Early Detection vs Late Treatment of Amblyopia


Commentary by David G. Hunter, MD, PhD

AMBLYOPIA IS AN IMPORTANT PUBLIC HEALTH PROBLEM, causing unilateral vision loss in 2% to 4% of the population. As a result, amblyopia may be the leading cause of monocular vision loss in children and adults up to age 70 years.1,2 The loss of binocular depth perception in amblyopia leads to functional and occupational consequences. To further compound the cost to individuals and society, affected patients will suffer blindness and permanent disability if the unaffected eye loses vision from disease or trauma. The risk of such trauma, and the risk of developing bilateral blindness from any cause, is higher in patients with amblyopia.3,4

Amblyopic patients have poor vision in an eye that has no structural defect other than, perhaps, refractive error. Why does this occur? In a child’s developing brain, the competition between the 2 eyes for the attention of the visual cortex is fierce. Any perturbation in the visual experience of 1 eye allows the commandeering of binocular cortical cells by the unaffected eye. Amblyopia can thus be caused by a relatively mild asymmetry of refractive error (anisometropia), which causes deprivation, or by binocular misalignment of less than 1° (microstrabismus), which causes suppression as a defense against double vision. If conditions placing a child at risk are detected early in life, while the visual pathways are still developing, vision can be restored with treatment. Unfortunately, many of the conditions that cause amblyopia are not detected early, with nearly half of all amblyopic patients reaching school age with their condition undetected and un-
treated, leading to silent unilateral vision loss. Up to 800,000 (of the nearly 20 million preschool children in the United States) may have amblyopia in the present cohort; thus, today up to 400,000 preschool children with treatable amblyopia will lose vision simply because the condition will not be detected until they reach school age.

The failure to detect amblyopia in young children gives ophthalmologists far too much experience treating amblyopia in older children. Conventional teaching is that the likelihood of recovering useful vision diminishes with increasing age, so that many clinicians do not even offer treatment if children are diagnosed with amblyopia after age 8 years. But are ophthalmologists assuming too much, and possibly withholding a treatment that might in fact be beneficial? In the April issue of *Archives of Ophthalmology,* the Pediatric Eye Disease Investigator Group (PEDIG) published a randomized, controlled trial designed to investigate whether the commonly held clinical assumptions about amblyopic treatment in older children are valid.

Over the past 7 years, PEDIG has performed numerous multicenter randomized controlled trials to address questions about amblyopia and other conditions affecting children’s vision. The trials conducted by PEDIG differ from traditional multicenter clinical settings in that a national infrastructure of pediatric ophthalmologists and data managers was put in place long before the first patient was ever enrolled. A governing committee then selected and designed the studies, which used this preexisting infrastructure. These trials have enrolled patients rapidly, been completed at relatively low cost, and produced tremendously valuable information about amblyopia. The productive PEDIG concept should serve as a model for clinical trials in many specialties.

In the PEDIG study of amblyopia in older children aged 7 to 17 years, patients were randomized to either treatment or occlusion, and followed up to determine how many improved over 6 months of observation. This study of amblyopia was actually 2 studies, conducted with slightly different protocols: a younger group (aged 7-12 years) and an older group (aged 13-17 years). Visual acuity improved modestly (by 2 lines on the eye chart) in some cases, with the surprise finding that about 25% of the control patients, treated only with glasses, improved at all ages. Vision also improved with treatment in about half of the younger group and in about half of a subset of never-before-treated children in the older group. These results should be viewed in the context that responders improved 2 or more lines, technically a positive outcome, but disappointing when compared with the treatment response of younger patients, and of no demonstrated functional benefit.

The response might have been underestimated due to the study design. Treatment of severe amblyopia was minimal compared with the standard for treatment of younger patients. Due to the strict definition of response to treatment, 20% to 40% of patients were considered “nonresponders” by the halfway point of the study and not treated further. Compliance with treatment could not be measured, making this a study of treatment prescribed, not treatment dosage.

A casual reader of the article may be left with the impression that certain factors were investigated when there was no attempt to do so. For example, near tasks such as using handheld video games or homework were used to supplement treatment, but the study did not investigate whether such attention-demanding visual tasks provide additional benefit in treating amblyopia. A variety of treatments, including occlusive patching, blurring eye drops (pharmacologic penalization), and various combinations of the 2, were administered, but this study did not attempt to compare their effectiveness. The study measured the initial response to treatment, but PEDIG’s investigation has not yet assessed how frequently the treatment effect will regress, or whether adult amblyopic patients might also respond to treatment in a similar degree. The authors also did not report functional benefits such as improved stereopsis. Until questions can be answered about whether late treatment gives lasting and functional benefit, and whether treatment in late childhood is any better than treatment later in adulthood, this study should most certainly not be used as a rationale for changing the approach to treatment of older patients with amblyopia, nor should it be used as a reason to step back from efforts to identify very young children with amblyopia.

It is clear from this study that amblyopia treatment was more difficult to initiate and sustain in older children, and that the response to treatment was not as complete as with younger children. These results support the imperative that the medical community must work to increase awareness of the threat of amblyopia to vision and to improve the quality of vision screening in the very young.

At present, the best way to prevent vision loss from amblyopia may be to improve objective screening in preverbal children and to increase awareness of the condition. Illinois has launched an awareness campaign to educate the public—including both parents and primary care physicians—about amblyopia. Programs to mandate comprehensive eye examinations for school age children, such as an eye examination mandate now in force in Kentucky, are expensive and not sufficiently timely. In Massachusetts and Illinois, legislation to require vision screening before kindergarten, rather than comprehensive eye examinations, has passed due to the joint support of both ophthalmologists and optometrists. These initiatives are more appropriate than the approach used in Kentucky, but ultimately a highly accurate screening test for amblyopia is needed for use in mass screening of preverbal infants and toddlers rather than preschoolers. As technological approaches to objective vision screening are developed, as the sensitivity and specificity of vision screening increases, and as awareness of the
threat of amblyopia becomes universal, the hope is that amblyopia will be detected and treated in children during the toddler years. When early and effective detection strategies are finally developed, the need to consider the fine points of treating amblyopia in older children will be eliminated.


A human being is part of a whole, called by us the “Universe,” a part limited in time and space. He experiences himself, his thoughts and feelings, as something separated from the rest—a kind of optical delusion of his consciousness. This delusion is a kind of prison for us, restricting us to our personal desires and to affection for a few persons nearest us. Our task must be to free ourselves from this prison by widening our circles of compassion to embrace all living creatures and the whole of nature in its beauty.

—Albert Einstein (1879-1955)