



Amblyopia in the Twenty-First Century

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Keywords

- Amblyopia • Patching • Atropine • Pediatric ophthalmology • Levodopa
- Acupuncture • Binocular amblyopia treatment

Key points

- There have been many advances in amblyopia in the twenty-first century; studies and randomized controlled trials have greatly advanced our understanding of the pathophysiology, prevalence, appropriate screening regimens, and treatment of amblyopia.
- The treatment of amblyopia has consisted of deprivation of the healthy eye with various methods, including atropine and patching.
- There continue to be many unanswered questions regarding the pathophysiology of amblyopia, and this will continue to be an area of further investigation and study.

INTRODUCTION

The word *amblyopia* takes its root from the Greek root *amblyos*, which means dull, and *ops* meaning eye. In the early eighteenth century amblyopia was defined as impaired or dim vision without defects in the eye. The recognition of this entity dates back to as early as 480 BC when Hippocrates used amblyopia to describe diminished acuity in otherwise healthy eyes (at this time presbyopia also fell in this category) [1]. The understanding of amblyopia has advanced since that time with the help of animal studies and functional human neurologic imaging. We now understand this disease as a dysfunction of the processing of visual

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information. Amblyopia can be thought of as the result of other pathologic processes, including strabismus, anisometropia, or sensory deprivation during a period of critical visual development. It accounts for most of the cases of uncorrectable visual impairment in children and adults up to 60 years of age [2].

Studies and evidence-based data in the twenty-first century have significantly advanced the understanding of the prevalence, pathophysiology, and treatment of amblyopia. Amblyopia is a disease that the ophthalmologist and optometrist both need to be familiar with in order to properly diagnose and treat this entity.

This article highlights recent advances in the understanding of disease prevalence, burden of disease, and pathophysiology. There is also a discussion of recent studies and long-term data comparing treatment of patching versus atropine, use of levodopa, acupuncture, and binocular treatment of amblyopia. This article further discusses future avenues for study and progress within ophthalmology.

SIGNIFICANCE/IN-DEPTH ANALYSIS

Prevalence

Numerous studies have aimed to estimate the prevalence of amblyopia. It is the most common cause in children with monocular vision loss; however, depending on the study, population prevalence rates range anywhere from 1% to 5% [2]. For example, in a Tanzania population prevalence was estimated at 0.2% [3], whereas in a Dutch population, prevalence was estimated at 3.7% [4]. A large-scale population-based, cross-sectional survey using data from China, India, Chile, Malaysia, Nepal, and South Africa by Xiao and colleagues [5] in 2015 aimed to update our understanding of global prevalence rates of amblyopia. Of the 39,321 children enrolled in the study, 290 were found to be amblyopic (0.74%; 95% confidence interval [CI] 0.64–0.83). Of note, the rates of amblyopia were significantly lower in all ethnic groups when compared with the Chinese and Hispanic populations. The investigators point out that it is possible amblyopia rates were underestimated in this study as inclusion criteria required presence of amblyopia risk factors and visual acuity (VA) less than 20/40 in at least one eye. The inclusion criteria did not include the intraocular VA difference as a criterion. The important conclusions from this study are as follows: prevalence of amblyopia was lowest in the African children and up to 3 to 5 times higher in Chinese and Hispanic ethnicities; the prevalence did not increase with age (5–15 year olds were included); no sex-specific difference was found; bilateral amblyopia was uncommon (0.11%); and in at least half of the cases amblyopia was secondary to anisometropia. This study helps to further define the rates of amblyopia according to sex, age, cause, and ethnicity in the largest population-based study to date.

Mechanism of amblyopia

Studies characterizing the mechanism of amblyopia have historically ranged from psychophysical studies of humans with amblyopia to single-cell neurophysiology testing of animals who are made artificially amblyopic. Previous

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