Rectus Muscle Plication
Kenneth W. Wright, MD
Lisa S. Thompson, MD

Standard tightening procedure:
- Resection – remove muscle
  - Risk of lost muscle
  - Disrupts anterior ciliary vessels

Tuck – muscle to muscle

Rectus Muscle Tuck
Muscle to Muscle

Wright Plication
Muscle to Sclera
Iris Angiogram
Preserve Anterior Ciliary Arteries
- SR, LR, & MR removed
- IR Wright Plication


- Semi-reversible
- Vessel sparing
- Safe – no lost muscle
- Use same surgical tables as resection

Pass needle anterior to muscle insertion

The bump goes away

Wright Plication
Hong Kong Commission Trainer

- 18 month previous maximal MR recession
- ET 60-70 PD limited abduction

Need to re-recess the MR!

Groove Hook for strabismus surgery

Financial disclosure - Titan Surgical and Springer Publisher

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Parks Standard Suturing Technique
Pull up - Suture between the hook and sclera

- Difficult to suture tight muscles - small orbit
- Difficult to place full thickness locking bites
- Variable suture placement

Grooved muscle

KOWAL STRABISMUS HOOK

Wilson Dacamara Double Sided Strabismus Recession Muscle Hook
Designed by Ed Wilson, MD

Wright Groove Hook
“Angled to the surgeon”

- Consistent suture placement
- Safe needle pass
- Great for tight muscles

Recession with Wright Groove Hook

Hong Kong 2005
Tight MR re-recession
Inferior Oblique Exposure and Suturing

Conclusion

With the Wright hook even a Neuro-ophthalmologist can do strabismus surgery!
In Situ Tissue Dissection to Facilitate True Topical Anesthesia for Strabismus Surgery

David K. Coats, MD
Houston, Texas

Anesthesia for Strabismus Surgery

- Objectives
  - Comfortable patient
  - Comfortable surgeon
  - Safety
  - Effectiveness

What about Anesthesia? Can we learn anything from a cataract surgery?

Cataract Surgery
- General
- Retrobulbar
- Topical

Strabismus Surgery
- General
- Retrobulbar
- Quasi-Topical

Anesthesia for Strabismus Surgery

- General anesthesia
- Bilateral surgery
- Healthy patient
- Retrobulbar
- Unilateral surgery
- Health risks
- Topical
  - Adjustable sutures
  - Combined with Rb for patient with health risk

Topical Anesthesia for Strabismus Surgery

- Appropriate indications
  - Rectus muscle recessions (any)
  - Rectus muscle resections (any)
  - Re-operations (most)
  - Not good for oblique surgery

Idea Patients for Topical Anesthesia

- Small deviations
- Surgery for diplopia
- Outcome not predictable
- Patient understands his/her role and is willing participant

True topical anesthesia strabismus surgery requires in situ dissection

Standard Strabismus Surgery
- Not in situ at all
  - Pulling on the muscle
  - Stretching the tissues
  - Consequences
    - Pain
    - Tissue swelling
    - Slowed healing
    - Post op nausea and vomiting

In Situ Dissection for Topical Strabismus Surgery

- 2% Lidocaine jelly
- Tetracaine intraop, if needed to supplement
- Use sedatives only if required
- Limbal incision
  - No tissue stretching required
  - Exposure without pain
  - Bridle sutures in situs
  - No muscle hook
  - Everything remains in situ during dissection
  - Works efficiently
In Situ Dissection for Topical Strabismus Surgery

- Avoiding pain, discomfort, and anxiety
- Do not pull on the muscle
- Do not pull on the muscle
- Manipulate only what you must
- Avoid using bright OR lights
- Minimize conversation in the OR

In Situ Tissue Dissection to Facilitate True Topical Anesthesia for Strabismus Surgery

Thank You
David K. Coats, MD
Houston, Texas
Amniotic Membrane Transplant and Strabismus

Yi Ning J. Strube, MD, MS, FRCSC, DABO
Assistant Professor, Pediatric Ophthalmology & Adult Strabismus
Queen’s University, Kingston, Ontario, Canada
AAPOS Annual Meeting, April 4, 2014, Palm Springs CA
Novel Strabismus Surgical Techniques – Not the Standard Stuff

Financial Disclosures

- I have no financial interests or relationships to disclose.

Outline

- Describe amniotic membrane
- Discuss types of amniotic membrane available for ophthalmic surgery
- Describe the use of amniotic membrane transplant to treat restrictive strabismus

Amniotic Membrane

- Innermost, avascular layer of the placenta

Amniotic Membrane

- Human amniotic membrane consists of 3 layers:
  - Single layer of metabolically active epithelial cells, attached to a thick basement membrane and avascular stromal matrix

Amniotic Membrane: Features

- Immunologically inert
- Provides substrate for epithelial growth, attachment
- Reduces inflammation, fibrosis, angiogenesis
- Many ophthalmic uses:
  - Pterygium
  - Conjunctivochalasis
  - Corneal defects
  - High-risk trabeculectomies, Leaking glaucoma blebs
  - Chemical burns, Stevens-Johnson Syndrome
  - Strabismus

Types of Amniotic Membrane

- Fresh Human Amniotic Membrane
  - Site-specific processing variability
  - Risk of transmission of communicable diseases
  - Cheaper than preserved AM
- Preserved Human Amniotic Membrane:
  - Lyophilized tissue
    - Incubated with EDTA (degrades epithelial cells)
    - Air-dried, freeze-dried to dehydrate
    - Vacuum-packed and sterilized with γ-irradiation
  - Cryopreserved tissue
    - Stored in glycerol
    - Frozen at –80°C until used

Cryopreserved Amniotic Membrane

- Locally prepared or commercially available (i.e. AmnioSoft)
- Advantages
  - No dehydration necessary
  - Easy to handle and suture
  - Basement membrane and stroma minimally affected
  - Soluble wound-healing mediating factors remain intact
- Disadvantages
  - New lot separate from backing (heat/surgical time)
  - Wet preparation sometimes difficult to unravel
  - Must identify stromal and epithelial side
  - Freezing/Refrigeration required
  - More expensive, limited availability

Lyophilised Amniotic Membrane

- Commercially available (i.e. AmnioDry™)
- Advantages
  - Free-standing configuration – no reconstitute backing
  - Can be applied to surgical site dry
  - Activated with saline and fluided
  - Watermark identifies basement and stromal surface
  - No freezing/refrigeration required
  - Cheaper, more available
- Disadvantages
  - Difficult to handle once activated
  - Basement membrane and stroma partially degraded
  - Wound-healing mediating proteins affected
  - Fibrosis and adherence of EOM reported in strabismus surgery
When To Use Amniotic Membrane Transplantation?
- Treatment Option for Restrictive Strabismus
  - Occurring as a result of ocular surgeries i.e. strabismus, retinal detachment, orbital, pterygium and blepharoplasty surgeries
  - Adhesions often recur, difficult to manage
  - Previously used treatments not effective
  - Mitomycin C can increase scarring

Amniotic Membrane Transplantation to Treat Restrictive Strabismus
- Strube et al. Ophthalmology 2011; 7 patients with restrictive strabismus after periconal surgery treated with surgical removal of restrictive adhesions and AMT
- Broad range of inciting surgeries cause restrictive strabismus
- Cause of ocular motility restriction after periconal surgery - at least three mechanisms:
  1) Conjunctival scarring with contracture
  2) Fat adherence to the globe or muscle
  3) Contracture of rectus muscles

Fat Adherence and Restrictive Strabismus
- Trauma to posterior Tenon's capsule
- Scarring of orbital fat to globe or extracocular muscles
- Extremely difficult to repair
- Prevent by careful surgical dissection

Amniotic Membrane in Restrictive Strabismus
- Mechanism of action:
  - Provides a barrier separating fat adhesions from reattaching to sclera
  - Tissue spacer to cover exposed sclera
  - Replaces missing or contracted conjunctiva
  - May reduce scarring, prevent recurrence

AMT in Strabismus Surgery: Technique
- Blunt and sharp dissection to mobilize conjunctiva and remove restrictive adhesions
- Seral forceful ductions to verify improvement of ocular rotations
- After scar removal and obtaining full ductions, AMT placed over bare sclera to provide a barrier to prevent recurrent adhesions
- If forced ductions still restricted after mobilizing the conjunctiva and removing scar, rectus muscles isolated - if tight, resected as needed to provide improved ductions intra-operatively, followed by AMT

AMT in Strabismus Surgery: Technique (cryopreserved AM)
- AM carefully peeled off of the nitrocellulose paper with non-toothed forceps (main and assisting surgeon) to keep AM on starch
- Sticky side of the membrane (the side originally in contact with the paper) is placed down facing the sclera and positioned to cover the defect as required

AMT in Strabismus Surgery: Series
- Once AM is in place an adherent, 1-2 drops of each tissue glue component is sequentially placed under AM
- AM smoothed over the glue quickly to ensure proper placement, using the non-toothed forceps edge
- Glue allowed to set for several minutes, excess dried glue removed with toothed scissors

AMT in Strabismus Surgery: Technique
- 7-0 Vicryl interrupted sutures to secure the edges of the transplant to cut edge of conjunctiva in deep fornices and the sclera; sutures pre-placed prior to the placement of tissue glue
- Eye patched for 24 hours at the end of the case to prevent dislocation of the AMT

Amniotic Membrane Transplantation for Restrictive Strabismus: Case Series
- Representative case described in next few slides
- Full details available in paper and online
CASE REPORT: Patient 1

- 76 yo female
- Diplopia x 4 weeks after bilateral transconjunctival lower lid blepharoplasties
- In position K/D: OD 7 PD, OS 2 PD
- Right gaze – normal versions, orthotropia
- Left gaze:
  - Right eye: -4 adduction, -3 supraduction
  - Significant downshoot on adduction
  - XT: 30 PD, LHT: 18-20 PD

Patient 1: Pre-AMT, Intra-operatively

- Right eye
  - Positive forced ductions
  - Restriction to supraduction, adduction
  - Inferior temporal fornix scarring
  - Conjunctival Contracture
  - Fat Adherence
- Surgery:
  - Removal adhesions
  - 7 mm conjunctival recession

Patient 1: Post-AMT, 7 months follow-up

- Right inferior temporal fornix
- No significant scarring
- Transplant not contracted
- No significant diplopia
- No recurrence of strabismus

Post-operative Results

- Full ductions and versions, no diplopia
- But...3 weeks after surgery:
  - Restrictive surgery recurred identical to pre-op
- Second surgical exploration:
  - Recurrence of adhesions in inferotemporal quadrant
  - Conjunctival contracture
- Surgical repair:
  - Removal adhesions to free forced ductions
  - Conjunctival recessed
  - Amniotic Membrane Transplant in inferotemporal quadrant to cover exposed sclera

Amniotic Membrane Transplantation for Restrictive Strabismus: Summary

- AMT used to replace missing or contracted conjunctiva
- AMT can reconstruct a tissue barrier that separates orbital fat and adhesions from sclera
- AMT may reduce secondary scarring, and help prevent recurrence of restrictive strabismus and the diplopia and pain that often accompanies this type of strabismus

References

A Minimally Invasive Procedures

No off label use of drug or device
Financial disclosure - Titan Surgical and Springer Publisher

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In office topical anesthesia
"Wright Mini Tenotomy"

Post Operative Wright Mini Tenotomy

Secure the muscle insertion with 0.75 tooth forceps

Westcott scissors central tenotomy

Wright Mini Tenotomy

Mini tenotomy of the 2 to 3 mm of central rectus tendon

Chart review 15 consecutive cases at least 1 month follow up

Success - No Diplopia
- Hypertropia - 6 of 9 or 66%
- Esotropia - 2 of 6 or 33%

Change per Mini T
- Hypertropia - 0 to 6 mean 2.3 PD
- Esotropia - 0 to 4 mean 1.3 PD

Myectomy, Tenotomy and Myotomy
first strabismus surgery 1830's

Florent Curier 1839 first strabismus surgery
Ruete in 1841 described the tenotomy
Bohn 1840's partial lateral tenotomy avoids overcorrection

55 yo with diplopia for over 2 yrs after Lasik

- Dsc RH-2
- Nsc RH-2

Head tilt - neg.

Ortho ortho ortho ortho ortho

Myectomy, Tenotomy and Myotomy
Graded Rectus Tenotomy

Allan B. Scott, MD
Arch Chil Vol 63 No 2 pp127-128. 2006

- 60 – 70% tenotomy corrects 3 to 4 PD
- Even 90% tenotomy may not correct 6 to 10 PD

Caudal or Cranial Slant Partial Tenotomy of Horizontal Rectus Muscles in A and V Pattern Strabismus
van der Muelen-Schot BJ O 2008

- Improve A or V patterns by 3.5 to 7 PD
- Bilateral surgery result in reduction of angle in primary by 4.5 to 7.5 PD

Results Central Wright Tenotomy

- Ages 35 yrs to 86 yrs
- All binocular diplopia
- Pre operative Deviation
  9 Hypertropia = 2 to 6 PD (mean 3.5 PD)
  6 Esotropia = 2 to 16 PD (mean 8 PD)

Cranial MR slant partial tenotomies for V- esotropia
Results Central Wright

- Ages 35 yrs to 86 yrs
- All binocular diplopia
- Pre operative Deviation
  9 Hypertropia = 2 to 6 PD (mean 3.5 PD)
  6 Esotropia = 2 to 16 PD (mean 8 PD)


Post operative

- Hypertropia - 0-4 prism diopters (mean 1.3 PD)
- Esotropia - 1 to 8 PD (mean 5.9 PD)

Post operative results

- Success No Diplopia
  9 Hypertropia - 6 of 9 or 66%
  6 Esotropia - 2 of 6 or 33%
- Note immediate results 100% improved


Ray Oyakawa, M.D.

- Vertical diplopia after retinal surgery
  LH 3 - 4

Wright Central Tenotomy

- Worth a try for treating diplopia associated with:
  - Small Hypertropia
  - About 2 PD per mini tenotomy

New muscle tightening procedure “Mini Plication”

- Worth a try for treating diplopia associated with:
  - Small Hypertropia
  - About 2 PD per mini tenotomy

65 yr old ET 8 PD increasing in left gaze
R- LR Mini Plication

In office – Awake

Group 1- Mini- P Only
Ave. Change = 5 PD

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<th>Total Deviation treated per muscle</th>
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<td>7</td>
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Group 2- Mini- P with previous antagonist recession - Ave. change= 7 PD

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Conclusion
- Mini Plication will correct 5 - 7 PD per muscle
- Mini Tenotomy will correct 2 PD per muscle

Minimally invasive strabismus surgery has potential for correcting small angle strabismus