**Dissociated Vertical Deviation**

Dissociated vertical deviation (DVD) is an innervational disorder found in more than 50% of patients with infantile strabismus (esotropia or exotropia). It is typically associated with other sequelae of deficient binocular vision, including fusion maldevelopment, nystagmus syndrome, and inferior oblique overaction. There are 2 theories to explain the origin of DVD:

1. The vertical vergence movement of DVD is harnessed to dampen fusion maldevelopment nystagmus syndrome and thereby improve vision, with the oblique muscles playing the principal role (Video 10-3).
2. Deficient fusion allows the primitive dorsal light reflex, which is prominent in other species, to emerge.


**Clinical Features**

Dissociated vertical deviation usually presents by age 2 years, whether or not any underlying horizontal strabismus has been surgically corrected. Either eye slowly drifts upward and outward, with simultaneous extorsion, when occluded or during periods of visual inattention (Video 10-4, Fig 10-8). Some patients have an associated head tilt, for reasons that are unclear.

DVD is usually the most prominent component of the *dissociated strabismus complex* (DSC), but sometimes the principal dissociated movement is one of abduction (*dissociated horizontal deviation, DHD*) (Video 10-5), and occasionally it is almost entirely a torsional movement (*dissociated torsional deviation, DTD*) (Video 10-6). DVD is usually bilateral.
but is frequently asymmetric. It may occur spontaneously (manifest DVD) or only when 1 eye is occluded (latent DVD).

**VIDEO 10-5**  DHD in right eye and DVD in left eye.  
*Courtesy of Inas Makar, MD.*

**VIDEO 10-6**  Bilateral torsional DVD.  
*Courtesy of Inas Makar, MD.*

**CLINICAL PEARL**

Even in the absence of true inferior oblique overaction, an eye with latent DVD may overelevate in adduction, because it is occluded by the nose. Because DVD can mimic OEAd, distinguishing it from simple overaction of the inferior oblique muscles is important, as the surgical approaches to these 2 conditions may differ. In addition, the 2 conditions may coexist.

Measurement of vertical deviations in the presence of DVD cannot be performed with standard prism and alternate cover testing, because no single prism neutralizes the vertical refixation movement in both directions of the cover test. One approach is to measure the deviations when the left eye is fixating and when the right eye is fixating separately: a prism is placed in front of the nonfixating eye while it is behind an occluder. The occluder is then switched to the initially fixating eye. The prism power is adjusted until the deviating eye shows no vertical movement to refixate. These steps are then repeated for the other eye. The measurement taken when a given eye is fixating reflects the combined effect of the DVD in the fellow eye and any coexisting true hypertropia.

**Management**

Treatment of DVD is indicated if the deviation is noticeable (generally more than 6Δ–8Δ) and occurs frequently during the day. When DVD is unilateral or highly asymmetric, encouraging fixation by the eye with greater DVD by optically blurring the fellow eye is sometimes sufficient.

Surgery on vertical muscles can make DVD less noticeable but rarely eliminates it. For constant DVD of 1 eye in a child who never alternates fixation, vertical muscle surgery on the affected eye can mask the deviation. However, in a child with bilateral DVD and alternating fixation, any vertical eye muscle surgery that would mask the DVD in 1 eye would worsen the appearance of the DVD in the fellow eye. Treatment in this situation therefore involves bilateral procedures that limit the vertical excursions of each eye. These usually consist of large (6–10 mm) recessions of the superior rectus muscles, or anterior transposition of the inferior oblique muscles (especially if inferior oblique overaction is present). If there is residual DVD, inferior rectus muscle resection or plication can be performed.
Figure 24-1  Schematic of the retina of the right eye (RE) and left eye (LE), showing zone borders and clock-hour sectors used to describe the location of vascularization and extent of retinopathy. Solid circles represent borders of zones I–III, and dashed circles represent borders of posterior zone II (2 disc diameters beyond zone I). The LE illustration shows a hypothetical example of examination findings, representing approximately 3 clock-hours of stage 1 disease in zone II (the single line documents the presence of stage 1 disease). (Courtesy of Chiang MF, Quinn GE, Fielder AR, et al. International Classification of Retinopathy of Prematurity, 3rd ed. Ophthalmology. 2021;128(10):e51–e68. With permission from Elsevier.)

Figure 24-2  Staging of retinopathy of prematurity (ROP). A, Stage 1 ROP. The demarcation line has no height. B, Stage 2 ROP. The demarcation line has height and width, creating a ridge. C, Stage 3 ROP. Ridge with extraretinal fibrovascular proliferation. D, Stage 4A ROP. Partial detachment of the retina not involving the fovea. E, Stage 4B ROP. Partial detachment of the retina involving the fovea. F, Stage 5 ROP. Total retinal detachment. (Part A courtesy of Daniel Weaver, MD; part B courtesy of Andrea Molinari, MD; part C reproduced with permission from Lueder GT. Pediatric Practice Ophthalmology. McGraw-Hill Medical; 2011:232. Permission conveyed through Copyright Clearance Center, Inc.; parts D–F courtesy of R.V. Paul Chan, MD, and Michael F. Chiang, MD.)
CLINICAL PEARL

Clinically, the temporal edge of zone I is visible with a 25.00 D or 28.00 D lens, with the other edge of the field of view on the nasal optic nerve head margin.

Plus disease (Fig 24-3) and pre–plus disease (Fig 24-4) are a continuum of marked arteriolar tortuosity and venous dilation of retinal vessels as assessed in zone I (see Table 24-1).

The term aggressive posterior ROP (AP-ROP) was previously used to describe a severe, rapidly progressive form of ROP in posterior zone I and posterior zone II. However, because this aggressive form of ROP can occur outside the posterior zones and in larger preterm infants, particularly in countries with limited resources, the ICROP3’s new preferred term is aggressive ROP (A-ROP), which reflects the varied location of disease. A-ROP is associated with plus disease out of proportion to the stage of ROP present. In addition, A-ROP does not progress in the typical fashion (ie, through stages 1, 2, then 3), and stage

Figure 24-3  Wide-angle fundus photos demonstrating the spectrum of plus disease as defined by the International Classification of Retinopathy of Prematurity, 3rd edition (ICROP3). The vascular abnormalities are assessed in the central retina within the region of zone I. A, Plus disease with notable venous dilation and arterial tortuosity. The plus disease is out of proportion to visible peripheral findings, suggesting flat neovascularization (stage 3, arrows). B, Severe plus disease, with dilation and tortuosity of both arteries and veins. C, Severe plus disease. Note the presence of ill-defined posterior flat stage 3 (arrows), which, combined with severe plus disease, is typical of aggressive ROP (A-ROP). (Courtesy of Chiang MF, Quinn GE, Fielder AR, et al. International Classification of Retinopathy of Prematurity, 3rd ed. Ophthalmology. 2021;128(10):e51–e68. With permission from Elsevier.)