Strabismic Amblyopia: When to Treat the Amblyopia, When to Operate

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ABSTRACT

Introduction: Strabismic amblyopia is frequently encountered by pediatric ophthalmologists and orthoptists. An understanding of its onset and of the timing of treatment may lead to better long-term treatment results.

Methods: A review was conducted of past and recent literature pertaining to strabismic amblyopia. Articles relevant to further understanding the onset, course, and management of strabismic amblyopia were included.

Results: The timing of suggested surgical alignment and amblyopia treatment in the literature has shifted. In contrast to recommendations of the past, it is now more accepted to perform strabismus surgery as soon as possible, in conjunction with continuous amblyopia therapy. Both patients with moderate amblyopia associated with infantile esotropia and those with partially accommodative esotropia may benefit from a longer duration of amblyopia therapy preoperatively.

Conclusions: Patients with strabismic amblyopia need to be followed closely pre- and postoperatively. Recent research has suggested that for most patients with strabismic amblyopia, therapy should begin at once, followed closely by surgery, and continued amblyopia therapy postoperatively if needed. Though parents may feel more relaxed about their child’s condition, good education by the orthoptist and pediatric ophthalmologist should help to encourage the parents to continue to work toward their child’s best visual outcome.

INTRODUCTION

Orthoptists and pediatric ophthalmologists encounter strabismus on a daily basis. Amblyopia will develop if the child has a preference for one eye. In younger children, the amblyopia can develop and become dense quickly. This underlines the
importance of recognizing and promptly treating strabismic amblyopia.

Amblyopia has been described as “abnormal binocular interaction and foveal pattern vision deprivation or a combination of both factors.” Much of the initial research conducted regarding amblyopia replicated form deprivation amblyopia and showed that absence of vision within critical periods of development led to markedly decreased visual development. Recent research into the anatomical changes that occur in amblyopic patients indicate that there is a difference in the mechanism of vision loss when the patient has amblyopia associated with strabismus and anisometropia. Research comparing anisometropic and strabismic amblyopia has found that there are differences between these entities. There is some evidence that strabismic amblyopia is taxonomically different than anisometropic amblyopia. Of note, “the better eye in strabismic amblyopia is not in fact a ‘normal’ eye. It has small defects in visual acuity, small amounts of fixational eccentricity, unsteady fixation, and small deficits in tracking . . . greater neural ‘noise’ than normal eyes . . . increased VEP latency even in the presence of normal visual acuity (following treatment), subnormal scotopic sensitivity, and dark adaptation, and more hyperopia, thicker lenses and shallower anterior chambers than normal eyes.” Following will be a consideration of the onset of strabismus, type of strabismus, and the timing of treatment in patients with strabismic amblyopia, both of the surgical alignment and the amblyopia therapy.

ONSET OF STRABISMIC AMBLYOPIA

The onset and severity of strabismic amblyopia varies depending on the type of strabismus and the age of onset. In newborn infants, the eyes are not immediately used together. Conversely, there is some degree of semi-independence of the two eyes. The “normal” child develops fusion and stereopsis levels of binocular cooperation. Binocular rivalry is crucial to the development of stereopsis, in which slightly disparate images seen by each eye are fused. When these images cannot be fused, the individual perceives diplopia. In order to avoid this uncomfortable situation, one eye may be suppressed, thus eliminating binocular rivalry. This suppression may be alternating, by which the patient will use each eye at different times, or it may be monocular, which may lead to unilateral amblyopia. Strabismic amblyopia has been found to be caused by active inhibition within the retinocortical pathways of visual input originating in the fovea of the deviating eye. This inhibition is elicited by overlap of the different foveal images transmitted to the visual centers.

Patients with exotropia frequently are able to alternate fixation, which greatly minimizes their risk of developing amblyopia. The fovea of their deviated eye competes with the relatively weaker contralateral nasal hemifield. It has been reported that patients with intermittent exotropia rarely have associated amblyopia. Romanchuk and colleagues found that when amblyopia was present in their study of 109 exotropic patients, it was found to cause only a moderate decrease in vision, with vision of 20/25 in 30.2%, 20/30 in 13.8%, and 20/40 in 1.8% of patients.

In patients with constant exotropic deviations in which surgical intervention is indicated there is a risk of overcorrection. If this occurs, the patient may face the increased risk of developing amblyopia that is associated with esotropia. This higher prevalence of amblyopia associated with esotropia “may be related to the nasotemporal asymmetry of the retinocortical projections.” In esotropia, the fovea of the deviating eye has to compete with the strong temporal hemifield of the fellow eye.
WHEN TO TREAT STRABISMIC AMBLYOPIA

In patients with infantile esotropia and no amblyopia, surgical correction increases the risk of developing amblyopia, but is generally seen to be outweighed by the chance of obtaining some degree of binocular vision. Research has shown that early surgical alignment is associated with better stereopsis in those patients with infantile esotropia treated in the first 24 months of life, because early surgery minimizes the duration of misalignment. However, in patients in which the strabismus is accompanied by amblyopia preoperatively, caregivers must decide whether to treat the strabismus or amblyopia first. Treating the strabismus first will decrease the length of misalignment and possibly increase the chance of some degree of binocularity. Treating the amblyopia first will potentially give the patient better vision in each eye, which may aid the stability of the postsurgical alignment. There is some difference in opinion in regards to preoperative treatment of strabismic amblyopia, and most physicians will continue to follow the plans they have devised from years of clinical practice.

Historically, it has been taught that when amblyopia is present, it should be treated prior to surgery for esotropia, so as to avoid interfering with the surgical outcome. It had been found that persistent amblyopia, along with latent-manifest nystagmus at the time of surgery, was associated with less satisfactory outcomes, causing the recommendation to be made to perform surgery only after the amblyopia was thoroughly treated.

Some feel that presurgical amblyopia treatment unnecessarily extends the duration of abnormal binocularity due to the strabismic misalignment, which is known to degrade the prognosis for postoperative binocularity. Some have found that performing strabismus surgery on children with esotropia prior to complete correction of their amblyopia is safe and efficient, if the therapy is continued postoperatively.

A study by Dadeya and Kamlesh comparing the motor and sensory success in patients after surgery for all esotropic deviations found that there was overall no difference between the group whose amblyopia was fully treated preoperatively and those in which it was not. However, one sub-group of patients stood out when the authors considered the preoperative esotropia. Patients with infantile esotropia who had moderate amblyopia—defined as unmaintained fixation or 3–5 lines difference in visual acuity—tended to have poorer surgical outcomes. The authors suggested that these patients may benefit from having their amblyopia treated prior to surgery. They found that the presence of mild amblyopia did not adversely affect surgical outcome in infantile esotropia, as did Weakley and Holland, who recommend immediate commencement of amblyopia therapy, surgery, and continuation of amblyopia therapy after surgical alignment. If this is not done, persistent amblyopia postoperatively will lead to poorer outcome and lack of binocular function.

Birch and colleagues found that delay in alignment and stereopsis of infantile esotropic patients may allow for compromised binocular sensory status that allows accommodative esotropia to develop at low to moderate levels of hypermetropia. Spontaneous postoperative improvement of amblyopia has been seen simply with ocular alignment. Lam and colleagues suggest that surgery may be therapeutic in itself. All of these findings support the suggestion to perform surgery early.

Most authors agree that in the case of acquired esotropia, surgery may be done at the soonest available time. Studies have shown that the presence of mild or moderate amblyopia did not appear to have an influence on surgical outcome for these patients. However, Koc and colleagues sug-
gested that in cases of high hypermetropic partially accommodative esotropia, it is more beneficial to treat the amblyopia first and proceed to surgery if still needed afterward. In some of their patients, there was a decrease in the nonaccommodative angle such that they no longer required surgery. Koc et al. performed surgery on 38% of their patients, versus the pretreatment anticipated 81%.12

One concern associated with postoperative amblyopia therapy is the partial disruption of binocularity and its affect on alignment. While amblyopic patients with no deviation may develop strabismus during patching or penalization, Repka and colleagues found that amblyopia therapy is infrequently associated with the development of significant strabismus.13 They note that further research would need to be done in this area in order to determine the best timing of amblyopia therapy associated with strabismus surgery in relation to this question. However, it would be beneficial to warn parents that they may see an increase or instability of the postoperative alignment associated with patching or penalization.

One drawback to rapid surgical alignment is the false security it gives parents that their child’s eyes are “fixed”. This may lead them to be more relaxed in returning to clinic or complying with patching or penalization regimens. A study by Dixon-Woods and colleagues found that parents feel strain in their relationship with their child associated with patching and will modify or abandon patching if they feel it is not helping.14 Parents may be more likely to discontinue patching if their child’s eyes look good and they do not feel that what they are doing will make a difference in their child’s outcome.

MAINTENANCE

Postoperatively, and after amblyopia therapy, maintenance of visual acuity in the amblyopic eye is of concern. One study found that when amblyopia therapy was discontinued, the only risk factor identified as statistically significant was the presence of mixed (strabismic and anisometropic) amblyopia.15 There was no statistical significance for patients with anisometropic or strabismic amblyopia alone.15

In a compilation by Flynn and colleagues of amblyopia studies done from 1965 to 1997, 617 patients out of 857 had strabismic amblyopia and 98 patients had mixed (anisometropic/strabismic) amblyopia. Successful amblyopia therapy was found in 77.6% of strabismic, 66.7% of anisometropic, and 58.7% of strabismic-anisometropic patients.16 This review found that, overall, 52.8% of patients who achieved success by occlusion retained their vision after therapy was discontinued. The authors note that some visual development that occurs simply with age may also play a role.16

CONCLUSION

Patients with strabismic amblyopia need to be followed closely pre- and postoperatively. Amblyopia is most frequently seen in patients with esotropic deviations. Recent research has suggested that for most patients with strabismic amblyopia, therapy should begin at once, followed closely by surgery and continued amblyopia therapy postoperatively if needed. Exceptions may be made for patients with infantile esotropia with moderate amblyopia, in which the patient may benefit from some improvement of their vision prior to surgery. Patients with partially accommodative esotropia may also benefit from extended preoperative amblyopia therapy, which may help them better control their deviation and eliminate the need for surgical correction. Though parents may feel more relaxed about their child’s condition, good education by the orthoptist and pediatric ophthalmologist should help to encourage
the parents to continue to work toward their child’s best visual outcome.

REFERENCES


Key words: strabismus, amblyopia, treatment