Combined resection-recession in true divergence excess sensory exotropia

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PURPOSE To assess the effect of combined resection and recession on the same lateral rectus muscle in patients with true divergence excess sensory exotropia.

METHODS Patients were divided into two groups. One group of patients underwent combined resection-recession of the lateral rectus muscle in one eye (LR group); the other group, with exodeviation of $>40^{\Delta}$ for distance underwent additional ipsilateral medial rectus resection (LR + MR group). Postoperative measurements were taken at 1 week, 1 month, and 3 months.

RESULTS Eleven patients were included in the study (mean age, 23.5 ± 6.7 years): 7 in the LR group and 4 in the LR + MR group. For the LR group, mean preoperative deviation was $35.7^{\Delta} \pm 3.5^{\Delta}$ at distance and $16.3^{\Delta} \pm 3.9^{\Delta}$ at near. The mean near–distance disparity (NDD) was $11.4^{\Delta} \pm 2.7^{\Delta}$. The mean lateral rectus recession was 8.6 ± 1.1 mm: the mean resection, 4.3 ± 0.5 mm. At 3 months, mean deviation at distance was $8.3^{\Delta} \pm 2.1^{\Delta}$; at near, $3.1^{\Delta} \pm 1.6^{\Delta}$ ($P = 0.01$). The NDD was $5.7^{\Delta} \pm 2.7^{\Delta}$ ($P = 0.01$). For the LR + MR group, mean preoperative deviations at distance was $65.0^{\Delta} \pm 12.9^{\Delta}$; at near, $35.0^{\Delta} \pm 12.2^{\Delta}$. The mean NDD was $30.0^{\Delta} \pm 4.0^{\Delta}$. Mean lateral rectus recession was 9.5 ± 1.8 mm; the mean resection, 4.8 ± 0.8 mm. The mean medial rectus resection was 5.5 ± 0.6 mm. At 3 months, mean deviation at distance was $8.3^{\Delta} \pm 2.1^{\Delta}$; at near, $3.1^{\Delta} \pm 1.6^{\Delta}$ ($P = 0.06$). The NDD was $5.7^{\Delta} \pm 2.7^{\Delta}$ ($P = 0.06$).

CONCLUSIONS In our study combined resection and recession of the same lateral rectus muscle in patients with divergence excess sensory exotropia significantly reduced the NDD, with no adverse outcomes. (J AAPOS 2019;23:258.e1-4)

Patients with exotropia and near–distance disparity (NDD) with distance deviation exceeding near deviation, unaltered by monocular occlusion and +3 D lenses are considered to have true divergence excess, as suggested by Kushner,[1] and attributed to excessive proximal convergence. The management of patients with true divergence excess exotropia has always been difficult with conventional surgeries (unilateral or bilateral lateral rectus recession with or without medial rectus resection), because they have high chances of consecutive esotropia for near (when surgery is for distance deviation) or residual exotropia for distance (when surgery is for near deviation). Lateral rectus recession with posterior fixation sutures may be theoretically possible for correction of such cases. However, posterior fixation procedure on the lateral rectus muscle is technically difficult or inefficient.[2-4] An alternative surgical option would be a combined recession-resection procedure on the lateral rectus. This procedure was first described by Scott,[5] who operated on 3 patients with horizontal gaze incomitance with good results. Other studies[3,4,6] have also evaluated the effectiveness of this procedure in patients with incomitant strabismus and have shown a significant decrease in the amount of measured incomitance. Ramasamy and colleagues[7] and Somer and colleagues[8] performed the surgery on convergence excess esotropic patients and obtained good outcomes. The current study aimed to evaluate the effect of combined resection and recession of single (same) lateral rectus muscle (CRRSM) on primary near deviation, distance deviation, and near–distance disparity in patients with true divergence excess sensory exotropia.

Subjects and Methods

This was a prospective, interventional, nonrandomized study approved by the AIIMS Institutional Ethics Committee. Patients were recruited for this study from the strabismus clinic at Dr. Rajendra Prasad Centre for Ophthalmic Sciences, AIIMS, New Delhi, between December 2016 and May 2018. All patients had

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Table 1. Patient data, preoperative exodeviation, surgical data, and postoperative results

			Preoperative deviation, PD			LR surgery, mm			Postoperative, 3 months		
									Deviation, PD		
Group	Patient	Age/sex	Distance	Near	NDD, PD	Rec	Res	MR res, mm	Distance	Near	NDD, PD
LR	1	20/F	35	18	17	7	3.5	—	8	−2[a]	10
	2	24/M	40	20	20	9	4.5	—	8	2	6
	3	18/M	35	18	17	9	4.5	—	12	6	6
	4	40/M	40	20	20	9	4.5	—	6	2	4
	5	20/F	35	10	25	10	5	—	8	4	4
	6	20/F	35	16	19	7	3.5	—	10	2	8
	7	24/F	30	12	18	9	4.5	—	6	4	2
LR + MR	8	30/M	60	30	30	12	6	5	35	20	15
	9	18/F	80	45	35	9	4.5	6	10	2	8
	10	26/F	70	45	25	9	4.5	6	6	2	4
	11	18/F	50	20	30	8	4	5	6	2	4

LR, lateral rectus; *MR*, medial rectus; *NDD*, near distance disparity; *PD*, prism diopter; *Rec*, recession; *Res*, resection.
[a]All deviations are exodeviations except this which is esodeviation.

constant sensory exotropia with NDD, with distance deviation exceeding near deviation by at least 15^{Δ}. Patients with previous ocular surgeries and children <5 years of age were excluded. Informed consent was obtained from all patients. All subjects underwent a detailed examination, including clinical history, general examination, and ocular examination. Orthoptic evaluation included refraction, assessment of ocular movements, measurement of near and distance deviation using prism bars (after proper refractive correction), calculation of the accommodative convergence–accommodation ratio and evaluation of sensory status. The NDD was calculated as the difference between distance and near deviation.

The amount of lateral rectus recession was planned according to the measured distance deviation, near deviation, and the NDD. The amount of lateral rectus recession was (x + y), where lateral rectus resection (x) was based on the NDD and (y) was based on the near exodeviation. In our cases, because the near deviation and the NDD were the same, the amount of lateral rectus resection was exactly half the amount of recession. These patients underwent CRRSM on the lateral rectus only (LR group). Patients in whom there was a deviation of $>40^{\Delta}$ for distance additionally underwent ipsilateral medial rectus resection (LR + MR group). All patients were operated on by a single surgeon (PS).

Surgical Technique

A peribulbar block was administered to the deviating eye prior to surgery. With a conjunctival fornix incision made, the lateral rectus was identified, hooked, and freed from the surrounding soft tissues then secured with 6-0 polyglactin 910 sutures and resected. The resected muscle was then reinserted at the desired recession site (as far behind the original insertion as the amount of recession planned) using nonadjustable sutures. In the LR + MR group additional ipsilateral medial rectus resection was performed at the same operative session.

Follow-up evaluations of ocular movements, near and distance deviations, and NDD occurred at 1 week, 1 month, and 3 months. A residual or consecutive deviation of up to 10^{Δ} with NDD of $<10^{\Delta}$ was considered surgical success. Statistical analysis was performed using SPSS 20 (IBM, Armonk, NY). The Wilcoxon signed-rank test was performed to compare pre- and postoperative deviations.

Results

A total of 11 patients (7 females) with sensory exotropia were included (Table 1). Mean patient age was 23.5 (range, 18-40 years). The normal eye had a mean visual acuity of 0.00 logMAR (20/20 Snellen); the abnormal eye, 1.2 ± 0.4 logMAR (20/300).

The LR group included 7 patients. Mean preoperative deviation at distance was $35.7^{\Delta} \pm 3.5^{\Delta}$ (range, 30^{Δ}-40^{Δ}); at near, $16.3^{\Delta} \pm 3.9^{\Delta}$ (range, 10^{Δ}-20^{Δ}). The mean NDD was $11.4^{\Delta} \pm 2.7^{\Delta}$ (17^{Δ}-25^{Δ}). The mean lateral rectus recession was 8.6 ± 1.1 mm; the mean resection, 4.3 ± 0.5 mm. One week postoperatively, the mean deviation at distance was $8.6^{\Delta} \pm 1.9^{\Delta}$ (range, 6^{Δ}-12^{Δ}); at near, $2.6 \pm 1.5^{\Delta}$ (range, 2^{Δ}-6^{Δ}; $P = 0.01$). The NDD had decreased to $6.6^{\Delta} \pm 1.9^{\Delta}$ (range, 4^{Δ}-10^{Δ}; $P = 0.01$). At 3 months, mean deviation at distance was $8.3^{\Delta} \pm 2.1^{\Delta}$ (range, 6^{Δ}-12^{Δ}); at near, $3.1^{\Delta} \pm 1.6^{\Delta}$ (range, $+2^{\Delta}$-6^{Δ}; $P = 0.01$). The NDD was $5.7^{\Delta} \pm 2.7^{\Delta}$ (range, 2^{Δ}-10^{Δ}; $P = 0.01$).

The LR + MR group included 4 patients. The mean preoperative deviation at distance was $65.0^{\Delta} \pm 12.9^{\Delta}$ (range, 50^{Δ}-80^{Δ}); at near, $35.0^{\Delta} \pm 12.2^{\Delta}$ (range, 20^{Δ}-45^{Δ}). The mean NDD was $30.0^{\Delta} \pm 4.0^{\Delta}$ (25^{Δ}-35^{Δ}). The mean lateral rectus recession was 9.5 ± 1.8 mm; mean resection, 4.8 ± 0.8 mm. The mean medial rectus resection was 5.5 ± 0.6 mm. One week postoperatively, mean deviation at distance was $15.0^{\Delta} \pm 10.5^{\Delta}$ (range, 6-30^{Δ}); at near, $7.5 \pm 8.4^{\Delta}$ (range, 2^{Δ}-20^{Δ}; $P = 0.06$). The NDD had decreased to $7.5^{\Delta} \pm 4.4^{\Delta}$ (range, 2^{Δ}-12^{Δ}; $P = 0.06$). At 3 months, the mean deviation at distance was $14.0^{\Delta} \pm 10.9^{\Delta}$ (range, 6^{Δ}-35^{Δ}); at near, $7.0 \pm 8.7^{\Delta}$ (range, $+2^{\Delta}$-20^{Δ}; $P = 0.06$). The NDD was $7^{\Delta} \pm 3.8^{\Delta}$ (range, 4^{Δ}-15^{Δ}; $P = 0.06$).

At 3 months, 9 of the 11 patients (82%) had successful correction of distance deviation, with residual exotropia

of $\leq 10^{\Delta}$. One patient (patient 3) had a residual exotropia of 12^{Δ} for distance; another (patient 8) had a residual exotropia of 35^{Δ} for distance.

Ten patients (91%) had acceptable results for near deviation; of these, 9 patients had a residual exotropia of $<10^{\Delta}$ of and 1 had a consecutive esotropia of 2^{Δ}. Patient 8 had residual exotropia of 20^{Δ} for near.

Ten patients (91%) had NDD of $\leq 10^{\Delta}$; patient 8 showed an NDD of 15^{Δ}.

Discussion

Management of true divergence excess exotropia is challenging. One surgical option is lateral rectus muscle recession along with posterior fixation suture, which may help correct the primary deviation and collapse the NDD. However, the surgery can be challenging because of difficulty in access and exposure, thin posterior sclera, and placement of the sutures far posterior close to the macula. Additionally, reoperation can be difficult because the part of the muscle anterior to the posterior fixation suture often undergoes fibrosis.[2] This surgery is also often ineffective when performed on the lateral rectus muscle because of its large arc of contact with the sclera.[3,4] Moreover, the procedure does not permit postoperative adjustment, if required.

A combined recession-resection procedure on the lateral rectus muscle may be more effective in patients with divergence excess exotropia. This technique, which creates a posterior fixation effect without the placement of posterior sutures, was first described by Scott.[5] Whereas conventional recession surgery slackens and thus weakens the muscle, simultaneous recession and resection on a rectus muscle shortens the rotational lever arm without slackening the muscle; hence, it may work in the same way as a posterior fixation operation.[9]

Scott[5] reported good results using this technique in 3 patients with horizontal gaze incomitance.[5] Bock[3] studied reported use of this procedure in 12 patients with incomitant strabismus, with significant decrease in the amount of measured incomitance in 4 of 5 patients in whom adjustable sutures were used and 3 of 7 patients with permanent sutures. Thacker and colleagues[6] reported (retrospective) surgical results in 12 patients with incomitant strabismus and no diplopia in primary gaze but had diplopia in secondary gazes. All of them underwent combined resection and recession of the respective rectus muscles, with resection being half the amount of recession. They noted successful correction of diplopia in 11 cases.[6] Roper-Hall and colleagues[4] also concluded that combined resection-recession of a single muscle reduced incomitance, with no significant effect on primary gaze. They suggested that this technique is more effective for the management of vertical deviations (which worsened on downgaze, with deviations of $<2^{\Delta}$ in the primary gaze) than for reducing horizontal incomitance.

CRRSM of the medial rectus muscle has been described as a surgical treatment for NDD in convergence excess esotropia to create a greater effect at near than at distance. Ramasamy and colleagues[7] performed the surgery on 5 patients with true convergence excess esotropia. Postoperatively 4 patients attained full binocular control at near and distance fixation; 1 patient with a consecutive exotropia underwent a second surgical procedure and regained binocularity. Somer and colleagues[8] also performed the procedure in 21 patients with convergence excess esotropia. Resection of 2.5 mm of the medial rectus muscles was combined with recession (based on the patient's near deviation), and an additional recession of 1 mm was performed on each rectus muscle. All patients had satisfactory ocular alignment for near and distance fixations, and the residual NDD was $<10^{\Delta}$.[8] It was assumed that the change in disparity or incomitance was due to the posterior fixation effect, owing to an alteration in the arc of contact.

Scott[5] recommended the use of large resections and small recessions in his study of combined resection-recession for horizontal incomitance. Bock and colleagues[3] and noted that the primary position was altered when resections were larger than recessions. Hence, they recommended recessions that were either equal to or larger than resections. In our study, the amount of lateral rectus recession was (x + y), where the amount of lateral rectus resection (x) was based on the NDD and (y) was based on the near exodeviation. When equal amounts of recession and resection are performed on the same muscle, the effect, which addresses the NDD, is similar to a posterior fixation on the muscle.[2] Further recession (y) corrects the primary deviation for near (which is equal to the remnant deviation for distance). Thus, the total amount of recession required would be x + y. If NDD is the same as near deviation, x = y and the lateral rectus recession becomes 2x. In all of our patients, because NDD was approximately equal to the near deviation, lateral rectus recession was 2x and the amount of LR resection (x) was thus half of the recession. We did not place adjustable sutures in any patients in our study, although that is possible and another advantage of this procedure to help improve the postoperative outcome.

Both groups in our study experienced significant clinical improvement in near deviation, distance deviation, and NDD. However, for the LR + MR group, the results were not statistically significant, probably because the study population was too small (4 patients), with a single patient with residual deviation (patient 8) skewing the results.

We encountered no complications of muscle loss, scleral perforation, or late overcorrections. None of our patients had abduction deficit in the operated eye. Patient 8 had a residual distance and near deviation, but the NDD had reduced significantly. He was offered surgery for the other eye, but he was satisfied with the cosmetic results and declined further surgery. This technique may require longer operation time, because the same muscle is both resected and recessed) and may cause more edema and congestion compared to conventional surgeries. Finally, our study is limited by lack of a control group, the small sample size, and the short follow-up period.

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