Management of Down Syndrome: A 21st Century Approach

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I. Brief Overview of Down syndrome
   A. What is trisomy 21?
   B. Phenotypic characteristics
   C. Common medical findings and average IQs

II. Current Protocols Utilized for Cognitive Enhancement in Down syndrome
   A. Changing Minds Protocol
      i. Nutritional supplementation
      ii. Prozac
      iii. Focalin
   B. Warner Protocol
      i. Nutritional supplementation
   C. StemCells21 Protocol
      i. Umbilical cord blood combined with growth factors & supplements

III. Current Research for Improved Cognition in Down syndrome
   A. Amyloid precursor protein (APP)
      i. Affects the development of Alzheimer's disease
      ii. May help predict age of onset of dementia in Down syndrome
   B. GABA-A receptor block
      i. Decreases inhibitory communication of neurons in mouse models
      ii. Improves learning in mouse models of Down syndrome
   C. Sonic hedgehog signaling pathway-activator compound
      i. Restored cerebellar development in mouse models
      ii. Improved memory and learning in mouse models
   D. L-DOPS
      i. Corrects norepinephrine deficiency in the hippocampus of mouse models
      ii. Improved contextual learning and memory in mouse models
   E. Development of cognitive test battery specific for use in Down syndrome
      i. Targets specific brain regions known to be impaired in Down syndrome
      ii. Includes non-verbal tests to separate cognition and language skills
      iii. Sensitive measures will enable determination of therapeutic efficacy of human drug treatment trials

IV. Brief Overview of Common Visual Findings in Down syndrome
   A. High refractive errors
      i. High hyperopia
      ii. Lack of emmetropization
      iii. High magnitude oblique astigmatism

B. Strabismus
C. Nystagmus
D. Reduced best corrected visual acuity
E. Reduced near visual acuity

V. Research Findings Related to Accommodative Dysfunction and Reduced Near Vision
   A. MEM retinoscopy studies (Woodhouse, et al.)
      i. Large accommodative lags in persons with Down syndrome
      ii. Accommodative lag does not improve with age
      iii. Full distance correction of hyperopia may not reduce lags
   B. Accommodative Amplitude Studies (Woodhouse, et al. & Anderson, et al.)
      i. Reduced amplitudes compared to age norms in Down syndrome
      ii. Reduced amplitudes present even in early school years
   C. Objective Measurements of Accommodative Dynamics (Anderson, et al.)
      i. Reduced reaction times to initiate changes in accommodation
      ii. Increased fluctuations of steady state accommodative responses
      iii. Poor performance likely due to sensory deficits, not mechanical deficits
   D. Bifocal Studies (Stewart, et al. & Nandakumar, et al.)
      i. Bifocals improve near focus
      ii. Bifocals may encourage improved accommodation once removed
      iii. Bifocals may result in improvement in literacy skills

VI. Management of Accommodative Dysfunction in Down syndrome Patients
   A. Measure accommodation on all patients with Down syndrome
      i. MEM retinoscopy
      ii. Open field autorefraction
   B. Measure near acuity on patients with Down syndrome
      i. Near LEA chart
      ii. Measure through tentative add prior to dilation
   C. Prescribing guidelines
      i. Full hyperopic corrections
      ii. Bifocals fit high
      iii. Glasses with appropriate fit
         a. Cable temples
         b. Specs for Us (designed specifically for Down syndrome)