

CORNEA

Ocular Sealants: One New Option, but Still Room for Innovation

BY LORI BAKER-SCHENA, MBA, EDD, CONTRIBUTING WRITER
INTERVIEWING DAVID R. HARDTEN, MD, CHRISTOPHER J. RAPUANO, MD,
AND DAVID C. RITTERBAND, MD

Ocular sealant technology advanced in 2014 when the U.S. Food and Drug Administration approved ReSure (Ocular Therapeutics) for use in sealing cataract surgery incisions. The hydrogel solidifies within 15 to 30 seconds, and lasts for two to three days until the wound is secure.

“Some self-sealing cataract incisions don’t seal the way they are supposed to, increasing the risk of infection,” said Christopher J. Rapuano, MD, at the Wills Eye Hospital in Philadelphia. “ReSure helps secure the wound.”

However, although ReSure is a welcome advance, room for improvement remains, Dr. Rapuano said. “The needs are great. Fibrin glue only works in certain circumstances, and cyanoacrylate is often too hard to use on the ocular surface. Now we have ReSure, but it only lasts a couple of days. There is definitely room for innovation.”

ReSure Overview

ReSure is a polyethylene glycol-based hydrogel that is applied as a liquid and gels on the surface of the eye in less than 20 seconds. Once the material forms a gel, it remains localized over the incision to seal the wound and form a surface barrier (Fig. 1). It then gradually sloughs off in the patient’s tears during re-epithelialization.

Benefits. “Sutures close the wound but don’t hermetically seal it,” said David C. Ritterband, MD, at the New York Eye and Ear Infirmary in New York. “ReSure truly waterproofs the

wound, preventing fluid from leaking out or bacteria from leaking in. And it lasts for a minimum of 24 to 48 hours, allowing the wound to epithelialize.”

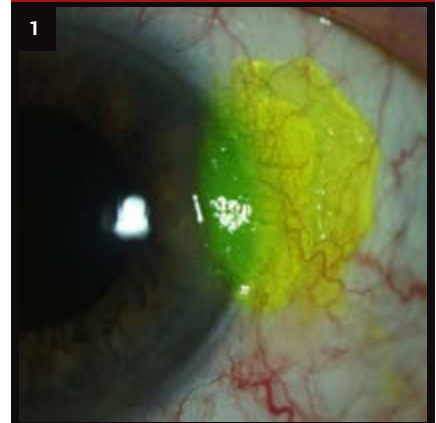
In a clinical trial presented last year, 487 patients who underwent cataract surgery with clear corneal incisions were randomized to either ReSure (n = 304) or sutures (n = 183) and evaluated for 28 days following surgery. A Seidel test was performed intraoperatively and at the one-, three-, seven-, and 28-day marks. The hydrogel successfully prevented wound leaks in 95.9 percent of cases. In contrast, sutures prevented wound leaks in 65.9 percent of cases. In addition, fewer device-related adverse effects were noted in the sealant cohort (1.6 percent) than in the control group (30.6 percent).¹

Finding its niche. According to David R. Hardten, MD, of Minnesota Eye Consultants in Minneapolis, ReSure is a “useful product” for surgeons seeking the extra security of a sealant for their corneal incision sutures, or for those incisions that do not necessarily need sutures and will heal in less than a week.

However, ReSure is not suitable for larger incisions that require more than a week to close—for example, incisions associated with penetrating keratoplasty or other corneal transplants. “For these cases, you are better off with sutures,” Dr. Hardten said.

Dr. Rapuano foresees a larger role for the hydrogel in cataract surgery with keratoconus patients and in those whose cataract wounds tend to not seal

Suture Substitute

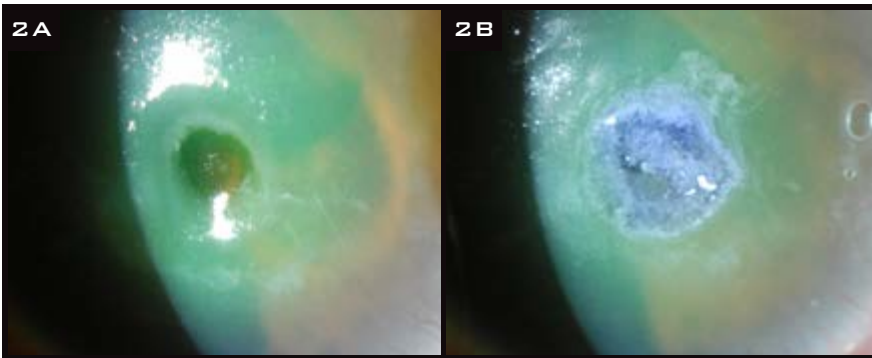


ReSure on a clear corneal wound.

well. It may eventually play a role in some patients with corneal lacerations or in corneal transplants after radial keratotomy, where the stellate nature of the wounds often leak slightly, even with sutures. Moreover, he said, the sealant “may have other uses that we are just beginning to explore. It may be useful for certain very small ocular leaks, or to treat a glaucoma bleb leak where you don’t want hard glue and fibrin doesn’t work.”

Stumbling over cost? Widespread adoption of ReSure may rest upon whether the cost of the product is perceived as burdensome.

As Dr. Ritterband pointed out, “Since the incidence of infections with cataract surgery is so small, the price point has to be low enough that surgeons would use this routinely. Right now, it is difficult to prove that using ReSure offers better care.”



CYANOACRYLATE. (2A) Large central descemetocoele in a patient with dry eye syndrome and limbal stem cell deficiency. (2B) Immediately after application of cyanoacrylate glue and placement of a bandage soft contact lens.

Fibrin and Cyanoacrylate

As ReSure begins to find its way into practice, fibrin glue and cyanoacrylate-based adhesives remain the most commonly used suture substitutes in ophthalmology, Dr. Rapuano said.²

Cyanoacrylate. “Cyanoacrylate, often regarded as medical-grade ‘Super Glue,’ is an adhesive that works extremely well to fill in or seal holes” and remains the state-of-the-art choice for sealing corneal perforations, he said. “The downside is that the glue has a rough surface; thus, we need to cover it with a soft contact lens [Figs. 2A, 2B].”

Fibrin. Fibrin glue is used to attach tissue to other tissue—for example, to attach conjunctival graft tissue to the sclera in pterygium surgery or to secure amniotic membrane transplants—and lasts two to three weeks. “The newer formulations are easier to use and do not need to be diluted in the operating room,” said Dr. Rapuno.

Dr. Hardten uses fibrin glue to secure the flap after LASIK, a technique he introduced in 2003 to prevent epithelial ingrowth after the procedure.³ “We hypothesized that epithelial growth after LASIK may be related to poor flap adherence,” Dr. Hardten said. “Fibrin is a barrier glue, and when it is dissolved under a LASIK flap, it prevents epithelial ingrowth because the flap is sealed down. That buys you time for the stromal bed to heal.”

Dr. Hardten uses a two-component fibrin glue (Tisseel VH), placing the glue over the entire corneal surface or at the edge of the flap. The glue is left

to dry for about eight minutes, and a bandage soft contact lens is placed on the eye. This contact lens is removed when the glue dissolves.

In a recent expansion of this approach, Dr. Hardten has used fibrin glue to prevent recurrent epithelial ingrowth involving IntraLase flaps. “While the incidence of this side effect is rare, some cases still occur. Fibrin glue is useful to help prevent these cases from recurring after removal.”

Novel Applications

As tissue adhesives have become more accepted in ocular surgery, researchers have come up with novel applications.

Glued IOLs. A number of cataract surgeons are using fibrin glue to aid in the fixation of posterior chamber intraocular lenses (IOLs) in patients with insufficient capsular support.^{4,5}

“Eyes without capsular support cannot sustain a nonsutured IOL implant,” Dr. Ritterband said. “This approach involves both placing the haptics through a sclerotomy and under a scleral flap and closing the flap with fibrin glue.” The technique prevents a subconjunctival bleb from forming and limits the use of Prolene sutures, which may degrade and break or loosen after five to 10 years.

Corneal trauma. Fibrin glue and ReSure may also have a role to play in corneal trauma. For instance, researchers investigated the challenges of glue for corneal trauma in animal models.⁶ They found that the cyanoacrylate glue polymerized almost immediately during an intraoperative proce-

dure, limiting the surgeon’s ability to manipulate the wound. In contrast, the fibrin glue polymerized gradually, giving the surgeon time to reconstruct the wound and remove excessive glue.

The excessive glue was a problem, irritating the cornea. Dr. Hardten warned that, in fact, too much adhesive is a challenge whenever surgeons are using ocular sealants. He stresses that too much glue “creates a mess,” and he uses an extremely small amount, applied with a 30-gauge needle, when using fibrin on top of LASIK flaps to prevent epithelial ingrowth; ditto for conjunctival surgery.

Dr. Hardten does see a role for ReSure in trauma involving complex corneal cuts or lacerations that are difficult to suture. The hydrogel sealant has the capability of restoring structural integrity to the laceration as it starts to heal without the need for extra sutures, and the resorption time of two to three days may be optimal for these cases, he said. ■



MORE ONLINE. For a discussion of future applications of sealants, see this article at www.eyenet.org.

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