TREATMENT – PRISM THERAPY

Purpose of Course
- To review how to determine prismatic prescriptions for patients with different binocular vision conditions, such as diplopia, symptomatic heterophorias and abnormal head postures using prism.

Clinical Pearls you will learn from this lecture
- What is the terminology for the different types of prism treatments?
- How might a person with a long-standing strabismus be different than a person with a more recent onset strabismus?
- In a patient with a long-standing paresis, what are the considerations when prescribing prism?
- In a patient with a recent onset paresis, what are the considerations when prescribing prism?
- How do you prescribe prism using Sheard's criterion?
- How do you prescribe prism using Caloroso's Residual Vergence Demand Criterion?
- When should you not consider prism as a treatment option?

1. Terminology

a. Corrective or Neutralizing Prism
   - Goal – To stabilize normal sensory fusion
   - Prism Action – Neutralizes the demand for controlling fusional vergence

b. Relieving Prism
   - Goal – To stabilize sensorimotor fusion
   - Action – Reduces the demand for controlling fusional vergence

c. Overcorrective Prism
   - Goal – To disrupt anomalous correspondence
   - Action – Reverses the demand for controlling fusional vergence

d. Inverse Prism for Training or Disruptive Prism Therapy
   - Goal – To increase fusional vergence ability
   - Action – Increases the demand for controlling fusional vergence

e. Inverse Prism for Cosmesis
   - Goal – To enhance cosmesis of a strabismus when a patient has poor treatment prognosis
   - Action – Optically displaces the image of the eyes in a direction opposite the strabismus when an observer views the patient.

f. Yoked Prism
   - Goal – To stabilize bv in non-concomitancy or dampen nystagmus
   - Action – Directs the eyes into a specific gaze direction

g. Sector / Regional Prism
   - Goal – To stabilize binocular vision in one or more gaze positions
   - Action – Reduces the demand for controlling vergence in more than 1 gaze
2. Onset and Duration of Problem
   a. Early Onset & Long Duration Strabismus
      • Patients who develop strabismus at an early age and/or have had the condition for many years tend to develop sensory adaptations, such as suppression or anomalous sensory fusion.
      • These patients are often asymptomatic. In some cases, they may have compensatory head turns.
      • In these cases, you must confirm or establish normal sensory processing before prescribing prism for fusion
   b. Recent Onset & Short Duration Strabismus
      • Patients who develop later onset strabismus or have had the condition for a short-duration generally do not have adaptations. Thus they are often symptomatic, but capable of normal sensory fusion.
      • These patients may also present with compensatory head turns.
      • These patients usually respond well to prism therapy
      • Make sure to rule out pathological cause for strabismus when recent onset.

3. Heterophoria or Intermittent Strabismus
   a. Good candidates for prism therapy
      • Patients with intermittent strabismus with normal sensory fusion part of time
      • Patients with constant strabismus, but have the ability to achieve binocularity when prism is added (normal sensory fusion with prism)
   b. Relieving Prisms
      • Generally, you want to prescribe the minimal amount of prism that allows you to achieve your goals.
      a. Dissociated Prism Criteria
         In these methods, prism amount prescribed is determined based on the size of the deviation when the patient is fully dissociated (magnitude of the deviation obtained with alternating cover test)
         1. Percentage Criteria
            1/3 to 1/2 of total deviation, 2/3 of vertical deviation
         2. Residual Vergence Demand Criterion (Caloroso, 1993)

<table>
<thead>
<tr>
<th>Direction</th>
<th>Magnitude (Δ)</th>
<th>RVD (Δ)</th>
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<tbody>
<tr>
<td>Esodeviation</td>
<td>6 – 20</td>
<td>4 – 6</td>
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<tr>
<td>Hyperdeviation</td>
<td>3 – 10</td>
<td>2 – 4</td>
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<tr>
<td>Exodeviation</td>
<td>20 – 30</td>
<td>10 - 15</td>
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b. **Associated Prism Criteria**
   In these methods, prism amount is determined based on the size of the deviation when patient has both eyes open at the same time – associated conditions.

1. **Fixation Disparity Neutralization (Associated Phoria)**
   a. Best way to determine the proper amount of prism for symptomatic vertical heterophoria - results in the least amount of prism needed to relieve symptoms.

   ![Polarized Vectographic Slide](Image)

   **Vertical Fixation Disparity**

   **Horizontal Fixation Disparity**

   b. Prism is added in the appropriate direction until perceived displacement is neutralized. This is the associated prism amount.

2. **Sheard’s Criterion**
   a. Best for basic exo >4°
   b. This method states that the compensating fusional reserve should be twice the amount of the phoria.
   c. The formula is:

   \[
   \Delta = \frac{2 \text{ (phoria)} - (BO \text{ to blur})}{3}
   \]

   **Ex:** Patient has 9° XP and BO to Blur is 6°
   Prism needed would be \(\frac{2}{3}(9) - \frac{1}{3}(6) = 4\)
   Prescribe 4° BI.
3. **Percival’s Criterion**
   a. This method states that the heterophoria should be in the middle third of the total range of fusional amplitude.
   b. The formula is:

   \[ \Delta = \frac{(\text{greater limit BI or BO range}) - 2(\text{Lesser limit BI or BO range})}{3} \]

   Prism is only needed if this is a positive number

   **Ex#1.** Patient has 9° XP.
   BO range is 9/12/8. BI range is 24/26/22
   Prism needed would be \( \frac{1}{3}(24) - \frac{2}{3}(9) = 2 \)
   Prescribe 2° BI.

   **Ex #2.** Patient has 9° XP.
   BO range is 18/24/10. BI range is 12/16/10
   Prism needed would be \( \frac{1}{3}(18) - \frac{2}{3}(12) = -2 \)
   No prism is needed since number is negative.

4. **Fusion Prisms** – prism that changes diplopic or suppression response to normal BV response
   - Use minimal amount of prism to achieve fusion response
   - When patients are diplopic this is easy... just add prism until patient tell you they see single and stable.

**Noncomitant Strabismus Considerations**

**Goals**
1. Eliminate abnormal head position
2. Provide single binocular vision

**Assessment**
1. Measure deviation with compensatory head posture and with head physically straight
   - If recent-onset: usually safe to prescribe based what is found when head is straight
   - If long-standing: determine if head feels straight when physically straightened; you may need to prescribe prism gradually to assist with adjustment

2. If the cause of noncomitancy is a muscle under action, such as in a paralysis or paresis (innervational) and the deviation is long-standing or not expected to resolve, consider prescribing a greater amount of prism over the effected eye because this will result in less total prism required for fusion.

3. If the paresis is recent-onset or you anticipate resolution, consider placing prism over non-affected eye to prevent secondary contracture of the ipsilateral antagonist.
Ex. Longstanding LLR paresis

Ex. Recent onset LLR paresis

Other considerations
- Monocular ocular motility activities
- Part-time alternate occlusion
- Yoked prisms may be used to move eyes into specific field of gaze. This can be combined with relieving prisms
- Two pair of spectacle lenses with and without prism for patients who have different deviation magnitudes at distance and near
- Sector prism for patients who have diplopia in a specific gaze.

4. Constant Strabismus

a. Corrective Prisms for Resolvable Strabismus
- Avoid using prism when patient has Anomalous Correspondence, peripheral suppression, amblyopia.
- Must have normal correspondence and normal peripheral sensory fusion
- Once normal sensory fusion achieved for 3-6 months (can be less for infants)
  - Titrate prism 2-4Δ at a time
Pediatric Eye Care – An Update for the Primary Care Clinician – Yin C. Tea

Pediatric Eye Care Research Summaries

1. Myopia

a. Collaborative Longitudinal Evaluation of Ethnicity & Refractive Error Study (CLEERE)

Accommodative Lag before and after the Onset of Myopia. Mutti DO et al. for the CLEERE Study Group

Purpose
• To evaluate accommodative lag before, during the years of, and after the onset of myopia in children who became myopic, compared with emmetropes.

Results
• Accommodative lag was not significantly different in the two groups before or during the year of onset of myopia
• Consistently higher lag was seen in children after the onset of myopia
• Asian children typically showed the most lag, Hispanic children having intermediate amounts and African-American and white children showed the least.

Conclusions
• Increased accommodative lag is unlikely to be a useful predictive factor for the onset of myopia.
• Increased hyperopic defocus from accommodative lag may be a consequence rather than a cause of myopia.


Refractive error, axial length, and relative peripheral refractive error before and after the onset of myopia. Mutti DO et al. for the CLEERE Study Group

Purpose
• To evaluate refractive error, axial length, and relative peripheral refractive error before, during the years of, and after the onset of myopia in children who became myopic compared with emmetropes.

Results
• When compared to children who were emmetropic, children who became myopic had less hyperopia and longer axial lengths before and after the onset of myopia and more hyperopic relative peripheral refractive errors

Conclusions
• More negative refractive error, longer axial length, and more hyperopic relative peripheral refractive error may be useful for predicting the onset of myopia.
• Becoming myopic does not appear to be characterized by a consistent rate of increase in refractive error and expansion of the globe.
• Acceleration in myopia progression, axial elongation, and peripheral hyperopia in the year prior to onset is followed by relatively slower, more stable rate changes once myopia onsets. This suggests that more than one factor may influence ocular expansion during myopia onset and progression.

Invest Ophthalmol Vis Sci. 2007 Jun;48(6)2510-9
b. Correction of Myopia Evaluation Trial (COMET)

**A randomized clinical trial of progressive addition lenses versus single vision lenses on the progression of myopia in children.** Gwiazda Jj et al. for the COMET Study Group.

**Purpose**
- To evaluate the effect of progressive addition lenses compared with single vision lenses on the progression of juvenile-onset myopia.

**Results**
- The 3-year difference in progression of myopia was 0.20 +/-0.08 D
- This was statistically significant
- Children with lower baseline accommodative response at near had higher treatment effect
- Mean changes in axial length correlated with those in refractive error

**Conclusions**
- Progressive addition lenses slowed the progression of myopia in COMET children by a small, statistically significant amount only during the first year.
- Size of treatment effect remained same over next 2 years.
- Small magnitude of effect does not warrant change in clinical practice


c. Contact Lens and Myopia Progression Study (CLAMP)

**A randomized trial of the effects of rigid contact lenses on myopia progression.** Walline JJ et al. for the CLAMP Study Group

**Purpose**
- To compare the effects of rigid gas-permeable contact lenses and soft contact lenses on myopia progression in children.

**Results (over 3 year period)**
- Mean refractive error progressed -1.56 +/-0.95 D for RGP wearers
- Mean refractive error progressed -2.19 +/-0.89 D for SCL wearers
- Axial growth of eyes not significantly different between treatment groups
- Steep corneal meridian of RGP wearers steepened 0.62 +/-0.60 D
- Steep corneal meridian of SCL wearers steepened 0.88 +/-0.57 D

**Conclusions**
- RGP wearers progressed less than that of the SCL wearers although axial length not significantly different between two groups
- Most treatment effect limited to first year of trial
- Results provide information to clinicians to share with parents, but do not indicate that RGP’s should be prescribed primarily for myopia control.

*Arch Ophthalmol. 2004 Dec;122(12)1760-1766*
A Randomized Trial of the Effect of Soft Contact Lenses on Myopia Progression in Children. Walline JJ et al. for the CLAMP Study Group

Purpose
- To determine whether soft contact lenses affect myopia progression in children.

Results
- There was a statistically significant interaction between time and treatment for myopia progression
- Average rate of change was 0.06 D per year greater for contact lens group
- After 3 years, the difference was not statistically significant
- There was no difference in axial length or change in steep corneal curvature between the two groups

Conclusions
- Soft contact lens wear by children does not cause clinically relevant increases axial length, corneal curvature, or myopia relative to spectacles

Invest Ophthalmol Vis Sci. 2008 June 19 (Epub ahead of print)

A Randomized trial of Rigid Gas Permeable Contact Lenses to Reduce Progression of Children’s Myopia. Katz J et al.

Purpose
- To test whether rigid gas permeable contact lens wear can reduce the rate of myopia progression in school age children.

Results (over 2 year period)
- Increase in spherical equivalent was -1.33 D in RGP group
- Increase in spherical equivalent was -1.28 D in spectacle group
- Increase in axial length was 0.84 mm in RGP group
- Increase in axial length was 0.79 mm in spectacle group

Conclusions
- RGP lenses did not slow the rate of myopia progression, even in children who used them regularly and consistently

Am J of Ophthal 2003 July;136(1)82-90
d. Collaborative Assessment of Myopia Progression with Pirenzepine Study (CAMPP)

**Safety and efficacy of 2% pirenzepine ophthalmic gel in children with myopia: a 1-year, multicenter, double-masked, placebo-controlled parallel study.**

US Pirenzepine Study Group

**Purpose**
- To evaluate the safety and efficacy of pirenzepine hydrochloride in slowing the progression of myopia in school-aged children.

**Results**
- At 1 year, increase of myopia of:
  - 0.26 D (pirenzepine group)
  - 0.53 D (placebo group)
- At 2 years, increase of myopia of:
  - 0.58 D (pirenzepine group)
  - 0.99 D (placebo group)
- 11% (13/117) pirenzepine patients dropped out due to adverse effects.
- 4% (5/117) due to excessive antimuscarinic effects

**Conclusions**
- Pirenzepine is effective and relatively safe in slowing the progression of myopia over a 1-year treatment period

*Arch Ophthalmol. 2004 Nov;122(11):1667-74*

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**One-Year Multicenter, Double-Masked, Placebo-Controlled, Parallel Safety and Efficacy Study of 2% Pirenzepine Ophthalmic Gel in Children with Myopia.**

Asian Pirenzepine Study

**Purpose**
- To evaluate the safety and efficacy of pirenzepine ophthalmic gel in slowing the progression of myopia in school-aged children.

**Results**
- Increase in myopia of:
  - 0.47 D (gel twice daily group)
  - 0.70 D (gel once daily and placebo once daily group)
  - 0.84 D (placebo twice daily group)
- 11% (31/282) discontinued from study for adverse events
- Of 15 serious adverse events, none was ophthalmic in nature, all subject recovered, and only 1 judged possibly related to treatment.

**Conclusions**
- Pirenzepine Ophthalmic Gel (2% twice daily) was effective and relatively safe in slowing the progression of myopia over a 1-year treatment period

*Ophthalmology 2005:112:84-91*
Two-year multicenter, randomized, double-masked, placebo-controlled, parallel safety and efficacy study of 2% pirenzepine ophthalmic gel in children with myopia.

US Pirenzepine Study Group

Purpose
- To evaluate if the safety and efficacy of pirenzepine in slowing the progression of myopia in children is sustained over a 2-year period.

Results
- At 1 year, increase of myopia of:
  - 0.26 D (pirenzepine group)
  - 0.53 D (placebo group)
- At 2 years, increase of myopia of:
  - 0.58 D (pirenzepine group)
  - 0.99 D (placebo group)
- 13/117 pirenzepine patients dropped out due to adverse events in the 1st year, 1/53 did so in the 2nd year

Conclusions
- Pirenzepine Ophthalmic Gel 2% was effective compared with placebo in slowing the progression of myopia over a 2-year treatment period and demonstrated a clinically acceptable safety profile

J AAPOS 2007 (Epub ahead of print)  J AAPOS 2008 Mar 21

2. Infants

a. Congenital Esotropia Observational Study (CEOS)

The Natural History of Infantile Esotropia During the First Six Months of Life.

Birch E et al. for the Pediatric Eye Disease Investigator Group

Purpose
- To address the natural history ocular alignment in infantile esotropia that presents at 2 to 4 months of age.

Results
- Among infants who had constant ET of ≥40 PD, none (0/66) showed resolution to orthotropia
- Only 2 infants showed a reduction below 40 PD
- Resolution to orthophoria was noted in a few infants who initially had small angle or variable angle ET
- On follow-up at 4.5 years or greater (79/80 children examined), 91% had alignment within 8 PD of orthoposition and 30% had stereoacuity of 3000’ to 60”
- Children who underwent surgical alignment at 6 months of age had higher prevalence of course stereopsis than children who underwent alignment at 7 to 15 months of age

Conclusions
- Infants who present at 2-4 months of age with constant ET of 40 PD or greater are valid candidates for surgical treatment.
- Data from long-term follow up support the hypothesis that early surgical alignment may promote the development of at least coarse stereopsis.

J AAPOS 1998 Dec;2(6):325-8
The Clinical Spectrum of Early-onset Esotropia: Experience of the Congenital Esotropia Observational Study. Pediatric Eye Disease Investigator Group

Purpose
- To describe historical and presenting features of infants with the onset of esotropia in early infancy to provide a better understanding of the clinical spectrum of the disorder.

Results
- Average age at enrollment $97 \pm 26$ days
- 56% Constant
- 25% Variable
- 19% Intermittent
- 49% $\geq 40$ PD
- Most of larger angle deviations were constant and majority of smaller angle deviations were intermittent or variable
- 65% seen after 12 week of age had constant deviation
- 19% diagnosed with amblyopia

Conclusions
- Clinical presentation of ET in early infancy shows more variation in ET’s size and character than previously appreciated
- Only a minority who are diagnosed to have ET before 20 weeks of age have large angle constant deviation
- Amblyopia frequently develops, so an evaluation for amblyopia should be an integral part of the examination of an infant with ET.


Spontaneous Resolution of Early-onset Esotropia: Experience of Congenital Esotropia Observational Study. Pediatric Eye Disease Investigator Group

Purpose
- To determine the probability of spontaneous resolution of esotropia with onset in early infancy.

Results
- Esotropia resolved in 27% of patients (46/170)
- Most resolved cases had intermittent or variable deviation at enrollment
- Resolution in only one of 42 cases with constant ET $\geq 40$ PD at baseline and first follow-up
- Resolution in only one who had 35 PD at baseline and 40 PD at follow-up

Conclusions
- Esotropia with onset in early infancy frequently resolves in patients first examined at less than 20 weeks of age when deviation is $< 40$ PD in size and intermittent or variable.
- Cases with $\geq 40$ PD presenting after 10 weeks of age have low likelihood of spontaneous resolution.

b. Retinopathy of Prematurity

**Light Reduction on Retinopathy of Prematurity (Light-ROP)**

**Lack of efficacy of light reduction in preventing retinopathy of prematurity.**

**Purpose.**
- To determine if reduction in ambient light exposure to premature infants’ eyes would reduce the incidence of ROP.

**Results**
- ROP was diagnosed in 102 (54%) in the reduced light group
- ROP was diagnosed in 100 (58%) of control group

**Conclusions**
- A reduction in ambient-light exposure does not alter the incidence of ROP in high risk infants.

*N Engl J Med. 1998 May 28;338(22):1572-6*

**Early Treatment for Retinopathy of Prematurity Study (ETROP)**

**Final Results of the Early Treatment for Retinopathy of Prematurity (ETROP) Randomized Trial.** Good WV on behalf of The ETROP Cooperative Group

**Purpose**
- To study early treatment for retinopathy of prematurity

**Results**
- Grating acuity showed reduction in unfavorable visual acuity outcomes with early treatment from 19.8% to 14.3%
- Unfavorable structural outcomes were reduced from 15.6% to 9% at 6 months
- Analysis supported retinal ablative therapy for eyes with type I ROP
- Analysis supported “wait and watch” approach to type II ROP. These eyes should be considered for treatment only if they progress to type I ROP or threshold

**Conclusions**
- Early treatment of high-risk prethreshold ROP significantly reduced unfavorable outcomes in both primary (acuity) and secondary (structural) measures


**Cryotherapy for Retinopathy of Prematurity (Cryo-ROP)**

**15-year outcomes following threshold retinopathy of prematurity: final results from the multicenter trial of cryotherapy for retinopathy of prematurity.**

**Purpose**
- To report the ocular structure and visual acuity outcomes at age 15 years, and the incidence of retinal detachment between 10 and 15 years of age for patients in the Multicenter Trial of Cryotherapy for ROP.

**Results**
- 30% of treated eyes and 51.9% of control eyes had unfavorable structural outcomes
- Between 10 and 15 years of age, new retinal folds, detachments, or obscuring of the view of the posterior pole occurred in 4.5% treated and 7.7% control eyes
- Unfavorable acuity found in 44.7% of treated and 64% of control eyes
Conclusions

- The benefit of cryotherapy for treatment of threshold ROP, for both structure and visual function, was maintained across 15 years of follow-up.
- New retinal detachments, even in eyes with relatively good structural findings at age 10 years, suggest value in long-term, regular follow-up of eyes that experience threshold ROP.


Supplemental Therapeutic Oxygen for Prethreshold ROP (STOP-ROP)

Supplemental Therapeutic Oxygen for Prethreshold Retinopathy of Prematurity (STOP-ROP), a randomized, controlled trial. I: primary outcomes.

Purpose

- To determine the efficacy and safety of supplemental therapeutic oxygen for infants with prethreshold ROP to reduce the probability of progression to threshold ROP and the need for peripheral retinal ablation.

Results

- Rate of progression to threshold in at least one eye was similar both arms
  - 48% in conventional arm (89% to 94% saturation)
  - 41% in supplemental arm (96% to 99% saturation)
- Rate of retinal detachments or folds similar in both arms
  - 4.4% conventional vs 4.1% supplemental
- Rate of macular ectopia similar in both arms
  - 3.9% conventional vs 3.9% supplemental
- Infants without plus disease ay be more responsive to supplemental tx
  - 46% conventional vs 32% supplemental
- Infants with plus disease responded similar in both arms
  - 52% progression conventional vs 57% supplemental
- Pneumonia and/or exacerbation of chronic lung disease occurred more in supplemental arm
  - 8.5% conventional vs 13.2% supplemental
- At 50 weeks of postmenstrual age, fewer conventional than supplemental infants remained hospitalized, on oxygen, on diuretics
  - 6.8% conventional vs 12.7% supplemental hospitalized
  - 37.0% vs 46.8% on oxygen
  - 24.4% vs 35.8% on diuretics
- Growth and developmental milestones did not differ between the 2 arms

Conclusions

- Use of supplemental oxygen at pulse oximetry saturations of 96% to 99% did not cause additional progression of prethreshold ROP but also did not significantly reduce number of infants requiring peripheral ablative surgery
- Supplemental oxygen increased the risk of adverse pulmonary events and the need for oxygen, diuretics, and hospitalization at 3 months of corrected age.
- Although relative risk/benefit of supplemental oxygen for each infant must be individually considered, clinicians need no longer be concerned that supplemental oxygen, as used in this study, will exacerbate active prethreshold ROP.

3. Binocular Vision
   a. Convergence Insufficiency Treatment Trial (CITT) Pilot study

   **A Randomized Clinical Trial of Treatments for Convergence Insufficiency in Children.** Scheiman M et al. for the CITT Study Group

   **Purpose**
   - To compare vision therapy/orthoptics, pencil push-ups, and placebo vision therapy/orthoptics as treatments for symptomatic convergence insufficiency in children age 9-18 years.

   **Results**
   - Symptoms were significantly reduced in the vision therapy/orthoptics group but not in the pencil push-ups or placebo vision therapy/orthoptics group
   - Decrease in symptoms from 32.1 to 9.5 for VT group, 29.3 to 25.9 in pencil push-up group, and 30.7 to 24.2 in placebo VT group

   **Conclusions**
   - In this pilot study, VT was more effective than pencil push-ups or placebo VT in reducing symptoms and improving signs of convergence insufficiency
   - Neither pencil push-ups nor placebo VT was effective in improving either symptoms or signs associated with convergence insufficiency


   b. Amblyopia Treatment Trials (ATS) Pediatric Eye Disease Investigator Group

   **ATS1 – A Randomized Trial of Atropine vs Patching for Treatment of Moderate Amblyopia in Children**

   **Purpose**
   - To compare patching and atropine as treatments for moderate amblyopia in children < 7 years

   **Results**
   - VA improvement was 3.16 lines in patching group
   - 2.84 lines in atropine group
   - Improvement initially faster in patching group but difference clinically inconsequential by 6 months
   - 6-month VA was 20/30 or better or improved by 3 or more lines in 79% of patching group
   - 74% in atropine group
   - Both treatments well-tolerated. More patients in atropine group had reduced VA in sound eye at 6 months, but did not persist at follow-up

   **Conclusions**
   - Atropine and patching produce improvements of similar magnitude, and both are appropriate modalities for the initial treatment of moderate amblyopia in children aged 3 to less than 7 years.

   *Arch Ophthalmol.* 2002;120:268-278
ATS2A – A Randomized Trial of Prescribed Patching Regimens for Treatment of Severe Amblyopia in Children

**Purpose**
- To compare full-time vs 6 hours daily patching for severe amblyopia in children < 7 years

**Results**
- VA improved a similar amount in both groups. At 4 months, VA improved
  - 4.8 lines in 6 hour group
  - 4.7 lines in full-time group

**Conclusions**
- Six hours of prescribed daily patching produces an improvement in VA similar in magnitude to improvement produced by full-time patching when treating severe amblyopia in children 3 to <7 years.

*Ophthalmology 2003;110:2075-2087*

ATS2B – A Randomized Trial of Patching Regimens for Treatment of Moderate Amblyopia in Children

**Purpose**
- To compare 2 hours vs 6 hours of daily patching for moderate amblyopia in children <7 years

**Results**
- VA improved a similar amount in both groups. At 4 months, VA improved
  - 2.4 lines in each group
- 4-month VA was 20/32 and/or better or improved by 3 or more lines in 62% of patients in both groups

**Conclusions**
- 2 hours of daily patching produces an improvement in VA similar to 6 hours for moderate amblyopia in children 3 to <7 years

*Arch Ophthalmol. 2003;121:603-611*

ATS2C – Risk of Amblyopia Recurrence After Cessation of Treatment

**Purpose**
- To study amblyopia recurrence once treatment is discontinued.

**Results**
- Recurrence occurred in 24% (35/145) cases.
  - 25% who stopped patching
  - 21% who stopped atropine
- Patients treated with moderately intense patching (6-8 hrs) had different recurrence
  - 42% (11 of 26) when treatment was not reduced prior to cessation
  - 14% (3 of 22) when treatment reduced to 2 hours prior to cessation

**Conclusions**
- About ¼ patients successfully treated for amblyopia will have recurrence within 1st year of treatment.
- For patients treated with ≥ 6 hrs daily patching, our data suggests risk of recurrence greater when patching stopped abruptly rather than when reduced to 2 hours per day prior to cessation.

*J AAPOS 2004;8:420-428*
ATS3 – Randomized Trial of Treatment of Amblyopia in Children Aged 7 to 17

Purpose
- To evaluate effectiveness of treatment of amblyopia in children age 7 to 17

Results
- Younger group (7-12 years) number of responders
  53% treatment group vs 25% in optical correction group
- Older group (13-17 years) if NOT previously treated
  47% in treatment groups vs 20% in optical correction groups
- Older group (13-17 years) if previously treated
  25% in treatment group vs 23% in optical correction group

Conclusions
- Acuity improves with optical correction alone in ¼ of patients age 7 to 17
- For younger group, 2-6 hrs patching + atropine can improve VA even if amblyopia has been previously treated
- For older group, 2-6 hrs patching may improve VA when amblyopia has not been previously treated, but appears to be of little benefit if amblyopia previously treated


ATS3 Follow-up – Stability of Visual Acuity Improvement Following Discontinuation of Amblyopia Treatment in Children Aged 7 to 12 years

Purpose
- To assess stability of VA improvement during 1st year after cessation of treatment other than spectacle wear

Results
- During year following cessation of treatment, cumulative probability of worsening VA ≥ 2 lines was 7%
- 82% of patients maintained and increase in VA of ≥10 letters compared to their baseline VA

Conclusions
- VA improvement is sustained in most children age 7 to 12 years for at least 1 year following cessation of treatment other than spectacle wear.

Arch Ophthalmol. 2007;125:655-659

ATS4 – A Randomized Trial of Atropine Regimens for Treatment of Moderate Amblyopia in Children

Purpose
- To compare daily atropine to weekend atropine for moderate amblyopia in children < 7 years.

Results
- VA improved a similar amount in both groups. At 4 months, VA improved 2.3 lines in each group
- 4-month VA was 20/25 and/or better or equal to sound eye in 47% (39 children) in daily group vs 53% (45 children) in weekend group
- Stereoacuity similar in both groups

Conclusions
- Weekend atropine provides improvement in VA similar to daily atropine in treating moderate amblyopia in children 3 to 7 years

Ophthalmology 2004;111:2076-2085
ATS5 Primary – A Randomized Trial to Evaluate 2 Hours of Daily Patching for Strabismic and Anisometropic Amblyopia in Children

Purpose
- To compare 2 hours daily patching with control group of spectacles only for moderate to severe amblyopia in children 3 to <7 years.

Results
- Improvement in VA from baseline to 5 weeks averaged 1.1 lines in patching group
  0.5 lines in control group
- Improvement in VA from baseline to best VA at any visit averaged 2.2 lines in patching group
  1.3 lines in control group

Conclusions
- After a period of treatment with spectacles, 2 hours of daily patching combined with 1 hour of near activities modestly improves moderate to severe amblyopia in children 3 to 7 years.

Ophthalmology 2006;113:904-912

ATS5 Secondary – Treatment of Anisometropic Amblyopia in Children with Refractive Correction

Purpose
- To evaluate effectiveness of refractive correction alone for treatment of anisometric amblyopia in children 3 to <7 years.

Results
- Amblyopia improved with optical correction alone by ≥ 2 lines in 77% of patients an resolved in 27%.
- Improvements took up to 30 weeks for stabilization criteria to be met.
- Treatment outcome not related to age, but related to better baseline VA and lesser anisometropia

Conclusions
- Refractive correction alone improves VA in many cases and results in resolution in at least 1/3 of children age 3 to <7 with untreated anisometric amblyopia.
- Most cases of resolution occur with moderate amblyopia, but average 3-line improvement may lessen burden of subsequent therapy for those with denser levels of amblyopia.

Ophthalmology 2006;113:895-903
ATS5 Secondary – Treatment of Strabismic Amblyopia with Refractive Correction

Purpose
- To report data on the response of previously untreated strabismic amblyopia to spectacle correction.

Results
- Amblyopic VA improved by 2 lines or more from baseline VA in 75% (9/12) patients, resolving in 3.
- Mean change from baseline to maximum VA improvement was 2.2 lines
- Improvement continued for up to 25 weeks.

Conclusions
- Results support suggestion that strabismic amblyopia can improve and even resolve with spectacle correction alone.

*Am J Ophthalmol 2007;143:1060-1063*

ATS7 – Treatment of Bilateral Refractive Amblyopia in Children 3 to <10 Years

Purpose
- To determine amount and time course of binocular VA improvement during treatment of bilateral refractive amblyopia in children 3 to <10 years.

Results
- Mean binocular VA improved from 20/63 to 20/25 at one year (3.9 lines)
- Mean improvement at one year for 84 children with acuity of 20/40 to 20/80 was 3.4 lines
  20/100 to 20/320 was 6.3 lines
- Cumulative probability of binocular VA of 20/25 or better was
  21% at 5 weeks
  46% at 13 weeks
  59% at 26 weeks
  74% at 52 weeks

Conclusions
- Treatment of bilateral refractive amblyopia with spectacle correction improves binocular VA in children 3 to <10 years, with most improving to 20/25 or better within one year.

*Am J Ophthalmol 2007;144:487-496*