

Binocularity following surgery for secondary esotropia in childhood

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Abstract

Binocularity was assessed in children who developed large, constant esotropia following bilateral lateral rectus recessions for intermittent exotropia. Nine such patients were identified who warranted medial rectus recession. Seven were finally aligned within 6 prism dioptres after secondary surgery. Stereopsis measured 50 seconds or better in six of these patients and 200 seconds of arc in the seventh. Two patients had residual deviations: one child with 30 prism dioptres of residual esotropia had 400 arc seconds and the remaining patient, with 12 prism dioptres of exotropia and marked anisometropia, did not show stereopsis. Children with constant acquired esotropia for as long as two years may still have normal stereopsis after surgical alignment. The risk of losing binocularity because of a large overcorrection following exotropia surgery may be smaller than previously assumed.

Most authors agree that children with strabismus, especially if it is constant, are at risk of losing binocularity.¹⁻⁴ Many believe that, because intermittent exotropia often increases in frequency during childhood, affected patients should be operated on early to counter this threat to binocular function.^{2,5-7} Similarly, most authors consider treatment of children with acquired esotropia to be urgently indicated.³ Esotropia acquired from surgical overcorrection of exotropia is often termed secondary or consecutive esotropia.

It is uncertain how long a constant deviation can be tolerated in childhood without loss of binocular potential. We observed that some patients following secondary surgery have normal binocularity despite prolonged periods of constant consecutive esotropia. In order to determine what binocularity can be expected in patients with this history, we reviewed our

patients who required esotropia surgery following repair of childhood exotropia.

Patients and methods

The records of all patients aged 6 months to 7 years who underwent recessions of both lateral recti (by JWS or LBN) for exotropia were reviewed. Nine were identified who developed constant secondary esotropia large enough to warrant medial rectus recessions. Patients with small postoperative deviations were not a subject of this study. All patients had 20 or more prism dioptres of esotropia.

The age and ophthalmic alignment of all nine patients prior to both operations were noted. Also tabulated were the amount of lateral rectus and medial rectus recessions, the final alignment, and the duration of follow-up.

Sensory data included: visual acuity with most recent refraction, Worth-4 dot test results at 1/3 m and 6 m, and stereoacuity by Titmus or Randot testing. Stereopsis was assessed in standard room illumination at a distance of 14 inches (36 cm). Stereoacuity was defined by the level of the first error which could be confirmed on retesting. Any adjunctive treatment, such as occlusion therapy for amblyopia, optical or prismatic correction, and orthoptic exercises, was also noted.

Results

As shown in Table I, the nine identified patients underwent lateral rectus recession at 22 to 84 months of age (mean 43, SD 19 months). Preoperatively, exotropia was intermittent in all cases, ranging at distance from 25 to 60 prism dioptres (mean 34, SD 11 prism dioptres). Generally, the deviations were initially better controlled at near. In all cases the parents stated that progression of frequency or duration occurred gradually. In this retrospective study, assessment of binocularity was available prior to exotropia surgery in only the first patient. This child preoperatively had Worth-4 fusion at distance and near with 100 arc seconds stereopsis.

Postoperatively, esotropia ranged from 20 to 70 prism dioptres (mean 34, SD 16 prism dioptres) and was constant in all of the patients. Hyperopic correction was prescribed where appropriate (Table II) but was inadequate to control the esotropia in any case. Prisms were likewise ineffective in patient 1. In general, most notably in patients 3 and 4, gradual increase in the esodeviation was observed prior to secondary surgery. Medial rectus recessions were performed when, after discussion of surgical risks and benefits, parents elected to proceed. The patients ranged in age at second surgery from 38

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TABLE I Motor and surgical data

Case	Age BLR recess (mo)	Preop. X(T)*	Amt BLR recess (mm)	Age MR recess (mo)	Preop. ET	Amt MR recess (mm)†	Postop. F/U (mo)	Final align
1	57	25	5.0	61	30	4.5	94	LX(T) 6
2	28	30	6.5	38	20	3.0	62	Ortho
3	38	35	7.0	70	40	5.0	14	Ortho
4	22	60	10.0	42	70	6.5	25	RXT 12
5	32	40	7.5	60	50	5.5	39	LET 30
6	42	30	6.0	78	25	6.0	12	Ortho
7	84	25	6.0	90	25	4.0	12	Ortho
8	54	30	7.0	66	30	4.5	24	X 6
9	30	35	7.0	72	20	5.5	6	Ortho

BLR recess=bilateral lateral rectus recession. Preop X(T)=preoperative intermittent exotropia. Amt=amount. MR recess=medial rectus recession. Postop. F/U=postoperative follow-up. Align=alignment. XT=exotropia. ET=esotropia. X=exophoria. *Alignment given in prism dioptres of distance deviation with correction; †All medial rectus recessions were bilateral except cases 6 and 9, which were unilateral.

TABLE II *Sensory and refractive data*

Case	Refraction	Acuity	Amblyopia	Patch	Glasses	Stereo*	W4†
1	OD -0.25 OS -0.50+0.50×85	20/20 20/20	No	No	Yes	30	Fuse
2	OD -3.00 OS -3.00	20/20 20/20	No	No	Yes	25	Fuse
3	OD +1.00+0.75×65 OS +1.75+0.50×90	20/20 20/20	No	No	Yes	50	Fuse
4	OD -6.75+1.50×90 OS -0.25+1.75×60	20/30 20/20	OD	Yes	Yes	None	Diplopia
5	OD +0.75+0.50×5 OS +1.00	20/20 20/25	OS	Yes	No	400	Suppress OS
6	OD +2.00 OS +2.00	20/20 20/20	No	No	No	50	Fuse
7	OD +0.50 OS +0.50	20/20 20/20	No	No	No	40	Fuse
8	OD +1.00+0.25×90 OS +1.00+0.25×90	20/25 20/25	No	No	No	200	Fuse near, suppress far
9	OD +1.50 OS +1.50	20/25 20/25	No	No	No	50	Fuse

*Stereoacuity measured in arc seconds by Randot test in cases 1 to 5 and Titmus in cases 6 to 9.

†Worth-4 dot test at near and distance.

to 90 months (mean 64, SD 16 months). The interval between surgeries ranged from 4 to 42 months (mean 21, SD 14 months).

Follow-up after secondary surgery ranged from 6 to 94 months (mean 32, SD 29 months). No patient has undergone a third surgical procedure. When the patients were last examined, alignment in seven of the nine was within 6 prism dioptres of orthophoria at distance and near. Table II shows that, of the seven aligned patients, six showed stereoacuity of 50 arc seconds or better. The one remaining aligned patient had 200 arc seconds of stereopsis. All seven aligned patients fused the Worth-4 lights at 1/3 m and six of the seven fused at 6 m.

One of the nine patients had 30 prism dioptres of persistent esotropia following medial rectus recession but still had gross stereopsis of 400 arc seconds. Worth-4 testing revealed suppression of the left eye at distance and near. The remaining patient, with 12 prism dioptres of recurrent exotropia and anisometropia, failed to show stereopsis or Worth-4 fusion at any test distance. The three patients with stereopsis of 200 seconds or poorer were initially operated upon at a mean age of 36 months. The remaining children, with 50 seconds or better, had a mean age of 46.5 months at first surgery.

Discussion

The timing of surgery for intermittent childhood exotropia has been the subject of considerable controversy. Although Pritchard and Flynn⁸ have presented evidence of abnormal binocular interactions even during periods of alignment, most authors have observed normal stereopsis and Worth-4 test results when the deviation is controlled.³ Proponents of early surgery argue that in children with intermittent exotropia the deviations tend to worsen with time.^{2,5-7} They fear that increasing frequency of exotropia during the period of visual system plasticity will then generate predictable abnormal sensory adaptations. According to this argument deepening suppression and anomalous retinal correspondence will probably preclude useful binocularity if surgery is deferred.

Von Noorden, Jampolsky, and others with the opposing viewpoint have questioned the frequency of motor deterioration but not the poten-

tial threat to binocularity.^{1,3,9} It is because young children may be at risk of postoperative small angle esotropia, with its comparable risk to normal binocular function, that some believe surgery should be delayed. They argue that early surgery may exchange a preoperative state of intermittent fusion for a surgical overcorrection, with constant monofixation and possible amblyopia. This sequence has been most commonly observed in children operated on before the age of 4 years.⁶ In our series, by excluding patients with small postoperative deviations, we have attempted to eliminate patients with intermediate binocular status after primary surgery.

The patients we report on all developed large constant esotropias following repair of intermittent exotropia. Because the secondary deviations were observed for prolonged periods during childhood, we expected all to have poor binocular function. Yet all seven of the successfully aligned patients had stereopsis. Six had stereoacuity of 50 arc seconds or better and Worth-4 fusion at distance and near. There did not seem to be any correlation between the duration of the constant esotropia and the final stereopsis that was observed.

The one patient who did not show stereopsis had marked anisometropia. In view of previous observations that binocular potential is often poor in patients with anisometropia¹⁰ this child's absence of stereopsis is not surprising.

We recognise that Randot testing of stereopsis is preferable to Titmus in that it avoids monocular cues. As this is a retrospective study, stereopsis has been measured only by the latter test in four of our patients. Because the Titmus test results were better than might be expected from such artefacts of testing and because they were confirmed on repeated visits and corroborated by Worth-4 testing, we believe the results are accurate in these four patients.

To our knowledge this is the first series of patients with normal binocular function following a defined period of constant strabismus in childhood. Clinical reports rarely specify the onset and duration of abnormal visual experience. The unexpected binocularity in our patients presumably reflects the establishment of cortical visual connections during early childhood, prior to the onset of intermittent exotropia or during its latent periods. Our results show that constant strabismus acquired in childhood does not cause loss of binocular potential in all cases.

Our experience will not resolve the controversy on timing of surgery for intermittent exotropia. Early surgery may not jeopardise binocular potential as previously feared, even in children with large overcorrections. On the other hand delaying surgery may not be harmful if binocularity is firmly established. It is conceivable that small-angle overcorrection of younger children may be more dangerous to binocular development than large consecutive esotropia. We acknowledge that our patients with better binocularity were operated on at a later mean age than those with poorer binocularity. At present we favour a conservative approach, operating when each patient's symptoms, whether cosmetic or functional, are substantial.

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