

Combined Recession–Resection of The Superior Rectus Muscle in the Treatment of Dissociated Vertical Deviation.

Hala Kamal Mattout (✉ utopia4881@hotmail.com)

Zagazig University Faculty of Human Medicine <https://orcid.org/0000-0003-4809-6745>

Sameh Mosaad Fouda

Zagazig University Faculty of Human Medicine

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Abstract

Purpose

This is retrospective study that evaluates the use of combined recession-resection of the superior rectus muscle in the treatment of dissociated vertical deviation (DVD)

Methods

The medical records of 21 patients with bilateral DVD were retrospectively reviewed. Preoperative data were extracted for age, gender, BCVA (logMAR), amblyopia, angle of stereopsis, previous strabismus surgeries and angle of deviation. All included patients received resection of 2.5 mm of the superior rectus muscle prior to its recession in an amount determined by the maximum DVD angle. The main outcome measure was postoperative angle of DVD at the end of six postoperative months and success was identified as absence of manifest DVD .

Results

The mean angle of preoperative DVD was 18.09 PD in the right eye and 16.76 PD in the left eye. The mean amount of SR recession was 8.9 ± 1.4 mm in the right eye and 8.7 ± 1.5 in the left eye with symmetrical surgery performed in only 7 patients. Mean postoperative angle of DVD was 5.96 in the right eye and 5.86 in the left eye. Surgical success was achieved in 15 patients (71%).

Conclusions

Combined recession-resection of the superior rectus muscle seems to be an effective technique in the management of DVD and could represent a good alternative to other surgical procedures.

Introduction

Dissociated vertical deviation (DVD) is a unique motility disorder that violates Hering's law of equal innervation of yoke muscles; it is described as a simultaneous upward deviation, extorsion and lateral deviation of the non-fixing eye, the condition is usually bilateral but asymmetrical (1, 2).

Different theories were suggested to explain DVD including vertical muscle imbalance, vestibular dysfunction, supranuclear input abnormalities and nystagmus blockage syndrome (3, 4, 5). However, the common finding in most cases of DVD is marked binocular vision disturbance in early childhood that usually results from other types of associated motility disorder such as latent nystagmus, infantile esotropia or exotropia (6, 7, 8).

Various surgical strategies were adopted to correct DVD with varying success rate; including large superior rectus recession, inferior oblique weakening procedures, inferior rectus strengthening procedures and superior rectus posterior fixation sutures alone or combined with superior rectus recession. The presence of such variable surgical approaches indicates that no fully satisfactory result could be obtained from any of the recommended operations alone (9, 10, 11, 12, 13).

Combined recession-resection of the rectus muscle is a technique that involves resection of part of the muscle followed by its recession to an amount "equal to or greater than" the amount of resection to simulate the effect of posterior fixation suture in addressing incomitance by selectively weakening the muscle in its field of action without affecting the primary gaze (14, 15) .

In this retrospective study, we report our experience with the combined recession-resection of the superior rectus muscle in patients with DVD.

Patients And Methods:

A retrospective review of medical records was performed to identify all patients diagnosed with dissociated vertical deviation and treated with combined recession-resection of the superior rectus muscle. A total of 21 patients were identified in the period between 2016 and 2020 in Delta Eye Hospital in Egypt, our exclusion criteria were previous surgeries on the superior rectus muscle, simultaneous surgery on other muscles, oblique muscle dysfunction and incomplete follow-up. Sufficient follow-up was defined as attending a follow-up visit at least 6 months following the procedure. The study was carried out in accordance with the tenets of the Declaration of Helsinki of 1964, as revised in 2013 and an informed consent was obtained from all patients or their guardians before the procedure.

Preoperative data that were collected from patients records included cycloplegic refraction, best corrected visual acuity measurement (BCVA), ocular motility examination and history of previous strabismus surgeries if present. The angle of deviation was measured using a prism cover test with base-down prism held in front of the non-fixing (covered) eye with patient looking at distance and wearing his best optical correction ; the degree of DVD is determined by the prism power at which the downward refixation movement is neutralized. DVD was considered asymmetrical when there was more than 10 PD difference in DVD measurement between both eyes. The preoperative angle of stereopsis was measured using Titmus fly test.

All surgeries were performed under general anaesthesia using the standard limbal incision approach, 2.5 mm from the insertion end of the superior rectus muscle were resected first by the conventional resection technique then the muscle is recessed by an amount exceeding the resection using fixed scleral sutures. The amount of recession was calculated based on the maximum deviation angle as shown in the established nomogram previously used by Tibrewal et al (16) and presented in table 1. Bilateral surgery was performed in all patients using either symmetrical or asymmetrical amounts of recession according to the pre-existing deviation angle.

Table (1): Amount of SR recession performed for different grades of DVD (16)

DVD in PD	Amount of SR recession in mm
<10	6.0
11–15	8.0
16–20	9.0
>20	10.0

Final deviation was assessed at six months post-operatively and success was defined as absence of manifest DVD. However, any residual latent deviation was measured and the postoperative motor outcome was graded according to the residual deviation angle as measured by prism cover test as excellent (0-4 PD), good (5-9 PD), fair (10-14 PD) and poor (>14 PD) (16, 17, 18)

The postoperative stereopsis was assessed by Titmus test at 6 months following the operation; significant change in stereopsis was defined as change of at least 2 octaves from the previous preoperative examination to overcome any test-retest variability (19).

Statistical analysis:

The collected data was entered to and analysed by computer using Statistical Package of Social Services, version 25 (SPSS) (IBM, 2017).

Mean, median, standard deviation, and range were used for quantitative data summarization. For qualitative data summarization and analysis; number and percentage were used.

IBM. (2017). IBM SPSS Statistics for Windows, Version 25. Armonk, NY: IBM Corp. <http://www-01.ibm.com/support/docview.wss?uid=swg27049428>

Results:

Bilateral combined recession resection of the superior rectus muscle was performed in 21 patients (10 male and 11 female patients). The mean age at surgery was 14.2 year (range; 8–28). The mean BCVA was 0.32 logMAR (range, 0–1) in the right eye and 0.31 logMAR (range, 0–1) in the left eye. Amblyopia was seen in 12 patients (57 %) at the time of surgery and 14 patients (67 %) had history of previous strabismus surgeries for correction of either exotropia (6 patients) or esotropia (8 patients). Only 5 patients (29 %) had demonstrated bifoveal fixation and the remaining patients had only gross stereopsis or no detectable stereopsis at all. The mean angle of preoperative DVD was 18.09 PD in the right eye and 16.76 PD in the left eye. Table 2 shows the preoperative data of the patients included in the study.

Table 2
Preoperative data of the patients

Age	Mean: 14.2 ± 6.3 year (range: 8–28)
Gender (M:F ratio)	(10:11)
BCVA OD	Mean = 0.3 (median = 0.2, range:0–1)
BCVA OS	Mean = 0.3(median = 0.2, range:0–1)
Presence of amblyopia	57%
Previous strabismus surgeries	67%
Preoperative stereopsis	43% lost stereopsis 33% gross stereopsis 24% bifoveal
DVD OD in PD	18.09 ± 6.1 PD (median = 20, range:8–25)
DVD OS in PD	16.76 ± 5.1 PD (median = 18, range:6–25)

The mean amount of SR recession was 8.9 ± 1.4 mm in the right eye and 8.7 ± 1.5 in the left eye with symmetrical surgery performed in only 7 patients (33 %). The mean postoperative DVD ranged from 0 to 10 PD in the right eye (mean = 5.96 ± 3.2) and 2 to 12 in the left eye (mean = 5.86 ± 3.5) with no change in stereopsis in any of the patients included in the study. The surgical outcomes after 6 postoperative months are summarized in table 3 with surgical success (absence of manifest DVD) seen in 15 patients (71%)

Table 3. The surgical outcomes after 6 postoperative months are summarized in table 3 with surgical success (absence of manifest DVD) seen in 15 patients (71%)

Postoperative motor outcome	OD (21 eyes)	OS(21 eyes)	Total (42 eyes)
Excellent (latent DVD 0–4 PD)	12 (57%)	11(52%)	23(55%)
Good (latent DVD 5–9 PD)	6 (29%)	7 (33%)	13(31%)
Fair (latent DVD 10–14 PD)	3 (14%)	2(10%)	5 (12%)
Poor(latent DVD > 14 PD)	0	1 (5%)	1 (2%)
Success (Absence of manifest DVD)	15 (71%)	15 (71%)	30 (71%)

Discussion:

Combined recession-resection is a technique that was first described by Scott AB (1994) in combination with adjustable sutures to correct horizontal incomitant strabismus (14). The technique was further

modified and investigated by many surgeons who used it to correct both horizontal and vertical incomitance with promising results (15, 21–26)

This technique acts in variable suggested ways, one mechanism is by changing the functional insertion of the muscle after rendering part of it inactive by resecting it, another proposed mechanism is anterior displacement of the orbital layer of the muscle's pulley thus establishing a new relation between the recessed insertion and the anteriorly displaced pulley (20, 21). One possible explanation is extirpating the proprioceptive impulses at the myotendinous junction thus interrupting centrally driven incomitant motility disorders (22, 26)

Combined recession-resection of the superior rectus offers a relative advantage over the retro-equatorial posterior fixation sutures that require adequate posterior exposure -which could be challenging in some cases- with an increased risk of haemorrhage, muscle scarring, superior oblique injury and difficult reversibility (27). Moreover, it is theoretically advantageous over large recession of the superior rectus muscle which commonly results in incomitance manifested by correction of DVD in abduction more than in adduction which was not recorded in any of the patients in our study (28)

The main issue in the recession-resection procedure is finding a reproducible nomogram suitable for different indications, Scott originally performed a resection more than the recession (17). Thacker et al, Roper-Hall and Cruz performed a recession that was twice the amount of resection (21, 23). Nearly the same nomogram was adopted by Bhaskaran et al in correction of true divergence excess exotropia (29).

In cases of near-distance disparity esotropia, Fermont et al performed a recession (8mm) slightly exceeding the amount of resection (6mm) (30) while Ghali MA and Somer et al recommended resection of 2.5 mm combined with recession according to near angle (22, 26) We adopted a modification of this technique with resection of 2.5 mm combined with recession based on the angle of DVD using the established nomogram.

To our knowledge, this is the first study to evaluate the effect of combined recession –resection in cases of DVD. It was previously assumed that the effect of combined recession-resection is more pronounced when performed in the inferior and medial recti muscles (21), the results of our study support the effectiveness of this technique in the superior rectus muscle as well with a success reaching 71% which is comparable to the success rate obtained with superior rectus recession alone (ranging from 63 to 76%) (18, 31, 32) and to superior rectus recession combined with posterior fixation sutures that shows a success reaching 75% (33, 34). No complications were encountered in all patients apart from mild limitation of elevation – 1 (25%) in 2 patients in the early postoperative period which improved later on and was not associated by hypotropia in the primary position with no recorded intraoperative complications such as lost muscle nor scleral perforation.

The main limitations of our study are its retrospective design, relatively small number of cases and short follow-up period. Future prospective studies could add more to our experience in the use of combined

recession-resection for the correction of DVD regarding recommended surgical nomograms and comparing it to other procedures like posterior fixation suture with or without superior rectus recession.

Conclusion:

Surgical correction of DVD is left -to a large extent- to the surgeon's preference and experience as there is no widely recommended surgery for it. In our experience, combined recession-resection of the superior rectus muscle seems to be an effective technique and could represent a good alternative to other surgical procedures in selected cases.

Declarations

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*Conflicts of interests:

The authors have no conflicts of interest to declare that are relevant to the content of this article.

*Availability of data and materials:

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

*Ethics approval and consent to participate

- Informed consent was obtained from all patients or their guardians prior to surgical procedures
- The study was approved by the research ethics committee of Delta Hospital .

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