaluations by members of a multi-disciplinary team. Areas of assessment include:

- Eye health and refractive error assessment
- Clinical low vision assessment
- Functional vision assessment
- Expanded core curriculum assessment
- Learning media assessment.

The ophthalmologist or optometrist completes the ocular evaluation of the child to diagnose the eye condition(s) and presence of refractive error, as well as to give a prognosis of the visual impairment. Surgical interventions, if required, are performed by an ophthalmologist. Glasses may be prescribed by either the optometrist or ophthalmologist. Use of functional vision is not emphasized.

A clinician, either trained in optometry or ophthalmology with additional training and experience in the care of people with low vision, performs the clinical low vision assessment. This assessment consists of measures of visual function, including visual acuity at distance and near, visual field, contrast sensitivity, binocularity and colour vision. During this assessment, a recommendation as to whether or not the child will benefit from low vision devices is made. In addition, during this assessment, the child may need to be referred for special educational services. If appropriate, low vision devices are prescribed. One of the most beneficial results of the low vision assessment is the link made between medical and functional aspects of vision loss.

FUNCTIONAL VISION ASSESSMENT

The functional vision assessment (FVA) includes a variety of evaluations that test the child's use of vision and visual efficiency in daily activities. A trained teacher, orthoptist, or low vision counsellor completes the functional vision assessment. Based on the information collected through record review, interviews, observations, and assessment, a report is generated to enable the child's parents, therapists and educational team to maximize the child's visual efficiency.

The purpose of the assessment is to determine how the child uses his/her vision in real-life situations. The assessment findings:

- Help to explain how a child is functioning with his/her level of vision
- Provide strategies and ideas on how to make the best use of available vision or to make adaptations to make the visual world easier to understand
- Give a comparison of levels of vision to other children of the same age
- Look at other related areas of vision such as depth perception and colour vision and their impact on function where appropriate
- Give information as to how the child's vision impacts their mobility and social interactions
- Give ideas about how information that is typically obtained visually is best presented for learning.

There is no gold standard FVA. In one study in the United States, 233 respondents reported using over 200 forms or combinations of forms for reporting functional vision; most used forms they developed themselves.[4] Reasons for this include the varying developmental levels of the children being assessed as well as medical and cognitive comorbidities. The environment, time available, skill of the examiner and needs of the child also play a role.

There have been a number of attempts to develop a standardized methodology and testing materials for the functional vision assessment. The first significant attempt to standardize the procedure and develop a kit for functional vision assessment was developed by Natalie Barraga which was followed by the introduction of a FVA kit developed Keeffe for use in the developing countries.[5] The FVA kit developed by Yasmin and Minto[6] is an attempt to further streamline and standardise functional vision assessment, and to make this available to professionals working in the areas of vision rehabilitation at an affordable price through the Vision 2020 Low Vision Resource Centre in Hong Kong.[7]

However, FVA's are often intentionally not standardized. Rather they are selected to suit each individual child's expected needs. For example, if a child needs to read a chalkboard, a functional assessment of the circumstances required for

success would be determined. The FVA covers many of the same areas as the clinical low vision exam and may also address appropriate learning medium/media. Alternatively, a separate learning media assessment may be conducted.

TESTING ENVIRONMENT

Whether using a standardised FVA or an individualised FVA, it is important to document the testing environment. Effort should be made to do the testing in the environment where the information is needed. For example, a toddler's FVA might be conducted in the home, or a school age child in the classroom. Lighting and glare sources in particular should be noted, as they may have a profound impact on the performance of some children with vision impairment. Time of day may also be important, as performance may decrease as the child fatigues.

VISUAL ACUITY

Visual acuity measured in a clinical exam is performed under optimal illumination with high contrast test objects. Visual acuity is a measure of best function, but the functional vision evaluation also takes into account the actual circumstances of the task. The amount of vision required varies depending on the contrast of the material, lighting, glare and complexity of the material. How functional visual acuity is measured is partially determined by the visual ability and developmental stage of the child.

Clinically, visual acuity is measured in infants and young children as well as non-verbal older children and adults with cognitive delays using grating tests, such as the Teller Acuity Card Test. Functionally in those same groups, measures of visual ability could consist of the ability to fixate a light, recognise a face or a toy. Toys, including blocks and balls of different colours and sizes are readily available and easy to use. The size of the object and distance at which the child fixates on it further describes visual ability. Objection to having one eye covered but not the fellow eye, suggests that vision may be poorer in the eye for which there is no objection when covered.

As preschoolers, many children will be able to perform matching tasks and visual acuity can be measured. A parallel functional vision task would be to match pictures or identify the face of a familiar cartoon character or a particular toy. The examiner records the distance at which the task can be completed and information about the size and contrast of the object used for testing.

In school-aged children, letter based charts are commonly used for visual acuity measurement. In the FVA, measurements that might be made include distance from the board to read materials written on it or font size for comfortable, sustained reading. The evaluation would also determine characteristics of the writing instrument or lighting that optimise the child's ability to access the information. Commercially produced acuity cards are not necessary, but can be used. Using a word processing program, it is easy to prepare a word reading test to assist with varied print sizes for reading (Figure 1).

Figure 1: Word reading test to assist with print size for reading

Ultimately, the FVA report should address questions such as:

- Distances at which the child can identify people and recognise facial expressions
- Whether or not the child can see a chalk board/white board/smart board, and at what distance(s)
- Print size recommendations for optimal reading

VISUAL FIELD

Visual fields, functionally, can be thought of as the space around the child in which they can see while looking straight ahead. Many conditions that cause paediatric vision impairment do not affect the visual field, for example albinism or achromatopsia. But others, especially retinal degenerations and impairments from brain injury related to tumors or stroke are associated with visual field loss. Visual fields are clinically measured monocularly, however we use our eyes simultaneously. Functional fields can be measured either monocularly or binocularly. The child's attention should be directed to a target straight ahead. Many different targets can be used, so long as the child is interested in them. Faces, toys and lights are common targets. As the child is looking straight ahead, an object is moved from a non-seeing area (such as behind them) toward fixation. The child will typically change their gaze to look at the object coming into their peripheral field. This can be repeated in different regions of the child's field. When the child is verbal, they can be instructed to tell you when they see the test object coming in from the periphery. Larger test objects should be seen further out in the periphery than very small test objects.

Visual field testing informs the child's caregivers and teachers as to locations to best present information. It can also be very informative in terms of the need for mobility services.

COLOUR VISION AND CONTRAST SENSITIVITY

Colour vision is the ability to discriminate various hues and saturations of colour. Clinically this is tested in several ways, most commonly using colour vision test plates such as the Ishihara test. A test plate is made up of hundreds of coloured

circles, some of which are in a different hue and form a number or shape. Because this test to some degree relies on acuity, some children with poor vision will fail the colour vision test when in fact their colour vision is intact. The Ishihara test was designed to test for inherited red green colour vision deficiencies that are more common in boys. It was not intended to test colour vision in children with vision impairment. There are other colour vision tests that can be used clinically that do not depend on acuity, such as the Farnsworth D-15.

From a functional standpoint, many different common objects can be used. For example, have the child identify the colours in a box of crayons. Colour sample cards from a paint store can also be useful, as are toys with bright colours. Having two sets of toys, one with saturated colours and one with desaturated colours gives further functional information about the child's ability to see colour.

Contrast sensitivity is a measure of how well the child sees objects that are similar in colour to their background. This can be evaluated functionally by placing objects of similar colour and contrast on top of one another, for example, a piece of chalk on a white plate. A sheet of white paper on a white desk – would the child perform better if their desk were covered in a dark colour so that they can more easily see the boundaries of the paper? A toddler may see their toys better on a contrasting colour blanket than they would on a busy, patterned rug.

OCULAR MOTILITY

Ocular motility refers to how the eyes move. This is tested in the FVA by observation. Many children with vision impairment have nystagmus - a rhythmic, involuntary, conjugate motion of the eyes, which may make these determinations more difficult, but not impossible to perform. It should also be noted that many children with nystagmus adopt a head posture that places their eyes in a position where their nystagmus is minimised. This is a natural and helpful posture that should not be discouraged. If there are concerns regarding neck strain or similar problems due to the head posture, the child should be referred to a paediatric ophthalmologist for evaluation, as surgical correction may be possible. In the meantime, the head posture should be noted in the FVA, but again should not be discouraged.

The first determination should be whether or not both eyes are pointing in the same direction. If they are not, the child has strabismus and this finding should correlate with the doctor's report. If this finding is not noted on their report, the child should be referred back to their eye care provider for further evaluation. An inward turn of one eye is called esotropia and an outward turn is called exotropia. In either condition, the child lacks fine depth perception (stereopsis) and has only the depth perception that can be afforded by viewing with one eye. Tasks requiring depth perception, such as putting marbles in a cup should be tested to determine functional effects of the misalignment. Many children will not exhibit difficulties with this task, as this is typically a long-standing problem and they have learned compensatory skills.

Other important observations include whether or not the child can easily change fixation from one object to another or if they can they smoothly follow an object as it moves across their visual field. Clinically, these are respectively referred to as saccadic and pursuit eye movements. Their ability to scan and track has implications for reading as well as for everyday activities like playing ball in the playground, or tracking a friend as they move through the classroom.

LIGHTING

Lighting can be very important to people with vision impairment. People with some eye conditions such as cone dystrophy or achromatopsia typically experience day-blindness and require reduced light conditions for optimal performance. Others with conditions such as retinitis pigmentosa or Leber's congenital amaurosis experience night-blindness and require more lighting. By observing the child under differing light conditions, both indoors and out, recommendations for optimal lighting can be made. This may include the use of glare shields and hats even indoors or perhaps removal of some bulbs in overhead lighting near a child's seat in the classroom if the child requires dim illumination. For children needing more lighting, an additional lamp at their desk may enhance their functional performance.

It is also important to note any safety issues that might be present under certain lighting conditions. For example, the child who needs more light may not be able to safely follow their classmates in an emergency situation resulting in a power outage. In contrast, the child who is day-blind may need assistance when going outside into bright sunlight.

FUNCTIONAL VISION ASSESSMENT REPORT

The culmination of a FVA is the summary report. This should be written in a way that is meaningful to lay persons without experience with vision impairment or blindness. At a minimum, it should include a description of how the child sees in their typical environment as well as information about environmental conditions, adaptations and accommodations that maximize the child's performance and ways to increase their visual efficiency. Standardized assessments may also have standardized reporting forms.

Recommendations for specific modifications should be based on the objective testing in the FVA. The findings of the FVA may also support referral for other evaluations such as an orientation and mobility evaluation, an assistive technology assessment, a learning media assessment or if it has not already been done, a clinical low vision evaluation.

CONCLUSION

Whether a standardized or individualized FVA is performed, it addresses critical issues related to vision that are important for access to learning. The overarching goal of the FVA is to identify both the strengths and weaknesses of the child's visual abilities in their environment so that appropriate accommodations can be made to limit the impact of their vision impairment on their education. The FVA is a critical assessment needed to maximize the potential academic and life success of each child.

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