UPDATE ARTICLE

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Adapting the school environment to enhance functionality in visual rehabilitation

Adaptação do ambiente escolar para favorecer a funcionalidade na reabilitação visual

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KEYWORDS:

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ABSTRACT

Low vision in childhood directly interferes with school performance and a child's overall functioning. Although optical prescription is essential, it is insufficient if not accompanied by appropriate adaptation of the school environment. The ophthalmologist plays a central role in advising families and schools regarding the child's functional visual needs. The aim of this article is to present, from a clinical perspective, the main principles and strategies for adapting the school environment to promote the functional vision of children with low vision and to provide practical support for ophthalmologists. The concepts of functional vision and functional vision assessment are discussed, along with the main domains of school environment adaptation, including lighting, contrast, spatial organization, teaching materials, optical resources, assistive technologies, and pedagogical modifications. The role of the ophthalmologist in communicating these needs to parents, teachers, and educational specialists is emphasized. Appropriate medical guidance on environmental adaptations reduces functional limitations, improves the use of residual vision, and contributes to children's academic success. Coordinated action with the school and other professionals enhances the outcomes of visual rehabilitation. Adapting the school environment is an integral component of practical visual rehabilitation and should be explained and guided by the ophthalmologist as an essential complement to the clinical treatment of children with low vision.

PALAVRAS-CHAVE:

Baixa visão; Reabilitação visual; Oftalmologia pediátrica; Ambiente escolar; Funcionalidade visual.

RESUMO

A baixa visão na infância interfere diretamente no desempenho escolar e na funcionalidade global da criança. Embora a prescrição óptica seja fundamental, ela é insuficiente quando não associada à adaptação adequada do ambiente escolar. O oftalmologista tem papel central na orientação de famílias e escolas quanto às necessidades visuais funcionais da criança. O objetivo deste artigo é apresentar, sob uma perspectiva clínica, os principais princípios e estratégias de adaptação do ambiente escolar que favorecem a funcionalidade visual de crianças com baixa visão, fornecendo subsídios práticos para a atuação do oftalmologista. São discutidos os conceitos de funcionalidade visual, avaliação funcional da visão e os principais eixos de adaptação do ambiente escolar: iluminação, contraste, organização espacial, materiais didáticos, recursos ópticos, tecnologias assistivas e adaptações pedagógicas. Destaca-se o papel do oftalmologista na tradução dessas necessidades para pais, professores e pedagogos. A orientação médica adequada sobre adaptações ambientais reduz limitações funcionais, melhora o aproveitamento da visão residual e contribui para o sucesso escolar. A atuação integrada com a escola e outros profissionais potencializa os resultados da reabilitação visual. A adaptação do ambiente escolar é parte integrante da reabilitação visual prática e deve ser compreendida e orientada pelo oftalmologista como complemento essencial ao tratamento clínico da criança com baixa visão.

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INTRODUCTION

In ophthalmic clinical practice, particularly in the care of children with low vision, complaints of poor academic performance, reading difficulties, visual fatigue, inattention, and lack of motivation are common. These difficulties often persist even after appropriate refractive correction and the prescription of optical aids.

This occurs because a child's visual function depends not only on visual acuity or visual field but also on the environmental conditions in which visual performance is required. The highly visual school environment may either facilitate or hinder the effective use of residual vision[1].

In this context, adapting the school environment should be understood as an integral part of visual rehabilitation in clinical practice. By recognizing this need, the ophthalmologist assumes a fundamental role in guiding parents and school staff, thereby contributing to a more effective and functional approach to managing low vision in children.

Functional vision: A clinical concept applied to the school setting

Clinically, functional vision refers to a child's ability to use residual vision efficiently in everyday activities. In the school environment, this includes tasks such as:

- Reading printed texts and information on the board
- Copying information
- Recognizing figures, symbols, and graphs
- Navigating the classroom and school environment

Visually interacting with classmates and teachers

It is essential for the ophthalmologist to understand that children with the same ophthalmologic diagnosis may present completely different functional performances. Therefore, functional vision assessment complements the objective data obtained from the traditional ophthalmologic examination[2].

Functional vision assessment: The basis for guiding adaptations

Although functional vision assessment is not always performed directly by the ophthalmologist, it must be understood and considered in clinical management. This assessment provides information about how the child uses vision in real-life situations, taking into account factors such as:

- Lighting
- Reading distance
- Contrast
- Size of visual stimuli
- Time needed to perform visual tasks
- Font type
- Spacing between lines and characters
- Visual fatigue

Based on these findings, the ophthalmologist can recommend specific environmental adaptations, thereby avoiding generic or ineffective indications.[3,4]

Adaptations to the school environment: What the ophthalmologist should recommend

1. **Lighting: Practical clinical guidance**

   Inadequate lighting is one of the main causes of reduced functional performance in children with low vision.

   The ophthalmologist should recommend:

   Positioning the child to maximize natural light while avoiding direct glare to the eyes.

   Ensuring homogeneous artificial lighting, avoiding shadows and reflections.

   Using task-directed lighting (e.g., a desk lamp), which often significantly improves reading performance.

   Adjusting the position and intensity of the light source according to the specific eye condition (e.g., photophobia or need for increased illumination).

   These simple guidelines can be communicated directly to parents and school staff.

2. **Contrast: An essential facilitator of visual function**

   Improving contrast often results in greater functional gains than simply increasing font size.

   Practical recommendations include:

- Using high-contrast text (e.g., black on white or yellow backgrounds).
- Avoiding materials with colored or patterned backgrounds.
- Using high-contrast markers on the board.
- Highlighting stairs, doors, and frame edges with contrasting tape when necessary.

The ophthalmologist should emphasize that adequate contrast reduces visual strain and fatigue.

3. **Spatial organization and student positioning**
   From a clinical-functional perspective, a predictable environment enhances visual orientation and autonomy.
   Common recommendations:
   Seating the child in a position that respects their functional visual field (the front row is not always the optimal location).
   Avoiding frequent changes in classroom layout.
   Maintaining obstacle-free corridors.
   Adjusting desk height and providing an inclined plane (slant board) for reading and writing.
   These recommendations may be included in the medical report provided to the school.[5]

Teaching materials and visual aids

1. **Printed materials**
   The ophthalmologist should recommend:
   Individualized magnification of printed materials.
   Simple, sans-serif fonts (e.g., Arial or Verdana) with adequate spacing between lines and characters.
   Matte paper to reduce glare.
   Avoiding excessive visual information on a single page.
2. **Optical and non-optical aids**
   The prescription of optical aids must be accompanied by guidance regarding their functional use in the school environment. Examples include:

- Magnifiers for near reading
- Telescopes for viewing the board
- Slant boards
- Reading guides
- 3B, 4B, and 6B pencils (softer graphite produces darker, thicker, high-contrast strokes)

3. **Optical aids**
   Stand magnifiers are so named because they are used while resting on the reading material. Models are available with or without a built-in light source and with either fixed or adjustable focus. Magnifiers with adjustable focus compensate for refractive errors and do not require accommodative effort or the use of additional lenses. Stand magnifiers are widely used for functional guidance in schoolchildren and for reading small print in dictionaries, rulers, or magnifiers in the form of paperweights. For stand magnifiers without built-in lighting or transparent sides, non-optical aids such as lamps or additional lighting are recommended to enhance the brightness of the reading material.

Hand-held magnifiers are so called because they are held in the hand while magnifying the retinal image. For optimal focus, they must be used with optical distance correction. Hand-held magnifiers are typically used for short-duration tasks (e.g., reading product labels and prices in the supermarket). They provide a reading distance that is closer to normal compared to other magnifier models and are well accepted by visually impaired adult students. However, they have the disadvantage of occupying the hands. Some models have built-in lighting, which improves illumination when ambient light is insufficient.

Spheroprismatic glasses (binocular) consist of spherical lenses with base-in prisms in both eyes, allowing binocularity. The prisms, positioned at the base near the nose, make reading more comfortable, as the student's eyes do not need to converge as much. The advantages of this model include keeping the hands free, suitability for prolonged reading, and facilitation of writing.

Aspherical glasses (monocular) may include spherical, aspherical, or microscopic lenses. Because the lenses are mounted in spectacle frames and sit very close to the eyes, the reading material must be held closer to the face to achieve focus.

Distance-vision aids (telesystems, telemagnifiers, or telescope systems) are optical systems that increase the size of the image projected onto the retina and allow closer viewing of distant objects. Telemagnifiers may be hand-held or attached to monocular or binocular glasses. These optical aids are important for improving visual performance at a distance and allow students to see the blackboard[6,7].

It is important to explain to families and schools that these resources require training and adaptation and that their proper use increases the student's autonomy.

Assistive technologies in clinical practice

- Tablets with adjustable magnification and contrast
- Screen reader software
- Reading and text-recognition applications
- Digital resources as alternatives to printed materials
- Electronic magnifiers (which allow adjustable magnification of text and images in real time, with high contrast and built-in lighting)

1. **Modern operating systems, such as Windows and macOS, include native accessibility tools for screen enlargement**

- Magnifier: An integrated tool that enlarges parts of the screen or the entire screen, with options for color and contrast adjustment.
- Accessibility settings: These allow users to increase the size of fonts, icons, and the mouse pointer, as well as apply color filters, high contrast, or color inversion.
- Professional software: Specific programs such as SuperNova and ZoomText are assistive technology solutions designed to help people with low vision or blindness use computers running the Windows operating system. They offer screen magnification features and, in more comprehensive versions, screen reading (speech synthesis). Developed by Dolphin Computer Access, SuperNova combines screen enlargement, speech output, and braille display support. ZoomText, originally developed by AI Squared and now part of Freedom Scientific (Vispero), allows magnification of up to 64×, image smoothing, and different viewing modes (dynamic magnifier, split screen) and, in some versions, includes a speech synthesizer for screen reader).[8]

2. **Mobile devices also offer native features and specific applications**

- Zoom/accessibility: Integrated functions in iOS (VoiceOver) and Android (TalkBack) allow users to magnify the screen, adjust contrast, and use pinch-to-zoom gestures in browsers and applications.
- Digital magnifier applications: Applications such as weZoom Magnifying Glass and Vision Enhancer use the phone's camera as a magnifying glass, allowing enlargement of text and objects in the environment.
- Artificial intelligence (AI) applications: Tools such as Microsoft Seeing AI and Google Lookout use artificial intelligence to describe environments, read text, identify products and currency, and convert descriptions into audio for the user.

These technologies often increase functionality beyond what traditional methods alone can provide[9].

Guidance for families and schools: The role of the ophthalmologist

A key aspect of medical practice is communicating the child's clinical visual condition to parents and educators. This includes:

- Clearly explaining what the child can and cannot see
- Setting realistic expectations
- Encouraging autonomy while avoiding overprotection
- Referring to a multidisciplinary team when necessary, including an orientation and mobility specialist, an orthoptist, a specialized educator, an occupational therapist, and a psychologist

Objective medical reports that include practical recommendations are valuable tools for communication with schools.

DISCUSSION

In ophthalmologic practice, the absence of appropriate environmental adaptations may lead to the false impression of limited cognitive or behavioral potential. Many difficulties attributed to attention deficits or learning problems stem from unrecognized visual barriers.

Considering the adaptation of the school environment as part of visual rehabilitation broadens the impact of the ophthalmologist's practice and integrates clinical care into the child's daily life. Minor guidance, when properly directed, can produce a significant functional impact.

Interdisciplinary work, although desirable, does not replace the role of the ophthalmologist as the primary reference for the family and the school regarding the child's visual condition.

FINAL CONSIDERATIONS

Adapting the school environment should be regarded by the ophthalmologist as a natural component of caring for a child with low vision. Prescribing glasses or optical aids without providing guidance on the environment in which visual performance is required limits the effectiveness of visual rehabilitation.

By offering practical and objective guidance to parents and schools, the ophthalmologist contributes directly to the child's functional performance, academic achievement, and quality of life. Integrating

these recommendations into daily clinical practice strengthens a truly functional approach to visual rehabilitation.

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