

# Vertical rectus muscle recession versus combined vertical and horizontal rectus muscle recession in patients with thyroid eye disease and hypotropia

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<b>PURPOSE</b>	To compare the postoperative vertical drift in patients with thyroid eye disease (TED) with hypotropia who underwent vertical rectus recession alone versus vertical rectus recession combined with horizontal rectus recession.
<b>METHODS</b>	The medical records of patients with TED who underwent strabismus surgery for hypotropia between 2006 and 2015 were reviewed retrospectively. Patients were divided into two groups: group 1 underwent vertical rectus recession only; group 2 underwent vertical rectus recession plus horizontal rectus recession. Data collection included pre- and postoperative deviation measurements and amount of surgical recession performed. The amount of postoperative vertical drift between groups was compared.
<b>RESULTS</b>	Of 67 patients who underwent surgery during the study period, 18 met inclusion criteria, 9 in each group. Mean postoperative hypotropia was 24.2 <sup>Δ</sup> in group 1 and 24.5 <sup>Δ</sup> in group 2 ( $P = 0.82$ ). Mean vertical deviations were 0.3 <sup>Δ</sup> and -2.2 <sup>Δ</sup> ( $P = 0.134$ ) on postoperative day 1; -0.9 <sup>Δ</sup> and -8.0 <sup>Δ</sup> ( $P = 0.043$ ) at final follow-up for groups 1 and 2. Mean postoperative vertical drift toward hypertropia was 1.2 <sup>Δ</sup> in group 1 and 6.8 <sup>Δ</sup> in group 2 ( $P = 0.048$ ). The surgical success rate for group 1 was superior to that for group 2 (89% vs 67% [ $P = 0.024$ ]).
<b>CONCLUSIONS</b>	There was a significantly larger postoperative vertical drift in TED patients with hypotropia who had combined vertical rectus and horizontal rectus recessions compared with those who underwent vertical rectus recession alone. (J AAPOS 2018; ■:1-5)

**T**hyroid eye disease (TED) is an autoimmune condition characterized by an acute inflammatory phase followed by a chronic fibrotic phase, which leads to restricted eye movements and diplopia.<sup>1</sup> The inferior rectus muscle is the most commonly affected muscle, followed by the medial and superior rectus muscles.<sup>1,2</sup> Late overcorrection following inferior rectus muscle recession is a well-known occurrence in TED patients with hypotropia.<sup>3</sup> However, the effects of operating on multiple muscles at the time of inferior rectus recession are not well understood.<sup>3</sup> The current study investigated TED patients who underwent vertical rectus recession to

correct hypotropia and compared the results to those in patients who also underwent simultaneous horizontal rectus recession to correct horizontal strabismus to quantify postoperative alignment changes and dose-response behaviors in both groups of patients.

## Subjects and Methods

This study was approved by the Institutional Review Board of Massachusetts Eye and Ear Infirmary, Harvard Medical School. The medical records of patients with TED who underwent surgical treatment for hypotropia between July 2006 and May 2015 were reviewed retrospectively. TED was diagnosed by clinical symptoms and findings and, in most cases, by orbital imaging. Preoperatively, all patients demonstrated stable thyroid disease activity, and the status of their deviations had remained stable for at least 6 months. The indication for surgery was the presence of diplopia in primary position of gaze.

Patients were included if inferior rectus recession or inferior rectus recession plus contralateral superior rectus recession was performed to correct hypotropia in the primary position. Patients were excluded if they had a history of previous strabismus surgery, concomitant ophthalmological problems other than TED, or if postoperative follow-up occurred <3 months postoperatively. Informed consent was obtained from all patients prior to surgery.

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Patients were divided into two groups: group 1 consisted of patients who underwent inferior rectus recession to correct hypotropia; group 2, of patients who underwent inferior rectus recession and concurrent horizontal rectus recession to correct hypotropia with concomitant horizontal strabismus. Patients were also included if their procedure occurred in conjunction with contralateral superior rectus recession. Data collection included age at diagnosis, sex, length of follow-up, pre- and postoperative deviation in primary and cardinal positions of gaze, and amount of surgical recession. The amount of corrected hypotropia in primary position, the magnitude of postoperative vertical drift, and the surgical success rate were analyzed and compared between groups.

Inferior rectus recession with or without contralateral superior rectus recession according to the amount of preoperative vertical deviation present in the primary position was performed to correct hypotropia and symptomatic diplopia of TED patients. Specifically, patients with hypotropia of  $<15^\Delta$  underwent adjustable inferior rectus recession on the hypotropic eye, and patients with hypotropia of  $\geq 15^\Delta$  underwent nonadjustable inferior rectus recession on the hypotropic eye and adjustable superior rectus recession on the contralateral eye. In hypotropic TED patients with concurrent horizontal strabismus, either lateral rectus recession or medial rectus recession (determined based on the deviation angles in the patient) was added to the above-mentioned procedures. Polyglactin 910 suture used in recession surgery. The amount of recession of the inferior rectus muscle was based on the expectation that vertical deviation in primary position would be reduced by approximately  $3^\Delta$  per mm of recession; adjustable sutures were used on the inferior rectus muscle when possible. Postoperative adjustments were performed on the day of surgery with the goal of achieving orthophoria in primary and reading positions. The following postoperative outcome parameters were compared between groups: vertical deviation in primary position measured as the amount of postoperative hypotropia, the amount of corrected hypotropia, and postoperative drift. Surgical success was defined as vertical deviation of  $<5^\Delta$  at distance in primary position at the last follow-up examination. Postoperative overcorrection was defined  $\geq 5^\Delta$  of hypertropia of the operated globe in the primary position at final follow-up.

Statistical analyses were performed using SPSS version 18.0 (SPSS Inc, Chicago, IL). The Wilcoxon signed ranks test was used to compare pre- and postoperative data. The Mann-Whitney U and the Fisher exact tests were used for comparisons between the two groups. *P* values of  $<0.05$  were considered statistically significant.

## Results

Of the 67 patients who underwent surgery during the study period, 18 (12 females) met inclusion criteria: 9 in group 1 and 9 in group 2. Clinical findings are shown in Table 1. The mean age at surgery was 64.3 years in group 1 and 58.7 years in group 2. There were no significant differences in mean preoperative hypotropia in primary position between the groups 1 and 2 ( $24.2^\Delta$  and  $24.4^\Delta$ , resp. [ $P = 0.82$ ]). In addition, there was a signifi-

Table 1. Demographics of patients undergoing vertical muscle recession only (group 1) and vertical muscle recession plus horizontal muscle recession (group 2)

	Group 1	Group 2	<i>P</i> value
Number of patients	9	9	
Sex (male:female)	3:6	3:6	1.00 <sup>b</sup>
Mean age at surgery, years	64.3	58.7	0.59 <sup>c</sup>
Preoperative deviation, <sup>a</sup> PD, mean $\pm$ SD			
Hypotropia	24.2 $\pm$ 7.2	24.4 $\pm$ 6.6	0.82 <sup>c</sup>
Horizontal deviation	0.3 $\pm$ 3.2	ET (n = 6) 15.2 $\pm$ 4.6 XT (n = 3) 29.0 $\pm$ 29.5	
Follow-up, months	4.3	4.8	0.76 <sup>c</sup>

ET, esotropia; PD, prism diopter; SD, standard deviation; XT, exotropia.

<sup>a</sup>In primary position.

<sup>b</sup>Fisher exact test.

<sup>c</sup>Mann-Whitney *U* test.

Table 2. Average amount of vertical rectus recession and surgeries performed to correct hypotropia in patients with thyroid eye disease (TED) in group 1 and group 2<sup>a</sup>

Group 1	Recession, mm		Group 2	Recession, mm	
	SR	IR		SR	IR
IR recess (n = 2)		3.5	IR recess + LR recess (n = 1)		5.0
SR+IR recess (n = 7)	3.2	3.7	SR+IR+LR recess (n = 2)	3.5	4.0
			SR+IR+MR recess (n = 6)	3.7	3.8

IR, inferior rectus muscle; LR, lateral rectus muscle; MR, medial rectus muscle; SR, superior rectus muscle.

<sup>a</sup>Two patients of group 1 and 1 patient of group 2 underwent IR recession on absorbable adjustable sutures; the rest underwent SR recession on absorbable adjustable sutures to correct hypotropia.

cant difference in mean preoperative horizontal deviations in the primary position between the groups ( $0.3^\Delta$  in group 1 and  $15.2^\Delta$  of esotropia and  $29.0^\Delta$  of exotropia in group 2 [ $P < 0.000$ ]). There was no significant difference between groups in duration of follow-up ( $P = 0.76$ ).

Table 2 shows the average amount of vertical rectus recession and the surgeries performed to correct hypotropia in TED patients. In group 1, 2 patients underwent inferior rectus recession with a mean amount of inferior rectus recession of 3.5 mm, and 7 patients underwent inferior rectus recession plus contralateral superior rectus recession with mean amounts of inferior rectus and superior rectus recession of 3.7 mm and 3.2 mm, respectively. In group 2, 1 patient with combined exotropia underwent an inferior rectus recession of 5.0 mm, 2 patients with combined exotropia underwent inferior rectus recession plus contralateral superior rectus recession with mean amounts of inferior rectus and superior rectus recessions that were 4.0 mm and 3.5 mm, respectively. Finally, 6 patients with combined esotropia underwent inferior rectus recession

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