A. Introduction

“the definition of insanity is doing the same thing over and over and expecting different results”

B. Reconsidering the pathophysiology and treatment approach for amblyopia

1. Current evidence suggests that amblyopia is driven by binocular mechanisms.
   i. Earliest functional and anatomic abnormalities occur in cortical area V1
   ii. Reduction in binocularly driven neurons,
   iii. Reduction in neurons driven by amblyopic eye
   iv. Increase in “suppression” a deficit in binocular processing (sometimes called “interocular contrast sensitivity ratio”), an inhibitory influence of the better seeing eye over the amblyopic eye when both eyes are viewing
   v. Other abnormalities in downstream extra striate and specialized cortical areas including higher order perceptual defects and motor function

2. Monocular treatment methods have limited efficacy.
   i. Success rate of patching ranges from 60-80%
   ii. 25% recurrence rate after patching is discontinued
   iii. Binocular outcomes are often poor in spite of improved acuity

3. Newer behavioral, physical and pharmacologic interventions aim to balance visual input and processing thereby promoting fusion and binocularity
   i. Anti-suppression treatment
   ii. Balanced binocular viewing
   iii. Transcranial brain stimulation
   vi. Drugs (Citicoline, levodopa, donepezil)

C. Fusion and anisometropia

1. Fusion requires images to fall on corresponding retinal areas and to be similar in size, sharpness and brightness

2. Anisometropia preludes fusion by inducing static and dynamic aniseikonia
   i. For each diopter of corrected anisometropia 1% image size disparity is introduced.
   ii. On average, humans can fuse images with no more than 5% disparity
   iii. The probability of amblyopia increases with increasing magnitude of anisometropia and with strabismus
D. Evidence of safety and efficacy of pediatric refractive surgery

   i. 25 papers, 597 patients, 682 eyes
   ii. Includes corneal refractive surgery (CLRS) and phakic IOLs (pIOL)
   iii. Indications: CLRS for myopic anisometropia (N=318); mean SE -10 ± 2.7
        CLRS for hyperopic anisometropia (N=218); mean SE 5.6 ± 1.3
        pIOLs for high myopia or anisometropia (N=61; 75 eyes); mean SE -14 ± 2
   iv. Mean age:
        a. CLRS: 9 ± 3 years
        b. pIOL: 8 ± 3 years
   v. BCVA (decimal):
        a. CLRS improved from 0.3 ± 0.1 to 0.5 ± 1
        b. pIOL improved from 0.1 to 0.4 ± 1
   vi. Binocular function:
        a. CLRS: 12 papers reported; improved from 11% to 71%
        b. pIOL: 6 papers reported; improvement in > 50% of patients
   vii. Complications (none severe):
        a. CLRS: myopic regression
           haze (19/607 greater than grade 2)
        b. pIOL: endothelial cell loss
           temporary pigment dispersion
           acute iridocyclitis

2. Comparative studies of refractive surgery vs conventional methods
   i. Autrata et al 2016 (abstract only)
        a. age 3-7
        b. 43 patients with refractive surgery (CLRS and pIOL), 37 with contact lens
        c. BCVA, stereopsis were significantly better in refractive surgery group
        d. “no complications after surgery”
        e. 2 year follow up
   ii. ATS 19 (PEDIG study to begin in 2017)
        a. Up to 200 patients
        c. prospective, randomized to PRK vs conventional management
        b. regional sites in USA
        c. outcome at 7 months

E. ?The future of amblyopia treatment?:

1. Old thinking: Improve vision and binocularity will follow

2. New thinking: Establish the possibility for binocularity (strabismus and or refractive surgery) and improved vision will follow
References


