Low Plus Prescriptions - Summary of Evidence

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Behavioural optometrists use low plus prescriptions to optimise near vision performance, based on well-established clinical regimes of assessment of refraction, accommodation function, distance and near phorias, and vergence function, in relation to the symptoms and visual performance issues of individual patient concerns.

This is based on the behavioural concept that refractive deviations from the norm of minimal hyperopia, such as myopia; and binocular vision dysfunctions, such as esophoria and high exophoria; develop as a result of gradual adaptations over time of the complex visual system to frequent and sustained episodes of near visual demand, such as reading, computer and I-device use. This can cause fatigue of accommodative and vergence accuracy, with near vision-related signs and symptoms, effects on visual performance, and gradual adaptation to the physiologically adverse task demand, or task avoidance in some cases.

This concept is different to the traditional optometric and ophthalmological concept that refractive errors and binocular vision dysfunctions just happen for no reason, a surprisingly unscientific concept which is rapidly being eroded as a result of research into development of the worldwide epidemic of myopia.

Case analysis in a behavioural approach may point toward a low-plus prescription for select patients in the absence of abnormalities detected using a traditional optometric approach.

In their textbook on Clinical Pearls in Refractive Care, used as a primer for their course at the State University of New York's College of Optometry, Werner and Press point out the limitations of traditional optometric case analysis for a wide variety of conditions, and the importance of considering a behavioural approach [1].

Behavioural optometrists commonly employ, as do other optometrists and some ophthalmologists, near retinoscopy to objectively measure the accuracy, equality, stability or fatigue, and response to lenses, of the accommodative system.

Different powered lenses can be trialled with near (sometimes called dynamic) retinoscopy to aid in determining the best prescription for reading, computer use and iPad and iPhone use, as

distinct from the limited distance refraction traditionally employed by many. The technique is used by many optometrists who work with children and adults with near vision symptoms.

Dr David Lee Guyton, Professor of Pediatric Ophthalmology, John Hopkins University School of Medicine states "The technique (of near retinoscopy) has been extensively investigated by the optometric profession….. It can be of value in screening infants for astigmatism and anisometropia, in detecting incomplete cycloplegia (paralysis of focus), in detecting abnormalities of accommodation (focusing ability), and probably in determining the treatment strategy for eyes with amblyopia (lazy eye) and deficient accommodation." [2]

Boston Children's Hospital Professor of Ophthalmology Dr David Hunter writes "This clinical tool can provide critical data that can help solve treatment dilemmas, such as when a child presents with high hyperopia (long sightedness) or when a patient presents at any age with possible accommodative insufficiency (focusing inaccuracy)." [3]

There are indications that uncompensated hyperopia can interfere with the reading and learning process, and therefore plus lens application may be considered even in the absence of symptoms – particularly among children who are receiving special education services. Research from Quaid and Simpson in Canada looked at the nature of hyperopia in students with IEPs (Individualized Education Plans in Special Education Servies) as compared to controls. The IEP group had significantly greater hyperopia relative to the control group on cycloplegic examination. Furthermore, vergence facility was significantly correlated to (i) reading speed, (ii) number of eye movements made when reading, and (iii) a standardized symptom scoring system. Vergence facility was also significantly reduced in the IEP group versus controls. Significant differences in several other binocular vision related scores were also found [4].

Larabee and Jones (1980)[5] looked at the relationship between the application of low plus reading lenses and the improvement of performance at a child's near working distance. Statistically significant behavioural changes were associated with wearing the low plus-power reading lenses while performing the near paper-and-pencil task.

Greenspan (1990)[6] demonstrated clinically significant improvement in overall visual efficiency using low plus lenses relative to the subject's ametropia correction. In other words, if a person needed glasses for correction of a refractive condition such as myopia or astigmatism, they had improved visual efficiency on near tasks if a low plus lens power was

added to their correction. The data for all subjects suggested trends related to the relative lens power, and in this case the lens powers were low plus. These trends featured systematic alterations in near point working distance and performance with reference to a critical low powered plus lens approximated by dynamic retinoscopy for each subject[7].

Subsequently, Iyer and Harris (2013)[8] demonstrated that low plus lenses had a significant positive effect on reading comprehension as well as improving reading speed for all subjects ($p<0.001$). Objective data for this study was obtained using infrared eye movement recording devices, and the "N" for the study was large enough for these finding to be quite clinically significant.

Work in the area of the use of low plus prescriptions for accommodative-convergence dysfunctions continues, with well - established textbooks and a plethora of papers showing strong evidence for models of accommodative convergence dysfunction, and application of low plus lenses where indicated by competent clinical assessment.

Low Plus and Myopia

Behavioural optometry concepts hold that "the near work demands imposed by our culture are incompatible with our physiology and provoke a stress response characterised by a drive for convergence to localize closer than accommodation". As a person works to meet the demands of our culture, the physiological stress response triggers or manifests as convergence being postured closer in space than to the location to where accommodation is responding. This results in the measurement of esophoria at near when the person is under prolonged near vision demand. This same observation is supported by evidence from Goss (1991)[9]. However, one must be clear that the measurement of the "esophoria at near" by no means suggests that the esophoria itself is the causative agent of progressive myopia, rather it is a result of a pattern of accommodative and vergence dysfunction.

Evidence suggests (Gwiazda et al., 2003)[10] that substantial reading additions (e.g. +2.00 D) provided to pre-presbyopic patients can slow the progression of myopia by a statistically significant amount.

There is now a good deal of evidence showing that more plus addition can slow myopia progression in patients with esophoria at near (Goss,1991[11]; Fulk et al.[12] , 2000; Brown et al.,

2002)." In these studies, low plus lenses at near were prescribed to just eliminate the esophoria, based on the principles of behavioural optometry.

Regarding the effect of plus lenses at near and the progression of myopia, Goss and Rainey provide evidence of the impact of plus lenses, particularly when there is esophoria at near. They note, and this is a crucial point, that a limitation of much research on the effect of a plus lens addition on myopia progression, is that an arbitrary plus lens value or addition at near is used for all subjects rather than individualizing these powers based on their plus lens acceptance profile [13].

A study of over 5,000 eyes by Huang et al (2016)[14] showed that a range of interventions can significantly reduce myopia progression when compared with single vision spectacle lenses or placebo. In terms of refraction, atropine, pirenzepine, bifocal soft contact lenses and progressive addition spectacle lenses were all found to be effective in slowing myopic progression. Pharmaceutical intervention was most effective, but the secondary side effects on accommodation later in life, and other problems have led to limited application of some of these approaches, although the use of low dose atropine is gradually building a clinical and research support.

Gifford has recently published a comprehensive review of contact lens management of myopia, in advance of her PhD completion, on current understanding of theoretical and clinical aspects of myopia, in which she states "standard single vision spectacles, rigid contact lenses and soft contact lenses do not offer any useful myopia control effect" [15].

Mainstream Optometry and Low Plus Lenses

There are different approaches to use of low-plus corrections in pre -presbyopic individuals, particularly in children (e.g. Donahue, 2004[16]; Robaei et al., 2006[17]; Ip et al, 2006[18]; Filips, 2008[19]). For example, in a recent, large-scale study of over 2300 12-year-old Australian children, Robaei et al. (2006) concluded by saying that the recommendation by the American Optometric Association for the use of plus lenses for the treatment of convergence excess, accommodative insufficiency, or in-facility, ill-sustained accommodation, or spasm of accommodation, is a practice that is well reflected in their study population in Australia.

It should be noted that Filips firmly refuted the Robaei articles, citing several major important flaws in the study, most of which simply reflect worldwide philosophical differences between

the approaches of ophthalmology and optometry at large. As noted, the American Optometric Association represents all optometrists in the United States and their Clinical Practice Guidelines clearly indicate that low plus lenses are recommended for a number of conditions, and that this is not a disparate behavioural optometric stance.

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