Small-Gauge Incision Techniques: The Art of Wound Construction

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The first 23-gauge vitrectomy system was the 23-gauge Dutch Ophthalmics Research Company (DORC, Zuidland, Netherlands) system with a two-step incision. In Eckardt’s two-step incision, first, the stiletto blade enters the vitreous chamber at an oblique angle of 30°, then the cannula-trocar system is inserted tangential to the scleral surface, 3.5 mm from the corneoscleral limbus. Then, the port is screwed into place.1

There are some problems related to the two-step-incision, however, that make it difficult. It can be difficult to recognize the stiletto cut, and a double incision may occur when inserting the cannula system (Figure 1).

Recently, a 23-gauge one-step system was developed by Alcon Laboratories (Forth Worth, Texas). The system is similar to the 25-gauge systems with a combined blade and cannula, and it allows a quicker one-step maneuver. The incision modality proposed by Eckardt, however, does not suit 23 gauge due to the larger dimension of the 23-gauge trocars. Therefore, we must create an incision suitable for the 23-gauge one-step system.

To achieve a tunnel-like effect, the incision construction has to be as oblique and as long as possible.2 To achieve an optimal watertight/airtight sclerotomy, the first step is to modify the incision angle. With an incision angle of 45° we achieve a tunnel of 1.154 mm (Figure 2). By reducing the incision angle by 15° and using an angle of 30°, the length of the tunnel increases by 30%. Because the tunnel is 1.415 mm, it is more airtight (Figure 3).

The second trick is to modify the incision direction by inserting the system obliquely without straightening. The blade is inserted 3.2 mm from the limbus, at an oblique angle of 10° to 15°. It enters the vitreous without

Figure 1. A double incision could be created when inserting the cannula system.

Figure 2. With an incision angle of 45°, a tunnel of 1.154 mm is achieved.
Figure 3. With a 30° angle, the 1.415-mm tunnel is more airtight.

Figure 4. Direct insertion is called a “Zorro” incision.

Figure 5. At day 1 on ultrasound biomicroscopy, the incision appears to be sealed and is barely detectable.

Figure 6. In an endoscopic view, the Zorro incision is smaller and more narrow than the standard incision.

Figure 7. Incisions running parallel to the scleral fibers may seal quicker, as the majority of the fibers should be separated.

Figure 8. The incision is made parallel to the limbus and the scleral fibers using the same modality as a 20-gauge incision.
straightening. We have called this direct insertion a “Zorro” incision, because we run through the sclera like a swordsman with a foil (Figure 4).

At day 1 on ultrasound biomicroscopy (UBM) the incision appears to be completely sealed and is barely detectable (Figure 5). In an endoscopic view (Figure 6), the Zorro incision is smaller and more narrow than the standard incision. We have demonstrated that this incision is airtight and safe in complicated vitrectomy.3

Recently, Pollack has improved the Zorro direct-and-oblique technique by suggesting a biplanar insertion modality. To perform this technique, hold the trocar bevel up with the tip at approximately 5° to the sclera, then insert the trocar at 50% of the scleral depth—until just past the end of the bevelled tip. Raise the handle until the trocar shaft is at about a 30° angle to the sclera. Then, complete the insertion.4 Taking into account Pollack’s suggestions, we have performed further development, keeping in mind our 25-gauge modified techniques.5

In all previous oblique incisions, the blade, positioned perpendicular to the cornea, was directed toward the 12-o’clock position. The sclerotomy is airtight, but the scleral fibers, arranged in concentric circles near the cornea, are dissected. This can delay the sealing of the wound. We have hypothesized that incisions running parallel to the scleral fibers may seal quicker, as the majority of the fibers should be separated, but not cut (Figure 7).

Taking the arrangement of scleral structure into consideration, we make the incision parallel to the limbus and to the scleral fibers using the same modality as a 20-gauge incision (Figure 8). Trocars are inserted at an oblique angle of 30° tangential to the scleral surface. The port is then screwed on to exert the necessary pressure for inserting the cannula. The blade, positioned parallel to the cornea, enters the sclera directed toward the posterior pole—in a phakic eye at 3 mm from the limbus. (Figure 9). The blade enters the sclera directed toward the posterior pole—in a phakic eye at 3 mm from the limbus. (Figure 10). The system is straightened and the scleral fibers are spread apart, but not completely torn. (Figure 11). In pseudophakic patients, the incision is performed by inserting the system parallel to the limbus and 5° tangential to the sclera. (Figure 12). The system is straightened to a 30° angle to enter the vitreous chamber, avoiding the intraocular lens.
phakic eye at 3 mm from the limbus (Figure 9)—and exits in the vitreous chamber at 4 mm. Then, the system is straightened, and thus scleral fibers are spread apart but not completely torn (Figure 10). The oblique-parallel insertion modality is good for 25-gauge vitrectomy but even better for 23-gauge vitrectomy due to the larger diameter and the more extensive vitrectomy performed with the 23-gauge system (as in retinal detachment repair).

In pseudophakic patients, the incision is performed by inserting the system parallel to the limbus and 5° tangential to the sclera (Figure 11). We then straighten to a 30° angle to enter the vitreous chamber, avoiding the intraocular lens (Figure 12). In phakic eyes, we can injure the lens, so we usually perform a Zorro or a Pollack incision. To compare the morphology of the parallel incision with the standard oblique incision, we have removed the conjunctiva. The 23-gauge parallel incision is regular and narrow (Figure 13), whereas the 23-gauge standard oblique incision, after removal of the conjunctiva, is larger and more irregular (Figure 14). It is well known that the sclera heals with a fibrin plug within 6 to 12 hours, so it is critical to assess if the incision is closed in the early postoperative period. UBM performed 3 hours postoperatively shows that the 23-gauge oblique-parallel incision is already sealed (Figure 15).6

We wish to point out that sclerotomy construction is a key point in the success of the minimally invasive sutureless vitrectomy. Undoubtedly, the main complications (eg, hypotony, endophthalmitis) are caused because of incompetent wound closure. The chance to more safely perform the majority of vitreoretinal surgery with small-gauge technique is based on our efforts to improve the skill and knowledge concerning the incision modality and on the development of technology. ■

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