Real-world Workplace Return on Investment of a Computer-specific Vision Intervention Benefit for Presbyopes

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Abstract

This protocol is designed to assess the real-world workplace return-on-investment (ROI) of a computer-specific vision intervention benefit for presbyopes. Although studies have suggested potential benefits of specially-designed eye glasses for computer use (Brewer et al, 2006; Daum et al, 2004), no study in the workplace has confirmed the benefits of a vision intervention for presbyopes. This proposal describes a prospective, randomized, parallel-group comparison of workplace productivity, visual comfort and visual function of presbyopic call-center employees using computers wearing habitual bifocal lenses (with uncorrected refractive error (RE)), best refractive correction and traditional bifocal lenses or specially-designed computer eyewear, the Essilor Computer lens. The hypothesis of the study is that computer users wearing an accurate prescription and optimized Essilor Computer lenses will demonstrate greater productivity, visual comfort and visual function than workers wearing their best refractive correction and traditional bifocal lenses and that workers wearing their best refractive correction and traditional bifocal lenses will, in turn, demonstrate greater productivity, visual comfort and visual function than workers wearing lenses with their habitual RE and traditional bifocal lenses. Estimates of changes in productivity over the course of a year will also enable an assessment of the return on investment of the intervention and the study is designed to allow an assessment of the relative importance of refractive error and lens design in using a computer.

Introduction

Health care costs related to medical conditions burden business activities via direct medical costs and indirectly via productivity losses (Ramsey et al, 2002; ADA, 2008). Productivity related to health issues can be sub-divided into absenteeism and presenteeism as well as direct costs for health care and associated items (e.g., surgery, pharmaceuticals, workers comp, etc.). Presenteeism describes workers who are present but not fully productive because of health-related concerns such as discomfort, depression, anxiety or musculoskeletal pain related to ergonomic issues (Jinnett et al, 2008). Overall, the criticality of enhancing worker productivity is increasingly being recognized as important to the profitability of business activities (Loeppke et al, 2007; Jinnett et al, 2008; Loeppke et al, 2009; Ramsey et al, 2002; Daum et al, 2004).

Presbyopes using computers also may suffer from issues related to the design of the near addition. Typically prescribed bifocals are designed for reading at a relatively low angle and at a distance of 16 inches (40 cm). Since computer monitors are nearly always higher in the field of

vision and further away (20 inches or 50 cm), presbyopes are forced to tilt their head back to achieve the proper viewing angle and at the same time, to move forward to adjust for the distance of the monitor.

This protocol is designed to assess the real-world workplace return-on-investment (ROI) of a computer-specific vision intervention benefit for presbyopes. The presence of visual dysfunction apparently related to the use of a computer has been extensively documented (Butzon et al, 2002; Brewer et al, 2006; Bergqvist & Knave, 1994). Visual dysfunction of computer users reduces productivity (Sheedy et al, 1989; Sheedy et al, 1987; Daum et al, 2004) and also impairs visual comfort (Daum et al, 2004; Sheedy & McMinn, 2003). Although studies have suggested the potential benefits of specially-designed eye glasses for computer use (Brewer et al, 2006; Daum et al, 2004), no study to confirm the direct benefits of a vision intervention on employee productivity has been completed in the workplace on presbyopes. Since employers provide benefits that maintain worker health and provide adequate ROI, vision care providing a positive ROI would make sense for both workers and employers.

Goals & Objectives

The primary goal of this proposal is an assessment of the impact of a vision intervention using ophthalmic lenses that correct refractive error and are optimized for using a computer for presbyopes in a call-center.

Hypothesis

The hypothesis of the study examines differences between three arms of the study (Table 1). The primary hypothesis for the work aspect is that presbyopic computer users with optimized visual correction for computers (group 3, ECL) will demonstrate greater productivity than workers with visual corrections not optimized in optical design (bifocals, group 2, CRE/B) or refractive error (group 1, placebo-like, RE/B).

The primary hypothesis for the visual health aspect is that presbyopic computer users with optimized visual correction for computers (group 3, ECL) will report fewer and less intense symptoms than workers with visual corrections not optimized in optical design (bifocals, group 2, CRE/B). In turn, we hypothesize that workers in group 2 (CRE/B) should experience fewer symptoms than workers in group 1, placebo-like (RE/B).

Significance

The study proposes an examination of a strategy to manage the two most common and most probable limiting factors affecting visual productivity and comfort for presbyopes who work on computers: poor refractive correction resulting in eyestrain and blurred vision and the limitations of inadequate lens design i.e., traditional bifocals, for computer use. Blur as a result of poorly corrected RE prevents or slows the recognition and use of visual information of a computer task (Daum et al, 2004). This blur also may result in decreased performance and decreased visual comfort (Daum et al, 1988).

This study proposes the first direct examination of the efficacy of a vision intervention involving refractive correction and optical lens design for presbyopes while collecting performance data in an actual workplace. If the hypothesis is confirmed, the study may provide: (1) scientific evidence documenting the advantages of vision testing and lenses specially designed for use on a computer; (2) currently unavailable, on-the-job assessments of comfort and productivity for

the effects of refractive error and optical lens design for presbyopes; and, (3) evidence of the separate and combined cost-effectiveness of refractive correction and ophthalmic lens design. The study has the potential to address and provide a solution for two of the most common and important visual issues of presbyopic computer users.

Methods

Inclusion/exclusion criteria, Recruitment of subjects

- Volunteers of any ethnicity and gender who are 40 yrs of age or older;
- Volunteers younger than 40 years excluded;
- Corrected visual acuity at near (40 cm) of at least 20/40 or better in each eye;
- Stereopsis of at least 40 seconds at 40 cm (corrected, Randot);
- Employee of the call-center and use a computer for 6 hrs or more per day;
- Willing to wear the glasses assigned during the study and to complete visual function surveys;
- At least 0.50D vector dioptric difference (VDD) in RE in their habitual correction in both eyes i.e., not be fully corrected; and,
- Other criteria in full proposal.

Subjects would be recruited from the employee population answering phone calls from clients in the call-center in cooperation with the sponsor and approved recruitment protocols of the institution.

Independent variables

The independent variable for this study is the group of the subject that indicates the prescription and lenses in either the traditional form or in specially-designed lenses (Table 1).

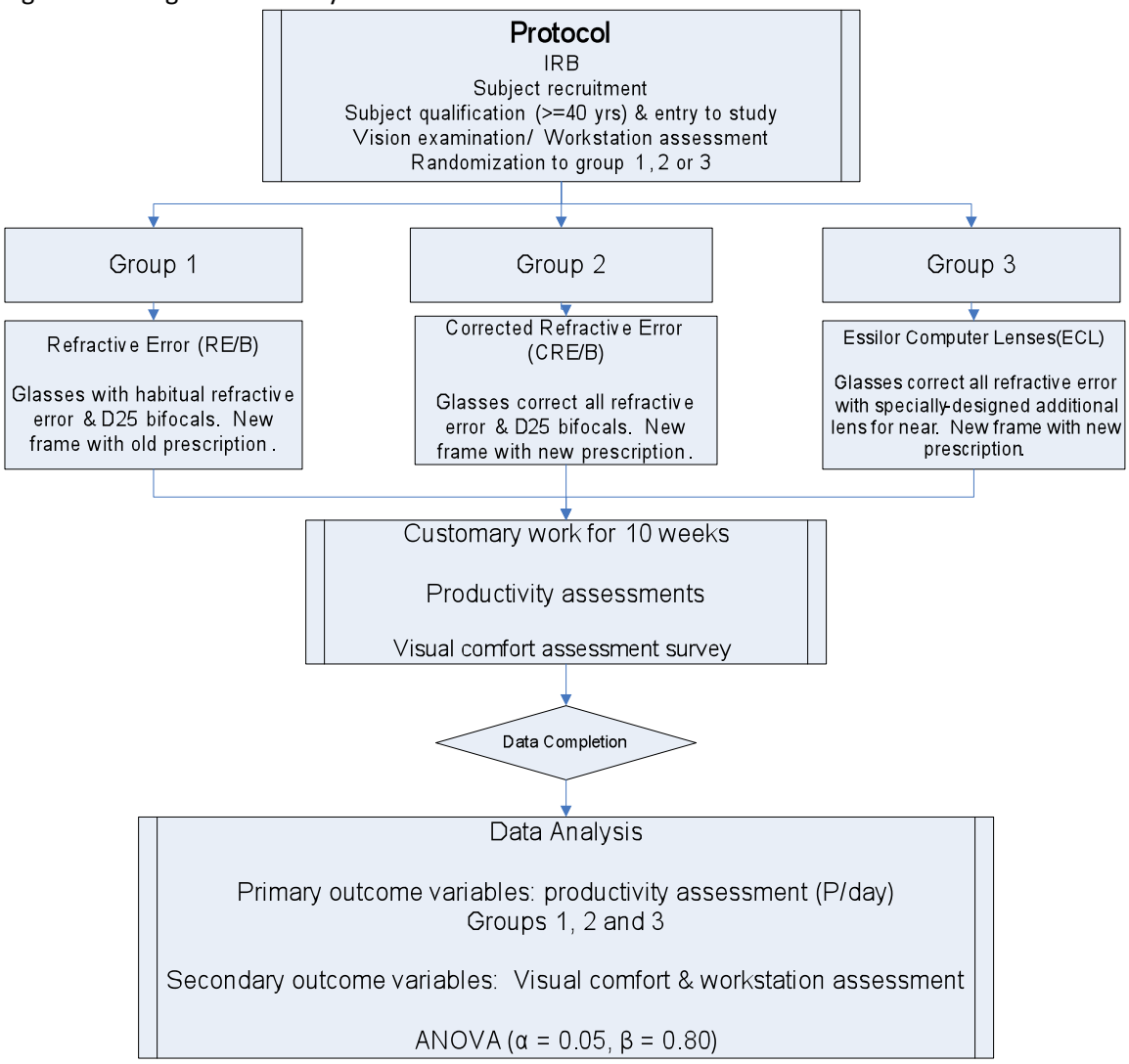
Table 1. Description of dependent variables in the study (presbyopes, 40 yrs or greater)

Group	Refractive error	Special Design	Description	Hypothesized Issues	Difference Hypotheses*
1, RE/B	Poorly corrected (habitual error, minimum 0.50 VDD in each eye)	No	D-25 Bifocal	Blur, discomfort, under or excess or unequal accommodation resulting in decreased visual function and reduced productivity Limitations of D-25 bifocal for computer use	Group 1, placebo-like (-) vs. group 2 (+): refractive error Group 1, placebo-like (-) vs. group 3 (+): combined optical design and refractive error
2, CRE/B	Corrected	No	D-25 Bifocal	No issues related to refractive correction Limitations of D-25 bifocal for computer use	Group 1, placebo-like (-) vs. group 2 (+): refractive error Group 2 (-) vs. group 3 (+): optical design
3, ECL	Corrected	Yes	Essilor Computer Progressive Addition lens	No issues related to refractive correction Enhanced viewing of computer monitor related	Group 2 (-) vs. group 3 (+): optical design

			(PAL)	to PAL design	Group 1, placebo-like (-) vs. group 3 (+): combined optical design and refractive error

*+, improved, better; -, decreased, poorer

Figure 1. Design of the study



Dependent (Outcome) variables

The primary outcome variable for the study is productivity per day (productivity/day, P/day). Conceptually, productivity in a given day is defined as:

Productivity = Number of calls * Efficiency in answering calls * Accuracy in answering calls * Proportion of time on job

The magnitude of number of calls is modified by how well they are answered, both in time and accuracy adjusted for the proportion of time that the employee is actually working. The time actually working does not include lunch or other breaks.

Secondary outcome variables include two validated surveys of visual symptomology, the Convergence Insufficiency Symptom Survey (CISS; Borsting, Rouse, DeLand, 1999; Borsting et al,

2003; Rouse et al, 2004; attachment 1) and the NEI-RQL (National Eye Institute Refractive Quality of Life survey; Hays et al, 2003; attachment 2).

Sample size

The data used to calculate sample size were taken from a total of seven months (August 2008 to February 2009) encompassing a total of 589,722 calls over a total of 134 days. The study will enroll 150 subjects and 181 subjects will need to be screened to obtain that number. A 10% excess of subjects will be required to account for drop-outs.

Baseline Characteristics, Ergonomic Evaluation, Masking, Randomization

The baseline characteristics of all subjects will be assessed. Subjects included in the study will have an on-site assessment of their workstation by a licensed ergonomist. The study will be a double-masked protocol. Subjects are to be randomly assigned to either the RE and traditional bifocal (group 1, placebo-like, RE/B), the corrected RE and traditional bifocal (group 2, CRE/B) or the corrected RE via Essilor Computer Lens (group 3, ECL).

Analysis, Return-on-Investment

The independent variable is the intervention group (1, 2 or 3). ANOVA will be used to evaluate the association between the independent variables and P/day as the dependent variable. ROI will be computed from the change in P/day versus intervention costs over a period of a year.

Other Factors

We will examine the covariates as potential confounders in the analysis. Subjects who are absent for 5 consecutive days or longer will have the opportunity to extend the study to provide a complete set of data. Missing data will be imputed with the mean of that data for the day immediately preceding and the day immediately following the loss. Drop outs will be tracked as to the date of the drop out and the reason for the withdrawal. VDD will be assessed using previously described vector methodology (Harvey, Miller, Dobson, Tyszko & Davis, 2000; Thibos, Wheeler & Horner, 1997; Raasch, 1995).

Pilot Data

The pilot includes 6 subjects (2 in each group) with a trial duration of 1 month.

Publication

The funding agencies agree that the data will be available without restriction of any kind to the first author (KD) to be published after completion of the study.

Budget

Table 5. Projected budget for the project

Item	Comment	Unit Cost	Total Cost
Vision examinations	171 subjects	$75	$12,825
Lenses and frames	171 subjects	Varies	$23,541
On-site supervisor	Estimate 1/hr day, 20 weeks (100 days)	$25/hr	$2,500
ICO Materials management (check and order frames and lenses for each patient)	Estimate 0.5 hr/patient	$25/hr, 171 patients	$2,137.50
ICO Data Management Technician (ICO Optometry	Input, manage and save qualification data (1), eligibility, vision exams (1), CISS	$20/hr, 171 patients, 5	$17,100

Clinical Research)	(10), NEI-RQL (2), UCSF ergonomics survey (1), productivity data (10) Estimate 2 hr/patient double entry, data entry surveys (initial data, vision examination, VFL, RQL, vision comfort, ergonomic surveys, quality control) 5 total hrs/ patient	hrs/patient	
Miscellaneous expenses, contingency	ICO IRB, contingency, disposables (forms)		$1,500
Statistical support		HealthCore	$5,000
Release time	Dr. Daum &/or ICO faculty, 5 days (40 hrs) 1 day work preparation; 1 day work pilot; 2 days work with optician on-site; 2 days work with ICO data management Drs. Amick, Daum, DeRango, other time	$200/hr Donated	$8,000
Protocol development, analysis	Dr. Amick, 12 hrs	$200/hr	$2,400
Protocol development, analysis	Dr. Daum, 15 hrs	$200/hr	$3,000
Protocol development, analysis	Dr. DeRango, 30 hrs Travel, 2 days with per diem	$175/hr $150/day	$5,250 $300
	Direct Costs		**$83,554**
	Indirect Costs	**@25% of direct costs**	**$20,888**
	Total Costs		**$104,442**

Budget Support	Committed Funds	**WellPoint**	**$25,000**
		Essilor	**$50,000**
	Requested Funds	**OERC**	**$29,442**

Schedule

The project would be scheduled for about a year for completion (available in full protocol).

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Attachments

Attachment 1. Convergence Insufficiency Symptom Survey (CISS)
Attachment 2. National Eye Institute Refractive Error Quality of Life Instrument, Hays et al, 2003
Attachment 3. Ergonomic Assessment Questionnaire
Attachment 4. Eligibility vision examination