EBPX CAT

Evidence Topic
Eye movement exercises

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Evidence Question
Are eye movement exercises effective in improving academic performance for students with learning disabilities?

Question Background
Eye movements can play an important part in a child’s ability to read. Efficient reading requires the ability for accurate eye movements and ability to translate this information within the brain. A literature review by Kulp and Schmidt (1996) showed a relationship between oculomotor efficiency and reading skills. Many problems can go wrong with the eye that can disrupt eye movements and/or transmission of information to the brain. These problems can include reduced visual acuity, low vision, visual field deficits, binocular vision disorders (strabismus), amblyopia, accommodative disorder, ocular motility disorders, nystagmus, and visual perception disorders. Vision therapy can often be used as treatment for many of these eye problems. Vision therapy is prescribed and implemented by an optometrist and consists of a program tailored to fit the individual. Vision therapy usually includes lenses, prisms, filters, occlusion, modalities, eye equipment and other specific procedures. Occupational Therapists and Optometrists can work
together to implement the vision therapy program, this is most often seen in hospitals and school systems. The Occupational Therapist usually performs the parts of the vision therapy program that consists of activities to improve eye movements, scanning, or visual information procession skills (Fishman-Hellerstein & Fishman, 1999).

**Parameters of the Search**

**Parameters:**
The original EBPX question was related to ocular motility exercises in the improvement of academics. A search was first completed looking for studies on ocular motility exercises within the occupational therapy (OT) literature and then progressed to searching literature within vision specific professions. Through researching the literature no articles were found on ocular motility related to academics in the OT or vision literature. Within searching the vision literature studies were found comparing eye movement exercises and vision therapy. The question was then broadened to eye movement exercises according to the research findings. All articles included within the CAT are from vision related journals, no articles were found within the occupational therapy journals.

The initial search only incorporated research within the last ten years. Only two studies were found related to the research question. An additional search was completed expanding to the most recent research within 20 years. Two more articles were found and included. These articles expanded on the use of vision therapy for children with reading problems.

**Keywords:** convergence, convergence insufficiency, dyslexia, exercises, eye exercises, eye movements, impaired vision, learning disabilities, ocular motility, perception scan, pursuits movement, reading, saccades, saccadic accuracy, saccadic movement, scanning, sensory integration, sensory training, vergence, vision, visual perception, vision therapy, and vision training program

**Databases searched:**
CINAHL
PUBMED
MEDLINE
ERIC
Google Scholar
Cochrane Collaboration
National Guideline Clearinghouse

**Websites, Resources:**
- www.aota.org
- www.dr-s.net
- www.optometrists.org
- www.covd.org
- www.visionandlearning.org
- www.simplybrainy.com
- www.pave-eye.com
- www.ocp.org
- www.nora.cc
- www.aoa.org
- www.guideline.gov
- www.childrensvision.com

**Evidence Table**
Contains appraisals of evidence reviewed.

**Key to Level of Evidence**
*(Level of evidence may be adjusted downward by EBPX team if study has poor rigor.)*

<table>
<thead>
<tr>
<th>Level</th>
<th>1</th>
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<th>5</th>
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<tbody>
<tr>
<td>Type of Evidence</td>
<td>Systematic Reviews and meta-analyses</td>
<td>Randomized Control Trials (RCT)</td>
<td>Quasi-experimental and Comparative studies</td>
<td>Correlation and Non-experimental studies</td>
<td>Descriptive studies &amp; Expert Opinion articles</td>
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| Rawstron, J.A., Burley, C.D., & Elder, M.J. (2005). A systematic review of the applicability and efficacy of eye exercises. *Journal of Pediatric Ophthalmology and Strabismus*, 42(2), 82-88. | Systematic Review: database searched included AMED, SCSR, CCTR, EMBASE, & MEDLINE | 43 studies were reviewed, 14 clinical trails, 18 review articles, 2 historical articles, 1 case report, 6 editorial/letters, and 2 position statements from professional colleges | 1 | Through the review of articles eye exercises were used with children and adults with the following vision problems:  
  - vergence disorders  
  - amblyopia  
  - myopia  
  - accommodation (focusing)  
  - learning disabilities/dyslexia  
  - stereacuity  
  - sports vision  
  - training residual function (after brain damage)  
  - motion sickness | Research articles for each vision problem were reviewed.  
For learning disabilities and dyslexia 4 articles were reviewed.  
1. Learning disabilities, dyslexia, and vision: a subject review, 1998, by the American Academy of Pediatrics revealed that no significant or scientific evidence exists proving that eye exercises improve academic learning disabilities.  
2. Vision training revisited, 1985, by Keogh and Pelland gathered information from optometrist, psychologist, and scientific/professional literature. From their review they concluded that there is not enough controlled studies to say if eye exercises assist those with learning disabilities.  
3. Optometric vision therapy, results of a demonstration project with a learning disable population by Seiderman is a RCT including 18 pairs of children. One member of the pair was in the control group and the other in the experimental group. The experimental group received vision therapy. The study was conducted for 2 years with improvements in reading assessment (not spelling) and visumotor and perception measures (not in divergence break or recovery at near/distance).  
4. Efficacy of vision therapy as assessed by the COVD quality of life checklist, 2002, by Maples and Bither indicated an improvement in symptoms after vision therapy. This trail did not have uniform inclusion criteria, consistent treatment and application of checklist, and there were no controls. | There were not enough controlled studies that clearly supported the use of eye exercises in treating the before mentioned vision problems except in the area of convergence insufficiency (CI). There were 15 studies with over 2,000 participants on vision therapy for patients with CI. The success rates in these studies rated about 70%. |
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<th>Description of Intervention</th>
<th>Outcome/ Findings</th>
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<td>Scheiman, M., Mitchell, L., Cotter, S., Cooper, J., Kulp, M., Rouse, M., et al. (2005). A randomized clinical trial of treatments for convergence insufficiency in children. <em>Arch Ophthalmology</em>, 123(1), 14-24.</td>
<td>RCT</td>
<td>12 week, masked, placebo-controlled, multicenter, randomized control trial. Participants were randomly assigned to either: pencil push-ups, office based therapy/orthoptics, or a placebo office based therapy/orthoptic.</td>
<td>2</td>
<td>47 children ages 9-18 who had symptomatic convergence insufficiency. Eligibility requirements; exophoria at near at lest 4 times greater than at far, receded near point of convergence break, and insufficient positive fusional convergence at near. Eligibility testing included the 13 item CI symptoms Survey and a variety of vision tests including; best corrected visual acuity (distance/near), cycloplegic refraction, sensorimotor, near point of convergence, positive/negative fusional vergence at near, near stereoacuity, accommodative amplitude, and accommodative facility.</td>
<td>Pencil push-ups each participant was instructed to place a sharpened pencil at arms length between there eyes and move the pencil forward. An index card was taped to the wall in front of them. When the participant could no longer see the index card on the wall they were to blink there eyes and repeat. 3 sets of 20 were completed per day at home, 5 days per week. Office based vision therapy/orthoptics 60 minute office visit and home program 15 minutes per day, 5 days a week. A specific procedure and order of treatments was followed: <em>Accommodative Procedures</em>  • Loose-lends accommodative facility  • Letter chart accommodative facility  • Binocular accommodative facility <em>Convergence Procedures</em>  • Barrel card  • Brock string <em>Divergence Procedures</em>  • Vectograms  • Computer orthoptics  • Aperture rule  • Eccentric circles free-space fusion cards  • Loose prism facility</td>
<td>Each child was assessed at the beginning &amp; the end of the 12 weeks with the CI symptom survey 15-item. A score of less than 16 was considered a successful outcome and patients were considered “cured.” Patients who experienced decrease in symptoms were considered “improved.” The office based treatment 8/15 achieved the cured status while only 1/12 in the placebo, and 0/11 in the pencil push-up group. The results indicated office based vision therapy is effective in improving the symptoms and signs of CI. Pencil push-ups were proven to not be effective.</td>
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| Atzmon D., Nemet P., Ishay A., & Karni, E. (1993). A randomized prospective masked and matched comparative study of orthoptic treatment verses conventional reading tutoring treatment for reading disabilities in 62 children. *Binocular Vision and Eye Muscle Surgery Quarterly, 8*, 91-106. | RCT | Double blind prospective study divided into 3 treatment groups | 2 | 120 children with reading disabilities having 100% poor fusional convergence, 60% receded near point convergence, and several had asthenopic (eye strain) symptoms | 3 treatment groups which included:  
  - Group one received orthoptic (the same as vision therapy) treatments including Tibbs Binocular trainer, physiologic diplopia instruction, framing and bar reading exercises, and loose prism convergence training.  
  - Group two received conventional reading tutoring  
  - Group three was the control and received no treatment | Asthenopic (eye strain) symptoms were eliminated in the orthoptic treatment group. Reading improved significantly in both the orthoptic and tutoring groups but not in the control group.  
The study concluded that orthoptic therapy is as effective as reading tutoring in improving reading for children with learning disabilities. Orthoptic therapy is beneficial in eliminating eye strain. |
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<td>Getz, D.J. (1980). Learning enhancement through visual training. <em>Academic Therapy</em>, 14(4), 457-66.</td>
<td>RCT</td>
<td>Posttest only control group design with random assignment of subjects using a two-tailed t test with a 0.05 level of significance</td>
<td>2</td>
<td>120-2nd grade students from 4 different elementary schools who were assessed as poor readers. At the end of the study only 70 students, who had completed at least 80% of the study, were included in the results. Inclusion criteria were students who failed the Bender Gestalt Test or optometric screening and who scored in the bottom 25% on the 1st grade Cooperative Primary Test.</td>
<td>Background on study: A school district hired an optometrist to conduct a program to assist there students who were poor readers by implementing a vision training program. This study was conducted by the school before implementing the vision program to prove the program worked. The optometrist trained the special education teachers in each school to implement the vision training. Study consisted of 2 treatment groups: One half of the 120-2nd graders were the control group receiving general special education services to assist with reading and the other half were treated with the vision training program. The vision therapy program consisted of 1.5 hours a day, five days a week for 4 months. Vision training was conducted in groups of 6-8 students and each received a total of 40 hours of therapy. Therapy consisted of 52 specific activities. The activities were outlined in a manual given to the special education teachers by an optometrist hired by the school. Activities included general games (jig saw puzzle, simon says), vision specific (convergence, penlight versions, fixations,), motor, chalkboard, and balance. At the end of the 4 months the 70 students with 80% program completion were assessed with the following post-test measures: California cooperative primary (standardized reading test), Spelling section of the Wild Range Achievement test, and the reading section of the Wild Range Achievement test.</td>
<td>Significant results were found for both the reading measures (California and wild range). These tests indicated that the vision training program improved reading skills over the control group with an additional mean growth of 2 months for the California test (reading) and a additional mean growth of 3 months for the wild range (reading and word recognition). There was only 1 month additional mean growth difference for the vision training for the spelling section of the wild range, which was not significant. The study concluded that vision training gives significant results for children with reading problems in the area of reading and word recognition but not in spelling.</td>
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**EBPX Summary**

There is not enough evidence to clearly state if eye exercises improve academic performance in school aged children.

The studies reviewed revealed that pencil push-ups is the most widely used eye exercise. The studies comparing eye exercise to vision therapy all used pencil push-ups as the eye exercise. Pencil push-ups are a convergence (reading) and divergence (distant focus) exercise holding a pencil in between the eyes and moving it backward and forward. Evidence indicated that pencil push-ups do not have significant effect in improving reading and/or reducing eye strain.

Vision therapy consists of combining a variety of vision instruments, eye exercises, and prism lenses within several therapy sessions most often in a clinic. Convergence insufficiency is the vision problem that the literature pointed to as having the most significant results when treated with vision therapy. When compared to reading tutoring, vision therapy had the same results in that they both showed improvement in reading skills however vision therapy completely eliminated eye strain as well as improved reading.

**EBPX Strength and Impact Summary**

There is NO EVIDENCE that eye exercises improve academic performance in school children. Based on individual response, methods without evidence are appropriate if methods backed by evidence have been ineffective for this person. Therapists are cautioned to carefully measure individual outcomes when selecting this intervention.

**References**


