Ophthalmic Surgical Instruments

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LEARNING OBJECTIVES

1. Identify common eye instruments used during an eye muscle procedure
2. Review toxic anterior segment syndrome and ways to avoid the postoperative inflammatory reaction
3. Discuss the function of eye instrumentation during an eye muscle procedure

The success of every Central Service/Sterile Processing (CS/SP) department and, ultimately, the success of every procedure performed in surgery, depends on the quality of the instruments provided. Ensuring each surgical procedure has functional instruments available and instrument sets that are correct, complete and ready for use when needed is an essential, yet challenging responsibility. This lesson will identify commonly-used instruments found in ophthalmic surgery, review steps to avoid toxic anterior segment syndrome (TASS) and explain how ophthalmic instruments are used during eye muscle procedures.

Objective 1: Identify common eye instruments used during eye muscle procedures

Instrumentation can differ from healthcare facility to healthcare facility and is generally selected based upon the surgeon's specific procedure needs and preferences. The following is a list of common eye muscle instrumentation:

Basic Eye muscle set

- Jameson muscle hook
- Graefe Strabismus hook (See Figure 1)
- Stevens tenotomy hook
- Manson double-ended strabismus hook
- Desmarres lid retractor
- Bishop-Harmon tissue forceps

Figure 1: Graefe Strabismus Hook

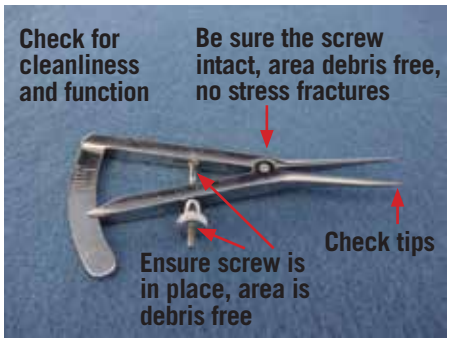

Figure 2: Castroviejo Caliper

Figure 3: Vannas Scissors

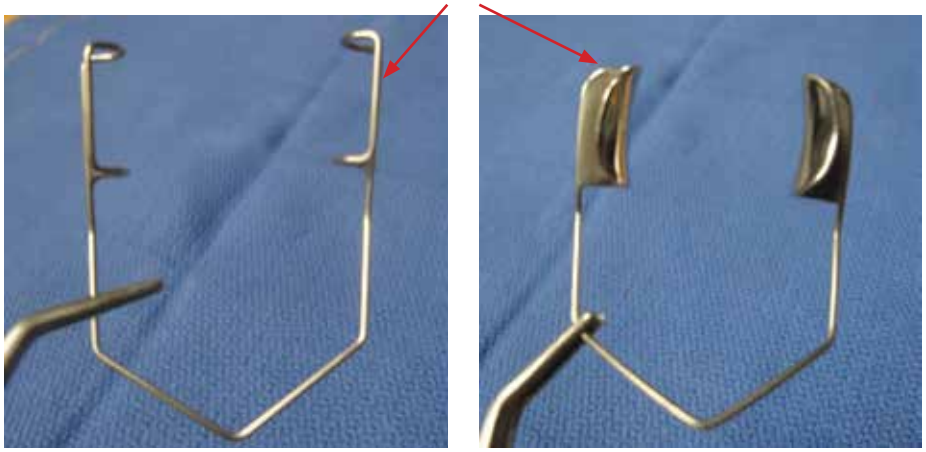

Figure 4: Wire Eye Speculums: Barraquer Wire (Left) and Solid Eye Speculum (Right)

- Castroviejo fixation forceps (0.3mm or 0.5mm)
- Moody locking forceps
- Castroviejo caliper (See Figure 2)
- Vannas scissors (See Figure 3)
- Westcott curved tenotomy scissors
- Troutman-Castroviejo corneal section scissors
- Barraquer needle holder
- Castroviejo needle holder, curved (with/without lock)
- Lancaster eye speculum
- Barraquer eye speculum (See Figure 4)
- Jeweler bipolar forceps forceps (See Figure 5)

Objective 2: Review toxic anterior segment syndrome and ways to avoid a postoperative inflammatory reaction

TASS is an acute postoperative inflammatory reaction in which a noninfectious substance enters the anterior segment of the eye and introduces toxic damage to the intraocular tissues. The inflammatory process of TASS generally begins 24 hours after eye surgery; when it occurs, patients may experience blurred vision, ocular pain, redness and corneal edema. In severe cases, TASS can cause permanent damage to the iris and impairment of the pupil and require additional surgery to restore vision.

Several factors can contribute to TASS, including sterilization process failures, reactions with enzymatic and detergent solutions, residuals from viscoelastic materials and cross-contamination of instrumentation from other services. As with any instrument being sterilized, all sterilization parameters must be monitored closely to ensure the physical, chemical and biological indicators have been met. Any failures in these areas should be investigated before instrumentation is released for use. Improperly-sterilized instrumentation can potentially transfer harmful microorganisms to patients, resulting in an infection. Enzymatic solutions and detergents should be compatible with the instrumentation and diluted and rinsed according to the manufacturer's instructions for use (IFU). Failure to follow the IFU and adequately rinse residual enzymes and detergents from instrumentation can cause TASS.

Viscoelastic material is a solution used in cataract surgery to create and maintain space in the anterior chamber of the eye during the phacoemulsification and implantation of an intraocular lens (IOL), as well as protect the corneal endothelium. When viscoelastic material is allowed to dry and harden on instrumentation, it can be difficult to see and remove. Viscoelastic material that is not removed creates an ideal place for bacteria to grow and biofilm to form. If not removed, microorganisms can be transferred to the patient. According to the Association for the Advancement of Medical Instrumentation (AAMI), eye instruments, especially intraocular instruments, should be processed separately from other instruments. This separation reduces the potential for cross contamination from other services, such as orthopedic and general instrumentation. The following steps can be helpful in reducing the risk of TASS:

- Carefully following the instrument manufacturer's IFU for cleaning;
- Using only enzymes and detergents recommended by the manufacturer;
- Having a designated cleaning area for intraocular instrumentation;
- Keeping cleaning tools separated from tools used with other services;
- Cleaning and disinfecting cleaning tools regularly;
- Flushing lumens completely in accordance with the IFU;
- Rinsing with the recommended critical water for the amount and time stated in the IFU;
- Allowing adequate time for reprocessing between patients; and
- Inspecting instrumentation under lighted magnification.

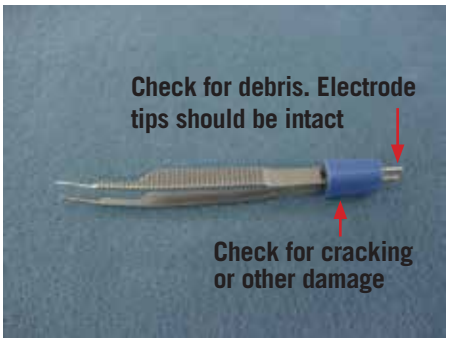

Figure 5: Jeweler Bipolar forceps

Objective 3: Discuss the function of eye instrumentation during an eye muscle procedure

The eye muscle procedure is indicated when there is a misalignment of the eyes and one or both eyes do not look at the same place at the same time. This misalignment is called strabismus and the condition occurs as a result of poor neuromuscular eye control. Eye alignment is important for good depth perception and for avoiding "seeing double." When eyes are misaligned, the brain receives two separate images, which can create confusion and double vision. Over time, the brain will compensate and eventually ignore one of the images, which can then affect the vision of the other eye. Without treatment, strabismus will worsen.

The type of strabismus is classified by the direction in which the eye turns. There are four types of strabismus:

- Esotropia – Inward turning of one or both eyes;
- Exotropia – Outward turning of one or both eyes;
- Hypertropia – One eye is higher than the other or upward turning; and
- Hypotropia – One eye is lower than the other or downward turning.

The eye muscle procedure for correcting strabismus begins by placing the lid speculum to expose the eye. There are two types of lid speculums. The first type uses a thumb screw to expand the blades and retract the eye lids. It is important to inspect the blades to ensure they are free of nicks or burrs, which could damage the eye lids during the procedure. The thumb screw should move freely without having to place significant tension on it; if the thumb screw does not move easily, refer to the manufacturer's IFU. It is essential to only use lubricant that is approved by the manufacturer as unapproved lubricants could result in unintended inflammation, or TASS. The second type of lid speculum is a wire speculum, without a screw, which provides tension on the eye lids. It is important to ensure the speculum can provide tension; this is done by pressing together the ends with the thumb and index finger. The speculum should be replaced if it does not spring back against the thumb and index finger during the test.

Once the lid speculum is in place, forceps are used to hold the conjunctiva tissue, which is the clear thin membrane that covers the anterior part of the sclera. Small forceps are used in eye muscle surgery because of the thin delicate tissue that comprise the eye. Forceps like the Bishop-Harmon and Castroviejo with teeth are used to grasp the delicate tissues in the eye. As with other forceps, it is essential to check the distal tips to ensure they approximate and the fine teeth do not overlap.

After the conjunctiva tissue is secured by the forceps, a Westcott tenotomy scissor is then used to make the incision in the conjunctiva. The scissors must be carefully inspected before sterilization. The Westcott scissor uses a spring action to engage the blades and must be tested before use. The blades of ophthalmology scissors must be sharp and free of nicks and burrs. Scissors that are not sharp or have imperfections in the blades can rip and tear tissue. The tissue layers of the eye can be as thin as the skin on a grape, so sharp scissors in good working order are important. Once the incision is made, the scissors are used to dissect tendons and episcleral tissue until the sclera is reached. Bleeding can occur when making the incision or during the dissection phase. The Jeweler-type bipolar forceps are used to cauterize blood vessels and control bleeding. Inspection of the bipolar tips is important because the tips of the forceps act like electrodes. An electrical current is used to cauterize as it passes through one side of the forceps electrode and returns through the other side of the forceps electrode, restricting the electrical current so it only passes through the tissue between the tips or electrodes. If the forceps tips do not approximate as intended, the patient may be burned or harmed by cauterizing unintended structures.

Once the sclera is exposed, the Jameson and Stevens muscle hooks are used to isolate the targeted muscle. Muscle hooks come in different sizes and shapes. In this procedure, the Stevens hook (the smaller of the two hooks) is used to locate the muscle. When the muscle is found, the hook is replaced with the larger Jameson hook to expose the entire muscle. The two hooks have specific functions, so it is important when assembling the tray that the correct hook be placed in the set. If a hook is missing, it should not be replaced with an alternative unless approved by the surgeon or Operating Room (OR) team. A double-ended suture is passed through the muscle at the insertion point.

Again, since eye procedures involve delicate tissue, a small suture size is used. In this procedure, the suture used is 6-0 to 7-0 in size. The suture size determines the size of the needle and

needle holder to be used. The larger the number in the suture size means that the needle will be smaller in size and a smaller, more delicate needle holder must be used. Conversely, a smaller number in the suture size means that the needle will be larger and a heavy or larger needle holder must be used. For example, during an abdominal case, one could expect to find 0, 1-0 or 2-0 suture, which would require a heavy needle holder like the Mayo-Hegar needle holder. To suture skin from a small laceration on the forearm, one could expect to use a 4-0 or 5-0 suture with a Webster or Halsey needle holder. For the eye muscle procedure, a small delicate Castroviejo needle driver is needed to accommodate the small 6-0 and 7-0 suture. When inspecting the Castroviejo needle driver, it is important to check the spring and locking function to ensure the instrument can hold the suture needle in place. Often, a needle holder can become magnetized. A magnetized instrument can be difficult to use during surgery, especially when working in small spaces with small needles. When inspecting the needle driver, check the instrument for magnification and take steps to demagnetize, if necessary.

After the muscle is sutured, two Moody locking clamps are placed at each end of the muscle, at the original insertion point. The muscle is then cut and separated from the sclera. The Moody locking clamp resembles the Castroviejo forceps in size and shape, and both have small teeth that approximate at the distal tip to allow for grasping of fine tissue. One distinct difference between the Castroviejo forceps and Moody clamp is the curved shape of the Moody clamp and locking mechanism. When the Moody clamp is used, it is clamped and locked to the sclera and follows the contoured shape of the eye to allow the surgeon to manipulate the eye for better visualization. It is important to check the locking mechanism of the Moody clamp in the assembly area before each use to ensure there is enough tension to keep the clamp locked during use. A malfunctioning clamp can frustrate the surgeon and delay the procedure.

Once the Moody clamps are in place and the eye is moved to expose the operative site, a double hook or Desmarres lid retractor is used to retract the conjunctiva tissue and expose the new location where the muscle will be reattached. A Castroviejo caliper is then used to mark the location. If performing a lateral rectus resection, the muscle would be placed posterior to the insertion point. The calipers play a crucial role in the procedure and are used for precise measurement of the structures of the eye. The calipers in this procedure will mark the new attachment point for the muscle, which is essential in correcting the strabismus. The caliper resembles a V-shape, with very fine distal tips and a horizontal measuring bar at the proximal end. The box lock area has a large holding screw. It is important to ensure the screw is intact, clean and functioning properly. The proximal end has a screw-type device to hold the distal tips open or closed, depending upon the desired measurements. During inspection, it is essential to ensure the distal tips are clean, intact, free from burrs, and not bent. The tips on the caliper are used to measure and mark the precise location to reattach the muscle.

When the calipers have marked the new location for the muscle, the muscle is then sutured into place using the Castroviejo locking needle driver. After the muscle is secured, the placement of the muscle is rechecked with the calipers to ensure correct placement. To complete the eye muscle procedure, the double hook or Demarres retractor and Moody clamps are removed and the conjunctiva tissue is closed with suture.

During an eye procedure, most surgeons will use a microscope or loupes to magnify the operative site. Loupes are glasses that are equipped with built in telescopes that enhance the field of vision. If the surgeon needs magnification to perform the procedure, this is an indication that lighted magnification should also be used in the assembly area to inspect eye instrumentation. *Note: There are several variations of the eye muscle procedure. Objective 3 covers some but not all surgeon specific instrument preferences or procedure styles.*

Conclusion

The eye muscle procedure to correct strabismus could not be successful without the knowledge of the CS/SP instrument technician. CS/SP technicians who understand the importance of instrument inspection and testing and are familiar with how instrumentation is used during a procedure are better equipped to prevent adverse patient outcomes.

Resources

International Association of Healthcare Central Service Materiel Management. Central Service Technical Manual. Chapter 8, Cleaning and Decontamination. P. 155. 2016.

International Association of Healthcare Central Service Materiel Management. Instrument Resource Manual. Chapter 16, Ophthalmic (Eye) Instruments. P. 266. 2018.

Alexander's. Care of the Patient in Surgery, Chapter 25, Pediatric Surgery. P. 1127. 2011.

Association for Advancement of Medical Instrumentation. ANSI/AAMI ST79: *Comprehensive Guide to Steam Sterilization and Sterility Assurance in Health Care Facilities*. 2017.