

DISSOCIATED VERTICAL DEVIATION

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Dissociated vertical deviation (DVD) is an ocular motility disorder of unknown etiology characterized by elevation, abduction, and excyclo-torsion. Both eyes are usually affected but the involvement is often asymmetric. DVD may present as a phoria, an intermittent tropia, or a constant tropia. It occurs in early childhood and is almost always associated with a horizontal strabismus.

Several factors must be considered before surgically correcting a DVD. Because the treatment may be different, DVD should be distinguished from other types of vertical deviations. The most useful clinical feature is the absence of a corresponding hypotropia in the contralateral eye on an alternate cover test. All "true" vertical deviations follow Hering's Law and demonstrate a corresponding hypotropia of the contralateral eye.

Overaction of the inferior oblique muscle is characterized by hypertropia in adduction and is commonly confused with DVD. The distinction between these conditions is further complicated because they often occur together. Comitancy of the vertical deviation and the lack of a V pattern strongly support the diagnosis of a DVD.

The size of the DVD is a useful guide in determining the amount of muscle surgery that is required. DVDs can be measured by placing a base-down prism and an occluder over the eye with the DVD while the patient is fixating with the contralateral eye. The occluder is moved from the DVD eye to the fixing eye. The amount of prism required to neutralize the downward movement of the DVD eye as it picks up fixation is noted.

Indications and Contraindications

The primary indication for surgical correction of a DVD is an abnormal ocular appearance that disturbs the patient or, in the case of a child, the patient's family. The need for surgery therefore depends on the size of the deviation, the frequency of occurrence of the deviation, and the patient's or family's perception of the severity of the problem. A less common indication for DVD surgery is the presence of ocular symptoms. Rarely, a patient will complain of visual disturbances such as eye strain or a pulling sensation when the DVD is manifest. Another still rarer indication for treatment may be when the DVD is an impediment to fusion.

The possible risks of surgery for DVD should be balanced against the anticipated benefits. Absolute contraindications to surgery for this condition are the same as for all strabismus surgeries and include the presence of any medical problem that places the patient at significant anesthetic risk of morbidity or mortality. Previous ocular surgery for strabismus, retinal detachment or glaucoma, or past ocular trauma may make DVD surgery impossible without creating a serious risk to the eye. Another possible contraindication is when DVD occurs in association with other complex strabismus disorders. True vertical deviations, paretic and restrictive disorders, and previous muscle surgery all make the assessment and treatment of DVD more difficult. In some cases, it may be better to first correct these conditions and treat the DVD later if necessary.

Surgical Techniques

In my experience, the best surgical treatment for DVD is a moderate to large recession of the superior rectus muscle or muscles. The amount of the muscle recession is determined by the size of the DVD and whether it is manifest in one or both eyes. For unilateral DVD, the recession varies between 5 and 10 mm from the muscle insertion. For bilateral DVD, the superior recti

TABLE 35-1
Superior Rectus Recessions

DVD (Prism Diopters)	Unilateral Recession (mm)	Bilateral Recession (mm)
<10	5	8
10-14	7	9
15-19	8	10
20-25	9	11
>25	10	12

are both recessed between 8 and 12 mm with slight variations depending upon the asymmetry of the condition (Table 35-1).

The type of anesthesia is no different from that employed for other strabismus operations. Topical, local, or general anesthesia may be used, depending upon the patient, the surgeon, and the facilities available. I do not use topical anesthesia for DVD surgery; in my experience, topical anesthesia does not provide sufficient pain relief for this procedure and additional anesthesia is usually required. Local anesthesia in the form of a retrobulbar or peribulbar injection of mepivacaine (2%) or lidocaine (2%) can be used. A supplemental injection in the superior orbit may be necessary with this technique. I prefer general anesthesia for DVD surgery. Newer anesthetic agents such as propofol offer a short recovery time with fewer side effects than most inhalation agents.¹

The surgeon orients the eye by assessing the configuration of the limbus and the anterior ciliary vessels. If there is any doubt, evaluation of the retina for landmarks is helpful.

I usually perform a limbal incision for DVD surgery, although a fornix incision is equally suitable if the surgeon and assistant are experienced in this technique. The limbal incision is approximately three clock hours in length with relaxing incisions at each end. This is slightly wider than for a horizontal muscle to accommodate the increased width of the superior rectus insertion. The superior rectus muscle is exposed with blunt and sharp dissection. Scissors are used to bluntly open the superior temporal and nasal quadrants, and the muscle is isolated on a muscle hook. It is often necessary to pass a second muscle hook in order to confirm that the superior oblique tendon is not entrapped. The intermuscular septum is elevated with two muscle hooks and cut near the border of the muscle (Fig. 35-1). Care is taken to avoid cutting the superior oblique tendon. It is important to sever the fascial attachments between the superior rectus and levator palpebrae muscle as far posteriorly as possible. This can best be accomplished by using two muscle hooks for traction or by removing the lid speculum and using a Desmarres retractor (Fig. 35-2). It is also necessary to cut the attachments between the superior rectus and superior oblique tendons. Otherwise, these may prevent the rectus muscle from being recessed the desired amount (Fig. 35-3).

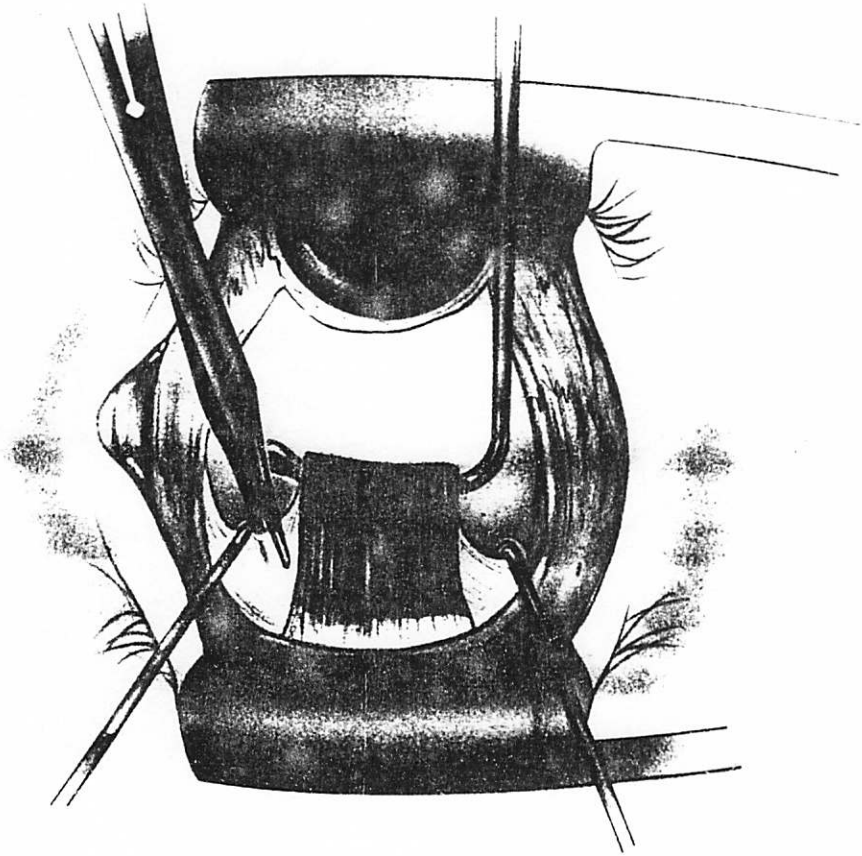
A double-armed 6-0 polyglactin suture with spatulated needles is passed through the muscle tendon, approximately 0.5 mm from the globe, with full-thickness lock bites at each edge. Each lock bite incorporates approximately one-fourth of the muscle tendon (Fig. 35-4). The muscle is excised from the sclera with scissors. The technique for resuturing the muscle to the globe depends on the amount of muscle recession. If the recession is 7 mm or less, the preplaced muscle sutures are reattached and tied to the sclera at the new muscle insertion site. If the recession is greater than 7 mm, the sutures are reattached at the original insertion and allowed to "hang back" to achieve the desired amount of recession. Each arm of the suture is passed through a scleral tunnel approximately 4 mm in length with the needles exiting 1 mm apart. The suture ends are tied together (Fig. 35-5).

The conjunctival flap is pulled up to within 1 to 2 mm from the limbus and closed at each corner of the peritomy with an interrupted 7-0 chromic collagen suture. The relaxing incision may be closed with additional sutures if necessary (Fig. 35-6).

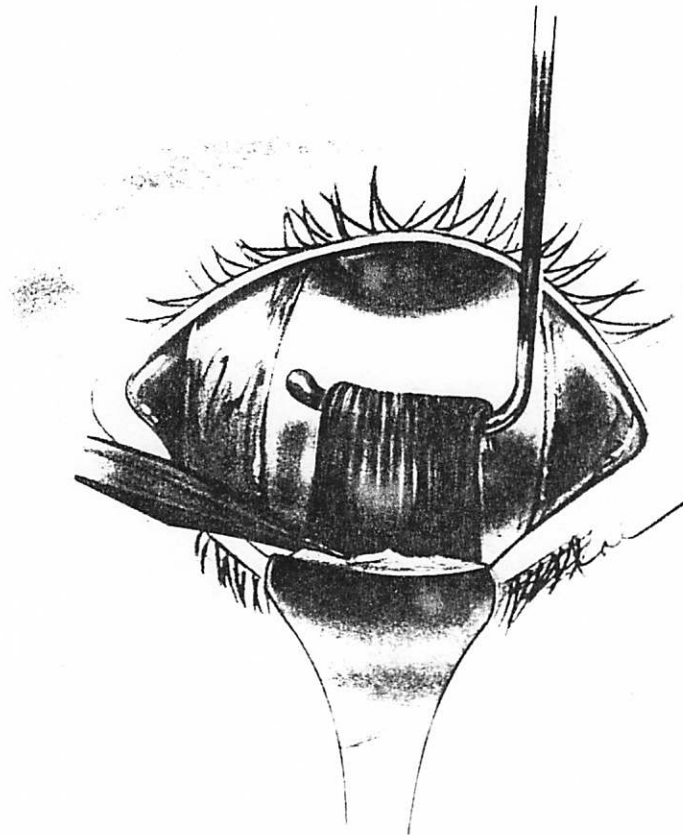
After the eyelid speculum is removed, a topical steroid and antibiotic ointment is applied to the eye. An eye patch is not necessary unless there is excessive bleeding. In the recovery room, the patient's head is elevated 30° and ice is applied over the eye. This regimen is continued at home through the first postoperative day.

Fig. 35-1.

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 Surgeon's view of right eye. Following a limbal incision, the superior rectus muscle is isolated on a muscle hook. The intermuscular septum is elevated with two Stevens muscle hooks and cut near the border of the muscle.

**Fig. 35-2.**

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 The lid speculum has been removed and replaced with a Desmarres retractor. The fascial attachments between the superior rectus and levator palpebrae muscle are severed.



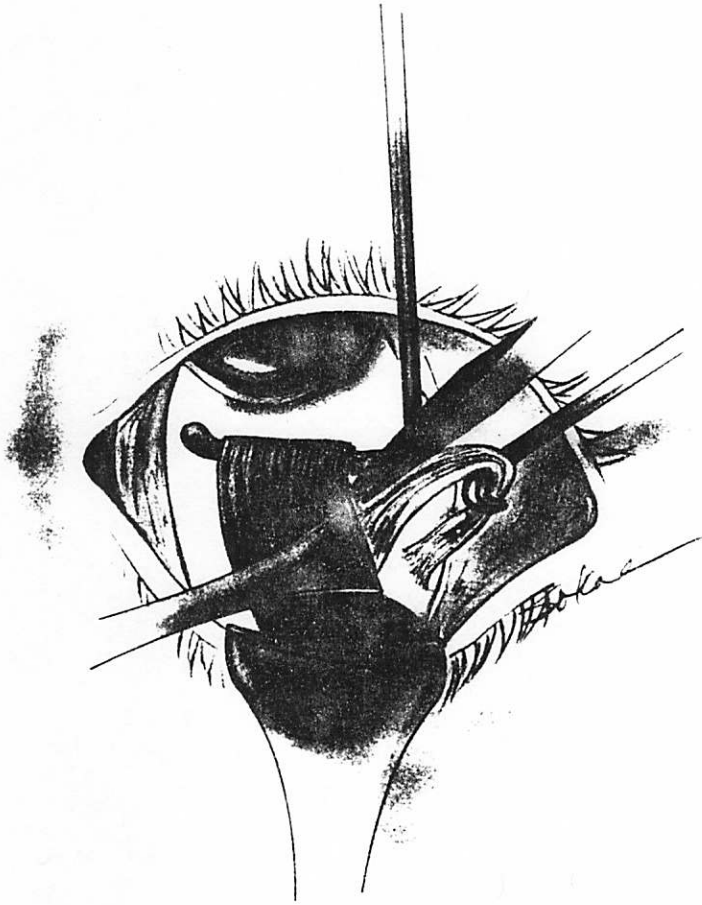


Fig. 35-3.

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 The superior oblique tendon is retracted temporally and the superior rectus muscle is retracted nasally to allow the fascial attachments to be severed.

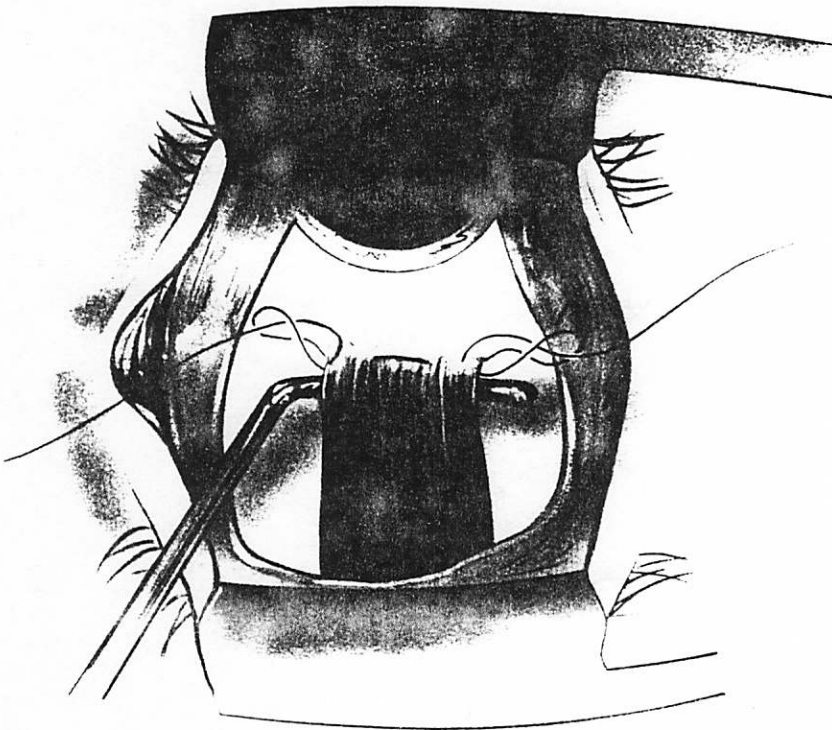


Fig. 35-4.

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 A double-armed 6-0 polyglactin suture with spatulated needles is weaved through the muscle tendon with full-thickness lock bites at each edge.

Fig. 35-5.

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 The preplaced muscle sutures are reattached and tied to the sclera at the new muscle insertion site. For large recessions, the sutures are reattached at the original insertion and allowed to "hang back" (insert).

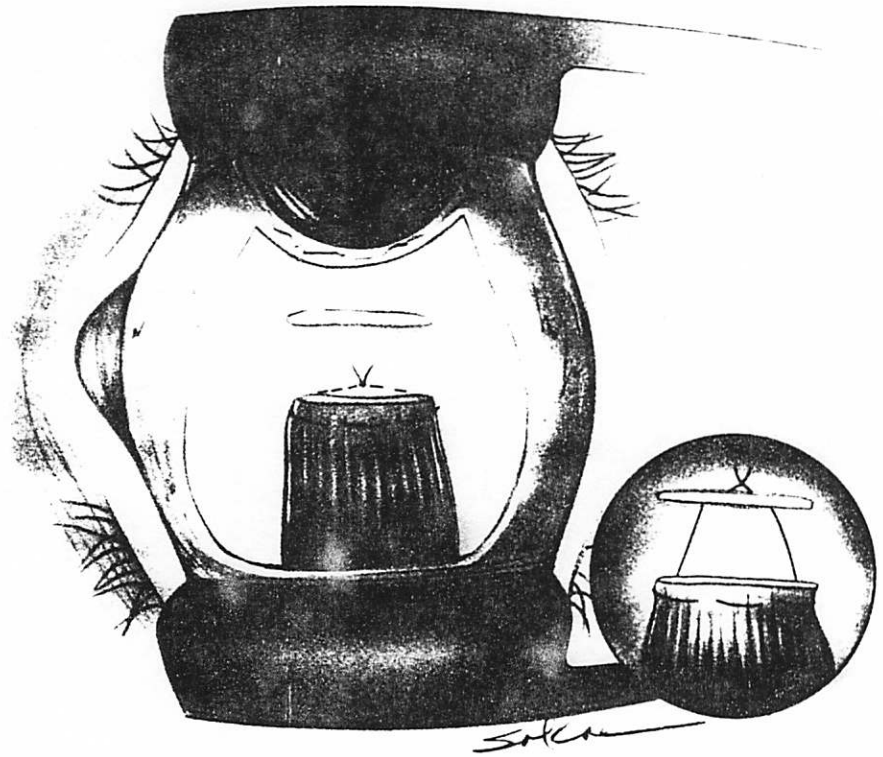
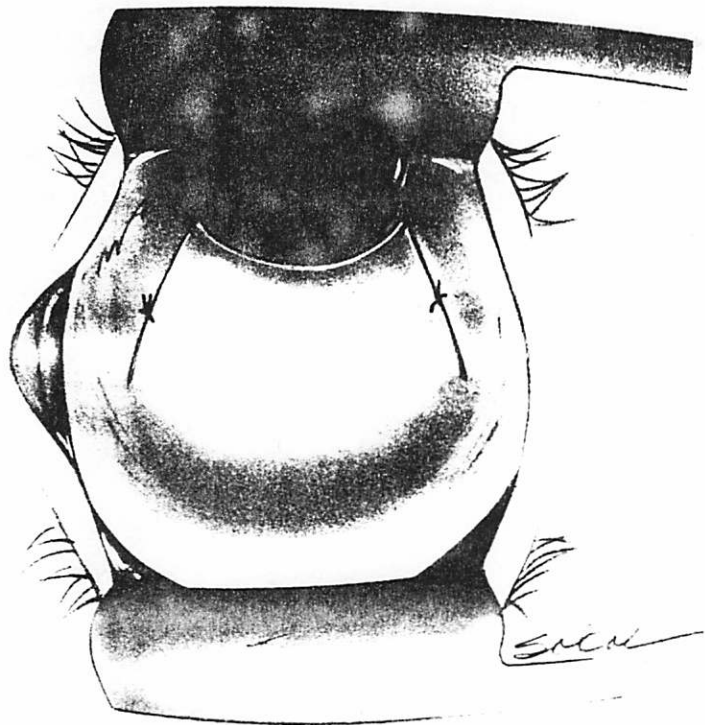


Fig. 35-6.

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 Conjunctival closure.



OTHER TYPES OF TREATMENT AND PITFALLS

Other surgical procedures may be indicated in selected cases. Patients with inferior oblique overaction and DVD may benefit from a recession and anterior displacement of the inferior oblique muscle to a position near the lateral pole of the insertion of the inferior rectus muscle.⁴ Anterior displacement of the inferior oblique muscle converts its vertical action from elevation to depression (Fig. 35-7).

If a DVD is still present after bilateral large superior rectus recessions, resection of one or both inferior recti is a reasonable alternative. Inferior rectus resection has been used in the past but was largely abandoned as a primary surgical treatment for DVD.^{9,10} Very rarely, DVD may present as an exodeviation with minimal vertical deviation. Recession of the lateral rectus muscle has been beneficial in this situation.¹³ Posterior fixation of the superior recti has been performed both with and without a superior rectus recession for DVD. Although popular in Europe, the procedure does not appear to be as effective as large superior rectus recessions.²

Recently, botulinum toxin injection of superior rectus muscle has been attempted in the treatment of DVD, but the longterm results are unknown.⁸

Nonsurgical treatment of DVD is usually unsuccessful but should always be considered before attempting surgery. DVD may be better controlled if the visual acuity and single binocular vision are improved. The best optical correction to provide the most equal and optimal acuity is important. Any amblyopia should be treated. Optical or orthoptic manipulation of a horizontal phoria or intermittent tropia may also lead to greater fusion. With unilateral or very asymmetric DVD, optical manipulation to encourage fixation preference with the DVD eye is sometimes helpful.

There are no randomized prospective studies of the surgical treatment of DVD. All of the information about treatment of this condition is based on retrospective reviews of nonrandomized patients.

Magoon and associates⁶ performed bilateral superior rectus recessions on 25 patients with bilateral DVD. Most of their patients underwent recessions of 10 mm or more. Nineteen (76%)

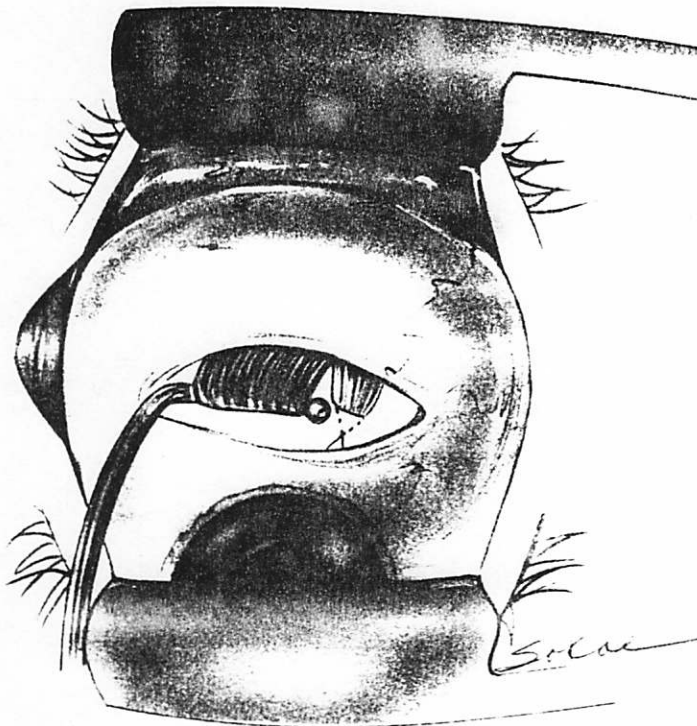


Fig. 35-7.
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Inferior oblique recession
and anterior displacement
for DVD and inferior oblique
overaction.

Outcomes

of the 25 patients had a small (0 to 9 prism diopters) residual DVD. No patients required a reoperation for the DVD and there were no complications. Braverman and Scott¹ performed unilateral superior rectus recessions ranging from 5 to 9 mm on 15 patients. Twelve (80%) patients had postoperative deviations of 9 prism diopters or less and seven (47%) had postoperative deviations of 4 prism diopters or less. At the same institution in a 1982 study, 31 patients with mostly unilateral DVDs had unilateral superior rectus recessions ranging from 4 to 9 mm. Thirteen (41%) had postoperative vertical deviations within 5 prism diopters of orthotropia. An additional 13 (41%) had residual DVDs between 5 and 9 prism diopters.¹²

In 1991, Schwartz and Scott¹¹ reported on 67 patients with DVD who underwent superior rectus recessions and were followed for an average of 40 months after surgery. Fifty-seven patients had a unilateral recession ranging between 5 and 9 mm. Ten patients had bilateral recessions ranging between 5 and 12.5 mm; 77% of the patients who had unilateral surgery had an excellent result (0 to 4 prism diopters) and 16% had a good result (5 to 9 prism diopters). For the bilateral cases, 32% of the eyes had an excellent result (deviation 0 to 4 prism diopters), and 11% had a good result (5 to 9 prism diopters). Mallette and associates⁷ performed bilateral superior rectus recessions between 5 and 14 mm on 26 patients. Postoperatively, 23 eyes (44%) had excellent results (0 to 4 prism diopters) and 13 (25%) had good results (5 to 9 prism diopters).

In the largest reported study to date, Eswein and associates² compared superior rectus recession with and without posterior fixation sutures for DVD in 228 patients. They found better longterm success with large (7 to 9 mm) superior rectus recessions compared to posterior fixation sutures with or without small (3 to 5 mm) recessions for this condition. Seventy-two percent of the patients followed for at least 3 years after the surgery had "successful" outcomes after large superior rectus recessions, compared with 55% of patients undergoing small superior rectus recessions with posterior fixation sutures. The outcome criteria were not clearly defined in this study, and the authors did not distinguish between bilateral and unilateral cases.

Complications specific to surgery for DVD are uncommon. Undercorrections occur much more frequently than overcorrections.¹¹ Limitation to elevation has also been reported; however, it is rarely of clinical significance.⁶ Changes in the palpebral fissure are unusual with superior rectus recessions but more common with inferior rectus resections for DVD.¹⁰

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