Article

Vision Therapy In The Modern Behavioural Optometry Practice: The History of Vision Therapy and Contemporary Approaches to Case Selection, Case Management, and the Delivery of Treatment

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ABSTRACT

Vision therapy can be found in the literature under the alternative descriptions of training or exercises; however, these terms imply a substantially motor-based regimen which has a tendency to narrow the scope or understanding to that offered in behavioural optometry. The following document reviews vision therapy as it applies today, with the objective being that of a guideline for optometrists new to, or considering, vision therapy.

Keywords: behavioural optometry, binocular vision, case history, vision therapy, visual information processing

Introduction

Vision therapy (VT) had its documented origins with orthoptic principles by the ophthalmologist Javal in 1865[1] and the first orthoptist Maddox in 1919. Early optometric pioneers such as Sheard, Percival, and Skeffington also began their work in the early 1900s.[2] Office- and home-based vision therapy have remained the general mode of delivery while also being augmented by computer- and internet-based programs. These advances have expanded the options of treatment available. Theories and implementation continue to change, as does the discussion and preference for the varied modalities of treatment.

History

Vision therapy is described as being an extension of traditional orthoptics[2,3] whereby a therapeutic regimen is employed to address a vision disorder concerned with binocular vision or amblyopia. An important difference between the disciplines is that VT involves the understanding of the visual development hierarchy and subsequent integration into the therapeutic programs. Press explains further that optometric therapy "can be habilitative in a developmental framework, preventative as part of ongoing vision care, rehabilitative for visual dysfunction amenable to therapeutic intervention, or enhancing to meet specific, individual needs or goals for maximum visual efficiency."[1] It is understood by this to include visual processing and visual behaviour. A more clinical description of vision therapy by Ciuffreda[4] is "that it involve[s] oculomotor integration with the head, neck, limbs, and overall body with information from the other sensory modalities, producing temporally efficient, coordinated behaviour within a context of harmonious spatial sense under a variety of external and internal conditions and states." Furthermore, the goal is to attain clear and comfortable binocular vision at all times. Contemporary VT is used in sports training, the management of neurological injuries and disorders (Parkinson's, stroke), traumatic brain injury, and amblyopia.

The foundation of VT was laid in the late 1800s as what we would presently refer to as orthoptics. This is defined as "the evaluation and non-surgical treatment of visual disorders caused by imbalance of the eye muscles, such

Table 1: Major Events in the History of Visual Therapy

1928	OEPF formed. Developed regimens for those visual problems not amenable to conventional lens prescriptions.
1930s	Knowledge shared between various professions involved in vision. Improved understanding of influence of lenses on visual perception. VT techniques circulated to OEPF members. Orthoptic organizations formed in U.S., Europe, and Britain. Optometric community divided on vision models of structural versus functional and hence best management.
1940s	VT program circulation increases. Concept of training in free space & natural environment expanded. Application of VT to child development expands.
1950s	Harmon develops model that relates vision to posture & spatial relations.[6]
1960s	VT applied by optometrists to children with learning-related visual difficulties. Pre- and post-treatment criteria for functional cure of strabismus established. VT credibility falls due to perceptuomotor program resemblance and learning performance achievements not realized. Later models involving understanding of intersensory integration rebuilds credibility.
1966	First extensive vision-training instruction manual for professionals produced.
1971	The College of Optometrists in Vision Development (COVD) formed, which established certification, advocacy, and standards for behavioural optometry.
1976	The first optometric textbook on VT from a major author (Griffin) and publishing house is written.
Late 1970s	Interactive computer screens used in VT.
1980s	Random Dot Stereograms (RDS) produced on monitors; computerised programs for VT evolve.
1987	Australasian College of Behavioural Optometrists (ACBO) formed.
1991	Peachey authors seminal article on minimum attention and automaticity goal of vision therapy.
2005	Computer program internet interaction available for practitioner/patient.
2006-present	Commencement of Convergence Insufficiency Treatment Trials for substantiation and evidence-based criterion.[7,8]

as strabismus."[5] According to Press,[2] the French ophthalmologist Javal pursued and formulated non-surgical means for the correction of strabismus. This was followed later by the invention of the amblyoscope in England by Worth. Stereoscopic exercises were introduced in the early 1900s by an American ophthalmologist, Wells. He expanded the use of orthoptics to encompass more than just strabismus correction. Optometry entered the orthoptic arena via Skeffington and Peckham in 1928. They wrote papers on procedures and treatment of binocular functions, respectively.[2] Well-received by his peers, Skeffington went a step further in the same year with the formation of the Optometric Extension Program Foundation (OEPF). Table 1 highlights major events collated from the writings of Press,[1] following this development.

Case Selection

For a behavioural optometrist who intrinsically wants to understand the particular status and requirements of the visual world of the presenting patient, the case history is paramount. Patient questionnaires are often used to determine the individual's history in reference to cognitive development, current and previous medical conditions, vision, and learning. Appendices 1 & 2 are examples of a format used for school-age children.

Patients may present with referral from medical practitioners, teachers, or allied health professionals such as occupational therapists, speech therapists, chiropractors, and physiotherapists. Age and lifestyle will often indicate the priority of information gathered. The developmental history is a prerequisite for the three-year-old, but the 80-year-old recuperating from a stroke would require a sound review of the medical circumstances. Similarly, the working-age patient would likely require investigation of the work environment, ergonomics, work load, and visual expectations.

An example of a thorough case history guiding the behavioural optometrist is when a patient presents with blurred distance vision. Whether the complaint is intermittent or constant, occurs in the morning and/or afternoon, or is associated with or without near activities requires clarification. We then use the retinoscope, which may show anything from

Table 2: Standard Tests and Additional Tests (in italics) as Adapted from Nathan[10]

Standard procedures	Components	Basic equipment
History taking	Presenting complaint, personal details, past ocular history, general health, definition of visual requirements	Vertometer
Physical development	Primitive reflexes	N/A
Assessment of vision	Unaided and aided vision Colour vision Visual fields	Acuity charts suitable for adults and children Pseudoisochromatic plates Diagnostic colour vision test Field screening device
External and anterior eye examination	General inspection Examination of lids and adnexae, conjunctiva and sclera, tears and tear drainage, cornea, anterior chamber assessment, iris, lens Orbit & facial asymmetry, head posture	Overhead adjustable light Magnifying loupe Focal illuminator Slit lamp biomicroscope Staining agents UV light source Gonioprism
Internal eye examination (posterior)	Vitreous, ocular fundus	Direct ophthalmoscope Indirect ophthalmoscope Mydriatic
Refraction	Objective Subjective, distance and near Visual acuity	Retinoscope Autorefractor (optional) Keratometer Trial lens set and frame/refractometer Distance & near acuity charts Range of distance & near low vision aids
Oculo-motor examination	Excursions Cover test, distance & near Convergence (npc) Accommodation (amplitudes) Pupil reactions Binocular vision assessment	Fixation light Near point chart Fusion/stereopsis chart (Randot) Fixation disparity device Trial prisms Prism bar Howell phoria card
Binocular vision assessment expanded	Fixation Correspondence Strabismus quantification Amblyopia quantification Suppression	Ophthalmoscope fixation grid Worth 4 dot far and near Brock string Bar reader Amigo red plate
Accommodation assessment expanded	Lag Lead Facility Stamina	Retinoscope -MEM, book, bell, dynamic Fused & unfused cross cylinder Lens flipper +/-2.00 PRA/NRA
Convergence expanded	Flexibility Range AC/A	Prism bar PRC and reserves NRC and reserves Prism flippers Howell phoria card
Intra-ocular pressure measurement	Instrument tonometry	Applanation or non-contact tonometer Topical anaesthetic Alcohol swabs
Case assessment		
Discussion	Explanation – diagnosis Counselling – prognosis Treatment plan	
Disposal	Further consultation Prescription writing Referral	

minus to plus at distance, to provide insight on visual needs at near. This patient may be ecstatic with -0.50 D to improve acuity, but if accommodative deficiencies are found at near and plano refraction at distance with the retinoscope … a different management plan is indicated.

The developmental history in particular may provide a prognosis and indicate which other professions are likely to be required in

the overall rehabilitation program. As different sensory systems interact at the perceptual level, visual perception can become distorted by these systems;[9] hence, prudent cooperation and referral may be necessary. Having differences in location, facilities, and expertise of the practitioner can make the clientele mix quite different in modern behavioural practices. Vision problems may occur in children with learning difficulties, special populations, or those with acquired or developmental brain injuries.

In general practice, accommodative/convergence problems are quite common. In symptomatic, non-presbyopic patients, the prevalence of accommodative dysfunction is approximately 17%. Amongst children and adults, convergence insufficiency is the most common of the fusional vergence dysfunctions and has a prevalence of 7%. Remediation rates for both exceed 70%.[4]

In 1990, Nathan[10] revised the policy of the Optometric Association of Australia concerning the recommended primary eye care examination by optometrists. Certain additional tests are performed in behavioural practice, and these have been tabulated in italics in Table 2 for comparison. Clinical judgment will dictate which of these tests are applicable for the consultation. It is also recognized that any advancements in equipment or skill, such as topography or therapeutics, would now be included in the primary eye care examination.

Following an initial general visual examination, a visual information processing (VIP) assessment is often scheduled if the functional visual results are within expected ranges but visual performance is not. The following skills are typically reviewed:

Visual spatial – This is defined as the ability to understand directional concepts that organise external visual space. It is required to understand orientation in different symbols (b & d), orientation in space (up, down, left, or right), and the sequence and manipulation of symbols.[11]

Table 3: Visual Information Processing

Visual Spatial	Piaget L/R awareness Jordan's L/R awareness Gardner Reversal Frequency Alphabet Array
Visual Analysis	Divided Form Board Grooved Pegboard Rosner Test of Visual Analysis Skills (TVAS) Test of Visual Perceptual Skills (TVPS) Motor Free Visual Perception Test (MVPT)
Visual Motor	Beery Test of Visual Motor Integration (VMI) Wold Sentence Copy Test
Visual Auditory	Rosner Test of Auditory Analysis Skills (TAAS) Auditory Visual Integration Test (AVIT) Auditory Digit Span Rapid Automatic Naming (RAN)

Visual analysis – A group of abilities used for the recognition, recall, and manipulation of visual information. These allow the judging of similarities or differences between forms and symbols, remembering them, and visualisation.[11]

Visual motor – The ability to co-ordinate motor skills with visual information processing skills such as in writing, drawing, and copying information.

Visual auditory – The ability to process and to link sounds with vision. The primary spoken language is learned informally; however, reading is a deliberate acquired skill[12] that requires integration with speech/hearing for efficient learning.

Table 3 lists examples of tests used in the assessment of visual information processing. Tests will vary according to the age of the child.

Assessment results allow the practitioner to decide what therapy is indicated, how it can be delivered, and in what approximate time frame improvements would be expected. Referral to other health professionals may be required in the integrated global management of the patient.

Case Management

Successful VT is largely associated with how a process is learned rather than what is used in the process to accomplish that goal. This helps to explain the myriad of tools and appliances that are used by practitioners. The procedure or apparatus that the optometrist understands and

Table 4: Examples of Skills and Tools/Activities in Vision Therapy

Accommodation	Loose lens powers, lens flippers, Hart charts, monocular and binocular
Vergence	Loose prisms, prism flippers, anaglyphs, computer programs
Accommodation/ convergence	Brock string, aperture rule, tranaglyphs
Spatial awareness	Yoked prisms, movement therapy (angels in the snow, crocodile swim), arrow charts
Suppression	Lens filters, R/G activities, monocular fixation in a binocular field (MFBF)
Light & colour stimulation	Syntonics, Eyelights
Visual analysis	Geoboards, tachistoscope, parquetry blocks
Occlusion	Patching, opaque filters, lens fogging
Spatial loading	Balance boards, trampolines, walking rails
Peripheral awareness	Chalk boards, Wayne saccadic fixator, Sanet Vision Integrator
Eye movement control	Marsden Ball, Sheet tracking exercises
Auditory loading	Metronomes

feels most confident with often yields the best results. Most modern practices use computer-based therapy, on some level, which allows for the choice of computer VT programs alongside the traditional components involving free space, supportive sensory stimulation such as tactile and auditory input, and proprioception. While there exists a vast array of activities from which to choose, a sample of the tools and activities is listed in Table 4.

Successful management is based on successful planning. A widely used sequential format used in planning is:

Monocular accommodation amplitudes > monocular eye movement control > biocular/ binocular teaming > vergence amplitudes > stereopsis > automaticity of skills.

This sequential format is facilitated with the understanding of using activities that deal with learned and innate skills required for visual function. For ease of grasping this concept, these processes have also been referred to as top-down and bottom-up strategies,[13] whereby actions can be initiated through thought (psychoanalytical) or externally through an ocular response to a stimulus.

While proceeding through the program, the addition of temporal awareness in the form of a metronome or clapping may be required, especially for children with reduced attentiveness or impulsiveness. Most behavioural practices[14] commence a program with a standardized format and then modify/customize according to the progress measured and in accordance with this overall understanding.

The management of patients with special needs, including those with acquired head injury, will often require special considerations. Kenefick[15] wrote that after ruling out pathology and assessing refractive error, the best approach may be to concentrate on areas that are trainable and provide a patient with useful skills. Correction of a refractive error should relate to the visual demands of the individual, and any VT should relate to the activities of the time and also future possibilities that may benefit from skill development. Specialised equipment may not be required; however, a keen imagination is of great assistance. Reviewing the therapy environment[16] is a consideration for a child with a mental disability, as he/she will have an easier time tracking an object with fewer distractions in the room. For example, removing noise or unrelated visual stimuli may be required.[17]

Delivery of Treatment

The duration of therapy will depend on what is regarded as a successful outcome. Alleviation of the presenting symptoms without improving the ranges of visual skills will require less time but will not necessarily protect against a relapse under times of renewed visual demands. Birnbaum[6] commented that "minimal therapy produces minimal results." Success can mean different things to different people. This author's definition of success is having achieved the patient's or parent's goals as determined at the initiation of therapy and to have established sufficient robustness to maintain these goals. Long- term success may require on-going support. This success may not always measureable by scales or numbers but rather by subjective comfort,

Table 5: Therapy Timelines as per the ACBO Survey

Average vision therapy program duration	3-4 months (12-24 visits)
Therapy techniques per session	4-6
Average time per therapy session	30–45 minutes
Average frequency of OBVT sessions	Twice weekly
Time planned for HBVT as part of OBVT program	15-20 minutes daily, 5 days/wk
Scheduled review of progress	6-8 visits

ease of concentration, cosmetic appearance, endurance, or performance changes.

A review of the texts[2,5,11] and a sample poll of ACBO fellows in Australia produced the following summary on therapy timelines found in Table 5.

Important to Birnbaum[6] is that modifying the degree of difficulty within the correct sequence of a program is essential for a positive outcome, which underlines the necessity of office- based vision therapy (OBVT) as opposed to home-based vision therapy (HBVT). Goss et al.[18] found a significant improvement in reading skills with one computer program as long as the recommended training protocols on accommodation and vergence function were completed. Peachey[19] found, in a retrospective study that compared HBVT to OBVT, that OBVT had a three times better cure rate, required less time to achieve correction, and caused less stress on family dynamics. Other separate studies by Scheiman et al.[7,8] and Birnbaum et al.[20] also found greater success with OBVT compared to HBVT. Confusingly, Scheiman,[11] in another text, also stated that whether therapy took place at home or the office was less important as long as it was effectively administered at home. He wrote that home compliance was easier now that computer programs were available, which may not have been the case in earlier studies.

Prior to computer programs, any HBVT effectively delegated the role of a vision therapist to a home helper (invariably a parent) who did not necessarily have the time or competence to implement the program successfully.[2] With computers, this effectiveness relies more on the strength of the software.

The unreserved use of computer programs is not without some degree of controversy. Behavioural optometry has, in its basic philosophy, the tenets of posture, balance, movement, proprioception, free space, and natural environment. Performing seated VT with intangible targets at a fixed working distance challenges these principles unless augmented by free-space proprioceptive activities. In this author's experience, screen-based tasks often exacerbate near-point stress, so the use of this mode of delivery requires appropriate planning and management.

Cooper[21] explored the advantages of computer-based vision therapy. He found in some cases that this mode of delivery brought success over traditional therapies of vectograms, stereograms, and synoptophore targets, especially with non-communicative or reduced-attention children.

Birnbaum[5] advises that "vision training is most effective when a broad variety of procedures is applied, since variety facilitates transfer of learning and generalisation of skills, as opposed to the development of splinter skills." As such, it is less important as to what procedures are employed but rather the variation used to maintain interest and cognitive challenge to the goals at hand. The challenge includes, at times, taking a step back in the difficulty of an activity to ensure that the mindset remains positive.

While a best outcome should be the primary goal of the practitioner, a number of factors may influence this delivery decision. Examples include:

- Equipment at hand to use in-office, to sell, or to loan to patient
- Available office space to demonstrate, to conduct, and to review procedures
- Available trained staff to delegate or to assist with program elements
- Travel time or distance to office by patient and family
- Family dynamics – authoritarian parenting style, sibling distractions, parent teaching abilities, financial status

- Length of VT program and related costs
- Computer/internet competence and availability
- Availability of other practices with VT facilities
- Availability of other allied health professions, e.g. occupational therapy

The decision-making process then proceeds to the following options:

- OBVT with vision therapist
- OBVT without vision therapist
- OBVT + HBVT with loan equipment (HBVT may be in the form of a computer program[22])
- HBVT with loan equipment
- HBVT with computer program and reviews
- HBVT with computer program linked to internet and reviews
- Co-management with other allied health professions

Arguably, the most sustainable and effective method of conducting OBVT in a busy practice is with the use of a vision therapist. Vision therapists are either staff accredited via training through the behavioural colleges, staff trained in-house, or employed orthoptists with further training in aspects of behavioural optometry.

Office-based training without a therapist may allow for maximum observation and control of a program by the optometrist but can be difficult due to the time constraints on a solo practitioner. The adjunct of computer therapy may assist in this situation.

The option of co-management requires the development of rapport and understanding. Feedback and timely review is paramount to positive progression and appropriate sequencing of a program, of which the control is the responsibility of the initiating behavioural optometrist. Conflicting philosophies on management would be certain to stifle or to negate a good outcome. Important to this distinction is that behavioural optometry offers optometric vision therapy. The use of lenses, prisms, and filters in VT remains in the domain of optometric practice, as opposed to the more limited resources of other professions. As such, the methodology will often vary in depth and measurement of treatment and subsequent robustness of outcome.

Conclusion

The practice of behavioural optometry offers expanded services to the patient with respect to the prevention and rehabilitation of visual disorders and enhancement of visual efficiency. This generally refers to VT, which is most often conducted in-office by trained staff or accredited vision therapists with the collaboration and supervision of an experienced optometrist. The most varied aspect between practices is that of delivery of the therapy. The efficacy of office-based versus home-based therapy with or without computer programs continues to be debated. In keeping with the philosophy of behavioural optometry and applying this to the demands and restraints involved in running a modern successful practice, consensus dictates a balanced approach involving all aspects of delivery. Clearly stated and understood expectations followed by a supervised management plan involving all of the tools applicable and available to the optometrist will deliver a successful outcome to our patients. As vision is a dynamic sense, it should be managed in a dynamic and interactive way for maximal potential and results.

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References

1. Roper-Hall G. Historical Vignette: Louis Emile Javal (1939-1907): The Father of Orthoptics. Am J Orthoptics 2007;57:131-6. http://bit.ly/1PK9xpI
2. Press LJ. Applied Concepts in Vision Therapy. St. Louis, MO: Mosby, 1997: 2-6,26. http://bit.ly/1ol3NIL
3. Peachey GT. Perspectives on optometric vision training. J Behav Optom 1990;1:65-70. http://bit.ly/20jLQGb
4. Ciuffreda KJ. The scientific basis for and efficacy of optometric vision therapy in nonstrabismic accommodative and vergence disorders. Optometry 2002;73:735-62. http://bit.ly/HLEClients
5. Answers.com-Definition of orthoptics http://bit.ly/1Q55DKc. Last Accessed November 2, 2012.
6. Birnbaum MH. Optometric Management of Near Point Vision Disorders. Boston, MA: Butterworth-Heinemann, 1993:73,288,296. http://bit.ly/1okV6xY
7. Scheiman M, Mitchell GL, Cotter S, Kulp MT, et al. Randomized Clinical Trial of Vision Therapy/Orthoptics versus Pencil Pushups for the Treatment of Convergence Insufficiency in Young Adults. Optom Vis Sci 2005;82:E583-E595. http://bit.ly/1T8w8yp
8. Convergence Insufficiency Treatment Trial Study Group. Randomized clinical trial of treatments for symptomatic convergence insufficiency in children. Arch Ophthalmol 2008;126:1336-49. http://1.usa.gov/1YcHlS9
9. Howell ER. Educational implications of visual dysfunction. Behav Optom 1990;2:3-21.
10. Nathan J. Recommended primary eye care examination. Clin Exper Optom 1990;73(4):132-5. http://bit.ly/20jMd3A
11. Scheiman M, Rouse M. Optometric Management of Learning-Related Vision Problems. St. Louis, MO: Mosby, 2006:45,49,475-6,498. http://bit.ly/1Q3l27m
12. Forrest E. Visual Imagery: An Optometric Approach. Duncan, Oklahoma: Optometric Extension Program Foundation, 1981.
13. Peachey GT. Minimum attention model for understanding the development of efficient visual function. J Behav Optom 1991;2:199-206.
14. Sample poll of ACBO fellows by correspondence, May 2009.
15. Kenefick J. Behavioural optometric care for the rehabilitation of CVA trauma and other stable brain compromised vision disorders. Behav Optom 1990;6,:23-36.
16. Duckman RH. Vision therapy for the child with cerebral palsy. J Am Optom Assoc 1987;58:28-35. http://bit.ly/1nSNrGP *abstract only
17. Harris PA. Diagnosis and Treatment of Oculomotor Dysfunction. In: Taub MB, Batuccio M, Maino D, eds. Visual Diagnosis and Care of the Patient with Special Needs. Philadelphia, PA: Lippincott Williams & Wilkins, 2012: 195-216. http://bit.ly/1SZCbUX
18. Goss DA, Downing DB, Lowther AH, Horner DG, et al. The effect of HTS vision therapy conducted in a school setting on reading skills in third and fourth grade students. Optom Vis Dev 2007;38:27-32. http://bit.ly/1Sbfb6k
19. Peachey GT. Effectiveness of vision therapy as influenced by the delivery mode. J Behav Optom 2004;14:91-7. http://bit.ly/1Lb99ey
20. Birnbaum MH, Soden R, Cohen AH. Efficacy of vision therapy for convergence insufficiency in an adult male population. J Am Optom Assoc 1999;70:225-32. http://1.usa.gov/23SKg2N *abstract only
21. Cooper J. Review of computerized orthoptics with specific regard to convergence insufficiency. Am J Optom Physiol Opt 1988;65:455-63. http://bit.ly/1KAV7rx
22. Cooper J. Computerised vision therapy for home and office treatment of accommodative and vergence disorders, and amblyopia. J Behav Optom 2007;18:88-93. http://bit.ly/1UY8rqx

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