Veterinary ophthalmic surgery can be challenging and tedious, but a number of procedures can be performed by the general practitioner. Proper positioning of the patient and appropriate instrumentation are imperative to avoid frustration and facilitate success. A moldable vacuum support pack aids in positioning the patient and is preferable to towels or sand bags. The forearms of the surgeon must be steadied to allow for microsurgical manipulations without tremors, and this is most easily accomplished with the surgeon in a seated position. An adjustable surgical stool is optimum for comfort of the surgeon. An OptiVISOR loupe provides adequate magnification for examination of the anterior segment of the eye and for routine surgery of the eyelids, third eyelid, conjunctiva, and some corneal procedures. Disadvantages include a short working distance and absence of a built-in light source. The OptiVISOR may be obtained in magnifications ranging from 1.5-3.5X. I prefer the OptiVISOR model #3 (actual power 1.75X) for most procedures because it provides reasonable magnification and a comfortable working distance of 14 inches. The working distance is reduced at higher magnifications. Lenses of different strength are interchangeable with the head-loupe. Spectacle loupes provide image quality superior to the OptiVISOR but at a greater cost. Ophthalmic instruments are small and more delicate than those used for general surgery. Many are intended for use with high magnification provided by an operating microscope, and therefore, are held in a manner similar to a pencil. The common hand-actions for use of such instruments include compression/decompression for opening and closing tissue forceps or scissors, rotation (at the wrist) when suturing, and linear movement for incising tissue. Tying forceps are often used when suturing in preference to hand tying. Rough handling, stacking instruments, and inadequate cleaning are common causes of damage. It is best to store ophthalmic instruments in a surgical tray separate from larger instruments. Be certain when purchasing an instrument tray that it will fit in your sterilizer. Delicate instrument tips can be protected with silicone or plastic tip protectors that are autoclave resistant, and these are usually provided at the time of instrument purchase.

**Recommended instruments (basic pack)**

The Derf needle holder is excellent for eyelid surgery and can also be used for both corneal and conjunctival surgery. Derf needle-holders can hold suture as small as 6-0 with a P-3 needle, but smaller needles are easily bent. If much corneal surgery is anticipated, then Castroviejo microsurgical needle-holders are recommended. Bishop-Harmon forceps (1x2 teeth, 0.3-0.8 mm) are good for eyelid or conjunctival surgery, and if the tips are small enough (i.e., 0.3 mm), they can be used for corneal surgery as well. Two different sizes of the Bishop-Harmon forceps may be desirable, with one for eyelid (0.8 mm) and one for conjunctiva or cornea (0.3-0.5 mm). If much corneal surgery is anticipated, the Colibri-type forceps are preferable and can be obtained with a tying platform (0.3-0.5 mm teeth) or without a tying platform (0.12 mm teeth). Stevens tenotomy scissors are excellent for tissue dissection (e.g., conjunctival flaps, eyelid procedures) and for cutting of microsurgical suture material. Standard straight scissors with blunt tips are recommended. An eyelid speculum is necessary for adequate surgical exposure of the cornea and conjunctiva. Barraquer and Castroviejo speculums are commonly used. The Jaeger lid plate provides lid support while incising the eyelid skin, for example, during entropion repair. Desmarres chalazion forceps are helpful for procedures such as cryosurgery of lid masses or aberrant hairs, ectopic cilia removal, chalazion curettage, etc. A Bard-Parker #9 handle and #15 blade can be used for eyelid and corneal surgery. However, the Beaver handle and blades (#64 and 65) are more conducive to delicate corneal procedures. Barraquer cilia forceps are intended for epilation of distichia, but they can also substitute for tying forceps. Air injection cannulas in 27 and 30 gauge sizes can be useful for re-inflating the anterior chamber or simply irrigating the eye during surgery. An irrigation bulb is nice, but a sterile 12 cc syringe works just as well. Small gauze, sterile cotton-tipped swabs, and cellulose spears are also necessary for various procedures.

**Suture material**

The desired suture material and needle varies with the intended procedure and surgeon, and there is no universal suture for veterinary ophthalmic surgery. Polyglactin 910 is commonly used in sizes ranging from 5-0 to 8-0 for suturing conjunctiva and 7-0 to 9-0 for cornea. The small suture needed for corneal work requires microsurgical instruments and high magnification for use. Polyglactin 910 can be obtained in the 6-0 size with a larger needle (P-3) that is convenient for eyelid and conjunctival surgery. Though not the ideal for corneal suturing, 6-0 can be used for this purpose but is then best used with a smaller spatula needle (TG100-8) and a 7-0 size or smaller would be a better choice. Absorbable and non-absorbable suture can be used for lid surgery in sizes ranging from 3-0 to 6-0. I prefer nylon for most cutaneous lid sutures, but one must be especially careful that suture ends do not contact the cornea. Multifilament braided material is less likely to result in corneal damage compared with monofilament nylon should a suture be misdirected toward the eye.
**Eyelid tacking**

Eyelid tacking is indicated for temporary relief of entropion in young dogs (< 6 months) or in older dogs which have a primary spastic component to the entropion. The procedure can be repeated if necessary until the pet reaches its adult facial conformation, at which time a permanent correction may be performed. For some pups, a single tacking procedure can be curative. I usually use 3-0 or 4-0 nylon because it is minimally reactive and the sutures can remain in place for extended periods. Smaller suture (e.g., 5-0) may be required for small pups or kittens. Multiple vertical mattress sutures are used; the first bite is taken through the eyelid skin 2-3 mm from the lid margin, and this bite should engage about 4-5 mm of tissue. A second bite is taken beneath the first in facial skin overlying the orbital rim. The suture is tied with a surgeon's throw and two square knots, adjusting tension to evert the eyelid margin. The eyelid(s) should be slightly over-corrected for temporary repair, and the number of sutures required for eversion varies with the individual dog. Sutures are left in place for 2-3 weeks and can remain in place longer in the absence of suture reaction or infection. Artificial tear gel or ointment may be applied to the eye BID-TID until the sutures are removed.

**Temporary tarsorrhaphy**

Temporary closure of the eyelids can be helpful for protection of the globe during treatment of corneal ulcers and after graft surgery or proptosis repair. Simple interrupted or horizontal mattress sutures can be used, but it is imperative that the sutures be placed at least 2 mm thickness within the lids to avoid contact of suture with the cornea. I prefer to use 5-0 nylon for tarsorrhaphy of most of small animal patients, but even smaller suture may be required for very small pets. One or more sutures are typically placed in the lateral lids until the desired degree of closure is obtained.

**Nictitans flap**

The nictitans (or third eyelid) flap is also beneficial to protect the globe and reduce frictional irritation in selected instances. The nictitans flap is not advised for treatment of deep or infected corneal ulcers, it can be difficult to extend across the globe in exophthalmic breeds, it likely reduces the amount of drug that reaches the ocular surface, and it obscures visualization of the globe. A conjunctival graft or other procedure that provides tectonic support is more appropriate for the treatment of deep ulcers. The nictitans flap can be beneficial as an adjunctive treatment of non-healing superficial ulcers, but a soft contact lens may serve the same function. The most common nictitans flap secures the membrane to the superotemporal lid. Three mattress sutures of 3-0 nylon are usually used. The suture needle is first directed through the superotemporal eyelid skin to enter the superotemporal conjunctival fornix. The needle engages conjunctiva on the anterior nictitans surface a few millimeters below the free margin. Finally, the needle is redirected through the superotemporal fornix to exit the skin near the initial entry site. The first suture often engages the vertical portion of the nictitans cartilage for added support but should not penetrate the bulbar aspect of the nictitans. An additional suture is then placed on each side of the first suture, and all three sutures are tied over stints. Another procedure involves placing a single mattress suture around the proximal and vertical portion of the nictitans cartilage (with care taken not to penetrate the bulbar nictitans conjunctiva) and securing it in the superotemporal fornix. Finally, smaller absorbable suture can be used to secure the nictitans margin to the superior episclera with the advantage that the nictitans now moves in conjunction with the globe.

**Entropion repair**

The most common entropion repair is the Hotz-Celsus procedure. The affected eyelid is stabilized with a Jaeger lid plate or sterile tongue depressor coated with sterile lubricant ointment. The eyelid is incised 2-3 mm from the margin (at the haired and non-haired junction) using a #15 Bard-Parker blade; the incision is extended parallel to the lid margin for the entire length of the affected area. The second incision is made distal and parallel to the initial incision and incorporates enough eyelid tissue to correct the entropion; it is then tapered laterally and medially to meet the first incision. The incised strip of skin is removed by sharp dissection. The defect is closed with 4-0 or 5-0 braided or monofilament suture in a simple interrupted pattern starting at the central portion of the wound. Skin sutures are placed at 2-3 mm intervals. A useful rule-of-thumb to determine if correction is sufficient is that the lid margin should be visible after correction without digital manipulation of the eyelid. If corneal disease is present, an antibiotic ointment may be applied to the eye(s) BID-TID sutures are removed.

**Wedge resection for eyelid mass/lid laceration repair**

A "four-sided" excision is recommended over the standard "v" or "wedge excision" in order to conserve eyelid margin and minimize tension at the incision site. Two full-thickness cuts are made parallel to the mass and perpendicular to the eyelid margin. The cuts should 1-2 mm on either side of the mass and extended at least 5 mm distal from the lid margin (or more if required for removal of the mass). The incisions are then extended to converge at a point distal to the eyelid margin. Chalazion forceps or a lid plate can provide support for scalpel incision, or sharp scissors can be used. Following excision of the mass, the wound is typically closed in two layers. A horizontal mattress suture of absorbable material (e.g., 5-0 or 6-0 polyglactin 910) is used to close the tarsоconjunctival layer (1st layer) adjacent to the lid margin, and additional sutures may be required toward the distal incision. Care must be taken not to penetrate palpebral conjunctiva to avoid suture irritation post-operatively. A figure-8 suture is used for accurate apposition of the
cutaneous lid margin to start the 2nd layer. The meibomian gland orifices are used as an anatomical landmark for accurate alignment of the lid margin; the suture is passed through the meibomian glands or just to the cutaneous side of them. Simple interrupted sutures are placed in skin distal to the lid margin. The same procedure may be used to repair lid lacerations.

**Nictitans gland repair**

Nictitans gland prolapse (or cherry eye) is common in young dogs and in certain breeds. Replacement (or repositioning) of the gland is advised to reduce the risk of dry eye. Almost a dozen different surgical techniques have been described and are broadly categorized as either “anchor” or “pocket” techniques. The most commonly performed “pocket” technique was described by Dr. Rhea Morgan (J Am Anim Hosp Assoc 1993;29:56-60). The prolapsed gland is exposed by placing hemostats on the posterior nictitans conjunctiva medial and lateral to the gland. Curvilinear incisions are made above and below the base of the gland using either scissors or a blade, and the cut edges are gently undermined to free sufficient tissue for suturing. The incisions are then apposed using a continuous suture of 5-0 or 6-0 absorbable material with knots tied on the anterior nictitans surface. To do this, suture is first anchored to the anterior nictitans conjunctiva (medial or lateral), the needle pushed through the nictitans to enter the incision, and the conjunctiva then apposed with continuous suture. The gland is then pushed into position as suture progresses and is tightened across the posterior nictitans surface. Once the opposite end of the incision is reached, the needle is redirected back through the nictitans to the anterior conjunctiva where the final knot is tied. The medial and lateral extent of the two incisions do not meet to allow for egress of tears and to reduce the risk of cyst formation. Perhaps the most common “anchor” technique is that described by Dr. Renee Kaswan (J Am Vet Med Assoc 1994;205:1412-1414). This procedure utilizes a mattress suture to anchor the nictitans directly to the fascia and periosteum of the inferior orbital rim. The inferior conjunctival fornix is exposed by retracting the lower lid and extending the nictitans across the globe with hemostats. A conjunctival incision is made over the orbital rim anterior to the nictitans. Tenotomy scissors are used to make the incision, and blunt dissection performed to expose the orbital rim. A secure bite of periorbital fascia is taken with 3-0 or 4-0 monofilament suture. Next, the needle enters the gland and is directed dorsally to exit the gland on one side. The needle is then redirected into the same exit hole and across the gland to exit the opposite side. Finally, the needle is redirected into the latter exit site and directed ventrally to exit near the initial suture bite. The gland is gently pushed back into normal position as the suture is tied. The initial conjunctival wound can be closed with 5-0 or 6-0 absorbable suture or left open.

**Traumatic proptosis**

Proptosis of the globe after trauma is relatively common, especially in exophthalmic dog breeds. The globe should be assessed to determine if it can be salvaged, but it is often difficult to determine the visual status of a proptosed globe. The “rule-of thumb” is to replace the globe if possible, and enucleation can be performed later if necessary. In instances of obvious globe rupture, compete hyphema, and avulsion of multiple extraocular muscles, enucleation is preferred. If the globe is intact and not grossly deviated, the eye is cleansed and liberally lubricated with antibiotic ophthalmic ointment. To reduce swelling and to allow repositioning, the globe is gently massaged with gloved fingers and replaced under the eyelids. Allis tissue forceps may be helpful to replace the globe by applying a forceps to each eyelid (but do not clamp the lid margin). After grasping the central portion of the upper and lower eyelid, the lids are extended and pulled up and over the globe. Nearly complete temporary tarsorraphy is then performed by placing three or four horizontal mattress sutures of 4-0 or 5-0 non-absorbable through the eyelids and tying them once the globe is repositioned. Suture can be tied over stints (e.g., IV tubing) to reduce tension and prevent sutures from cutting into the lids. Lateral canthotomy is occasionally required to replace the globe and is then closed in two layers as described for a wedge resection. Tarsoraphy sutures should remain in place for a minimum of 2 weeks until orbital swelling has resolved. Postoperative treatment should include topical antibiotic applied to the globe at the nasal canthus, and a broad-spectrum oral antibiotic. Systemic steroid is more effective in reducing orbital swelling than nonsteroidal drugs, and analgesia is appropriate. Keratoconjunctivitis sicca, chronic keratitis, corneal ulceration, medial strabismus, and blindness are possible after proptosis.

**Enucleation**

Removal of a globe may be indicated for treatment of intraocular tumor, after globe rupture or proptosis when repair is not possible, or any instance of a permanently blind and painful eye (such as chronic glaucoma). There are several enucleation procedures described, but I presently use a modified subconjunctival approach as described by Swinger et al. (http://veterinarymedicine.dvm360.com/vetmed/article/articleDetail.jsp?id=575298).

**Keratotomy or corneal burr polishing**

Keratotomy is commonly performed for treatment of indolent corneal ulcers (aka spontaneous chronic corneal epithelial defects, or SCCEDS). Most ulcers (>80%) are healed within two weeks after surgery. There is no data to suggest that grid (linear) keratotomy is more or less effective than punctate keratotomy, though scarring may be less pronounced with the latter procedure. In one study where corneal burr polishing was used as the primary treatment and combined with placement of a contact lens, 92% were healed by 2 weeks after surgery. Topical anesthesia alone may be sufficient to perform these procedures, but sedation may be necessary to
facilitate surgery. Corneal burr polishing utilizes a sterilized rotary burr (Algerbrush II) and is more easily performed than keratotomy using topical anesthesia alone. Linear keratotomy is performed by lightly dragging a 25 gauge needle across the cornea at an angle of 30-45 degrees and with the bevel up; multiple striations are created and spaced approximately 1 mm apart. I prefer multifocal superficial punctate keratotomies (MSPK) rather than linear grid keratotomies. Deep cuts and larger needles should be avoided when performing either type of keratotomy.

*These notes were modified with permission from B. Keith Collins, DVM, MS, DACVO