# Visual Information Processing Evaluation and Orthoptic and Vision Therapy

**Policy Number:** VISION 011.16 T1  
**Effective Date:** November 1, 2016

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### INSTRUCTIONS FOR USE

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When deciding coverage, the member specific benefit plan document must be referenced. The terms of the member specific benefit plan document [e.g., Certificate of Coverage (COC), Schedule of Benefits (SOB), and/or Summary Plan Description (SPD)] may differ greatly from the standard benefit plan upon which this Clinical Policy is based. In the event of a conflict, the member specific benefit plan document supersedes this Clinical Policy. All reviewers must first identify member eligibility, any federal or state regulatory requirements, and the member specific benefit plan coverage prior to use of this Clinical Policy. Other Policies may apply.

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### CONDITIONS OF COVERAGE

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### BENEFIT CONSIDERATIONS

Before using this policy, please check the member specific benefit plan document and any federal or state mandates, if applicable.
**Coverage Rationale**

Occlusion therapy is proven and medically necessary for treating amblyopia (lazy eye).

Prism adaptation therapy is proven and medically necessary for treating esotropia (a form of strabismus when the eye deviates inward).

Orthoptic or vision therapy is proven and medically necessary for treating convergence insufficiency (ability of eyes to fix on the same point).

Orthoptic or vision therapy is unproven and not medically necessary for treating the following:
- Exotropia (eye deviates outward) without convergence insufficiency
- Nystagmus (involuntary movement of the eyeballs)
- Convergence excess (esotropia is greater for near vision than for far vision)
- Divergence insufficiency
- Divergence excess
- Stroke or traumatic brain injury with visuospatial deficit, hemispatial neglect, or visual loss

The available data supporting the use of vision therapy for these indications is weak and inconclusive, and derived primarily from uncontrolled or poorly controlled studies with significant methodological flaws.

The use of visual information processing evaluations to diagnose reading or learning disabilities is unproven and not medically necessary.

There is inadequate clinical evidence to support the use of visual information processing evaluations for diagnosing reading or learning-related disabilities. Additional well-designed studies with larger sample sizes are needed to establish the diagnostic utility of this procedure.

Orthoptic or vision therapy including colored lenses, filters, and overlays is unproven and not medically necessary for treating dyslexia and other learning and reading disabilities.

There is a lack of robust data available on the efficacy of orthoptic therapy for treating dyslexia and other reading and learning disabilities. Several small randomized controlled trials of vision therapy have been published, but these studies were flawed by design limitations (including small sample size and poorly defined patient selection criteria). The American Academy of Pediatrics has published a statement that concludes that vision therapy is ineffective for the treatment of learning and reading problems.

Visual perceptual therapy is unproven and not medically necessary for any type of learning disability or language disorder, including developmental delay.

The available data supporting the use of visual perceptual therapy to treat learning or developmental disabilities is weak and inconclusive, and derived primarily from uncontrolled or poorly controlled studies with significant methodological flaws.

Vision restoration therapy is unproven and not medically necessary for treating visual field deficits following stroke or neurotrauma.

There is inadequate evidence of efficacy for this treatment. The number of participants in the few available published studies is small and follow-up time is short.

**Applicable Codes**

The following list(s) of procedure and/or diagnosis codes is provided for reference purposes only and may not be all inclusive. Listing of a code in this policy does not imply that the service described by the code is a covered or non-covered health service. Benefit coverage for health services is determined by the member specific benefit plan document and applicable laws that may require coverage for a specific service. The inclusion of a code does not imply any right to reimbursement or guarantee claim payment. Other Policies may apply.
Visual Information Processing Evaluation (VIPE) identifies problems with processing of information for enhanced visual, motor integration skills and rapid naming. Patients utilize a computer screen to focus on a displayed central point and respond every time they see light stimuli appear. The light stimuli are presented in the area most likely to recover visual function, an area which will change as therapy progresses and vision is improved. (Nova Vision, 2007)

Visual information processing evaluation (VIPE) identifies problems with processing of information for enhanced school and/or social development. Visual processing refers to a group of skills used for interpreting and understanding visual information. The evaluation may include testing for visual spatial orientation skills, visual analysis skills, including auditory–visual integration, visual–motor integration skills and rapid naming.

**CLINICAL EVIDENCE**

**Vision Therapy for Amblyopia**

Amblyopia, sometimes called lazy eye, is characterized by poor vision in an eye that did not develop normal sight during childhood so that 1 eye develops good vision while the other does not. This condition affects approximately 2% to 3% of the population. There are three major causes of amblyopia: strabismus (misaligned or crossed eyes), unequal focus (a refractive error) and cloudiness in normally clear tissues (such as from cataracts). To correct amblyopia, the patient must be made to use the weak eye. This is accomplished through patching the good eye. This treatment is known as occlusion therapy and is a standard treatment. Atropine sulfate has also been used to blur the good eye (Kushner, 2002).

In a prospective, randomized, multicenter clinical trial, the Pediatric Eye Disease Investigator Group (PEDIG) (2013) evaluated the effectiveness of increasing prescribed daily patching from 2 to 6 hours in children with stable residual amblyopia. The study group consisted of 169 children aged 3 to <8 years (mean, 5.9 years) with stable residual amblyopia (20/32–20/160) who had received 2 hours of daily patching for at least 12 weeks. The main outcome measure was best-corrected visual acuity (VA) in the amblyopic eye after 10 weeks. Ten weeks after randomization, amblyopic eye VA had improved an average of 1.2 lines in the 6-hour group and 0.5 line in the 2-hour group (difference in mean VA adjusted for acuity at randomization = 0.6 line; 95% confidence interval, 0.3–1.0; P = 0.002). Improvement of 2 or more lines occurred in 40% of participants patched for 6 hours versus 18% of those who continued to patch for 2 hours (P = 0.003). The authors concluded that when amblyopic eye VA stops improving with
2 hours of daily patching, increasing the daily patching dosage to 6 hours results in more improvement in VA after 10 weeks compared with continuing 2 hours daily.

Repka et al. (2014) reported visual acuity of patients at 15 years of age who were younger than 7 years when enrolled in a treatment trial for moderate amblyopia. In a multicenter clinical trial, 419 children with amblyopia (visual acuity, 20/40 to 20/100) were randomly assigned to patching (minimum of 6 h/d) or atropine sulfate eyedrops, 1% (1 drop daily), for 6 months. Treatment after 6 months was at the discretion of the investigator. Two years after enrollment, an unselected subgroup of 188 children were enrolled into long-term follow-up. At 15 years of age, most children treated for moderate amblyopia when younger than 7 years have good visual acuity, although mild residual amblyopia is common. The authors found the outcome to be similar regardless of initial treatment with atropine or patching. Better visual acuity at the 15-year examination was achieved in those who were younger than 5 years at the time of entry into the randomized clinical trial (mean logMAR, 0.09) compared with those aged 5 to 6 years (mean logMAR, 0.18; P < .001). When we compared subgroups based on original treatment with atropine or patching, no significant differences were observed in visual acuity of ambylopic and fellow eyes at 15 years of age (P = .44 and P = .43, respectively). The authors concluded that the results indicate that improvement occurring with amblyopia treatment is maintained until at least 15 years of age.

In a randomized controlled clinical trial, Rutstein et al. (2010) evaluated whether visual acuity improvement with Bangerter filters is similar to improvement with patching as initial therapy for children with moderate amblyopia. The study enrolled 186 children, 3 to <10 years old, with moderate amblyopia. Children were randomly assigned to receive either daily patching or to use a Bangerter filter on the spectacle lens in front of the fellow eye. Study visits were scheduled at 6, 12, 18, and 24 weeks. At 24 weeks, amblyopic eye improvement averaged 1.9 lines in the Bangerter group and 2.3 lines in the patching group. The authors concluded that because the average difference in visual acuity improvement between Bangerter filters and patching was less than half a line and there was lower burden of treatment on the child and family, Bangerter filter treatment is a reasonable option to consider for initial treatment of moderate amblyopia. The authors indicated that although the mean difference between groups was only 0.38 line, the end of the confidence interval on the difference was 0.76 line, and thus, treatment with Bangerter filters did not quite meet the prespecified definition of non-inferiority to patching when initiating therapy for moderate amblyopia. However, the authors also did not find that patching was statistically superior to Bangerter filters. Therefore, the authors could not conclude that the Bangerter filter treatment effect is similar to that seen with patching (based on our predefined definition of non-inferiority), but they also could not conclude that patching is definitely better.

In a prospective, randomized clinical trial, Agervi et al. (2010) compared spectacles plus patching 8 hours or more daily 6 days a week with spectacles plus patching 8 hours or more on alternate days to treat amblyopia in 40 children 4 to 5 years of age. The main outcome measure was median change in best corrected visual acuity (BCVA) of the amblyopic eye after 1 year. The median change in BCVA of the amblyopic eye did not differ significantly between the 2 groups. Binocular function improved in both groups with no significant differences between the groups at 1 year. The investigators concluded that the magnitude of change in the BCVA 1 year after spectacles plus prescribed alternate-day patching was not significantly different than that after spectacles plus prescribed daily patching to treat amblyopia in children 4 to 5 years old. The effect of patching was not separate from that of optical correction with a period of refractive adaptation. Thus, the improvement in visual acuity is a combined effect of spectacle wear and occlusion therapy.

A large randomized controlled trial supported by the National Eye Institute involved 419 children. The participants were assigned to either patching or atropine drops as treatment for amblyopia. Visual acuity improved in both groups (79% in the patching group and 74% in the atropine group). Both treatments were well tolerated, but the parents of the atropine treated group reported a slightly higher degree of acceptability (PEDIG, 2002).

Shotton and Elliott (2008) systematically reviewed the available evidence to establish the most effective treatment for strabismic amblyopia. This review aimed to examine the impact of conventional occlusion therapy for strabismic amblyopia and analyze the role of partial occlusion and optical penalization for strabismic amblyopia. Two randomized controlled trials (RCTs) were included in the review. The authors concluded that occlusion, while wearing necessary refractive correction, appears to be more effective than refractive correction alone in the treatment of strabismic amblyopia.

In a Cochrane review, Taylor and Elliott (2014) evaluated the most effective treatment for strabismic amblyopia. The review found that occlusion, while wearing necessary refractive correction, appears to be more effective than refractive correction alone in the treatment of strabismic amblyopia.
Vision Therapy for Strabismus

Strabismus is an ocular misalignment. The most common types are esotropia (inwardly deviating eyes) and exotropia (outwardly deviating eyes). Less common is hypertropia, when one eye turns upward and hypotropia, when one eye turns downward. Prevalence estimates of strabismus range from 1% to 6% in different populations.

Williams et al. (2014) systematically searched 13 databases to evaluate the most effective strategies for treating children with visual and neurodevelopmental problems (VND). The authors found 4450 abstracts from which they identified 107 papers for inclusion. Of these, 42 related to interventions involving a change in visual input or function: 5 controlled trials, 8 before and after studies and 29 case reports. The strongest evidence supported the provision of spectacles to improve distance or near vision. Less strong but suggestive evidence supported vision training/practice routines to improve acuity or oculomotor control including strabismus. The authors indicated that while training programs and environmental modifications may help children with VND, more evidence is needed on type of vision training, optimum duration and age for vision training, and the degree to which improvements are lasting, transfer to other skills/activities or add to quality of life.

Esotropia

The goal of strabismus surgery is to align the eyes and permit fusion with a minimum number of operations. Prisms have proposed as a way to more accurately determine the angle of deviation, or the target angle, for strabismus surgery. The National Eye Institute (NEI) sponsored the Prism Adaptation Study (PAS), a randomized, multicenter, controlled, clinical trial to determine the overall effect of prism adaptation. The PAS defined prism adaptation as the preoperative wearing of Fresnal prisms to offset the angle of esotropia, with adjustment of prism power over time to accommodate buildup to larger angles of esotropia, until fusion is achieved or it is demonstrated that fusion cannot be attained. Prism-adapted surgery refers to surgery for the angle of deviation at which the prism wearer achieves fusion. The study randomized 333 eligible patients who were at least 3 years of age, had no previous eye surgery, and had acquired deviations of 12 to 40 prism diopters. All patients had 20/40 or better visual acuity in each eye, and amblyopic patients underwent occlusion therapy before entry. Two levels of randomization were used. Sixty percent of the patients (n=199) underwent prism adaptation and 40% (n=134) did not. Those who did not have prism adaptation underwent conventional surgery for their entry angle of deviation. Of those who responded to prisms with motor stability and sensory fusion (n=131), half (n=67) underwent a conventional amount of surgery, i.e., surgery for angle at entry, and half (n=64) underwent augmented surgery based on the prism-adapted angle of deviation. A successful outcome was defined as a deviation of less than or equal to 8 prism diopters of esotropia or exotropia. Success rates 6 months after surgery were highest in prism adaptation responders who underwent augmented surgery and lowest in patients who did not undergo prism adaptation (89% versus 72%). The estimated overall rate of success for patients who went through the prism adaptation process was significantly better than the success rate of patients who did not undergo prism adaptation but underwent surgery for their deviation at entry into the study (83% versus 72%). The investigators concluded that there was a beneficial overall effect of the prism adaptation process for patients with acquired esotropia (PAS, 1990). A second report included the 1-year motor and sensory outcomes for patients enrolled in the PAS. Of the 333 patients originally randomized in the study, 305 (92%) completed the 1-year postoperative follow-up. The overall 1-year motor success rate for all patients in the study was 74%. The authors concluded that prism adaptation identifies those patients who can undergo enhanced or augmented surgery without increasing the risk of overcorrection (Repka, 1996).

Exotropia

Since evidence of effectiveness of interventions for treatment of childhood intermittent exotropia is unclear, Joyce et al. (2015) conducted a systematic review to locate, appraise and synthesize evidence of effectiveness. The authors included randomized controlled trials, quasi-experimental and cohort studies with a comparison group examining interventions for divergence excess, simulated divergence excess or basic type exotropia in children, up to and including 18 years of age, followed for at least 6 months. Dual data extraction and critical appraisal were conducted and a narrative synthesis undertaken. Eleven studies satisfied the eligibility criteria. Seven examined the comparative effectiveness of two surgical procedures; four compared surgery with other interventions, including botulinum toxin A therapy, orthoptic exercises, occlusion, binocular vision training and watchful waiting. The evidence retrieved was of limited extent and quality with differences across studies in terms of outcome assessment and most appropriate time-point for measuring long-term outcomes. There were mixed outcomes when comparing unilateral recession/resection (R&R) with bilateral lateral rectus recession (BLR) on improving angle of deviation, which makes it difficult to recommend either surgical option with confidence. While non-surgical interventions appear less effective in terms of improving angle of deviation, they are rarely associated with adverse outcomes. The authors concluded that given the limited evidence base, better designed studies are required to address the question of the most effective management for treatment of childhood exotropia. Importantly, consensus is required on what constitutes a successful outcome as well as agreement on how this should be measured.

Gnanaraj and Richardson (2005) conducted a systematic review to clarify the effects of various surgical and nonsurgical treatments for management decisions in intermittent distance exotropia. No randomized controlled trials were found that met selection criteria. The authors found that the current literature consists mainly of retrospective
reviews and these are difficult to compare and analyze due to variations in definition, intervention criteria, and outcome measures. Data from individual studies on suggested intervention criteria were found to be variable, although there was some consistency in suggesting that small-angle deviations (less than 20 prism diopters) may be improved by nonsurgical treatments such as exercising fusion, eliminating suppression, or inducing accommodation using minus lenses. According to the authors, the efficacy of these treatments remains debatable.

Hatt and Gnanaraj (2013) analyzed the effects of various surgical and non-surgical treatments in randomized trials of people with intermittent exotropia, to report intervention criteria and determine the significance of factors such as age with respect to outcome. The authors searched for randomized controlled trials of any surgical or non-surgical treatment for intermittent exotropia. One randomized trial was eligible for inclusion in the review. This trial showed that unilateral surgery was more effective than bilateral surgery for correcting basic intermittent exotropia. According to the authors, measures of severity and criteria for intervention were poorly validated for all identified studies. The authors concluded that there is a need for improved measures of severity, a better understanding of the natural history and carefully planned clinical trials of treatment to improve the evidence base for the management of this condition.

Buck et al (2012) investigated the current patterns of management and outcomes of intermittent distance exotropia in an observational cohort study which recruited 460 children aged < 12 years with previously untreated distance exotropia. Data collected included angle, near stereoaucity, visual acuity, control of distance exotropia measured with the Newcastle Control Score (NCS), and treatment. The main outcome measures were change in clinical outcomes in untreated and untreated distance exotropia, 2 years from enrolment (or, where applicable, 6 months after surgery). At follow-up, data were available for 371 children (81% of the original cohort). Of these: 53% (195) had no treatment; 17% (63) had treatment for reduced visual acuity only (pure refractive error and amblyopia); 13% (50) had non-surgical treatment for control (spectacle lenses, occlusion, prisms, exercises) and 17% (63) had surgery. Only 0.5% (2/371) children developed constant exotropia. The surgically treated group was the only group with clinically significant improvements in angle or NCS, but rates of overcorrection are high. Non-surgical treatment of intermittent distance exotropia had less significant impact on angle of deviation or scores on the NCS.

**Vision Therapy for Convergence Insufficiency and Accommodative Disorders**

Scheiman et al. (2011) systematically assessed and synthesized evidence from randomized controlled trials (RCTs) on the effectiveness of non-surgical interventions for convergence insufficiency. The review included six trials (three in children, three in adults) with a total of 475 participants. The authors concluded that for children, office-based vision therapy is more effective than home-based convergence exercises (i.e., pencil push-ups) or home-based computer vision therapy. The evidence of the effectiveness of nonsurgical treatments of CI in adults was considered less consistent.

Cacho Martinez et al. (2009) conducted a systematic review of reports published from 1986 to 2007 to analyze the scientific evidence available on the nonsurgical treatment of accommodative and non-strabismic binocular dysfunctions, identifying the types of treatment used and their efficacy. Of the 565 articles identified, 16 met the inclusion criteria. Only 3 were clinical trials. All analyzed treatment of convergence insufficiency. Results of clinical trials support the conclusion that vision therapy improves symptoms and signs for convergence insufficiency. Further, the evidence indicates that pencil push-up treatment is not as effective as vision therapy and that prism glasses are no more effective than placebo glasses. For the other non-strabismic binocular conditions and accommodative disorders, there is a lack of published randomized, clinical trials that support the evidence for the efficacy of each treatment.

Rawstron et al. published a systematic review of eye exercises in 2005. The review concluded that small controlled trials and many case reports support the use of eye exercises in the treatment of convergence insufficiency. However, there was no clear evidence supporting the use of eye exercises for other vergence disorders, myopia, amblyopia, accommodative dysfunction, and learning disabilities and dyslexia; thus, their use for these indications remains controversial.

The National Eye Institute (NEI) sponsored the Convergence Insufficiency Treatment Trial (CITT) study, a randomized controlled trial comparing the effectiveness of different treatment options for convergence insufficiency (CI) in 221 children (age 9 to 17 years). Three types of vision therapy were compared with a placebo therapy intervention. Vision therapy included: (1) office-based vision therapy with at-home exercises; (2) home-based pencil push-ups with additional computer vision therapy; and (3) home-based pencil push-up therapy alone. The placebo therapy group was given placebo vision activities that simulated office-based therapy. The study found that after 12 weeks of treatment, nearly 75% of children who received office-based vision therapy with at-home reinforcement achieved normal vision or had significantly fewer symptoms of CI. In comparison, only 43% of patients who completed home-based therapy alone showed similar results, as did 33% of patients who used home-based pencil push-ups with computer therapy, and 35% of patients who underwent office-based placebo therapy (NEI 2008).
Shin et al. (2011) conducted a prospective controlled trial comparing office-based vision therapy with no vision therapy treatment. The study included 57 children aged 9-13 years who were diagnosed with symptomatic CI (n = 27) or combined symptomatic CI and accommodation insufficiency (AI) (n = 30). They were independently divided into a treatment and a control group, matched by age and gender. Office-based vision therapy significantly improved symptoms and clinical signs including NPC, PFV, mean accommodative amplitude, and mean accommodative facility relative to no treatment in children with CI and accommodative insufficiency. Of the patients with concurrent CI and accommodative insufficiency who received vision therapy, 77% were considered improved and 61% were considered cured. Of the 11 patients who completed the 1-year follow-up, symptom scores had deteriorated to abnormal levels in 2 children and 1 child also showed regression of the NPC. The authors concluded that this study supports the use of vision therapy as a successful method of treating CI and CI combined with AI.

In a randomized clinical trial, Scheiman et al. (2011b) assessed the effectiveness of various types of vision therapy for improving accommodative amplitude or accommodative facility in 221 children with deficiencies in these measures at baseline. All types of vision therapy (i.e., office-based vision therapy, HBCVAT+, and HBPP) were superior to office-based placebo vision treatment for improving mean accommodative amplitude. With regard to accommodative facility, only the office-based vision therapy group exhibited a significantly greater improvement than the placebo group. This study did not report the results of symptoms or other clinical signs. One year after completion of therapy, reoccurrence of decreased accommodative amplitude was present in only 12.5% and accommodative facility in only 11%. The authors concluded that vision therapy/orthoptics is effective in improving accommodative amplitude and accommodative facility in school-aged children with symptomatic CI and accommodative dysfunction.

**Vision Therapy for Nystagmus**

No well-designed clinical trials that support the use of vision therapy for nystagmus were identified.

**Vision Therapy for Convergence Excess**

Convergence excess is a sensorimotor anomaly of the binocular vision system, characterized by a tendency for the eyes to overconverge at near.

To evaluate the effectiveness of vision therapy for convergence excess, a common ocular motility disorder, Gallaway and Scheiman (1997) retrospectively reviewed the records of 83 consecutive patients with this condition, seen in two private practices over a 3-year period and treated with vision therapy. The mean age of subjects was 11.8 years, with a range of 7 to 32 years. Therapy consisted of once- or twice weekly 45-minute office visits, and home therapy for 15 minutes 3 to 4 times per week. The mean number of vision therapy sessions was 18.5, with a range of 9 to 32. The investigators observed statistically and clinically significant changes in direct and indirect measures of negative fusional vergence, with 84% of patients reporting a total elimination of initial symptoms. The design of the study, a retrospective case series, and possible patient selection bias limit the value of these findings.

**Vision Therapy for Divergence Insufficiency**

No well-designed clinical trials evaluating the use of vision therapy for divergence insufficiency were identified.

**Vision Therapy for Divergence Excess**

The literature review did not identify any controlled studies evaluating vision therapy for divergence excess. In addition, a 2010 review of intermittent exotropia did not specifically discuss intermittent exotropia of divergence excess type and was not considered further for this report (Thorburn et al., 2010). Thus, few studies specifically evaluated the efficacy of vision therapy for divergence excess exotropia (Hayes Directory Vision Therapy for Accommodative and Vergence Dysfunction, 2011).

**Vision Therapy for Stroke and Traumatic Brain Injury**

Hunt et al. (2016) conducted a systematic review of evidence regarding the use of oculomotor-based vision assessment to identify and monitor recovery from mild traumatic brain injury (mTBI). Their objectives were to (1) identify changes in oculomotor-based vision following mTBI; (2) distinguish methods of assessment; (3) appraise the level and quality of evidence; and, if warranted, (4) determine clinical recommendations for assessment. Articles were included if study populations were clearly identified as having mTBI and used an assessment of oculomotor-based vision. 20 articles met their inclusion criteria (study populations were clearly identified as having mTBI and used an assessment of oculomotor-based vision.). Exploratory findings suggest that measurements of saccades, smooth pursuit, and vergence are useful in detecting changes associated with mTBI. Assessment methods included eye tracker protocols, optometric assessment, and the King-Devick test. The authors noted that the strength of this evidence is not yet sufficient to warrant clinical recommendations. Research using rigorous methods is required to develop reliable, valid, and clinically useful assessment protocols.

In a systematic review of interdisciplinary literature, Klinke et al. (2015) identified rehabilitation interventions that can be integrated into ward-based nursing for patients with hemispatial neglect following stroke in the right brain...
hemisphere. Using 41 original studies, 11 interventions were identified. The selected studies were graded according to the strength of their evidence (Levels 1-5); the proposed interventions were given recommendation grades (Grades A-D). The interventions included right half-field eye patching (Grade D), smooth pursuit eye-movement training (Grade B) and visual scanning training (Grade D). The authors noted that there was general low level of evidence and the diversity of interventions which made it difficult to endorse specific priorities and combinations for implementation.

An overlap of investigators and, presumably, overlap of study participants were found for several studies evaluating vision therapy after traumatic brain injury. Three randomized controlled trials by the same primary author appeared to be reporting data for different endpoints on the same study group (Thiagarajan and Ciuffreda, 2014; Thiagarajan et al., 2014; Thiagarajan and Ciuffreda, 2013). These trials showed improvement with the use of vision therapy but evaluated only 12 patients.

van Wyk et al. (2014) evaluated the effect of saccadic eye movement training with visual scanning exercises (VSEs) integrated with task-specific activities on unilateral spatial neglect (USN) poststroke. A matched-pair randomized control trial was conducted. Subjects were matched according to their functional activity level and allocated to either a control (n = 12) or an experimental group (n = 12). All patients received task-specific activities for a 4-week intervention period. The experimental group received saccadic eye movement training with VSE integrated with task specific activities as an “add on” intervention. Assessments were conducted weekly over the intervention period. Statistical significant difference was noted on the King-Devick Test (P = .021), Star Cancellation Test (P = .016), and Barthel Index (P = .004). The authors concluded that intensive saccadic eye movement training with VSE integrated with task-specific activities has a significant effect on USN in patients poststroke. Long-term follow-up and further studies with larger patient populations are needed to verify these results.

Mizuno et al. (2011) conducted a multicenter, double-masked, randomized, controlled trial to evaluate the effects of a 2-week prism adaptation (PA) therapy on unilateral spatial neglect (USN)). A total of 38 USN patients with right-brain damage were divided into prism (n = 20) and control (n = 18) groups. Patients were divided into mild and severe USN groups according to Behavioral Inattention Test (BIT) parameters (mild ≥ 55 and severe<55). The prism group performed repetitive pointing with prism glasses that induce rightward optical shift twice daily, 5 days per week, for 2 weeks, whereas the control group performed similar pointing training with neutral glasses. The Functional Independence Measure (FIM) improved significantly more in the prism group. In mild USN patients, there was significantly greater improvement on BIT and FIM in the prism group. The authors concluded that PA therapy can significantly improve ADL in patients with subacute stroke. These findings require confirmation in a larger study.

In a Cochrane review, Pollock et al. (2011) determined the effects of interventions for visual field defects after stroke. Thirteen studies (344 randomized participants, 285 of whom were participants with stroke) met the inclusion criteria for this review. However, only six of these studies compared the effect of an intervention with a placebo, control or no treatment group and were included in comparisons within this review. The authors concluded that there is insufficient evidence to reach generalized conclusions about the benefits of visual prisms (substitutive intervention) for patients with visual field defects after stroke.

The Veteran’s Administration (VA) issued a technology assessment for vision problems and interventions for patients with blast-related traumatic brain injury (TBI). The report was a systematic review intended to evaluate 2 issues: (1) The frequency of visual problems associated with mechanisms of TBI and (2) The effectiveness of rehabilitation interventions (including prisms) for vision problems in patients with these mechanisms of TBI. No studies met inclusion criteria for mild TBI. Two studies with controls and one prospective cohort study met inclusion criteria for moderate to severe TBI. All were small studies evaluating various visual rehabilitation interventions. The authors concluded that given the low level of certainty in the study results, there was insufficient evidence to assess the net benefits of the interventions in this review, and if offered, patients should understand the uncertainty about the balance of benefits and harms of the interventions (Veteran’s Administration, 2009).

In a single blinded pilot randomized controlled trial, Turton et al. (2010) evaluated the feasibility of delivering prism adaptation treatment in a clinically valid sample and assessed its impact on self-care in 37 right hemisphere stroke patients with unilateral spatial neglect. The patients were randomized into either prism adaptation (using 10 diopter, 6 degree prisms) or sham treatment (using plain glasses) groups. Treatment was delivered each weekday for two weeks. Thirty four patients received treatment: 16 with prisms, 18 with sham treatment. Mean compliance was 99% and 97%, respectively. Over the treatment days only the prism treated group showed increased leftward bias in open loop pointing to targets on a touch screen. However, despite the group level changes in pointing behavior no overall effect of the treatment on self-care or Behavioral Inattention Test (BIT) were found.

A National Institute for Health and Care Excellence (NICE) guidance document states that eye movement therapy can be offered to people who have persisting hemianopia after stroke and who are aware of the condition. This recommendation was based on a randomized clinical trial (Carter et al., 1983) comprised of 33 participants that showed a statistically significant improvement in the visual scanning (letter cancellation) test and visual spatial tasks
for participants who received eye movement therapy compared to the usual care group. The NICE document indicated that the study had serious limitations and a moderate confidence in effect (NICE, 2013).

**Vision Therapy for Dyslexia and Other Reading and Learning Disabilities**

Dyslexia is a neuro-developmental condition that causes reading difficulties in 5% to 10% of children. A deficiency in processing linguistic units (phonemes) that make up written and spoken words is believed to be the major etiologic factor for dyslexia. Proponents of vision therapy hypothesize that many dyslexics have impaired development of the magnocellular component of the visual system, which is important for timing visual events and controlling eye movements. They believe that poor control of eye movement may cause unstable binocular fixation with unsteady vision and may explain why some patients report that the words move around the page (Stein, 2000).

Hall et al. (2013) conducted a randomized, double blind trial with 73 delayed readers to compare changes in reading and spelling as well as irregular and non-word reading skills after 3 months of wearing either the Harris or the Dyslexia Research Trust (DRT) filters. Reading improved significantly after wearing either type of filter, with 40% of the children improving their reading age by 6 months or more during the 3 month trial. However, spelling ability and non-word reading improved significantly more with the DRT than with the Harris filters. The authors concluded that education and rehabilitation professionals should consider colored filters as an effective intervention for delayed readers experiencing visual stress. According to the authors, this research will help to support the use of colored filters for visual reading capacity but further more rigorous research is needed.

In a double-masked, placebo crossover randomized controlled trial, Ritchie et al. (2011) tested the efficacy of Irlen colored overlays for alleviating reading difficulties thought to have been caused by Irlen syndrome, a proposed perceptual disorder with controversial diagnostic status. Sixty-one school children (aged 7-12 years) with reading difficulties were included in the study. Based on the study results, the authors concluded that Irlen colored overlays do not have any demonstrable immediate effect on reading in children with reading difficulties.

**Visual Perceptual Therapy**

In a prospective study, Yalcin and Balci (2014) evaluated the efficacy of neural vision therapy, also known as perceptual vision therapy, in enhancing best corrected visual acuity (BCVA) and contrast sensitivity function in amblyopic patients. The study enrolled 99 subjects (age 9 to 50 years) previously diagnosed with unilateral hypermetropic amblyopia. 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, the minimal number of subjects required to achieve statistically significant results were enrolled. 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. 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. The authors concluded that the results of the study demonstrate the efficacy of perceptual vision therapy in improving visual acuity. According to the authors, long-term follow-up and further studies are needed to verify these results.

The available data regarding visual perceptual therapy is relatively weak, inconclusive, and derived primarily from uncontrolled or poorly controlled studies with significant methodological flaws. There are no well-designed clinical trials that indicate that visual perceptual therapy is an effective treatment for any type of learning disability or disorder.

**Vision Restoration Therapy (VRT)**

Vision Restoration Training (VRT) aims at improving lost vision by activating residual visual functions by training light detection and discrimination of visual stimuli. This is accomplished by stimulation of areas of partial injury (represented by partially functioning regions of the visual field) might induce synaptic plasticity and thus improvement to lost visual functions. Restoration techniques aim at modifying the visual system itself by lowering the threshold of perception. There has been a vigorous and controversial debate about whether vision restoration is possible at all (Dundon, 2016)

In a prospective, double-blind, randomized, placebo-controlled clinical trial, Sabel and Gudlin (2014) determined if behavioral activation of areas of residual vision using daily 1-hour vision restoration training for glaucoma for 3 months improved detection accuracy compared with placebo. The study participants included a volunteer sample of patients with glaucoma (mean age, 61.7 years) with stable visual fields and well-controlled intraocular pressure. Study interventions included computer-based vision restoration training for glaucoma (n = 15) or visual discrimination...
placebo training in the intact visual field (n = 15). After randomization, 4 patients withdrew from the trial because of mild headaches (n = 2) or lack of time to complete the schedule (n = 2). The primary end point was change in detection accuracy in high-resolution perimetry. Vision restoration training for glaucoma led to significant detection accuracy gains in high-resolution perimetry, which were not found with white-on-white or blue-on-yellow perimetry. Furthermore, the pre-post differences after vision restoration training for glaucoma were greater compared with placebo in all perimetry tests, and these results were independent of eye movements. Vision restoration training for glaucoma (but not placebo) also led to faster reaction time. Vision-related quality of life was unaffected, but the health-related quality-of-life mental health domain increased in both groups. The authors concluded that visual field defects caused by glaucoma can be improved by repetitively activating residual vision through training the visual field borders and areas of residual vision, thereby increasing their detection sensitivity. According to the authors, this trial revealed evidence that visual field loss is in part reversible by behavioral, computer-based, online controlled vision training, comprising a new rehabilitation treatment option in glaucoma. These findings require confirmation in a larger study with long-term follow-up.

In a systematic review, Dundon et al. (2016) evaluated the rationale underlying treatment paradigms in visual rehabilitation and summarized the available evidence with respect to treatment efficacy. The authors observed that sustained improvements require repetitive stimulation which, depending on the method, may take months. fMRI studies have revealed effects within wider distributed networks, i.e., BOLD changes occur not only in the visual cortex, but also in extrastriate areas. In a similar vein, the notion that treatment improvements driven by VST are exclusively driven by compensatory eye movements has been challenged by some recent experimental findings. They concluded that, broadly speaking, visual rehabilitation targeting restoration of a portion of the visual field, appears to represent an optimal approach to address visual field function and size. However, VRT consists of a long-lasting training protocol, which may not suit the life circumstances of all patients.

In a Cochrane review, Pollock et al. (2011) determined the effects of interventions for people with visual field defects after stroke. Thirteen studies (344 randomized participants, 285 of whom were participants with stroke) met the inclusion criteria for this review. However, only six of these studies compared the effect of an intervention with a placebo, control or no treatment group and were included in comparisons within this review. The authors concluded that there is insufficient evidence to reach generalized conclusions about the benefits of visual restitution training (VRT) for patients with visual field defects after stroke.

Jung et al. (2008) evaluated the effects of vision restoration therapy (VRT) on the visual function of 10 patients with anterior ischemic optic neuropathy in a randomized controlled double-blind pilot trial. All patients were evaluated before VRT and after 3 and 6 months of treatment by Early Treatment Diabetic Retinopathy Study (ETDRS) visual acuity, contrast sensitivity, reading speed, 24-2 SITA-standard Humphrey visual field (HVF), High Resolution Perimetry (HRP) (perimetry obtained during VRT), and vision-based quality of life questionnaire. Patients were randomized between two VRT strategies (5 in each group): I) VRT in which stimulation was performed in the seeing VF of the affected eye (“seeing field-VRT”); II) VRT in which stimulation was performed along the area of central fixation and in the ARV (areas of residual vision) of the affected eye (“ARV-VRT”). The results of the HRP, HVF, and clinical assessment of visual function were compared for each patient and between the two groups at each evaluation. Visual acuity qualitatively improved in the ARV-VRT group, however the change was not statistically significant (p=0.28). Binocular reading speed significantly improved in the ARV-VRT group (p=0.03). HVF foveal sensitivity increased mildly in both groups (p=0.059). HRP analysis showed a similar increase in stimulus accuracy in both groups (mean improvement of about 15%). All patients reported functional improvement after VRT. A small study population limits the conclusions that can be reached from this study.

Mueller et al. (2007) performed a clinical observational analysis of visual fields of 302 patients before and after being treated with computer-based vision restoration therapy for a period of 6 months. The visual field defects were due to ischemia, hemorrhage, head trauma, tumor removal or anterior ischemic optic neuropathy. Primary outcome measure was a visual field assessment with super-threshold perimetry. VRT improved patients’ ability to detect super-threshold stimuli in the previously deficient area of the visual field by 17.2% and these detection gains were not significantly correlated with eye movements. Notable improvements were seen in 70.9% of the patients. Efficacy was independent of lesion age and etiology, but patients with larger areas of residual vision at baseline and patients older than 65 years benefited most. Conventional perimetry validated visual field enlargements and patient testimonials confirmed the improvement in every day visual functions. The lack of a control group limits the validity of the results of this study.

**Visual Information Processing Evaluation**

Limited clinical evidence was found to support the use of visual information processing evaluations for diagnosing learning-related or other types of visual deficits.

Goldstand et al. (2005) compared visual and visual-information processing skills between children with and without mild reading and academic problems and examine the incidence of visual deficits among them. Seventy-one seventh
graders classified as proficient \((n = 46)\) and non-proficient \((n = 25)\) readers were compared with respect to scores on an accepted vision screening, on tests of visual-perception, visual-motor integration, and academic performance. Further, academic performance and visual-information processing were compared between children who failed and passed the vision screening. Visual deficits were found in 68% of the participants, and among significantly more boys than girls. Non-proficient readers had significantly poorer academic performance and vision-screening scores than the proficient readers. Participants who passed the visual screening performed significantly better in visual perception than those who failed. According to the investigators, visual function significantly distinguishes between children with and without mild academic problems, as well as on visual-perception scores. The investigators concluded that the high occurrence of visual deficits among participants warrants consideration of vision deficits among schoolchildren with academic performance difficulties. These findings require confirmation in a larger study.

**Professional Societies**

**American Academy of Pediatrics (AAP), Section on Ophthalmology, Council on Children with Disabilities; American Academy of Ophthalmology (AAO); American Association for Pediatric Ophthalmology and Strabismus (AAPOS); and American Association of Certified Orthoptists (AACO)**

According to a joint policy statement issued by the AAP, AAO, AAPOS, and AACO, diagnostic and treatment approaches for dyslexia that lack scientific evidence of efficacy such as behavioral vision therapy, eye muscle exercises, or colored filters and lenses are not endorsed or recommended (American Academy of Pediatrics, 2009; reaffirmed 2014).

A 2011 AAP technical report reinforces the above 2009 policy statement. The 2011 report indicates that vision problems can interfere with the process of reading, but children with dyslexia or related learning disabilities have the same visual function and ocular health as children without such conditions. Currently, there is inadequate scientific evidence to support the view that subtle eye or visual problems cause or increase the severity of learning disabilities. According to the report, scientific evidence does not support the claims that visual training, muscle exercises, ocular pursuit-and-tracking exercises, behavioral/perceptual vision therapy, "training" glasses, prisms, and colored lenses and filters are effective direct or indirect treatments for learning disabilities. There is no valid evidence that children who participate in vision therapy are more responsive to educational instruction than children who do not participate (Handler and Fierson 2011).

**American Academy of Ophthalmology (AAO)**

In a separate policy statement, the AAO maintains that children with possible or diagnosed learning disabilities, such as dyslexia, should undergo a comprehensive eye examination so that any undiagnosed vision impairment can be identified and treated. Such children should be referred for appropriate medical, psychological, and educational evaluations and treatment of any learning disability. The organization states that there is insufficient evidence to conclude that "defective eye teaming" and "accommodative disorders" can be underlying causes of educational impairment (AAO, Vision Screening for Infants and Children, 2013).

The AAO Preferred Practice Pattern Guidelines (2012) for the management of esotropia and exotropia indicate that in some patients with acquired esotropia, prisms are used to promote binocular vision and establish the full angle on which to base extraocular muscle surgery. Patients with intermittent exotropia do not typically have diplopia, so prisms are not generally prescribed. However, some patients with intermittent exotropia also have convergence insufficiency. In these cases, base-out prism can be used during convergence exercises. Training in diplopia recognition (antisuppression training) and strengthening vergence amplitudes is ineffective in the treatment of most esotropic patients and may occasionally produce permanent diplopia, especially in patients with monofixation syndrome. In cases of symptomatic convergence insufficiency exotropia that is refractory to exercises, base-in prism can be included in eyeglasses to improve comfort while reading. Orthoptic therapy may improve fusional control in patients with convergence insufficiency exotropia and with small- to moderate-angle exotropia (i.e., 20 prism diopters or less), with the goal of strengthening fusional convergence amplitudes. Patients with the convergence insufficiency type of exotropia (exotropia greater at near) and asthenopic symptoms with near viewing (typically reading) may be good candidates for orthoptic therapy. Near point of convergence exercises on an accommodative target are useful if the near point of convergence is distant. Convergence exercises with a base-out prism may be beneficial once the near point of convergence improves. Treatment is tapered as symptoms improve, and it may need to be resumed if symptoms recur. Other treatments include computer-based convergence exercises and in-office orthoptics. The AAO Preferred Practice Pattern Guidelines (2012) for amblyopia recommend that most children who have moderate amblyopia respond to initial treatment consisting of at least 2 hours of daily patching or weekend atropine (strong recommendation, good evidence for treatment of amblyopia) and (discretionary recommendation, good evidence for dosage [amount of time] of treatment).

**American Academy of Optometry (AOA) and American Optometric Association (AOA)**

In the AAO and AOA 1999 joint policy statement, vision therapy is described as an effective treatment option for many visual dysfunctions, including ocular motility dysfunctions, non-strabismic binocular disorders, strabismus, amblyopia, accommodative disorders, and visual information-processing disorders (AAO/AOA, 1999). In an earlier, 1997 joint
policy statement on vision, learning, and dyslexia, the AAO and the AOA maintained that while vision therapy does not treat learning disabilities or dyslexia directly, it can improve visual efficiency and visual processing to allow an individual to be more responsive to educational instruction. This statement claimed that, as such, vision therapy should be part of a multidisciplinary approach to learning disabilities (AAO/AOA, 1997). The position of the American Academy of Optometry is that management of learning related vision problems prepares the individual to take full advantage of opportunities to learn including educational instruction, remediation and programming (Christenson 1990).

**American Optometric Association (AOA)**

The AOA issued a statement on the use of tinted lenses for the treatment of dyslexia and other related reading and learning disorders. While research does not support the validity of an actual visual perceptual dysfunction termed "scotopic sensitivity syndrome" (SSS), that has been claimed to cause reading problems and symptoms such as light sensitivity, headaches, blurring of print, and watery eyes, in most patients, the underlying symptoms associated with SSS are related to identifiable vision anomalies, such as accommodative and convergence dysfunctions, which may be responsive to vision therapy. However, since the results of research on the effectiveness of tinted lenses and filters have been inconclusive, the AOA supports further research in carefully controlled clinical studies to investigate the effect that these optical devices may have on a person’s visual function related to reading performance (Williams, 2004).

AOA has issued a clinical care publication on the definition of optometric vision therapy. The document states that research has demonstrated vision therapy can be an effective treatment option for:

- **Ocular motility dysfunctions** (eye movement disorders)
- **Non-strabismic binocular disorders** (inefficient eye teaming)
- **Strabismus** (misalignment of the eyes)
- **Amblyopia** (poorly developed vision)
- **Accommodative disorders** (focusing problems)
- Visual information processing disorders, including visual-motor integration and integration with other sensory modalities
- **Visual sequelae of acquired brain injury**

(American Optometric Association April 2009)

The AOA released a revised guideline on Care of the Patient with Strabismus: Esotropia and Exotropia in 2010. According to the AOA, vision therapy is successful in the treatment of many forms of strabismus. The AOA states that vision therapy or orthoptics involves active training procedures to improve the patient’s fixation ability and oculomotor control, to help eliminate amblyopia, to improve sensory and motor fusion, and to increase facility and the range of accommodation and vergence responses. According to the AOA, the prognosis is most favorable for patients with intermittent strabismus, especially intermittent exotropia, who have sensorimotor fusion at some point in space and those with recently developed strabismus. (AOA, 2010b).

The AOA released a revised guideline on care of the patient with accommodative and vergence dysfunction in 2010. According to the guideline, improvement in both accommodative and vergence adaptation systems is the basis of the success of vision therapy. According to the guideline, data is lacking for the efficacy of home-based vision therapy by itself. Home-based vision therapy may be less effective than office-based therapy, as there is no therapist available to provide motivation or correct inappropriate procedures. Therefore, preferred clinical management involves office-based vision therapy in combination with home therapy. The AOA states that therapy combining diplopia awareness with operant-conditioning technique to reinforce alignment in the absence of visual cues has been advocated for divergence excess. The AOA also states that vision therapy is usually successful in patients with divergence insufficiency (AOA, 2010a).

**U.S. FOOD AND DRUG ADMINISTRATION (FDA)**

Vision therapy is a procedure and, as such, is not subject to FDA regulation. Devices used in vision training programs may be classified under a number of different product codes. Some of these devices may be exempt from the 510(k) clearance process. For information on a specific device or manufacturer see the following Web sites:


Nova Vision™, an attention task performance recorder, received FDA 510(k) approval on April 22, 2003. NovaVision™ presents visual stimuli on a computer screen, for the diagnosis and improvement of visual functions in patients with impaired vision that may result from trauma, stroke, inflammation, surgical removal of brain tumors or brain surgery, and may also be used to improve visual function in patients with amblyopia. Additional information is available at:

REFERENCES

The foregoing Oxford policy has been adapted from an existing UnitedHealthcare national policy that was researched, developed and approved by UnitedHealthcare Medical Technology Assessment Committee. [2016T0072P]


**POLICY HISTORY/REVISION INFORMATION**

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