

Corporate Vision Screening

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Abstract

The Cumberland Health and Research-Centre is a commercial arm of the Faculty of Health Sciences, University of Sydney, and had requested the School of Applied Vision Sciences, to conduct vision screening of employees at CSR Bradford at Ingleburn in NSW. The employees fell into two work groups, office based staff, who were predominantly computer operators, and operator / fork lift drivers, who were predominantly involved in the factory operation. Vision screening programs were tailored to suit the work requirements of these employees.

Screening was performed on 114 employees and individual written reports were supplied to the company along with a corporate report, summarising the findings of the vision screening and providing recommendations in relation to vision and the workplace arising from the screening program.

A summary of results is presented with a recommendation that orthoptists accept this challenge to be involved in corporate vision screening whenever possible.

Key words:

Corporate vision screening, vision screening in industry, Cumberland Health and Research, Occupational Health and Safety.

Introduction

Occupational health, safety and rehabilitation has become an agenda item at every board room table due to an increased awareness of the cost of injury and an organisation's legal responsibility.

Corporate health programs are designed to keep organisations healthy and productive. This is where an organisation like Cumberland Health and Research provides health management programs and workplace education so that people can effectively manage their health and wellbeing. In this way, both employees and organisations are encouraged to reach their potential in taking responsibility for preventing health problems.

Cumberland Health and Research Centre is a commercial arm of the Faculty of Health Sciences, University of Sydney. One of the Centre's primary objectives is to coordinate and utilise the knowledge, expertise, resources and research facilities of the University, to work with and for their clients, hence providing a comprehensive range of quality health services to them. Cumberland Health and Research Centre is Australia's leading national centre for corporate health, occupational health and rehabilitation, sports medicine, exercise science and rehabilitation programs.¹ The team approach is important to the service Cumberland Health and Research provides, by clients not needing to visit several places for different tests, other opinions or further care, hence maximising effectivity.

Some services offered by Cumberland Health and Research Centre for companies are Health and Management Profiles and Corporate Health Audits, where the auditor, such as the testing of vision and hearing every two years stipulates recommendations.

Strang² in 1945 discussed Orthoptics in Industry and concluded that Orthoptics and or an Orthoptic department can be considerably helpful to the industrial worker, especially those with heterophoria. This study did find that a considerable number of heterophoria cases required and could benefit from orthoptic treatment.

Occupational health and safety is an issue for any organisation due to the strategic development of Occupational Health and Safety legislation. By law,

every employer must provide a healthy and safe workplace, which is also owed personally to each employee. For example, there is a general obligation to provide goggles if there is a likelihood of eye injury, but there is an even greater obligation to protect an employee who has only one eye.³

In April 1992, The National Occupational Health and Safety Commission, Work Safe Australia, issued in particular a Technical Report of the study group on eyesight testing of users of screen based equipment,⁴ where the need and justification for eyesight testing for users of screen based equipment was documented. Silver and Daniel⁵ looked at vision assessment for display screen users and Good, Weaver and Augsburg⁶ state that job related vision standards do benefit both employee and employer, and hence devised in their study a model for the application of visual standards to the work place for 40 job classifications. Desai et al⁷ also recommended visual screening of industrial workers prior to job placement.

Over the past two years, Cumberland Health and Research has been involved in a variety of vision projects within industry. Vision screening and assessment has been done for companies and industries such as the NSW Bush Fire Brigades, Merck, Sharp and Dohme, BTR Engineering, Telstra, Australian Archives and this year, CSR Bradford is added to the above list.

employment, and this particular example of corporate vision screening done at CSR Bradford at Ingleburn NSW, is to increase awareness of this type of involvement orthoptists can have when there is the opportunity to do so.

Method

The vision screening done at CSR Bradford was carried out in the workplace by two Orthoptists in four days, over a period of five weeks (May / June 1998). The vision screening program was tailored to suit the work requirements of the two main groups of employees, office based staff and operators / fork lift drivers.

The screening program for CSR Bradford (Vision Screening Protocol⁸) was prepared by Corporate Health Services at Cumberland Health and Research Centre, University of Sydney, and aimed at detecting the following for each individual employee.

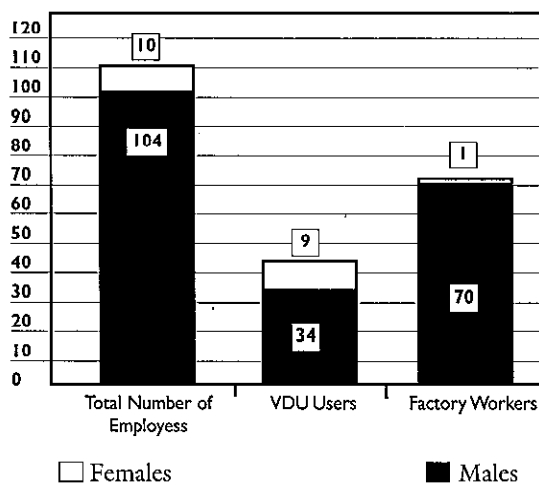
- Need for person to wear glasses or have existing glasses reviewed, but not to provide a prescription for glasses
- Presence of vision which is below the accepted normal adult standard, and may affect work performance in certain circumstances
- Presence of defective eye coordination
- Presence of an eye muscle weakness which may result in double vision or poor coordination when looking in a particular direction
- Inability of the eyes to maintain accurate alignment during prolonged periods of close work
- Inadequate focussing ability of the eyes which would affect prolonged close work
- Reduction in depth perception
- Congenital colour vision abnormalities
- Binocular vision.

Between the two employee groups, 114 employees were screened (Figure 1).

Forty three (38%) of employees tested fell into the group of office based staff, (VDU users), who predominantly used computers for many hours of the day (average hours/day = 5). The age of office based staff ranged from 22 - 63 years (mean age = 38.8 years).

Seventy one (62%) of the employees tested fell into the group of operator / fork lift drivers, (factory workers), who were predominantly involved in the factory operation. The age of this group ranged from 21 - 61 years (mean age = 35.8 years).

Figure 1. Types of employees



CSR Bradford is a company that has been in operation since 1990 at Ingleburn in the South Western Sydney area, and has been a client of Cumberland Health and Research Centre since approximately 1991. CSR Bradford has an Employee Health Monitoring System where recommendation has been made that employee vision is to be tested every two years.

Due to the fact that every organisation is obligated to provide a safe and healthy working environment for their employees, many companies undergo corporate health audits, and it is from this that recommendation for screening is generated. Something such as corporate vision screening does have its place in the scheme of Orthoptic

Each group's testing procedure differed slightly from the other, (Table 1).

Employee Group	VA 1/3m & 6m	CTN	CTD	CNP (RAF)	OM	BSV (Titmus)	PFR	Accommodation	Saccades/Pursuits	Colour Vision
Office Based Staff
Operator/ Fork lift Driver

Table 1. Tests performed on two employee groups

Vision was tested at both 1/3m and 6m, and with glasses if the employee currently wore glasses. If vision was less than 6/6, then the pin hole test was done at 6m. Cover testing near and distance was also done with their distance correction. Convergence was assessed by using the RAF Rule and measured at the point of when double was appreciated. If no diplopia was noted, measurement was at the point at which the Orthoptist noted that the eyes were no longer binocular. Diplopia recognition was always questioned.

Stereopsis was evaluated by using the Titmus Fly test and in some cases if this test was inconclusive, the Langs I card was used. Prism Fusion range was done for both work groups and these were tested at 1/3m using prism bars and an accommodative target. Ocular movements were assessed for each group, but for the Operator / fork lift drivers group, horizontal and vertical saccades, distance to near - near to distance adjustments and smooth pursuit were also evaluated. The Office based staff group alone had their accommodation assessed to the first point of blur. The right eye, left eye, and both eyes open were measured three times each for an average to be taken and to see if fatigue was a factor.

All employees were questioned as to whether they had any eye and visual complaints, signs or symptoms. It was also asked as to when their last eye examination was, especially if glasses or contact lenses were worn, or if a specific problem arose or was observed by the Orthoptist whilst testing such as pterygia, eye irritation, redness or infection.

A written report on each employee screened, including advice where appropriate for further assessment or treatment was forwarded to CSR Bradford. A corporate report was also developed for CSR Bradford, summarising the findings of the vision screening. Recommendations were provided in relation to vision and the workplace arising from the screening program.

Results

Referrals stemming from the corporate vision screening performed at CSR Bradford are summarised in the following graph (Figure 2).

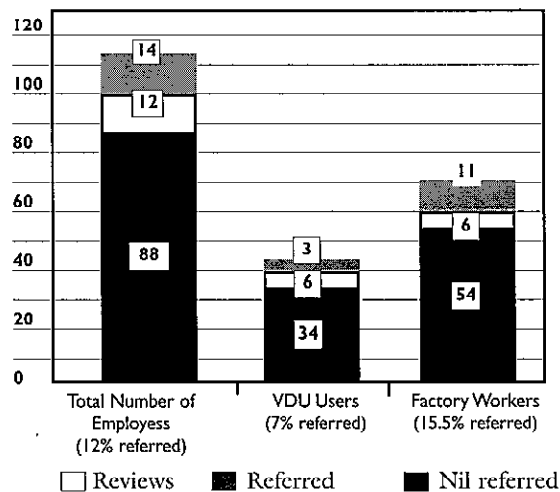


Figure 2. Referral rates and types of employees

Referral procedure was based on whether there was:

- reduced vision for near or distance
- apparent signs and symptoms of eye strain along with poor binocular vision functions
- a long standing visual problem needing review or a condition not already under care of an eye health professional.

Discussion with the employee in regards to being aware that review or referral may be necessary if signs and symptoms occur in the future and review of glasses on a two yearly basis for those with glasses was recommended.

It was noted that overall, 50 of the 114, (44%) of employees screened wore glasses at a full time or part time capacity. Comparing the two groups, there were a greater percentage of VDU users, (58%), who wore glasses compared to the factory workers, (35%).

Late last year, vision screening done by Wozniak and Wilcox⁹ at the Australian Archives on 47 office based staff, found that over 50%, 33 out of 47 participants were wearing glasses in a full time or part time capacity. This may possibly be due to small, previously uncorrected refractive errors being uncovered by the daily use of computers, as working with screen based equipment is most certainly a visually demanding task.¹⁰

In the 12% of participants that were referred, the main reason of referral was due to reduced near or distances vision in 12 participants. Another two employees were referred for a problem with near work caused by an ocular muscle imbalance and one for recently diagnosed diabetes with a history of fluctuating vision when diagnosed six weeks prior to the vision screening at CSR Bradford.

For another 12 participants, review in twelve months or two years was suggested as these were employees that had signs of potentially having problems with near work in the future due to borderline readings on tests for ocular muscle balance and binocularity. These employees for review did not suffer from any symptoms and had no complaints regarding their eyes. Hanne and Brewitt¹¹ found a significant difference in asthenopia and daily hours of Video Display Terminals (VDTs) work between VDT workers working less than six hours daily and those working more than six hours daily. It was also noted that their investigation of monocular VDT workers, no visual problem was found. As part of our recommendations, methods of trying to prevent potential asthenopic symptoms from developing were suggested such as:

- the need for frequent breaks from intensive near work and the need to relax the eyes,
- the appropriateness of the participant's current glasses for their present work position
- reinforced the need to have regular two yearly check ups of glasses and employees made aware of the necessity for further ocular examination if current problems increased or if signs, symptoms and concerns arose.

Recommended review in two years was mainly for employees who wore glasses and were currently happy with their present spectacle prescription.

Jackson et al¹² stated that workers involved in uninterrupted display screen equipment (DSE) work for prolonged periods reported visual symptoms twice as frequently as those who spent less time working with DSE. This is therefore showing the need to recommend review and to give general advice regarding ocular posture required for comfortable use of screen based equipment.

Other findings were that nine participants were found to have a red - green colour vision deficiency including one female, though the percentage of males with red - green colour deficiency was 7.7%,

which is closely consistent with what literature documents as approximately 8% of the male population.^{13,14}

Overall, 15/114 (13.2%) of employees at CSR Bradford had a convergence near point of 10cm or more. Convergence near point results showed that just over 50% (22/43) of VDU users had a near point of 6cm or less. The majority of VDU users (95%) had a convergence near point of 10cm or less. The majority of participants with a convergence near point of 10cm or more (11.6%), also showed below normal base out fusional amplitudes at near, where the normal prism fusional amplitudes used were taken from McIn and Trimble.¹⁴ Stereopsis results for these people were predominantly 40 seconds of arc. It was noted that 24/43 (55.8%) of the office based staff had prism fusion ranges below the normal fusion amplitudes at near compared to 41/71 (57.7%) of the factory workers.

The employees that showed slightly defective accommodation for their age values were predominantly those with below normal fusional amplitudes, yet their stereopsis results were no less than 50 seconds of arc. It was interesting to see that for those who spent 8 hours or more on computers per day tended to have poorer fusional amplitudes, and those who spent no more than 2 - 3 hours doing computer work per day were the majority of those with slightly defective measures of accommodation. Cornell and Heard¹⁵ concluded that measures of accommodation over the age of 50 are moderately and consistently better than those previously published in literature. This is also seen in the office based staff group at CSR Bradford on whom accommodation was measured.

Convergence near point results showed that 41/71 (57.7%) of operator / fork lift drivers had a near point of 6cm or less. The employees in this group that presented with convergence near point of 10cm or more (10/71, 14%) also had below normal prism fusional amplitudes at near. In this group, instead of accommodation being measured, ocular movements were looked into with more detail due to the different nature of their work to the office based staff group. Table 2 shows results from performing ocular movements for the whole group of employees and as two separate groups.

As previously mentioned, Strang² deduced that a considerable number of heterophoria cases could benefit from orthoptic treatment. Wozniak and Wilcox⁹ may have also found that heterophoria was present and that 13% of participants screened at the Australian Archives suffered from problems with near work that was caused by ocular muscle imbalances.

Campbell and Mein¹⁶ found in a study titled "Civilian Heterophoria" that 75% of subjects complained of headaches, chiefly frontal, which mostly occurred after close work. Others suffered from eyestrain, blurred vision or diplopia on close work.

Table 2.
Ocular Motility

Findings	Total number of employees	VDU Users	Factory Workers
V Exo pattern	4		4
V Eso pattern	1		1
A Exo pattern	1		1
End point nystagmus	4	1	3
Inferior Oblique O/A	1		1
Unsmooth Pursuit	4	1	3
Saccadic Undershoot	7		7
Saccadic Overshoot	1		1
Distance-near problem	2		2
Duanes	1		1

The majority of subjects attributed their symptoms to bad illumination and long hours at work. Upon analysis of occupations, many had to use finely graded instruments and prolonged close work was the most important factor generating the above symptoms.

Overall in vision screening CSR Bradford, the following graph (Figure 3) shows the prevalence of heterophoria and squint in the 114 employees

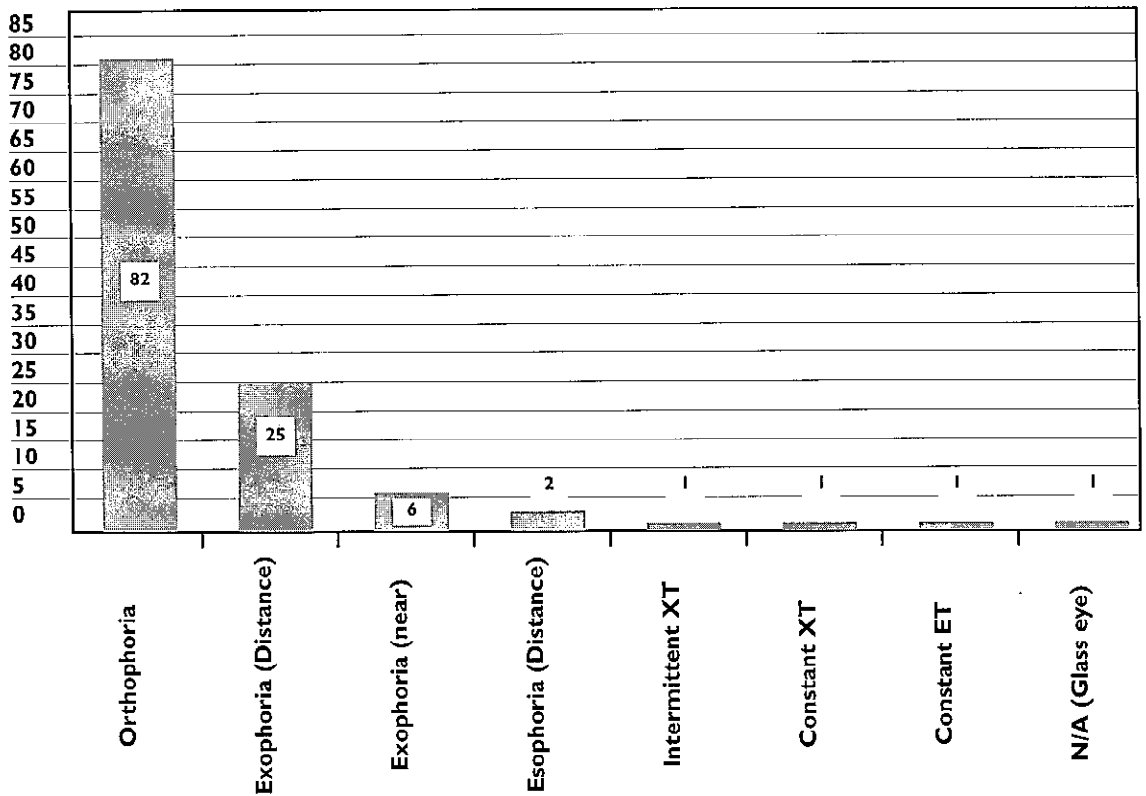
screened. Table 3 shows the two groups separately at CSR Bradford. Figure 3 shows the overall prevalence of heterophoria and strabismus.

In an article looking at a particular computer user with visual fatigue, Irving and Woo¹⁷ stated that it is recommended that attention be paid to the muscle balance and binocular function especially if low plus lenses are to be prescribed for computer use. This is also supported by another study (Dain

	VDU Users (n= 43)	Factory Workers(n= 71)
Orthophoria	32 (74.4%)	50 (70.4%)
Exophoria (Near)	1 (2.3%)	5 (7.4%)
Exophoria (Distance)	11 (25.6%)	14 (19.7%)
Esophoria (Near)	-	-
Esophoria (Distance)	-	2 (2.8%)
Esotropia (Constant)	-	1 (1.4%)
Exotropia (Constant)	-	1 (1.4%)
Exotropia (Intermittent)	-	1 (1.4%)

Table 3.
Prevalence of heterophoria and strabismus.

Figure 3.
Prevalence of
heterophoria and
strabismus.



et al) mentioned by Irving and Woo, where it was found that there was a statistical significant relation between heterophoria and symptomatic computer users. Insignificant deviation may become a problem with the increase in near work associated with computers, and the case presented by Irving and Woo shows that positive fusional vergence can be increased and symptoms relieved with orthoptic training.

Lastly, a list of conditions found upon screening is listed in Table 4 below.

Table 4.
Miscellaneous
conditions.

Condition	Number
Contact lens wearer	4
Borderline asthenopic symptoms	6
Retinal embolism	1
Eye injury	2
Glare sensitivity	2
Pterygia	3
Eye irritation / infection	3
Welders flash	1
Lid lesion	1
Diabetes	1
Duane's	1
Prosthetic eye	1

Discussion

First of all, it is imperative to note the importance of setting standards, especially in such a role like this where occupational health and safety is being dealt with. Along with occupational health and safety goes education and awareness. If certain signs and symptoms are potentially a hazard in the future, it is essential that the person being assessed is advised or made aware that secondary assessment is necessary at the time that problems occur.

Overall, there are many trends with particular results, but many of these trends do have their inconsistencies. Initially this overview on corporate vision screening was not set out to become a statistical piece of research which now has limited me in executing statistical analyses, yet rather just talk about the findings in this particular number of subjects.

The inconsistencies encountered were the uneven numbers between the groups of office based staff and Operator / fork lift drivers and there was also a vast majority of males to females. Test understanding by employees varied throughout testing, and the fact that there were two orthoptists doing the screening, meant that techniques and results may not have been as consistent as if there was only one screener. When comparing differences or similarities between groups, all of the above needs to be kept in mind.

It was interesting to see the trends in relation to asthenopic symptoms. Borderline asthenopic complaints and ocular complaints in general predominantly stemmed from the office based staff group, despite the larger group of operator / fork lift drivers that also had a significant amount of poor convergence and fusional ranges. Sore eyes towards the end of the day was a common complaint, though there were no complaints of diplopia or watery, sore, red eyes whilst doing close work at any time. This then probably isolates soreness at the end of the day as a fatigue factor, due to computer screen glare or decreased blink rate.

It seemed that the fewer the hours one worked on a computer, (half the hours of a working day compared to 6-8 hours a day), prism fusion ranges and convergence near points were slightly reduced. Decreased prism fusion ranges were not only found amongst office based staff, which then raises the question to whether computers or excessive near work helps fusional reserves and convergence near points, or whether it is a detriment to them. There was a larger percentage of factory workers with decreased prism fusion ranges compared to VDU users, but that may purely be due to sample size.

Eye strain linked with computer work may aggravate fusional and convergence mechanisms hence causing them to be reduced. On the other hand, by having to use the two mechanisms constantly throughout the day, could the fact that they do a lot of close work actually be exercising their positive fusional amplitudes and convergence?

This then could be noted that the lack of close work done by the factory workers could possibly be a reason for their fusion ranges and convergence being reduced. It is in the latter group that employees with very poor convergence results were found, yet with no complaints of asthenopic symptoms.

Could a reason for no sign of asthenopic symptoms amongst factory workers then be due to them not having to use computers as part of their job which aggravate decreased mechanisms of fusion and convergence?

More VDU users wore glasses hence signifying that computers aggravate a minimal or borderline need for spectacles and it was also noted that other ocular conditions such as pterygia, glare sensitivity and squint were seen in the non-office based staff.

Trends in a task such as a literature search showed that much research has been done on many other forms of vision screening such as school screening, screening for diabetes, glaucoma, ROP and in the aged, but in comparison, a minimal amount related to screening in industry.

Conclusion

In conclusion then, it is obvious that corporate / industry screening is very much a part of every organisation, and that due to legislation it must be.

Most literature speaks of setting standards and protocols so that less occupational and health problems arise. As a co-assessor of the 114 employees screened at CSR Bradford, it can also be concluded that it was beneficial working as a team, achieving experience in a diverse orthoptic role by using people's occupation as a guide to assessment. It also brings to attention the necessary importance of discussing helpful orthoptic and visual advice and recommendations to patients based on their test results, keeping their workplace and occupation in consideration.

It is suggested that if the opportunity arises, orthoptic expertise should be employed in a designed and tailored way, in order to expand the role and awareness of orthoptics within the community.

Acknowledgements

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