

# The Clinical Course of Recurrent Exotropia after Reoperation for Exodeviation

I Rum Hahm, MD, Sang Won Yoon, MD, Seung-Hee Baek, MD, Sang Mook Kong, MD

Myung-Gok Eye Research Institute, Department of Ophthalmology,  
Kim's Eye Hospital, Konyang University College of Medicine, Seoul, Korea

**Purpose:** To determine the clinical course of recurrent exotropia after a secondary operation for exotropia.

**Methods:** The surgical results in 58 patients who had undergone reoperation for recurrent exotropia (reoperation group) were retrospectively investigated and compared with those of 100 patients who had undergone primary strabismus surgery only (primary operation group) using survival analysis.

**Results:** In the reoperation group, recurrence occurred in 19 of the 58 patients (33%). Survival analysis revealed that the recurrence rates in the reoperation group were significantly lower than those in the primary operation group at the same follow-up period after the corresponding strabismus surgery ( $p=0.018$ ). The distant esodeviation at the postoperative 1<sup>st</sup> week after reoperation was the only significant factor associated with the recurrence after reoperation ( $p=0.01$ ).

**Conclusions:** Exotropia did recur after a secondary operation, although the recurrence rate was lower than that after a primary operation only. *Korean Journal of Ophthalmology* 19(2):140-144, 2005

**Key Words:** Recurrence Rate, Recurrent Exotropia, Secondary operation, Survival Curve

Exotropia is the most common form of strabismus occurring in about 50~70% of all strabismic cases in Asia, whereas esotropia is much more common than exotropia in the West.<sup>1-7</sup> The results of surgical correction for intermittent exotropia have been reported to deteriorate with time.<sup>8,9</sup> As expected, the recurrence rate increases with lengthening follow-up after operation. It has been reported that the overcorrection immediately after operation of intermittent exotropia is associated with satisfactory long-term results,<sup>8,10</sup> but also that the deviation immediately after surgical correction of intermittent exotropia did not affect the final surgical results.<sup>11</sup> However, the clinical course after surgical correction of recurrent exotropia is unclear. No previous studies have documented the clinical course after reoperation for recurrent exotropia.

The purpose of this study is to illustrate the clinical course after secondary strabismus surgery for recurrent exotropia. We investigated the recurrence rate, the recurrence time after surgical correction of recurrent exotropia, and the factors that

could be associated with the surgical outcomes of reoperation for recurrent exotropia.

## Materials and Methods

The records of 630 patients diagnosed as intermittent exotropia and who had undergone surgical correction by one of the authors at Kim's Eye Hospital between 1996 and 1999 were retrospectively reviewed.

Patients with postoperative esodeviation at the last visit after the primary operation, and patients with amblyopia, nystagmus, oblique muscle overaction, A- or V-pattern strabismus or dissociated vertical deviation were excluded. Fifty-eight patients who underwent reoperation for recurrent exotropia (reoperation group) were identified, and for comparison 100 patients out of 572 patients who had undergone only primary surgery for intermittent exotropia were randomly sampled (primary operation group).

The following information was recorded when available: sex, age at diagnosis and surgery, best corrected visual acuity, refractive error, preoperative and postoperative angle of strabismus, surgical procedure performed, and follow-up information from the postoperative first week to the last follow-up visit. The amount of exodeviation measured by alternative prism cover test, or if not available, by Hirschberg or modified Krinsky test, both at near and at distance were recorded. All 58 patients in the reoperation group underwent recession and resection of horizontal recti in the non-

Received: December 27, 2004 Accepted: May 16, 2005

Reprint requests to Sang Mook Kong, MD, Myung-Gok Eye Research Institute, Department of Ophthalmology, Kim's Eye Hospital, Konyang University College of Medicine, #156 Yeongdeungpo-dong 4-ga, Yeongdeungpo-gu, Seoul 150-034, Korea. Tel: 82-2-2639-7822 Fax: 82-2-677-9214, E-mail: sheebaek@yahoo.com

\* This study was presented in part at the Korean Ophthalmological Society, Autumn Meeting, Seoul, Korea, October, 2004.

dominant eye as primary surgery. None of the 58 patients showed significant limitation of eyeball movement after the primary operation, and unilateral recession and resection procedure in the fellow eye was done as a reoperation for recurrent intermittent exotropia. Surgical dosages, based on the ocular deviation in prism diopters (PD) significantly noticed by the surgeon and parents (more than or equal to 20 PD), were applied using standard tables,<sup>12</sup> unless the surgeon determined it was necessary to deviate from the table after the clinical examination.

The change in angle of horizontal deviation during follow-up or until a tertiary operation in the reoperation group was compared with that of horizontal deviation after primary surgery in the primary operation group by Student t-test.

Surgical success was defined as a final distance deviation of less than 10 PD at primary position, and recurrence, or an undesirable outcome as a final ocular misalignment of greater than or equal to 10 PD. Survival analysis for recurrence after reoperation for recurrent exotropia according to follow-up duration was done by Kaplan-Meier method, and the survival curve of the reoperation group was compared with that of the primary operation group by Log-rank test.

The reoperation group was divided into two groups according to surgical success as success group and recurrence group. The differences in factors that could be associated with the surgical success of reoperation for recurrent exotropia were investigated between the two groups.

Student's t-test, chi-square test, Kaplan-Meier survival analysis, and Log-rank test were used for statistical analysis where appropriate using software SPSS (version 12.0). P values less than 0.05 were considered statistically significant.

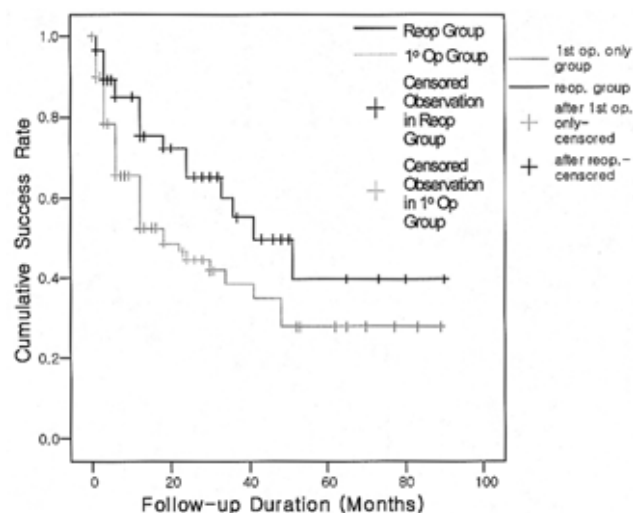
## Results

Fifty-eight patients, 23 boys and 35 girls with an average age at reoperation of 8 years ( $8.0 \pm 3.0$  years), underwent reoperation for recurrent exotropia (reoperation group). The median follow-up duration after reoperation was 18 months (range 1-90 months). The 100 patients, 43 boys and 57 girls, randomly sampled from 572 patients (primary operation group) underwent only one operation for intermittent exotropia; unilateral resection and recession procedure of horizontal recti in 92, bilateral recession and unilateral resection of 3 horizon recti in 6, and bilateral lateral rectus recession in 2. The average age of the primary operation group at operation was 7 years ( $7.0 \pm 2.9$  years), and the median follow-up duration after the operation was 18 months (range of 1-89 months).

At the final follow-up period after reoperation, 41 patients (71%) in the reoperation group maintained surgical success without recurrence. Among the 17 patients (29%) who showed recurrent intermittent exotropia again after the reoperation, only 1 patient who presented 25 PD exodeviation at distance underwent a tertiary operation for exotropia.

**Table 1.** Comparisons of recurrence rates according to the follow-up (F/U) duration between the primary operation group (1° Op Group) and reoperation group (Reop Group)

F/U duration (Months)	Recurrence rate (%)	
	Reop group	1° Op group
1	5	10
3	11	22
12	25	48
24	35	56
41	51	65
51	60	72



**Fig. 1.** Comparison of survival curves between the primary operation group (1° Op Group) and the reoperation group (Reop Group) ( $p=0.018$  by Log-rank test).

The change in angle of horizontal deviation during the follow-up or until a tertiary operation in reoperation group was  $5.6 \pm 7.3$  PD, which was significantly lower than that of  $9.0 \pm 11.1$  PD in the primary operation group after primary surgery ( $p=0.012$  by Student t-test).

For survival analysis, surgical failure was defined as recurrence of 10 PD or more exodeviation after operation, and the analysis showed that the survival period (from reoperation to recurrence) of the reoperation group was 1 to 90 months (median survival 41 months), and that the recurrence rate of the reoperation group increased with increasing the follow-up duration (Table 1); i.e., success rate decreased with increasing follow-up duration. However, the reoperation group showed a reduced decrease in success rate compared to the primary operation group. For example, at 51 months of follow-up, the success rate in the reoperation group of about 40% was higher than the 27% in the primary operation group ( $p=0.018$  by Log-rank test) (Fig. 1).

Among the reoperation group, factors showing differences between the two groups were studied. Ages at both the primary operation and reoperation did not show significant differences between the two groups. Duration of exotropia

Table 2. Comparisons between the success group (SG) and recurrence group (RG) in the reoperation group

	SG (n=41)	RG (n=17)	p-value
Gender (male : female)	7 : 10	16 : 25	0.88
Age at 1° op (years)	4.9±2.0	5.4±2.2	0.46
Duration of exotropia before 1° op (months)	18.3±15.6	10.3±11.3	0.06
Duration between 1° op & recurrence (months)	12.1±12.4	15.2±21.5	0.49
Age at 2° op (years)	8.4±3.1	9.0±3.4	0.59
Duration between 1o and 2o op (months)	42.5±22.6	43.9±23.4	0.82
1° preop deviation at distance (PD)	34.3±6.66	33.8±6.74	0.82
1° postop deviation at 1 week (PD)	-0.6±3.61	-0.2±2.90	0.71
1° postop deviation at 1 month (PD)	2.3±4.5	3.6±6.1	0.37
2° preop deviation at distance (PD)	29.5±5.75	29.1±5.37	0.82
2° postop deviation at 1 week (PD)	-3.5±4.93	0.2±5.5	0.01*
2° postop deviation at 1 month (PD)	-3.3±5.01	-2.1±6.07	0.43

Values represent mean±standard deviation.

1°: primary, 2°: secondary, op: operation, preop: preoperative, postop: postoperative, PD: prism diopters.

\*:  $p < 0.05$  by Student t-test.

before the primary operation, duration between the primary operation and recurrence, and duration between the primary operation and reoperation did not differ between the two groups. The postoperative deviation at one week after reoperation was the only factor which showed a significant difference, with the success group presenting overcorrection greater than the recurrence group (Table 2).

## Discussion

In this study, the recurrence rate after reoperation for recurrent exotropia was 33%, which was similar to the earlier Korean reports<sup>13-15</sup> of 14% to 42% for the recurrence rate after a primary surgical correction of intermittent exotropia. The recurrence rate after surgery for intermittent exotropia has been known to vary, because of the large variation in inclusion and exclusion criteria, length of follow-up, and definition of success. Pratt-Johnson et al<sup>11</sup> found that 59% of 100 cases of intermittent exotropia recurred after a primary operation, compared to 5% of 111 cases by Richard and Parks,<sup>16</sup> 22% of 100 cases by Hardesty et al,<sup>17</sup> and 40% of 67 cases by Beneish and Flanders.<sup>18</sup>

The mean change in angle of horizontal deviation after reoperation in the reoperation group was 5.6 PD, which was significantly less than that of the primary operation group. It is likely that the amount of exodrift after reoperation was less, which is in agreement with Sohn and Chang.<sup>19</sup> They reviewed 31 patients who underwent reoperation for recurrent exotropia retrospectively, and found a mean change of exodeviation of 12.1 PD after primary operation and of 2.3 PD after reoperation, which were significantly different.

The survival analysis of the reoperation and primary operation groups showed that the recurrence rates of both increased with increasing follow-up duration. These findings are in agreement with the accepted view that there is a tendency toward exodrift with increasing time after surgery for exotropia.<sup>8,9,10,20</sup> However, the increase in the recurrence

rate of the reoperation group was significantly less than that of the primary operation group in this study. The exodrift after strabismic surgery has been studied by many authors. Kushner et al<sup>20</sup> demonstrated that 75% of exotropic patients presented postoperative exodrift, compared with 7.4% of esotropic patients. Rabb and Parks<sup>10</sup> reported that among 159 exotropic patients, 32% of the patients that were initially orthotropic or had small residual exotropia developed 10 PD undercorrection by the postoperative 8th week. Hahm et al<sup>9</sup> stated that exotropic drift after surgery for intermittent exotropia was more common during the first 2 years after surgery and then stabilized, whereas Scott et al<sup>8</sup> advocated that the exodrift stabilized after the 6th postoperative week and then became fairly constant during follow-up of two years.

In the present study, for patients after reoperation for recurrent exotropia, the only discriminate predictor for a successful outcome was the postoperative deviation at one week after reoperation. Various factors have been studied for their associations with surgical success of intermittent exotropia without any definite consensus having been reached. Scott et al<sup>22</sup> found age, the difference between near and distance deviations and the change of deviation with upward and downward gaze to be significant predictors influencing response in exotropic patients. Gordon and Bachar,<sup>23</sup> using the same predictor variables, found that response was determined by the magnitude of the larger preoperative deviation, the average corrected visual acuity, the degree of anisometropia and the average spherical equivalent. Kushner et al<sup>24</sup> demonstrated that the preoperative deviation significantly influenced response in exotropic patients, that is, patients with larger preoperative deviations had a poorer chance of having a successful outcome, while Graf et al<sup>25</sup> asserted that there was no such influence. The lack of agreement in these studies may be due to the patients' variability in response to strabismus surgery. One factor creating the discrepancy may be the variability in the

postoperative exodrift encountered in exotropic patients.<sup>26</sup>

There is wide agreement that initial overcorrection after surgery for intermittent exotropia is desirable because of a tendency toward postoperative exotropic drift, which also appears to be true after the reoperation in this study. Rabb and Parks<sup>10</sup> found an overcorrection of exotropia of 10 to 20 PD gave the best outcome, Scott et al,<sup>8</sup> 4 to 14 PD, and McNeer,<sup>27</sup> 0 to 10 PD, whereas Ruttum<sup>28</sup> asserted that there was poor correlation between initial and final measurements after surgery for intermittent exotropia.

Our findings showed that the surgical outcome was not significantly related to the age, either at primary operation or at reoperation, which is in agreement with Stoller et al,<sup>29</sup> and others.<sup>9,16,30-32</sup> Stoller et al<sup>29</sup> found that patients with intermittent exotropia were more likely to remain aligned postoperatively than those with constant deviations, and that the age at onset of exotropia, age at surgery, angle of deviation at different fixation distances, early postoperative alignment, and presence of symptoms, amblyopia, anisometropia, or incomitance before surgery were not predictive of success.

Duration of exotropia before the primary operation, duration between the primary operation and recurrence, and duration between the primary operation and reoperation were not found to be significant in determining the surgical outcome of recurrent exotropia, which disagreed with the findings of Lee et al<sup>33</sup> who found that these duration factors, as well as the duration of exotropia contributed significantly to the recurrence after operation of intermittent exotropia. The preoperative angle of deviation was also not found to be related to the surgical success of recurrent exotropia in the present study, which is also in agreement with Stoller et al,<sup>29</sup> and others.<sup>9,33</sup>

In summary, there was a significant difference between the recurrence rates after reoperation for recurrent exotropia and after the primary operation for intermittent exotropia, but the change of horizontal deviation after reoperation was significantly smaller than that of the primary operation. The success rate deteriorated with increasing follow-up duration, but the increase in recurrence rate after reoperation was less than that of the primary operation. The secondary postoperative esodeviation at 1 week was found to be the predictor for response to strabismus surgery for the reoperation group and was the only discriminate factor for a successful surgical outcome in reoperation for recurrent exotropia.

## Conclusion

In the case of reoperation for recurrent exotropia, it should be considered that exotropia may recur after a secondary operation, even though the recurrence rate is lower than that after the primary surgery, and that overcorrection after reoperation might be advisable, although care must be exercised as the amount of exodrift is significantly smaller

than that after the primary operation.

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