Strabismus treatment is not only for kids! Adult strabismus, whether recent-onset or longstanding, compromises binocular function, can cause diplopia and other symptoms, and is associated with wide-ranging effects on various aspects of patients’ lives, particularly psychosocial functioning. Three pediatric eye care providers will dialogue and share the reasons they enjoy managing adult strabismus and how they do it. Clinical pearls for non-surgical and surgical management and pre- and post-surgical considerations for patients with adult strabismus will be provided.

Speakers:
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Moderator: Susan Cotter, OD, MS, FAAO
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I. Introduction (Susan Cotter)

II. Scope of the Problem & Practical Pre- and Post Surgical Concerns in Adult Strabismus (David Stager)

A. Scope of problem in adults: 4%-5%
   1. Types of patients – muscle, nerve, scar tissue problems
   2. Adult onset –CNP 3, 4, 6, accommodative and nonaccommodative ET, accommodative spasm, XT new or consecutive, DI, Graves Disease, myasthenia gravis, trauma, CNS issues
   3. Childhood onset – ET, XT, HT, cranial dystosis
• New-onset or consecutive XT among most common types
• Stager study: 140 middle-aged adults, two-thirds had history of childhood onset and two-thirds of those had childhood strabismus surgery. These XT patients among the most easy to treat.
• I also have a series of 57 cases of divergence insufficiency that have had over 90% treatment success.
• Superior oblique palsy is usually pretty straightforward.
• More difficult cases include thyroid eye disease, extensive trauma and third cranial nerve palsies.

B. Spectrum of patient concerns
   1. Diplopia
   2. Visual confusion – poor stereopsis
   3. Psychosocial concerns

C. What is different about managing adult strabismus versus child strabismus?
   1. Adults may prefer no treatment, occlusion, outpatient Botox, or consultation by national expert
   2. Health issues may be more significant
   3. Greater variety of causes
   4. Do not adapt to post-op misalignment as quickly

D. Clinical Evaluation
   1. History – complaints, onset, other health problems and symptoms.
   2. Sensory motor evaluation
      • Horizontal, vertical, torsional measurements in cardinal fields
      • Versions
      • Fusion, stereo, diplopia fields, visual fields
      • Prism adaptation test
      • Fundus – disc, retina, torsion
      • Convergence and divergence amplitudes
      • Get stable measurements
   3. Refraction – manifest and cycloplegic

E. Surgical Management
   1. Goal – fusion and alignment in the primary gaze and reading position, and as much into the periphery as possible, recognizing that diplopia may persist in some remote field of gaze.
   2. Insurance – Surgery is reconstructive, not cosmetic. Returns eyes to normal position and improves binocularity.
   3. Preoperative
      • Preoperative physical required
• Blood thinner may need to be discontinued

4. Anesthesia
• General (asleep, higher risk, adjust in OR or recovery room)
• Regional - like cataract procedure (numb eye, no vision, safer, adjust 1-7 days post-op)

5. Surgery
• Time – 15 minutes per muscle; 30 minutes in recovery room
• Risk – to the vision 1/10,000, health 1/100,000, infection 1/10,000
• Surgical decision – recess, resect, transposition depends on case. Some require bilateral and others unilateral surgery.
• Success rate 80% long term

6. Post-surgery
• Infection – Betadine used preoperatively to soak sutures and needles and postoperatively for sterilization. Topical or systemic antibiotics may be used postoperatively.
• Pain medicine varies with case – Tylenol, Advil, Vicodin depending on the level of discomfort and surface irritation
• Home in 30-60 minutes, limited activity for 24-36 hours, limit activity to what feel safe doing including driving, work, workout, and flying; shower in 24 hours.
• Patch may or may not be necessary for 24 hours
• Redness, swelling last an average of 2 weeks
• Suture adjustment 1-7 days; adjustment needed in 5%-10%
• Follow up – immediate (1-4 days), 2 months for final assessment; every 1-2 years by O.D. for recurrence

7. Potential Complications
• Immediate scleral perforation, possible cryotherapy or retina consult – detachments extremely rare
• Infections less than 1/10,000
• Tenon’s prolapse at wound; usually clears but may need steroid drops
• Over- and under-corrections often treated with adjustment procedure or repeat surgery within 1-2 months in <10% of cases
• Diplopia: 10% but clears spontaneously in all but 0.7%
• Remote problems – anterior segment ischemia (usually after 3 or 4 rectus muscles have had surgery). One needs to review previous surgery to avoid
8. Post-operative Diplopia
   • Less common with adjustable techniques. When eyes within a few degrees of straight, brain’s fusional ability often takes over to realign small deviations.
   • Fresnel prisms helpful in some cases.
   • Change in retinal correspondence frequently happens
   • 10% short-time diplopia but only 0.7% long-time diplopia (Kushner)
   • PAT can help the patient decide whether to have surgery to eliminate the deviation and take a small risk that eyes and brain will not adapt to the straight-ahead position.
   • PAT often predicts post-op diplopia; patient may prefer tropia to post-op diplopia
   • Patients with ARC usually adapt to a new ARC or NRC following surgery for the peripheral retina. Often have monofixation syndrome with suppression of non-dominant fovea.
   • Medical treatment is preferred for patients with MG, diabetes, CNS issues and smaller deviations that would respond to prism
   • Building fusional vergences helpful for CI patients
   • Surgery may be discouraged when bitemporal hemianopsia and XT (surgery would cut down peripheral field of vision)
   • Some patients may have underlying extensive orbital scar tissue that holds eye out of line despite muscle adjustment
   • Guyton describes patients with pulled fovea diplopia syndrome that continue to have diplopia that is unresponsive to surgical or prismatic treatment.
   • Most CN palsies need to be followed 6 months to 1 year until neurologist feels deviation is going to be permanent. Then like to get repeated consistent measurements of deviation.

III. Adult Strabismus: Assessment of the Patient’s Perspective (J. Holmes)

A. Quality of Life Considerations
   1. AS-20 Questionnaire
      • Development
      • Comparison to VFQ-25
      • Responsiveness to treatment
      • Prism
      • Surgery
• Evidence for improved quality of life following interventions
• Practical use of AS-20 in the office

2. Diplopia questionnaire
• Development of diplopia questionnaire
• Development of data-driven scoring algorithm
• Responsiveness of diplopia questionnaire
• Practical use of the diplopia questionnaire in the office

3. Assessment of risk of post-op diplopia with prism
• Adults with childhood-onset strabismus and no diplopia
• High sensitivity but very poor specificity
• Tells you which patients are at low risk
• Absolute risk of intractable diplopia is very low <1%
• Concept of re-establishing new ARC at new angle

4. Outcome measure assessment in adult strabismus
• Alignment – simultaneous prism and cover test
• Diplopia
• Health-related quality of life
• Combining outcome measure to define success/failure

5. Case example
• Longstanding large angle exotropia – no diplopia
• Lost medial rectus
• Severe psychosocial concerns
• Surgical and post-op course
• Management of post-op diplopia
• Outcome and importance of health-related quality of life

IV. Tips for the Management of Adult Strabismus (Richard London)

• If the patient does not experience diplopia:
  – Suppression vs. suspension: Differences and implications
  – Anomalous correspondence
    • Implications for post-operative outcomes
    • Rapid clinical tests
      • Bagolini lenses
      • Red lens test
      • Hering-Bielschowsky
• Prolonged Cover Test
  – Occlude one eye approx. 45 minutes
  – For suspected latent vertical, occlude the H hypo eye

• Prism Adaptation Test: RCT Overview
  – Treatment Protocol
    ▪ Neutralize deviation with prism ACT
    ▪ Rx Fresnel for full amount
    ▪ Wear Rx for 1 week
  – PAT Responder (positive test)
    ▪ If angle through prism 0 to 8Δ ET, and...
    ▪ Worth fusion at near, or...
    ▪ 2 of 3 animals or 2 of 9 dots on Titmus
  – PAT non-responder (negative test)
    ▪ Motor stability not achieved and angle increased to 60Δ
    ▪ Motor stability stopped between 0- 8Δ, but no fusion on Worth after 30 days wearing
  – Study Results
    ▪ Highest post-op success (89%) in responders
    ▪ Also best sensory results
    ▪ Lowest success (72%) in non-responders

• Weaning Patients Off Prism
  – Constant wear for several weeks
  – Retest red glass in dark room
  – 2 P.D. opposite to direction in Rx (1 P.D. for vertical)
  – Retest in 2 - 4 weeks

• Vision Therapy Considerations
  – Goals
  – When to begin VT

• Considerations for the Management of Post-treatment Diplopia

V. Panel Discussion including Cases: TBD

1. Divergence Insufficiency – Prism versus surgery
2. Large angle esotropia (since infancy) – never surgery
3. Pre-op assessment
4. ARC issues
5. Outcomes and expectations
6. Decompensated presumed 4\textsuperscript{th} nerve palsy

7. Graves eye disease with horizontal, vertical and torsional diplopia

   1. XT – Acquired or consecutive
   2. XT – Slipped MR
   3. XT – Third cranial nerve palsy
   4. ET – Accommodative or nonaccommodative
   5. ET – Sixth cranial nerve palsy
   6. Thyroid myopathy
   7. HT after trauma – Fourth cranial nerve palsy, flap tear
   8. HT after cataract surgery