

**AAPOS Strabismus Surgery Hands-On Workshop**  
**Novel Strabismus Surgery Techniques**

**Workshops - Session B, Friday, March 31, 2023, 8:30 – 9:45 AM**

**Course Director:**

**Kenneth W. Wright, MD, Director**

Adjunct Professor Queens University, Kingston, Canada  
Director Wright Foundation for Pediatric Ophthalmology and Strabismus  
Torrance, California, kw2020md@gmail.com

**Instructors:**

**Rebecca Leenheer, MD**

Clinical Assistant Professor, Department of Ophthalmology and Visual Sciences,  
University of New Mexico

**Cem Mocan, MD,**

Associate Professor of Ophthalmology, Department of Ophthalmology & Visual Sciences,  
Illinois Eye & Ear Infirmary, University of Illinois, Chicago, IL

**Yi Ning J. Strube, MD, MS, FRCSC, DABO**

Associate Professor and Director of Pediatric Ophthalmology and Adult Strabismus,  
Departments of Ophthalmology and Pediatrics, Queen's University, Kingston, Canada

**Lisa Thompson, MD**

Ophthalmology Residency Program Director  
Director Pediatric Ophthalmology Cook County Health  
Assistant Professor Ophthalmology Chicago Medical School

**Acknowledgements:**

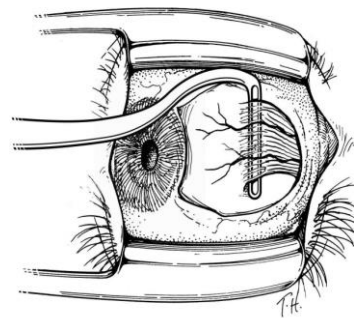
Figures borrowed with permission from the Color Atlas of Strabismus Surgery, Strategies and Techniques, 4<sup>th</sup> edition, by Kenneth W. Wright and Yi Ning J. Strube, 2015, Springer.

The 3D-printed silicone Strab Lab faceplates and eyes used in the skills transfer course were generously donated by Dr. Yi Ning Strube, Dr. Lisa Thonpson, and the Wright Foundation for Pediatric Ophthalmology and Strabismus (a 501K non-profit organization).

**Peer-reviewed references for all the procedures described herein are listed at the end of handout.**

## Grooved Hook

A grooved hook provides excellent exposure for suturing of the muscle insertion during strabismus surgery. The hook lies flat on sclera and the surgeon pulls the muscle insertion horizontally so the insertion is centered in the surgical field. The grooved hook provides added safety as suture passes are over the groove, thus preventing inadvertent scleral perforation. This is especially important when suturing tight muscles, the inferior oblique muscle insertion which overlies the macula, and suturing muscles during enucleation for retinoblastoma. The grooved hook is also very helpful when suturing tight or contracted rectus muscles (e.g., thyroid related strabismus, and congenital fibrosis syndrome) because the hook lies flat on sclera and pulls the insertion into the surgical field without lifting up. In contrast, standard suturing requires lifting the hook up off sclera making the tight muscle even tighter. We find a grooved hook is an invaluable new tool for strabismus surgery.



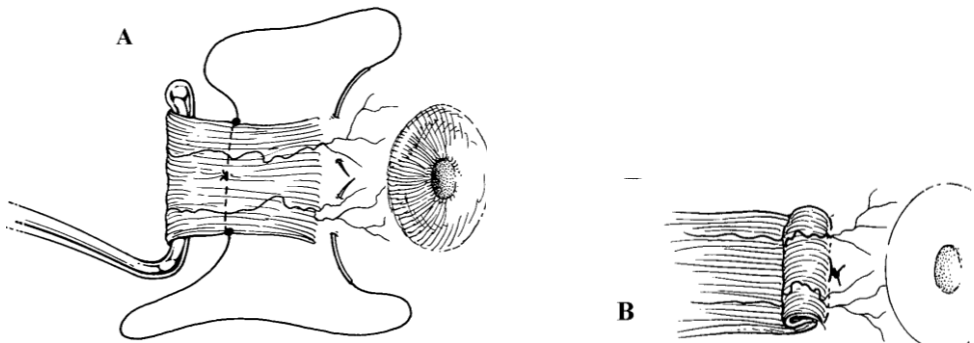
## Muscle-Sclera Plication

The rectus muscle plication is a muscle tightening procedure which has advantages over other procedures as it is revisable, safe as the muscle is not disinserted, secure, and preserves anterior ciliary artery circulation. Muscle tightening procedures include muscle resections, tucks, and plications. These procedures tighten the muscle, they do not actually strengthen the muscle.

Rectus muscle plication tightens the muscle by folding the muscle to sclera. With the plication, the posterior muscle is sutured with a 6-0 or 5-0 vicryl suture then secured to the scleral  $\frac{1}{2}$  mm anterior to the insertion. This is in contrast to a tuck, where muscle is sutured to muscle and it undoes over time. The plication is more secure and can be used in place of a standard resection.

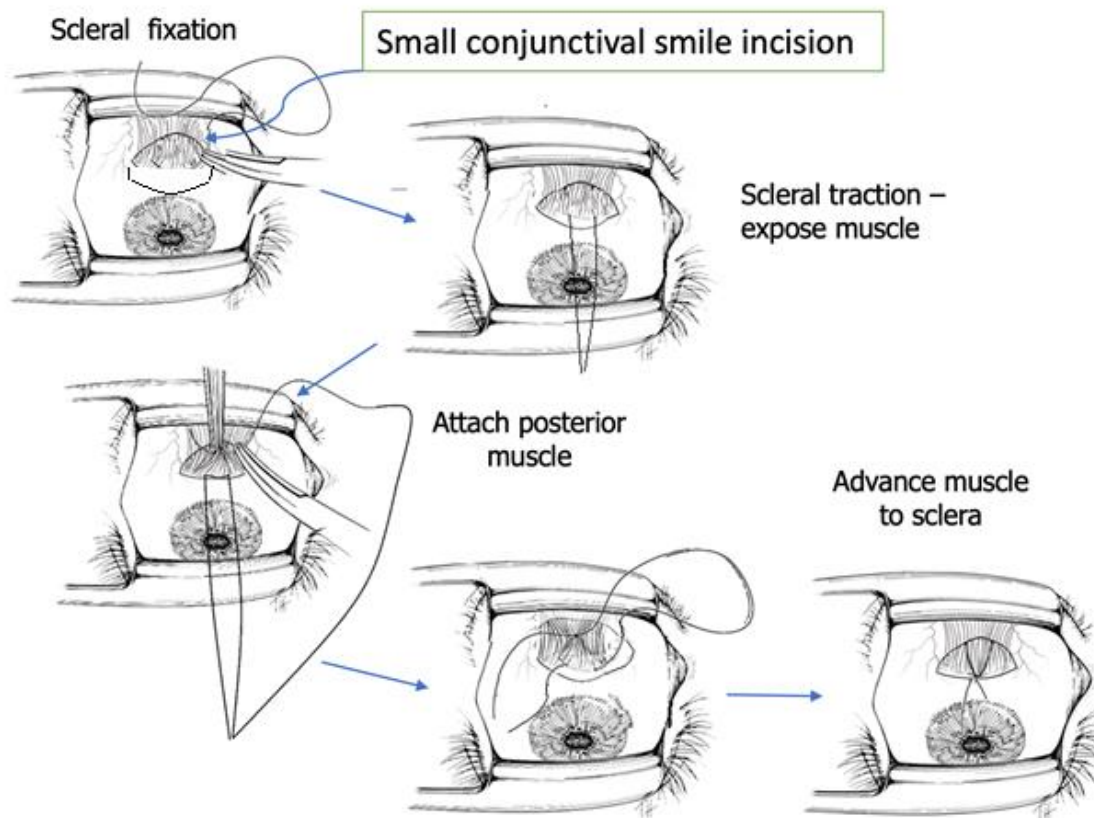
Because there is a fold of tendon associated with the plication, a small lump is present immediately after surgery but disappears within 3 to 4 weeks. Important advantages of the plication procedure over resection include reversibility. A plication procedure can be removed by simply cutting and removing the suture within 2 days of surgery, before the muscle heals to sclera. Another advantage is safety against a lost muscle. Because the muscle is not disinserted, there is little risk of a lost muscle. An important aspect of the procedure is that it preserves the anterior ciliary vessels and reduces the risk of anterior segment ischemia. Iris angiogram studies have shown preservation of anterior ciliary blood flow after the plication. These advantages

have made the plication popular for rectus muscle tightening. (Developed by Dr. Wright in the early 1980's)



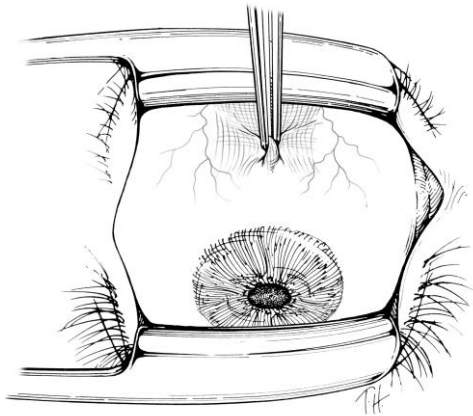
### Central Plication

The central plication is a minimally invasive way to treat small angle strabismus. A 5 mm central plication will correct approximately 6-8 PD of horizontal strabismus and 5-6 PD of vertical strabismus. Cooperative patients can have the procedure with topical anesthesia and mild sedation. (Developed by Dr. Wright 2010)

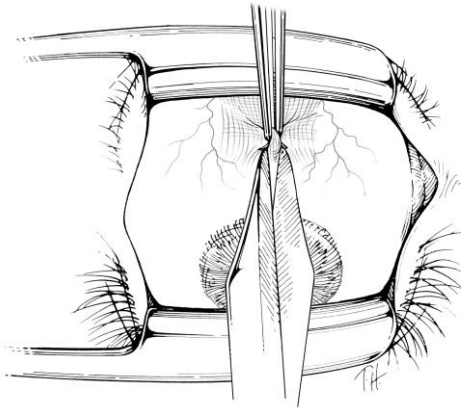


## Central Tenotomy

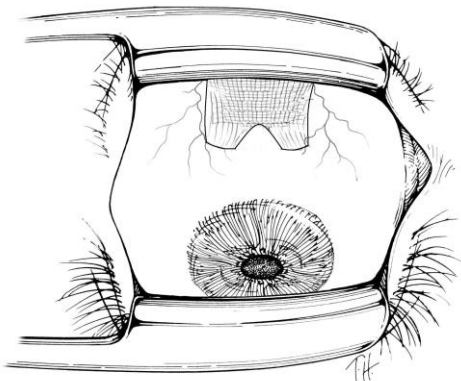
The central tenotomy is used to treat micro vertical deviations 1 to 2 PD causing diplopia. It will correct about 1-2 PD of strabismus for each tenotomy, so a tenotomy of one vertical muscle each eye will correct a total of 2-3 PD. It is most useful for diplopia caused by small hypertropias. (Developed by Dr. Wright 2008)



1)



2)



3)

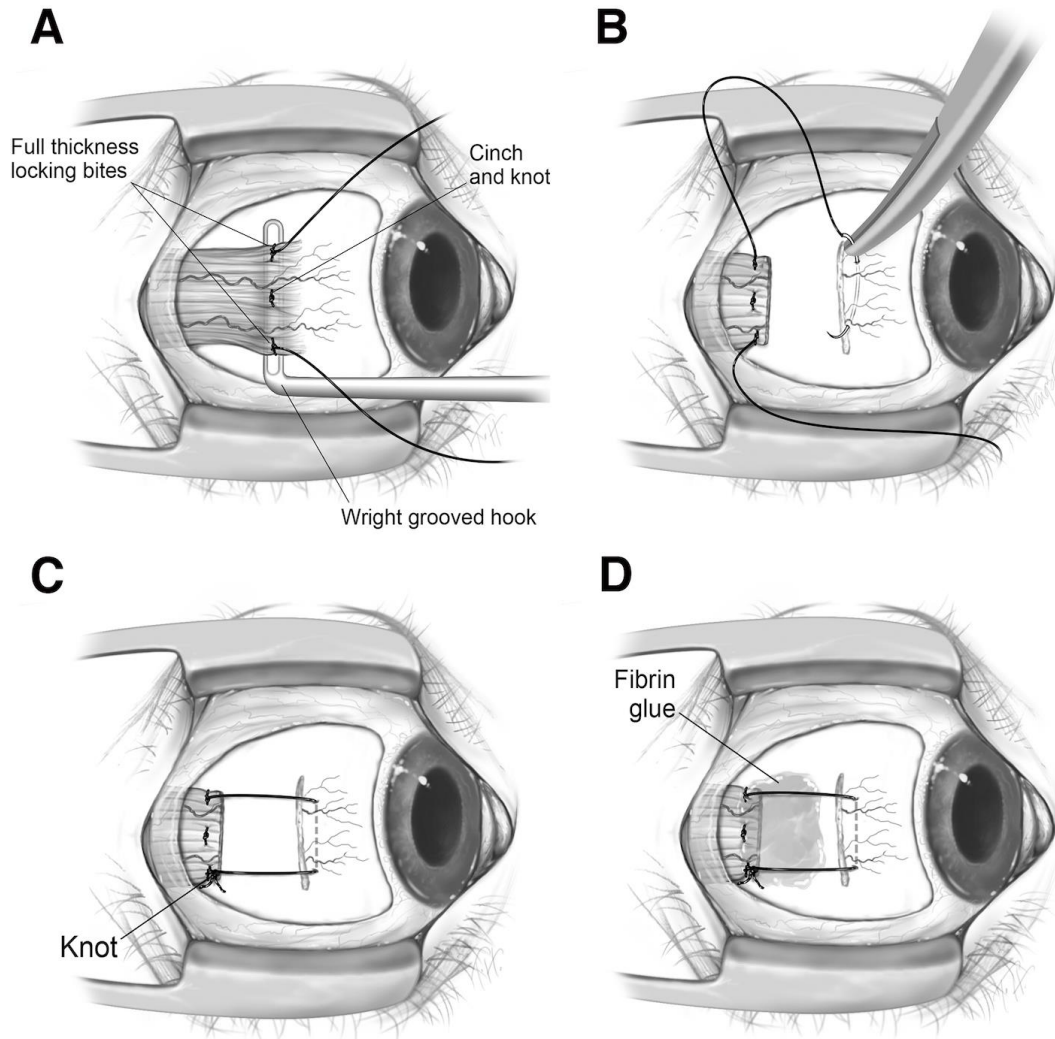
## **Fibrin Glue Hang-back Recession**

Scleral perforation is a known and potentially serious complication of rectus muscle recessions. It occurs during reattachment of the muscle by an inadvertent deep needle pass posterior to the rectus insertion. Hang-back recession avoids this complication as the needle pass is anterior to the insertion over the pars plana – no retina. Since the sclera is twice as thick anterior to the rectus insertion, the risk of scleral perforation is also reduced with the hang-back. Human and animal studies have shown the problem with hang-back recession is the muscle may not adhere at the desired recession point. The suspended muscle can shift horizontally or vertically, can creep forward when attempting large recessions, and may increase the risk of late posterior slippage and over-correction.

Fibrin glue is a tissue adhesive that forms a fibrin clot out of fibrinogen and thrombin. It has been used in various fields such as cardiovascular surgery, neurosurgery, and some ophthalmological procedures. While fibrin glue alone has been shown to not be strong enough as a muscle sealant in animal models of strabismus surgery, it can stabilize the new muscle insertion allowing strong initial healing and a stable hang-back rectus muscle recession.

We have studied the clinical safety and efficacy of fibrin glue as an adjuvant to hang-back surgery in humans in a retrospective, case-controlled clinical study comparing surgical outcomes of hang-back rectus recession with fibrin glue (HBG) versus standard fixed suture rectus recession (SFR) to treat horizontal strabismus. HBG was safe and effective with post-operative results similar to SFR. HBG has an important advantage, eliminating the complication of retinal perforation that can occur with SFR whilst avoiding under- or overcorrection that can occur with traditional hang-back recession. HBG resulted in as good surgical results as SFR, with no complications. This technique increases patient safety without sacrificing surgical outcomes. (Developed by Dr.Wright 2019)

**A.** Muscle is secured with 3-point fixation using a 5-0 coated vicryl suture (soaked in povidone-iodine 5%) (Ethicon©, INC 2007; CA, USA) over the grooved hook. **B.** The muscle is detached and hung back from its original insertion site with a single long horizontal suture pass 1mm anterior and parallel to the insertion. **C.** The suture knot is posterior to the scleral muscle insertion, closer to the rectus muscle recession point, in contrast to the usual hang-back where the knot is tied anterior to the scleral insertion. **D.** Following placement of the hang-back suture, a small amount of fibrin glue is applied between the recessed muscle bed and the sclera (including the hang-back sutures) with a 60 sec waiting time to allow glue hardening.



## References:

Wright KW, Lanier AB. Effect of a modified rectus tuck on anterior segment circulation in monkeys. *J Pediatr Ophthalmol Strabismus* 1991;28:77-81.

Park C, Min BM, Wright KW. Effect of a modified rectus tuck on anterior ciliary artery perfusion. *Korean J Ophthalmol* 1991;5:15-25.

Leenheer RS, Wright KW. Mini-plication to treat small-angle strabismus: a minimally invasive procedure. *J AAPOS* 2012;16:327-30.

Wright KW. Mini-tenotomy procedure to correct diplopia associated with small-angle strabismus. *Trans Am Ophthalmol Soc* 2009;107:97-102.

Wright KW, Arow M, Zein M, Strube YJ. Wright hang-back recession with fibrin glue compared to standard fixed suture recession for the treatment of horizontal strabismus. *CJO* 2021;56:244-249.

Jagan L, Turk W, Petropolis C, Cofie N, Egan R, Wright KW, Strube YJ. Validation of a novel strabismus surgery 3D printed eye model for ophthalmology resident simulation training. *JAAPOS*,2020;24:3.e1-3.e6