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Management of Exotropia Associated with Hyperopia in Children

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Abstract

Introduction: exotropia is a deviation outside the visual axes. In children, an association with ametropia is often observed, however, that with hyperopia is rare. The objective of this study was to highlight the particularities of the management of exotropia associated with hyperopia in children. **Subjects and Methods:** this was a retrospective study over 78 months including all children aged 0 to 15 years, treated for exotropia associated with hyperopia. **Results:** we found 20 cases of exotropia with hyperopia, or 57.15% of exotropia. The mean age was 4.3 years and the sex ratio was 0.82. Hyperopia was mild in 30 eyes (75%), moderate in 9 eyes (22.5%) and high in 2.5% of eyes. Over a one-year follow-up, 10 children (50%) had regular follow-up, including 6 with full hyperopic correction and 4 with partial hyperopic correction. After full hyperopic correction, one child had a resolution of his exotropia; 2 had a decrease in the angle of deviation and 3 had no improvement of their exotropia. Among the 4 with partial hyperopic correction children, 2 had a resolution of their exotropia. Strabismus surgery was planned in 3 children after iso-acuity. **Conclusion:** the association of exotropia and hyperopia poses a management problem. The total correction or not of hyperopia is discussed according to several authors.

Keywords

Exotropia, Hyperopia, Spectacle Correction

1. Introduction

Exotropia or divergent strabismus are ophthalmological syndromes characterized

by a deviation of the ocular axes in relation to each other and by sensory alterations [1]. They may be constant or intermittent. Some authors have demonstrated an association between hyperopia and strabismus [2]-[4]. However, the association between exotropia and hyperopia is rarely reported in the literature and raises the problem of optical correction of hyperopia. A study carried out in Cameroon reported that cases of exotropia were associated with hyperopia in 59% of cases [5].

Treatment must be quick and appropriate because of the risk of amblyopia. The aim is to prevent or cure amblyopia, straighten the deviation and restore good binocular vision. The methods used may be optical, orthoptic or surgical. The correction of hyperopia when associated with exotropia is a contentious issue.

The purpose of this study was to highlight the particularities of managing exotropia associated with hyperopia in children.

2. Subjects and Methods

This was a retrospective study covering a 78-month period from 1 January 2015 to 30 June 2021. The inclusion criteria were medical records of children aged 0 to 15 years treated for exotropia associated with hyperopia. The medical records of children treated for exophoria or the association of exotropia with myopia were not included. The exclusion criteria were records of children who underwent previous strabismus surgery.

All patients had completed ophthalmologic evaluation. Visual acuity was measured using fixation preference in preverbal children or by age-appropriate recognition optotypes, such as LEA test, Snellen letters, or Monnoyer test. Deviation was measured using the Hirschberg method in near vision with and without correction. Refraction was done after cycloplegia either with atropine (1 drop morning and evening for 7 days) or cyclopentolate (1 drop at T0, T5 and T10 min). A retinoscope and/or an automatic refractometer were used after one week for atropine and at T45 min for cyclopentolate.

We also analyzed treatment and results after optical correction.

We considered patients followed up regularly with a follow-up at 3, 6 and 12 months, and patients lost to follow-up.

Patients followed up regularly were divided into two groups: children in group I with full hyperopic correction and those in group II with partial hyperopic correction.

Resolution of exotropia was defined as orthotropia with or without an exophoria. Improvement was defined as a minimum 5Δ decrease in exotropia or an improvement in the control of intermittent exotropia. Conversely, worsening of exotropia was defined as an increase of 5Δ or more.

Data analysis was performed using Excel software.

3. Results

A total of 20 patients met inclusion criteria, representing 57.14% of exotropie

cases. The sex ratio was 0.82 (9 males and 11 females). The average age of the population studied was 4.3 years, with extremes of 8 months and 9 years.

Parental consanguinity was found in 25% of cases, familial strabismus in 5% and caesarean section in 20%. Abnormalities of the central nervous system (hydrocephalus, meningitis and delayed psychomotor development) were observed in 15% of cases.

Uncorrected distance visual acuity in 14 eyes averaged 0.56 Log MAR. We noted amblyopia in 2 patients, one moderate and one severe.

Exotropia was alternating in all cases. The average deviation was 36.9Δ of exotropia (range, 13Δ and 50Δ) for 14 patients in near vision.

Exotropia was congenital in 50% of cases, late in 10%, sensory in 5% and intermittent in 10%.

Cycloplegic refraction revealed mild hyperopia (<3 D) in 75% of eyes, moderate hyperopia (between 3 and 6 D) in 22.5% of eyes and high hyperopia (>6 D) in one eye (**Table 1**).

Hyperopia was associated with astigmatism in 36 eyes (90%). This astigmatism was <0.75 D in 52.8% of eyes, between 0.75 and 2.50 D in 38.9% of eyes and >2.50 D in 8.3% of eyes.

Full optical correction for hyperopia was prescribed after cycloplegia in 85% (n = 16) of patients and partial hyperopic correction in 15% (n = 4) of patients.

One child received orthoptic rehabilitation in addition to full optical correction.

After one year, 50% of patients were lost to follow-up, while 10 patients (50%) had regular follow-up. Of these, 6 received their full cycloplegic correction (group I) and 4 received partial correction (group II).

In group I, one patient (16.7%) had orthotropia, 2 (33.3%) had improvement and one (16.7%) had no improvement of their exotropia (**Table 2**). The average deviation was 40Δ before and 26.5Δ after full hyperopic correction.

Of the patients who received partial hyperopic correction (group II), 2 (50%) had resolution of deviation, and one (25%) had worsening of his deviation (**Table 3**). The average deviation was 21.3Δ before and 10Δ after partial hyperopic correction.

In total, after constant wearing of the optical correction (n = 10), 3 patients (30%) had resolution in the exotropia (**Table 4**). The average deviation (n = 7) was 32Δ before and 18.7Δ and after optical correction.

During follow-up, 3 patients required surgery after obtaining iso-acuity and one child had amblyopia secondary to sensory exotropia. Monitoring without optical correction was recommended for 3 children.

4. Discussion

In our series, exotropia with hyperopia accounted for 57.14% of exotropia. This is in line with the results of Mvogo, who noted this association in almost 59% of his patients [5]. According to Mvogo, exotropia is more frequent in black people [5]. This assertion is debatable since in Chew's study, a similar prevalence of exotropia

Table 1. Distribution of hyperopia.

Hyperopia	OD (n)	OG (n)	n (%)
Mild	15	15	30 (75)
Moderate	5	4	9 (22.5)
High	0	1	1 (2.5)
			40 (100)

Table 2. Characteristics of children in Group I.

Child	Type of exotropia	Hyperopia	Deviation before full hyperopic correction	Deviation after full hyperopic correction
1	Congenital exotropia	Moderate	50Δ	35Δ
2	Congenital exotropia	Mild	30Δ	21Δ
3	Congenital exotropia	Moderate	50Δ	50Δ
4	Unspecefied	Mild	30Δ	Orthotropia
5	Sensory exotropia	Moderate	Unspecefied	Unspecefied
6	Congenital exotropia	Moderate	Unspecefied	Unspecefied

Table 3. Characteristics of children in Group II.

Child	Type of exotropia	Hyperopia	Deviation before partial hyperopic correction	Deviation after partial hyperopic correction
1	Intermittent exotropia	Mild	20Δ	Orthotropia
2	Intermittent exotropia	Mild	21Δ	30Δ
3	Late exotropia	Mild	30Δ	Orthotropia
4	Congenital exotropia	Mild	Unspecefied	Unspecefied

Table 4. Patient outcomes with exotropia and hyperopia.

Traitement	n (%)	Resolution	Improvement	No change	Worse	Unspecified
Full hyperopic correction	6 (60)	1 (16.7)	2 (33.3)	1 (16.7)	0 (0)	2 (33.3)
Partial hyperopic correction	4 (40)	2 (50)	0 (0)	0 (0)	1 (25)	1 (25)
Observation only	3 (30)	1		1	1	

was found in black and white patients [6].

We noted a predominance of females which, according to Nusz, could be explained by X-linked dominant inheritance in exotropias [7].

We also noted a low incidence of amblyopia in our population (10%). Other authors report higher rates [5] [8]. This difference could be explained by the alternating aspect of exotropia in our patients.

In our study, the majority of patients (75%) had mild hyperopia. This is in line with the results of Tinley [9]. Cotter [10] and Zhu [11] obtained higher results with 90.6% and 95.3% respectively. We found moderate hyperopia in 22.5% of cases. Zhu's study showed that mild and moderate hyperopia were associated with a high risk of exotropia [11]. This was not the case in Cotter's series [10]. Indeed, several authors have reported a correlation between hyperopia and esotropia [12]-[14], but a reduction in accommodative convergence in high hyperopia increases the risk of exotropia.

It should also be noted that hyperopia was associated with astigmatism in 90% of cases. Recent studies have shown that astigmatism is a risk factor in exotropia. Zhu [11] found in his study that astigmatism between 0.50 and 1.00 D is a risk factor for exotropia, whereas Cotter [10] found that astigmatism must be higher than 2.50 D to be a risk. In our series, astigmatism was 0.75 D in 52.8% of patients and higher than 2.5 D in 8.3%, thus justifying its role in the appearance of exotropia.

All patients underwent optical correction. According to Bui-Quoc and Espinasse-Berrod, optical correction of ametropia in strabismus allows a clear retinal image to be obtained, which is essential for fusion [15]. Full optical correction was achieved in 85% of patients and under-correction in 15%. In exotropia with hypermetropia, whether or not to correct refractive errors completely is debated. Some authors maintain that in the case of strabismus, any refractive anomaly should be corrected in its entirety, whatever the type of strabismus [16].

After one year, 50% of patients had regular follow-up, including 6 patients with full optical correction (group I) and 4 with partial hyperopic correction (group II).

Of the patients who had full optical correction, 16.7% had orthotropia, 33.3% had improvement in the exotropia and one (16.7%) had no improvement of their exotropia. Our results are similar to those of Kassem [8]. In his study of exotropia with high hyperopia, out of 15 patients with full optical correction, 67% had satisfactory results (orthotropia or a decrease in angle) and 13% had no change deviation. In Iacobucci's series of 7 patients treated for exotropia associated with hypermetropia, full optical correction gave good results in all his patients [17]. In fact, accommodative power in higher hyperopia is low, resulting in a blurred retinal image. Correcting this ametropia therefore makes it possible to correct the deviation. The average deviation was 40Δ before and 26.5Δ after full optical correction in our study. Kassem had an angle of deviation of 26Δ before and 13.5Δ after full optical correction [8].

After partial hyperopic correction, 2 patients (50%) had orthotropia and one (25%) had a worsening of his deviation. In Iacobucci's study, out of 3 children with partial correction, 2 had an unchanged deviation [17]. In Kassem's series, out of 8 patients with partial correction, 3 (38%) had a good result and 5 (63%) had a stationary or worsening deviation [8]. It should be noted that in our series, the patients in group II had mild hyperopia, whereas in the other two studies, the

hyperopia was moderate or high.

One patient had a worsening of his deviation after under-correction of mild hyperopia. This has also been noted by authors when correcting hyperopia on exotropia [8] [18]. For this reason, observation only without correction may have been sufficient for our patient.

Our results show that partial correction of mild hyperopia allows control of the deviation. In fact, partial hyperopic correction makes it possible to maintain the accommodative vergence necessary to control exotropia. Full optical correction of hyperopia in exotropia would be more beneficial in the case of mild hyperopia. There are some limitations in our study such as: small sample size and lost to follow-up. In our study, 50% of the children were lost to follow-up. This could be explained by the lack of means for parents to buy glasses, the existence of certain beliefs in Africa about wearing glasses or strabismus, the absence of improvement or even a good evolution of strabismus or a good evolution of the strabismus.

5. Conclusion

In our study, exotropia associated with hyperopia was the most common exotropia. The majority of children had mild hyperopia. Partial optical correction seems to give better results in mild and moderate hyperopia, whereas full optical correction is more indicated in higher hyperopia or in cases of amblyopia.

Conflicts of Interest

The authors declare that they have no links of interest.

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