The Surgical Overcorrection of Intermittent Exotropia

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ABSTRACT

Many strabismus surgeons recommend an initial surgical overcorrection for intermittent exotropia. Others caution against overcorrection because of possible nasal suppression and amblyopia in children, or because of possible diplopia in adults. We reviewed the records of 69 patients who were initially overcorrected following surgery for an intermittent exotropia. The mean postoperative follow-up was 3.1 years. Eight patients (11.6%) had a persistent overcorrection of 3 prism diopters or more and three patients (4.3%) had persistent diplopia. Patients with a persistent overcorrection had a greater mean age (P < .02) and a greater mean initial overcorrection (P < .005) compared with the patients who were not overcorrected 3 Δ or more. No child lost stereoacuity or developed amblyopia due to the overcorrection.

INTRODUCTION

The choice of best initial ocular alignment following surgery for an intermittent exotropia is controversial. Some authors have demonstrated an increased success rate with a moderate surgical overcorrection.1,2 Others have suggested that overcorrection of an intermittent exodeviation in some cases can be harmful.3,4 A child may develop nasal suppression, reduced binocular function, and amblyopia following overcorrection of an intermittent exotropia. Adults risk permanent diplopia if the overcorrection does not resolve.

At the University of Iowa, we routinely attempt to overcorrect all exodeviations requiring surgery. In our experience, very few patients have persistent problems due to a deliberate overcorrection. To study this further, we reviewed the records of patients with an intermittent exodeviation who were overcorrected following strabismus surgery.

MATERIALS AND METHODS

The medical records of all patients who underwent surgery for an intermittent exodeviation from 1969 to 1987 at the University of Iowa Hospitals and Clinics were reviewed. Only patients with a postoperative overcorrection recorded within the first week after surgery were included in this study. Exclusion criteria included incomplete data, prior strabismus surgery, a convergency insufficiency type deviation (a near deviation 10 Δ or more greater than distance) treated with bilateral medial rectus resections, or a postoperative follow-up of less than 6 months.

Ocular alignment was measured by prism cover test with fixation at 6 m and 1/2 m on an accommodative target. An intermittent deviation had to be present with fixation on a target at either 6 m, 1/2 m, or both to be included in this study. For data collection, the size of the deviation was based on the measurement with distance fixation. Sensory function was assessed with the Worth 4 dot and Titmus tests. A diplopia response to the Worth 4 dot test or complaints of diplopia were used to determine postoperative diplopia.

The choice of surgical procedure varied with the type of deviation and the age of the patient. Older patients most often had a unilateral lateral rectus recession and medial rectus resection. Younger patients usually received bilateral lateral rectus resections. Adjustable sutures were used on most older patients. The amount of surgery was based exclusively on the size of the deviation.

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**TABLE 1**

Preoperative and Postoperative Characteristics

<table>
<thead>
<tr>
<th>Group</th>
<th>Patients ( # )</th>
<th>Mean Age at Surgery (years)</th>
<th>Mean Alignment (Prism diopters)</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>8</td>
<td>21.0</td>
<td>18</td>
<td>&gt;= 3 eso</td>
</tr>
<tr>
<td>II</td>
<td>61</td>
<td>10.6</td>
<td>10</td>
<td>&lt; 3 eso</td>
</tr>
<tr>
<td><em>P value</em></td>
<td>&lt; .02</td>
<td>.10</td>
<td>&lt; .005</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 2**

Type of Surgery and Persistent Overcorrection

<table>
<thead>
<tr>
<th>Type of Surgery</th>
<th>Patients (#)</th>
<th>Patients with Final Alignment &gt;= 3 eso*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilateral lateral rectus recession</td>
<td>47</td>
<td>4</td>
</tr>
<tr>
<td>Lateral rectus recession, medial rectus resection</td>
<td>14</td>
<td>1</td>
</tr>
<tr>
<td>Three or four horizontal muscles</td>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>

*BLR vs. R&R = P > .10, R&R vs. R&R + = P > .05, BLR vs. R&R + = P < .025*

The *t*-tests were used to test for differences between means. The frequency of variables between groups was evaluated by chi square analysis.

**RESULTS**

Sixty-nine patients met the criteria for this study. The mean age at surgery was 11.8 years. Twenty-five (36%) patients were less than 6 years old and seven (10%) were less than 4 years old at the time of surgery. Thirteen (19%) patients had a vertical muscle procedure in addition to surgery for the esodeviation.

Patients were divided into two groups according to their ocular alignment on the last examination. Group I consisted of patients who were overcorrected 3 Δ or more. Eight patients with a mean postoperative follow-up of 2.0 years were included in this group. The remaining 61 patients (Group II) had either an exodeviation, an esodeviation of less than 3 Δ, or were orthotropic. The mean postoperative follow-up for group II was 3.2 years.

The age of the patient at surgery and the mean preoperative deviation were compared with the incidence of postoperative overcorrection (Table 1). Patients in Group I had a mean age at surgery nearly twice that of Group II (*P < .02*). There was no significant difference in the mean preoperative deviation between the two groups (*P > .10*).

The mean ocular alignment during the first week following surgery was significantly related to the incidence of persistent overcorrection (Table 1). The mean initial postoperative esodeviation was 18 Δ for patients in Group I compared with 10 Δ for patients in Group II (*P < .005*).

The relationship between the type of surgery and the incidence of overcorrection were also evaluated (Table 2). Patients were divided into three groups according to the surgical procedure: bilateral lateral rectus recessions (BLR), unilateral lateral rectus recession, and medial rectus resection (R&R), and surgery on three or four horizontal muscles (R&R +). The patients who had R&R + procedures had a significantly greater rate of persistent overcorrection of 3 Δ or more compared with patients who had BLR (*P < .025*).

Thirty-six percent (25/69) of all patients experienced diplopia during the first postoperative week. On the latest examination, three patients had diplopia by sensory testing and all three had a persistent overcorrection of 3 Δ or more. Two of the three patients were symptomatic, requiring treatment with prisms in one case and a reoperation in the other.

Patients with and without persistent diplopia who were overcorrected 3 Δ or more on the final examination were compared. There were no differences in the age of the patient at surgery, the size of the preoperative deviation, or the initial postoperative alignment.

The stereoaucity of patients 8 years of age or less at surgery was evaluated before and after surgery (Table 3). Fifty percent (17/34) of those tested had reduced (> 60 seconds of arc) or absent stereoaucity before and after surgery. Nine (26%) patients demonstrated an improvement, while no patient had a reduction in stereoaucity following surgery.

Eleven (28%) of the 39 patients 8 years of age or less at surgery had preoperative amblyopia and were treated with patching. After surgery, five of the 11 patients required supplemental patching. The remaining 28 patients without preoperative amblyopia also did not develop amblyopia following surgery.

**DISCUSSION**

Previous studies of the surgical treatment of esodeviations report a variable rate of overcorrection. Raab and Parks† performed bilateral lateral rectus recessions in 159
patients for intermittent exotropia. Two percent (3/159) were overcorrected more than 10 Δ between 5 and 8 weeks after surgery. Pratt-Johnson et al. had a 15% overcorrection rate in 100 cases of intermittent exotropia with a postoperative follow-up of at least 1 year. Two percent of their cases were overcorrected more than 10 Δ. Richard and Parks noted seven (8%) overcorrections of more than 10 Δ in 111 patients with intermittent exotropia followed at least 2 years. Six of the seven cases required bilateral medial rectus recessions. Schlossman et al. studied 44 adults with intermittent exotropia. They performed a unilateral lateral rectus recession and medial rectus resection in 95% (42/44) of the patients and had three overcorrections with only one symptomatic patient.

Since we excluded all patients who were undercorrected in the first postoperative week, our study had a higher incidence of persistent postoperative overcorrection compared with previous reports. Eight (11.6%) of our patients were overcorrected 3 Δ or more and one (1.4%) was overcorrected 10 Δ or more after 2 years of follow-up.

There was a significant relationship between the age at surgery and the incidence of overcorrection in our study. Patients with a persistent overcorrection of 3 Δ or more had an older mean age at surgery (P < .02). Richard and Parks also studied the relationship between age at surgery and the success rate in 111 patients with intermittent exotropia. They found no significant difference in the number of overcorrections over 10 Δ in patients between 6 and 16 years of age compared with patients 6 years of age or younger (P > .25, chi square). They did not compare the percentage of patients overcorrected less than 10 Δ.

The postoperative alignment within the first week following surgery was also closely associated with the incidence of postoperative overcorrection in our study. Patients with a final alignment of 3 Δ or more of esodeviation on the last examination had a greater mean initial postoperative overcorrection (P < .005). Other authors have noted similar results. Raab and Parks found a lower success rate when the early postoperative alignment was overcorrected more than 20 Δ. Scott and associates reported a greater rate of persistent overcorrection if the esodeviation was initially overcorrected more than 14 Δ.

We found a 4.3% (3/69) incidence of persistent diplopia. Diplopia was a common complaint immediately following surgery; however, most patients’ symptoms resolved over time as the overcorrection decreased. Five of the eight patients with a persistent overcorrection denied diplopia on sensory testing. All of these patients had well-controlled phorias or intermittent tropias. We found no significant differences in the preoperative and postoperative characteristics of the patients with and without diplopia who were overcorrected 3 Δ or more.

Preoperative stereoaucity was reduced or absent in 50% of our patients tested. Baker and Davies also reported a relatively high incidence of reduced stereoaucity with intermittent exodeviations. None of the children in our study who were 8 years of age or less at surgery and were tested had a deterioration in stereoaucity or developed amblyopia as a result of the overcorrection. In contrast, Edelman and associates found a 27% (16/59) incidence of reduced or lost stereoaucity and a 14% (8/59) incidence of amblyopia in children 6 years of age or younger at surgery. They noted the greatest incidence of reduced stereoaucity and amblyopia in patients under 4 years of age.

Preoperative amblyopia occurred more frequently in our study than might be expected. The 28% incidence of amblyopia we found may be attributed in part to the nature of our referral practice. We see a large number of strabismus patients who also have other ocular disorders, such as amblyopia. Another factor that may contribute to a higher rate of amblyopia is the use of the binocular fixation pattern method for assessing vision. This technique can result in a false positive response, especially with exodeviations. Preoperative amblyopia was diagnosed in eight of 11 children by the binocular fixation pattern. Five of these eight children exhibited only a slight fixation preference preoperatively and none had postoperative amblyopia.

In summary, a persistent overcorrection occurred in 11.6% (8/69) of patients initially overcorrected for an intermittent exotropia, while 2.9% (2/69) required treatment for diplopia. A persistent overcorrection was associated with an older mean age at surgery, a larger mean initial overcorrection, and a surgical procedure on three or four horizontal muscles. No child had a reduction in stereoaucity or developed amblyopia as a result of the overcorrection.

REFERENCES