

# Results of an Initial Strabismus Surgery for Infantile Esotropia before and after 2 Years of Age

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**ABSTRACT :** We performed a retrospective study of all patients who underwent strabismus surgery for infantile esotropia between June 1, 1998 and May 31, 2003 in Songklanagarind Hospital. There were 45 patients who met the inclusion criteria and mean follow up time was 29.8 months. Ten patients (22.2%) had initial surgery before the age of two years, 7 patients (70%) achieved a final ocular alignment within 10 prism diopters (PD). Thirty-five patients (77.8%) had the surgery after 2 years old, 19 of them (54.3%) had a final ocular alignment within 10 PD. There was no statistical difference in the final surgical alignment between the 2 groups. ( $p = 0.497$ ) However a surgical alignment before the age of two years tended to obtain a higher successful result. **Thai J Ophthalmol 2005 ; January-June : 19(1) : 27-35.**

## Introduction

Infantile esotropia, an esodeviation with an onset before 6 months of age, is characterized by a large stable angle, a limited potential for binocular single vision, and association with dysfunction of oblique muscles, dissociated vertical deviation, and latent or manifest-latent nystagmus.<sup>1</sup> The results of surgery in infantile esotropia have been classified by von Noorden<sup>2</sup> into the following outcome groups : (1) subnormal binocular vision (optimal treatment result) ; (2) microtropia (desirable treatment result) ; (3) small-angle deviation (cosmetically acceptable residual esotropia or consecutive exotropia of less than 20 prism diopters) ; and (4) large-angle deviation (cosmetically unacceptable residual esotropia or consecutive exotropia of more than 20 prism diopters).

At least two large previous studies<sup>3,4</sup> have supported the recommendation that surgical re-alignment in the infantile esotropia patient should be accomplished by 2 years of age to attach the highest yield of binocular vision and motor alignment. Furthermore, alignment within 10 prism diopters (PD) prior to 2 years of age may significantly improve the prospects of developing binocular single vision.

We therefore considered it was worthwhile to review patients in our care, who had undergone surgery for infantile esotropia to determine a surgical outcome.

## Patients and Methods

This is a retrospective study reviewing medical records of patients younger than 16 years of age who

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underwent surgery for infantile esotropia at the pediatric ophthalmology service of Songklanagarind hospital from June 1, 1998 to May 31, 2003. Patients who had previous muscle surgery and had less than 6 months of follow-up time were excluded.

All data were collected as following categories :

1. Preoperative diagnosis and treatment data - age, sex, family history, deviation in primary position measured in prism diopters, presence or absence of dissociated vertical deviation, amblyopia, fusion status, cycloplegic refraction and use of spectacles.

2. Data associated with the surgical technique, age at which the surgery was done, determination of whether or not the conjunctiva was recessed, whether oblique surgery was done, and whether dissociated vertical deviation surgery was done at a subsequent operation.

3. Postoperative data - final ocular alignment, presence or absence of fusion and degree of fusion.

4. Reoperations for persistent esotropia, consecutive exotropia, or dissociated vertical deviation, and total number of reoperations.

Amblyopia was determined in patients who were able to be evaluated as a difference of two lines or more between the monocular visual acuities using appropriate correction and using binocular fixation pattern test in younger patients. Standard care for amblyopic treatment was performed before surgery. Ocular deviation was measured by the Hirschberg test, Krimsky's prism test or alternate cover testing at near range. The sensory status was evaluated using the Worth four-dot test, the Titmus

stereo test, the Bagolini lenses test and/or the Four-prism base-out test. Cycloplegic refraction was done using either cyclopentolate or atropine. Refractive errors were treated if required.

Statistical analysis was performed using medians and the non-parametric Mann-Whitney test for comparing continuous variables, and the  $X^2$  test with Fisher's exact test for categorical data. For all inferential statistics, P values less than 0.05 were considered statistically significant.

## Results

Fifty-seven patients met the inclusion criteria and their medical records were reviewed.

Four patients who had previous extraocular muscle surgeries and 8 patients who had less than 6 months follow-up time were excluded

From 45 patients, there were 29 males (64.44%) and 16 females (35.56%). The follow-up time ranged from 6 months to 60 months. (mean = 29.8 months)

The mean age at the initial visit was 3.9 years (ranged from 1 month to 12.6 years) and the mean age of surgery were 5 years (9 months to 13 years) Preoperative deviation angle was 41.13 PD (18-80 PD) Amblyopia was found in 9 patients. (20%)

Inferior oblique overaction (IOOA) and dissociated vertical deviation (DVD) were presented in 8 patients (17.8%) and 2 patients (4.4%), respectively.

Amblyopia, IOOA and DVD were not associated with the final visual outcome ( $p = 0.71$ ,  $p = 0.71$  and  $p = 0.19$  respectively)

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There was no latent or manifest latent nystagmus.

A family history of strabismus in a first-degree relative was presented in 5 (83.35%) of 6 patients whose family history data were confirmed.

The baseline refractive errors of patients obtained for the whole group were shown in Table 1. Most patients (64.4%) had a refractive error ranging from 0 to

+2.00 diopters (D). Spectacles were prescribed in 22 patients for hyperopic correction especially +2.00 D or more and high accommodation convergence-accommodation ratio. (more than 10 PD). The spherical equivalent (average of the two eyes) was not associated with the character of the esotropia ( $p = 0.76$ ).

**Table 1** The baseline refractive errors of 45 patients with infantile esotropia

Refractive error*	Right eye	Left eye	Total (%)
> -10.0 D to $\leq$ - 8.0 D	1	1	2 (2.2%)
> - 8.0 D to $\leq$ - 6.0 D	1	2	3 (3.3%)
> - 6.0 D to $\leq$ - 4.0 D	1	0	1 (1.1%)
> - 4.0 D to $\leq$ - 2.0 D	1	1	2 (2.2%)
> - 2.0 D to < 0 D	5	4	9 (10.0%)
0 D to $\leq$ + 2.0 D	28	30	58 (64.4%)
>+ 2.0 D to $\leq$ + 4.0 D	8	7	15 (16.7%)

\*In terms of spherical equivalent

Average of spherical equivalent in the two eyes (mean  $\pm$  SD) = 0.4  $\pm$  2.3 D

There were 16 patients (35.5%) with a large angle deviation (>40 PD). (Table 2) Bimedial rectus recessions with or without other muscle surgery were used for the initial operation in 38 patients (84.4%). (Table 3)

Final ocular alignment obtained for the whole group was detailed in Table 4. There were 26 patients (57.8 %) with the final alignment within 10 PD. A single operation was performed for 33 patients (73.3 %), and

**Table 2** Preoperative deviations

Preoperative esotropia* (PD)	Numbers of patients (%)
11 to 20	3 (6.7%)
21 to 30	13 (28.9%)
31 to 40	13 (28.9%)
41 or more	16 (35.5%)

\*Mean esotropia = 41.13 PD

**Table 3** Initial surgical procedures with numbers of cases undertaken for infantile esotropia

Procedure (s)	Number (s) of cases (%)
Bimedial rectus recessions	32 (71.1%)
Bimedial rectus recessions with lateral rectus resection	4 (8.9%)
Monocular medial rectus recession with lateral rectus resection	4 (8.9%)
Bimedial rectus recessions, bilateral inferior oblique recessions with anteriorization	1 (2.2%)
Bimedial rectus recessions, bilateral inferior oblique recessions without anteriorization	1 (2.2%)
Inferior oblique recession with anteriorization	3 (6.7%)

**Table 4** Final alignment obtained in 45 patients with infantile esotropia

Final alignment (PD)	Number(s) of cases (%)
Within 10 PD	26 (57.8%)
Between 10 to 20 PD	11 (24.4%)
More than 20 PD or consecutive XT*	8 (17.8%)

\*XT indicates exotropia

a second procedure was carried out for the remaining 12 patients (26.7 %) for persistent esotropia or consecutive exotropia. (Table 5) There was no significant difference between reoperation procedure and the age of patients at initial surgery before 2 years ( $p = 0.418$ ).

A comparison of the final postoperative angle in the two groups is shown in Table 6. A total of 10 patients (22.2%) underwent initial surgery before the age of 2 years ; of these, 7 patients (70.0%) had final ocular alignment within 10 PD and 4 (57.1%) of the 7 patients

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**Table 5** Age at initial surgery and amount of surgical procedures

Age at initial surgery	Numbers of patients		
	One procedure	Reoperation	Total
≤ 24 months	6	4	10
> 24 months	27	8	35
<b>Total</b>	<b>33</b>	<b>12</b>	<b>45</b>

**Table 6** Age at initial surgery and final postoperative alignment

Age at initial surgery	Numbers of patients with final deviation		
	Within 10 PD	over 10 PD	Total
≤ 24 months	7	3	10
> 24 months	19	16	35
<b>Total</b>	<b>26</b>	<b>19</b>	<b>45</b>

underwent only one procedure. A total of 35 patients (77.8%) underwent surgery after the age of 2 years ; of these, 19 patients (54.3%) had final ocular alignment within 10 PD and 13 (68.4%) of the 19 patients underwent only one procedure. Based on these data, the difference in the results of alignment within 10 PD between each group did not reach a high level of statistical signi-

ficance ( $p = 0.497$ ).

There were only 17 patients who had postoperative stereopsis test. Evidence of binocular single vision was found in 11 patients (64.7%) ; of these, 8 patients (72.8%) had final alignment within 10 PD. All eight patients had undergone initial surgery after the age of 2 years.

## Discussion

The functional value of surgical alignment for infantile esotropia prior to 2 years of age has been confirmed by several studies.<sup>3-7</sup> Furthermore, alignment within 10 PD of straight prior to 2 years of age may significantly improve the prospects of developing binocular single vision. Our study showed the motor and sensory results of a series of patients who underwent strabismus surgery for infantile esotropia over a 5-year period in Songklanagarind Hospital. We defined a successful result as the angle of deviation within 10 PD or the patient having fusion and/or stereopsis.

- Size and character of the esotropia : Our results indicate that esotropia is often not a large angle (40 PD). There were 16 patients (35.5%) with a deviation 40 PD. The older the patient at enrollment the more likely the esotropia was to be a large-angle ( $p = 0.03$ ).

- Refractive error : Mild hyperopia was present in most of our patients. Most patients (64.4%) had a refractive error ranging from 0 to +2.00 D. The study results met the classic profile for infantile esotropia (+3.00 D). Early-onset esotropia that included older patients, hyperopia  $> +3.00$  D was found in 15% of the 54 cases.<sup>8</sup> Helveston and associates<sup>9</sup> and Ing<sup>10</sup> reported the mean preoperative refractive errors to be +1.90 and +2.20 D, respectively.

- Amblyopia : Amblyopia was diagnosed in 20% of our patients at the first visit. There were 22% reported by Hiles and associates<sup>8</sup> for 54 patients between 3 and 10 months of age and 13% reported by Hoyt and associates<sup>11</sup> for 31 patients between 2 and 11 months of age.

- Associated motor abnormalities : The preva-

lences of IOOA, DVD and nystagmus at baseline were 17.8%, 4.4% and 0%, respectively. These results are similar to those reported by Hiles and associates.<sup>8,12</sup> with a rate of IOOA of 15% and DVD 2% at an initial examination of patients between 3 and 10 months of age. However, Nystagmus was not noted in our study. Robb and Rodier<sup>12</sup> reported a frequency of nystagmus of 10% in the primary position and 16% with occlusion. Sprunger<sup>13</sup> reported the frequency of nystagmus to be 18% in 84 patients.

- Surgical procedure : There were many surgical techniques for infantile esotropic correction. Bimedial rectus recessions with or without other muscle surgery were used for the initial operation in 38 patients (84.4%) in our study. Several studies<sup>9,14,15</sup> reported satisfactory success rates for infantile esotropia using bimedial rectus recessions procedures.

- Reoperation : Keenan and Willshaw<sup>16</sup> reported a reoperation rate of 35% in patients who underwent surgery who had a follow-up time of at least 2 years. Hiles and colleagues<sup>8</sup> reported a reoperation rate of 40% in patients who had a follow-up time of at least 5 years. In our study, a mean follow-up time of 29.8 months, demonstrated reoperation procedures in 12 patients (26.7%). Our results showed a considerably less number of reoperation rate than the mentioned studies.

- Results of surgery : Final surgical alignment within 10 PD was achieved in 26 of 45 (57.78%) patients, 19 of 35 (54.29%) patients who underwent surgery after 2 years of age and 7 of 10 (70%) patients who underwent surgery before 2 years of age. Although there was no significant difference in the percentage of pa-

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tients between both groups ( $p = 0.497$ ), this is in accordance with the findings of Ing,<sup>17</sup> who found an improved outcome for patients who underwent surgery prior to their second birthday.

Several studies have reported strabismus surgery with infantile esotropia in patients younger than 2 years of age to improve the quality of binocular results.<sup>5,16-23</sup> Some studies demonstrated improved binocularity in patients who received re-alignment by 6 months of age.<sup>18-20</sup>

Both motor and sensory components should be considered in successful surgery. In this series we found evidence of binocular single vision postoperatively in 11 (64.7%) out of 17 patients who had postoperative stereopsis test. A final alignment within 10 PD was shown in 8 (72.7%) out of 11 patients ; all of the eight patients underwent surgery after the age of 2 years. Unfortunately, of 45 participants, there were only 17 patients with the postoperative stereopsis test and there were so few patients who underwent initial surgery before 2 years of age, that the findings from this group can only be called tentative.

We believe that surgery for infantile esotropia before completion of the second year of life improves the chance for an optimal treatment result. The esotropia should be corrected as soon as possible, if there is no other compelling reason to defer surgery. We decide to conduct further prospective study to collect more data in the future, especially sensory functional data from a series of patient who aligned within 10 prism at age before 2 years of age, for supporting the concept that earlier rather than later surgical alignment provide a better result in strabismus surgery.

This study is limited by its retrospective design, small and unequal sample sizes. Further studies are required to confirm the findings. Nevertheless, we believe our study has important value for clinician planning treatments and a study at some future time.

### Conclusion

There was no statistical difference between patients who underwent an initial operation before and after two years of age in terms of final ocular alignment within 10 PD. However, surgical alignment before 2 years of life tended to increase the chance for an optimal treatment result.

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# ผลการผ่าตัดกล้ามเนื้อตาครั้งแรกก่อนและหลังอายุ 2 ปี ในผู้ป่วยตาเขเข้าในแต่กำเนิด

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**บทคัดย่อ** คณะผู้รายงานได้ศึกษาย้อนหลังผู้ป่วยตาเขเข้าในแต่กำเนิดทั้งหมดที่ได้รับการผ่าตัดกล้ามเนื้อตา ณ โรงพยาบาลสงขลานครินทร์ในช่วงเวลา 5 ปี ระหว่างวันที่ 1 มิถุนายน 2541 ถึงวันที่ 31 พฤษภาคม 2546 เพื่อเปรียบเทียบผลการผ่าตัดกล้ามเนื้อตาระหว่างกลุ่มผู้ป่วยที่ได้รับการผ่าตัดครั้งแรกที่ก่อนและหลังอายุ 2 ปีโดยใช้ผลสำเร็จของการรักษาคือ ผู้ป่วยมีมุมเขภายใน 10 prism diopters เมื่อมาตรวจครั้งสุดท้ายพบว่าจากระยะเวลาการติดตามการรักษาหลังผ่าตัดโดยเฉลี่ย 29.8 เดือนของผู้ป่วยตาเขเข้าในแต่กำเนิดจำนวน 45 ราย มีผู้ป่วยจำนวน 10 ราย (22.2%) ที่ได้รับการผ่าตัดก่อนอายุ 2 ปี โดยในจำนวนนี้มี 7 ราย (70.0%) ที่มีมุมเขครั้งสุดท้ายอยู่ภายใน 10 prism diopters และมีผู้ป่วยจำนวน 35 ราย (77.8%) ที่ได้รับการผ่าตัดหลังอายุ 2 ปี โดยในจำนวนนี้มี 19 ราย (54.3%) ที่มีมุมเขครั้งสุดท้ายอยู่ภายใน 10 prism diopters โดยสรุปพบว่าผลการผ่าตัดกล้ามเนื้อตาในผู้ป่วยตาเขเข้าในแต่กำเนิดระหว่างกลุ่มผู้ป่วยที่ได้รับการผ่าตัดครั้งแรกที่ก่อนและหลังอายุ 2 ปี ไม่มีความแตกต่างกันอย่างมีนัยสำคัญ ( $p = 0.497$ ) อย่างไรก็ตาม ผู้ป่วยที่เข้ารับการผ่าตัดก่อนอายุ 2 ปีมีแนวโน้มของผลการรักษาดีกว่า **จักษุเวชสาร 2548 ; มกราคม-มิถุนายน 19(1) : 27-35.**

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