5. Garne E, Dolk H, Krägeloh-Mann L, et al.. Cerebral palsy and congenital malformations. *Eur J Paed Neurol* 2008; **12:** 82–8.
6. Petterson B, Bourke J, Leonard H, Jacoby P, Bower C. Co-occurrence of birth defects and intellectual disability. *Paediatr Perinat Epidemiol* 2007; **21:** 65–75.
7. Schendel DE, Autry A, Wines R, Moore C. The co-occurrence of autism and birth defects: prevalence and risk in a population-based cohort. *Dev Med Child Neurol* 2009; **51:** 779–86.
8. Jelliffe-Pawlowski LL, Shaw GM, Nelson V, Harris JA. Risk of mental retardation among children born with birth defects. *Arch Pediatr Adolesc Med* 2003; **157:** 545–50.

Cerebral palsy: the central nervous system informs the visual system

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This commentary is on the original article by Fazzi et al. on pages 730–736 of this issue.

The effects of cerebral palsy (CP) are generally described in motor terms. A child with CP may have diplegia, tetraplegia, hemiplegia, or other motor movement difficulty, with significant clinical emphasis placed on physical rehabilitation and its attendant consequences. Fazzi et al.[1] report a systematic evaluation of the visual system categorized by subtype of cerebral palsy. Their findings that certain visual system abnormalities segregate with subtypes of CP is of considerable interest.

The article is also of interest because it methodically and quantitatively describes the impact of CP on the visual system. The results can only be described as alarming. So many children are visually impaired in every type of CP, albeit in different ways, that it is clear that the child with CP should perforce have a visual system evaluation as early as possible, with follow-up examinations also obligatory. We should remember that many children with CP cannot communicate effectively, so clinicians who overlook refractive errors, strabismus, eye movement problems, and the like are missing the opportunity to improve the quality of life of their young patients.

Fazzi et al. have raised many interesting questions that seem relevant to this population of children, but could indeed have ramifications for all children with visual pathway abnormalities. The first of these is the high rate of strabismus in their cohort. This has been noted previously in studies of children with CP,[2,3] but there now are new ways to look at strabismus, and this cohort and others like it may be ideal for future studies. Most of the time, the etiology of strabismus is unknown. A new theory that neurological tone modulation to extraocular muscles is at fault in some cases of strabismus could be tested in children such as those reported here.[4] New methods to determine muscle tone and modify it in extraocular muscles are needed, and could lead to advances in prevention of strabismus. Future research findings could have broad implications for all children with strabismus.

Also perplexing is the high rate of refractive errors. While this is more common in certain groups of children with CP, it remains more common than average in all groups. Enormous energy is expended on studying the etiology of refractive errors in children, with genetic influences inculpated, but also environmental factors blamed. Night lights, accommodation (near vision effort), and even exposure to the outdoors have had their run, but the etiology of refractive error in children remains elusive.[5] Is there anything different about children with CP that could cause such an increase in refractive error? Clearly there must be. Perhaps sedentary status, or even central nervous system factors could play a role. Research on the development of refractive error in children has missed out by not exploring this important population of children.

Fazzi et al. should be congratulated on their approach to the problem of visual disorders in CP. They have left us with many important questions, ones that could have ramifications for all children with visual system problems. The authors have also reminded us that visual problems are very common in children with CP and must not be overlooked.

REFERENCES

1. Fazzi E, Signorini SG, La Piana R, et al. Neuro-ophthalmological disorders in cerebral palsy: ophthalmological, oculomotor, and visual aspects. *Dev Med Child Neurol* 2012; **54:** 730–36. DOI: 10.1111/j.1469-8749.2012.04324.x.
2. Hiles DA, Wallar PH, McFarlane F. Current concepts in the management of strabismus in children with cerebral palsy. *Ann Ophthalmol* 1975; **7:** 789–98.
3. Lerner HA. Spastic and cerebral palsy squint problems. *Am Orthopt J* 1961; **11:** 72–5.
4. Campos EC. Why do the eyes cross? A review and discussion of the nature and origin of essential infantile esotropia, microstrabismus, accommodative esotropia, and acute comitant esotropia. *J AAPOS* 2008; **12:** 326–31.
5. Rose KA, Morgan IG, Ip J, et al. Outdoor activity reduces the prevalence of myopia in children. *Ophthalmology* 2008; **115:** 1279–85.