



## Guidelines for the management of amblyopia in children

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### ABSTRACT

Amblyopia is the most common cause of decreased visual acuity in children. Among adults, it shows itself to be the major cause of unilateral visual impairment. Amblyopia compromises the quality of life and has an adverse impact on the range of available oc-

cupational opportunities. The Section of Pediatric Ophthalmology and Strabismus Treatment of the Polish Ophthalmological Society presents guidelines and recommendations on the basic principles of amblyopia management in children.

**KEY WORDS:** amblyopia, guidelines, pediatric ophthalmology.

Guidelines of scientific societies and associations (including the Polish Ophthalmological Society) do not constitute binding laws and do not determine the only correct procedures; they are only an opinion of a group of experts from a given field. The opinion reflects the current state of knowledge based on available scientific research results.

The guidelines do not exempt healthcare workers from personal liability with regard to making the correct decisions for individual patients. Personal responsibility for the used therapeutic methods rests with all individuals who practise medicine. It should be based on thorough knowledge and practical skills, while observing necessary safety measures with regard to oneself and the patient.

Readers of this paper are obliged to make themselves familiar with current information on the presented treatments and pharmacotherapies with special attention paid to manufacturers' information on doses, time, and administration as well as side effects of the used drugs.

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### DEFINITION

Amblyopia is defined as a unilateral or, less commonly, bilateral reduction in visual acuity despite using the best possible refractive correction, in which an organic cause cannot be detected. In many cases, amblyopia is reversible, if diagnosed early and treated appropriately.

Amblyopia is the most common cause of decreased visual acuity in children, affecting 3-6% of the pediatric population [1]. Among adults, it shows itself to be the major cause of unilateral visual impairment [2]. Amblyopia compromises the quality of life and has an adverse impact on the range of available occupational opportunities [3].

Several types of amblyopia are distinguished, depending on the causative (amblyogenic) factor, including anisometropic, deprivation (from lack of use), strabismic, ametropic, and occlusive amblyopia [4].

### DIAGNOSIS

Amblyopia is diagnosed by measuring visual acuity. The assessment of visual acuity in young children and its monitoring throughout the therapy should preferably be done with LEA, HOTV, Sloan or E-hooks eye charts [5].

A difference of 2 lines or more between the eyes – combined with the presence of factors conducive to the development of amblyopia (amblyogenic) – are a basis for the diagnosis [6].

Amblyogenic risk factors in children over 2 years of age:

- any media opacity > 1 mm in size,
- manifest strabismus > 8 Dpt,
- astigmatism > 1.5 Dsph,
- myopia > 1.5 Dsph,
- hyperopia > 3.5 Dsph,
- anisometropia > 1.5 Dsph.

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In children under 3 years of age, in whom the assessment of visual acuity is impossible, the mere presence of amblyogenic risk factors is enough to raise the suspicion and take measures to eliminate amblyopia.

The severity of amblyopia is classified according to the visual acuity in the affected eye as mild up to 0.6; moderate: 0.5-0.25; and severe: 0.2-0.05 [5].

## DIAGNOSTIC PROCEDURE

Patients with amblyopia should undergo a full ophthalmic examination extended to include an assessment of ocular motility, level of binocular vision, type of fixation, and accommodation capacity.

## MANAGEMENT

### Elimination of causes

In cases of deprivation amblyopia, the elimination of causes consists in the treatment of the underlying disease (cataract, droopy eyelid, etc.). The timing and method of treatment should be consistent with the guidelines applicable to a particular disease.

In cases of anisometropic amblyopia and ametropic amblyopia, the elimination of underlying causes consists in the correction of refractive error.

In children with strabismic amblyopia, the cause should be eliminated by normalizing the position of the eyeballs, so that at least a basic degree of binocular vision can be restored. This can be achieved by correcting the refractive error or by surgery. The timing of surgical treatment for strabismus in amblyopic children is at the discretion of the treating physician [7]. The basic principles in this area should be followed:

- In children with early-onset strabismus with a doubtful potential for binocular vision, an alternation of fixation should be sought prior to undertaking a surgical intervention.
- In cases of moderate to severe amblyopia, intensive efforts should be made to improve visual acuity prior to strabismus surgery.
- If the treatment of strabismic amblyopia fails (following the exclusion of other causes – see below), surgical restoration of orthotropia may be conducive to therapeutic progress and, in such situations, should not be delayed.

### Refractive error correction

The first step in the treatment of amblyopia is refractive error correction, after which the patient is followed up for 3-4 months [8]. Determining the refractive error in a child with suspected amblyopia definitely requires the use of cycloplegic agents regardless of the child's age. These include atropine at 1% in children over 6 years of age, 0.5% in children between 1.5 and 6 years of age, and 0.25% in children between 9 and 18 months of age; cyclopentolate at 1% in children from 1 year of age; and tropicamide at 1%. The agents listed above should be used in a manner that brings about complete cycloplegia, while taking into account the patient's age.

Principles of refractive error correction in amblyopia [9].

### *Children with strabismus*

1. For hyperopia, full refractive error correction to the value obtained after cycloplegia.

2. For myopia, full refractive error correction to the value obtained after cycloplegia or lower, but ensuring full distance visual acuity.

3. For with-the-rule astigmatism, full correction is recommended, but undercorrection of 0.5 Dcyl is acceptable; otherwise full correction to the value obtained after cycloplegia.

4. For anisometropia, full refractive error correction to the value obtained after cycloplegia. Spectacle power in the eye with higher refractive error should not be reduced, regardless of the magnitude of anisometropia. Where high differences (over 4.0 Dsph) are found, a contact lens is recommended.

### *Children without strabismus*

1. For hyperopia, refractive error correction to the value obtained after cycloplegia, with a slight undercorrection of up to 1.0 Dsph.

2. For myopia, full refractive error correction to the value obtained after cycloplegia or lower, but ensuring full distance visual acuity.

3. For with-the-rule astigmatism, full correction is recommended, but undercorrection of 0.5 Dcyl is acceptable; otherwise full correction to the value obtained after cycloplegia.

4. For anisometropia, full refractive error correction to the value obtained after cycloplegia, regardless of the magnitude of anisometropia, with a slight undercorrection of up to 1.0 Dsph. Undercorrection should be symmetrical to keep the difference in correction in line with the level of anisometropia. Spectacle power in the eye with a higher refractive error should not be reduced. Where high differences (over 4.0 Dsph) are found, a contact lens is recommended.

### Penalization treatment

If spectacle correction used as the only treatment fails to bring about an improvement, after a follow-up period of 3-4 months, treatment based on applying penalization methods to the individual's better-sighted eye is initiated. Before proceeding with treatment, the measurement of refractive error should be repeated after cycloplegia to rule out undercorrection as the cause of therapeutic failure.

### *Patching with an adhesive eye patch*

The patching regimen depends on the type of amblyopia and is selected at the discretion of the ophthalmologist or orthoptist. The basic principles in this area should be followed [10-13]:

1. The recommended patching time is 2, 4 or 6 hours a day, depending on the depth of amblyopia (mild, moderate, severe). The duration of patching should be adequately reduced if visual acuity improves.

2. Eye patching for the entire duration of the child's activity is acceptable but reserved for selected cases (see below).

3. There is no evidence that the type of child's activity during patching therapy affects the degree and rate of improvement in visual acuity.

4. It has been proven that with appropriate spectacle correction, the occurrence of reverse amblyopia (i.e. decreased visual acuity in the patched eye) is extremely unlikely. However, if it occurs, refraction should be reverified after cycloplegia, and patching time should be reduced for a certain time or patching therapy should be withdrawn altogether. Patching therapy should be resumed after full visual acuity in the healthy eye has been restored.

#### *Atropinization*

Atropinization should only be used in children over 3 years of age in whom, for various reasons, eye patching cannot be used. The efficacy of atropinization depends on the depth of amblyopia: more severe amblyopia correlates with poorer treatment outcomes.

1. Atropine administered into the conjunctival sac can be used for visual penalization. The efficacy of atropinization is comparable to patching in cases of mild to moderate amblyopia [14].

2. Atropine concentration should be adjusted to the child's age (see above).

3. The atropine treatment regimen is prescribed by the ophthalmologist. Generally, for mild and moderate amblyopia, a weekend atropine regimen is applied, with a single drop administered to the better sighted eye on Saturday and Sunday.

Penalization treatment outcomes are determined by evaluating visual acuity under the same conditions and using the same type of charts as previously. Follow-up examinations should be performed by the child's physician or orthoptist at a frequency matched to the child's age (younger children require more frequent follow-up visits).

At present, there is no scientific evidence to recommend any other treatment modality for amblyopia than those listed. Pleoptic exercises, vision therapy, or antisuppressive therapy using digital techniques or virtual reality are beyond the scope of evidence-based medicine.

#### **Further management**

If gradual improvement is seen, penalization treatment should be continued until full visual acuity is achieved in the amblyopic eye. At the time of reaching the so-called plateau (2 follow-up measurements yielding the same visual acuity results), the determined visual acuity should be considered as the target value.

Continuing patching therapy when visual acuity does not improve should be regarded as medically futile treatment and is thus not recommended. Treatment discontinuation must not be done abruptly but gradually, over a period of 2-3 months or longer [15]. If a child experiences a recurrence of amblyopia, full-time patching should be resumed with the next discontinuation period extended. Special consideration should be given to the possibility of amblyopia recur-

rence in older children with a baseline diagnosis of severe amblyopia.

If treatment is unsuccessful or the improvement is slow and inadequate to the intensity of patching, the following steps should be taken:

1. Refraction must be reverified after cycloplegia and the patient's refractive error must be corrected completely, making sure that the spectacles are properly made.
2. Repeat the physical examination of the anterior and posterior ocular segments to look for organic causes.
3. Evaluate relative afferent pupillary defect and perform electrophysiological assessment of visual pathway function.
4. Examine the central region of the retina by OCT.
5. Assess fixation and determine whether the child has monofixation syndrome.
6. Make sure the patient's parents comply with the prescribed plan of care.

#### **Special cases**

##### *Deprivation amblyopia*

Amblyopia due to the presence of organic obstacles to vision poses a therapeutic challenge for pediatric ophthalmologists. There is currently no scientific evidence to provide precise guidance in this scope. Optical correction of aphakia taking into account postoperative lack of accommodation is the cornerstone of treatment. Further therapeutic decisions are taken at the discretion of the child's physician based on the available scientific data [16, 17].

##### *Occlusive amblyopia*

This type of amblyopia develops as a result of temporary occlusion of the pupil of one eye or a temporary vision impairment, either for iatrogenic causes or in association with other diseases. If the abnormality does not involve the critical period (initial 4 months of life) and persists for a relatively short time, it may not require treatment.

##### *Nystagmus*

In patients with amblyopia and nystagmus, in view of the adverse effect of occlusion treatment on visual acuity, Bangerter foils or atropinization are recommended [18].

##### *Eccentric fixation*

Patients with eccentric fixation often fail to respond to treatment, and patching therapy produces no effect. In this group, the so-called reverse patching can be used. The amblyopic eye is patched for the entire period of the child's activity for 7 days, after which the regular patching regimen is resumed. This is an attempt to normalize fixation [19].

##### *Ametropia*

Patients with bilateral ametropic amblyopia should be treated with full correction of the refractive error. There is no convincing evidence that alternate occlusion therapy is effective in restoring full visual acuity in these children.

### Children over 9 years of age

Treatment according to the principles outlined in these guidelines can be attempted also in patients diagnosed with amblyopia after the period of susceptibility of the visual cortex. There is evidence that such treatment is effective even in

12-year-old children [20]. This does not apply to older children previously treated unsuccessfully for amblyopia.

### DISCLOSURE

The authors declare no conflict of interest.

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