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Y-splitting with recession of lateral rectus versus lateral rectus recession in correcting upshoot in Duane retraction syndrome

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Abstract:

PURPOSE: To report the surgical effect in upshoot of Duane retraction syndrome (DRS) with corecession of horizontal rectus muscles with or without Y-splitting.

PATIENTS AND METHODS: A retrospective chart review of six patients of DRS received muscle surgeries for upshoot in adducted position was performed.

RESULTS: From 1994 to 2010, six Duane patients received muscle surgeries for upshoots of lesion eye in adduction. Their age of receiving surgery ranged from 5 to 41 years. Four of the patients were male, and five had their left eye involved. Three underwent recession of ipsilateral medial and lateral rectus (LR) muscles, and the other three also received Y-splitting of LR muscle when recession. One of the patients that received Y-splitting showed mild hypertropia at down gaze postoperatively, and another one had little improvement of exotropia at the primary position. All patients showed improvement of their upshoots and lid fissure narrowing in adduction as well as face turn.

CONCLUSION: Postoperative improvements in abnormal head posture and upshoots were achieved with corecession of horizontal muscles with or without Y-splitting. Although Y-splitting of the LR muscle is an effective surgery, it might cause undesired complications.

Keywords:

Duane syndrome, up/downshoot, Y-splitting

Introduction

Duane retraction syndrome (DRS) is a spectrum of complex strabismus with mechanical and innervational anomalies. It is now considered to be part of the broad category of congenital cranial dysinnervation disorders.^[1] DRS was classified by Huber into three types according to their clinical manifestations.^[2]

There are many schools of thought on the management of strabismus in DRS. The surgical indications include severe lid narrowing on adduction, up/downshoot on adduction, significant face turn, and concomitant strabismus.

The overshoot of the globe in adduction is believed to be the result of a bridle or leash effect caused by tight rectus muscles that slip over or under the globe as the eye adducts. Therefore, the surgical approaches include recession of the ipsilateral lateral and medial rectus muscles,^[3,4] posterior fixation suture of the ipsilateral lateral rectus (LR) muscle alone or both the lateral and medial rectus muscles, vertical rectus muscle recession,^[5] and inferior oblique myectomy.^[6] Jampolsky has described Y-splitting of the LR muscle with or without recession for the treatment of overshoots.^[7,8]

The aims of this study are to share our surgical experience in Duane's retraction

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syndrome and to report the adverse effects of Y-splitting of the LR muscle.

Patients and Methods

Medical records of DRS patients received surgeries for up/downshoot between 1994 and 2010 were retrospectively reviewed. Totally 6 patients were found. The surgical goals were to reduce severe lid fissure narrowing and up/downshoot on adduction and strabismus at forced primary position.

Three patients received ipsilateral medial and LR muscle recession. The other three patients received medial rectus recession and LR muscle recession with Y-splitting.

When Y-splitting of LR was performed, the LR muscle was split into upper and lower equal halves as far back as possible and then was reattached at upper and lower border of original insertion with recession [Figure 1].

All patients had no previous ocular surgery and were followed for 3 months and above. An improvement of up/downshoot is recorded from pre- and post-operative photos. The amount of deviation is measured with the prism needed to release diplopia when patients were in forced primary position or the prism needed to release face turn. The upshoots were measured on a 4-point scale: 1 indicating minimal upshoot and 4 indicating severe rotation of the globe that the cornea is not visible [Figure 2].

Results

The age of surgery varied from 5 to 41 years. Four of the patients were male.

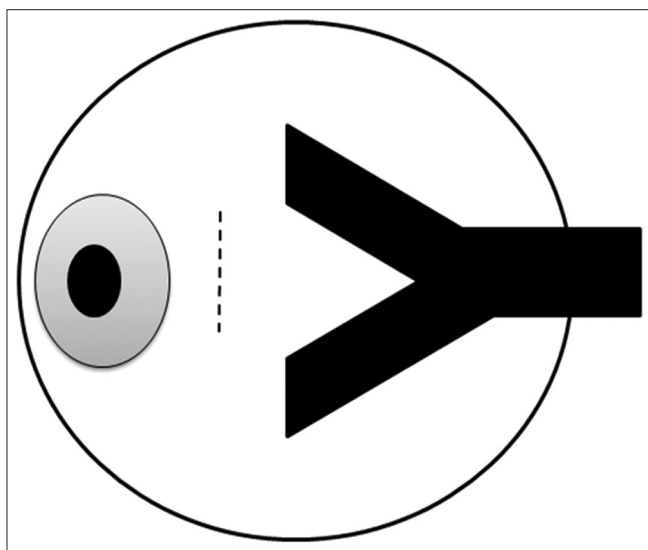


Figure 1: Schematic illustration of recession and Y-splitting of the lateral rectus muscle

Three of them were Type I, two were Type III, and one was Type II according to Huber's classification. Five of the six patients had their left eye involved [Table 1].

The severity of upshoots varied from scale one to four. None of them showed amblyopia, and good stereo acuity was noted in four of the five patients tested with Titmus charts. Three patients received ipsilateral medial and LR muscle recession. The other three patients received medial rectus recession and recession with Y-splitting of the LR muscle. The amount of recession was decided according to the preoperative appearance of face turn, upshoot and lid fissure narrowing, and the tightness of muscles found intraoperatively.

All patients showed improvement of upshoot and lid fissure narrowing as well as their face turn postoperatively. The upshoots improved one to three points according to our scale (average 1.83), which improved clinical appearance significantly [Figure 3]. However, one patient showed worsened adduction deficiency (Type III patient) and needed advancement of the recessed medial rectus. One of the patients received recession with Y-splitting of the LR showed mild hypertropia at down gaze but orthotropia at primary gaze [Table 2].

Table 1: Demographic character of patients before surgery

Age	Sex	Type	OD/OS	Visual acuity (OD/OS)	Up-shoot scale	Forced PP	Stereo
7	M	I	OS	1.0/1.0	2	6 pd XT	+
41	M	III	OS	1.0/1.0	4	40 pd XT	na
35	M	I	OS	1.0/1.0	1	6 pd ET	+
6	M	II	OD	0.8/0.9	4	20 pd XT	-
6	F	III	OS	1.0/1.0	3	10pd XT	+
5	F	I	OS	1.0/1.0	3	Orthotropia	+

PP = Primary position

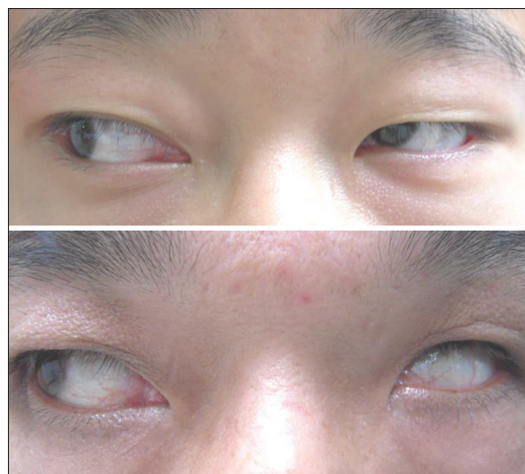


Figure 2: Upper: Case 1 showed grade 2 upshoot. Lower: Case 2 showed grade 4 upshoot



Figure 3: Case 4 in primary, right and left gaze. (a) First visit at 2 years old. (b) preoperative photos at 6 years of age. (c) One-week postoperative. (d) One year after surgery

Table 2: The surgical procedures and postoperative results

Surgery dose (mm)	Forced PP	Lid narrowing	Up –shoot (improved scale)	Undesired outcome
MR rec 4, LR rec 6 + Y-splitting	Orthotropia	Improved	1 (1)	-
MR rec 6, LR rec 9	14 pd XT	Improved	2 (2)	-
MR rec 5.5, LR rec 5.5	Orthotropia	Improved	0 (1)	-
MR rec 5, LR rec 8.5	Orthotropia	Improved	1 (3)	-
MR rec 4.5, LR rec 7.0 + Y-splitting	10 pd XT	Improved	1 (2)	Exotropia not improved
MR rec 4, LR rec 5.0 + Y-splitting	Orthotropia	Improved	1 (2)	Mild LH at downgaze

MR = Medial rectus muscle, LR = Lateral rectus muscle, Rec = Recession, pd = Prism diopter, PP = Primary position, XT = Exotropia, LH = Left hypertropia

Discussion

The goal of surgery in DRS patients is to reduce anomalous head posture, increase the range of binocular single vision, and reduce the lid change and globe shift on adduction. There have been many surgical suggestions for DRS. Some authors suggested bilateral medial or LR recession or unilateral recession and resection in DRS patients depending on whether they showed esotropia or exotropia at the primary position. However, there is still a lack of consensus about muscle resection in DRS patients. As for the improvement of abduction in Type I patients, transposition of the superior rectus muscle was reported by many authors showing good results.^[1,9-11]

Up- and down-shoot in DRS patients are believed to be due to cocontracture of the medial and LR muscles and a taut LR muscle.

Splitting of an LR muscle lessens lateral slippage of the muscle and recession reduces of torque.^[12] The effectiveness

of Y-splitting depends on the restriction created by each of the two arms of the Y. As the eye looks above the midline in adducted position, the upper arm of Y rotates over the globe and the lower arm of Y, placed under further tension, contracts and prevents the eye from slipping upward and vice versa. Hence, the bifurcation of the muscle halves balances their position as the eye adducts. When globe retraction is present and the LR muscle is tight, it is prudent to recess the LR muscle in addition to Y-splitting.^[1] Rao *et al.* published a good result in 10 patients treated with Y-splitting and LR recession (with medial rectus recession in 6 patients).^[7] Rogers and Bremer achieved marked decrease in up- and down-shoots in a series of 5 patients undergoing Y-splitting of LR muscle without recession.^[13] Sukhija *et al.* reported 7 patients treated with Y-splitting and recession versus 8 patients treated with anchoring of the LR muscles to the lateral palpebral ligament and showed comparative results.^[14]

In our series of 6 patients, we found significant improvement in head posture, primary position

deviations, lid fissure narrowing, and upshoot in all the patients.

The patients treated with Y-splitting and recession showed comparative results in all the parameters with the patients without Y-splitting. However, one of the patients treated with Y-splitting had hypertropia at down gaze postoperatively, and one showed little improvement in exotropia. The result of this study is limited by small patient size and a retrospective design. However, this study revealed that corecession of horizontal rectus muscles may be equally effective as corecession with Y-splitting of the LR muscle in reducing abnormal head position, lid fissure narrowing, and upshoots in Duane retraction patients, and most importantly, less complications.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

The authors have no conflicts of interest to declare.

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