Micro-Incisional Vitrectomy System (MIVS)

Indications for Use: The CONSTELLATION® Vision System is an ophthalmic microsurgical system that is indicated for both anterior segment (i.e., phacoemulsification and removal of cataracts) and posterior segment (i.e., vitreoretinal) ophthalmic surgery.

Caution: Federal (USA) law restricts this device to sale by, or on the order of, a physician.

Warnings and Precautions:
- Attach only ALCON® supplied products to console and cassette luer fittings. Improper usage or assembly could result in a potentially hazardous condition for the patient. Mismatch of surgical components and use of settings not specifically adjusted for a particular combination of surgical components may affect system performance and create a patient hazard. Do not connect surgical components to the patient's intravenous connections.
- Each surgical equipment/component combination may require specific surgical setting adjustments. Ensure that appropriate system settings are used with each product combination. Prior to initial use, contact your ALCON® sales representative for in-service information.
- Care should be taken when inserting sharp instruments through the valve of the Valved Trocar Cannula. Cutting instrument such as vitreous cutters should not be actuated during insertion or removal to avoid cutting the valve membrane. Use the Valved Cannula Vent to vent fluids or gases as needed during injection of viscous oils or heavy liquids.
- Visually confirm that adequate air and liquid infusion flow occurs prior to attachment of infusion cannula to the eye.
- Ensure proper placement of trocar cannulas to prevent sub-retinal infusion.
- Leaking sclerotomies may lead to post operative hypotony.
- Vitreous traction has been known to create retinal tears and retinal detachments.
- Minimize light intensity and duration of exposure to the retina to reduce the risk of retinal photic injury.

ATTENTION: Reference the Directions for Use labeling for a complete listing of indications, warnings, precautions, complications and adverse events.

Peter K. Kaiser, MD is a paid consultant for Alcon.

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Micro-incision vitrectomy surgery has many benefits, but we still need to worry about its disadvantages, including the risk of wound leakage, hypotony and endophthalmitis.\(^1\)\(^2\) I believe one key to avoiding these complications is wound construction, and three factors are critical for proper wound construction.

3 KEYS TO PROPER WOUND CONSTRUCTION

Displacing the conjunctiva is the first step in proper wound construction. We want to make sure the hole in the conjunctiva is located away from the hole in the sclera. Intuitively, it makes sense that if there is some vitreous wick, we want to avoid allowing this wick to extend beyond the conjunctiva. By misaligning the holes, we minimize the chance of this occurring.

Second, I flatten the sclera quite dramatically when I insert the trocar (Figure 1). Why do I do this? If we make an incision into a curved structure, we get a certain chord length or distance within the sclera. If we press down and flatten that structure and use the same angle, the chord length is longer. The longer the chord length within the sclera, the better the wound sealing and the less likely we are to have problems.

Third, I angle all of my incisions, and a recent study supports my decision. My colleagues and I performed a dynamic wound study to look at 23-gauge and 25-gauge straight and angled incisions with anterior segment, spectral domain optical coherence tomography.\(^4\) We wanted to identify in real time what happens to fresh wounds when intraocular pressure fluctuates from low to high to medium, which is what happens when the eye is rubbed, for instance.

With the straight incisions, we found wide-open wounds, regardless of the pressure in the eye. In contrast, the angled incisions were apposed and closed, regardless of the pressure. We went one step further in our experiments to find out what happens to bacteria under these variable pressure conditions. Using a WECK-CEL\(^*\) sponge, we applied India ink, which mimics the size of bacteria, to the ocular surface and examined the wounds histopathologically.

As shown in Figure 2, the India ink was visible in the 25-gauge and 23-gauge straight incisions, not only on the ocular surface, but also within the wound itself and inside the eye, while the angled incisions were clean with no ink found in the wound or eye.

Many surgeons feel that wound construction, in terms of straight versus angled, is important only when you are doing 23-gauge surgery. I want to emphasize that a straight incision, even with 25-gauge surgery, probably is not a good idea. In fact, some physicians even recommend angled incisions when performing 30-gauge intravitreal injections.

\*WECK-CEL is a trademark of Medtronic Xomed, Inc.
IMPROVED TROCAR FOR LINEAR INCISIONS

Initially, we performed micro-incision surgery with a needle-like entry blade. Then, we moved to a beveled blade, which improved our wounds. If you think about it, however, a linear incision is probably the best and easiest way to ensure wound closure, and this is the idea behind the new EDGEPLUS® trocar blade. Not only does the EDGEPLUS® blade create a linear incision (Figure 3), but much less force is required to enter the eye with this new blade.

One of our main concerns with micro-incision surgery is endophthalmitis. It is a fact that endophthalmitis rates are higher with micro-incision surgery than with 20-gauge surgery, but if you analyze the papers and look at the patients who developed endophthalmitis, most of those patients had straight incisions. It is important to note that endophthalmitis rates in micro-incision surgery with angled incisions are similar to those with 20-gauge (Figure 4).2,3,5,7

WOUND CLOSURE TIPS

Just as wound creation is important in micro-incision surgery, so is wound closure. To prevent suction through the cannula that can lead to a vitreous wick, I place a solid instrument into the wound when I remove the cannula.

I always use a small air bubble in my cases, so at the end of a case, my nurse turns on the air to create an air bubble that reaches the level of the bottom of my cannulas. Then I place my light pipe, remove the cannula over the light pipe, remove the light pipe, and finally roll a cotton-tipped applicator over the wound. This wound will never close until you place either a plug or your light pipe into that other wound. This pressurizes the eye and helps close the internal lip against the external lip of the angled wound. You can use a plug instead of a light pipe to remove the cannula, but the idea of using something solid when you remove the cannula is to prevent suction that may pull vitreous into the wound and cause complications.

In many cases, after removing the cannula and placing my light pipe in the other cannula, I like to bump up the pressure momentarily to slam that trap door closed. This
has been shown very nicely in angled, clear cornea cataract wounds, where the higher the eye pressure, the better the closure of these angled incisions.\(^6\)

**CONCLUSION**

Wound construction is critical in micro-incision surgery, and after reviewing the literature, I hope you agree that angled incisions are better than straight incisions, regardless of the gauge we use. In fact, if we move to 27-gauge surgery in the future, I still will be creating angled incisions.

Remember, too, that wound closure is just as critical as wound construction. Some of the new advancements, especially the EDGEPLUS® trocar blade, will make our ability to do micro-incision surgery better in the future.

Peter K. Kaiser, MD, is professor of ophthalmology at Cleveland Clinic Lerner College of Medicine, and on staff at Cole Eye Institute in Cleveland, Ohio. Dr. Kaiser is a consultant for Alcon Laboratories, Inc.

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**REFERENCES**