

CONSECUTIVE EXOTROPIA

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Abstract

From a retrospective study of the records of one hundred and seventy four patients who underwent surgical correction of esotropia, nineteen were found to develop consecutive exotropia. A study of these patients was undertaken to identify characteristics common to patients with consecutive exotropia.

A lack of any significant differences between the consecutive exotropia and the non divergent groups pre-operatively suggested that consecutive exotropia is difficult to predict. Post-operatively the only differences found were a higher percentage of patients in the divergent group with "V" patterns and with two or more lines of amblyopia. No associated inferior oblique overaction or superior rectus underaction was found to explain the higher percentage of "V" patterns in the divergent group.

No patients became divergent within six months post-operatively. Divergence occurred from 0.50 to 25 years post-operatively, with a mean of 5.0 years.

Key words: Consecutive exotropia, esotropia, surgical correction.

INTRODUCTION

Consecutive exotropia following surgery for esotropia has been associated with characteristics such as high hypermetropia, post-operative changes in refraction, amblyopia, the presence of a vertical deviation, "A" or "V" patterns and weak binocular function.^{1-6,9}

A retrospective review of one hundred and seventy four patients who had undergone surgical correction of their esotropia found that a number of patients had developed consecutive exotropia. Patients with consecutive exotropia following a single operation were evaluated by comparing them with patients who did not diverge post-operatively in an attempt to isolate any indicators of consecutive exotropia.

PATIENTS AND METHODS

The records of patients examined by one

Ophthalmologist and one Orthoptist and who underwent surgical correction for esotropia were reviewed. Cases were included if the following criteria were met:

- more than three years follow up.
- no prior surgical intervention by another Ophthalmologist.
- absence of any congenital or acquired medical condition affecting the central nervous system, thought to be a contributing factor of the squint.

Consecutive exotropia was defined as greater than five degrees of divergence with and without glasses (measured with the synoptophore), for at least three consecutive visits. The pre-operative visit refers to the visit immediately prior to the first or only operation. The final visit refers to the last recorded entry prior to any further surgery.

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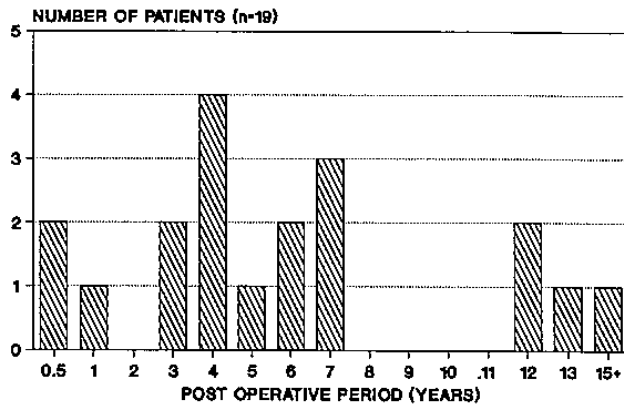


Figure 1: Time post operatively at which divergence occurred.

Statistical tests used included, *t*-test, One way analysis of variance, Fischers exact test, Mann-Whitney and Chisquare.

RESULTS

One hundred and seventy four patients were found to meet the criteria for inclusion in the study. Of these nineteen developed consecutive exotropia (CE) after one operation to correct their esotropia. The remaining six patients became divergent after a second operation and were not considered.

The number of patients with congenital esotropia was not statistically different between the CE group (64%) and the non divergent (ND) group (57%) ($p > 0.05$).

The number of patients with an accommodative esotropia pre-operatively did not vary significantly between the ND (19%) and the CE group (15%) ($p > 0.05$).

The mean age of patients at the time of surgery was 4.4 years (± 3.2) for the ND group and 3.6 years (± 2.0) for the CE group. This difference was not significant ($p > 0.05$).

TABLE 1
Mean angle measurement at the pre op., post op. and final visits

Group	Mean Deviation		
	Pre op.	Post op.	Final
ND group (<i>n</i> = 149)	30.1(± 9.0)	14.64(± 8.4)	13.3(± 8.8)
CE group (<i>n</i> = 19)	26.1(± 7.2)	7.16(± 7.1)	-11.0(± 5.5)

TABLE 2

Operation Type	ND Group	CE Group
5 mm recess 3 mm resect	11	2
5 mm recess 4 mm resect	15	6
5 mm recess 5 mm resect	43	5
5 mm recess 6 mm resect	35	4
5 mm recess 7 mm resect	11	0
Other	34	2

The average time of follow up between the pre-operative and final visit was 9.6 years (± 6.5) for the ND group and 13.92 years (± 7.0) for the CE group. The mean post-operative period at which divergence occurred was 5.02 years (range = 0.2-25 years) Refer Figure 1.

ANGLE SIZE

No statistical difference was found between the mean pre-operative angle size of the ND and the CE group ($p > 0.05$). The measurements between the two groups at the post-operative and final visits were significantly different ($p < 0.05$). Refer Table 1.

SURGICAL DETAILS

The majority of patients in both the ND and CE groups had monocular recess/resect procedures as an initial operation. There was no significant difference in the type of surgical procedures used for the two groups ($p > 0.05$). Refer Table 2.

OCULAR MOTILITY

The incidence of a "V" pattern post-operatively was significantly higher in the CE Group compared to the ND group ($p < 0.001$). The small number of patients with a "V" pattern pre-operatively meant the two groups were unable to be compared statistically. Refer Table 3.

The incidence of "A" patterns post-operatively did not appear to differ between the CE (3/19) and ND group (0/149), however the lack

TABLE 3
Number of patients with a "V" pattern pre operatively and during the post operative follow up period

Group	Pre op.	Post op.
ND group (<i>n</i> = 149)	2(1%)	6 (4%)
CE group (<i>n</i> = 19)	1(5%)	8(42%)

TABLE 4

Number of patients with a vertical deviation at the pre-operative visit or during the post operative follow up period

Group	Pre Op.	Post Op.
ND group	8(5%)	47(32%)
CE group	1(5%)	10(53%)

of numbers meant they were unable to be compared statistically.

No significant difference was found in the number of patients with an inferior oblique overaction between the ND group (96/149) and CE group (16/19) ($p > 0.05$). Only two patients in the CE and twenty one in the ND group were found to have a superior rectus underaction. These numbers were too small to compare statistically.

The proportion of patients with a vertical deviation present at the pre-operative visit or during the post-operative follow up period was not significantly different between the ND and CE groups ($p > 0.05$). Refer Table 4.

AMBLYOPIA

There was no significant difference found in the number of patients with visual acuity of 6/9 or less in the squinting eye, or in those with 1 line or more difference in the visual acuity, between the ND group and the CE group at the final visit ($p > 0.05$).

The CE group was found to have a higher percentage of patients with two lines or more difference in the visual acuity at the final visit than the ND group ($p < 0.05$). Refer Table 5. Over 50% of patients in both the ND and CE group were too young to have their visual acuity tested at the pre-operative visit, therefore the presence of amblyopia was based on fixation behaviour. No significant difference was found in the number of patients with amblyopia at the pre-operative visit between the CE (10/19) and ND groups (77/149) ($p > 0.05$).

TABLE 5

Number of patients with and without amblyopia at the final visit

Group	AMB		> = 6/9 in the squinting eye
	> / = 1 line	> / = 2 lines	
ND group	83(56%)	37(25%)	53(36%)
CE group	12(63%)	9(47%)	11(58%)

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BINOCULAR FUNCTION

Only two patients in CE group had fusion demonstrable on the synoptophore pre-operatively. This number was too small to compare statistically with the ND group (17). At the final visit seven (37%) of patients from the CE group had demonstrable fusion compared to forty five (30%) from the ND group. This was not significantly different ($p > 0.05$).

HYPERMETROPIA

The difference in the number of patients with low, medium or high hypermetropia, between the two groups, was not statistically significant ($p > 0.05$). Refer Table 6.

Each of the histories for the nineteen patients in the CE group was searched to determine the number of patients who had a change in refraction of greater than 1.00 dioptres sphere within three visits of divergence occurring. Only four patients were found to have a change in refraction, all becoming less hypermetropic. This did not appear to be a predisposing factor in consecutive exotropia.

TABLE 6

Number of patients with low, medium or high levels of hypermetropia

Group	Low (< = 3.0DS)	Med (3.0-6.0)	High (> 6.0)
ND group (n = 149)	47(31%)	87(58%)	15(10%)
CE group (n = 19)	9(47%)	10(52%)	0

DISCUSSION

The incidence of consecutive exotropia in this series of patients (11%) was higher than the three to seven percent range previously reported.¹⁻⁴ However these studies either had a follow up period shorter than five years,^{2,4} or failed to specify the follow up period.^{1,3,5} In an editorial comment by Dr. R. Aebli on the study conducted by Cooper (1961) it is suggested that "if these patients should be followed over a longer period of time through the adolescent years, his cases of secondary exotropia would be considerably higher". This study supports this with the mean post-operative period at which divergence

occurred being 5.02 years with 36% not becoming divergent until after this time. Therefore a true representation of the percentage of patients who developed a divergent deviation may not be given if the follow up period is less than five years.

A smaller pre-operative angle and/or larger recess resect procedures were considered as possible causes of consecutive exotropia. The results show this not to be the case with no significant differences found between the groups in the pre-operative angle size or operation type.

No difference was found in the percentage of patients who had an onset of squint of six months of age or less between the two groups ($p > 0.05$). Windsor (1966) suggested that a higher proportion of patients (57%) with consecutive exotropia had a congenital onset, however the number of patients with a congenital onset in those patients that did not diverge was not given.

Other authors suggest that consecutive exotropia is associated with a high incidence of vertical deviations.^{1,2} In this study the percentage of patients in the CE group with a vertical deviation post-operatively appears larger than in the ND group, however no statistically significant difference was found ($p > 0.05$).

From Table 3 it can be seen that the CE group developed a higher proportion of "V" patterns post operatively ($p < 0.001$). Stanworth (1968) and Mein et al. (1986) both associate a "V" exotropia pattern with an overaction of the inferior oblique, an underaction of the superior rectus or to a lower than normal lateral rectus insertion. In our study there was no associated inferior oblique overaction or apparent superior rectus underaction to account for the "V" patterns in the CE group. As all but one patient in this group had a monocular recess/resect procedure, the possibility that the lateral rectus insertion was inadvertently lowered during surgery could provide a possible cause for the higher percentage of "V" patterns, however this remains hypothetical.

Folk et al (1983) reported 38% of patients with two or more lines of amblyopia while others found that high degrees of amblyopia may

contribute to the development of consecutive exotropia. Our results support these theories as a higher proportion of patients in the CE group had two or more lines of amblyopia at the final visit than in the ND group.

Arruga (1965) commented that poor binocular function may contribute to the development of consecutive exotropia while in contrast Cooper (1961) and Windsor (1966) both suggest that binocular function is more common in overcorrected than undercorrected esotropia. This study was unable to support either finding as no difference was found in the percentage of patients with fusion demonstrable between either group.

Previous studies have suggested that consecutive exotropia commonly follows an increase in the optical correction of moderate to high degrees of hypermetropia.^{2,3,10} The range and distribution of refractive errors was not significantly different between the ND and CE group and of the nineteen patients in the CE group we found only four patients who appeared to diverge following a change in refraction. Therefore a refractive component did not seem to be a factor in the development of consecutive exotropia for this group of patients.

CONCLUSION

The findings in this study conclude that the development of consecutive exotropia is difficult to predict. Pre-operatively, the presence of amblyopia, ocular motility abnormalities, in particular vertical deviations and the range of refractive errors were not statistically different between the ND and CE patients.

Patients with large or small pre-operative angles were equally susceptible to consecutive exotropia. No difference in the pre-operative angle size was found between the groups and both exhibited a large range of pre-operative angle size.

Consecutive exotropia was associated with the development of a "V" exo pattern post-operatively with no apparent associated inferior oblique overaction or superior rectus underaction. Post-operative amblyopia of greater than or equal to two lines was more common with patients who developed consecutive exotropia.

In the majority of cases (78%) consecutive exotropia appeared before seven years post-operatively with an average of five years. The possibility of consecutive exotropia occurring cannot be conclusively excluded with a short (<5 years) post-operative follow up.

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