LIQUID OCULAR BANDAGE

New hydrogel preparation ensures corneal wound closure

by Roibeard Ó hÉineacháin in Istanbul

A hydrogel liquid ocular bandage called Oculeal™ (Beaver Visitec International) appears to be very effective in sealing corneal incisions after cataract surgery and may provide some protection against endophthalmitis, said Matteo Piovella MD, Centro Microchirurgia Ambulatoriale, Monza, Italy. “OcuSeal is easy to use and provides enough of a barrier against microbial infection to allow for the incision to heal. It degrades and disappears as tissue is regenerated and is transparent and comfortable for the patient,” Dr Piovella told the 15th ESCRS Winter Meeting.

He presented the results of a study involving 123 eyes of 91 patients with a mean age of 66.5 years who received the Oculeal liquid bandage at the conclusion of cataract surgery. The results indicated that the liquid bandage did not cause any complications or adverse reactions, he said.

The liquid ocular bandage also appeared to improve patients’ postoperative comfort. Only 15 per cent of patients with the Oculeal bandage reported a foreign body sensation in their eye on the day after surgery. That compares to 70 per cent of 63 eyes without the bandage in a subgroup of patients that received the bandage unilaterally.

Dr Piovella said that the only real difficulty with the liquid bandage occurred during the learning curve, when surgeons applied Oculeal incorrectly in 16 eyes. The problem arose because they did not apply the preparation onto the cornea quickly enough. The liquid bandage polymerises in 15 seconds, he noted.

Surgeons still in the learning curve with Oculeal may also have a tendency to apply too much of the substance, he said. However, eye blinking seemed to eliminate the excess within 12 hours in all cases where it occurred.

Easy to prepare for use Dr Piovella noted that Oculeal consists of a synthetic dendritic hydrogel that is easy to apply directly onto the ocular surface as a liquid. The hydrogel’s molecular structure takes shape when the surgeon mixes two separate components, powder polyethylene glycol and liquid polyethylene amine, he explained.

Preparing the Oculeal liquid bandage for use involves taking the two separate containers of the two components and joining them together. After breaking the membrane between the two containers, the preparer of the hydrogel substance must shake their contents together for five seconds. It must then be used within 10 seconds, he stressed.

When applied to the ocular surface, the Oculeal liquid bandage cross-links within 20 seconds to form a smooth soft and transparent protective barrier film that protects corneal incisions and is non-toxic, non-irritant and non-mutagenic, Dr Piovella said. The liquid bandage becomes invisible and undetectable by slit-lap evaluation in all patients within hours. The incision site itself becomes smooth and undetectable at day one, which is not the case in eyes without Oculeal, Dr Piovella pointed out.

As the corneal epithelium in the wound site recovers, the degradation of the hydrogel microstructure provides room for the tissue to regenerate and replace the liquid bandage material. Electron microscopy studies show that the holes in the hydrogel microstructure range from two to three microns in size 24 hours after cross-linking but by day two the holes are about 10 microns in size. The liquid bandage re-absorbs in all patients within four days.

“When the hydrogel film is spread over a patient’s wound it interacts with underlying tissues and forms a seal lasting one to two days. Since tissue healing occurs at roughly the same rate as hydrogel degradation hence the space is taken up by regenerated tissue,” Dr Piovella explained.

Dr Piovella noted that the team at the Moran Eye Institute, Salt Lake City, Utah, US, recently carried out an investigation into the wound strength of corneal incisions in cadaver eyes. It showed that the average pressure required to burst the wound was 221.84 mmHg with Oculeal compared to only 59.64 mmHg without it (Maddula et al ASCRS 2009).

“One of Oculeal’s advantages is that, unlike some liquid bandages it does not require activation by an argon laser to induce polymerization. In addition, unlike cyanoacrylate glue it does not require the cumbersome preparations, numerous instruments, a dry environment, a delicate application of a precise amount of adhesive,” Dr Piovella said.

Oculeal may also provide an additional line of defence against endophthalmitis following cataract surgery. Studies have implicated unsealed clear-corneal incisions as a possible entry point for infectious bacteria, Dr Piovella said. There is also research suggesting that rapid IOP fluctuations such as might occur with eye rubbing can cause fresh cataract incisions to gape, thereby allowing conjunctival fluid and bacteria into the eye, he added.

“I cannot prove scientifically any potential for Oculeal to decrease the endophthalmitis rate. It is difficult, perhaps impossible, to show this, because of the large case numbers required to detect any effect. But if Oculeal does prevent these horrible infections, then I will be protecting my patients’ eyes. And, either way, it will help me serve my patients better by giving them greater comfort after surgery,” Dr Piovella concluded.