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# Surgical results for consecutive exotropia

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## Abstract

**PURPOSE:** To evaluate the surgical results of medial rectus (MR) muscle advancement with or without recession of the antagonist muscle for consecutive exotropia.

**METHODS:** Medical records of patients with consecutive exotropia ( $n = 27$ ) were retrospectively reviewed. All patients received one-eye surgery with MR advancement, lateral rectus (LR) recession, or combined surgery. The pre- and post-operative angle of deviation was recorded. Characteristics were compared between groups. The follow-up period was at least 3 months.

**RESULTS:** The overall successful rate was 62.96%, with 50% in MR advancement group, 60% in LR recession group, and 71.4% in combined group. Patients in combined group had larger preoperative deviation. There were comparable surgical results between patients with inferior oblique (IO) muscle overaction receiving correction simultaneously and patients without IO muscle overaction.

**CONCLUSIONS:** The overall surgical successful rate for consecutive exotropia in this study was 62.96%. Combined MR advancement and LR recession yielded better results than MR advancement or LR recession alone although it was not statistically significant.

## Keywords:

Consecutive exotropia, lateral rectus recession, medial rectus advancement

## Introduction

Consecutive exotropia commonly developed months or years after medial rectus (MR) muscle recession, and sometimes, shortly after surgery. The incidence ranged from 3% to 29%. The causes of this situation include several types of abnormal MR muscle attachments such as slipped muscle, lost muscle, stretched scar,<sup>[1]</sup> and others without abnormal sclera attachment. Unilateral or bilateral MR muscle advancement/resection, lateral rectus (LR) muscle recession, and combined surgery had been reported as correction procedures. Yet no previous study directly compared the results of single advancement with combined double muscle operation before.

The aim of this study was to evaluate the surgical results of MR muscle advancement

with or without recession of the antagonist muscle for consecutive exotropia and investigate factors which may influence the surgical outcomes.

## Methods

The medical records of all patients diagnosed as consecutive exotropia at Kaohsiung Veterans General Hospital from 2003 to 2015 were retrospectively reviewed. The patients who had surgeries for esotropia before and showed exotropia more than 10 prism diopter (PD) at distance were included in the study. The patients followed for less than one month, or associated with neurologic disorders or had previous other ocular surgeries were excluded from the study.

Preoperative data collection included: gender, age, ocular alignment, adduction deficit or not, status of inferior oblique (IO) muscle function, best corrected visual

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acuity, and the presence of amblyopia or anisometropia. The angle of deviation was measured by the alternate prism cover test.

All surgeries were performed by a single surgeon (Muh-Chiou Lin). MR muscle advancement means to advance the muscle to its original insertion site. LR muscle recession was performed according to the standard table. The surgical decision was made according to the measured deviation angle and intraoperative findings. If the recessed MR could not be anchored to original insertion site due to severe scarring, then, the LR would be recessed. However, at most two muscles were treated at one surgery. We accordingly divided all patients into three groups: patients with MR advancement, patients with LR recession, and patients with MR advancement and LR recession. The patients were followed up at 1-week, 1-month, and 3-month postoperatively, and the visual acuity, ocular alignment, and ocular movement were recorded. Success was defined as alignment within 10 PD of orthotropia at distant at 3-month follow-up.

The characteristics of patients were compared within groups, including surgical results, and measured by ANOVA and Student's *t*-test.

## Results

A total of 27 patients with consecutive exotropia were included in the study. Eleven were male. The average age of surgery was 10.13 years (range: 2–23). The mean age of their first strabismus surgeries when traceable was 2.66 years (range: 0.8–7 years). Moreover, the median period between two surgeries was 60 months (range: 1–168 months). Nine patients had amblyopia in the deviated eye, and nine patients showed anisometropia. None of the patients showed adduction deficiency before and after surgery. The surgical effects and the characteristics of patients were compared within groups.

Seventeen of the patients showed alignment within 10 PD of orthotropia at distant at 3-month or longer

follow-up (62.96%). Patients receiving MR advancement showed 50% success rate with a mean of  $11.63 \pm 13.45$  PD exotropia at last visit (0~35 PD). Patients receiving MR advancement and LR recession showed a success rate of 71.4% with a mean of  $7.86 \pm 11.53$  PD exotropia (–8~30 PD). Patients receiving LR recession showed success rate of 60% with a mean of  $9.60 \pm 14.10$  PD exotropia (–4~30 PD) [Table 1].

Patient with concomitant IO muscle recession had surgery at younger age (6.79 vs. 11.30 years), and the successful rate was comparable with the patients without IO muscle recession (71.4% vs. 60%,  $P = 0.678$ ) [Table 2]. The presence of amblyopia or not did not influence the success rate [Table 3].

## Discussion

Consecutive exotropia is commonly seen after surgeries of infantile esotropia. It usually developed months or years after previous surgery. Correction of the consecutive exotropia remains a relatively difficult procedure because it is hard to determine which muscle to be operated on and how much surgical effect one will get. Advancement of the MR previously recessed to its original position sounds reasonable; however, the surgical dose effects were not constant according to previous reports.<sup>[2]</sup> Another approach is to recess the LR muscle, which can be planned according to the surgical table, but it will probably not solve the problem of adduction defect when present.

In our study, we got an overall successful rate of 62.96%, which is comparable to previous literatures despite different surgical modalities.<sup>[3]</sup> In the MR advancement group, the successful rate was 50%, which seemed poorer than that reported by Marcon and Pittino<sup>[4]</sup> and Kim *et al.*<sup>[2]</sup> However, recurrent exotropia frequently occurred after months to years resulting in an unsatisfactory long-term successful rate about 50%.<sup>[5]</sup> On the other hand, it is thought that MR advancement is preferred over LR recession due to the exploration of the suspect

**Table 1: Summary of characteristics of patients**

	Total	MR advancement	A and R	LR recession	P
Number of patients, <i>n</i> (%)	27 (100)	8 (29.6)	14 (51.9)	5 (18.5)	
Age (mean±SD)	10.13±5.42	8.13±6.35	10.89±5.28	11.20±4.26	0.475
Gender (%)					
Male/female	11/16 (40.7/59.3)	4/4 (50/50)	5/9 (35.7/64.3)	2/3 (40/60)	0.871
Preoperative XT (PD)	29.11±11.79	21.63±6.90	34.64±9.50	25.60±17.12	0.027*
Postoperative XT (PD)	9.30±12.19	11.63±13.45	7.86±11.53	9.60±14.10	0.796
Success (%)					
Yes	17 (63)	4 (50)	10 (71.4)	3 (60)	0.668
No	10 (37)	4 (50)	4 (28.6)	2 (40)	

\*The *P* value was estimated by ANOVA. A and R = Advancement of MR and recession of LR, LR = Lateral rectus, MR = Medial rectus, PD = Prism diopter, SD = Standard deviation, XT = Exotropia

**Table 2: Characteristics of patients with and without inferior oblique recession**

	Total	IO	Non-IO	P
Patients number, n (%)	27 (100)	7 (25.93)	20 (74.07)	
Age (mean±SD)	10.13±5.42	6.79±3.87	11.30±5.47	0.265
Gender (%)				
Male/female	11/16 (40.7/59.3)	2/5 (28.6/71.4)	9/11 (45/55)	0.662
Preoperative XT (PD)	29.11±11.79	19.71±4.64	32.40±11.82	0.022*
Postoperative XT (PD)	9.30±12.19	7.86±14.28	9.80±11.74	0.657
Success (%)				
Yes	17 (63)	5 (71.4)	12 (60)	0.678
No	10 (37)	2 (28.6)	8 (40)	

\*The P value was estimated by Student's t-test. IO = Combined inferior oblique muscle recession in surgery, Non-IO = No inferior oblique muscle recession during horizontal muscle surgery, PD = Prism diopter, SD = Standard deviation, XT = Exotropia

**Table 3: Characteristics between the success and nonsuccess groups**

	Total	Success	Nonsuccess	P
Patients number, n (%)	27 (100)	17 (62.96)	10 (37.04)	
Age (mean±SD)	10.13±5.42	10.98±5.79	8.68±4.63	0.648
Gender (%)				
Male/female	11/16 (40.7/59.3)	6/11 (35.3/64.7)	5/5 (50/50)	0.687
Amblyopia (%)				
Yes	9 (33.3)	5 (29.4)	4 (40)	0.683
No	18 (66.7)	12 (70.6)	6 (60)	

SD = Standard deviation

unfavorable insertion of the previously operated MR muscle. In this study, we did not notice stretched scar or slipped muscle intraoperatively, which is compatible with no adduction deficit noted preoperatively. In our study, the successful rate in the LR recession group was 60%, slightly better than the MR advancement group. This again probably attributed to no adduction deficiency before surgery. Combined surgeries have also been reported including MR advancement, MR resection, LR recession, or bilateral approaches. In this study, we found MR advancement plus LR recession showed a successful rate as 71.4%. Although not statistically significant, it was superior to MR advancement or LR recession alone despite larger preoperative deviation was present in combined surgery group ( $P = 0.027$ ). It seemed that this could be a more powerful surgical approach for larger consecutive deviation.

Some variables may influence the surgical outcomes, including binocularity, A- or V-pattern deviations, earlier onset of esotropia, and accompanying vertical deviations.<sup>16,71</sup> We found that patients with IO overaction had similar successful rate as nonoveraction group, which indicated the importance of simultaneously correcting the oblique muscle dysfunctions. We also noticed that patients with IO overaction tended to have the second surgery earlier (6.79 vs. 11.30). The concomitant vertical deviation prompted the parents for consultations, and the IO was treated in the same surgery.

The limitation of our study is the small number of patients and a retrospective design, which leads the

data analysis less powerful to show the significance and was hard to further evaluate possible prognostic factors. Another limitation is that all patients had no adduction defect, so the results may not be implied in these patients with abnormal muscle insertion, who represent part of the disease group.

## Conclusions

Consecutive exotropia is commonly seen after MR muscle recession. In this study, patients developed consecutive exotropia from 1 month to 14 years (median: 5 years) after the first surgery. Amblyopia was noted in 9 patients, but it did not show significant influence on the surgical result. IO muscle overaction, when noted, should be corrected as well. The overall successful rate was 62.96% in this study, and advancement with recession yielded better results than MR advancement or LR recession alone although it was not statistically significant.

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## Conflicts of interest

The authors have no any conflicts of interest to declare.

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