By Doing Eye Exercises Can you Really Throw Away your Myopic Correction?

Author:
Kathryn Thompson, DipApSc(Orth) DOBA
GradCertHealthScEd MAppSc(Orth)
Elaine Cornell MA Macq DipApSc Cumb PhD DOBA
Nathan Moss BSc(Hons) PhD

Address for Communication:
Kathryn Thompson, School of Applied Vision Sciences
Faculty of Health Sciences
University of Sydney
PO Box 170, Lidcombe NSW 2141
AUSTRALIA

ABSTRACT

Traditionally the correction of refractive error has primarily involved the use of spectacles, contact lenses or more recently refractive surgery. Vision therapists have proposed that visual blur caused by uncorrected refractive error, is a result of strain and stress by extra-ocular muscles and claim that ocular exercise regimes to alleviate such stresses are capable of altering adult refraction to the extent that no optical correction is required (Bates, 1920). However, there is little scientific evidence to support these claims.

Procedure

A study of 15 adults (18-53 years) who had myopic refractive errors were randomly assigned to one of two exercise regimes of similar duration (3 weeks). One treatment was based on the Bates method or Natural Vision Therapy (NVT) and the other used the Cam stimulator as a control therapy.

Results

While the subjects of this study were highly motivated to improve their visual function there were no statistically significant changes in refractive error with either form of treatment for spherical refractive error between NVT and Cam Stimulator treatments ($F(1,11) = 1.386, p = 0.264$). No significant main effects were found for spherical refractive error in either pre to post treatment ($F(1,11) = 0.438, p = 0.522$) or treatments ($F(1,11) = 0.035, p = 0.855$).

Discussion

A majority of participants reported perceived improvements in visual acuity and overall visual performance. However, objective measurements of visual acuity and eye muscle function revealed no significant alteration from baseline measurements. The reported improvement may be attributable to an increased tolerance of visual blur in some environments, and to the anticipation of improvement through ocular exercises as part of a belief that glasses were not remedial.

Key words: refractive error, vision therapists, Bates method

INTRODUCTION

Ametropia can be defined as an anomaly of the optical state of the eye where parallel light rays do not come to a focus on the retina specifically, the second principal focus of the eye does not fall on the retina when the eye is in a state of rest and subsequently results in blurred vision.[1,2] There are three main forms of ametropia. Hypermetropia or long sightedness is often described as an eye lacking in refractive power with the second principal focus behind the retina.[2] Myopia or short sightedness is described as a "powerful eye" where the second principal focus lies in front of the retina. Finally astigmatism is where the refractive system is such that no single focus of light on the retina occurs in an uncorrected state due to a non spherical surface, this primarily being the cornea. The causes of these refractive anomalies are multi-factorial with Genetics and environmental factors influencing the refractive status. Furthermore refractive status is not static by nature as it changes with age and developmental growth.[3]

As the prevalence of refractive error, particularly myopia is increasing [3,4] researchers are examining not only the causes of this irregularity but also available interventions to prevent its onset and progression. Interventions which have been trialed include optical methods such as under or over prescription of lens power[5], bio feedback training, [6] the use of bifocal[7] or varifocal glasses[8] and pharmacological cycloplegic agents[8]. Refractive correction with optical methods including glasses, contact lenses and refractive surgery can successfully correct refractive error, however these are not methods of preventing the disease or its progression.

Natural Vision Therapists or Vision Trainers claim that they have found success in the prevention and progression of refractive error using non optical methods including relaxation techniques and eye exercises. The origins of natural vision therapy (NVT) can be attributed to Dr.W.H Bates (1920)[9]. The Bates method was based on clinical observations that stress and strain on the extra ocular muscles appeared to cause a change in the shape of the eyeball and subsequently a change in the refractive state of the eye. The principles of the Bates method and its claims have yet to be empirically tested as there are very few scientific studies that have been conducted or reported in refereed journals. Farraway (1994)[10] studied a form of vision training derived from the Bates Method. This study did not reveal significant change in refractive status post treatment, however, it did highlight the need for further study and also identified the side effects of the treatment. In this study a high incidence of subjects self-reported adverse symptoms including headaches, pain and nausea. The dissemination of information pertaining to the practice and reported outcomes of vision training is primarily through self-publication and internet web sites.

The programs used by natural vision therapists are designed to modify the effects of environmental factors believed to impact on refractive status. They aim to relieve ocular stress and improve vascular circulation to the head and ocular structures. The treatment format encompasses at least some if not all of

the following practices: eye exercises, relaxation techniques, nutritional, spiritual and or mental guidance and spinal manipulation.[11-18]

In recent years, there has been a shift towards "natural" alternatives to traditional medical therapy. Studies of the use of alternative medicine have demonstrated significant increases in their provision and usage and an associated increase in expenditure. This shift is also evident with increased interest from the public and general medical practitioners[19,20]. Despite the international increase in the use of alternative medicine most alternative therapies have not been subjected to rigorous scientific evaluation [21].

While the outcomes of most alternative therapies have not been established the question remains as to why so many people are following the trend towards these remedies. Ernst and Herxheimer (1996)[22] suggested that patients who use both mainstream and alternative medicine report improved patient satisfaction with an alternative therapeutic encounter. Astin (1998)[23] investigated predictors for alternative medicine constructing a theoretical model to account for the increase in alternative health care use. The findings support a theory of "philosophical congruence" with individuals embracing health care that maintains a holistic or spiritual approach. MacLennan, Wilson and Taylor (1996)[24] profiled the Australian alternative medicine consumer as young, well-exercised, optimistic and residing in the country therefore not representing the chronically ill or disabled as predominant users.

Ernst et al[22] identified the need for research investigating placebo effects to distinguish benefits of mainstream and alternative practices. Recognition of any differences (likely non specific effects) with possible benefits are to be further studied, incorporated and subsequently optimised in mainstream medical practice.

It was the intention of this study to investigate whether any changes to: refractive error (quantified as a change in the dioptric power of the eye), visual acuity (quantified as a change in logMAR acuity) and factors which may affect ocular comfort (quantified as a change in accommodation and convergence values) occurred in participants who undertook a course of natural vision therapy (NVT) and a control treatment.

DESIGN

A within subjects' design was used with all subjects completing two treatments (Vision therapy and Cambridge stimulator [25]). Study protocol involved a daily home training schedule whilst without wearing refractive correction. An experimental period lasting eight weeks (six of active treatment) was conducted as existing literature (although often reporting instant improvement) suggests that this time should allow clear improvements to be witnessed [12]. To control for order effects, participants were randomly allocated into the two treatments treatment A was the NVT and treatment B was the Cambridge stimulator (CAM).

During the experimental period there were five observation periods where measurements were taken. To decrease any possible carry over effects of treatments, a one-week rest period where no treatment was conducted was given between each treatment period as follows:

Observation 1 = Pre measurements before commencing either treatment A or B

Observation 2 = End of treatment A or B after 3 weeks of continuous treatment

Observation 3 = Pre measurement before commencing either treatment A or B

Observation 4 = End of treatment A or B after 3 weeks continuous treatment

Observation 5 = Final measurements after completing both treatments and one week without any treatment.

Schematically this is represented below:

Key O = Observation X = continuous treatment

O1 XXX02 03 XXX04 05

SAMPLING

Subjects were recruited from within a University environment and were invited to participate in this study. All subjects were personally motivated to improve some aspect of their vision or lifestyle. Inclusion criteria were as follows: no previous history of vision training, a refractive error of any type and dioptric power corrected by either glasses or contact lenses, a willingness to participate in an eight week treatment program, be 18 years or over.

Fifteen participants took part in this study (three males and twelve females) aged between eighteen and fifty three years (mean = 31 years 2 months, SD= 14.1785). Twelve participants completed the entire treatment course within the treatment periods and the statistical analysis was based on these results. The three remaining participants completed one of the treatments and withdrew from the study citing work and life-related demands on time as their reasons for discontinuance. All of the participants naturally presented as having a myopic refractive error with or without associated astigmatism.

Pre treatment spherical refractive error ranged in strength from –0.75 DS to –13.75 DS with the mean spherical error being –3.71DS for all eyes. Pre treatment cylindrical error ranged in strength from +0.25 DC for all eyes with the mean cylindrical error + 0.76DC.

A calculation of an appropriate sample size to give relevant statistical power for this study was undertaken using the method described by Murphy and Myors (1998)31. Calculations indicated that for a sample where N = 15 it provides an F equivalent of 8.96 that extrapolates to a power of 79.4%, therefore it was planned to have a sample of 15 subjects. Even if the number of subjects was as low as N =10 this would still give power in excess of 0.8 with an effect size of 1. Given Bates' claims this is not unreasonable.

METHOD

Prior to commencing participants were asked a series of questions to establish present ocular comfort, present optical correction and satisfaction with this method of correction, as well as their motivation to participate in the current study.

At baseline and post treatment, measures of refractive error and keratometry readings were taken with the Humphrey Auto Refractor (Hark 599). Three measurements were taken of each eye and the mean was calculated for use in data processing. The corrected and uncorrected visual acuity of each subject

was assessed using a six metre direct LOGarithm of the Minimal Angle of Resolution chart (logMAR). The luminance over the chart was checked using a light meter (Sekonic Auto Lumi model L –158) and held constant within the range of 13001x (standard room lighting). A subjective refraction was performed at the baseline and post treatment. The convergence near point (CNP) was quantified using the RAF rule or a millimetre ruler with the amplitude of accommodation being assessed with the RAF rule (binocularly and monocularly where applicable).

To control for extraneous variables a number of parameters were held constant during the testing environment, namely the examiner, instructions given and instruments used were the same for all measures. Where possible the appointment time for each participant's return visit was the same.

The natural vision treatment consisted of the following sets of daily exercises involving warm up (sunning), relaxation (palming), active exercise (swinging, shifting and visual memory, tromboning and the modified eye exerciser) and concluded with relaxation. Subject specificity was ensured with the NVT program tailored to meet individual needs such as the distance of the vision chart, eye exerciser and fixation targets. A daily exercise session was timed to take an average of twenty-five minutes (first 2-3 days of the first treatment week) decreasing to around fifteen minutes once participants were familiar with each exercise.

The Cam Stimulator was performed as a daily treatment session for a minimum duration of five minutes. For each of the treatment weeks a different size grating was used. There was no clinical reason for the use of the varied gratings in this study other than to show participants some degree of progression, prevent boredom and increase the face validity of the treatment.

For both treatments all participants were supplied with an exercise calendar to record their daily compliance and comments regarding symptoms (description, onset duration, location and severity of the symptoms and other associated signs ie nausea, neck stiffness and possible relief).

Analysis

With each subject receiving both treatments, measurements of refractive error were taken pre and post treatment. The measures of both spherical and cylindrical components were separately analysed with a repeated measures analysis of variance (ANOVA) using planned comparisons this controls for familywise type I error rates. As no treatments were directed at modifying the corneal shape and surface the axis of the cylinder was not analysed. Each eye was analysed as a

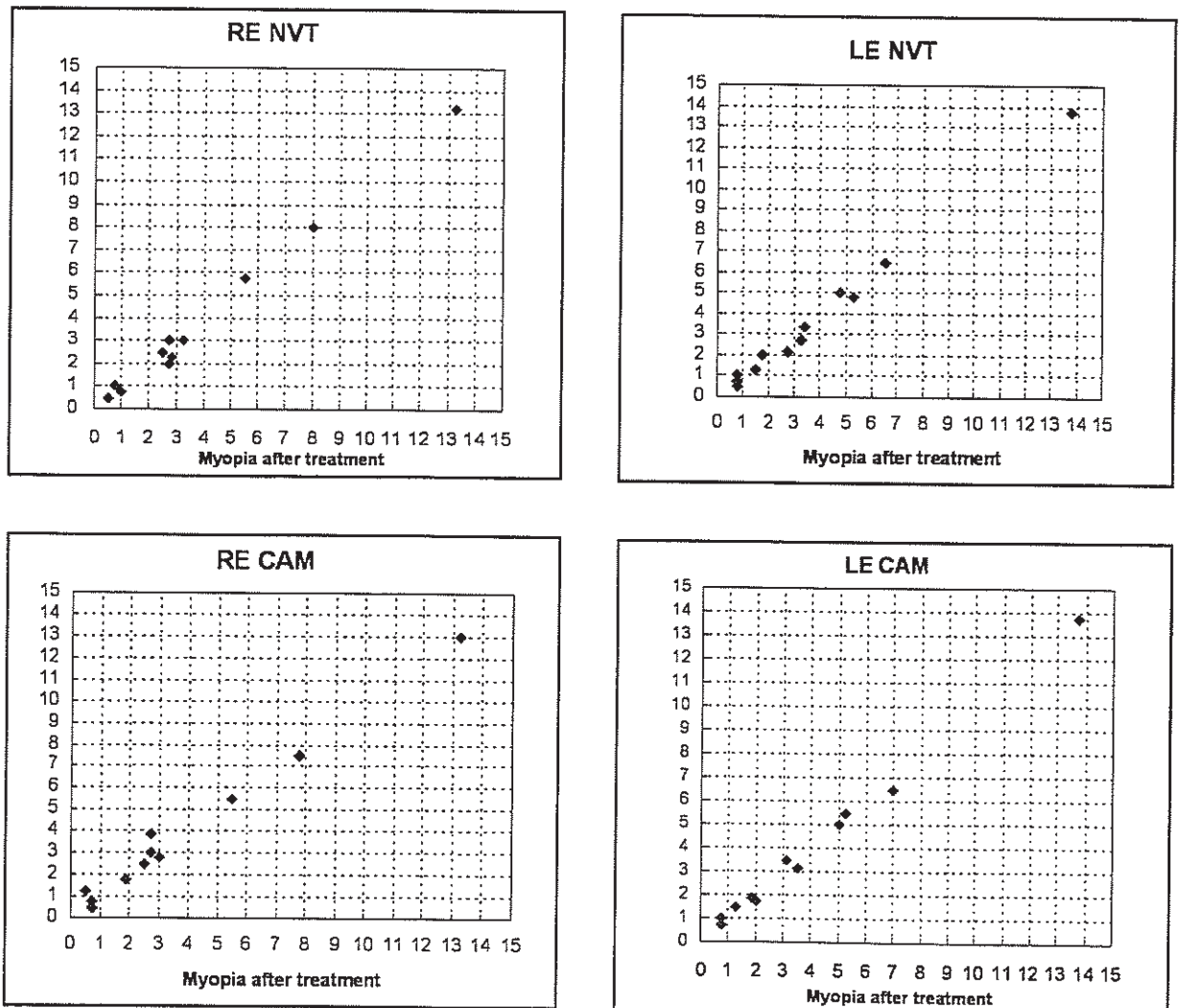

Figure 1 spherical myopic refractive error (DS) pre and post NVT and Cam stimulator treatment for both Right and Left eyes.

separate repeated measure in the analysis, therefore preserving the variance of both eyes (Newcombe & Duff, 1987).26

RESULTS

As noted in the methods section the individual motivations of participants to undertake treatment was addressed by interview. Table 1 lists the responses to this question. It is worth noting that some participants gave more than one reason.

Table 1 Participant motivations for treatment

Reason	Frequency of response
Go for periods without glasses and not feel the restriction of them.	2
Improve clarity of distant images.	1
Improve the health of the eye/s	1
Improve comfort and reduce symptoms of headaches.	3
Prevent the progression of myopia.	3
Go without glasses for social reasons whilst still maintaining clear vision	1
Tired of glasses and belief that there is minimal harm by participating	1
Problems wearing glasses for sport and exercise.	2

No significant interaction was found for spherical refractive error between NVT and Cam Stimulator treatments ($F(1,11) = 1.386, p = 0.264$). Similarly, no significant main effects were found for spherical refractive error in either pre to post treatment ($F(1,11) = 0.438, p = 0.522$) or treatments ($F(1,11) = 0.035, p = 0.855$). This can be further seen in Figure 1 where each participant's refractive error is plotted before and after treatment, with the diagonal line representing no change. Participants did not consistently vary from this line.

No significant interaction was found for cylindrical refractive error between NVT and Cam Stimulator treatments ($F(1,11) < 0.001, p = 1.000$). Similarly, no significant main effects were found for cylindrical refractive error in either pre to post treatment ($F(1,11) = 0.319, p = 0.584$) or treatments ($F(1,11) = 0.330, p = 0.577$). This can be further seen in Figure 2 where the diagonal line represents no change. Participants again did not consistently vary from this line.

As the focus of this study was to detect a change in refractive error, an analysis of many variables when the sample is small is undesirable. This type of analysis weakens the statistical power of the test and capitalises on chance to reveal a statistical difference. The results of the following variables are reported descriptively: pre and post treatment subjective refraction results, visual acuity; keratometry readings; accommodation; and convergence.

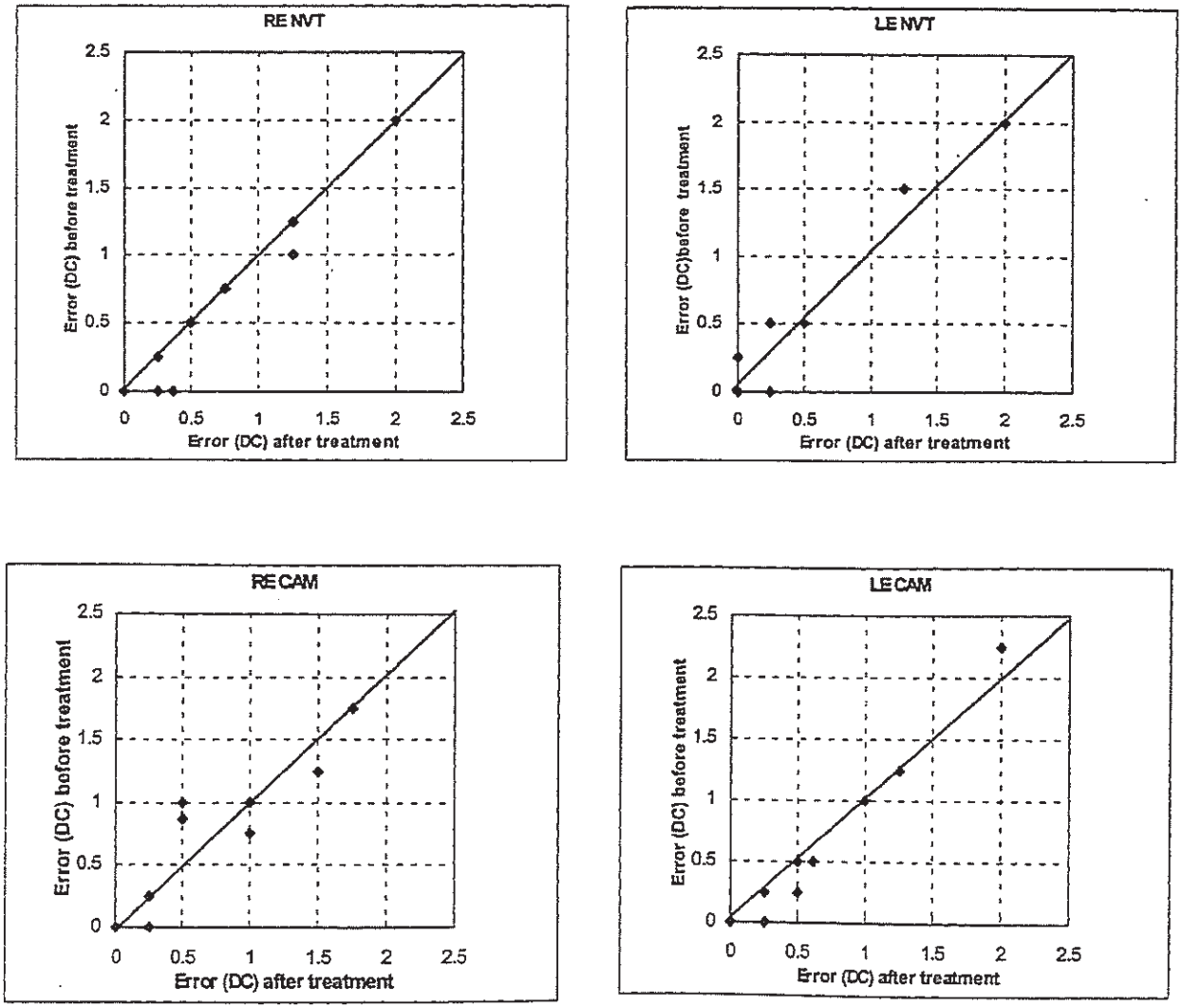

Figure 2 Cylindrical refractive error (DC) pre and post NVT and Cam Stimulator treatments for both Right and Left Eyes.

Table 2 shows the means and standard deviations of subjective refraction at observation one (pre treatment) and observation two (post treatment with either NVT or Cam Stimulator).

Table 2

Subjective refraction (Dioptres) Pre and Post NVT or Cam Stimulator treatments

	Right Eye M	SD	Left Eye M	SD	(n=12)
Pre	3.56	3.64	3.70	3.50	
Post	3.45	3.49	3.62	3.30	

Table 3 shows the means (M) and standard deviations (SD) for LogMAR visual acuity pre and post NVT and Cam Stimulator treatments respectively.

Table 3

Visual Acuity (log) Pre and Post NVT & Cam Stimulator treatments

Treatment		Right Eye M	SD	Left Eye M	(n =12) SD
NVT	Pre	.0583	.1165	.0416	.0793
	Post	.0500	.1168	.0583	.0900
Cam	Pre	.0416	.0793	.0583	.0900
	Post	.0416	.0793	.0583	.0900

The average automated keratometry readings were used for the calculation of the mean and standard deviation for both the right and left eyes pre and post both treatments. The right eye mean before (NVT) (Mean = 43.82 SD = 1.91) was very similar to post treatment (Mean = 43.83 SD = 1.86). Similarly the left eye mean did not change significantly pre NVT(Mean = 43.74 SD = 2.10) to post treatment(Mean = 43.71 SD = 2.03).

The right eye mean before Cam treatment was 43.68 (SD = 2.00) and post treatment was = 43.74 (SD = 2.04). No significant change was noted pre Cam treatment for the left eye (Mean = 43.80 SD = 2.12) to post treatment (Mean = 43.78 SD =2.12).

Tables 4 and 5 show the means and standard deviations for accommodative abilities with monocular and binocular results being presented pre and post NVT and Cam Stimulator treatments respectively.

Table 4

Accommodation Values (Dioptres) Pre and Post NVT

Eye/s		M	SD (n = 12)
Binocular	Pre	10.29	4.45
	Post	11.33	5.77
Right	Pre	9.08	4.58
	Post	10.79	6.24
Left	Pre	9.38	5.65
	Post	10.54	5.97

Table 5

Accommodation Values (Dioptres) Pre and Post Cam Stimulator

Eye/s		M	SD (n =12)
Binocular	Pre	11.63	5.75
	Post	10.79	4.77
Right	Pre	9.42	5.74
	Post	10.92	5.85
Left	Pre	8.75	6.04
	Post	10.50	6.03

Table 6 shows the means and standard deviations for convergence near point pre and post treatment for both NVT and Cam Stimulator treatments.

Table 6

Convergence (cm) Pre and Post NVT & Cam Stimulator treatments

Treatment		M	SD (n =12)
NVT	Pre	3.43	3.34
	Post	2.36	3.27
Cam	Pre	3.38	4.48
	Post	2.38	4.27

DISCUSSION

Various inferences can be drawn from the results of this study, however interpretation must take into account several factors; the sample size is small and the composition is only representative of an adult myopic population, therefore the findings of this study can only be related to this type of refractive error. Nevertheless, this sample's constitution is similar to that of the general population aged 18-53 years who wear glasses for distance vision Wu et al (1999)[27]. Even with a small sample there was a good cross section of refractive power studied, ranging from -0.50 DS to -13.50DS.

The results of this study clearly demonstrate that there was no evidence of a reduction in spherical or cylindrical refractive error following NVT and the placebo treatments, although NVT advocates that any size refractive error can be reduced. This finding corresponds with conventional clinical opinion and supports the belief that the dioptric amount of myopic refractive error cannot be reduced by treatments involving eye exercises and relaxation techniques. Figures 1&2 show participants individual refractive errors pre and post NVT and Cam Stimulator treatments respectively. It is evident that individual fluctuations did occur for some participants, this included changes in spherical error (either improving or worsening) usually ranging from 0.25DS to 0.50DS and in one case up to 0.75DS. For several cases no variation at all was recorded pre to post treatment. Overall, comparison of the sample pre to post treatments indicates the general ineffectiveness of NVT and the placebo Cam treatment on reduction of refractive error in adult myopic participants. These findings are consistent with Farraway (1994).

The lack of a noticeable reduction in physical factors causing refractive error is further supported by the measurement of corneal curvature, which did not reveal a significant change in mean curvature following either NVT or Cam Stimulator treatments. This lack of change in cylindrical error supports conventional opinion that exercises and relaxation techniques do not physically alter the anatomical structures or shape of the eyeball.

The role of perception of change and improvement in vision that may occur subjectively should be recognised. However, attributing them to change in refractive error cannot be substantiated by this study. Nevertheless, some participants did report feeling better. Better was described as seeing well, maintaining clear vision for periods without their glasses on, not experiencing symptoms of eyestrain. The reports of improved comfort and sight may well be the result of placebo

effect and possibly account for the success reported by NVT advocates; as stated by one subject "My sight is becoming clearer, I think". Another subject commented "I did not like the NVT as much as the Cam Stimulator. The Cam Stimulator treatment was more focussed and I felt the NVT was ineffective" and also "I did feel it work my eyes, sunning and palming were great relaxers and the tromboning exercise definitely made my vision clearer". Another participant's response was "I can now cope better at times without my glasses on and I feel more comfortable". Two participants voiced surprise that their visual acuity results did not reveal a measurable improvement and that the degree of their refractive error remained unchanged when they were convinced otherwise. Confirmation of participant satisfaction with vision post training was not measured in the current study. A Likert or similar scale asking participants to rank satisfaction pre and post treatment would be suitable if further study in this area was pursued. Angi et al (1996)[28] measured psychological distress pre and post biofeedback vision training using the self-rating symptom checklist (SCL 90). Results obtained indicated that all treated subjects reported a better quality of vision and satisfaction with vision training using biofeedback mechanisms. As with this current study, the reported satisfaction was unrelated to a change in refractive error.

A perceived subjective improvement in visual acuity could be attributed to an enhanced ability to tolerate and recognise blurred letters, as reported by Woods (1946)[29]. It seems possible that by purposeful training there may be an improved cortical ability to improve the interpretation of a blurred image and this may be achieved by NVT. Tolerance to blurred vision may also result from training for accommodative relaxation. This would be of assistance for accepting increased plus correction. If this is the case and its practice is not detrimental, then NVT advocates should acknowledge this component of training as an explanation for their supposed success.

It was hypothesised that improved accommodation and convergence recordings could result from undergoing the NVT training. As shown in the results, accommodation values did not appear to significantly change pre - post treatment. There was however, a slight trend towards improvement in accommodation values. Convergence near point also did not appear to vary greatly pre and post treatment. However, participants reported improved comfort when working in the near position.

During the treatment periods the participants in this study did not report unusual symptoms such as headache, nausea or retro- molar pain as noted in the Farraway study[10], however some did report tiredness for the first few sessions. The noticeable lack of unusual symptoms is attributed to the omission of head and neck rotations.

The possibility of adverse side effects generated by NVT is interesting in itself because it questions why NVT advocates continue to promote treatments in which participants can experience discomfort for little benefit?

In studies on the prevalence of myopia, researchers have studied associations between education, intelligence and income levels, reporting findings that the incidence of myopia is higher in college educated people.[27] The association between educational background and the incidence of myopia were not examined in this current study. However it would be reasonable to conclude that the sample used in this study is supportive of the above findings as the participants were university students, academic staff and professionals. Interestingly the sample used in this study also matched the profile of users of alternative medicine in an Australian population.

Consideration should be given to the sample in this current study, which was comprised predominantly of older subjects whose refractive error had stabilised. It is postulated that younger subjects (children) could be more suitable to vision training due to flexibility in accommodation and cortical plasticity. Birnhaum (1981) [30] states that in their experience it is very difficult to eliminate myopia which already exists, and that generally an aim of management is to stabilise or slow myopia progression.

Participant motivation is an essential pre requisite for any therapeutic effect.[28] One indicator which demonstrates a high level of participant motivation, is the good retention rate of this study, with only two out of the fifteen participants failing to return for follow up. Reasons cited for non-continuance stemmed from difficulties arising with regular performance of the treatments and regular attendance for measurements. These reasons are common problems and account for some of the drop out rates in treatment based studies and studies of long duration [28].

Repetition is an essential feature of exercise, training and learning. A daily compliance record of treatment supports the repetitive nature of training as well as monitoring participant motivation. An interpretation from the participants' recordings is that continuity of treatment occurred with daily repetition of the treatments and that the treatments were performed in the manner they were assigned. As the study's design was based on repeated measures, the participants had opportunities to regularly see the researcher. It is well recognised that the conduct of exercises under supervision is ideal to prevent repetition of flawed methods leading to faulty performance. Although participants in this study did not perform the treatments directly supervised by the researcher, it is believed that the regular contact between the researcher and participants further assisted compliance and participant accountability. It must be acknowledged that in a home treatment based study the final outcomes can be significantly influenced by poor or non- compliance. The analysis and interpretation of the results of this current study was necessarily based on the assumptions that the participants involved had performed both treatments and provided accurate information about their performance of these treatments.

Conclusions

In both this study and that of Farraway[10], NVT programs using similar treatment techniques and treatment periods of three and seven weeks respectively failed to show significant changes in refractive error, visual acuity and improved ocular comfort. Therefore, it appears that these treatments are inappropriate substitutes for mainstream practice. Whether there is any harm in practicing these alternative forms of treatment to complement the mainstream correction of refractive error remains to be seen. Although mainstream methods of correcting refractive error with glasses or contact lenses are not without problems, these methods are effective. It can be concluded that until further research provides evidence to enable a further understanding of the effectivity of NVT,

adherence to treatment methods which have been validated is strongly recommended.

REFERENCES

1. Duke- Elder. S. Practice of Refraction. Ninth Edition. (1978)Churchill Livingstone.
2. Elkington,A. Frank, H.and Greaney,M. Clinical Optics.Third Edition.(1999) Blackwell Science.
3. Saw,S,Katz,J,Schein,O,Chew,S.&Chan,T.Epidemiology of Myopia. Epidemiological Revies.1996.Volume 18,No.2.p175-187.
4. Kinge,B. Midelfart,A. Refractive changes among Norwegian university students-a three year longitudinal study. Acta Ophthalmologica Scandinavica. 77(3):302-5, 1999. June.
5. Flitcroft,D.(1998). Ophthalmologists should consider the causes of myopia and not simply treat its consequences. Commentary. Britsh Journal of Ophthalmology.82:210-211.
6. Gallaway,M.Pearl,S.Winkelstein,A.& Scheiman,M. Biofeedback training of visual acuity and myopia: a pilot study. Optometry and Vision Science. 1987;64:62-71
7. Fulk,G.& Cyert,L.(1996)." Can bifocals slow myopia progression?". The Journal of the American Optometrical Association.67(12):749-54.
8. Goss,D.(1982). Attempts to Reduce the Rate of Increase of Myopia in Young People- A Critical Literature Review. American Journal of Optometry and Physiological Optics. Vol 59.No.10 pp 828-841.
9. Bates,W.(1920). Better Eyesight Without Glasses. New York. Holt Publishers.
10. Farraway,C.(1994). Can Eye Exercises "Cure" Refractive Errors? Unpublished student manuscript. The University of Sydney.
11. Allridge,B.(Presenter) (1992). Eyes Right [Video Presentation]. Speciality Press Freedom Projects International, Albury.
12. Barnes,J.(1987). Improve Your Eyesight: A guide to the Bates Method for Better Eyesight Without Glasses. Robertson Publishers. Australia.
13. Benjamin,H.(1929). Better Sight Without Glasses. (1st impression). Croydon,Surrey: Health for all Publishing company.
14. Corbett, MD. (1970). Help Yourself to Better Sight. California: Wilshire Book Company.
15. Goodrich,J. (1990). Natural Vision Improvement. Viking, O'Neil. Victoria. Australia.
16. Hauser,G.(1974). Better Eyes Without Glasses. London. Faber and Faber.
17. Liberman,J. (1995) Take Off Your Glasses and See. London: Thorsons.
18. Rosanes-Berrett.M.(1974). Do you Really Need Eyeglasses? New York: Hart Publishing Co
19. Pirotta,V.Cohen,M.Kotsirilos,V. & Farish,S.Complementary therapies: have they become accepted practice? Medical Journal of Australia (MJA) Vol 172.Feb.2000,105-109.
20. Dowrick,P.R. Complementary medicine and general practice: an urban perspective. Complement Ther Med 2000 Jun;8 (2):71-5
21. Fontanarosa, P. & Lundberg,G. Alternative Medicine Meets Science. The Journal of the American Medical Association. Editorial. Volume 280 No.18. November 11,1998.
22. Ernst,E.Herxheimer,A.(1996). The power of placebo:Let's use it to help as much as possible. British Medical Journal. Volume 313 (7072)21/28 Dec 1996 pp1569-1570.
23. Astin,J. Why Patients Use Alternative Medicine: Results of a National Study. The Journal of the American Medical Association. (1998) Volume 279 (19),1548-1553.
24. MacLennan,A.Wilson,D & Taylor,A. (1996). Prevalence and Cost of alternative medicine in Australia. The Lancet. Volume 347. March 1996 p569-573.
25. Campbell,F.Hess,R.Watson,P.&Banks,R. Preliminary results of a physiologically based treatment of Amblyopia. British Orthoptic Journal. 1978;62:748-55
26. Newcombe,R.&Duff,G. (1987) Eyes or patients? Traps for the unwary in the statistical analysis of ophthalmological studies. British Journal of Ophthalmology.71.645-646.
27. Wu,H.Steinhart,R.Slade,S.& Hersch,P.(1999) Refractive Surgery.Thieme. New York.
28. Angi,M. Caucci,S. Pilotto,E & Racano,E. (1996). Changes in Myopia,Visual Acuity and Psychological Distress after Biofeedback Visual Training. Optometry and Vision Science. Vol.73,No.1,pp35-42.
29. Woods,A.Report from the Wilmer Institute on the results obtained in the treatment of myopia by visual training. American Journal of Ophthalmology.1946;29:28-57.
30. Birhbaum,M. Clinical Management of Myopia. Symposium paper. American Journal of Optometry and Physiological Optics. Vol.58. No.7.pp554-559.July 1981.
31. Murphy, K. Myors, B. (1998). Statistical power analysis: a simple and general model for traditional and modern hypothesis tests. Mahwah & Erlbaum Associates. NewJersey.