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Fibrin Glue in Glaucoma Surgery

This option offers multiple advantages in a number of common surgical situations.

Robert J. Noecker, MD, MBD & Michael C. Herceg, DO

Fibrin glues (such as Tisseel, from Baxter Healthcare) have been slowly increasing in popularity for use in a variety of medical and cosmetic surgeries. In eye care, fibrin glue is often used in pterygium repair, or at the end of vitreoretinal surgery. Generally, it's most useful when you need to work with the conjunctiva.

The use of fibrin glue specifically for glaucoma surgery is a relatively new concept. In my experience, however, it's an excellent tool in many situations. Here, I'd like to share some of what I've learned about this new surgical option.

Using Fibrin in the OR

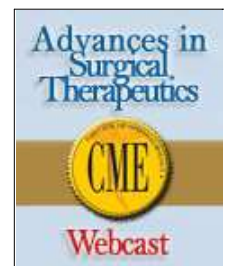
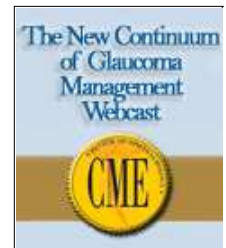
Tisseel comes in two components—the glue and an accelerant—that must be heated and then combined to activate the glue. Typically, nurses in the OR heat the components for about five minutes using a special heater that comes with the glue. Once warmed, you combine them much the way you would combine two components to create epoxy, using either a single syringe with two compartments or two syringes. You can combine the components and then place the mixture where it's needed, but in many situations we apply the components to the eye separately and let them blend on the field. This ensures that the glue is in place when it's activated. (Preparing and activating the glue takes a total of about five minutes.)

Once you combine the fluids, the glue molecules become crosslinked and the substance becomes sticky. At this point, assuming your goal is to fasten the conjunctiva in place, you move the tissue into the position in which you want it to remain. If you've mixed the glue away from the eye, you then squirt some of it under the tissue and push the tissue down into the glue using forceps or a Weck-Cel. After about 15 seconds it stays where you placed it. This is not as precise or elegant as you might think would be necessary, but it works extremely well.

I and my recent fellows, Malik Kahook, MD, Larissa Camejo, MD, and Michael Herceg, DO, have found the glue to be very useful, so we always keep it on hand in the operating room. If we encounter a difficult situation—say the conjunctival tissue is falling apart, and placing sutures is causing further problems—we can simply glue the tissue into place.

One caveat: It is important to know exactly how you're going to use the glue before you activate it, because once you combine the components it will begin to get sticky; you'll need to use it fairly quickly. Fortunately, if you don't like the result, you always have the option of separating the tissues and starting over (one of the advantages of using fibrin glue)—although this can be messy.

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Surgical Advantages

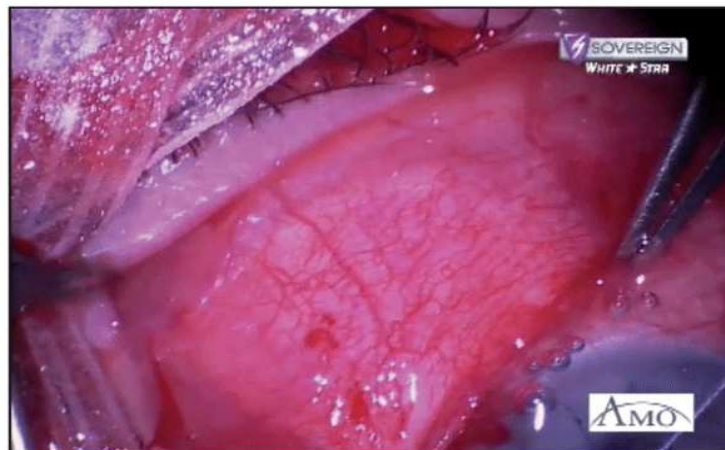
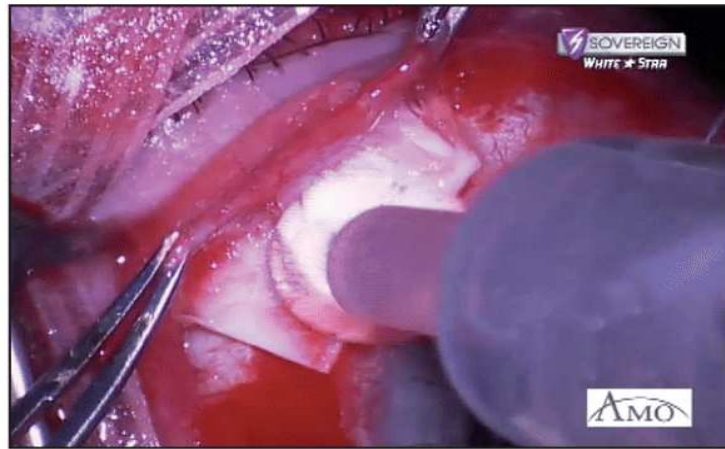
Using a glue such as Tisseel in glaucoma surgery has a number of advantages:

- **Time savings.** Closure can add a lot of time to the end of a case, and I'd argue that it's a non-value-added part of the case. So the quicker you can do it—in a safe manner, of course—the better for everybody. Using fibrin glue makes this part of the case quick and easy; it lets you focus more on the earlier parts of the case that require your surgical skill and judgment.
- **It stops bleeding.** Fibrin glue is often used in other medical surgeries, such as liver surgery, for this reason. In glaucoma surgery it's not uncommon to have little bleeders that can cause a relatively large inflammatory reaction. As a result, using the glue helps to minimize inflammation.
- **It's easy to undo.** When you use a glue such as Tisseel to fasten conjunctival tissue in place, it's easy to go back later, find the plane and dissect it without damaging the tissue (unlike tissues glued together with cyanoacrylate). The tissue lifts right up, and it's very easy to put it back down in place. In comparison, some eyes done without using glue are scarred and tissues such as Tenon's, sclera and conjunctiva can become stuck together, making it hard to find the plane and hard to lift the tissue.
- **It doesn't last forever.** This is an advantage shared by sutures: You just want to hold things in place for a while because the body will eventually form connective tissue that will take over and hold everything in position. So you need something that will last for days, not years. The fibrin glue will gradually disappear after a few days. Unlike sutures, however, it takes far less time to use, and patients are more comfortable because they don't have sutures on the surface of their eyes.
- **You can plug holes instead of stitching the edges together.** If you need to close up a small hole in the conjunctiva, it's fast and easy to simply let the glue plug it; there's no need for stitches and pulling on the tissue. Of course, you could try to pull the edges together and glue them, but that kind of strength is not a forte of fibrin glue.
- **You can trim off excess.** The texture of the glue when it's dry is somewhat rubbery. So, if excess glue protrudes from the wound, you can simply trim it off with scissors. It's no big deal.
- **It's easier on the patient.** Because of its rubbery texture—and the fact that it's easy to trim—it's very comfortable for the patient. And the eye looks pretty good very quickly.

Potential Downsides

Of course, every surgical option has limitations:

- **Fibrin glue doesn't have tremendous strength.** If you have to really pull and stretch something into position, you may be better off holding it in place with a stitch. Fibrin glue doesn't have the strength of cyanoacrylate glue, for example; even after it's dried, you can pull it apart with a little effort (a point in its favor in many situations). Of course, cyanoacrylate has its own disadvantages: It may last longer than you want it to; and it can be very irritating on the surface of the eye. Fortunately, you don't need a glue with mechanical strength for most eye surgery, making fibrin an ideal choice.



Top: The second component of fibrin glue is added to the first underneath the conjunctiva and patch graft.

Bottom: After application of the fibrin glue, forceps are used to hold the conjunctiva in place for 10 to 15 seconds to ensure proper positioning for closure.

- ***It has a learning curve.*** Fibrin glue isn't hard to use, but you do have to follow the instructions and use it correctly in your surgical situation.
- ***Staff have to be present.*** You'll need someone else to prepare the glue for use. They also need to understand how it works so that it doesn't start to set up prior to application.
- ***It's an extra cost.*** I'd say the biggest downside to using fibrin glue in glaucoma surgery is the expense; it costs a hospital about \$100 a case. For comparison, sutures are probably about \$15 to \$20 a pack. However, in the study I conducted with Dr. Kahook, we found that the savings we made by shortening our surgery time more than offset the cost of using the glue.¹ Using the glue shaves about 10 minutes off of the closing portion of the case because we don't have to suture. As you know, time is the most expensive component in the OR. So, if you're in a situation in which time doesn't matter, sutures are a cheaper option; but if time is money, using glue may make more sense.

Fibrin Glue and Tube Shunts

The easiest way to use fibrin glue in glaucoma surgery is the first way we used it: as a means to glue the conjunctiva back in place at the end of a case. We first tried this when implanting tube shunts such as the Ahmed or Baerveldt; we found that by using the glue for closure instead of multiple sutures we could accomplish this phase of the case in a couple of minutes. It's so quick and effective that we ended up using it during closure in every case.

Next, we tried using it to place a pericardial patch graft on top of the tube shunt on the scleral surface to prevent the tube from eroding through as a result of friction from the eyelid. This also works very well—it keeps the patch in place, right on top of the tube. Then, we tried using it to help keep the plate (the back part of the Baerveldt or Ahmed shunts) in position, replacing sutures. We found that it holds the plate in position long enough for scar tissue to form.

In short, we've found fibrin glue to be very useful in all phases of tube implant surgery as a replacement for stitches. At this point, we've done many cases in which we haven't used any stitches for attaching the plate or tube to the eye. It's possible that you'll still need stitches from time to time as a safety measure; it is important to keep the tube from moving. (In fact, we usually put one little safety suture over the tube just as insurance, but our experience suggests this may not be necessary.) In the average case, when everything is going your way, I'd argue that the glue largely eliminates the need for sutures.

Trabeculectomy and Beyond

We also sometimes now use fibrin glue in trabeculectomy, although we're not so bold as to try to perform this surgery without using any sutures at all. We use the glue for two purposes: to repair wound leaks and to create a space under the conjunctiva that's free of blood and scarring.

As you know, early postop leaks can be a serious problem after trabeculectomy. So in addition to suturing the front edge of the conjunctiva up to the cornea when we're replacing it, we use fibrin glue to plug holes temporarily. Meanwhile, we don't want the underside of the conjunctiva to adhere to the sclera because it will scar down and block fluid egress. If we use fibrin glue to adhere the conjunctiva in place, we end up with a nice plane that's not stuck together at multiple levels—possibly because the glue plugs up any bleeding vessels, creating a space that's free of blood and scarring, and that quiets down very quickly. As a result, when the fluid comes out of the eye you get a nice bleb and the surgery works well.

So far, we haven't used the glue in trabeculectomy as much as we have with tube shunts, but we're using it more and more. We find it cuts down on the leak rate, reducing the need for us to put a suture in or use a contact lens. I think of it as insurance against complications.

We're also now using fibrin glue in our canaloplasty and some ECP cases. In canaloplasty, where the scleral flap is closed tightly, we use fibrin glue to close the conjunctiva at the end of the case; we also use it to supplement our suture closure of the scleral flap to buy us a margin of error if there is some minimal leakage. In ECP cases in which we have a vitrectomized, non-phakic eye, we often prefer to use a pars plana approach. After closing sclerostomies at the end of the case with vicryl sutures, we use the glue for conjunctival closure as well.

Unfortunately, fibrin glue is not of much use in late bleb leaks following trabeculectomy—the kind that occur years later as a result of mitomycin-C use. Blebs that leak at this point are often very avascular; there's no viable tissue left. The glue could be used to seal the leak for a day or two, which works well for an early postop leak where you just want to stop any flow through the leak until the body plugs it. But when the tissue is falling apart, the temporary nature of this glue won't really solve the problem.

Off to a Good Start

Using fibrin glue in glaucoma surgery is still a relatively novel concept; there are only a few reports of it in the literature. And as we know, surgeons are creatures of habit. Also, this is an off-label use of the glue; it's not marketed or promoted as an ophthalmic product. On the other hand, it's readily available in most hospitals because surgeons in other branches of medicine frequently use it.

Currently, the Tisseel brand is the only glue I'm aware of that makes sense to use in glaucoma surgery. Its texture, consistency and other characteristics make it ideal for this purpose. Other glues are now being developed, but for this type of surgery Tisseel seems to be the most viable current option.

Certainly fibrin glue is not ideal in every surgical situation; it has the limitations mentioned above. But used in the right setting it provides significant advantages, and it can get you out of some tough spots, such as when you need to plug a hole or stop bleeding. We now use it in all of our glaucoma drainage device surgeries, and we're using it more and more in our trabeculectomies, as well as at the end of our canaloplasty and scleral-approach ECP procedures.

I've found fibrin glue to be a great tool, and it's cut down on my surgery time significantly. When I have to operate at a location where fibrin glue is not available, it's more painful than what I've become used to. Hopefully, the use of fibrin glue in glaucoma surgery will become commonplace in the future as more surgeons become aware of it and comfortable with it.

Dr. Noecker is an associate professor of ophthalmology at the University of Pittsburgh, as well as vice chair and director of the glaucoma service. Dr. Herceg is a clinical fellow at the University of Pittsburgh Department of Ophthalmology. They have no financial connection to Baxter Healthcare.

1. Kahook MY, Noecker RJ. Fibrin glue-assisted glaucoma drainage device surgery. Br J Ophthalmol. 2006;90:12:1486-9.

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