OVD USE IN CATARACT SURGERY

Viscoadaptive devices improve surgical safety.

BY ROBERT H. OSHER, MD

I have been an avid proponent of the Healon family (Johnson & Johnson Vision) of OVDs for more than 40 years. Before I explain my strong preference, I want to state that I am not a consultant for and have no financial interest in the company. When I completed my training at Bascom Palmer Eye Institute and several additional fellowships in the late 1970s, I was fortunate to be introduced to Healon by Norman S. Jaffe, MD, and Henry M. Clayman, MD. The advantages of this new OVD compared to air were obvious, but it was equally apparent that the inaugural product could be improved. Healon Yellow was developed to facilitate visualization of this clear material, followed by Healon GV, the name of which reflects its greater viscosity. However, it was the development of Healon5, the first viscoadaptive agent, that really impressed me.

FUNDAMENTAL 1 DEEPENING THE CHAMBER

The first Healon products created space between the cornea and the lens, but some of the OVD was easily expelled through the incision whenever it was manipulated. In addition, the cohesive behavior of the OVD was conducive to loss by aspiration. In contrast, Healon5 behaved more like a solid and provided a deeper chamber, even when scleral rigidity was low, the eyelids were tight, and positive pressure was present. The anterior chamber depth was maintained when the incision was separated to allow the introduction or withdrawal of instrumentation.

Because my preference was to perform the capsulorhexis with a needle rather than forceps, Healon5 was instilled to place tension on the anterior capsule, which made tearing and directing the capsulorhexis edge easier. Because the chamber did not shallow, there was virtually no tendency for the capsulorhexis edge to run toward the periphery. I found this extremely helpful in eyes with increased endolenticular pressure, namely those with an intumescent cataract.

FUNDAMENTAL 2 ENDOTHELIAL CELL PROTECTION AND OTHER PHACO ADVANTAGES

An advantage of using a dispersive OVD is that it is less likely than a cohesive OVD to leave the eye. I found that Healon5, a viscoadaptive, could be kept in the anterior chamber if I performed slow-motion phacoemulsification, a technique I developed in the 1980s.[1] By reducing the vacuum level and aspiration rate and applying ultrasound energy within the capsular bag or at the iris plane, the endothelium remained undisturbed! Even in an eye with advanced Fuchs corneal dystrophy, a borderline pachymetry reading, and an endothelial cell count of zero, the cornea was relatively clear during the early postoperative period when this OVD and my phaco technique were used. When Healon5 is used properly in routine cases, the cornea is usually crystal clear on the day following surgery, which confirms that this OVD can provide exquisite endothelial protection.

In addition to keeping the chamber deep throughout phacoemulsification, Healon5 can also retard the forward movement of the nucleus. Tiny nuclear chips typically remain stuck in the Healon5 rather than find their way into the angle or behind the iris. Healon5, however, can obstruct the fluid exchange at the phaco tip, which, in the hands of an inexperienced surgeon, can cause a thermal injury. I developed a bevel-down phaco tip (Alcon) that allows phacoemulsification to begin by removing the anterior cortex within the capsulorhexis margins. After sculpting about halfway through the nucleus, the bevel is rotated upward, and vacuum is reduced. This technique helps to prevent OVD occlusion of the tip, directs the initial energy away from the cornea, and allows the OVD to be retained during nuclear cracking and chopping maneuvers.

FUNDAMENTAL 3 CORTICAL REMOVAL

I often remove the cortex while working below the Healon5, which remains in the anterior chamber. When operating in the deep chamber of the highly myopic or postvitrectomy eye, the Healon5 is removed before cortical removal is initiated. I always prefer to remove the subincisional cortex first. This sequence makes sense because it is easier to remove cortex with a coaxial technique while the cortical bowl keeps the capsular bag open than it is to remove subincisional cortex at the end when the bag may be closed. In some challenging situations, such as when the capsule is open, the capsular bag can be opened with regular Healon, and a dry cortical removal technique can be employed using either a straight or a curved 27-gauge cannula on a 3-mL syringe filled with about 1 mL of balanced salt solution. This manual technique can be highly effective with Healon because of its cohesive behavior, which allows the cortex to be aspirated.

FUNDAMENTAL 4 IOL INJECTION

In 2007, Val Injev, MBA, PE, and I introduced microcoaxial phacoemulsification in a two-part article in the *Journal of Cataract and Refractive*

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Surgery.[2,3] We realized that, in order to reduce the incision size to 2.2 mm, it was necessary to use the incision as an extension of the injector cartridge. This was facilitated by a one-handed injection technique, countertraction in the stab incision, and a firm eye. Healon5 has been ideal for this technique, not only because it creates a firm eye but also because this OVD acts as a shock absorber as the lens is injected. Moreover, by filling the capsular bag, Healon5 allows the IOL to be easily rotated into position within a deep chamber. The haptics of a one-piece lens unfold slowly, facilitating atraumatic insertion. If a capsular tear is present, the surgeon can entirely avoid putting pressure on the capsular bag by positioning the lens while the haptics are still tucked. Should positive pressure be present, an injection of Healon5 can neutralize the pressure gradient.

FUNDAMENTAL 5 OVD REMOVAL

This is where Healon5 really shines. At high shear rates, this OVD behaves as a cohesive agent, and it is almost impossible to leave inside the eye. I remove Healon5 by nudging the optic nasally and advancing the silicone I/A tip beneath the lens. The aspiration hole is angled (perhaps 15° or 20° oblique) opposite the posterior capsule but not occluded against the posterior surface of the lens. Within a few moments, the OVD is evacuated from the bag, and the I/A tip can be redirected in front of the lens, where the remaining amount of OVD is removed from the anterior chamber.

I always hydrate the incision before removing Healon5 because the presence of this OVD can effectively mask positive pressure. When the OVD has been aspirated, I momentarily discontinue aspiration to assess the stability of the chamber. I then place a second cannula through the stab incision and inject either balanced salt solution or acetylcholine (Miochol-E, Bausch + Lomb) as the I/A tip is withdrawn. If positive pressure is present, the I/A tip is not withdrawn until a bolus of air has been injected through the stab incision. After additional hydration of the main incision, the air is exchanged through the stab incision in small aliquots.

SPECIAL SITUATIONS

When pupillary dilation is suboptimal, viscomydriasis using Healon5 can be performed. Injecting Healon5 can enlarge even a small pupil because it acts like iris retractors. If the surgeon encounters dense white peripheral cortex, which Abhay R. Vasavada, MS, FRCS, calls *corticocapsular adhesions*, I prefer to use regular Healon for gentle viscodissection. With this OVD, I can loosen the adhesions without damaging the zonules. When a capsular tear is present, I inject Viscoat (Alcon) through the tear to tamponade the vitreous. Unlike Healon, Viscoat can be left in the eye. If a minimal dry vitrectomy is appropriate, I maintain the anterior segment with Healon5 and place the vitrector through the tear. As mentioned earlier, dry cortical removal is best achieved with Healon. Fully dilating the bag with either Healon or Healon5 can facilitate the insertion and advancement of the capsular tension ring when this device is required. During an IOL exchange, Healon5 can maintain the anterior chamber while viscodissection using Healon is performed to open the capsular bag. Either OVD can be easily removed at the end of the procedure.

CONCLUSION

Phaco machines, microscopes, and the contemporary array of sophisticated IOLs receive a lot of press. I would argue, however, that it is viscosurgery that has allowed cataract surgery to become the safest operation in all of medicine. ■

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