

VMED 5467 SURGICAL LABORATORY

THIRD EYELID FLAP:

Indications:

The 3rd eyelid flap has very limited application, but it is useful to prevent corneal dryness and trauma resulting from the eyelids. Indications for a 3rd eyelid flap include:

1) Indolent corneal ulcers—Following debridement and a grid keratotomy a third eyelid flap will protect the cornea from dryness and eyelid-induced trauma. **One of the biggest obstacles to the healing of corneal ulcers is a dry cornea.** Many times indolent corneal ulcers occur as a result of KCS or the irregular ulcerated surface of a cornea with even a superficial corneal ulcer predisposes the corneal surface to dryness. Simple corneal ulcers will usually heal without a third eyelid flap unless the ulcer was due to KCS.

Remember, you don't want to use a third eyelid flap on a complex corneal ulcer—one that involves the corneal stroma—because you expect these ulcers to have more potential to become infected and progress to perforation. Deep corneal ulcers usually are or have been infected and/or have melted from degranulation of neutrophils. You don't want to cover this ulcer, you want to watch it. If you cover up a melting corneal ulcer, the delivery of medication behind the 3rd eyelid is reduced because the tear ducts drain the fluid in the front of the 3rd eyelid. So, much more medication is getting drained into the nose and much less of it is going to make contact with the cornea where it actually benefits your patient. Also, if a third eyelid flap is raised, you can no longer tell if the corneal ulcer is getting better or worse with your therapy. A temporary lateral tarsorrhaphy (~2/3 of the eyelid margin) is a much better option for complex (deep) corneal ulcers.

2) Corneal trauma due to eyelid trauma—Entropion or ectopic cilia, for example, which can not be corrected immediately for logistical reasons. I have used third eyelid flaps to postpone eyelid surgeries for a few days without risking more significant corneal trauma.

3) Proptosed eyes—A lot of veterinarians use the 3rd eyelid for traumatic proptosis once they put the eye back into the orbit. They will use the 3rd eyelid as a diaphragm of support to keep the eye in the orbit. Some veterinarians use a temporary tarsorrhaphy following proptosis and some prefer to use a 3rd eyelid flap. For this and many other problems a third eyelid flap and a temporary tarsorrhaphy are interchangeable.

4) Facial or trigeminal nerve paralysis—This is usually a relatively long-term problem. It is something that is not usually going to go away in days, and you really do not want to leave a 3rd eyelid flap up for more than 3-5 days before you look at the cornea again. So again, I would say a temporary (or even a permanent) lateral tarsorrhaphy is a better treatment choice.

5) Protection during transport to an ophthalmologist—For example, if you have a corneal laceration and an iris prolapse, you've recommended referral and the client is in willing, and you sedated the dog to do your exam because he was painful or fractious. In this scenario you might put up a 3rd eyelid flap for protection during transport before the animal recovers from sedation or general anesthesia. These situations always warrant an E-collar of course, but the 3rd eyelid flap would provide a little more support.

In my opinion, third eyelid flaps are primarily indicated for indolent corneal ulcers, protecting the cornea from eyelid trauma, prevention of corneal dryness, transport of corneal emergencies, and following correction of proptosed eyes.

Technique:

Drive your suture through a stent, through the dorsal eyelid at the conjunctival fornix, into the palpebral surface of the third eyelid ~3 mm behind the leading edge, passing behind the cartilage but not through the conjunctiva of the bulbar surface, out the palpebral surface on the other side of the T cartilage, back through the dorsolateral conjunctival fornix and out the eyelid, through the stent again, and tie your knot.

What suture do you want to use for 3rd eyelid flaps? You want a 3-0 non-absorbable suture with a cutting needle. Nylon, prolene, etc works well. The biggest criterion is that you want a big enough needle to make it through the skin and the conjunctiva. If you use too small of a needle, you will be frustrated. (A small needle is an even bigger problem when you are dealing with the cherry eye correction.)

Stents distribute the pressure from the 3rd eyelid wanting to pull back against the suture to minimize pressure necrosis of the eyelid skin. Rubber bands ¼" wide or IV tubing makes excellent stents. If you use suture without stents and leave the flap in place for more than a couple of days, you will notice more necrosis under the suture. Tape can be placed under the stent to further distribute the pressure.

The main thing you want to remember when raising a 3rd eyelid flap is the direction the 3rd eyelid wants to naturally move across the eye. This is from ventromedial to dorsolateral. You want to duplicate that natural tendency. You do not want to anchor the third eyelid at 12 o'clock. The other thing you will want is to pull the 3rd eyelid flap far enough into the conjunctival fornix that your suture does not have any chance of rubbing on the cornea. (I do not recommend anchoring the third eyelid to the bulbar conjunctiva.)

I slide a forceps or scalpel handle underneath the lateral upper eyelid and pull it out so that you can see the shape of the handle through the eyelid. When you drive your needle through, you're going around the end of the instrument. If you do not support the upper eyelid in this way, the eyelid skin and the underlying conjunctiva lose their previous orientation and as your needle drives through, it naturally tends to exit the conjunctival surface closer to the eyelid margin. If you make this mistake, your suture may contact the cornea due to the 3rd eyelid's natural tension. So, put an instrument under the eyelid and support it so that when you penetrate the eyelid, you are truly in the dorsolateral conjunctival fornix.

If you are able to grab the cartilage in the 3rd eyelid, it has enough holding strength that you do not need to put 2 or 3 sutures in it as some texts illustrate.

Your suture through the 3rd eyelid should pass parallel to the free margin of the 3rd eyelid. You want to place the suture in the third eyelid close to the free edge so that the third eyelid is more mobile. Some people tend to grab the 3rd eyelid too far away from the leading edge of the third eyelid. This results in a partially covered cornea and increased tension on the eyelids. The leading edge of the third eyelid usually has a pigmented stripe. When you look at the T cartilage, the top bar of the T—the one that corresponds to the margin of the 3rd eyelid—roughly corresponds with the pigmented stripe. Not every dog has this pigment, but most of them do. You want to grab the 3rd eyelid in such a way that you pass around the post of the T cartilage just behind the top of the T. Your needle should

enter the palpebral surface of the 3rd eyelid as opposed to the bulbar surface. To find the T cartilage grab the 3rd eyelid right in the center of its leading edge, and then kink the 3rd eyelid by rolling your forceps toward the cornea. The cartilage will be apparent as a 4-5 mm wide pale, stiff area under the conjunctiva the lateral and/or medial border of the cartilage should be evident as a ridge.

When you are trying to pass your needle, hold the leading edge of the eyelid next to the edge of the cartilage on the near side of your pass. For example, if you pass your needle from medial to lateral hold the eyelid just medial to where you initially enter the external (palpebral) surface of the third eyelid. As you pass your needle through, it pulls against your forceps and aligns the path of the needle. If you grab the third eyelid cartilage in the middle and pull the eyelid toward you, it tents the third eyelid making the eyelid curve out toward you like a U while the needle curves toward the eye in an upside-down U. This makes it more difficult to pass the needle without penetrating the bulbar conjunctiva.

When passing the needle behind the T cartilage, the needle and suture should pass underneath the bulbar conjunctiva on the corneal surface of the 3rd eyelid—between the cartilage and the conjunctiva on the back of the 3rd eyelid. You should be able to see the needle and the suture through the conjunctiva, but the needle and suture should never penetrate the corneal surface. Look for evidence that you penetrated the bulbar conjunctiva before passing the swaged end of the needle through the third eyelid so that you can simply back out the needle and try again if you penetrate the conjunctiva.

Now, it is simply a matter of passing the needle back through the dorsolateral conjunctival fornix, out the skin, and through the stent to tie your knot. When you go through the stent the points where it goes through first and comes out last should be close together. The closer together, the better your knot security will be. When there is more span between these points, you will have more slack in your suture.

TEMPORARY TARSORRHAPHY:

Indications:

Frequently, I will use a temporary tarsorrhaphy to close the lateral two-thirds of the eyelid instead of a third eyelid flap. A temporary tarsorrhaphy is a horizontal mattress suture holding the dorsal and ventral eyelids together. The nice thing about a temporary tarsorrhaphy is that you can still see the cornea, but you have narrowed the eyelid fissure to the point that even if you have reduced tear volume, the available tear film will do a much better job of keeping the cornea moist. Also, if you need artificial tears, they will last longer because the opening of the eyelid is so much smaller.

Technique:

Use 4-0 to 5-0 non-absorbable suture on a cutting needle to complete a temporary tarsorrhaphy. Place the suture at the junction of the medial 2/3 and the lateral 1/3 of the eyelid for partial closure or close the entire eyelid with 2-4 sutures following correction of a proptosed eye. Pass the suture through a stent (IV tubing section or ¼" wide rubber band) then into the eyelid 3-5 mm from the dorsal eyelid margin and out one of the Meibomian gland openings at the exact eyelid margin. If the suture is internal to the Meibomian gland ducts it will ulcerate the cornea and if it is external to the openings it will cause entropion. After exiting the first Meibomian gland duct, cross into the opposite eyelid's matching Meibomian gland duct and out the skin 3-5 mm from the eyelid margin. Pass through another stent and repeat the procedure 2-3 mm to the side. Be sure to pass back through

the stent in the lower eyelid before passing through the eyelids again. When passing through the dorsal stent to tie the knot, be sure to pass very close (≤ 2 mm) to the original suture pass to provide better knot security.

CHERRY EYE:

**The Kaswan technique, entropion repair, and V-eyelid resection should be done on the same eye. Use the lower eyelid for the Hotz-Celsus and the upper eyelid for the V-resection. This will allow one eye with intact eyelids for a transpalpebral enucleation.

Indications:

Before repairing a "cherry eye" or the prolapsed gland of the 3rd eyelid you must remember the differential list for third eyelid diseases that appear similar to a prolapsed gland of the third eyelid. The list should include third eyelid tumors, scrolled cartilage of the third eyelid, and third eyelid gland adenitis or neoplasia. Be sure you are replacing a prolapsed gland and not burying a third eyelid tumor. Do not be paranoid, but remember that "cherry eye" is a disease of young dogs – typically less than 1½ years old and the prolapsed gland appears behind the third eyelid – on the corneal side of the third eyelid. Tumors may appear anywhere including the anterior surface and typically occur in older dogs. If you had a mass in front of the free edge of the 3rd eyelid, it is not a prolapsed gland. Scrolled cartilage is a rare congenital abnormality that deforms the contour of the third eyelid. There is no bulbous gland or mass and the kink in the cartilage may curl the leading edge inward or outward. Third eyelid gland adenitis results in a hyperemic, thickened third eyelid, but again, no bulbous mass. Neoplasia can masquerade as a mass behind the third eyelid, but since third eyelid neoplasia is rare in very young dogs, biopsy of what appears to be a typical "cherry eye" in a young dog is not indicated.

Technique:

When you replace prolapsed glands of the third eyelid, there are many different techniques available. The first technique I recommend tacks the gland to the orbital rim. It is called the modified Kaswan technique. There are 2 different places that you can make your incision to expose that orbital rim: 1) over the ventromedial palpable orbital rim through the skin and 2) in the conjunctival fornix in front of the third eyelid. For simplicity's sake, this handout depicts going through the lower eyelid skin at the orbital rim.

Use a 3-0, non-absorbable suture on a taper needle. I've seen a lot of people lacerate the periosteum with a sharp cutting needle, resulting in a failed surgery.

For the purposes of this laboratory, you will have to choose a random place where you will pass your suture through the bulbar surface of the 3rd eyelid. If you look back on the back surface of the 3rd eyelid, you'll see a cobblestone-like area. That is a normal collection of lymph follicles. The ducts of the gland exit in that cobblestoned area. Deep to that area is the gland. When that gland prolapses, it is just behind the edge of the 3rd eyelid. For the laboratory, I would not anchor the normal gland, but I would act as if the gland was closer to the free edge of the 3rd eyelid. If you do this, you will have results that are closer to what it will look like once you fix a prolapsed gland.

When making the skin incision, it needs to be ventromedial, because again, you have to think about where the 3rd eyelid is naturally located – ventromedially. Palpate the ventral orbital rim on your own face. As you go around the bottom of it, it has a sharp edge, but as you palpate medially, right underneath the medial canthus, it flattens out as it curves

upward. Anchor the gland to the last sharp edge before it flattens out against the bone of the nasal passages. Make a little incision there—about an inch long. When making this incision, you will notice once you get through dermis, there is a thin layer of beige muscle—orbicularis oculi. It's a thin muscle but you can still see it. Use blunt dissection to split the fibers of that muscle. You will then see a shiny white tissue—periosteum and fibrous tissue extending from the orbital rim into the ventral eyelid. You do not want to cut through periosteum, but if you do penetrate it, you will notice a prolapse of white-yellow fat. If the fat prolapses, you have entered the orbit. You can still anchor to the periosteum of the orbital rim, but when you close you need to close the periosteum to keep the orbital fat in the orbit. If you do not cut through the connective tissue, you can simply close skin when you are done.

Hold your needle in the bottom of the curve with the point facing out towards you, and with the back of the needle and the needle drivers, push the lower eyelid and tissue back. (You can also use a scalpel handle to hold it back.) As the needle presses against the rim and you move it posteriorly you will feel it pass over the edge of the rim. Next drive the point rostrally through the periosteum at the ventromedial rim. If the needle is stopped by bone, walk it over the edge of the rim with small adjustments. Be careful not to bend your needle or anchor to periosteum over the flat bones of the face. You will be able to pick up the head by pulling on your suture if you have a bite of periosteum. This is an essential check on your suture placement.

Raise the 3rd eyelid with forceps and pass your needle through your skin incision again, underneath the conjunctival fornix anterior to the third eyelid, and out the prolapsed gland on the bulbar (corneal) surface of the 3rd eyelid. Come out on the right or left side of the gland. As you pass your suture back into the gland, enter exactly where suture exited the first pass, go across the gland horizontally, and come out on the opposite side of the gland. Again, go back into the gland exactly where your suture last came out and pass the needle out the skin incision without exposing suture in the conjunctival fornix in front of the third eyelid. If suture is exposed in the ventral conjunctival fornix you must replace the entire suture.

This technique creates a mattress suture between the gland of the 3rd eyelid and the orbital rim. By coming out and going in at exactly the same place on the prolapsed gland, you have essentially buried the suture. When you tie the knot, it will cause pressure necrosis. The conjunctiva will heal over and your suture will be buried. It should disappear at the time you place it. You should not see any suture on the back of the 3rd eyelid, just 2 small dimples.

Before tying the knot, be sure you do not have any suture showing in the conjunctival fornix in the front of the 3rd eyelid by pulling the lower eyelid out and examining the fornix. There should be no suture showing.

Raising the 3rd eyelid with forceps will also raise the conjunctival fornix to where you are less likely to pass the needle across it as you go up the first time, and as you come back. If you leave the 3rd eyelid retracted within the orbit, you are more likely to pass through the conjunctival fornix in front of the 3rd eyelid. Since this procedure calls for a non-absorbable suture, you will eventually get a fistulous tract following your suture line if suture is exposed.

Once you have your horizontal mattress suture tied, you close skin with simple interrupted sutures of 4-0 or 5-0 nylon.

POCKET TECHNIQUE:

Indications:

The pocket technique is what I use when a 3rd eyelid gland prolapse is sent to me for repair after someone else has already attempted surgery, or if the patient is an English bulldog. The orbital conformation of an English bulldog is such that their ventral orbital rim sits very close to the free edge of their lower eyelid. You're not moving their gland very far if you tack it to the orbital rim. The pocket technique basically imbricates the 3rd eyelid making it shorter. You are tucking the gland into an orbital pocket but this also shortens the 3rd eyelid. When healed there is a band of conjunctiva that spans over the top of the prolapsed gland and pushes it down. By making two incisions—a "smile" and a "frown", you have an area of conjunctiva at either side that does not grow together. This surgery creates a tunnel with the gland in the center of the tunnel and the fluid secretions exiting on either end of the tunnel.

Technique:

I often use towel clamps or stay sutures and hemostats as retractors. I put one in the third eyelid on the medial side and another on the lateral side of the prolapsed gland. Use tenotomy scissors or small, blunt-tipped scissors to make a small cut in the conjunctiva in front of the gland. Be sure to start to the side of the T cartilage. Bluntly undermine across the T cartilage in front of the gland creating a tunnel under the conjunctiva and then cut the conjunctiva. Your cut will be 2-3 mm posterior to the free edge of the 3rd eyelid. Next, pull out the gland and make another incision proximal to the prolapsed gland. This incision should be shaped like a frown as you look at it. Grasp the conjunctiva with small forceps, make a nip in the conjunctiva with scissors, bluntly undermine a tunnel of conjunctiva, and cut that tunnel open just like the first. Now you have 2 curved incisions, with the curves facing away from each other and the gland in the middle. Make sure you do not forget to make your pocket. Use tenotomy scissors to bluntly dissect under the globe creating a pocket into which you will press the prolapsed gland.

Use 5-0 or 6-0 vicryl suture to close the pocket with a simple continuous suture. Anchor the suture by tying knot on the palpebral (anterior) surface of the third eyelid, and then pass the suture through the eyelid to close the conjunctiva. At this point you can tie your final knot on the anterior surface of the third eyelid or you can go back over the first suture line with an imbricating (Lembert) suture pattern to provide additional support if any gaps are present in the conjunctival closure or if suture is exposed to the cornea. Be very sure that there is no exposed suture material to ulcerate the cornea. Finally, pass the needle and suture through to the palpebral surface of the 3rd eyelid, take a bite next to where the needle came through the eyelid on the anterior surface, carefully pull all slack out of the suture, and tie off the suture to the loop. The only exposed knots will be on the palpebral surface of the 3rd eyelid, not on the corneal surface preventing corneal trauma.

The pocket technique or the orbital rim fixation should take you about 10-20 minutes once you are comfortable with them. The pocket technique has a tendency to bleed more resulting in difficulty visualizing the tissues. You are also working behind the 3rd eyelid, so you need to have better retraction and it is helpful to have an extra set of hands when you are learning this technique. I think fixing it to the orbital rim is quick and easy for one person to do in private practice, but after you get used to it, you can do the pocket technique with just one person.

ENTROPION REPAIR (HOTZ-CELSUS PROCEDURE):

Indications:

The simplest, easiest entropion cases to fix are the ones that are ventrolateral. You will sometimes see entropion cases that are combination of entropion and ectropion. Labrador and Rottweiler dogs that have what is commonly called "diamond-eye," where their eyelid looks like a glass pitcher spout. The eyelid has ectropion medially and laterally but has entropion centrally. The top eyelid will be a mirror image of the lower lid. I recommend referring these more difficult cases. I recommend correcting the straightforward entropion cases where you can do a good job the first try.

Technique:

The important thing to remember for entropion correction is that all planning has to happen before anesthesia. Start planning your entropion repair from the time the dog walks through the door. Your guide should be the "Rule of Thumb." Before you put any topical anesthetics in the animal's eye, you want to figure out how much eyelid is rolled inward. Figure out where the eyelid is cresting over. Most of the time the eyelid will be wet, and there will be alopecia. This will help you identify a landmark. Visually identify a landmark without touching the animal's face anymore than you have to. You might have to hold the chin up, but do not put your hands on top of his head or around his eyes. Choose your landmark at the point where you think the entropion is most severe. This is usually ventrolaterally. Once you identify that landmark, reach toward the face. As you reach toward the face, the animal will squint because the eye is painful. The eyelid will move, which is why you have to identify landmarks before reaching for the eyelid. Put your thumb where the crest of the entropion is (your landmark) and roll the eyelid out. The distance from the landmark to the margin of his eyelid is how much entropion that dog has. Part of that entropion is his real conformational entropion, and part of that entropion will be a result of squinting (spastic entropion). The way to determine the extent of conformational entropion is to repeat this process after proparacaine is applied to the eye in the course of your exam. Remember to identify your landmark prior to reaching for the eyelid. The amount of skin that should be removed to correct the entropion is halfway between the spastic entropion measurement and the conformational entropion measurement. For example, if the first measurement is 5 mm and after you apply proparacaine the 2nd measurement is 3 mm, you want to remove about 4 mm of skin at that point. The excised piece of skin will be banana-shaped because the entropion usually tapers toward the medial and lateral canthi.

Once deciding how much skin to remove, support the inside of the eyelid with something solid like a scalpel handle or a wide forceps handle. Use a scalpel blade, usually a #15 blade, to make your first incision parallel to the eyelid margin and about 2-3 mm from the edge of the eyelid. To correct exactly what you measured by removing a precise amount of skin, you have to be close to the edge of the eyelid. The further away you get from the eyelid, the less accurate your corrections will be. The closer you get to the margin of the eyelid, the more accurate your correction will be. Make your next incision the previously measured distance from the first incision. The second incision will result in an outline that tapers towards either end. It will be shaped more or less like a banana.

Pick up one corner of the outlined skin and, with tenotomy scissors, snip away the dermis. Some textbooks will recommend removal of the orbicularis oculi muscle. Removal of the muscle is unnecessary. You do not need to cut any deeper than dermis, but you do need to cut all the way through the dermis – below the depth of the hair follicles. If on the other extreme you cut all the way through the eyelid, you need a 2-layer closure. You will have to close conjunctiva first (with buried suture) and then close skin.

You should use 4-0 to 5-0 nylon suture on a cutting needle to close skin. Close the incision beginning with the center of your incision. Your next sutures will be halfway between the central suture and either end of the incision. Keep dividing the distance of these gaps in half with sutures until there are no more gaps between the 2 edges of the incision. I usually place a suture about every 1 mm because, if the animal gets one suture out, I want to have enough sutures left so that the incision does not gape open.

Do not cut your suture until you have placed at least 4 throws. Your knot will be oriented so that one suture tag extends toward the eye and the other extends away from the eye. In the interest of protecting the dog's cornea, cut the tag toward the eye close to the knot. Place 4 or 5 throws until the tag toward the eye is the one attached to the needle so that you are conserving as much suture as possible. Aim to have a one inch tag pointing away from the eye to facilitate suture removal.

V AND HOUSE EYELID RESECTION FOR EYELID MASSES AND ECTROPION REPAIR:

Indications:

Small tumors on the eyelid margin are common in dogs. The V-eyelid resection is for removing small masses from the meibomian gland arcade and eyelid margin. It will also correct ectropion. It corrects ectropion because, in ectropion, the eyelid margin is too long. When you shorten the eyelid, it rests against the cornea.

Technique:

You should use tenotomy scissors for the V-resection or house resection. Scissors are better than scalpel blades because the crush of the scissor blades helps line up the conjunctiva and the skin. If you use a scalpel blade, the skin and the conjunctiva generally slide against each other losing their natural orientation and you do not wind up with matching incisions.

An important concept to remember is the dimension of the V. To provide the best closure the length should be 2 times the width. The length of the incision from the eyelid margin must be at least 2 times the width of the eyelid margin removed.

Usually you can remove 1/4 to 1/3 of the eyelid margin without adjunctive surgery, but it depends on the conformation of the dog. For example, if you are treating a collie, a dog whose breed standard describes small, almond-shaped eyelids and you remove a fourth of that dog's eyelid, you have taken a lot. You will be hard-pressed to close that incision without a notable defect. But, if you consider a bloodhound, you can easily take a third of that dog's eyelid margin and close it appropriately. The general consensus is that 1/4 to 1/3 of the eyelid can be removed without necessitating additional plastic surgery.

The house eyelid resection technique is designed to minimize the amount of eyelid margin affected by the mass removal and is so named because the shape of the incision resembles a house. It is otherwise identical the V-resection.

When you close the eyelid it should be closed in a two-layer closure. Any full thickness incisions in the eyelid, including lacerations, require two-layer closures. The conjunctiva should be closed first. Tie your knot at the point of the V and then work toward the eyelid margin taking bites parallel to the edge of the conjunctiva. When you are done this suture pattern will resemble an intradermal pattern. Do not pass your needle perpendicular to the conjunctival incision exposing the suture on the palpebral conjunctival surface. As you

approach the meibomian glands, you will find the eyelid becomes much tougher. This resilient tissue is called the tarsal plate. The tarsal plate makes this skin function as an eyelid instead of just a loose flap of skin. Once you reach the meibomian glandular tissue on one side of the incision be sure to grab the meibomian gland from the other side with your next pass. If you have not been working evenly toward the eyelid margin up to this point, you need to even it up immediately or start over. Closing the conjunctiva will keep tear film from leaking into your incision and delaying wound healing. Tie the suture on one side to a loop of suture on the other side to finish your conjunctival closure.

To close the skin you begin with the eyelid margin. The first suture you place is a figure eight suture. The main problem that people have with figure eight sutures is that they get too greedy and try to close too much with one suture. You want to close 2-3 mm at the free margin of the eyelid with the figure eight suture. I generally come about 1 mm over from the edge of my incision. So, 2-3 mm back, 1 mm over, that's where you begin the figure eight suture. These suture passes should split the thickness of the dermis. No full thickness sutures here. Cross the incision, split the thickness of the dermis again, and exit on the eyelid margin at the first Meibomian gland opening or about 1 mm from the cut edge. From here the suture should be a mirror image of itself. The suture should exit 3 mm back and 1 mm over on the other side of the incision. Then you tie it off. The illustration in the surgery handout looks like the whole incision is closed with figure eight, but you should only close 2-3 mm at the edge with a figure eight. Use simple interrupted sutures to close whatever remains. After you tie a square knot in the last simple interrupted suture, place another throw but do not tighten it. Place the long tags from your figure eight suture and other simple interrupted sutures through the last throw before tightening the throw and tying a square knot. Now all the suture material will point away from the eye.

ENUCLEATIONS AND EXENTERATIONS:

Indications:

The criteria that should lead you to suggest the owner remove the eye of their dog are blindness and pain or neoplasia. If an eye is painful but visual, we recommend therapy to fix the underlying problem. If an eye is blind, but not painful, we leave it alone. If the eye is blind and painful, you have reached a point of diminishing returns for the dog and the owner. You should recommend enucleation or an evisceration with intrascleral prosthesis.

The first enucleation I want you to do is a transpalpebral enucleation. If you finish that procedure and have time, proceed with a transconjunctival enucleation.

Exenteration and Orbital Anatomy:

Indications:

The indications for an exenteration include neoplasia or unresponsive orbital abscess. Exenteration means the globe and all the tissues in the orbit are removed. This brings us to defining the limits of the orbit. What are the borders of the orbit? The nasal wall of the orbit is bone. The dorsal edge of the orbit is bone. The medial aspect of the caudal orbit is also bone. This is where the orbital fissure and the optic nerve enters the orbit. The dorsolateral and dorsocaudal orbit is muscle – the temporalis muscle. The floor of the orbit, underneath the eye is delineated by more muscles of mastication—the pterygoid muscles. (One of the classic signs of an orbital abscess is purulent material draining from behind the last molar. This is treated by using a pair of hemostats to open the draining tract and create more drainage. You can do this because the floor of the orbit is soft tissue.) Additional important anatomical structures in the orbit include the 3rd eyelid and its gland ventromedially. The zygomatic salivary gland is located ventrolaterally. Most orbital abscesses are actually zygomatic salivary gland abscesses. The eye is also encased in orbital fat. Remember, if you cut through the periosteum and fibrous connective tissue when replacing a prolapsed gland of the third eyelid you will see a fat prolapse? The tissues you want to remove in an exenteration include the globe, the third eyelid, orbital lacrimal gland, rectus muscles, orbital fat, and the zygomatic salivary gland. Remove all tissue all the way out to bone and the muscles of mastication. Leave nothing else in the orbit. Where the temporalis muscles and pterygoid muscles are you usually stop at the muscle. You can cut out portions those muscles, but then you are extending the surgery beyond the orbit—more than an exenteration. Surgical oncologists may even cut out extensive portions of bone, in a surgery termed an orbitectomy, to attempt a surgical cure of neoplasia.

Technique:

There are a couple of things you do not want to touch when you are removing an eye during an enucleation or exenteration. Enucleations are usually considered surgeries where you are guided by bone -how wrong can you go? Even if you cut the muscles of mastication, it is usually not a big deal. The dog will be more painful, but you usually do not damage anything irreversibly. In the floor of the orbit, running in the ventromedial aspect against the bone, are arteries, veins, and nerves that you know by name—the maxillary artery, vein, and nerve. Generally, if you know the name of a vessel or nerve, you should not cut it—especially if it is an artery. These structures are important and supply critical tissues in the maxilla (teeth, etc), so you do not want to cut them. I have seen students cut these structures in these labs, by using curved enucleation scissors with the tips pointed down when dissecting under the eye. **Do not place curved scissors underneath the eye with**

the curved pointed down. When you are working in the orbit underneath the eye with curved scissors, the tips should always point up.

*Despite the extensive nature of an exenteration most orbital neoplasia is ultimately fatal and exenterations are more appropriately thought of as palliative therapy rather than curative therapy.

Transpalpebral enucleation:

Indications:

If you have a patient with a blind, painful eye due to a nonneoplastic cause, you have 2 choices regarding how to enucleate the eye: transpalpebral or transconjunctival enucleation. Indications for a transpalpebral enucleation include an infectious disease on the surface of the eye (cornea, third eyelid, etc)—for example a pseudomonas melting ulcer or squamous cell carcinoma. To prevent spreading squamous cell carcinoma cells or pseudomonas organisms throughout the orbit as you are doing your surgery you should surgically prepare the ocular surfaces and then suture the eyelids closed to keep the disease packaged safely out of the surgical field. The most common mistake made with this technique is to accidentally penetrate the conjunctiva exposing the diseased tissue to the orbit. Once this happens, you might as well have done a transconjunctival enucleation because you have not protected the orbit.

There is no contraindication to a transpalpebral enucleation, and you need to practice the transpalpebral enucleation until you are confident with the technique.

Technique:

Suture the eyelids closed leaving 2-3 inch long tags at the beginning and end of your suture pattern. Two to three millimeters from the eyelid margins make a circumferential incision in the skin with your scalpel blade. After this you can set the scalpel blade down because you do not need it anymore. The key, to avoiding accidental penetration of the conjunctiva when you're dissecting, is to keep the scissors in a plane where you can see the tips of the scissors moving underneath the skin. Use tenotomy scissors and, with sharp dissection at first and then blunt dissection, undermine the skin until you get to the point where you are at the orbital rim. When you can see or palpate the orbital rim, dive into the orbit with your blunt dissection. Until then, you should be working just underneath the skin. If you follow this technique, you will not penetrate the conjunctiva. Once you have dissected around the globe to the point it will rotate 360 degrees curved scissors can be used to free it from the orbit.

The handout describes clamping the optic nerve and other sources talk about tying off the optic nerve. I think this is a complete waste of time. When you get to the back of the eye, what you will find is that after cutting all the rectus muscles and then you have the optic nerve, retractor bulbi, and fat attached to the posterior sclera. If you try to tie off the optic nerve with suture, you cannot achieve good knot security, and if you succeed in tying the suture you will either cut the nerve proximal to the suture or you will see the suture slip off after the cut is made and the tissues retract. I recommend you just cut the globe out attempting to include 4-5 mm of optic nerve and then pack the orbit with gauze for hemostasis. Put pressure on the gauze in the orbit for 3-5 minutes, and then you can proceed. If you find a bleeder, use a hemostat to stop the bleeding. After several minutes it is usually coagulated enough you can remove the hemostat, but if not, simply tie off the bleeder.

Likewise, if you try to clamp the optic nerve with hemostats, there is not enough room to clamp it with a hemostat and use a pair of enucleation scissors to cut the optic nerve at the same time. Once you remove the clamp, you cannot know whether you are cutting proximal or distal to where you clamped. You are more likely to cut the nerve on the proximal side of the clamp than you are to cut between the clamped portion and the sclera. If you try to cut the nerve against the sclera, you will not provide the pathologist with enough optic nerve for a thorough evaluation.

Transpalpebral enucleation technique tends to remove much more orbital tissue. The typical result is very similar to an exenteration. It is very time consuming and difficult to dissect down to the sclera and prevent removal of the rectus muscles and orbital fat – often even the zygomatic salivary gland – without accidentally penetrating the conjunctiva using a transpalpebral approach. Many veterinarians feel the removal of additional tissues results in a deeper indentation and suggest a transconjunctival enucleation is more cosmetic. Personally, I cannot tell the difference postoperatively and feel the closure – specifically using absorbable vs. non-absorbable suture for the periosteal closure – is the most significant factor affecting the cosmetics of a standard enucleation.

One disadvantage to the transpalpebral enucleation is the extensive undermining of skin and the resulting seroma or extensive bruising after surgery. The transconjunctival enucleation also bleeds a little bit less until the globe is removed. It also leaves less tissue attached to the globe, and, if you're going to submit it for histopathology, is more convenient than a transpalpebral enucleation. If you do a transpalpebral enucleation and submit the globe without trimming the excess tissues, it will not fix as well. One thing you can do to fix a globe as well as possible is to draw up $\frac{1}{4}$ to $\frac{1}{2}$ cc of formalin in a 1-3 cc syringe, and inject the vitreous 5-7 mm behind the limbus or right through the optic nerve with a 25 gauge needle. Just barely enter the eye, and inject formalin until the globe's natural turgor is restored. Try to avoid the lens. Otherwise formalin may not normally penetrate sclera or cornea well enough to preserve the retinal architecture. Make it a rule to submit every eye for histopathology, and always put the globe in formalin as soon as possible.

Transconjunctival Enucleation:

A transconjunctival enucleation is completed with forceps and scissors exclusively. Begin by making a snip in the conjunctiva 5-7 mm caudal to the limbus. This conjunctiva and connective tissue will be an important "handle" to grasp during the enucleation, but can be easily torn free if you are not careful. Dissect perpendicularly to the sclera until you reach it. Sclera can be identified because it does not move as you move the overlying conjunctiva and it has a dense fibrous nature. Use blunt dissection to undermine the conjunctiva before cutting it 360 degrees around the globe. Once the conjunctiva and fibrous connective tissue (Tenon's capsule) are dissected free from the sclera, identify the six rectus muscles by their brown/beige color and silvery striated tendons that insert ~5-7 mm caudal to the limbus. Slide a scissor blade under each rectus muscle and then slide the scissors anteriorly to the insertion of the rectus muscle cutting the tendon to prevent hemorrhage. Once the globe will rotate 360 degrees easily cut it out by placing the scissors in a ventral to dorsal orientation behind the globe.

After you get the globe out, there are 4 other tissues that you need to remove. These can be remembered by the fact they make fluid secretions. **1)** Remove the whole 3rd eyelid with its gland. **2)** Next, remove the eyelid margins (no more than 2-3 mm from the margins) with the meibomian glands that secrete, the fatty, lipid, portion of the tear film. Be sure to

undermine the medial canthal ligament – you will feel this tough ligament as you cut it nasally. The most common serious mistake in transconjunctival enucleations is incomplete resection of the medial canthus and caruncle resulting in a permanent fistulous tract into the orbit. When undermining the medial canthus try to avoid the angularis oculi, a large vein that drains the rostral face. It is located at the dorsomedial rim of the orbit – dorsal to the medial canthus. If you cut it, it will bleed profusely making visualization difficult. It is too large to cauterize and is very difficult to tie off without tearing the vessel wall. **3)** Then remove any remaining pieces of conjunctiva because conjunctiva has goblet cells that secrete the mucous portion of the tear film. **4)** Finally remove the orbital lacrimal gland. The orbital lacrimal gland resides in the dorsolateral orbit, at the junction of the zygomatic process of the frontal bone and the lateral orbital ligament. You can feel this junction. Once you feel it, grab the orbital tissues adjacent to it do a “focal exenteration” from 12 o’clock over to the lateral orbit. Remove about 3 clock hours of tissue, right against the bone. That will include the lacrimal gland, but you will be hard-pressed to find it within the tissues of a live dog. If you see it, it will be yellow-white in color and have a glandular texture. When these tissues are removed you can close.

Closure of Enucleations and Exenterations:

The closure will be in 3 layers. We close **1)** periosteum, **2)** subcutaneous tissues, and **3)** skin. I use a 3-0 (2-0 to 4-0) non-absorbable suture (prolene or nylon) on a taper needle for the periosteal closure unless the orbit is infected or had a tumor. In these exceptions I would use an absorbable suture (PDS). Start the orbital closure by taking one bite of periosteum in the dorsolateral orbital rim and tying a knot with at least 6 throws. **Do not try to take two bites of periosteum and bring them together in a knot.** This is unnecessary and will weaken the knot security. Zigzag back and forth vertically across the orbital rim taking bites of periosteum. Use forceps to extend the periosteum toward the center and do not take large bites of periosteum (~1-2 mm). Periosteum is very tough and you do not need large bites that will further contribute to a large gap in the closure. **Each pass of the suture should be checked to be sure it is a good bite of periosteum by trying to raise the head by pulling on the suture.** Once the suture has been zigzagged to the medial orbit, zigzag back to the lateral orbit where the periosteum is more loose. There will almost always be a span in the periosteal closure that does not close and results in exposed suture material. This gap is narrower and occasionally absent following a transconjunctival enucleation because less tissue is removed. Be sure to remove all slack from the periosteal closure before finishing. To tie off the suture take two bites of periosteum on the same side of the orbit close together and tie to the loop of suture. Trying to tie the knot on suture bites across the orbit from each other results in poor knot security.

The next closure is the subcutaneous tissues. I would use a 3-0 absorbable suture (PDS or vicryl) on a taper needle. The subcutaneous closure should be a simple continuous pattern. Do not incorporate dermis into the closure – only loose connective tissue or the skin closure will be distorted and less cosmetic. Do not apply too much tension in this closure or the skin will again be pursed and the closure less cosmetic.

The final closure is skin. I would use 4-0 or 5-0 non-absorbable (nylon) suture on a cutting needle. Close with simple interrupted sutures from one side to the other. An intradermal pattern can be used, but frequently results in dog ears at the end of the incision. Always place an E-collar until suture removal in 10-14 days.

PROSTHESIS OPTIONS:

Orbital Prosthesis:

An orbital prosthesis is a black medical-grade silicone sphere that is placed in the orbit prior to closing the periosteum with non-absorbable suture. It provides support and a spherical shape under the skin reminiscent of an eye beneath closed eyelids and maintains the normal shape of the head. This is especially useful in horses or cats and in dogs with short, light-colored hair. It can be used following either a transpalpebral or a transconjunctival enucleation, but should not be used in cases of neoplasia or infection. Orbital prosthesis can be placed by referring veterinarians, but may arrive unsterilized and require gas sterilization. Therefore, placement of an orbital prosthesis is usually a referral surgery.

Evisceration and Intrascleral Prosthesis:

Evisceration and intrascleral prosthesis is an option for owners more concerned about cosmetics. If the owner wants the animal to be comfortable, but cannot bring themselves to remove the animal's eye for cosmetic reasons an intrascleral prosthesis may be a good option. If the animal does not have a tumor or infection in its eye, the eye has not undergone phthisis bulbi (shriveled up), and the cornea is reasonably healthy (no refractory KCS) the animal is a candidate for an intrascleral prosthesis. Following an intrascleral prosthesis an animal will still have its eye but it should not be painful anymore. Eviscerated eyes do not look perfectly normal, but most people think they look better than an enucleation. Evisceration with intrascleral prosthesis is a referral surgery.

Scleral Shell Prosthesis ("Glass Eye"):

Rarely, people go to extraordinary lengths to make their animal to look as close to normal as possible. The most natural appearance results from a scleral shell. These are hand-painted, inserts that fit under the eyelids. Fitting an animal with a scleral shell is a time-consuming undertaking and very expensive. These prostheses are identical to the ones people would use. The problem with scleral shells is that they need to be cleaned once or twice daily. Most owners are very turned off by the idea of cleaning the implant daily. Fitting of scleral shells is also a referral surgery.