Apt Lecture Workshop:
Cutting No Slack
For The Sagging Eye Syndrome

Joseph L Demer MD, PhD
Zia Chaudhuri MS, FRCS (Glasg)
Robert A Clark MD
Jules Stein Eye Institute and Department of Neurology,
University of California, Los Angeles,
Maulana Azad Medical College & Associated Hospitals,
New Delhi, India
Grant Support: EY08313
No financial conflicts of interest
Non-FDA approved surface coils used

Age-Related Degeneration
of LR-SR Band

Proposed Mechanism of
Divergence Paralysis Esotropia (DPE)
2. Conversion of the LR from a pure abductor to an infraductor bilaterally,
   decreasing abduction at distance, resulting in esotropia.

Studies of
Divergence Paralysis Esotropia (DPE)
Criteria
1. ET at distance, vertically comitant
2. Fusion at Near
3. Normal Abduction Saccades

Subjects - 11
1. Age: 72 ± 11 years
2. Gender: 7 women and 3 men
3. Distance ET: 11.5 ± 10.6 Δ (SD)
4. Near E: 1.3 ± 3.1 Δ

Exclusions:
1. Orbital Trauma
2. Restrictive Strabismus (i.e. thyroid)
3. Prior strabismus surgery
4. High myopia
5. Prior strabismus surgery

Proposed Mechanism of
Cyclovertical Strabismus (CVS)
2. Conversion of the LR from a pure abductor to an infraductor unilaterally,
   resulting in ipsilateral hypertropia and exocycloptropia.
Study of Cyclovertical Strabismus (CVS)

Subjects - 17
1. Age: 68 ± 2 years
2. Gender: 10 women and 17 men
3. Distance HT: 9.9 ± 9.4 (SD)

Exclusions:
1. Superior Oblique Palsy
2. Orbital Trauma
3. Restrictive Strabismus (i.e. thyroid)
4. Prior strabismus surgery
5. High myopia
6. Skew deviation

Magnetic Resonance Imaging
- T1 or T2 fast spin echo
- Surface coils
- Central target fixation
- Quasi-coronal planes for pulley positions
- Quasi-sagittal planes for vertical rectus lengths
- Axial planes for horizontal rectus lengths
- Digital analysis

Control Subjects

Younger Normal: 28 subjects, 52 orbits
Normal eye exam
Age 23 ± 5 years

Age-Matched Older Normal: 14 subjects, 25 orbits
No ocular disease (pseudophakia allowed)
Age 65 ± 5 years

Superior Sulcus Defect in SES
64% of subjects

Blepharoptosis in SES
29% of subjects with SES had ptosis and high lid crease

Prior Adnexal Surgery in SES
29% of subjects had prior blepharoplasty, brow lift, or face lift surgery.
Levator Aponeurosis Dehiscence

- Disinsertion of levator tendon from tarsus
- Aponeurotic blepharoptosis

Rectus Pulleys Heterotopic in SES

Table 1. Rectus Pulley Positions Relative To Globe Center, mm.

<table>
<thead>
<tr>
<th>Group</th>
<th>Medial Rectus</th>
<th>Superior Rectus</th>
<th>Lateral Rectus</th>
<th>Inferior Rectus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>DPE</td>
<td>11.5</td>
<td>2.4</td>
<td>13.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Controls</td>
<td>11.0</td>
<td>2.7</td>
<td>13.1</td>
<td>3.0</td>
</tr>
</tbody>
</table>

P = 0.02

OD - OS
Symmetrical
Always asymmetrical
> 1 mm

P = 0.05

Excyclo
5 ± 6°
7 ± 5°
12 ± 6°
17 ± 6°

P = 0.02

Always asymmetrical
> 1 mm

P = 0.01

Excyclo
7 ± 5°
12 ± 6°
17 ± 6°
22 ± 6°
SES is NOT “Heavy Eye Syndrome”

**“Heavy Eye Syndrome”**
- Axial high myopia.
- Inferonasal shift of lateral rectus.
- Nasal shift of inferior rectus.
- Nasal shift of superior rectus

**“Sagging Eye Syndrome”**
- No axial myopia.
- Inferotemporal shift of lateral rectus.
- Temporal shift of inferior rectus.
- No shift of superior rectus
**Treatment of Divergence Paralysis Esotropia By Medial Rectus Recession**

Since MR recession is effective in correcting divergence paralysis esotropia...

We hypothesized that recession of the MR, the antagonist of the LR muscle, would be equally effective as LR resection in DPE.


**Subjects For DPE Surgery**

- **Type of Study**: retrospective (1994-2011)
- **Inclusion Criteria**
  - Orthotropia / asymptomatic esophoria (≤ 10 Δ)
  - Symptomatic distance esotropia (ET) at least twice the measured near esotropia.
- **Surgery**
  - Limbal Approach (Fixed / Adjustable)
  - **Groups**
    - Group A (Lateral Rectus Resection): 8 Patients
    - Group B (Medial Rectus Recession): 16 Patients
- **Anesthesia**: General / Topical (Lidocaine 1% solution)

**Results**

<table>
<thead>
<tr>
<th>Group A (LR Resection)</th>
<th>8 Patients (2 male, 6 female); 73 ± 6 years</th>
<th>4.5 ± 1.2 mm resection</th>
<th>12.5 % (1/8) MAC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group B (MR Recession)</td>
<td>16 Patients (4 male, 12 female) 68 ± 14 years</td>
<td>3.7 ± 1.2 mm recession</td>
<td>93.75 % (15/16) MAC</td>
</tr>
</tbody>
</table>

Dosage of MR recession targeted to double the measured distance deviation


Recession of the MR, antagonist of the sagging LR, effectively treats DPE without convergence insufficiency at near, and is convenient for intra-operative adjustment under topical anesthesia.

MR recession avoids surgery near the disrupted LR-SR band.

**Dosage of MR recession targeted to double the measured distance deviation**

Predicted Advantages

1. Minimally invasive
2. Amenable to intra-operative adjustment under topical anesthesia

**Treatment of Cyclovertical Strabismus in SES By Graded Vertical Rectus Tenotomy**

Partial tenotomy at margin reduces EOM tension and shifts effective insertion point transversely.

Effect of Inferior Rectus Graded Tenotomy

Sagging Eye Syndrome

• Age-related degeneration of LR-SR band allows lateral rectus pulley to shift and tilt inferolaterally.
• Medial and inferior rectus pulleys shift inferolaterally.
• Rectus EOMs elongate.
• When symmetrical: divergence paralysis esotropia.
• When asymmetrical: ipsilateral hypertropia and excyclotropia
  (Note: SD palsy causes ipsilateral hypertropia and exocycotropia).

Sagging Eye Syndrome

• Adnexal “sag” strongly correlates with pulley sag.
• Diagnosis does NOT require imaging in most cases.
• Divergence paralysis ET effectively treated by large MR recessions.
• Cyclovertical strabismus effectively treated by large partial vertical rectus tenotomy.
• SES is probably a major cause of adult acquired strabismus.