



ORIGINAL ARTICLE

Should we add visual acuity ratios to referral criteria for potential cerebral visual impairment?

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KEYWORDS

Visual acuity;
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Abstract

Purpose: To determine whether the assessment of visual acuity ratios might improve the referral of children with (sub)normal visual acuity but at risk of cerebral visual impairment.

Methods: In an exploratory study, we assessed visual acuity, crowding ratio and the ratios between grating acuity (Teller Acuity Cards-II) and optotype acuity (Cambridge Crowding Cards) in 60 typically developing school children (mean age $5y8m \pm 1y1m$), 21 children with ocular abnormalities only ($5y7m \pm 1y9m$) and 26 children with (suspected) brain damage ($5y7m \pm 1y11m$). Sensitivities and specificities were calculated for targets and controls from the perspective of different groups of diagnosticians: youth health care professionals (target: children with any visual abnormalities), ophthalmologists and low vision experts (target: children at risk of cerebral visual impairment).

Results: For youth health care professionals subnormal visual acuity had the best sensitivity (76%) and specificity (70%). For ophthalmologists and low vision experts the crowding ratio had the best sensitivity (67%) and specificity (79 and 86%).

Conclusion: Youth health care professionals best continue applying subnormal visual acuity for screening, whereas ophthalmologists and low vision experts best add the crowding ratio to their routine diagnostics, to distinguish children at risk of visual impairment in the context of brain damage from children with ocular pathology only.

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PALABRAS CLAVE

Agudeza visual;
Ratios de agudeza visual;
Daño cerebral;
Criterios de derivación

¿Se deberían incorporar los ratios de agudeza visual a los criterios de derivación en los casos de discapacidad visual cerebral potencial?

Resumen

Objetivo: Determinar si la valoración de los ratios de agudeza visual en niños podría mejorar la derivación de niños con agudeza visual (sub)normal, pero con riesgo de discapacidad visual cerebral.

Métodos: En un estudio exploratorio, valoramos la agudeza visual, el ratio de aglomeración y los ratios comprendidos entre la agudeza de difracción (Teller Acuity Cards-II) y la agudeza visual de optotipos (Cambridge Crowding Cards) en 60 escolares con desarrollo normal (edad media $5.8 \pm 1,1$), 21 con anomalías oculares únicamente ($5,7 \pm 1,9$) y 26 niños con daño cerebral (sospechado) ($5,7 \pm 1,1$). Las sensibilidades y especificidades fueron calculados para los casos de estudio y controles desde la perspectiva de diferentes grupos de evaluadores: profesionales sanitarios para jóvenes (objetivo: niños con cualquier anomalía visual), oftalmólogos y expertos en baja visión (objetivo: niños con riesgo de discapacidad visual cerebral).

Resultados: Para los profesionales sanitarios para jóvenes la agudeza visual obtuvo la mejor sensibilidad (76%) y especificidad (70%). Para los oftalmólogos y los expertos en baja visión el ratio de aglomeración obtuvo la mejor sensibilidad (67%) y especificidad (79 y 86%).

Conclusión: Los profesionales sanitarios para jóvenes siguen aplicando la agudeza visual inferior a lo normal en los exámenes visuales, mientras que los oftalmólogos y los expertos en baja visión incorporan el ratio de aglomeración a sus diagnósticos rutinarios, para distinguir a los niños con riesgo de discapacidad visual en el contexto del daño cerebral, de los niños con patología ocular únicamente.

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Introduction

Childhood cerebral visual impairment often goes unrecognised, especially in case of mild brain damage which has remained obscure, delaying rehabilitation to support normal development. Dutch youth health care physicians (physicians providing preventive services), paediatricians and paediatric ophthalmologists indicated difficulties in recognising higher visual problems and expressed the need for clear diagnostic guidelines, whereas experts of low vision services indicated that it is not efficient to perform time-consuming assessments of cerebral visual functions, e.g. object and face recognition, in all referred children. They expressed the need for a quantitative, evidence-based measure that could help with the selection.¹

Hård et al.² suggested that 'crowding' might be an indicator for visual perception problems. Crowding is the phenomenon of impaired discrimination of visual stimuli in the middle of other stimuli.³ Abnormal crowding may show in daily life as difficulties handling complex visual situations, for example finding a toy in a toy box or coping with busy environments like supermarkets; reading may be hampered, as well as visual acuity testing with routinely used cards.⁴ It may either concern a selective attention problem, negatively influencing specific higher perceptual functions,⁵ or it might be a failure in the neural development of small integration fields.⁶ In both instances, crowding might predict (unidentified) brain damage and, indirectly, visual perception problems.⁷⁻⁹

Children without any neurological impairment who have developmental visual problems, like strabismic amblyopia, are also at risk of crowding^{10,11} as well as of cerebral visual impairments, for example motion-defined form perception.¹² All these visual problems in both children with amblyopia¹³ and children with cerebral visual impairment are associated with anatomical and functional abnormalities of the brain's visual system.^{13,14}

If, indeed, abnormal crowding is more common in children with brain damage than in other children, a small addition to routine visual acuity assessment might improve the detection of children at risk of cerebral visual impairment. Instead of a single acuity test, two tests at the same test distance would have to be performed, namely a test with a single optotype and a test with multiple optotypes, after which the difference can be expressed as a ratio. Studies comparing grating acuity (Teller Acuity Cards) with optotype acuity (single and/or multiple optotypes) also indicate that larger differences between acuities are found in children with strabismic amblyopia¹¹ and children with brain damage¹⁵ than in normally developing children and children with ocular disorders.^{11,15}

Therefore, the first aim of this exploratory study was to assess whether the crowding ratio, estimated by the Cambridge Crowding Cards (optotypes), and the ratio between grating acuity and optotype acuity, differentiate better than visual acuity alone between children without any neurological and ocular abnormalities, children with ocular disorders only, and children with (indications of) brain damage.

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