What's new in Vision Therapy, and why should I care?

75458-FV

Jarrod E Davies, OD, FCOVD

1

Disclosures

- No financial interest in any of the technologies discussed
- No pertinent financial disclosures

2

Why do we refer?

Research Paper

What percentage of patients presenting for routine eye examinations require referral for secondary care? A study of referrals from optometrists to ophthalmologists

David Dobbelsteyn , OD, Katherine Mckee , OD, Reece D Bearnes , MHA, Sujani N Jayanetti , MHA, David D Persaud , PhD & Alan F Cruess , MD FRCSC

Pages 214-217 | Received 13 Apr 2014, Accepted 17 Oct 2014, Published online: 15 Apr 2021

Results

The overall referral rate for the combined data set was nine per cent for all ages; 2.4 per cent of the overall patients were asymptomatic. There was a similar number of asymptomatic patients referred in the adult (20 to 64 years) age group compared to all ages (2.5 per cent).

3

Top reasons for referral

- Cataract
  - 17.1% of patients 40 and older (NEI)
- Glaucoma
  - 3.54% of 40-80 year olds (https://pubmed.ncbi.nlm.nih.gov/24974815/)
- Age Related Macular Degeneration
  - 3.33% of US population (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5178091/)

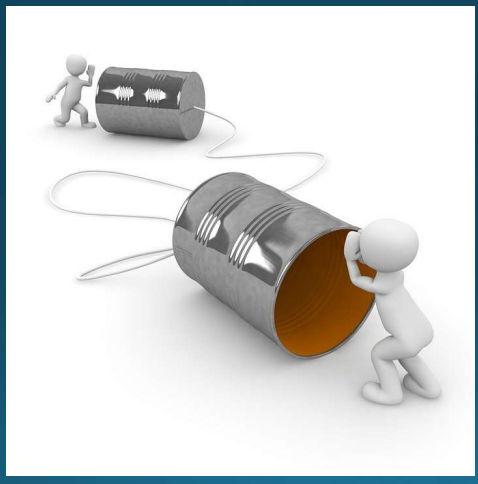
4

What about inter-optometry referral?

- Keratoconus
  - 1-2% of population
- Strabismus
  - 1.93% of population
- Concussion
  - 6228 utahns in 2011
  - 50% of concussion patients have visual symptoms
- Convergence insufficiency
  - 6% of population (studies vary from 1.75% to 33%)

5

Successful Therapy Comanagement



6

Optical Prescribing Considerations

- When should you prescribe?
- Contact lenses or Glasses
- Shaw Lenses for Amblyopia
- Prism considerations
  - Diplopia
  - Compensation vs correction
  - Prism adaptation
- VIP HIP study

7

Results of the Vision in Preschoolers—Hyperopia in Preschoolers (VIP-HIP) Study

*The VIP-HIP Study Group**
Writing Committee: Marjean Taylor Kulp, OD, MS,[1] Elise Ciner, OD,[2] Maureen Maguire, PhD,[3] Bruce Moore, OD,[4] Jill Pentimonti, PhD,[5] Maxwell Pistilli, MS,[3] Lynn Cyert, PhD, OD,[6] T. Rowan Candy, PhD,[7] Graham Quinn, MD, MSCE,[8] Gui-shuang Ying, PhD[3]

Purpose: To compare early literacy of 4- and 5-year-old uncorrected hyperopic children with that of emmetropic children.
Design: Cross-sectional.
Participants: Children attending preschool or kindergarten who had not previously worn refractive correction.
Methods: Cycloplegic refraction was used to identify hyperopia (≥3.0 to ≤6.0 diopters [D] in most hyperopic meridian of at least 1 eye, astigmatism ≤1.5 D, anisometropia ≤1.0 D) or emmetropia (hyperopia ≤1.0 D; astigmatism, anisometropia, and myopia <1.0 D). Threshold visual acuity (VA) and cover testing ruled out amblyopia or strabismus. Accommodative response, binocular near VA, and near stereoacuity were measured.
Main Outcome Measures: Trained examiners administered the Test of Preschool Early Literacy (TOPEL), composed of Print Knowledge, Definitional Vocabulary, and Phonological Awareness subtests.
Results: A total of 492 children (244 hyperopes and 248 emmetropes) participated (mean age, 58 months; mean ± standard deviation of the most hyperopic meridian, +3.78±0.81 D in hyperopes and +0.51±0.48 D in emmetropes). After adjustment for age, race/ethnicity, and parent/caregiver's education, the mean difference between hyperopes and emmetropes was −4.3 ($P = 0.01$) for TOPEL overall, −2.4 ($P = 0.007$) for Print Knowledge, −1.6 ($P = 0.07$) for Definitional Vocabulary, and −0.3 ($P = 0.39$) for Phonological Awareness. Greater deficits in TOPEL scores were observed in hyperopic children with ≥4.0 D than in emmetropes (−6.8, $P = 0.01$ for total score; −4.0, $P = 0.003$ for Print Knowledge). The largest deficits in TOPEL scores were observed in hyperopic children with binocular near VA of 20/40 or worse (−8.5, $P = 0.002$ for total score; −4.5, $P = 0.001$ for Print Knowledge; −3.1, $P = 0.04$ for Definitional Vocabulary) or near stereoacuity of 240 seconds of arc or worse (−8.6, $P < 0.001$ for total score; −5.3, $P < 0.001$ for Print Knowledge) compared with emmetropic children.
Conclusions: Uncorrected hyperopia ≥4.0 D or hyperopia ≥3.0 to ≤6.0 D associated with reduced binocular near VA (20/40 or worse) or reduced near stereoacuity (240 seconds of arc or worse) in 4- and 5-year-old children enrolled in preschool or kindergarten is associated with significantly worse performance on a test of early literacy. *Ophthalmology 2016;■:1–9 © 2016 by the American Academy of Ophthalmology.*

8

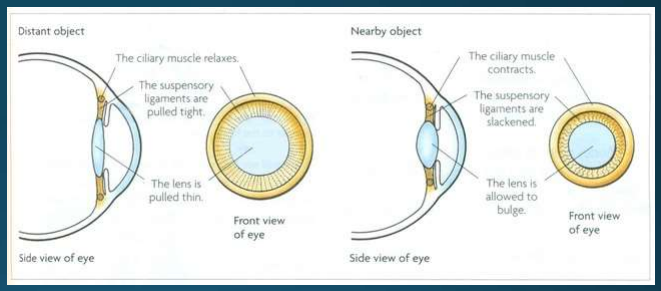
What do we Prescribe?

- Consider prescribing Hyperopic correction, especially in stereo deficient children
- Anything above a +4.00, and older than 4 years
- Measure stereo and binocular function with and without glasses (even in the absence of strabismus or amblyopia)
- If it improves near function, prescribe it
- When in doubt, get a second opinion!

9

Accommodative Dysfunctions

- Prescribing
- Pseudo CI
  - Accommodative target
- Pseudo Myopia
- Techniques to release spasm
- Patient Communication

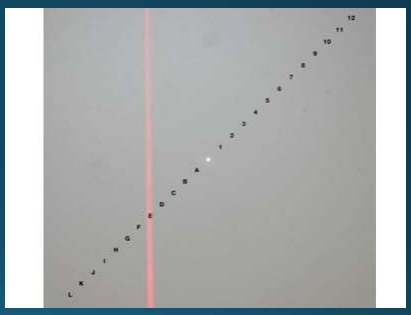


http://biology-igcse.weebly.com/-accommodation.html

10

Convergence excess

- Plus lenses at near
- Don't use Prism
- Vision Therapy



11

Prescribing for Concussion

- Small Changes
- Plus for near
- Filters

12

TBI

- Binasal
- Single Nasal or Sector Occlusion
- Referral

13

Diplopia?

- Fresnel Prism
- Consider two pairs of lenses

14

Convergence Insufficiency

15

CLINICAL TRIALS

SECTION EDITOR: ROY W. BECK, MD, PhD

Randomized Clinical Trial of Treatments for Symptomatic Convergence Insufficiency in Children

*Convergence Insufficiency Treatment Trial Study Group**

Objective: To compare home-based pencil push-ups (HBPP), home-based computer vergence/accommodative therapy and pencil push-ups (HBCVAT+), office-based vergence/accommodative therapy with home reinforcement (OBVAT), and office-based placebo therapy with home reinforcement (OBPT) as treatments for symptomatic convergence insufficiency.

Methods: In a randomized clinical trial, 221 children aged 9 to 17 years with symptomatic convergence insufficiency were assigned to 1 of 4 treatments.

Main Outcome Measures: Convergence Insufficiency Symptom Survey score after 12 weeks of treatment. Secondary outcomes were near point of convergence and positive fusional vergence at near.

Results: After 12 weeks of treatment, the OBVAT group's mean Convergence Insufficiency Symptom Survey score (15.1) was statistically significantly lower than those of 21.3, 24.7, and 21.9 in the HBCVAT+, HBPP, and OBPT groups, respectively ($P<.001$). The OBVAT group also demonstrated a significantly improved near point of convergence and positive fusional vergence at near compared with the other groups ($P \leq .005$ for all comparisons). A successful or improved outcome was found in 73%, 43%, 33%, and 35% of patients in the OBVAT, HBPP, HBCVAT+, and OBPT groups, respectively.

Conclusions: Twelve weeks of OBVAT results in a significantly greater improvement in symptoms and clinical measures of near point of convergence and positive fusional vergence and a greater percentage of patients reaching the predetermined criteria of success compared with HBPP, HBCVAT+, and OBPT.

Application to Clinical Practice: Office-based vergence accommodative therapy is an effective treatment for children with symptomatic convergence insufficiency.

Trial Registration: clinicaltrials.gov Identifier: NCT00338611

Arch Ophthalmol. 2008;126(10):1336-1349

16

Out Of Hippocrates' Shadow
THE POWER OF THE 35% PLACEBO
In the CITT Study

Leonard J. Press, O.D.

therapy. However, many of the "placebo" activities are key ingredients of standard, office-based protocols for CI therapy. These include:

1) equalizing monocular skills through fixation training
2) equalizing monocular just noticeable differences with loose prism jumps
3) equalizing monocular pursuits

Many of the other placebo procedures involved sustained visual attention under binocular conditions, and several involve looking for changes in spatial localization with low power lateral yoked prisms.

17

Research on Vision and Learning

Article: **Effectiveness of Vision Therapy for Children With Symptomatic Convergence Insufficiency With or Without Attention Deficit Hyperactivity Disorder**

Sun Haeng Lee, PhD
Chun Man Park, PhD
Sang Chul Park, OD, PhD, FCOVD-A
Willis Clem Maples, OD, MS, FCOVD
Hoy Sun Shin, OD, PhD, FCOVD-A

Vision Development & Rehabilitation Volume 1, Issue 3 • October 2015

18

Results: Visual symptoms and ADHD symptoms were negatively correlated with academic scores for both reading and mathematics. Children with ADHD symptoms were 9-times more likely to have visual symptoms than children without ADHD symptoms. Likewise, ADHD children were 30-times more likely to have CI than children without ADHD symptoms. Visual and ADHD symptom scores, and objective visual measures were statistically improved after 12 weeks of therapy.

Conclusion: ADHD and CI are correlated. Further, VT improved visual symptoms, ADHD symptoms and clinical signs of CI in those children with CI and ADHD. Both visual symptoms and ADHD symptoms negatively affected school achievement.

19

J. Phys. Ther. Sci.
26: 223–227, 2014

Improvement of Vergence Movements by Vision Therapy Decreases K-ARS Scores of Symptomatic ADHD Children

SUN HAENG LEE, PhD, OPT[1)], BYEONG-YEON MOON, PhD, OPT[2)], HYUN GUG CHO, PhD, OPT[2)]*

[1)] *Johnson & Johnson Vision Care, Republic of Korea*
[2)] *Department of Optometry, Kangwon National University: Dogye, Samcheok 245-907, Republic of Korea.*

Abstract. [Purpose] To determine whether the improvement of vergence movements by vision therapy can decrease the K-ARS scores of symptomatic ADHD children. [Methods] Eighty-one out of 1,123 children surveyed using the K-ARS, a parents'-reported questionnaire, led to 16 of these 81 children being showed scores of ≥19, and measurement of binocular function diagnosed as having convergence insufficiency. The 16 children were divided equally into a control group and a vision therapy group. [Results] After vision therapy for 12 weeks, near point convergence (4.38±0.69 cm) significantly neared compared to the near point convergence before vision therapy (11.50±2.28 cm), and both the break point (32.38±2.53 Δ) and recovery point (19.75±2.11 Δ) of near positive fusional vergence significantly improved compared to their values before vision therapy (15.88±2.64 Δ, 6.38±6.70 Δ, respectively). Near exophoria after vision therapy (7.81±2.00 Δ BI) significantly decreased compared to its value before vision therapy (12.00±1.16 Δ BI). The K-ARS scores referring to symptomatic ADHD significantly decreased after vision therapy (17.13±2.84) compared to before vision therapy (23.25±1.49). [Conclusions] Convergence insufficiency symptoms are closely related to symptoms screened for ADHD, and vision therapy to improve vergence movements is an effective method of decreasing the K-ARS scores.

Key words: Convergence insufficiency, Vision therapy, ADHD

(This article was submitted Jul. 24, 2013, and was accepted Sep. 1, 2013)

20

J Atten Disord. 2016 Oct;20(10):836-44. doi: 10.1177/1087054713511528. Epub 2013 Nov 22.

Behavioral and Emotional Problems Associated With Convergence Insufficiency in Children: An Open Trial.

Borsting E[1], Mitchell GL[2], Arnold LE[2], Scheiman M[3], Chase C[4], Kulp M[2], Cotter S[5]; CITT-RS Group.

⊕ Author information

Abstract

OBJECTIVE: This study investigated behavioral and emotional characteristics of children with convergence insufficiency (CI), before and after treatment with office-based vergence accommodative therapy (OBVAT).

METHOD: Parents of 44 children ages 9 to 17 years with symptomatic CI completed the Conners 3 ADHD Index and the Child Behavior Checklist (CBCL) before and after OBVAT. Pre-treatment scores were compared with normative data and post-treatment scores were compared with baseline using the Wilcoxon sign rank test.

RESULTS: Following OBVAT, CI children showed a significant mean improvement ($p < .0001$, effect size of 0.58) on the Conners 3 ADHD Index with the largest changes occurring in the 23 children who scored the highest at baseline. On the CBCL, anxious/depressed, somatic, and internalizing problems improved significantly ($p < .001$, effect sizes of -0.36, -1.15, and -0.67, respectively).

CONCLUSION: In an open trial, attention and internalizing problems improved significantly following treatment for CI.

21

Japanese Journal of Ophthalmology
July 2016, Volume 60, Issue 4, pp 326-332

First online: 25 April 2016

Relationship between reading performance and saccadic disconjugacy in patients with convergence insufficiency type intermittent exotropia

Masakazu Hirota, Hiroyuki Kanda, Takao Endo, Tibor Karl Lohmann, Tomomitsu Miyoshi, Takeshi Morimoto, Takashi Fujikado ✉

Abstract

Purpose

To determine the relationship between re-reading the same line and saccadic disconjugacy in patients with convergence insufficiency-type intermittent exotropia [CI-type X(T)].

Methods

Eight patients with CI-type X(T) and ten healthy orthophoric individuals were studied. Video-oculography was used to assess the eye movements during the reading of a Japanese novel displayed on a 23-in. liquid crystal monitor placed 60 cm from the eyes. The sentences were displayed horizontally and read from left to right. The number of unintentional re-readings of the same line was counted, and the disconjugacy at the median of the saccade between the end of a line and the next line was determined.

Results

The number of re-readings of the same line in patients with CI-type X(T) was 4.9 ± 2.3 times which was significantly higher than that in the controls at 0.2 ± 0.4 times ($P < 0.001$). The saccadic disconjugacy was significantly larger in patients with CI-type X(T) at −1.70° ± 0.72° than that in the controls at −0.40°± 0.30° ($P < 0.001$). The number of re-readings of the same line was significantly and positively correlated with the saccadic disconjugacy ($R = 0.84$, $R^2 = 0.71$, $P < 0.01$).

Conclusions

The results of our study indicate that saccadic disconjugacy is associated with re-reading the same line in patients with CI-type X(T).

22

frontiers in Integrative Neuroscience

ORIGINAL RESEARCH
published: 20 October 2016
doi: 10.3389/fnint.2016.00033

Benefits from Vergence Rehabilitation: Evidence for Improvement of Reading Saccades and Fixations

François Daniel[1†], Aurélien Morize[1*†], Dominique Brémond-Gignac[1,2] and Zoï Kapoula[1*]*

[1] IRIS Group, Physiopathologie de la Vision et Motricité Binoculaire Centre National de la Recherche Scientifique FR3636 Université Paris Descartes, Paris, France, [2] Ophthalmology Service, Hôpital Necker - Enfants Malades, Paris, France

correction of the intra-saccadic disconjugacy during the following fixation. The results corroborate the hypothesis of neuroplasticity based on saccade vergence interaction in young adults. It validates the clinical validity of the vergence double-step REMOBI method as a means to improve both, vergence and reading performances. It opens a new research approach on the link between fine binocular coordination of saccades, quality of the vergence response, attention, cognition and reading.

23

Improvement in Academic Behaviors Following Successful Treatment of Convergence Insufficiency

Eric Borsting, OD, MS, FAAO, G. Lynn Mitchell, MAS, FAAO, Marjean Taylor Kulp, OD, MS, FAAO, Mitchell Scheiman, OD, FAAO, Deborah M. Amster, OD, FAAO, Susan Cotter, OD, MS, FAAO, Rachael A Coulter, OD, FAAO, Gregory Fecho, OD, Michael F. Gallaway, OD, FAAO, David Granet, MD, Richard Hertle, MD, Jacqueline Rodena, OD, Tomohiko Yamada, OD, FAAO, and **the CITT Study Group**

Results—The mean ABS score for the entire group at baseline was 12.85 (SD=6.3). The mean ABS score decreased (improved) in those categorized as successful, improved, and non-responder by 4.0, 2.9, and 1.3 points, respectively. The improvement in the ABS score was significantly related to treatment outcome ($p<0.0001$), with the ABS score being significantly lower (better) for children who were successful or improved after treatment as compared to children who were non-responders ($p=0.002$ and 0.043, respectively).

24

CLINICAL TRIALS

Effect of Vergence/Accommodative Therapy on Reading in Children with Convergence Insufficiency: A Randomized Clinical Trial

CITT-ART Investigator Group

RESULTS

The adjusted mean improvement in WIAT-III reading comprehension was 3.7 (95% confidence interval [CI], 2.6 to 4.7) standard score points in the vergence/accommodative therapy group and 3.8 (95% CI, 2.4 to 5.2) points in the placebo therapy group, with an adjusted mean group difference of −0.12 (95% CI, −1.89 to 1.66) points that was not statistically significant. No statistically significant treatment group differences were found for any of the secondary reading outcome measures.

25

26

CITT-ART vergence/accommodative therapy group

Brock String	3 dot card	Eccentric Circles	Aperture Rule
Vectograms	Computer Orthoptics	Bulls Eye Rock	Lens Sorting

27

CITT-ART Placebo Group

Ductions and Versions	Prism dissociated bi-ocular rock	High Low contrast VA	After Image
Visual Closure Skills	Visual Figure Ground Skills	Visual Spatial Skills	Visual Discrimination

28

"As a group, participants performed in the average range on reading measures at baseline. One might argue that the study should have been limited to children with greater potential for reading improvement, such as younger children or those diagnosed as having mild to moderate reading problems."

29

Randomized Controlled Trial > Optom Vis Sci. 2016 Dec;93(12):1457-1465.
doi: 10.1097/OPX.0000000000000975.

Home-Based Therapy for Symptomatic Convergence Insufficiency in Children: A Randomized Clinical Trial

Pediatric Eye Disease Investigator Group

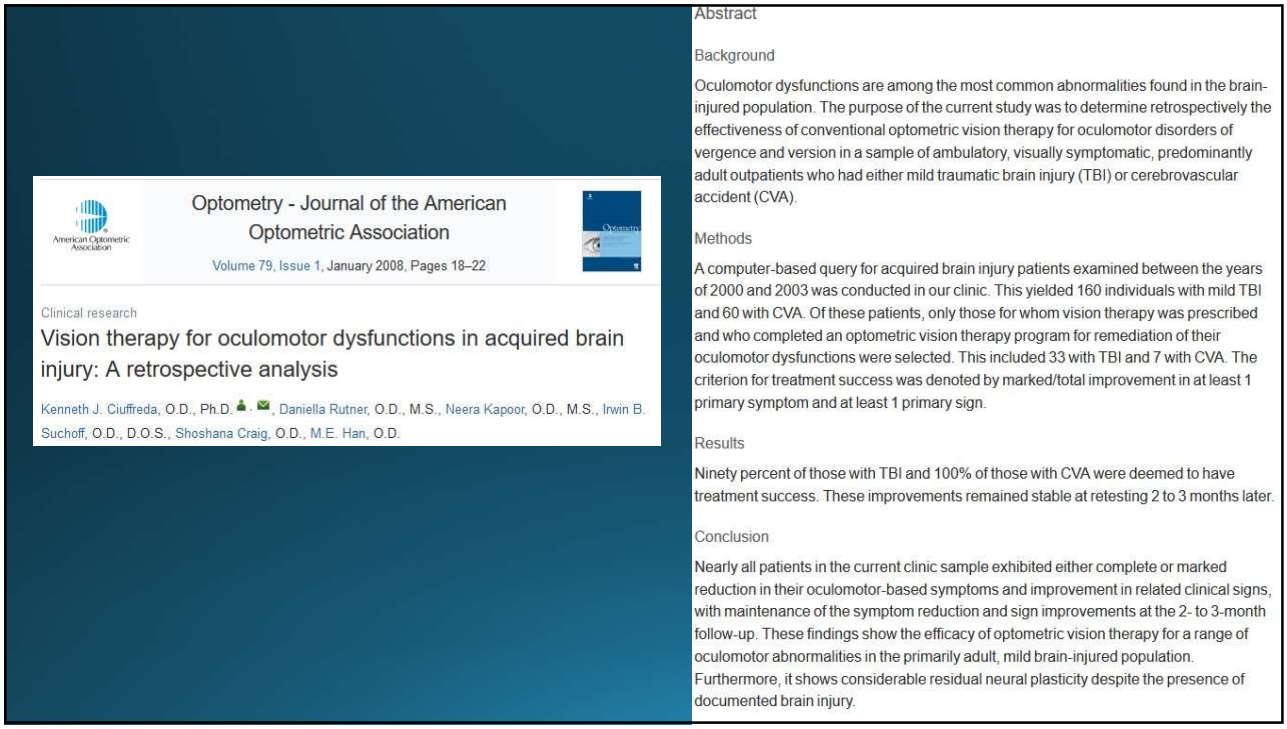
PMID: 27575992 PMCID: PMC5118058 DOI: 10.1097/OPX.0000000000000975
Free PMC article

- Computer Home therapy 23%
- Pencil Pushups 22%
- Placebo 16%

30

Ocularmotor Dysfunctions

31



Optometry - Journal of the American Optometric Association

Volume 79, Issue 1, January 2008, Pages 18–22

Clinical research

Vision therapy for oculomotor dysfunctions in acquired brain injury: A retrospective analysis

Kenneth J. Ciuffreda, O.D., Ph.D., Daniella Rutner, O.D., M.S., Neera Kapoor, O.D., M.S., Irwin B. Suchoff, O.D., D.O.S., Shoshana Craig, O.D., M.E. Han, O.D.

Abstract

Background

Oculomotor dysfunctions are among the most common abnormalities found in the brain-injured population. The purpose of the current study was to determine retrospectively the effectiveness of conventional optometric vision therapy for oculomotor disorders of vergence and version in a sample of ambulatory, visually symptomatic, predominantly adult outpatients who had either mild traumatic brain injury (TBI) or cerebrovascular accident (CVA).

Methods

A computer-based query for acquired brain injury patients examined between the years of 2000 and 2003 was conducted in our clinic. This yielded 160 individuals with mild TBI and 60 with CVA. Of these patients, only those for whom vision therapy was prescribed and who completed an optometric vision therapy program for remediation of their oculomotor dysfunctions were selected. This included 33 with TBI and 7 with CVA. The criterion for treatment success was denoted by marked/total improvement in at least 1 primary symptom and at least 1 primary sign.

Results

Ninety percent of those with TBI and 100% of those with CVA were deemed to have treatment success. These improvements remained stable at retesting 2 to 3 months later.

Conclusion

Nearly all patients in the current clinic sample exhibited either complete or marked reduction in their oculomotor-based symptoms and improvement in related clinical signs, with maintenance of the symptom reduction and sign improvements at the 2- to 3-month follow-up. These findings show the efficacy of optometric vision therapy for a range of oculomotor abnormalities in the primarily adult, mild brain-injured population. Furthermore, it shows considerable residual neural plasticity despite the presence of documented brain injury.

32

Association between reading speed, cycloplegic refractive error, and oculomotor function in reading disabled children versus controls

Patrick Quaid · Trefford Simpson

Received: 23 May 2012 / Revised: 15 July 2012 / Accepted: 3 August 2012 / Published online: 29 August 2012

Abstract
Background Approximately one in ten students aged 6 to 16 in Ontario (Canada) school boards have an individual education plan (IEP) in place due to various learning disabilities, many of which are specific to reading difficulties. The relationship between reading (specifically objectively determined reading speed and eye movement data), refractive error, and binocular vision related clinical measurements remain elusive.
Methods One hundred patients were examined in this study (50 IEP and 50 controls, age range 6 to 16 years). IEP patients were referred by three local school boards, with controls being recruited from the routine clinic population (non-IEP patients in the same age group). A comprehensive eye examination was performed on all subjects, in addition to a full binocular vision work-up and cycloplegic refraction. In addition to the cycloplegic refractive error, the following binocular vision related data was also acquired: vergence facility, vergence amplitudes, accommodative facility, accommodative amplitudes, near point of convergence, stereopsis, and a standardized symptom scoring scale. Both the IEP and control groups were also examined using the Visagraph III system, which permits recording of the following reading parameters objectively: (i) reading speed, both raw values and values compared to grade normative data, and (ii) the number of eye movements made per 100 words read. Comprehension was assessed via a questionnaire administered at the end of the reading task, with each subject requiring 80% or greater comprehension.
Results The IEP group had significantly greater hyperopia compared to the control group on cycloplegic examination. Vergence facility was significantly correlated to (i) reading speed, (ii) number of eye movements made when reading, and (iii) a standardized symptom scoring system. Vergence facility was also significantly reduced in the IEP group versus controls. Significant differences in several other binocular vision related scores were also found.
Conclusion This research indicates there are significant associations between reading speed, refractive error, and in particular vergence facility. It appears sensible that students being considered for reading specific IEP status should have a full eye examination (including cycloplegia), in addition to a comprehensive binocular vision evaluation.

33

The Effect of Saccadic Training on Early Reading Fluency

Danielle F. Leong, OD[1]
Christina L. Master, MD[2]
Leonard V. Messner, OD[3]
Yi Pang, OD, MD, PhD[3]
Craig Smith, MD[4,5]
Amaal J. Starling, MD[6]

[1]King-Devick Test, LLC, Oakbrook Terrace, IL, USA
[2]Children's Hospital of Philadelphia, University of Pennsylvania, Philadelphia, PA, USA
[3]Illinois Eye Institute, Illinois College of Optometry, Chicago, IL, USA
[4]Aegis Creative, Lakewood, CO, USA
[5]Bill and Melinda Gates Foundation, Seattle, WA, USA
[6]Department of Neurology, Mayo Clinic, Phoenix, AZ, USA

Danielle F. Leong, King-Devick Test, LLC, Two Mid America Plaza Suite 110, Oakbrook Terrace, IL 60181, USA. Email: dleong@kingdevicktest.com

Abstract

Background. Eye movements are necessary for the physical act of reading and have been shown to relate to underlying cognitive and visuoattentional processes during reading. The purpose of this study was to determine the effect of saccadic training using the King-Devick remediation software on reading fluency. *Methods*. In this prospective, single-blinded, randomized, crossover trial, a cohort of elementary students received standardized reading fluency testing pre- and posttreatment. Treatment consisted of in-school training 20 minutes per day, 3 days per week for 6 weeks. *Results*. The treatment group had significantly higher reading fluency scores after treatment ($P < .001$), and posttreatment scores were significantly higher than the control group ($P < .005$). *Conclusion*. Saccadic training can significantly improve reading fluency. We hypothesize that this improvement in reading fluency is a result of rigorous practice of eye movements and shifting visuospatial attention, which are vital to the act of reading.

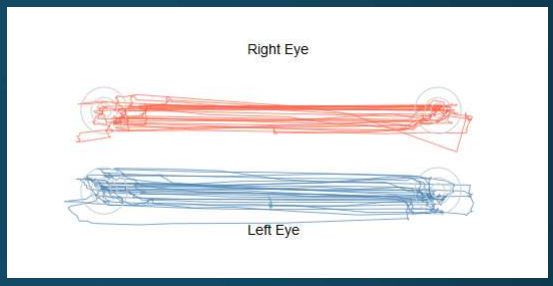
CLIN PEDIATR August 2014 vol. 53 no. 9 858-864

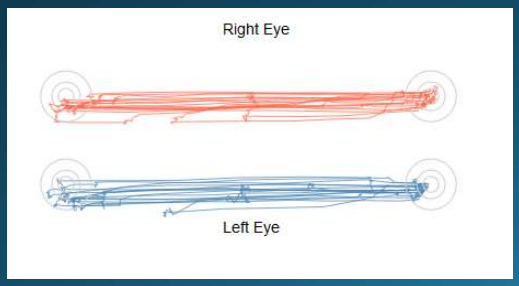
34

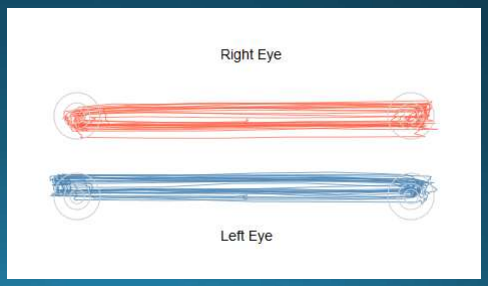
Oculomotor Screening

- How do you screen?
  - NSUCO Oculomotor
  - DEM
  - King Devick
  - Visagraph or Readalyzer
  - Right Eye System

35







36

Strabismus

37

Strabismus - Esotropia

- Where do you refer?
- Vision Therapy or Surgery? Both?

38

Cochrane Review

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2011, Issue 8

http://www.thecochranelibrary.com

PLAIN LANGUAGE SUMMARY

Different treatments for a squint (deviation of the eye) that occurs within the first six months of life

Infantile esotropia can affect the vision in the eye, the ability to use the two eyes together (binocularity) and also be a cosmetic issue to the child/parents. Treatment includes surgical and non-surgical interventions to reduce the squint and to enhance/aid binocularity in children. This review looks at the various interventions and also the timing of such treatment. The review did not find any randomised trials that compared treatment to another treatment or to no treatment. A large, multi-centre, non-randomised trial found that children operated on earlier had better binocularity at age six compared to the late surgery group. This group had been operated on more frequently however and there was no significant difference in the angle of the squint after surgery in either group. This review does not resolve the controversy regarding the best type of surgery, the value of non-surgical interventions and the optimal timing of either type of intervention. It highlights a need for further research in this area.

39

Monocular Acuity and Stereopsis in Infantile Esotropia

Eileen E. Birch and David R. Stager

Monocular acuity and stereopsis were assessed by preferential-looking procedures in untreated infantile esotropes. Results were compared to an age-matched normal population. Monocular PL acuity was not significantly different from normal during months 3–14 for infantile esotropes who freely alternated fixation and for the preferred eyes of unilateral infantile esotropes. PL acuity of the non-preferred eyes of unilateral esotropes was significantly below normal during months 9–14, but not during months 3–8. The percentage of normal and esotropic infants who demonstrated PL stereopsis was approximately equal at 3–5 months but, unlike normal infants, the percentage of esotropic infants demonstrating stereopsis was lower in the older age groups. Taken together, the acuity results support previous reports that deficits in PL acuity develop after the onset of fixation preference. The results of PL stereopsis testing are consistent with the hypothesis that stereoscopic pathways are present and potentially functional in at least some esotropic infants. Invest Ophthalmol Vis Sci 26:1624–1630, 1985

40

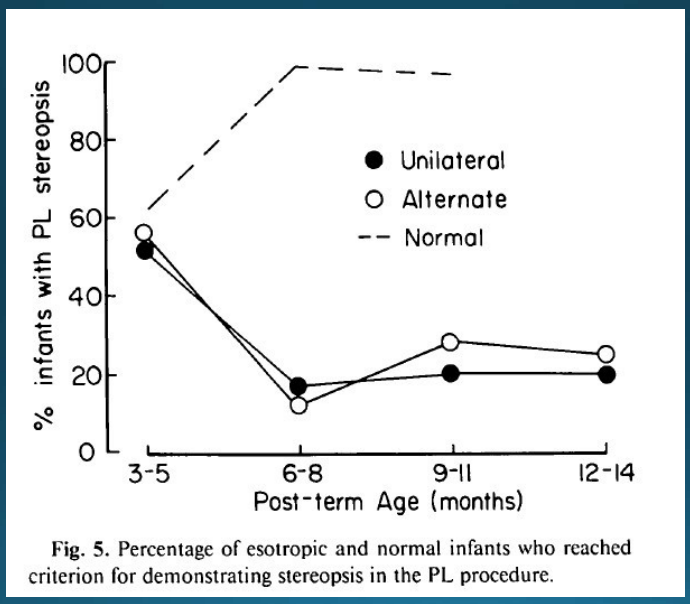


Fig. 5. Percentage of esotropic and normal infants who reached criterion for demonstrating stereopsis in the PL procedure.

41

Research from Richard Bruenech, PhD

- Minute and fine tuned contractions
- Possible ability to compensate for heterophoria
- Compartmental innervation of the EOMs

42

Richard Bruenech, PhD

Conclusion

- The oculomotor system consists of a multitude of sensory-motor neural loops with the ability to monitor and adjust neuromuscular activity. Non-invasive methods should therefore always be considered first.
- The organization of the distal myotendinous region in human EOM is more complex than previously assumed. The postoperative result after strabismus surgery is therefore difficult to predict.

43

Richard Bruenech, PhD

Conclusion

- The patient`s ability to perform smooth pursuit and convergence movements is of interest. Any method that will enhance these functions will also increase the amount of propriceptive feedback to the CNS
- Ocular proprioception is arguably not only important for the long term tuning of oculomotor activity, ocular alignment and perception, but also for somatic motor skills (including autonomic smooth muscle activity !!!!).

44

Volume 37/Number 3/2006

Treating the Trinity of Infantile Vision Development: Infantile Esotropia, Amblyopia, Anisometropia

W.C. Maples,OD, FCOVD [1] Michele Bither, OD, FCOVD[2]

Southern College of Optometry,[1] Northeastern State University College of Optometry[2]

45

Efficacy of therapy

The success of vision therapy and/ or surgery for esotropia is mixed in the ophthalmic literature.[1-7,16,17,20-23,35-42] Success rates may vary, depending on many diagnostic factors including: direction, frequency, correspondence, presence or absence of eccentric fixation, and the presence or absence of suppression.[2] Strabismus treatment efficacy studies by either optometry or ophthalmology have also not been well designed. These studies from both professions are typically retrospective, do not follow a double blind paradigm, nor do they institute placebo treatments. However, even with the lack of prospective, double-blind studies, optometric non-invasive results for all strabismus types are reported to be as good, or better, than surgical outcomes, and the optometric literature has individual case reports showing significant improvements from vision therapy.[1,37-40] This lack of well-designed treatment efficacy studies is troublesome. It makes determining the most appropriate, effective treatment strategy difficult and potentially confusing for the doctor, parent, and patient.

46

It is interesting to examine the surgical intervention success rates for infantile esotropia. We must keep in mind that the definition of success can vary with the two professions. Von Noorden[16] felt that the best success that one could hope for from surgical intervention was subnormal binocular vision, a condition in which the patient appears to be orthotropic, has motor fusion, unilateral foveal suppression, poor stereo (<120 arc sec) and normal retinal correspondence. However, he also noted that while this achievement of subnormal binocular vision has a potential to occur, it is also not as likely as what he termed a functional outcome. Von Noorden's functional outcome differs significantly from an optometric functional outcome in that he defined this as a residual small angle strabismus, gross stereopsis, peripheral fusion, and a monocular area of suppression when viewing with two eyes. This leaves many

Using this definition of functional success, Scheiman and Ciner[44] reviewed the surgical outcomes for esotropia and found that, of a sample of 1473 procedures, there was only a 15% functional cure rate and a 43% cosmetic cure rate. Scheiman, Ciner and Galloway[42] performed another review of the literature 2 years later and found that only 22% of a sample of 1286 infantile esotropes was able to achieve at least some binocularity. The cosmetic success was 63% of 2113 patients.

Several studies have also reported the best functional results (subnormal binocular vision) based upon when the first surgery was performed for infantile esotropes. Scheiman, Ciner and Galloway [42] reviewed seven studies. There was a 71% cosmetic success rate when surgery was performed before 12 months of age, a 30% cosmetic success rate when surgery was performed between 12-24 months, and 12% cosmetic success rate when it was performed after 24 months of age. A cosmetic cure is defined as less than 8^-10^ of heterotropia. The authors are cautious to note that these

47

Helveston[16] asked the interesting question: what would happen if we did not attempt to align the eyes surgically or otherwise treat patients with congenital esotropia? The answer to this was surprising. He noted that Calcutt[45] found that, if infantile esotropes were left alone without surgery, that only 6% of them developed amblyopia; of the ones who had surgery, 35-41% developed amblyopia.

48

Therapy or Surgery? Or Both?

49

March 4, 2021

Overminus Lens Therapy for Children 3 to 10 Years of Age With Intermittent Exotropia

A Randomized Clinical Trial

Angela M. Chen, OD, MS[1]; S. Ayse Erzurum, MD[2]; Danielle L. Chandler, MSPH[3]; et al

» Author Affiliations

JAMA Ophthalmol. 2021;139(4):464-476. doi:10.1001/jamaophthalmol.2021.0082

"Children 3 to 10 years of age had improved distance exotropia control when assessed wearing overminus spectacles after 12 months of overminus treatment; however, this treatment was associated with increased myopic shift. The beneficial effect of overminus lens therapy on distance exotropia control was not maintained after treatment was tapered off for 3 months and children were examined 3 months later."

50

What about patching?

May 01, 2014 | 14 min read SAVE

Round table: Pediatric ophthalmologists debate merits of patching for intermittent exotropia

NIH U.S. National Library of Medicine

ClinicalTrials.gov

Study Design Go to

Study Type :	Interventional (Clinical Trial)
Estimated Enrollment :	64 participants
Allocation:	Randomized
Intervention Model:	Parallel Assignment
Intervention Model Description:	the experimental group will be treated with part time patch therapy and control group will be observed without any treatment.
Masking:	Triple (Care Provider, Investigator, Outcomes Assessor)
Masking Description:	care provider, investigator and outcome assessor will be unaware the group of participants. because of the nature of study, patch therapy vs no treatment, masking of participant will not be possible.
Primary Purpose:	Treatment
Official Title:	A Randomized Clinical Trial of Part-time Patching Therapy on Improvement of Deviation Control in 3 to 8 Year-old Children With Intermittent Exotropia
Estimated Study Start Date :	November 1, 2018
Estimated Primary Completion Date :	May 10, 2020
Estimated Study Completion Date :	November 10, 2021

51

ORIGINAL ARTICLE | VOLUME 122, ISSUE 8, P1718-1725, AUGUST 01, 2015

Purchase Subscribe

A Randomized Trial Comparing Part-time Patching with Observation for Intermittent Exotropia in Children 12 to 35 Months of Age

Pediatric Eye Disease Investigator Group * • Writing Committee:Brian G. Mohney, MD • Susan A. Cotter, OD, MS • ... Raymond T. Kraker, MSPH • Melanie L. Christian, COA • Donny W. Suh, MD • Show all authors • Show footnotes

Published: June 10, 2015 • DOI: https://doi.org/10.1016/j.ophtha.2015.04.025 • Check for updates

Conclusions

Among children 12 to 35 months of age with previously untreated IXT, deterioration over 6 months was uncommon, with or without patching treatment. There was insufficient evidence to recommend part-time patching for the treatment of IXT in children in this age group.

52

Three-Year Observation of Children 3 to 10 Years of Age with Untreated Intermittent Exotropia

Pediatric Eye Disease Investigator Group; Writing Committee; Brian G Mohney [1], Susan A Cotter [2], Danielle L Chandler [3], Jonathan M Holmes [4], David K Wallace [5], Tomohiko Yamada [4], David B Petersen [6], Raymond T Kraker [3], Christie L Morse [7], B Michele Melia [3], Rui Wu [3]

Conclusions: Among children 3 to 10 years of age with IXT for whom surgery was not considered to be the immediately necessary treatment, stereoacuity deterioration or progression to constant exotropia over 3 years was uncommon, and exotropia control, stereoacuity, and magnitude of deviation remained stable or improved slightly.

53

Article | Published: 03 April 2019

Long-term outcomes of bilateral lateral rectus recession versus unilateral lateral rectus recession-medial rectus plication in children with basic type intermittent exotropia

Haeng-Jin Lee, Seong-Joon Kim & Young Suk Yu

Eye **33**, 1402–1410 (2019) | Cite this article

Results

Of 144 patients, 90 underwent BLR and 54 underwent RP. The angle of exodeviation of the RP group steadily increased over time after the surgery. The BLR group showed an earlier exodrift and a more stable course compared to the RP group. Kaplan–Meier survival analysis showed a better survival in the BLR group, with final success rates of 48.9% in the BLR group and 25.9% in the RP group after a mean follow-up of 2.2 years. Patients with a successful outcome had greater esodeviation at 1 week postoperatively (at distance 7.6 PD in the BLR group, 11.4 in the RP group).

54

Strabismus - Exotropia

This is a reprint of a Cochrane review, prepared and maintained by The Cochrane Collaboration and published in *The Cochrane Library* 2013, Issue 5

PLAIN LANGUAGE SUMMARY

Treatment for a type of childhood strabismus where one or both eyes intermittently turn outwards

Strabismus is a condition in which the eyes are not normally aligned, that is one eye looks straight ahead whilst the other eye turns inwards, outwards, up or down. Most cases of childhood onset strabismus are present constantly, but some types are intermittent that is only present sometimes. In intermittent exotropia (X(T)) an eye intermittently turns outwards (exotropia), typically more when looking into the distance, when tired or day-dreaming. When the child focuses on something close, the eye usually moves back to the centre. The eyes typically work together normally when the exotropia is controlled. When the exotropia occurs, the image from one eye is usually switched off or 'suppressed'. Treatment for X(T) may be sought to improve the appearance of misalignment or if there is concern that it is affecting the ability of the eyes to work together. Treatment typically consists of surgery on the muscles around the eye, either on the outside muscle of both eyes or on the inside and outside muscle of one eye. Exercises to strengthen the muscles may sometimes be used; sometimes patching or glasses for short or near sightedness can be tried. There is currently not a clear understanding of which treatments work most effectively and at what point any treatment should be given. We searched for studies where participants with X(T) had been randomised to receive treatment. The aim was to understand which treatments are most effective at correcting the exotropia without causing any harm. The one study included in this review was conducted by a single surgeon in the USA and compared surgery on one eye to surgery on both eyes in 36 children with the basic type of X(T). Success was defined as no exotropia (or other strabismus) one year following surgery. The study found that surgery on one eye was more effective (82% success) than surgery on both eyes (52% success). There are many studies of X(T) in the current literature but the methods used make it difficult to reliably interpret the results. Furthermore, there is a worrying lack of evidence regarding the natural history of X(T) and poor validation of measures of severity. There is a clear need for further randomised studies to provide more reliable evidence for the management of this condition.

55

Holmes Mohney Scale

Control Score	Control Score Description
5	Constant exotropia during a 30-second observation period (before dissociation)
4	Exotropia >50% of the time during a 30-second observation period (before dissociation)
3	Exotropia <50% of the time during a 30-second observation period (before dissociation)
2	No exotropia unless dissociated (10 seconds): recovery in > 5 seconds
1	No exotropia unless dissociated (10 seconds): recovery in 1-5 seconds
0	Pure phoria: < 1 second recovery after 10-second dissociation

56

Amblyopia

57

Amblyopic children read more slowly than controls under natural, binocular reading conditions

Presented at the 41st Annual Meeting of the American Association for Pediatric Ophthalmology and Strabismus, New Orleans, Louisiana, March 25-29, 2015.

Krista R. Kelly, PhD, Reed M. Jost, MS, Angie De La Cruz, BS, Eileen E. Birch, PhD

Results

Amblyopic children read more slowly and had more saccades compared with nonamblyopic children with treated strabismus and normal controls. Fixation duration did not differ significantly for amblyopic children versus normal controls. Treated strabismic children without amblyopia did not differ significantly from normal controls on any reading measure. Amblyopic eye visual acuity was not correlated with any reading measure.

Conclusions

Amblyopia was associated with slower reading speed in school-age children. Treatment for monocular amblyopia visual acuity impairment could improve reading speed and efficiency.

58

Sept 2015 Vision Research

- Amblyopia disrupts visuo-motor coordination, and difficulties in acquiring reliable visual information regarding the shape and location of target objects appear to play a role in the visuo-motor deficits associated with amblyopia.

- Impairments in motion-defined form perception and multiple object tracking occurs not only in the amblyopic eye, *but in the fellow eye.*

- **Crucially, these deficits were not improved by occlusion therapy, even when the acuity of the amblyopic eye improved significantly.**

- A binocular approach to amblyopia therapy, particularly when embedded in a video game format, resulted in significant improvements in visual acuity, stereopsis, contrast sensitivity and reading speed.

59

Clin Ophthalmol. 2014; 8: 49–53.
Published online 2013 Dec 12. doi: 10.2147/OPTH.S48300
PMCID: PMC3864996

Efficacy of perceptual vision therapy in enhancing visual acuity and contrast sensitivity function in adult hypermetropic anisometropic amblyopia

Elvan Yalcin and Ozlem Balci

nd

The purpose of this study was to evaluate the efficacy of neural vision therapy, also termed perceptual vision therapy, in enhancing best corrected visual acuity (BCVA) and contrast sensitivity function in amblyopic patients.

Methods

This prospective study enrolled 99 subjects previously diagnosed with unilateral hypermetropic amblyopia aged 9–50 years. The subjects were divided into two groups, with 53 subjects (53 eyes) in the perceptual vision therapy group and 46 subjects (46 eyes) in the control group. Because the nature of the treatment demands hard work and strict compliance, we enrolled the minimal number of subjects required to achieve statistically significant results. Informed consent was obtained from all subjects. Study phases included a baseline screening, a series of 45 training sessions with perceptual vision therapy, and an end-of-treatment examination. BCVA and contrast sensitivity function at 1.5, 3, 6, 12, and 18 cycles per degree spatial frequencies were obtained for statistical analysis in both groups. All subjects had follow-up examinations within 4–8 months. With the exception of one subject from the study group and two subjects from the control group, all subjects had occlusion during childhood. The study was not masked.

Results

The results for the study group demonstrated a mean improvement of 2.6 logarithm of the minimum angle of resolution (logMAR) lines in visual acuity (from 0.42 to 0.16 logMAR). Contrast sensitivity function improved at 1.5, 3, 6, 12, and 18 cycles per degree spatial frequencies. The control group did not show any significant change in visual acuity or contrast sensitivity function. None of the treated eyes showed a drop in visual acuity. Manifest refractions remained unchanged during the study.

Conclusion

The results of our study demonstrate the efficacy of perceptual vision therapy in improving visual acuity. The 2.6 logMAR lines improvement in visual acuity is encouraging, and is consistent with the results of previous studies. However, long-term follow-up and further studies are needed.

60

Can several days of complete darkness cure lazy eye?

61

Nature Neuroscience **10**, 1134 - 1136 (2007)
Published online: 12 August 2007 | doi:10.1038/nn1965

Experience-dependent recovery of vision following chronic deprivation amblyopia

Hai-Yan He[1], Baisali Ray[2], Katie Dennis[1] & Elizabeth M Quinlan[1,2]

The shift in ocular dominance induced by brief monocular deprivation is greatest during a postnatal critical period and is thought to decline irreversibly thereafter. However, here we demonstrate that complete visual deprivation through dark exposure restores rapid ocular dominance plasticity in adult rats. In addition, the loss of visual acuity resulting from chronic monocular deprivation is reversed if dark exposure precedes removal of the occlusion in adulthood, suggesting a potential use for dark exposure in the treatment of adult amblyopia.

62

Current Biology 23, 382–386, March 4, 2013 ©2013 Elsevier Ltd All rights reserved http://dx.doi.org/10.1016/j.cub.2013.01.017

Darkness Alters Maturation of Visual Cortex and Promotes Fast Recovery from Monocular Deprivation

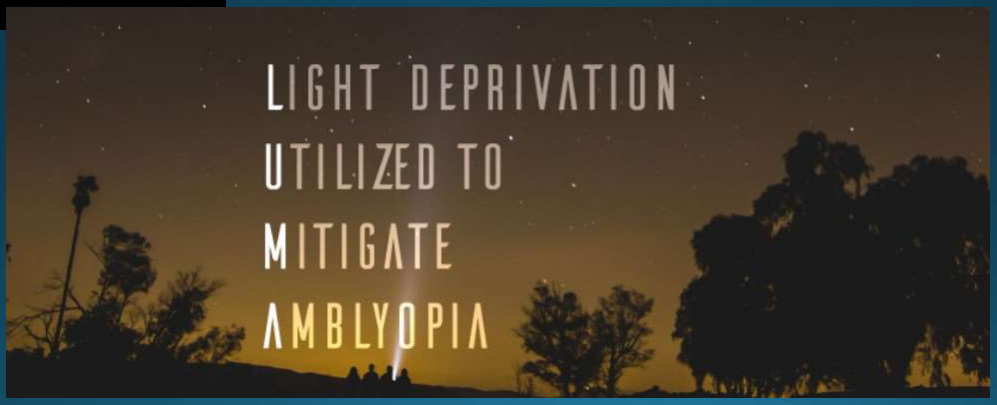
Kevin R. Duffy[1,*] and Donald E. Mitchell[1]
[1]Department of Psychology and Neuroscience, Dalhousie University, 1459 Oxford Street, Halifax, NS B3H 4R2, Canada

Summary

The existence of heightened brain plasticity during critical periods in early postnatal life is a central tenet of developmental sensory neuroscience and helps explain the enduring deficits induced by early abnormal sensory exposure [1, 2]. The human visual disorder amblyopia has been linked to unbalanced visual input to the two eyes in early postnatal visual cortical development and has been modeled in animals by depriving them of patterned visual input to one eye [3, 4], a procedure known as monocular deprivation (MD). We investigated the possibility that a period of darkness might reset the central visual pathways to a more plastic stage and hence increase the capacity for recovery from early MD. Here we show that a 10 day period of complete darkness reverses maturation of stable cytoskeleton components in kitten visual cortex and also results in rapid elimination of, or even immunity from, visual deficits linked to amblyogenic rearing by MD. The heightened instability of the cytoskeleton induced by darkness likely represents just one of many parallel molecular changes that promote visual recovery, possibly by release of the various brakes on cortical plasticity [2].

63

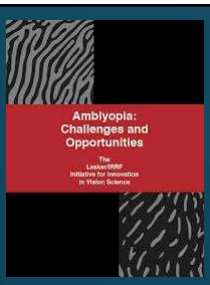
PROJECT LUMA



64

Participants will receive a comprehensive eye exam. If a new prescription will allow you to see better, we will provide new glasses or contact lenses. You will be spending up to ten days in total darkness—sequestered with 3 other participants. Accommodations, meals and activities will be provided. You will also be asked to commit to doing vision exercises (video game style) for 45 minutes per day, 5 days a week, for 8 weeks. You will have to come to the University Eye Center (33 W. 42nd St.) 18 vision tests over the course of 15 months. You will be paid a stipend of $100 per day for the sequestration portion of the study if you are chosen. You will also be compensated for doing vision training ($10 /day, $400 total), and for visual, psychological, and physical examinations ($15 per visit). If you are healthy, highly motivated to help find treatments for amblyopia, extremely reliable, and have outstanding group living skills, we would like to hear from you.

65



"The potential of physical activity to promote amblyopic recovery has caught the attention of the clinical field. Adult subjects who intermittently cycled on a stationary bicycle while watching a movie showed enhanced effects of transient eye patching compared to those subjects who watched the movie while sitting still (Lunghi and Sale, 2015). Moreover, tasks that directly engage both visual and motor circuits have achieved great success in reversing amblyopia. For example, recovery from amblyopia is expedited by tasks requiring coordination of hand and eye movements, such as having patients manipulate objects during visual training (reviewed in Daw, 2013)."

66

New Technologies in Amblyopia

67

Brain Injury and Stroke

68

TBI/Stroke

Optometry - Journal of the American Optometric Association
Volume 79, Issue 1, January 2008, Pages 18–22

Clinical research

Vision therapy for oculomotor dysfunctions in acquired brain injury: A retrospective analysis

Kenneth J. Ciuffreda, O.D., Ph.D., Daniella Rutner, O.D., M.S., Neera Kapoor, O.D., M.S., Irwin B. Suchoff, O.D., D.O.S., Shoshana Craig, O.D., M.E. Han, O.D.

Background

Oculomotor dysfunctions are among the most common abnormalities found in the brain-injured population. The purpose of the current study was to determine retrospectively the effectiveness of conventional optometric vision therapy for oculomotor disorders of vergence and version in a sample of ambulatory, visually symptomatic, predominantly adult outpatients who had either mild traumatic brain injury (TBI) or cerebrovascular accident (CVA).

Methods

A computer-based query for acquired brain injury patients examined between the years of 2000 and 2003 was conducted in our clinic. This yielded 160 individuals with mild TBI and 60 with CVA. Of these patients, only those for whom vision therapy was prescribed and who completed an optometric vision therapy program for remediation of their oculomotor dysfunctions were selected. This included 33 with TBI and 7 with CVA. The criterion for treatment success was denoted by marked/total improvement in at least 1 primary symptom and at least 1 primary sign.

Results

Ninety percent of those with TBI and 100% of those with CVA were deemed to have treatment success. These improvements remained stable at retesting 2 to 3 months later.

Conclusion

Nearly all patients in the current clinic sample exhibited either complete or marked reduction in their oculomotor-based symptoms and improvement in related clinical signs, with maintenance of the symptom reduction and sign improvements at the 2- to 3-month follow-up. These findings show the efficacy of optometric vision therapy for a range of oculomotor abnormalities in the primarily adult, mild brain-injured population. Furthermore, it shows considerable residual neural plasticity despite the presence of documented brain injury.

69

Brain Trauma and Stroke

Article ▸ Accommodative and Vergence Dysfunctions in mTBI: Treatment Effects and Systems Correlations

Preethi Thiagarajan, BS Optom, MS, PhD
State University of New York, College of Optometry, New York, New York
Kenneth J. Ciuffreda, OD, PhD
State University of New York, College of Optometry, New York, New York

ABSTRACT

Background: Traumatic brain injury (TBI) is a global, diffuse type of injury, which results in a constellation of visual dysfunctions. The extensive neural network of the oculomotor system makes it highly vulnerable following a TBI, hence the high prevalence of signs and symptoms related to accommodative and vergence dysfunctions.

Methods: The present study evaluated the therapeutic effects on clinical (subjective) and laboratory (objective) measures, as well as their correlated improvements, following an equal dosage of six weeks of vergence and accommodation training in mild TBI (n=12).

Results: With only three hours of training for each system, significant improvements in both static and dynamic parameters of both systems were found. Maximum amplitude of both systems increased markedly, along with faster dynamics demonstrating speedy responsivity, following training. Several key parameters between the two systems showed significant correlation ($p<0.01$), such as amplitudes ($r = -0.87$) and facilities ($r = 0.88$) of accommodation and vergence.

Conclusions: The present findings demonstrate efficacy of oculomotor rehabilitation in TBI, with the improvements being suggestive of intact neuroplasticity in the compromised adult brain following mTBI.

Keywords: accommodation, mild traumatic brain injury, oculomotor rehabilitation, reading, vergence, vision therapy

70

Brain Trauma and Stroke

The American Journal of Sports Medicine

Near Point of Convergence After a Sport-Related Concussion
Measurement Reliability and Relationship to Neurocognitive Impairment and Symptoms

Kelly L. Pearce, PhD*, Alicia Sufrinko, PhD*, Brian C. Lau, MD†, Luke Henry, PhD*, Michael W. Collins, PhD* and Anthony P. Kontos, PhD*,‡

Author Affiliations

‡Anthony P. Kontos, UPMC Center for Sports Medicine, 3200 South Water Street, Pittsburgh, PA 15203, USA (email: akontos@pitt.edu).

Results: Groups did not differ on demographic or injury characteristics. NPC differed between trial 1 and trials 2 ($P = .02$) and 3 ($P = .01$) for the CI group but not the normal NPC group. Internal consistency was high across NPC measurements (ICC range, 0.95–0.98). Patients with CI performed worse on verbal memory ($P = .02$), visual motor speed ($P = .02$), and reaction time ($P = .001$, $\eta^2 = .13$) and had greater total symptom scores ($P = .02$) after the injury. Results of hierarchical regression revealed that the NPC distance contributed significantly to the model for reaction time ($P < .001$).

Conclusion: CI was common (~42%) in athletes evaluated within 1 month after an SRC. Athletes with CI had worse neurocognitive impairment and higher symptom scores than did those with normal NPC. Clinicians should consider routinely screening for NPC as part of a comprehensive concussion evaluation to help inform treatment recommendations, academic accommodations, and referrals for vision therapy.

71

Sports Vision Training

72

Sports Vision

Article ▸ A Vision Training Program's Impact on Ice Hockey Performance

Alison Jenerou, OD, Michigan College of Optometry
Bruce Morgan, OD, Michigan College of Optometry
Robert S. Buckingham, OD, PhD, Michigan College of Optometry

ABSTRACT

Background: This study was carried out to determine whether a preseason vision training program would improve visual skills and season success in a Division I men's ice hockey team.

Methods: A six-week vision training program was implemented with the Ferris State team during their pre-season workouts. Vision training accommodative training along with dynamic visual skills

an improvement in base out vergence ranges, binocular Wayne Saccadic Fixator (WSF) scores and was viewed by e impact on their individual performance. The pre- and post- n goal, and shooting percentage all significantly improved

Conclusion: The vision training program during preseason workouts had a positive impact on the players' visual skills important for hockey. The players' perception of their vision and how they were using their vision during competitive play also showed a significant change. The majority of the players felt that vision training was an effective use of their practice time allotted by the NCAA.

Keywords: ice hockey, sports vision training, vision therapy, visual skills

Article ▸ Depth Perception Improvement in Collegiate Baseball Players with Vision Training

Joseph F. Clark, PhD, ATC, University of Cincinnati, Cincinnati, Ohio
Patricia Graman, MA, ATC, University of Cincinnati, Cincinnati, Ohio
James K. Ellis, OD, University of Cincinnati, Cincinnati, Ohio

73

An Exploratory Study of the Potential Effects of Vision Training on Concussion Incidence in Football

Joseph F. Clark, PhD, ATC, Department of Neurology & Rehabilitation Medicine, University of Cincinnati, Cincinnati, Ohio
Pat Graman, MA, ATC, Department of Education, University of Cincinnati, Cincinnati, Ohio
James K. Ellis, OD, Department of Sports Medicine, University of Cincinnati, Cincinnati, Ohio
Robert E. Mangine, MEd, PT, ATC, Associate Athletic Director of Sports Medicine, University of Cincinnati, National Director of Clinical Sports PT Residency, NovaCare Rehabilitation, Cincinnati, Ohio
Joseph T. Rauch, DPT, SCS, ATC, Department
University of Cincinnati, Cincinnati, Ohio
Ben Bixenmann, MD, Department of Neuros
Kimberly A. Hasselfeld, MS, Department of
University of Cincinnati, Cincinnati, Ohio
Jon G. Divine, MD, Department of Orthopae
University of Cincinnati, Cincinnati, Ohio
Angelo J. Colosimo, MD, Departments of Or
University of Cincinnati, Cincinnati, Ohio
Gregory D. Myer, PhD, FACSM, Division of Sp
Center, Department of Pediatrics and Ortho
Medicine Sports Health & Performance Insti
The Micheli Center for Sports Injury Prevent

Results: During the 2006-2013 pre- and regular football seasons, there were 41 sustained concussion events reported. The overall concussion incidence rate for the entire cohort was 5.1 cases per 100 player seasons. When the data were evaluated relative to vision trained versus referent untrained player seasons, a statistically significant lower rate of concussion was noted in player season in the vision training cohort (1.4 concussions per 100 player seasons) compared to players who did not receive the vision training (9.2 concussions per 100 player seasons; $p<0.001$). The decrease in injury frequency in competitive seasons with vision training was also associated with a concomitant decrease in missed play time.

Discussion: The current data indicates an association of a decreased incidence of concussion among football players during the competitive seasons where vision training was performed as part of the preseason training. We suggest that better field awareness gained from vision training may assist in preparatory awareness to avoid concussion-causing injuries. Future large scale clinical trials are warranted to confirm the effects noted in this preliminary report.

74

Questions

Jarrod E Davies, OD, FCOVD
801-810-1060
drdavies@utahvt.com

75